Lucerne University of
Applied Sciences and Arts

HOCHSCHULE
LUZERN

Technik & Architektur
FH Zentralschweiz

Team Lucerne – Suisse
Solar Decathlon Europe '14

Project Manual

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II Summary of Changes

I Cover Sheet 1

Updated

II Summary of Changes 3

Updated

III Table of Contents 6

Updated

IV Rules and Building Code Compliance Checklist 10

Updated (Codes Design Compliance)

V Contest Support Documents 16

1 Urban Design, Transportation and Affordability Report 18

Summary Our Vision of «Smart Sharing»	updated
Chapter 1.2: Summary	updated
1.2 Paragraph: Viability of the Project on the chosen Site	updated
Chapter 1.5: Summary	updated
1.5 Paragraph: Two Scenarios for the Financial Model	updated

2 Architecture Design Narrative 50

Summary Our Vision of «Smart Sharing»	updated
2.1 Paragraph: Spring Semester 2014: Construction Phase / Realisation	updated
2.2 Summary	updated
2.4 Summary	updated

3 Engineering and Construction Design Narrative 76

Summary Our Vision of «Smart Sharing»	updated
3.2 Paragraph: Shading System	updated
3.3 Paragraph: Special Application	updated
3.3 Paragraph: Grey Water Heat Recovery System	updated
3.4 Paragraph: The control App	updated
3.4 Paragraph: Light	updated
3.4 Paragraph: Shutter	updated
3.4 Paragraph: Ventilation	updated
3.4 Paragraph: Heating Cooling	updated
3.5 Paragraph: Adjustable photovoltaics Construction	updated
3.5 Paragraph: Indoor Exercising with Energy Recuperation	updated
3.5 Paragraph: Electrical Implementation of the E-Bike Battery Terminal	updated
3.5 Paragraph: Availability of Batteries and Bikes	updated
3.6 Paragraph: List of electrical Loads	updated

4 Energy Efficiency Design Narrative 132

Summary Our Vision of «Smart Sharing»	updated
4.1 Paragraph: Summary	updated
4.1 Paragraph: Multi-Energy Grid	updated
4.1 Paragraph: Supply Concept of the Energy System	updated
4.1 Paragraph: Thermal Energy grid	updated
4.1 Paragraph: Electrical Energy grid	updated
4.1 Paragraph: Gas Energy grid	updated
4.1 Paragraph: Synergies	updated
4.1 Paragraph: Prototyp	updated
4.1 Paragraph: Comparison of local and competition context	updated
4.1 Paragraph: Technical Specifications of the Prototype	updated
4.1 Paragraph: Electrical Energy Production in the Prototype	updated

4.1 Paragraph: Energy Consumption in the Prototype updated
4.1 Paragraph: Energy system updated
4.1 Paragraph: Water reuse system updated
4.1 Paragraph: Flexible use of the rooms updated
4.1 Paragraph: Combination of two different air-conditioning systems updated
4.1 Paragraph: Domestic water production through fresh water station updated
4.1 Paragraph: Toilet flush with grey water updated
4.1 Paragraph: Shower with heat recovery system updated
4.1 Paragraph: PCM in Construction of the Roof of the Space+ updated
4.1 Paragraph: Connection of the Heating and Cooling System updated
4.1 Paragraph: Electrical Network updated
4.1 Paragraph: Photovoltaics updated
4.1 Paragraph: Automation and Management updated
4.1 Paragraph: Building Control Application updated
4.1 Paragraph: redictive Controls updated
4.2 Summary updated
4.2 Paragraph: Energy analysis objectives and methodology updated
4.2 Paragraph: Minimizing technology updated
4.2 Paragraph: Networking the building technology updated
4.2 Paragraph: Predictive energy management updated
4.2 Paragraph: Optimizing energy production updated
4.2 Paragraph: Minimizing energy consumption updated
4.2 Paragraph: Example simulation: Phase change materials Question updated
4.2 Paragraph: Influence of the thermal Simulation updated
4.2 Paragraph: Thermal energy storage updated

5 Innovation Report 178
Summary Our Vision of «Smart Sharing» updated
Chapter Summary updated
5.1 Summary updated
5.1 Paragraph: Innovation Focus: Newly Applied Woodcraft Traditions updated
5.1 Paragraph: Innovation Focus: Connectable space updated
5.1 Paragraph: Innovation Focus: Interior Architecture updated
5.2 Summary updated
5.2 Paragraph: Innovation Focus: 3D BMI Cooperation updated
5.2 Paragraph: Innovation Focus: Smart house automation System updated
5.2 Paragraph: Innovation Focus: Smart Privacy Solutions updated
5.3 Summary updated
5.3 Paragraph: Innovation Focus: Smart Administration of Rooms updated
5.3 Paragraph: Innovation Focus: Space+ Concept updated
5.3 Paragraph: Innovation Focus: Unique photovoltaic Facilities updated
5.4 Summary updated
5.4 Paragraph: Innovation Focus: Interconnected multiplier updated
5.4 Paragraph: Innovation Focus: Focused Communication updated
5.5 Summary updated
5.5 Paragraph: Innovation Focus: Vision of your+ and Smart Sharing updated
5.5 Paragraph: Innovation Focus: Sustainable Affordability updated
5.5 Paragraph: Innovation Focus: Applied Avoid-Shift-Improve Principlesupdated
5.6 Summary updated
5.6 Paragraph: Innovation focus: Holistic applied sustainability updated
5.6 Paragraph: Innovation focus: Façade solutions without fungicide updated

6 Sustainability Report 207
Summary Our Vision of «Smart Sharing» updated
6.1 Summary updated
6.1 Paragraph: Smart Sharing Base updated
6.2 Summary updated
6.2 Paragraph: Urban Design updated
6.2 Paragraph: Support from the Canton updated
6.2 Paragraph: Savings through Sharing updated
6.3 Summary updated
6.3 Paragraph: Passive Heating updated
6.3 Paragraph: Passive Cooling updated

6.3 Paragraph: Thermal Energy Storage updated
6.6 Summary updated
6.6 Paragraph: HVAC updated
6.6 Paragraph: Household Appliances updated
6.6 Paragraph: Artificial Lighting updated
6.6 Paragraph: Domestic hot Water updated
6.7 Summary updated
6.7 Paragraph: Solar thermal Collectors updated
6.8 Summary updated
6.8 Paragraph: Grey Water and Rain Water Systems updated
6.9 Paragraph: End of Life, Wood updated
6.9 Paragraph: Metals updated
6.9 Paragraph: Management of domestic Waste updated
6.10 Paragraph: Minergie updated
6.10 Paragraph: Minergie and Minergie-P updated
6.10 Paragraph: Minergie-A: Net zero or plus energy building updated
6.10 Paragraph: Minergie-Eco updated

7 Communications Plan 239
Summary Our Vision of «Smart Sharing» updated
7.1 Paragraph updated
7.2 Summary updated
7.2 Paragraph: Waiting Area updated
7.2 Paragraph: Information Brochure updated
7.2 Paragraph: Southside wall and Sunshade updated
7.2 Paragraph: Sunshades updated
7.2 Paragraph: The Tour updated
7.2 Paragraph: Everyday Objects as Guiding Elements updated
7.2 Paragraph: Signage for the Greater Context updated
7.2 Paragraph: Room-Specific Acoustics updated
7.2 Paragraph: Urban Development Model in the space+ updated
7.2 Paragraph: Buttons (Give-Aways) updated
7.2 Paragraph: Exterior West Walls updated
7.2 Paragraph: Tour Times updated
7.2 Paragraph: Tour Types updated

VI Dinner Party Menu 287
Updated
VII Contest Week Tasks' Planning 301
New chapter
VIII Cost Estimate and Project financial Summary 309
Updated
IX Site Operations Report 323
Updated
X Health & Safety Report 337
Updated
XI Detailed Water Budget 365
Updated
XII Project Specifications 373
Updated (Electrical and Photovoltaic Design Approval)
XIII Structural Calculations 383
Updated
XIV Appendix .... A
Updated

III Table of Contents

II Summary of Changes 3

III Table of Contents 6

IV Rules and Building Code Compliance Checklist 10

V Contest Support Documents 16

1 Urban Design, Transportation and Affordability Report 18
1.1 Urban Design Strategy 23
1.2 Market Viability of the Product 31
1.3 Individual or Collective Housing Building Concept 41
1.4 Mobility Strategies 43
1.5 Affordability Strategies 47

2 Architecture Design Narrative 50
2.1 Architectural Concepts 55
2.2 Summary of Reconfigurable Features 67
2.3 Lighting Design Narrative 68
2.4 Acoustic Concept 72

3 Engineering and Construction Design Narrative 76
3.1 Structural Design 81
3.2 Constructive Design 88
3.3 Plumbing System Design 96
3.4 Electrical System Design 103
3.5 Photovoltaic System Design 111
3.6 Electrical Energy Balance Simulation 116
3.7 Solar Thermal Design 125
3.8 Building Integrated Solar Actice Systems 130

4 Energy Efficiency Design Narrative 132
4.1 Technical Project Summary 137
4.2 Comprehensive Energy Analysis and Discussion Report 154

5 Innovation Report 178
5.1 Innovation in Architecture 184
5.2 Innovation in Engineering and Construction 188
5.3 Innovation in Energy Efficiency 192
5.4 Innovation in Communication and Social Awareness 195
5.5 Innovation in Urban Design, Transportation and Affordability 198
5.6 Innovation in Sustainability 202

	6	**Sustainability Report**	**207**
	6.1	General Concept of the Project and Sustainability	212
	6.2	Urban Design, Transportation and Affordability	215
	6.3	Bioclimatic Strategies	218
	6.4	Construction System	222
	6.5	Materials	223
	6.6	Active Systems and Equipment	225
	6.7	Solar Systems	229
	6.8	Water	232
	6.9	Solid Waste	234
	6.10	Life Cycle Analysis	236
	7	**Communications Plan**	**239**
	7.1	Communication Project	244
	7.2	Public Tour Description	258
	7.3	Visual Identity Manual	268
	7.4	Sponsorship Manual	282
VI	Dinner Party Menu		287
VII	Contest Week Tasks' Planning		301
VIII	Cost Estimate and Project financial Summary		309
IX	Site Operations Report		323
X	Health & Safety Report		337
XI	Detailed Water Budget		365
XII	Project Specifications		373
XIII	Structural Calculations		383
XIV	Appendix		A
	01	Codes design compliance	A 2
	02	What we share	A 11
	03	Surface of the building	A 13
	04	Market viability	A 15
	05	Clusters and commons	A 21
	06	Transport cost information	A 29
	07	CO2 transportation calculation	A 31

08 Building of comparison Bonaduz .... A 33
09 Discounted cash flow cooperative .... A 36
10 Discounted cash flow investor .... A 38
11 Datasheets lights .... A 40
12 Datasheet electrical system .... A 48
13 EL-601-AC circuit layout .... A 98
14 Datasheet sunpower X21 PV module .... A 223
15 Datasheet bosch inverter .... A 226
16 Minergie certicicate .... A 231
17 Simapro graphics .... A 240
18 CO2 Emission analysis .... A 249
19 Medienspiegel .... A 253
20 Sponsoring Präsentation PARTNER .... A 539
21 Sponsoring Präsentation STANDARD .... A 588
22 Sponsoring SmartSharing .... A 602
23 Sponsoring Sponsorship Manual .... A 606
24 Sponsoring werden Sie Partner .... A 610
25 Sponsoring Partnervertrag .... A 623
26 Cost and shopping list .... A 629
27 Modullist .... A 637
28 Route to the hospital .... A 645
29 Emergency procedures .... A 647
30 Work and summer .... A 657
31 Dangerous products .... A 662
32 lifting attachments sytem .... A 664
33 Individual protection .... A 666
34 Detailed lifting plan .... A 668
35 Type and characteristics .... A 676
36 Route Horw-Versailles .... A 680
37 Truck arrival procedure .... A 682
38 Table of stock characteristics .... A 684
39 Safty training .... A 686
40 Layer plane .... A 689
41 Overlaps and incompatibilities in construction .... A 692
42 Risks identification and causes .... A 695
43 Formation and information on health and safety .... A 757
44 General instructions in case of fire .... A 764
45 Project specifications user manuals .... A 772
46 Structural design approval .... A 1625
47 Electrical and photovoltaic design approval .... A 1838

IV Rules and Building Code Compliance Checklist

SDE Rules Checklist

3.2 Team Officers and Contact Information	PR#6, chapter 3
Team officer's contact information completely fulfilled in Table 1 (SDE WAT)	
4.3 Lot Conditions and attribution	PD#6 XIV SO-102
Drawing(s) showing the storage and unloading areas and corresponding load's calculations	
4.3 Lot Conditions	PM#6, chapter IX
Calculations showing the structural design remains compliant even if there is a level difference, and drawing(s) showing shimming methods and materials to be used in case	
4.4 Footings	PD#6 ST-001
Drawing(s) showing the locations and depths of all ground penetrations on the competition site	
4.4 Footings	PD#6 ST-001 / ST-103
Drawing(s) showing the location, contact area and soil-bearing pressure of every component resting directly on the ground	
4.7 Construction Equipment	PM#6 IX
Drawing(s) showing the assembly and disassembly sequences and the movement of heavy machinery on the competition site and specifications for heavy machinery	
5.1 Solar Envelope Dimensions	PD#6 AR-002, PD#5 AR-011
Drawing(s) showing the location of all house and site components relative to the solar envelope	
6.1 Structural Design Approval	Appendix 45
Structural drawings and calculations signed and stamped by a qualified licensed professional	
6.1 Electrical and Photovoltaic Design Approval	Appendix 46
Electrical and Photovoltaic drawings and calculations signed and stamped by a qualified licensed professional	
6.1 Codes Design Compliance	Appendix 01
List of the country of origin codes complied, properly signed by the faculty advisor	
6.2 Architectural Footprint	PD#6 AR-014
Drawing(s) showing all information needed by the Rules Officials to digitally measure the architectural footprint	
6.2 Architectural Footprint	PD#6 AR-041
Drawing(s) showing all the reconfigurable features that may increase the footprint if operated during contest week	
6.3 Measurable Area	PD#6 AR-017
Drawing(s) showing the Measurable Area	
6.4 Entrance and Exit Routes	PD#6 XVI PT-001
Drawing(s) showing the accessible public tour route, specifying the entrance and exit from the house to the main street of La Cité du Soleil®	
7.3 PV Technology Limitations	PM#6 chapter 3.5
Specifications and contractor price quote for photovoltaic components	
7.4 Batteries	PD#6 EL-010, PM#6 chapter 3.4 + 3.5
Drawing(s) showing the location(s) and quantity of stand-alone, PV-powered devices and corresponding specifications	
7.4 Batteries	PD#6 EL-010, PM#6 chapter 3.4 + 3.5
Drawing(s) showing the location(s) and quantity of hard-wired battery banks components and corresponding specifications	
7.6 Thermal Energy Storage	PD#6 ME-101
Drawing(s) showing the location of thermal energy storage components and corresponding specifications	
7.7 Desiccant Systems	non existent in project
Drawing(s) describing the operation of the desiccant system and corresponding specifications	
7.8 Humidification systems	non existent in project
Specifications for humidification systems and corresponding certifications of the different elements.	
8.1 Containers locations	PD#6 PL-041, PD#6 ME-001a
Drawing(s) showing the location of all the water tanks	
8.2 Water Delivery	PD#6 PL-041, PM#6 chapter 3.3
Drawing(s) showing the fill location(s), quantity of water requested at each fill location, tank dimensions, diameter of opening(s) and clearance above the tank(s)	
8.3 Water Removal	PD#5 PL-041, PM#6 chapter 3.3
Drawing(s) showing the quantity of water to be removed from each fill location, tank dimensions, diameter of opening(s) and clearance above the tank(s).	
8.5 Grey Water Reuse	PD#6 PL-011, PD#6 PL-101, PD#6 PL-211, PM#6 3.3, PL-101
Specifications for greywater reuse systems	
8.6 Rainwater Collection	PD#6 PL-021, PM#6 chapter 3.3
Drawing(s) showing the layout and operation of rainwater collection systems	

8.8 Thermal Mass	PM#6 chapter 4.2 / non existent in project
Drawing(s) showing the locations of water-based thermal mass systems and corresponding specifications	
8.9 Grey Water Heat Recovery	PM#6 chapter 3.3 / non existent in project
Specifications for greywater heat recovery systems.	
9.1 Vegetation Placement	PD#6 AR-111/112, PD#6 AR-113/114, PD#6 AR-359
Drawing(s) showing the location of all vegetation and, if applicable, the movement of vegetation designed as part of an integrated mobile system	
9.2 Watering Restrictions	PM#6 chapter 3.3, PD#6 PL-011
Drawings showing the layout and operation of greywater irrigation systems	
10.2 SDE Sensors' Location and wire routing	MC#6, PD#6 ID-001-ID-005
Drawing(s) showing the location of bi-directional meters, metering box, sensors, cables and feed-through to pass the instrumentation wires from the interior to the exterior of the house	
11.2 Use of the Solar Decathlon Europe Logo	PM#6 chapter 7.3
artwork, and content of all communications materials, including signage	
11.3 Teams' sponsors & Supporting Institutions	PM#6 chapter 7.4
Drawing(s) showing the dimensions, materials, artwork, and content of all communications materials, including signage	
11.4 Team Uniforms	SDE WAT
Drawing(s) showing the artwork, content and design of the team uniform	
12.4 Public Tour	PD#6 XVI
Drawing(s) showing the public tour route, indicating the dimensions of any difficult point, complying with the accessibility requirements	
20.0 Contest 6: Drying Method	MC#6
Drawing(s) showing the clothes drying method and the place where the clothes will be dried.	
20.0 Contest 6: House Functioning	MC#6
Appliances and corresponding technical specifications (Appliances and Home Electronic Equipment specifications and user manuals, Rule 49.1).	
36.5 Photovoltaic systems design	PD#6 XI, PM#6 chapter 3.5
Specifications of PV generators, inverters, wiring, cables, protections, earthing systems, interface with the electricity distribution network	
36.5 Photovoltaic systems design	PD#6 XI, PM#6 chapter 3.5
Inverters' certificates	
36.5 Photovoltaic systems design	PD#6 XI, PM#6 chapter 3.5
Maintenance plan for PV generators, supporting structure, inverters, wiring, cables, protections, circuit breakers in case of fire and earthing system. Fire protection systems for PV DC wiring	
36.5 Photovoltaic systems design	PD#6 XI, PM#6 chapter 3.5
The corresponding table "design summary" must be filled out	
51.3 Fire Safety	PD#6 FP-001, PM#6 XII (Fire Safety Table)
Specifications for Fire Reaction of Constructive elements, extinguishers and fire resistance of the house's structure.	
51.3 Fire Safety	PD#6 FP-001
Drawings showing compliance with the evacuation of occupants' requirements and fire extinguishers location	
51.4 Safety against falls	PM#6 XII (Safety in Use Table)
Specifications of compliance with the slipperiness degree classes of floors included in House tour	
51.4 Safety against falls	PM#6 XII (Safety in Use Table)
Drawing(s) showing compliance with conditions for uneven flooring, floors with different level, Restricted Areas stairs, Public Areas Staircases, Restricted Areas Ramps and Public Areas Ramps	
51.4 Safety for avoiding trapping and impact risk	PM#6 XII, Safety in Use Table
Drawing(s) showing compliance with conditions for avoiding trapping and impact risk	
51.4 Safety against the risk of inadequate lighting	PM#6 XII, Safety in Use Table
Specifications for level of illumination of house tour areas light fittings	
51.5 Accessibility for People with Disabilities and Special Needs	PD#6 PT-001
Interior and exterior plans showing the entire accessible tour route	
51.6 Structural Safety	PM#6 XIII
Specifications for the use of dead loads, live loads, safety factors and load combinations in the structural calculations	
51.7 Electrical and PV Systems	ELEC#6, Appendix 13, Appendix 47
Complete the "Electrical System Design PV Chart and Checklist" Rule 48.	
51.7 Electrical and PV Systems	ELEC#6, Appendix 13, Appendix 47
Specifications of the wiring, channels, panels and protections of the electrical installation	
51.7 Electrical and PV Systems	ELEC#6, Appendix 13, Appendix 47
One-line electrical diagram and drawings showing the grounding, execution and paths	

Codes Design Compliance

LUC_APP#6 Design Approval Documents

LUC_APP#6_Code Design Compliance_CertifyingCompliance.pdf

LUC_APP#6_Code Design Compliance_Drawings.pdf

V Contest Support Documents

1 Urban Design, Transportation and Affordability Report

Project Summary

"smart sharing – our vision is **your⁺**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is "smart sharing". We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your⁺ suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of "smart sharing" addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

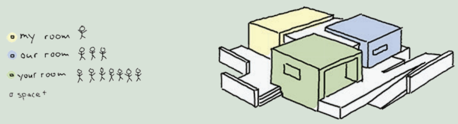
Flexible Room Usage

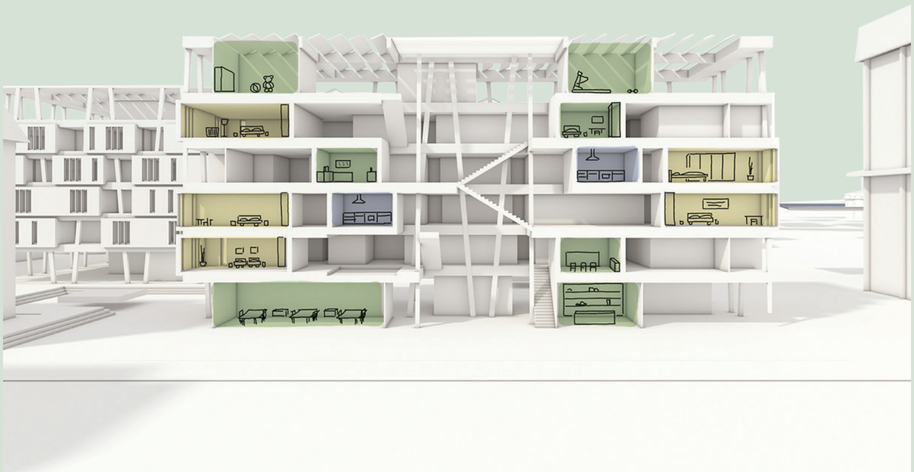
Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space+ as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your+.





Our Vision with Added Value

"smart sharing", our concept, provides a platform for sharing and exchanging that facilitates options, with whom you will save resources and simultaneously increase your quality of life. This is our response to the current challenges of population growth, living area limitations, resource use, and environmental pollution. So our idea of sharing and exchanging not only creates a communal platform, but also added value.

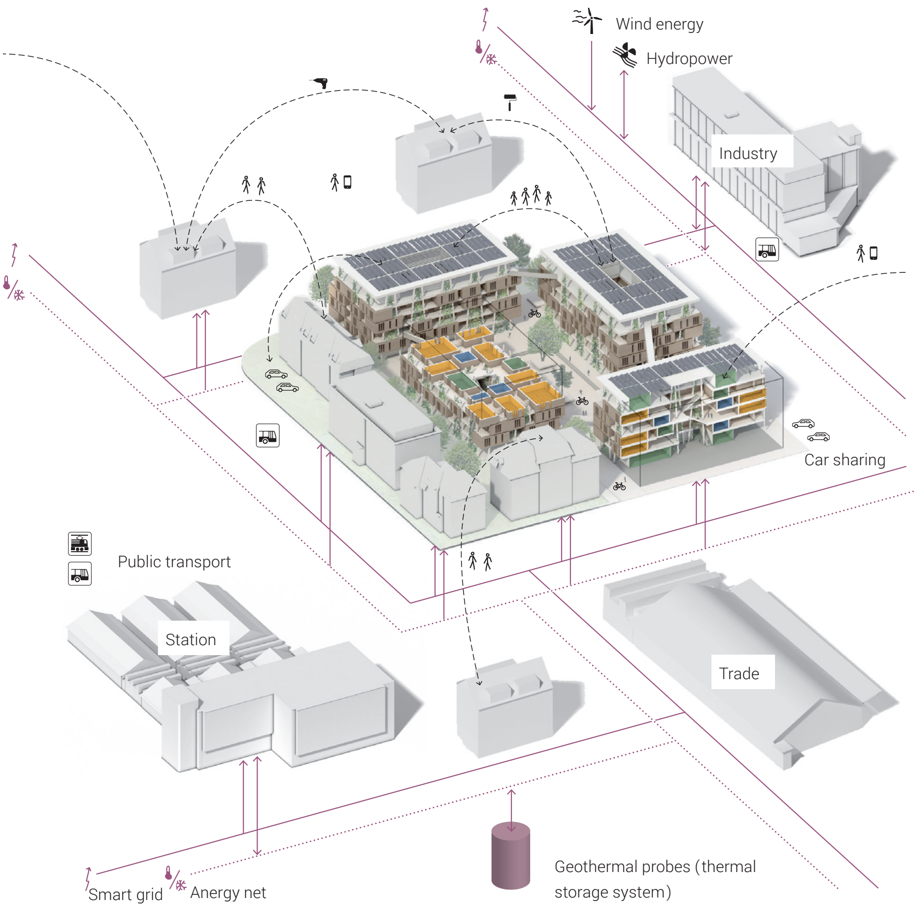
The concept of a cooperative, which has been firmly anchored in Swiss culture for centuries, serves as the basis for our work, focusing on the principle of common use. In view of the demographic trend and the consumption of resources it involves, we clearly need a new, sustainable philosophy of living. In addition to social aspects, we also integrate the development into the environment on an ecological and energy level.

Our your⁺ concept allows us to require only an average of 35 m^2 per person, as opposed to the previous 45 m^2, while maintaining the standard of living – indeed improving it.
Different target groups have different daily routines, so they allow "smart sharing".
We chose Industriestrasse in Lucerne as an exemplary context in the city, since it is centrally located, with good public transport connections and also because it already has a certain urban, lively mixture. Our development project plans four different building types as a replacement building (Ersatzneubau), which is networking, adding and compressing with the surroundings.

We have three different room types. my room is the most intimate, which I only use myself. our room is the kitchen and dining area, which I share depending on the target group and life situation. your room is a room with a specific use for example a music room, a library or a guest room. So this room is a common room which I share with the community. It´s also possible to rent this room for my own and use it as an office or an atelier.
space⁺ serves as a communicative connecting element that links all rooms and building sections together. It also provides an additional gathering space for living and working.

Communal use of rooms achieves a sustainable approach to costs and space. That also produces an added value in terms of efficiency of space. The flexible use potential of mobility and objects (such as tools, household appliances, clothing etc.) is a further added value offered by our vision.

"smart sharing" means implementing the key issues of sustainability.



1.1 Urban Design Strategy

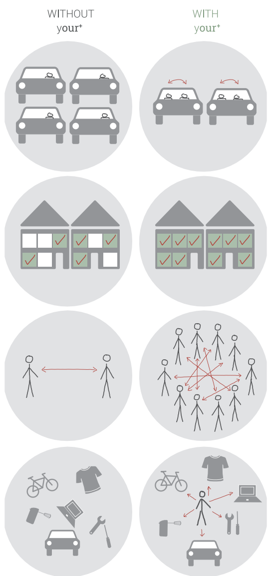
With our idea to organize limited and expensive resources, such as space and energy, we respond to the current challenges of population growth, living area limitations, rising energy costs and land use. We chose Industriestrasse in Lucerne as our exemplary local context in the centre of the city. The Industriestrasse area is a culturally diverse and attractive living area with old buildings that do not meet criteria for rehabilitation measures. We implement a new complex of buildings with six storeys to replace the existing buildings. This replacement aims to strengthen the existing mixed and cultural neighbourhood, as the concept of "smart sharing" is linked to the surrounding residential areas. So our idea of sharing and exchanging not only creates a communal platform, but beyond that also creates added value.

"smart sharing – our vision is **your⁺**"

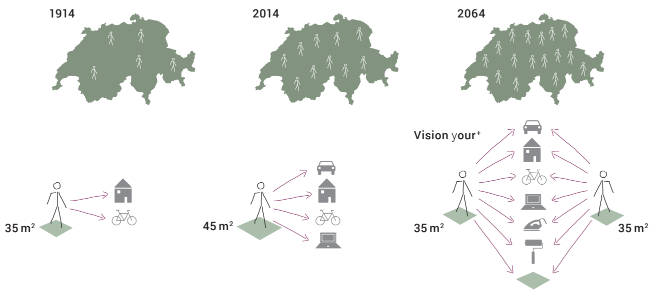
Our vision aims to create and build a base for "smart sharing". This base offers ways of saving resources while also improving quality of life. Ideal utilization achieves added value for everyone. The principle of a cooperative, which has a long tradition in Switzerland, serves as a basis for this vision. We apply the cooperative idea of sharing consumer goods to the way rooms are used. Initial situation: Although and because different social groups have different daily routines, requirements and demands, rooms are often empty. *Further information: PM#6 chapter 1.2.* The solution: By optimizing the way we use rooms, we save resources and space while also improving quality of life. *See Img. 1*

Current Challenges

We want our vision to actively address current challenges such as a growing population, increased land use and the burden on resources and the environment. Today's society consumes natural resources faster than they regenerate. In addition to consumer goods and mobility requirements, the way we use space is an important factor. In Switzerland, residential living space requirements have risen from 35 m^2 per person in 1980 to 45 m^2 today. Nevertheless, the population is not willing to reduce levels of comfort or consumption, neutralising every efficiency increase with further additional consumption. Our vision of "smart sharing" therefore seeks a different, sustainable future. *See Img. 2*



Img. 1 "smart sharing" with your⁺



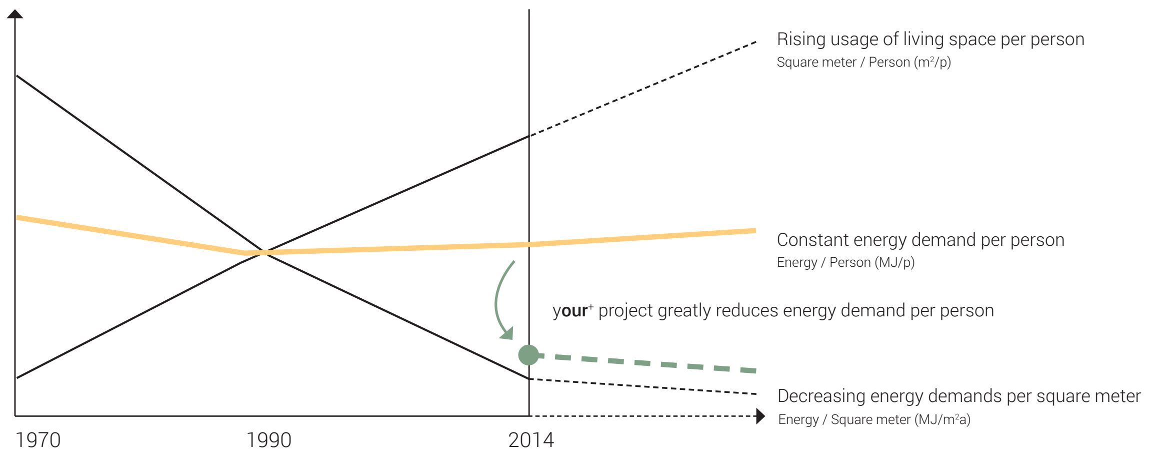
Img. 2 Evolution of demography and its needs

We also address a social level: We create social synergies through exchange, trust and integration, combined with responsibility and identification with the idea and the location. All this can be managed by the your+ smart sharing base.
Further information: Appendix 02 What we share...

A hundred years ago Switzerland had a population of about 4 million inhabitants. Nobody owned more than a house and a bicycle. Today in 2014, the population has doubled and individuals not only have a house and a bicycle but also a car, a guest room often more. *See Img. 2.* In reality we use significantly more resources than we need, and due to an increasing population we will consume more in the future if we don't change our lifestyle. By utilizing a concept of "smart sharing", we can save resources without reducing our standard of living.

Today, we use an average of 45 m² and live alone or as a pair in a 2-3 room apartment. That isn't just inefficient, it also burdens the resource of land. With our idea, the your+ concept of "smart sharing", we achieve a utilization of just 35 m² per person, instead of the usual 45, while not only maintaining the standard of living, but raising it. *See Img. 3*

Our idea of "smart sharing" not only creates a communal platform, but also added value.



Img. 3 Forecast of average demand for living space and energy per person

Implementation as an Urban Design Concept

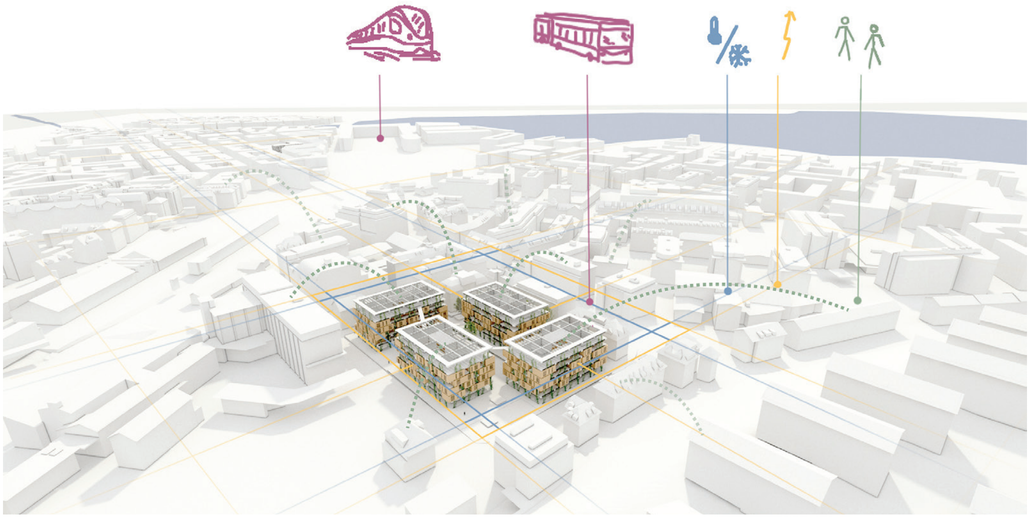
The contextual focus of the Solar Decathlon lies in urban areas. The urban planning development in Lucerne reveals several dynamic residential and business areas around a strong core and old-town zone.

We are planning an exemplary development in Industriestrasse in Lucerne to implement our vision of a new concept that is nevertheless anchored in tradition. It is a central urban area with great potential for urban density, in which current themes could be addressed in an exemplary way. Industriestrasse is characterized by its proximity to Lucerne train station and Lake Lucerne, a local recreation zone. *Further information: PD#6 GE-301 - 304.* It is also a lively area, which already has a diverse user group in a mixed socio-cultural context and is a perfect basis to create our vision. *See Img. 4 + 5*
Using the concept of "smart sharing", as we plan our project within this existing development because the characteristics are similar to many other urban situations in Switzerland and the world. We believe this quarter provides ideal conditions, since it is central and lively and already has a great variety.
Our replacement development involves four different buildings that complement, densify and network their surroundings. *See Img. 6 + 7.*

For our your + concept of "smart sharing" we select three different room types and connect them in various numbers and sizes. We present our smart sharing base in this way. The three room types show varying grades of shared and private areas, which are all connected by the space +. They also create zones with different levels of privacy, along which the appropriate uses and room accesses are aligned. The spatial density and building form, the results of energy aspects and the ideal use of solar power generation allow the new quarter to function autonomously. To secure the private areas, the floor plan arranges the rooms in a protective way. *See Img. 6 - 8.* Common areas are easily accessed and centrally located, semi-private rooms are more secluded and private areas are furthest from the normal circulation and walking paths. The private spaces are available in different variations to achieve attractive living solutions for various residents and accommodate their varying lifestyles.
Today, we utilize an average of 45 m^2 and live alone or as a pair in a 2-3 room apartment. That isn't just inefficiant, but it also burdens the resource ground. With our idea, the your+ concept of "smart sharing", we achieve a utilization of just 35 m^2 per person, instead of the usual 45, while not only maintaining the standard of living, but raising it.
Further information: PD#6 GE-310

Img. 4 Current state of the local context - overview

Img. 5 Current atmosphere of the local context



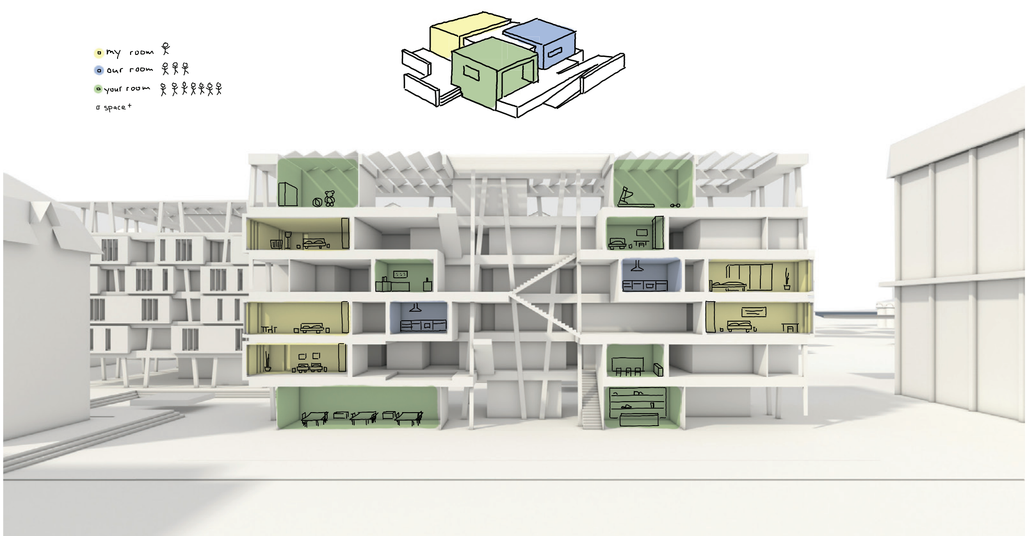
Img. 6 Localization of the urban context

Img. 7 Visualization of the urban context

Img. 8 Floor plan

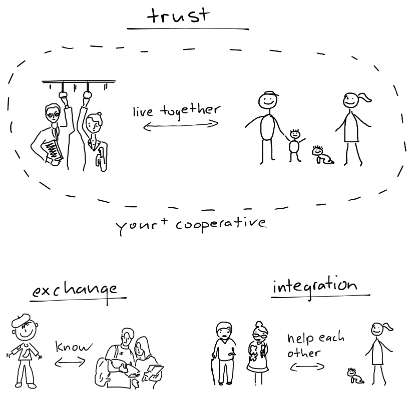
Room Types and Access

We have developed three different room types for the basic principle of "smart sharing":
my room = as a bedroom and bathroom, i.e. my very private area that I alone "own" and use.
our room = the kitchen and dining area that one shares with other people depending on the living situation. For instance each family has its own private kitchen, a shared apartment shares a kitchen and commuters have no kitchen at all.
your room = a room for specific use, which can be for performances or guests, a library or a music room, as well as e.g. a playing room for children. It is therefore a room that is shared communally. It should also be possible for individuals to hire and use such rooms when they are needed, e.g. as offices and studios.
These three different room types are connected and accessed by the space +, which also serves as a communal and meeting area. It stretches over the entire ground floor and the rooftop area, on which we have planned a rooftop terrace covered with PV modules. *See Img. 9*



Img. 9 The three room types and the **space⁺**

The added value of social synergies can develop within the safe basis of the community. A new way of living together can emerge by making exchange and integration possible.
See Img. 10 and *further information PD#6 GE-311*



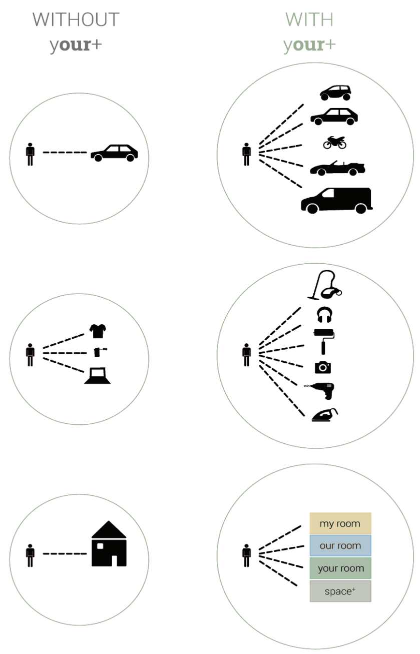
Img. 10 Surplus of social synergies

The flexible use potential of mobility and objects (such as tools, household appliances, clothing etc.) is a further added value offered by our vision.
See Img. 11 and *further information: PD#6 GE-312*

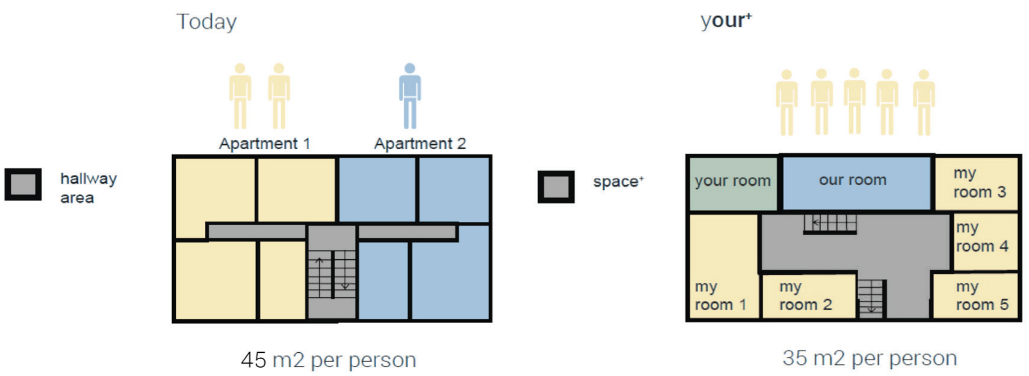
The communal use of your room achieves a sustainable approach to costs and space. That also produces an added value in terms of efficiency of space.
See Img. 12 and *further information: PD#6 GE-312*

Not only are mobile usage possibilities provided for externals, but also travel distances can be saved through internal solutions such as home offices.
Further information: PD#6 GE-313

Our development project plans four different buildings types that are networked together, but also have contact with the neighbouring buildings.
Further information: PD#6 GE-313



Img. 11 Surplus of flexible usage possibilities



Img. 12 Surplus of surface efficiency

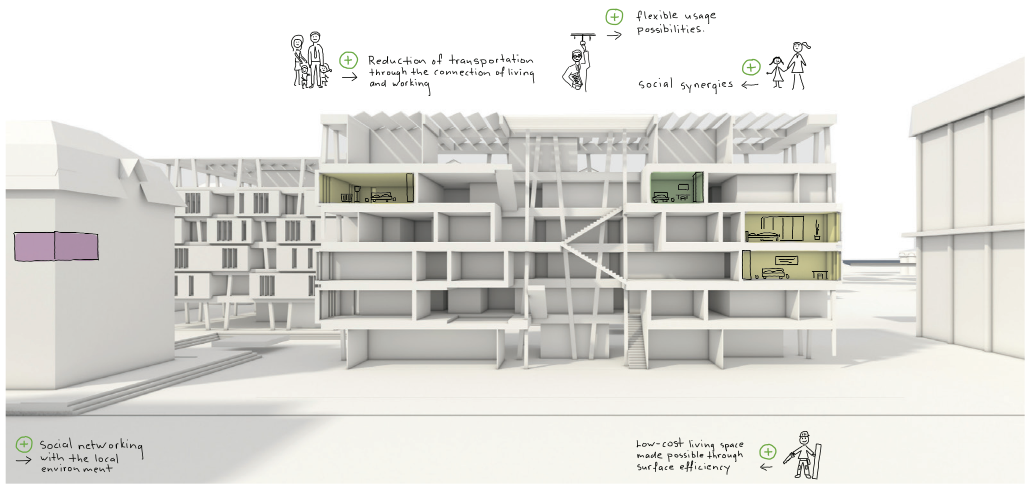
your⁺ as a smart sharing Base for your Added Value

Different users and residents that create a broad diversity increase their options through a cycle of "smart sharing". Offers of sharing can reduce spatial and mobility requirements, thereby preserving resources and simplifying problems related to ownership. People of different ages and status are offered an individual life within a shared environment. That creates a surplus for a heterogeneous community that saves resources by sharing them and benefits from an innovative lifestyle. In the future, ideal access to desirable things such as rooms, objects, services, mobility and energy will be very important. Using a smart sharing base, we activate that notion of ideal access in our project your⁺. An entire network spans across society, contributing to more efficient energy use to conserve resources and achieve a surplus in terms of living together. Our understanding of self-sufficiency is therefore demonstrated within a smart sharing base. With your⁺ we seek a solution for one location first, but with our eyes on the goal of global impact. Besides changing our energy supply to renewable sources, an important factor for a sustainable future is to use non-renewable resources as efficiently as possible. With our concept, we trigger identification with the idea of a self-sufficient lifestyle.

We are creating a platform that conveys a message – a message of a new lifestyle, your⁺, your added value. Everyone benefits mutually, everyone takes and everyone gives, everyone is networked with each other. The lifestyle focuses on using instead of owning and we provide the general conditions. In the community, anything is possible if space permits. The focus is on people, not money – objects, energy, shared spaces and experiences.

See Img. 13 + 14 and *PD#6 GE-330*

Img. 13 Your surplus with your⁺
Img.14 Summary of the surpluses



Implementation as a Prototype

The transition from the conceptual context to the prototype occurs through the vision of the smart sharing base. It is deliberately not built 1:1 in the way the building concept would be built. The prototype conveys a vision of a lifestyle and not a single-family dwelling. The prototype is presented as an example of our new spatial usage concept. So each of the three room types is built once and connected by the space$^+$. *See Img. 15.*

In addition to social aspects, we also integrate the development into the environment on an ecological and energy level. The urban context provides the networking of energy potentials to generate the possibility of energy in urban areas. Its excellent location also allows the building to provide for several households. Utilizing a smart grid, entire complexes and neighbourhoods are connected with energy technology, which can help meet their needs for heating and cooling efficiently. *See Img. 16.*

With sun-tracking photovoltaics, which also serve as a sun screen on our rooftop terrace, we use the roof area in a highly efficient way both energetically and compactly. *See Img. 17.*

General Idea of the Energy Systems

The proposed concept of sharing runs like a common thread through the whole project. For the urban buildings to function well as an overall system, every part of it must be implemented according to the concept. To fulfil these requirements the energy systems will be implemented with an energy-sharing concept.

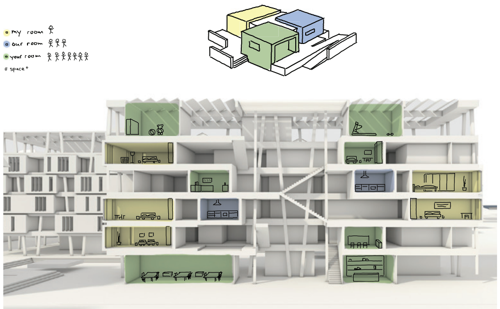
In the local context the whole energy system is optimized to connect the building's thermal and electrical systems to its surroundings.

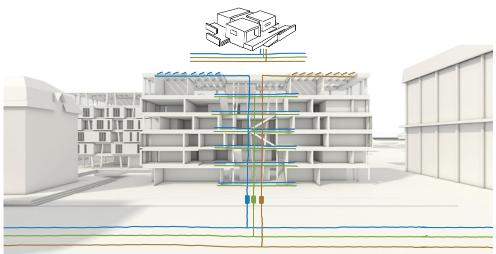
Multiple buildings receive a role in the demand and supply management of heating and cooling energy as well as electricity. *Img. 16* shows how the urban buildings will be connected to other buildings in the area. Electrical connection of buildings is widely known, but this connection needs to be smarter. Buildings in an area must not only be electrically and thermally connected, but must also communicate with each other. A coordinated strategy of demand and supply management allows the areal connection of built structures to adjust their energy systems to work together in an overall way. The entire area develops into an energy hub, which can provide various energy services. *Further information: PM#6 chapter 4.1.*

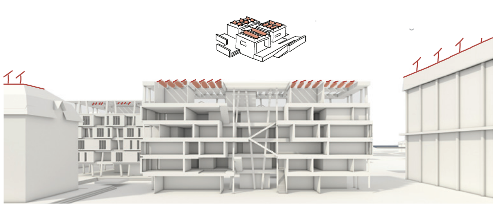
In the concept of your$^+$ the connection of buildings will not only remain in the electricity grid, but will expand to heating and cooling energy as well. This creates a multi-energy grid for a whole area. To optimize the functions of this multi-energy grid, enough buildings in the perimeter must be connected to the planned your$^+$ prototype.

Every building in the perimeter will receive its own task in the multi-energy grid. For example the hybrid solar collectors on one building's roof produce heating energy and electricity. Another building may work as a heat store, while yet another building may be an energy hub. All the buildings are connected by underground wiring and piping. To increase the efficiency of the whole system, thermal storage will be included in the multi-energy grid. Such thermal storage will be constructed underground and may be designed as geothermal probes. The storage capacity allows a shift in thermal energy between summer and winter. *See Img. 16.*

Img. 15 Translation prototype to urban design
Img. 16 Technical networking – energy and building technology
Img. 17 Technical networking – Photovoltaic modules on the roof top used also as sun screen

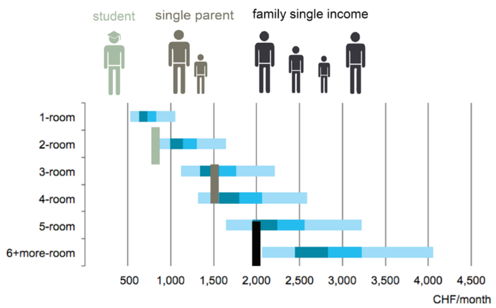




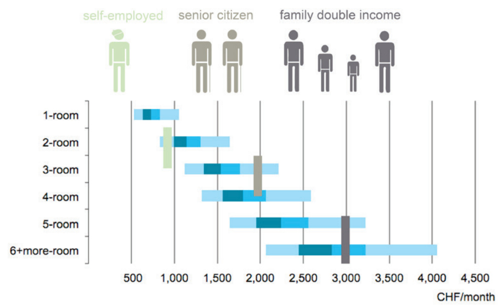


1.2 Market Viability of the Product

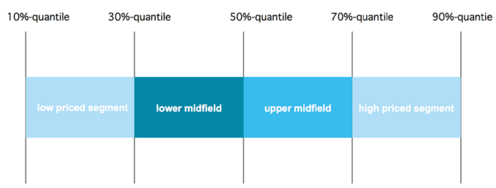
Our concept of sharing and exchanging shows a solution for developments in the Swiss society such as population growth, constantly rising rents and changes in family structures. With our spatial arrangement we reduce the living space per person to an average of 35 m^2 compared to the current average of 45 m^2 per person. Instead of reducing individuals' space, we do this by sharing it. Sharing reduces every resident's rent for two reasons.
1. Sharing space in terms of different times. Inhabitants only pay for the rooms when they use them.
2. Sharing space at the same time and reducing individual inhabitants' costs by dividing them.
In addition to the financial benefits, the concept offers inhabitants an easier and flexible way to control and manage their lives. To demonstrate the viability of our concept, we illustrate it in two different market segments: one based on a cooperative in the low price segment *see Img. 18 + 20* and one for a regular investor. *See Img. 19 + 20*. We can determine that both scenarios are affordable for Switzerland and that there is a need in the Swiss population for more efficient use of living space.



Img. 18 Rents of the target groups in the scenario cooperative compared to rents in Lucerne



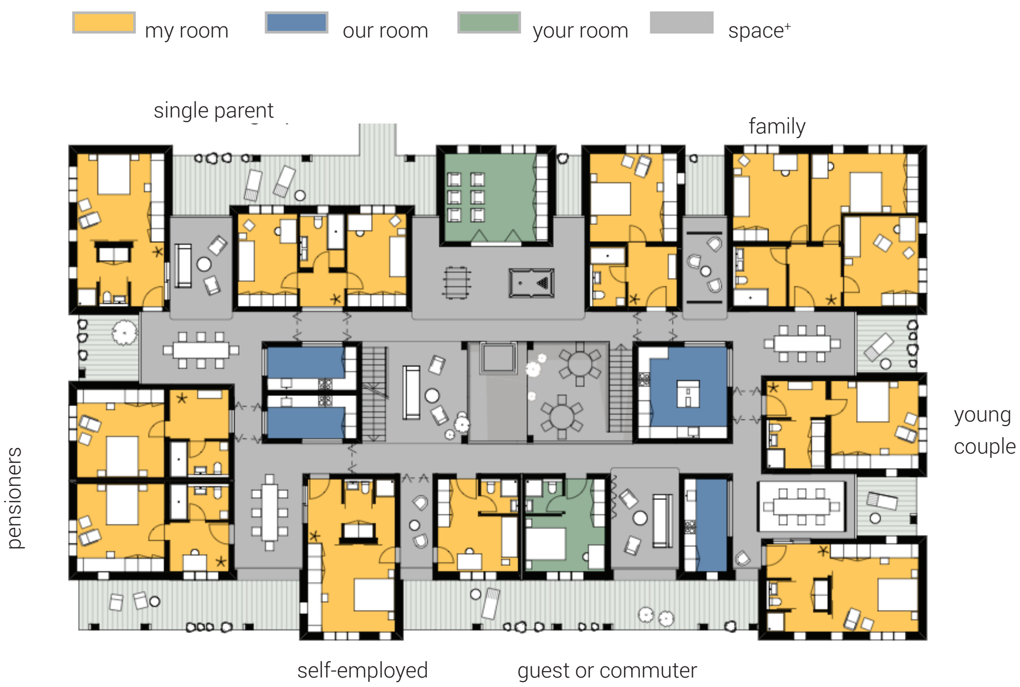
Img. 19 Rents of the target groups in the scenario investor compared to rents in Lucerne



Img. 20 Quantile definition

Target Groups

The most important aspect of our target group is that it is really heterogenic. To picture the target groups more clearly, we developed personas. The main characters are four basic persona types with the names: short stayer, open minded, socialiser and the family In each of these four groups, two different stereotypes are developed. These types lead us through the different stories to understand the project. In addition to the inhabitants, also neighbours around the project and even other cooperative participants can benefit from the your⁺ building. The project works in a lower and a higher price range. Therefore it should be mentioned that the income of all the different stereotypes is one reasonable example. These incomes can vary. So all the presented stereotypes could live in the higher price range or in the lower price range. *See Img. 21*. *Further information: PM#6 chapter 1.5* and *Appendix 03 Surface of the building*



Img. 21 Floor plan of all the target groups

Short Stayer

The first example is the short stayer, who is not planning on resting at one place for a long time. He is looking for a place that is prepared and furnished. He has an often-changing schedule, so he needs a housing solution that can adapt to this lifestyle. The short stayer can for instance be a traveller or a commuter. The furnished rooms in the your+ concept offer a perfect solution for short stayers, because they can reserve them flexible using the your+ App. Compared to a normal hotel room, users can reserve all the your rooms in the your+ concept and benefit from the offered social environment.
See Img. 22 - 24.

Luc, self-employed

room type	m2	shared with	m2 per person
my room	18.8	1 Pers.	18.8
our room	9.7	4 Pers.	2.4
your room	22.9	21 Pers.	1.1
space +	267.4	21 Pers.	12.7
total m2 per person			**35.0**

Img. 22 Rooms open-minded

Img. 23 Cooperative scenario

student

room type	m2	rent/m2	shared with	duration	rent	incom
my room	18.8	23.33 CHF/month	1 Pers.	1 month	439 CHF	
our room	9.7	23.33 CHF/month	5 Pers.	1 month	45 CHF	
your room	22.9	0.6 CHF/h	5 Pers.	10 h	27 CHF	
total month					**511 CHF**	**2'500 CHF**
total year					**6'137 CHF**	**30'000 CHF**

Img. 24 Investor scenario

self-employed

room type	m2	rent/m2	shared with	duration	rent	incom
my room	18.8	31.67 CHF/month	1 Pers.	1 month	595 CHF	
our room	9.7	31.67 CHF/month	4 Pers.	1 month	77 CHF	
your room	22.9	0.75 CHF/h	5 Pers.	10 h	34 CHF	
total month					**706 CHF**	**7'500 CHF**
total year					**8'478 CHF**	**90'000 CHF**

These two examples can be compared with a 1,5 - 3 room apartment in *Img. 39*

Open Minded

The second group is the open-minded inhabitant. This group is open to new styles of living. They are looking for new ways of living and an environment to get into contact with other people. They want to meet other people and engage themselves in a community. Generally, they are interested in many different things and activities. That means they need different types of rooms, which they can share with other residents. Exactly this need is covered by the your+ concept. This open-minded type could be a life artist or a student. *See Img. 25 - 27.*

Jan, commuter

room type	m2	shared with	m2 per person
your room	18.9	2 Pers.	9.5
your room	22.9	21 Pers.	1.1
space +	267.4	21 Pers.	12.7
total m2 per person			**23.3**

Img. 25 Commuter rooms

Img. 26 Cooperative scenario

traveler

room type	m2	rent/m2	shared with	duration	rent	incom
your room	18.9	3.5 CHF/night	1 Pers.	10 night	662 CHF	
your room	22.9	0.6 CHF/h	1 Pers.	10 h	137 CHF	
total month					**799 CHF**	**3'333 CHF**
total year					**9'587 CHF**	**40'000 CHF**

Img. 27 Investor scenario

commuter

room type	m2	rent/m2	shared with	duration	rent	incom
your room	18.9	5 CHF/night	1 Pers.	10 night	945 CHF	
your room	22.91	0.75 CHF/h	1 Pers.	10 h	172 CHF	
total month					**1'117 CHF**	**9'167 CHF**
total year					**13'402 CHF**	**110'000 CHF**

These two examples can be compared with a hotel -room in *Img. 42*

Socialiser

The next group is called socialiser. This group is looking for social integration, support from other people and is also willing to help others. Therefore, the your+ concept offers them the perfect base. They can live together with other people in shared apartments and share daily life situations like cooking or playing games together, or other specific activities in a your room. The socialiser can for instance be a single parent or a senior citizen. *See Img. 28 - 30.*

Laura, single parent

room type	m2	shared with	m2 per person
my room	19.1	2 Pers.	9.6
my room	19.1	2 Pers.	9.6
our room	9.8	4 Pers.	2.5
your room	22.9	21 Pers.	1.1
space +	267.4	21 Pers.	12.7
total m2 per person			**35.4**

Img. 28 Rooms socialiser

Img. 29 Cooperative scenario

single parent

room type	m2	rent/m2	shared with	duration	rent	incom
my room	19.1	23.33 CHF/month	1 Pers.	1 month	446 CHF	
my room	19.1	23.33 CHF/month	1 Pers.	1 month	446 CHF	
our room	9.8	23.33 CHF/month	1 Pers.	1 month	229 CHF	
your room	22.9	0.6 CHF/h	2 Pers.	20 h	137 CHF	
total month					**1'257 CHF**	**5'000 CHF**
total year					**15'089 CHF**	**60'000 CHF**

Img. 30 Investor scenario

senior citizen

room type	m2	rent/m2	shared with	duration	rent	incom
my room	19.1	31.67 CHF/month	1 Pers.	1 month	605 CHF	
my room	19.1	23.33 CHF/month	1 Pers.	1 month	446 CHF	
our room	9.8	31.67 CHF/month	1 Pers.	1 month	310 CHF	
your room	22.9	0.75 CHF/h	1 Pers.	20 h	344 CHF	
total month					**1'704 CHF**	**8'333 CHF**
total year					**20'452 CHF**	**100'000 CHF**

These two examples can be compared with a 3 1/2 - 4-room apartment in *Img. 39*

Family

The last group is the family, which can be a classic model with a mother, a father and two children. But it can also be any kind of patchwork family. Nowadays often both parents are working, so they depend on someone to take care of their children when they are not at home. The your⁺ concept presents a smart sharing base to achieve solutions, by finding another resident or a kindergarden, which is integrated in the your⁺ concept. Parents in the target group want their children to grow up and benefit from a socially aware environment and learn the concept of sharing and exchanging from the beginning. *See Img. 31 - 33.*

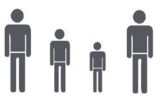
Hofstetter family

room type	m2	shared with	m2 per person
my room	22.3	4 Pers.	5.6
my room	23.7	4 Pers.	5.9
my room	22.6	4 Pers.	5.6
our room	20.7	5 Pers.	4.1
your room	22.9	21 Pers.	1.1
space +	267.4	21 Pers.	12.7
total m2 per person			**35.1**

Img. 31 Rooms family

Img. 32 Cooperative scenario

family single income



room type	m2	rent/m2	shared with	duration	rent	incom
my room	22.33	23.33 CHF/month	1 Fam.	1 month	521 CHF	
my room	23.73	23.33 CHF/month	1 Fam.	1 month	554 CHF	
my room	22.56	23.33 CHF/month	1 Fam.	1 month	526 CHF	
our room	20.65	23.33 CHF/month	2 Fam.	1 month	241 CHF	
your room	22.9	0.6 CHF/h	3 Fam.	15 h	69 CHF	
total month					**1'911 CHF**	**6'667 CHF**
total year					**22'926 CHF**	**80'000 CHF**

Img. 33 Investor scenario

family double income

room type	m2	rent/m2	shared with	duration	rent	incom
my room	22.33	31.67 CHF/month	1 Fam.	1 month	707 CHF	
my room	23.73	31.67 CHF/month	1 Fam.	1 month	751 CHF	
my room	22.56	31.67 CHF/month	1 Fam.	1 month	714 CHF	
our room	20.65	31.67 CHF/month	1 Fam.	2 month	1308 CHF	
your room	22.9	0.75 CHF/h	3 Fam.	15 h	86 CHF	
total month					**3'566 CHF**	**10'000 CHF**
total year					**42'796 CHF**	**120'000 CHF**

These two examples can be compared with a 5- 6 room apartment in the *Img. 39*

Time Schedules

The life rhythms of the target groups can be analyzed in two different ways: firstly who uses which room at what time of the day, and secondly for how long they stay in the apartment. Analysis of these rhythms clearly shows that there are many possibilities to improve the use of spatial resources. Optimizing this flexible living situation and coordinating it with the varying time schedules of the target groups allows maximum efficiency of usage for all aspects of your+. This means rooms, mobility options and house amenities are often used around the clock and can even be used simultaneously for a better efficiency with respect to different kinds of resources. *See Img. 34.*

Analysis of the Population (Target Groups)

To solve the question of the target groups, we used the analysis of the "Bundesamt für Statistik" (Federal Office of Statistics), and stereotypes of residents of cooperatives. Along with population growth, the way of life has changed. People are more flexible – changing their life partner as well as their living space more frequently.

In the next 40 years it is projected there will be nearly 1/3 more 80 year-olds than newborns.
The trend of commuting in Switzerland has strongly risen in recent years. This development is the result of expensive housing in the Swiss metropolitan areas among other factors. It is relevant for this target group to be offered living space in both places: place of residence and place of work.

The group of single parents in Switzerland is constantly growing. This group often has financial difficulties and must be integrated into social and community projects.

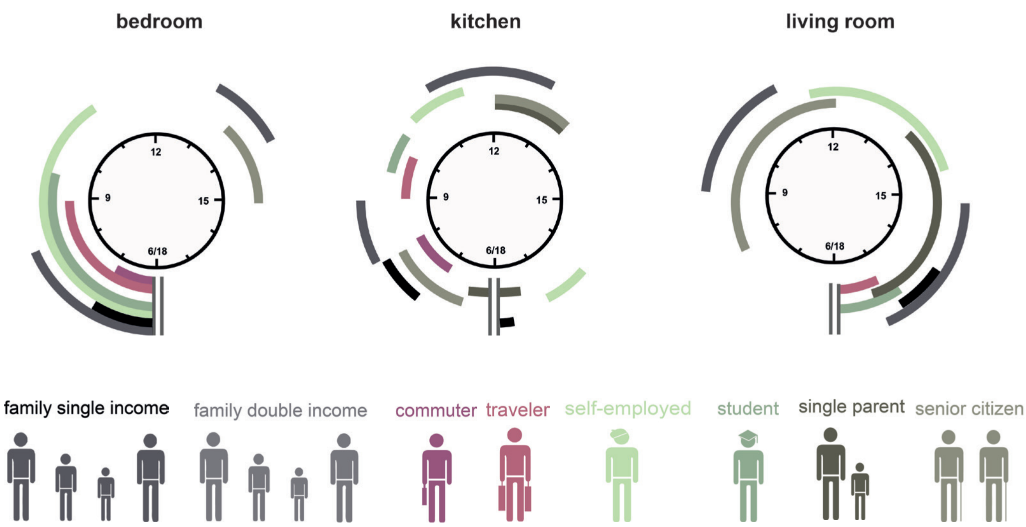
The target groups have been chosen in terms of their suitability for the cooperatives (students, travelers, self-employed) and development trends in the Swiss population (senior citizens, single parents, commuter), which were developed by the Swiss federal statistical office. *Further information: Appendix 04 Market Viability.*

Project Viability at the chosen Site

Our urban design project has the exemplary location of Industriestrasse, which is in the up-and-coming district of Lucerne. In 2011, the City of Lucerne, which owns the land, planned to sell the area. A competition was announced and won by the developer Allreal. The inhabitants of the area started a citizens' initiative to stop the development and forced the city to keep the land and give it to a residential building cooperative as a land lease. The initiative was accepted with 65 % approval. This showes that the inhabitants in Lucerne want affordable and innovative building concepts.

Applications for the Inhabitants

For our project we have developed two Apps, one to control the building and the other to explain our concept to the visitors. Both Apps are web-based and have been developed specifically for the competition, but should give an idea of how both tasks of control and manage could be implemented in a real building.



Img. 34 Daily schedules of the target groups

Market in Switzerland

The market in the city of Lucerne offers rented flats, owner-occupied flats and family homes. Therefore, the graph shows that almost 80% of the entire market is covered by rented flats. *See Img. 35.*

Furthermore, the vacancy rate for flats in Lucerne ranges between 0.5% and 0.9%. This ratio indicates a very low rate, which means that all vacant flats are rented very quickly. In 2012 over 800 new buildings for housing were built. Nevertheless, the vacancy rate even declined from 2011 to 2012. *See Img. 36.*

It should also be noted that the volume of rented flats on offer declined in 2012. Compared to owner-occupied flats they were lower in 2013. The outcome of all these points is that even though the market in Lucerne provides a high number of rented flats, there is still an increasing demand in Lucerne. Therefore the project, which especially offers rented flats, covers exactly the current market needs in Lucerne.

Affordability of Property Ownership

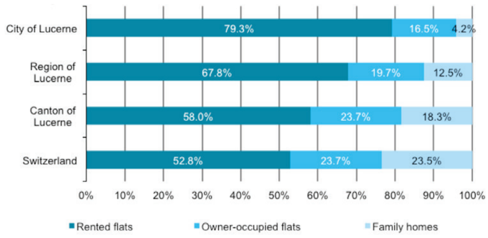
The Lucerne population has an average income of CHF 75,800 per year. It is slightly lower than the Swiss average, which has an annual income of CHF 83,900. In comparison to that, our target groups earn CHF 76,000 per year. This number is an income average of all the target groups. That contrast shows that all our target groups are congruent with the Lucerne population. This case is illustrated on the following chart. *See Img. 37.*

It is assumed that only a third of the available income is spent on living. This third of available income is used in our concept for the monthly financing of a rented apartment. As is clear in the above chart, all target groups are within this third, meaning all rooms are affordable.

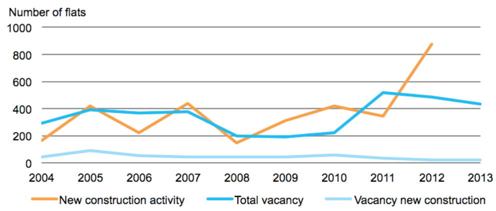
Price per Unit for Rented Flats in Lucerne

The prices of rented flats are divided in five different quantiles. The lowest quantile (10% quantile) represents flats with the lowest quality, whereas the 90%-quantile represents flats with best quality. Therefore these flats also cost the most. In Lucerne the price for a one room apartment is between CHF 530 and CHF 1,050 per month. For example a six-room apartment can cost between CHF 2,060 and CHF 4,060, depending on the age of the real estate, the condition and the location. The different prices are shown on the following table. *See Img. 38.*

Img. 35 Housing market in Lucerne

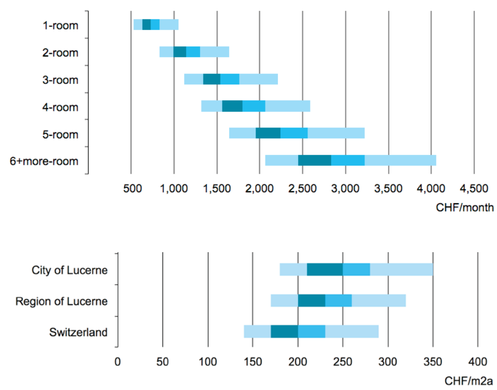


Img. 36 New construction and empty housing in Lucerne



Img. 37 Purchasing power per houshold

Owner-occupied flats	City of Luzern	Switzerland	Target Group
purchasing power per houshold (CHF)	75'800.00	82'700.00	76'000.00



Img. 38 Prices of rented apartments in Lucerne

Land costs at Industriestrasse are CHF 15.8 million, with a rate of 2,000 CHF/m². This number is a benchmark from *Img. 39*

Img. 39 Prices of land in Lucerne

Rent Analysis: Comparison with Kalkbreite Cooperative, Zurich

To compare the project with an already existent cooperative development, we chose the Kalkbreite cooperative in Zurich. The characteristics of this cooperative are very similar to those of the your⁺ project. The Kalkbreite cooperative is situated in Zurich in a very central, urban location. A highly diverse population also lives in that residential area. The concept of sharing and exchanging has already been successfully implemented in that cooperative. A share in the cooperative costs CHF 1,000 and is compulsory for acceptance in the community. Upon moving in, there are further payments depending on the size of the relevant apartments.

To compare our rent ideas with a real development, we found comparable calculation types in the Kalkbreite cooperative. They are presented in the following table. *See Img. 40.* It should be noted that the "Flex Rooms" in the Kalkbreite cooperatives are comparable with the your rooms in our project. The Garni Rosa in the Kalkbreite can be compared to our commuter rooms.

Img. 40 Prices compared to the Kalkbreite cooperative

1 room	member	non-member	unit
	600.00	-	CHF/month
Garni Rosa			
	40.00	60.00 - 80.00	CHF/night

Comparison with hotel rooms in Lucerne

To calculate our rents for the commuter/guestroom in the scenario "Investor", we have analyzed star hotels and hostels in Lucerne. We found rates of between CHF 80 and CHF 120 per night. Therefore we calculate our rates at CHF 95 per night. *See Img. 41.*

Img. 41 Prices of hotels in Lucerne

Hotel in Luzern	1 person	unit
Hotel-Pension Marrhahaus	80	CHF/per night
Hotel Bellary	95	CHF/per night
Hotel Hottingen	90	CHF/per night
Ibis Budget Hotel Luzern City	119	CHF/per night

Energy-System in the Urban Context

Living more efficient with local Energy Sharing
The implementation of a new lifestyle into an existing neighbourhood requires a sustainable energy system to carry the load of the new challenges. Because of the rising production of renewable energy the system needs new ways of storage.
To fulfil these requirements we pick up the concept of sharing, which runs like a common thread through the whole project. All energy systems will be implemented with an energy-sharing concept. Therefore the planned urban buildings of your+ will be connected to its surroundings with a Multi-Energy Grid which includes thermal energy, electricity and natural gas. Through this combination of the three energy networks a lot of connections between two grids can be used to transfer energy.

To be able to retrofit the energy systems of a whole neighbourhood each building needs to be renovated and its energy consumption must be reduced in the first point. Multiple buildings receive a role in the system for example production building with hybrid photovoltaic cells on the roof. A coordinated strategy of demand and supply management allows the areal connection of built structures to adjust their energy systems to work together in an overall way. After the retrofitting process all the buildings are able to use the synergies between them and the sharing of energy is realized in the local context.

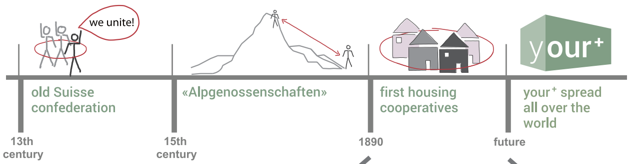
The most important thing in the future energy systems is being able to store electricity. Connecting electric vehicles such as e-cars or e-bikes to the electric system allows using their rechargeable batteries to work as additional storage. Also the user is able to travel by those vehicles, which generates an extra sustainable benefit. Thus the whole transportation strategy is integrated in the electric concept.
Further information: PM#6 chapter 4.1.

1.3 Individual or Collective Housing Building Concept

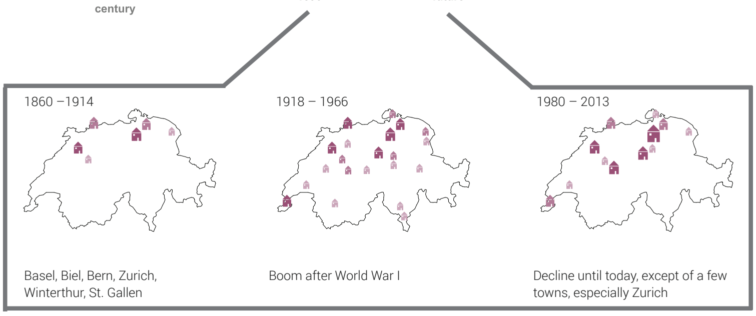
In Switzerland there is still a preference for owning an individual house, which requires plenty of space. But innovative collective housing construction concepts could demonstrate more sustainable ways of urban development. The high potential is shown in the project your⁺: We define three different room types: my room is the most intimate, which is only used by one party. our room is the kitchen and dining area, which is shared by two or three parties depending on the target group and living situation. your room is a room with a specific use, for example a music room, a library or a guest room. This room is a common room, which is shared with the community and can provide generous space for part time activities. It's also possible to rent this room for one's own and use it as an office or studio. The space⁺ serves as a communicative connecting element that links all rooms and building sections together. It also provides an additional gathering space for living and working.

Historical Basis in Switzerland

Cooperatives and sharing have a long tradition and cultural significance in Switzerland that began centuries ago. Since then, the idea of living and working together has been deeply rooted in Swiss society. We utilize this cultural tradition with our your⁺ concept and interpret the idea of cooperatives in a new way. The members of a cooperative society pool resources for the benefit of all members, always focusing on people and added values, not only revenue, as is common with corporations and profit-oriented businesses. In the early middle ages, "Allmends" were created by farmers for shared land to be used for livestock grazing. During the 15th century, Swiss mountain farmers joined together in "Alpgenossenschaften" ("mountain cooperatives") to collectively combat the overwhelming forces of nature and their surroundings. Survival amongst boulders and glaciers was hardly possible alone, and since then, the idea of working together has been deeply rooted in Swiss society. *See Img. 42.* Around 1860 the first housing cooperatives emerged. Created out of need due to the housing shortage, their goal and spirit remain relevant today. In addition to affordability and non-profit housing, they were also used to encourage solidarity, collaboration, and the exchange of information. During industrialization the regional and local aspects became more and more important, so small business and services were offered on-site. Towards the end of the 20th century, cultural life and social commitment increasingly developed as a central issue. *See Img. 43.*



Img. 42 Timeline of the tradition of cooperatives in Switzerland



Img. 43 Development of housing cooperatives

Development of Housing Cooperatives

Thirty Year Period

There are already many cooperatives in Lucerne. One very new area is the quarter around Industriestrasse, where the overwhelming result of a vote in 2012 "in favour of a lively Industriestrasse" led to the foundation of a cooperative. This is a strong signal in favour of more affordable residential and business space, and against the displacement of culture outside the city centre. What the people want – affordable residential space, maintaining open spaces for culture, support for small businesses and flexibility – are also the aims that we attempt to fulfil. We apply the cooperative idea of sharing consumer goods to the way we use rooms.
Further information: PD#6 GE-304.

After 10 Years

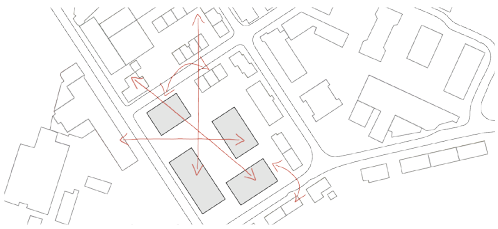
Our vision is a spatially, socially, technically and digitally networked quarter with the aim of ideally using rooms, services and means of transport and sharing them in a smart way. That proximity is also a social benefit, since an atmosphere of exchange and community encourage identification with a location and its residents. We want to live out that philosophy and will therefore engage with the local people intensively and work together with them and the already existent cooperative. The target timeline should mean that in 10 years, we have built our urban design concept with our four new buildings as replacement developments in the quarter. Networking and densification is sustained and continuous, so we are already strongly networked with the direct vicinity. *See Img. 44.*

After 20 Years

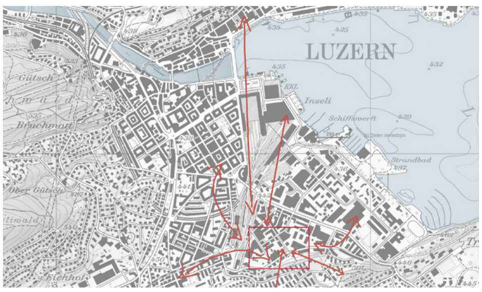
The more buildings, businesses and people participate, the more successful and diverse our concept will be. So after a further 10 years, we aim to have expanded into and be networked with other quarters in the City of Lucerne and even parts of the suburbs. *See Img. 45.*

After 30 Years

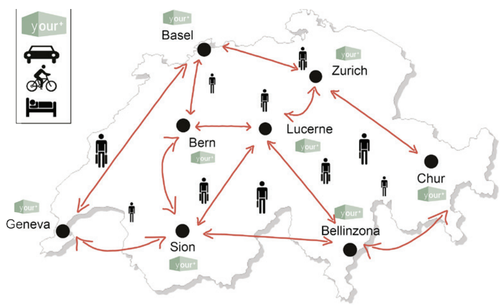
The concept of your⁺ functions most efficiently with multiple buildings in several Swiss cities to better serve the transient lifestyle of our target group. It is possible to offer the same concept in multiple cities and have a base station everywhere, be it as a commuter, a guest or a traveller. There are also examples of a cooperative system in Zurich, called "Kraftwerk". "Kraftwerk" started in 1990 and has now more than 5 settlements all over Zurich. *Further information: Appendix 05 Clusters and commons.* We will take our idea as a structural measure beyond the borders of Lucerne all over Switzerland. *See Img. 46.*



Img. 44 Connections in and out of the Industriestrasse quarter



Img. 45 Connections in and with the whole city of Lucerne



Img. 46 Connections between Swiss cities in thirty years

1.4 Mobility Strategies

Our smart sharing base also includes an integral mobility strategy for short, middle and long distance traffic. A network of different roads and stations for bycicles, e-bikes and cars, and nearby access to public transport are key elements. The context combined with the vision of sharing helps to implement new transport technologies like bike renting, the successful Swiss car sharing business by the "mobility" company or start-up ideas such as "Hitch|Hike". With these additions to the existing network we can increase comfort while decreasing the financial and ecological impact.
Buildings cannot cover all the needs of every inhabitant; therefore, we view our buildings as the starting point to every destination you travel to. Commuting, business purpose, educational pursuits, grocery shopping, leisure activities and other diverse destinations must be considered. *See Img. 47.*

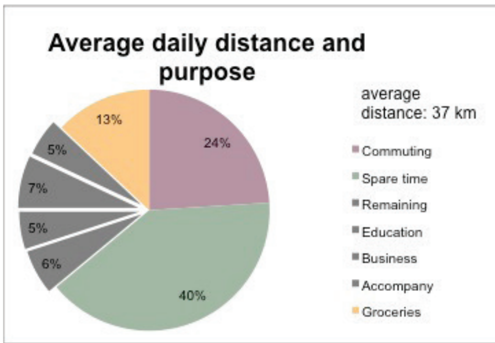
Average Daily Distance and Purpose

An average Swiss person travels 36.7 km per day in Switzerland. Representing a total of 77%, most of the distance travelled is due to:
• Leisure activities
• Commuting
• Shopping/groceries
These three points of interest will be addressed in this chapter. Although the 23% remain important, analysing these would take up an extensive amount of time and will not be further mentioned.

Implementation at Industriestrasse

For a specific transportation strategy we must determine the location of the housing. In our case this is Industriestrasse in Lucerne. your+ takes place in the urban centre in the City of Lucerne. This environment provides all the shops and stores required on a daily basis within a radius of 300 m. This map shows real examples. *See Img. 48.*

If you want to go grocery shopping, the nearest large shop is 2 minutes by bike. In general the bike must be considered as the main form of transport. Riding a bike not only saves you money, it also keeps you and the environment in good shape. Due to the already increasing percentage of cyclists as traffic participants, a city project has started to expand the network and provide easier access and security for cyclists.



Img. 47 Average daily distance and purpose

Img. 48 Transportation system in the urban context

Other ways to get your food home are delivery services. In your+, where the kitchen is shared with multiple groups, they can team up to send out an order to coop@home or LeShop. These home deliverers provide a supply of all daily groceries at minimal delivery cost. In the case of direct transport due to work or shopping, the bus station is just around the corner. A bus to Lucerne main station stops every 5 minutes. At the main station, train connections to travel to other Swiss cities are abundant. Other bus lines drive at the same frequency to the town centre, where the shops have the biggest and most diverse supply. To legally use all the public transport system you would have to buy the "GA travel-card" from SBB (the Swiss rail system). Once you buy it, you have access to the entire Swiss public transport grid. There are added benefits, such as ski tickets, cable cars, entrance to parks, resorts and so on.

Improvement due to the Urban Concept

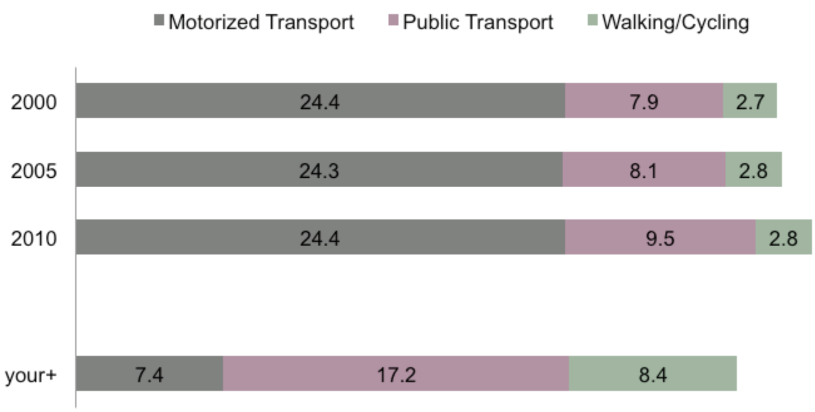
Living in an urban centre near working centres, grocery stores and leisure activities can reduce the average distance travelled. With the appropriate choice of your housing location - in this case Industriestrasse in Lucerne - the average daily distance can be reduced to 32 km (source: Swiss Federal Statistical Office). This is equivalent to removing the "Groceries" factor. *See Img. 49*

Classic Versus new Transportation Approach

The classic way of the average Swiss citizen is to buy a car and use it whenever he/she leaves the house. In cases where the distance is less than 6 kilometres, the car is used as often as all the other modes of transport together. That means that although the distance is feasible by bike, we use a car 50 % of the time. The only reason is our desire for convenience, which in this case means no physical effort, no timetables to study and no idle time. When calculated, this behaviour costs us an average total of 10,300 Swiss Francs a year for transport.

Our general approach to transport is AVOID – SHIFT – IMPROVE. your+ avoids unnecessary trips through urbanisation, shifts usage to public transport by urbanisation as well (availability of public transport in cities compared to rural areas) and improves the situation by sharing cars and other private vehicles, all made possible without compromising your comfort. *See Img. 49.*

The new transport approach has rules when to use which transport technology. The rules are not lined out exactly as every situation is special. It only helps to determine when to use what. The first rule is not to use any other transport than your feet. If the distance is less than half a kilometre you reach your destination within five minutes walking. For distances under 6 kilometres, it is advisable to use



Img. 49 Swiss Average Daily Distance and Means of Transport

the bicycle or e-bike. For this distance it is faster than a train, bus or trolley and there is no idle time. For activities like walking or cycling, all weather clothes are needed. It can be assumed that every Swiss citizen owns such clothes. If the weather circumstances increase the risk of an accident drastically it is advised to use public transport anyway.

For distances more than 6 kilometres it is advisable to use the public transport system, if a bus stop can be reached easily. Otherwise you have not followed the advice to move in an urban area. For further distances you also use the Swiss public transport system unless the destination lies out of reach of the system. Out of reach can be defined by common sense, i.e. to arrive in a reasonable amount of time compared to public transport. If no reasonable connections with train & bus are available, you are allowed to use the car. As you have mobility, Hitch|Hike, Sharoo and other car sharing suppliers, you can reserve a vehicle via your⁺ App and use it for the purpose you need.
The main strategic goals of the your⁺ transport approach are reducing the average distance per day per person and shifting the usage of modes of transport. In numbers, this means trebling the distance covered by foot or bike, doubling use of the best public transport system in the world and covering the rest of the distance using car sharing.

Convincing Residents to use the **your⁺** Transport Approach

A high percentage of the population wishes to drive a car although it is on average 4,300 Swiss Francs per year more expensive than the your⁺ approach. *Further information: Appendix 06 Transport cost information*.

This is a result of the car's safety, speed, comfort and ease of use. Different facts are put into perspective with respect to ease of use: A car can be steered with less physical effort, in common situations it cannot fall over, two or more individuals can comfortably use it at the same time and it can carry more luggage than an average bike. Summed up, the practicality and the fear of losing flexibility overcompensate for the economic and ecological drawbacks of a car. This is due to a subjective perspective. *See Img. 50.*
To alter this situation, your⁺ has planned to communicate the advantages actively through the mobility feature in the your⁺ App. Other facts also support the use of the vehicle smart sharing bases:

Img. 50 Sketch of your⁺ mobility feature

Direct implementation of sharing providers (mobility, m-way)

- In mobile device
- In space for vehicles
- Implementation to share your own car (Sharoo, Hitch|Hike)
- In mobile device
- In space for vehicles

Perfect vehicles for every purpose available, but only paying for what is needed

- Bicycles
- E-Bikes/Pedelecs
- Microcar
- Citycar
- Supermini
- Small family car
- Large family car
- Multi-van

All these facts contribute to awareness, but as the monetary motivation is not high enough to overcome the demand to own a car, we can only communicate the advantages. In this respect we trust that people who are able to recognize the advantage of sharing rooms are also smart enough to share vehicles.

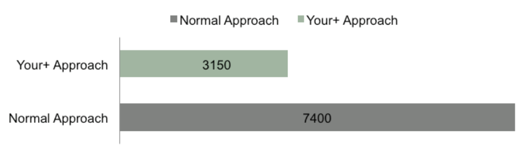
Energy and oil prices are experiencing a clear upward trend. The conclusion of this is that people will have to spend more money on heavy energy-consuming goods. These will also be the fields in which improvements have the most impact. Transport is in this respect already the biggest consumer. And since a transport rethink is already underway today, the prospects of greater investment in the outdated concept of owning will lose its attraction.

Carbon Footprint with New Transport Approach

The average bicycle costs 250 Swiss Francs a year. That includes bicycle amortisation, annual repair and lighting. Not considered are costs such as buying extra clothes – it can be assumed that suitable clothes are available – and opportunity costs, as the cyclist travels at lower speeds than a motorist, therefore spending more time on the road than being productive. Also not considered were possible additional costs due to the higher risk of injury. Likewise the gain in personal value through daily sports activities was ignored.

The average e-bike costs 550 Swiss Francs a year with the same cost positions included. Where the cyclist needs additional food to have the energy for pedalling, the e-bike requires the electric energy with which the e-bike accumulator is charged. These cost are equal and can be neglected. The same effect is visible with respect to the CO_2 footprint. The human body is less efficient in using the energy from food than the e-bike in using the electricity for riding.
In the end both modes of transport have an average CO_2 emission of 20 g/km. The only differences are in availability, as the e-bike might not be recharged again; comfort, since you don't have to pedal as hard on a normal bicycle, and speed, because e-bikes support speeds of up to 45 km/h.
The National SBB travelcard costs 3,550 Swiss Francs a year for adults. If you have another adult in the same household, who is also interested in the travelcard, he/she pays only 2,490 Swiss Francs a year. As your+ shares the household with several parties, we assume the average adult resident pays 3,020 Swiss Francs per year for the SBB travelcard. The average CO_2 emission of the bus and train system is 65 g/km per person.

Based on a TCS (Touring Club Switzerland) study, a respectable car costs 11,000 Swiss Francs a year including all related costs. On the ecological side, cars emit 270 g/km of CO_2. This includes the whole life cycle of the product. The effective reduction in CO_2 emissions through car sharing is only calculable in community situations. Because with car sharing you reduce the numbers of cars produced by a factor of 7.5 and the production of a car has a 20% impact on CO_2 emission, we calculated an average of 220 g/km per person. *See Img. 51* and *further information: Appendix 07 Transport cost information*
These specific emissions multiplied by the distance travelled result in the total transport-related CO_2 emission in grams per day and person.



Img. 51 Transport-related CO_2 emission in grams per day and person

1.5 Affordability Strategies

Two scenarios are developed to show how the your+ strategy can be implemented at the Industriestrasse in Lucerne. The first scenario illustrates costs if the project were developed in the form of a cooperative. Compared to that the second scenario shows the financial structure if an investor implemented the project. The costs for the development in the investor scenario are estimated at CHF 65 million (50 million or CHF 1,980 per m² for the building and 15 million for land costs). In the cooperative scenario we estimate costs of CHF 50 million. This includes building costs of CHF 1,980 per m² but no investment costs for the land, due to a cheap land lease contract. The average price for comparable buildings per m² is around CHF 2,750 m². In the investor scenario, earnings per year are estimated at 4.3 million (CHF 331 m²/a) *(See Img. 54)*, compared to CHF 3.5 million (CHF 249 m²/a) *(See Img. 53)* in the cooperative scenario. The average price per m² for new buildings in Lucerne is CHF 340 m²/a *(See. Img. 38)*, so the rents in both scenarios are lower than the average and affordable for different income classes in Switzerland.

Building Project Scenarios

Two scenarios are developed and show how the your+ strategy can be implemented at the Industriestrasse quarter in Lucerne. The first scenario illustrates how the costs would be if the project were developed in the form of a cooperative. Compared to that the second scenario shows how the financial structure would be if there were no cooperative, but an investor implementing the project

Two Scenarios for the Financial Model

There are two different scenarios for implementing the entire project. The first model involves a cooperative that implements and finances the project. The second model is financed by an external investor. It should be noted that both scenarios offer only rented accommodation and no owner-occupied apartments. The development therefore always remains in the hands of the cooperative or the investor.
The land intended for project development belongs to the City of Lucerne. It supports buildings that pursue communal or cooperative aims. As long as the project development guarantees affordable housing, the city will provide the land by means of a low-cost land-lease contract. If not, the land is sold

BKP		buildings of comparison					buildings your+				
		unity		CHF	CHF	%	unity		CHF	CHF	%
	GF (ground area)	**4'100**	m2				**20'576**	m2			
	HNF (habitable surface)	**2'129**	m2				**14'336**	m2			
2	building (BKP2 GF SIA 416)	12'061	m3	674	8'129'000		65'356	m3	674	44'050'000	
2	building (BKP2 GF SIA 416)	4'100	m2	1'983	8'130'000		20'576	m2	1'983	40'802'000	
0	**land total**	**2601**					**7900**	**m2**	**2'000**	**15'800'000**	
1	**preparation**				**55'000**	**0.6**				**288'000**	**0.6**
2	**building**				**8'129'000**	**84.9**				**42'500'000**	**84.9**
20	excavation				84'000	1.0				439'000	1.0
21	body shell 1				2'454'000	30.2				12'830'000	30.2
22	body shell 2				854'000	10.5				4'465'000	10.5
23	electrics				385'000	4.7				2'013'000	4.7
24	heating, ventilation, air conditioning				352'000	4.3				1'840'000	4.3
25	sanitary				864'000	10.6				4'517'000	10.6
26	elevator				113'000	1.4				591'000	1.4
27	interior fittings 1				1'019'000	12.5				5'328'000	12.5
28	interior fittings 2				595'000	7.3				3'111'000	7.3
29	fees				1'409'000	17.3				7'367'000	17.3
3	**equipment**				**310'000**	**3.2**				**1'621'000**	**3.2**
4	**environment**				**203'000**	**2.1**				**1'061'000**	**2.1**
5	**additional charges**				**848'000**	**8.9**				**4'433'000**	**8.9**
9	**facilities**				**30'000**	**0.3**				**157'000**	**0.3**
1-9	**building cost**				**9'575'000**	**100**				**50'059'000**	**100**
0-9	**building cost with land**									**65'859'000**	

Img. 52 Costs estimated through a comparative development

to an investor at market prices. The 7,900 m^2 Industriestrasse plot is valued at around CHF 15,8 million. Construction costs for the individual buildings are CHF 12.5 million. However the entire development consists of four buildings, representing a value of CHF 50 million. The building is based on a structure in concrete and a prefabricated facade in wood. The elements are produced in the same canton. The facade elements are produced with Swiss wood by a company near to the building area. Almost all other materials and extensions used for the remaining construction were also produced in Switzerland and have a short paths of delivery. The costs where estimated through a comparative development. *See Img. 52* and *further information: Appendix 08 Building of comparison Bonaduz.* White fir was chosen as a reference to Swiss timber construction. *Further information: PM#6 chapter 6.*

Scenario 1: Cooperative ownership

A housing cooperative is an association of an unlimited number of people who pursue the aim of supporting the economic and social aspects of its members by means of communal business operations. It is a charitable, non-profit organization. Any profits are used for the long-term maintenance of the buildings and the development of new cooperative settlements. The your+ team will found a new cooperative for this project or affiliate itself with an existent cooperative to finance the project including its construction and maintenance phases.

As an alternative to the team founding a cooperative itself, it could also pass on the concept of the project to an existing cooperative that would implement the your+ concept. In both cases, the cooperative finances the project on its own. It should also be noted that the cooperative pays a low-cost annual land-lease contract interest rate for the period of 60-100 years. The contract ensures that a sustainable, long-term development is created whereby the City of Lucerne continues to own the land.

The financial means that a cooperative requires are generated by its members. On the one hand, every member must acquire a share certificate worth CHF 1,000 to become a member. A one-off payment must also be made for renting and using a room, depending on the size of the rented space. The smallest room has 15 m^2 and requires a share certificate of CHF 3,000, while the largest room has a size of 30 m^2, requiring a share of CHF 6,000. So the larger the apartment or rooms, the larger the share certificate that must be acquired. In addition, monthly rent must be paid. The system of share certificates means that the apartments and rooms remain the property of the cooperative and are only rented out to cooperative members. There is also an occupancy regulation that says a single person can rent only one my room. A my room for two persons can only be rented by two people. This regulation ensures there are no unused rooms.
In this scenario, construction costs amount to CHF 50 million. To cover those costs, the rent table is calculated as shown in *Img. 53*. The table presents the income from various uses and calculation systems (my room, our room, your room). Since the different rooms are used in different ways, they are calculated separately. my rooms and our rooms are calculated on a monthly basis. your rooms (for

Land size	7'900	m2	
Building land price	6'700'000	CHF	(Net present value of the land lease over 60 years)
Overall building costs	50'059'000	CHF	
Total costs	**56'759'000**	**CHF**	
Earnings (rents)	3'577'136	CHF pro/a	
Net return	**3'031'956**	**CHF**	
Current market value	**53'090'956**	**CHF**	

	m2 total	CHF earnings total	rent CHF m2/a	CHF rent m2/month	CHF rent m2/day	CHF rent m2/h
my room	6'766.00	1'894'480	280	**23.3**	-	-
our room	1'006.00	281'680	280	**23.3**	-	-
your room (guest room)	378.00	317'520	840	70.0	**3.50**	-
your room	836.00	1'083'456	1'296	108.0	3.60	**0.60**
space +	5400.00	rent integrated in my room				
floor space total	*14'386.00*		***249***	*20.7*	*0.69*	*0.03*

Img. 53 Rent calculation at ownership cooperative

guests) have daily rates and the other your rooms are charged by the hour. It is assumed that your rooms for guests have an occupation rate of 20 days a month. It is also assumed that all your rooms are used for 6 hours a day.
For the purpose of plausibility, rent prices are orientated by those offered by the Kalkbreite cooperative in Zurich. The typical examples shown in the table *(Img. 40)* present rent prices that individual residents can expect. *Further information: PM#6 chapter 1.2.*

The yield cash flows presents, all total costs and the current market value of the building project in the following 10 years with a low-cost land-lease contract. The calculations for the next 50 years can be found in appendix. The benchmarks were taken over from the company Wüest & Partner AG. The discount factor is assumed (Wüest & Partner AG, 2012). It is assumed a vacancy rate of 1%, due to the low rental rates. The land lease contract is based on a discount of 20% from the country worth and a mortgage rate of 2.25%.
See Img. 53 and *further information: Appendix 09 Discounted cash flow cooperative*

Scenario 2: Investor ownership

If the city doesn't grant the land for the project, there has to be a second solution to create an affordable project for the target groups. In this case the project will be implemented through an investor who buys the land from the city. To cover its investments and achieve a return, the investor will position the rents of the apartments in the upper range.

These are equivalent to the highest prices in the City of Lucerne. Such a rent for a 43 m² (33 m² my room, 10 m² our room) apartment would cost CHF 1,185 and is comparable with a regular 2-room apartment. *Img. 38* shows that this price is still in the market range for Lucerne. However, the costs of the building always remain the same.
In this scenario, total development costs are calculated at CHF 65.8 million. To cover these and achieve a return of around 7% , the required rent would be as shown in *Img. 54*.

Since the different rooms are used in different ways, they are calculated separately. my rooms and our rooms are calculated on a monthly basis. your rooms (for guests) have daily rates and the other your rooms are charged by the hour. It is assumed that your rooms for guests have an occupation rate of 20 days a month. It is also assumed that all your rooms are used for 6 hours a day. For plausibility purposes, the rent prices are orientated by the 70-90% quantile of the rent market in Lucerne. *See Img. 38. PM#6 chapter 1.2* present the rent prices individual residents can expect.

The following *Img. 54* presents, all total costs and the current market value of the building project in the following 10 years. The calculations for the next 50 years can be found in appendix. The benchmarks were taken also over from the company Wüest & Partner AG. The discount factor is assumed (Wüest & Partner AG, 2012). As before, it is assumed that the vacancy rate is 2%. Only in the first six years it goes constantly down from 4% to 2%. *Further information: Appendix 10 Discounted cash flow investor*

Land size	7'900	m2	
Building land price	15'800'000	CHF	(2000 CHF / m2)
Overall building costs	50'059'000	CHF	
Total costs	**65'859'000**	**CHF**	
Earnings (rents)	4'761'280	CHF pro/a	
Net return	**9'586'921**	**CHF**	
Current market value	**75'445'921**	**CHF**	

	m2 total	CHF earnings total	rent CHF m2/a	CHF rent m2/month	CHF rent m2/day	CHF rent m2/h
my room	6'766.00	2'571'080	380	**31.7**	-	-
our room	1'006.00	382'280	380	**31.7**	-	-
your room (guest room)	378.00	453'600	1'200	100.0	**5.00**	-
your room	836.00	1'354'320	1'620	135.0	4.50	**0.75**
space +	5400.00	rent integrated in my room				
rentable floor space total	*14'386.00*		***331***	*27.6*	*0.92*	*0.04*
effective earnings	-	*4'761'280*	-	-	-	-

Img. 54 Rent calculation at ownership investor

2 Architecture Design Narrative

Project Summary

"smart sharing – our vision is **your⁺**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is “smart sharing”. We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your⁺ suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of “smart sharing” addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

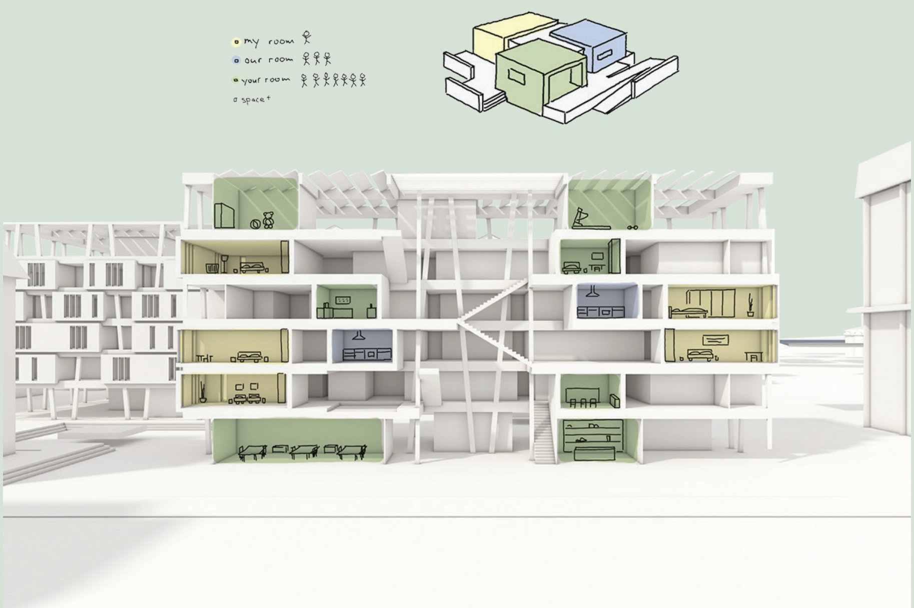
Flexible Room Usage

Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space⁺ as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your⁺.



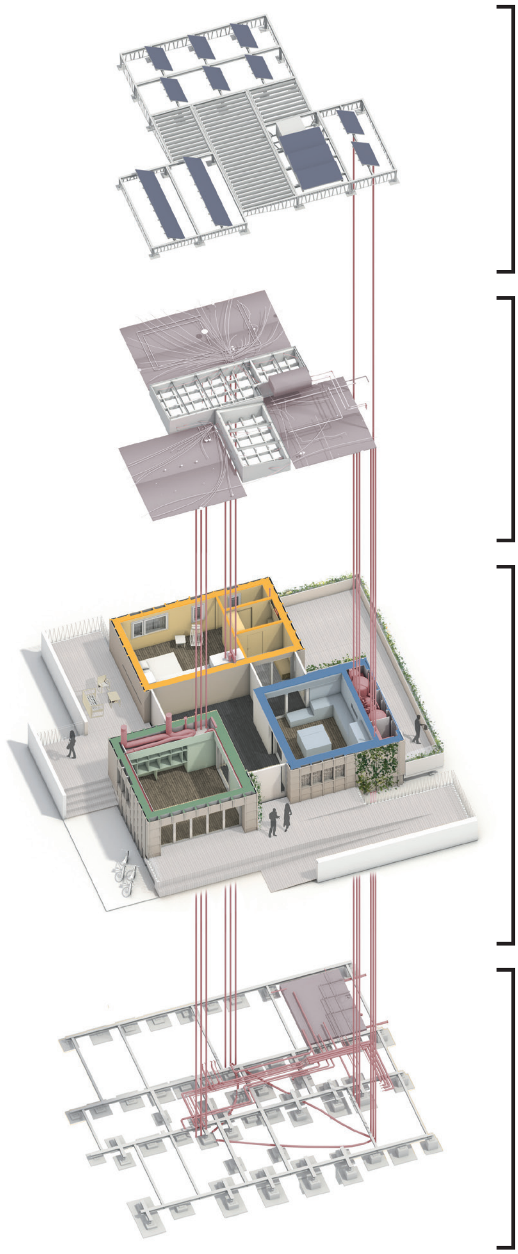
Smart Implementation in flexible Architecture

In our prototype for the competition in Versailles, we present three exemplary room types from our urban planning concept. We have three different room types. my room, our room and your room. The three rooms thereby represent the different levels of privacy and the way they can be used independently according to the residents' requirements. space⁺ serves as a communicative connecting element that links all rooms and building sections together. It also provides an additional gathering space for living and working.

Our three room types can be combined in any way using the space⁺ module to create a wide range of everyday scenarios. Such combinations and use overlapping are supported by flexible furnishing and a lighting concept that is installed in a targeted way. Different materials and colour tones are used to distinguish the three rooms. That gives each room its own identity. The built section does not represent an independent apartment, but instead communicates the idea of our living model, since the prototype is exemplary for an urban, multi-storey residential typology.

The architectural expression of the prototype is oriented by and reinterprets the Swiss timber construction tradition, leaving space for contextual further developments in view of the urban situation. Silver fir is used as timber for the prototype's construction and the exterior facade. Natural treatment methods and the separation of different elements ensure that worn out sections can be easily exchanged and replaced.

"smart sharing" means the combination and use of the potential of an urban context with local cultural identities.



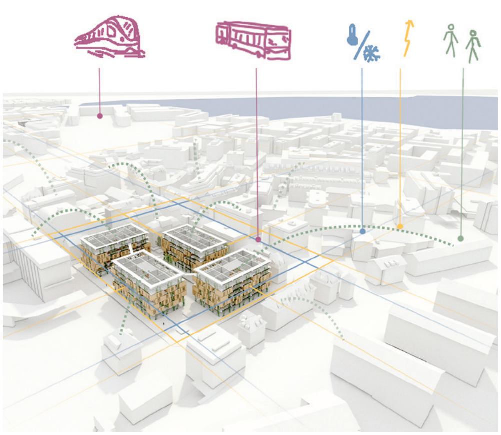
2.1 Architectural Concepts

The building layout provides the physical platform of "smart sharing" to organize the distribution space in a smart and shared way. We present three exemplary room types in our urban planning concept. The three rooms thereby represent the different levels of privacy and community, providing flexible use according to the residents' requirements. There is the possibility to connect the rooms depending on the situation. Flexible furnishing support such combinations and use overlapping. The characters of the spatial elements in the urban design are exemplified in the prototype for the competition. We use different materials and colour tones to distinguish the three rooms and create connections to the urban design. That gives each room its own identity. The architectural expression of the prototype is inspired by and reinterprets the Swiss timber construction tradition. Silver fir is used as timber for the prototype's construction and the exterior facade.

Excellent Urban Location

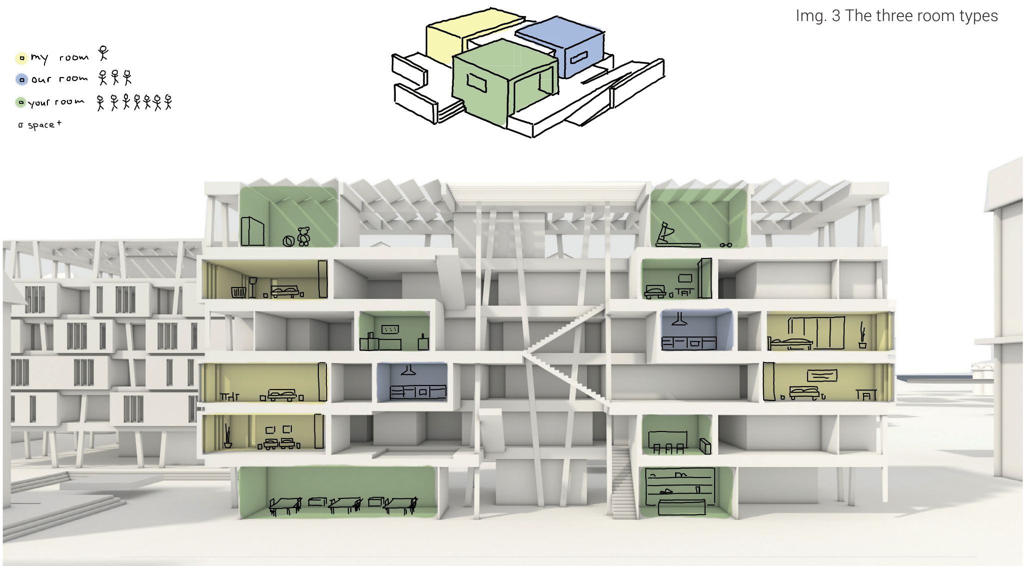
With our idea to organize limited and expensive resources, such as space and energy, we respond to the current challenges of population growth, living area limitations, rising energy costs and land use. We chose Industriestrasse in Lucerne as our local context in the centre of the city. The Industriestrasse area is a culturally diverse and attractive living area with old buildings that do not meet criteria for rehabilitation measures. We implement a new complex with buildings of four or five storeys to replace the existing housing. This replacement construction aims to strengthen the existing mixed and cultural neighbourhood since the concept of "smart sharing" is linked to the surrounding residential areas. So our idea of sharing and exchanging not only creates a communal platform, but also further added value.
In addition to social aspects, we also integrate the development into the environment on an ecological and energy level. Our your+ concept allows us to require an average of only 35 m² per person, as opposed to the previous 45 m², while maintaining the standard of living – indeed improving it.

Img. 1 Visualization of the urban context
Img. 2 Localization of the urban context



Different Room Types

We have three different room types. my room is the most intimate, which I only use myself. our room is the kitchen and dining area, which I share with an average of two to four other people. your room is the most common space, which I can rent additionally according to my requirements and therefore share with many other people (seven on average). space+ serves as a communicative connecting element that links all rooms and building sections together. It also provides an additional gathering space for living and working. The added value of the social synergies can develop through the secure basis of the cooperative. Communal use of your room achieves a sustainable approach to costs and space. That also produces an added value in terms of efficiency of space. The flexible use potential of mobility and objects (such as tools, household appliances, clothing etc.) is a further added value offered by our vision.



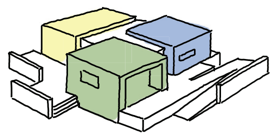
Img. 3 The three room types

The Prototype

For our your^{+} concept we select three different room types and connect them for our prototype. These three rooms are presented as an independent volume that is combined with the space^{+}.

Grades of Publicity

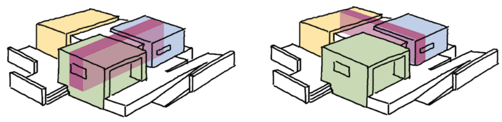
It contains the three most important rooms – a common room, your room with flexible use, a semi-public room with a kitchen, called our room, and a private bedroom area with washing facilities, my room. The three cubes of the prototype show varying grades of shared and private areas connected by the space^{+}. The common sharing room is multifunctional and relates to the outdoor area, while the kitchen cube is semi-private. The third, completely private cube includes the bathroom and bedroom. The space^{+} is a meeting zone and provides access to the cubes. It has an important social meaning. *See Img. 4.*



Img. 4 The three room types

Flexibility

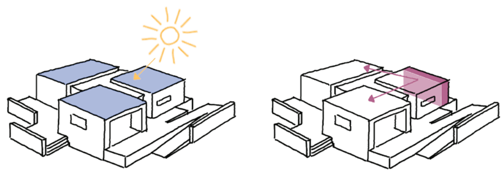
The cubes can be connected in a variety of ways. Thus various spatial situations and expansions are generated. Differently prioritized corridors indicate the relevant character of the subsequent rooms. Those transitions between the individual cubes are formulated to create switchable zones that can be allocated to one or other cube depending on the users' requirements. Such flexible use is supported by multifunctional furniture. *See Img. 5.*



Img. 5 Connecting situations

Technical Aspects

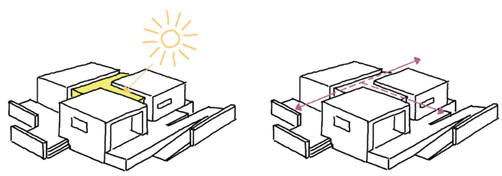
Highly efficient photovoltaic modules on the rooftops ensure the prototype's power supply. Excess electricity is supplied to the grid and the visitors. The building technology is interconnected and automatically responds to changes in the weather. *See Img. 6.*



Img. 6 Technical aspects

Uses of the space^{+}

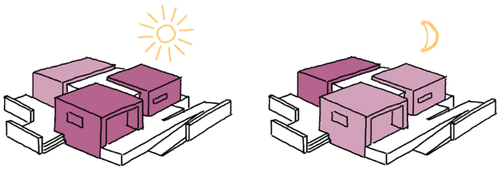
The space^{+} is a connecting element that assumes several roles. It is an accessing and meeting area and therefore has an important social status. The accessing area structures the different levels of privacy, organizes the uses and is formulated for communal life. In addition to social aspects, the space^{+} provides passive benefits, because it is insulated, rather than air-conditioned. Depending on the time of year, it regulates the interior climate with passive measures and increases the daylight yield. Through the natural ventilation in the summer and the heat through the skylights in winter, it can be used almost throughout the year. Surplus energy is made available to visitors in accordance with our philosophy. *See Img. 7.*



Img. 7 Uses of the space^{+}

Comfort Conditions

With respect to the architecture, the energy-consuming areas will also be flexible in terms of a zone demand control. There are two different types of spatial energy management (comfort and stand-by), which react quickly because of the air source heat pump. No energy is required to support the self-sufficient rooms that are not in use. *See Img. 8*



Img. 8 Comfort conditions

Construction Concept

The main focus of "smart sharing", as well as integrating and interpreting Swiss craftsmanship in the project, is obvious in the construction elements and the components of the energy systems. The base of the prototype is a platform made of steel and wood. The three different room types, constructed in timber frames, are grouped on the platform, connected and linked with the space⁺. The prototype roof marks in an abstract way the common element of an urban roof garden and forms the base for the active solar elements. The entire facade, roof and floor system are based on simple construction techniques. The prototype for the competition is founded on 64 adjustable steel footings, which are based on derived timber boards that distribute the weight to the soil. The prototype is a modular build-up, highly insulated wood construction with a glass roof, wooden windows and sliding doors as entrances to the cubes. The roof is designed as an independent steel construction, which is supported by punctual footings on the roof of the living cubes.

Material Concept

Exterior Materials

The facade of our prototype is based on the concept of reinterpreting traditional Swiss clapboards. To achieve this, we use over-dimensioned shingles made Class A of silver fir. This kind of wood is the most common softwood in Swiss forests.

Therefore its use is sustainable and involves short transport distances. Silver fir is very weather-resistant and is also quite easy to work with. To prevent any deformation of the wood, our shingles consist of several slim boards beside each other. Swiss craftsmanship, traditionalism and innovation are combined in this exterior facade. *See Img. 9 .*

We use smoked oak for the floor on our deck. The dark colour creates a nice contrast compared to the light silver fir facade and the colourful forms in the interior spaces. The floor will be a connecting element between exterior and interior.
We use fiber cement boards as a third exterior facade material. It is only applied in two special positions, where visitors are able to share ideas using crayons for writing and designing. *See Img. 10*

Img. 9 Example of the wooden facade

Img. 10 Example of the fiber cement boards

Interior Materials

We use the same material base in all the three cubes. The floor has a smoked oak parquet which we oil twice in a fine black oil. On our walls we put three different types of wallpaper: two non-woven wallpapers and a fibreglass paper in your room. We have chosen wallpaper due to the prototype's the transportation and the high-end surface. All the walls are painted in colour.
The construction of the furnishing uses wood-based panels. In my room, the ash wood has been veneered and lightly oiled in white. We powder-coat them in the other rooms. Using this method we save materials and reach a very robust and scratch-proof surface.
The worktop in the kitchen is made of chrome steel. We use the ceiling for cooling and heating. The aluminium panels are colourfully powder-coated.

Img. 11 my room materials

Img. 12 our room materials

Interior Architectural Concept

To understanding our concept quickly, we've made use of connective and differentiated elements. All the interior intentions are based on the attempt to show the rooms' different degrees of privacy. All three cubes have different ceiling heights, which can only be perceived and experienced from the inside. The dimensions of the openings intensify the feeling of an intimate or extroverted expression.
The room extensions are supported by the same opening mechanism in each connection. The floor is also a connective element.

Our decisions for the floor plan were influenced by the fact that we have to give public tours in Versailles and our communicative strategies should be implemented in our interior concept. That is why every room has its own arrangement of colours and specific materials. We hope that people will thereby connect it more easily to our urban concept.
See Img. 11 - 13.

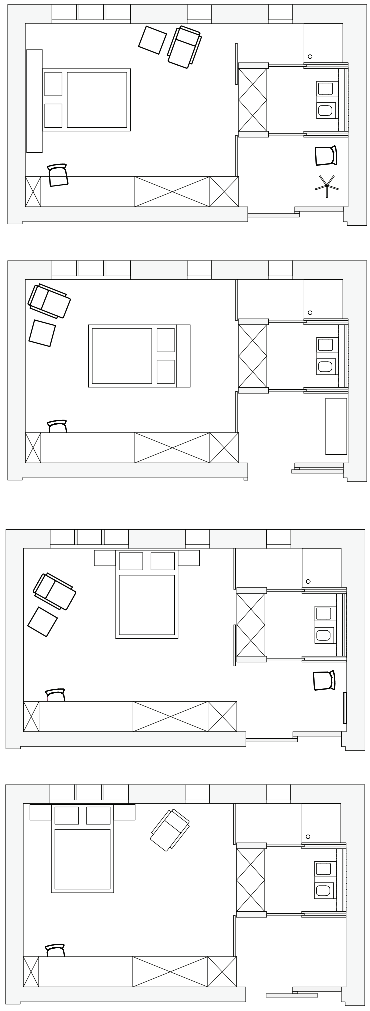
Img. 13 your room materials

Img. 14 Color concept for the prototype

Room Characteristics

my room

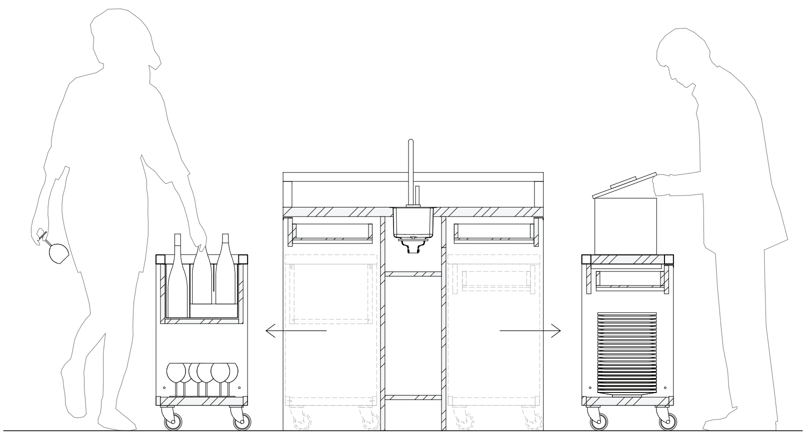
my room contains the bedroom and bathroom as well as an entrance. The shower can be used separately and allows better usage by two people. Sliding doors that either close a shelf or a room enable a variety of situations. Important furniture is installed, such as shelving, a working table and bath-room installations. All the other furniture is private property and creates an individual room expression *See Img. 15.* The inhabitant or guest should feel – perhaps even strongly – the privacy and intimacy of the place. Wooden walls turn the room into a more tranquil and warm place. The rooms are more enclosed and less visible from the outside.



Img. 15 my room scenarios with individual furniture

our room

The kitchen is transformed into a semi-public or semi-private area. The large dimensions of the kitchen enable concurrent cooking. The middle of the room is marked as a centre and generates a collective work surface. Two serviceboys with different functions can help the users so organize a dinner and are thought to put them where ever they are needed. *See Img. 16.* A fine line through the fittings shows a separation of the kitchen into a more private and a more public section. The organisation of the kitchen is ergonomic to optimize the workflow. It is important for the surfaces in the kitchen to be made of robust materials because they are used by a lot of residents. The colours are derived from chrome steel, supporting the aspect of public access. Blue elements, like the kitchen fronts or the walls, present a clear colour world.



Img. 16 Service-boys for cooking and serving in our room

your room

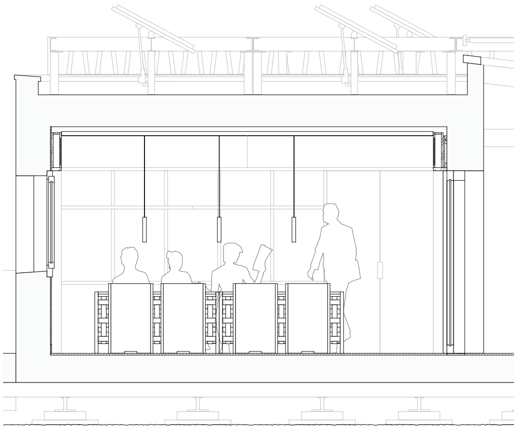
your room is marked by a wide opening. The use of this room is multifunctional and collective. *See Img. 18*. A shelf contains moveable furniture and allows it to be furnished differently. We've chosen a green and yellow colour to let the room look active and fresh. The pulverised material is durable and easy to clean. Robust wallpaper provides a texture. Three curtains enable various acoustic situations and support the room's flexibility. With these elements and its users, it can turn into a place of creativity. *See Img. 17 + 18.*

space⁺

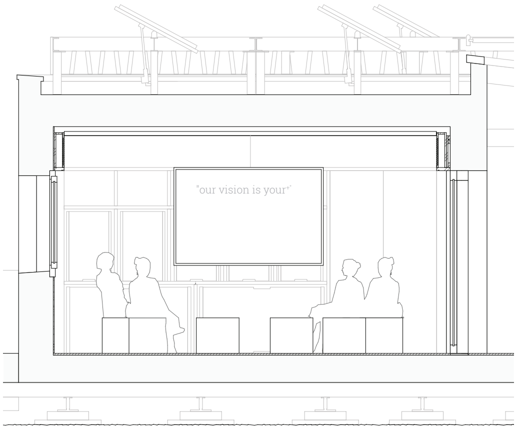
The space⁺ is an area in between the rooms that is used as a collective area. The floor flows from the space⁺ into the interior rooms, but the walls, with their white vanished colour, create a contrast to the colourful insides. The materialisation and colours are neutral and cautious. Depending to the usage, some parts are filled with private elements and furnishings. Private objects can spread out into the space⁺ if necessary. *See Img. 21 + 22.*

Terms of Scenarios

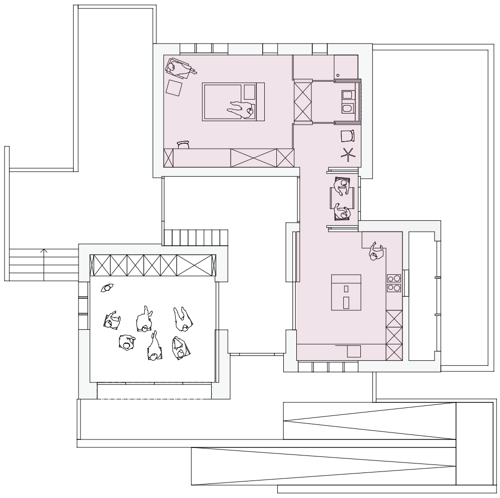
During the 24-hour cycle we climatize the rooms based upon usage. Not expending energy to climatize an unused room helps us save energy. During the night we mostly use the private cube. In the afternoon we are frequently in the kitchen and common space. Based on occupancy we generate various usage scenarios, as demonstrated here with a day cycle. *See Img. 19 – 22*



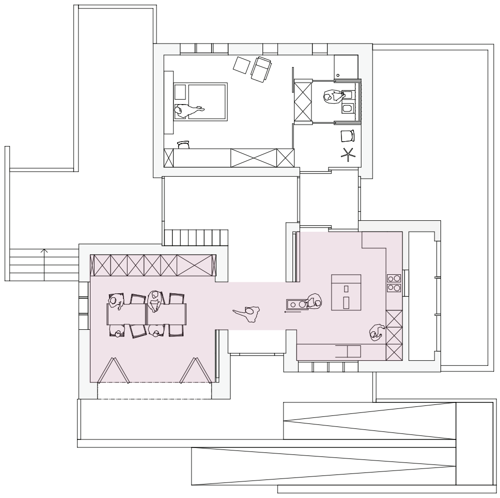
Img. 17 Dinner for eight people in your room



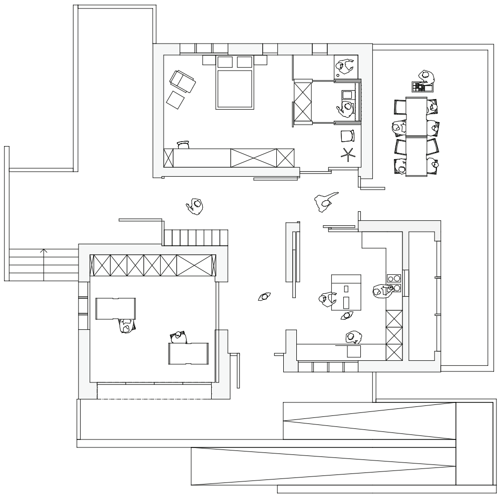
Img. 18 Cinema evening in your room



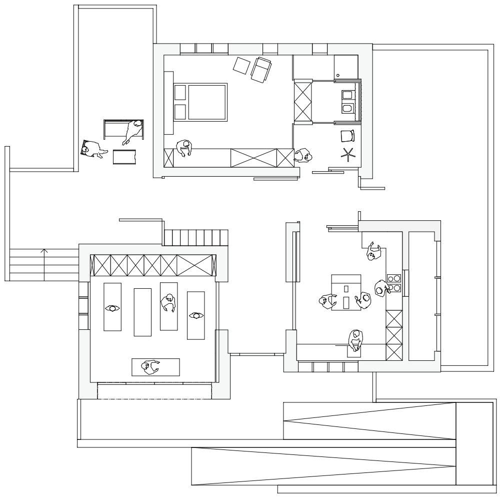
Img. 19 Night scenario



Img. 20 Dinner Scenario



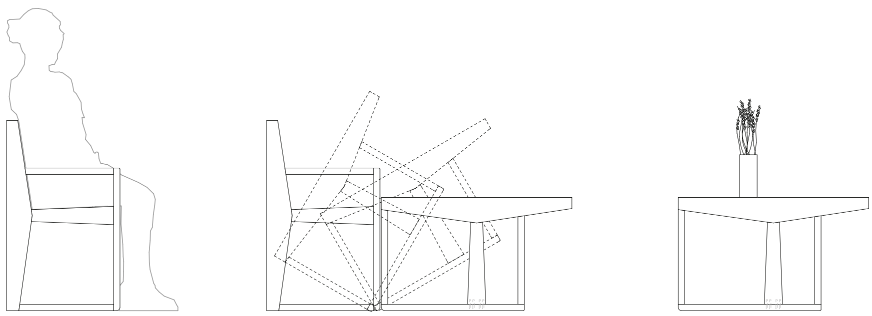
Img. 21 space+ floor scenario



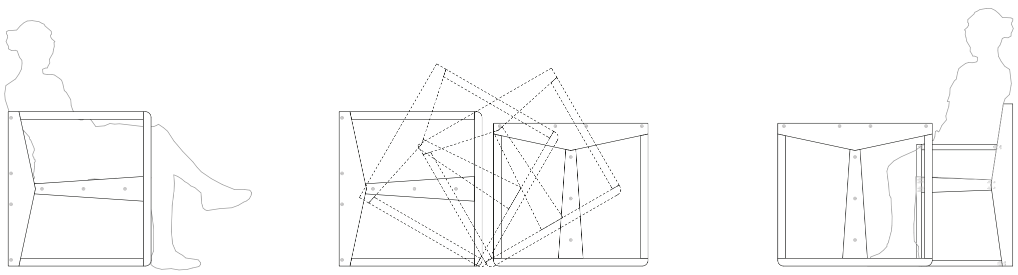
Img. 22 Yoga lesson floor scenario

Multifunctional Furniture

The rooms' switchable nature offers various forms of use, which means the furniture must be very variable. Maximum flexibility for the furniture is ensured while using only two furniture types. Both furniture types offer two uses and are mutually compatible. The dining table can be tilted to create a sofa and the chair rotates to become a coffee table. This saves vast quantities of materials, weight, and space. The most of all flexible furniture made for the whole prototype can be stacked away on a shelf, which is especially made for this purpose. *See Img. 23 + 24*



Img. 23 Multifunctional furniture: chair becomes a side table



Img. 24 Multifunctional furniture: sofa becomes a table

Working Process

Spring Semester 2013: Vision

The design process was divided into three phases:

First phase

We initially worked on developing a vision for a context, a mobility strategy and solutions for urban density. To achieve a wide range of ideas, we worked in five groups. Each group worked on different ideas and concepts regarding the issue of urban density. Ideas for technology elements, solar usage, energy efficiency and energy storage were already complete by this stage. Three of these five groups were selected to carry on and focus on their concepts.

Second phase

The three concepts developed their projects further and broke down the conceived concept from urban-scale dimensions to a prototype. This prototype had to tell the story of the context and its concept.

Third phase

In this phase we decided which concept would represent Switzerland in Versailles. All the groups joined together to work as one team with one project.

Context

In this new phase, the context was re-examined on a larger scale and on different levels. It is important that the context is understood not only in purely spatial terms, but also as a social and cultural context.

Prototype

During the design process, we rearranged the volume and checked and replayed various formations. *See Img. 25.*

Aspects such as the design of the outdoor space and the glazed buffer zone became more precise.

Construction

Four students dedicated themselves to this area. Each of them dealt with a variety of optional designs for different integral concepts such as sustainable building and prefabricated building. This way we could compare four absolutely different construction methods.

Interior design

In the field of interior design, each interior architect specialized on a specific topic: built-in furniture, flexible furniture, natural and artificial light, materials and transitions between rooms and areas.

Engineering / housing technology

The topics addressed in this working field include: electrics (lighting, equipment, installation, photovoltaic systems), building automation, water (waste water, rain water, heat) and room air (ventilation, acoustics, heating, cooling, sun protection).

See Img. 26.

The concept

The project is explained as three volumes with different sizes and heights that are connected to each other through a glazed buffer zone. Each volume contains a different program.

Img. 25 First ideas of the concept of your+

Img. 26 First ideas of the interior concept of your+

Autumn Semester 2013: Detailed Design / Construction Phase

In mid-September 2013 our team grew and we organized ourselves in a new structural system based on departments and contest sections. Between September and November we had our redesign phase where we worked on intensive optimization and spatial design. *See Img. 27*

The concept and project from the third phase was adopted and developed further. Since then, we have been working on detailed work drawings using the internal exchange of ideas and also by addressing external critiques. Intense weeks revising the working drawing resulted from the cooperation with the wood construction company Renggli Holzbau.

We were able to successfully hand in our plans to our partners just before Christmas. Since the beginning of the current year the plans have become even more detailed. At the same time we prepared a booth for the Swissbau Basel construction exhibition. That also manifested itself in our concluding presentation to the public. *See Img. 28.*

Spring Semester 2014: Construction Phase / Realisation

We started the new semester with a one-week workshop in mid-February. The topic of that workshop was an introduction into construction site safety and construction hardware at a wood construction company, to kick off our implementation phase. *See Img. 29.* During the evenings a communication workshop also took place, leaving enough time to get to know the new group members at a dinner organized by us students.
We started building our prototype next to the university for the testing phase at the end of March. *See Img. 30* Every day some students have been constructing the prototype on the construction site, while others have still been working on theoretical aspects and deliverables.
Now – in June – our your+ prototype has been completed and we are loading all the modules, elements and tools on ten trucks for the journey to France.
The Solar Decathlon Europe 2014 competition will begin in Versailles in only two weeks and we are really looking forward to the final phase.

Img. 27 Our working studio

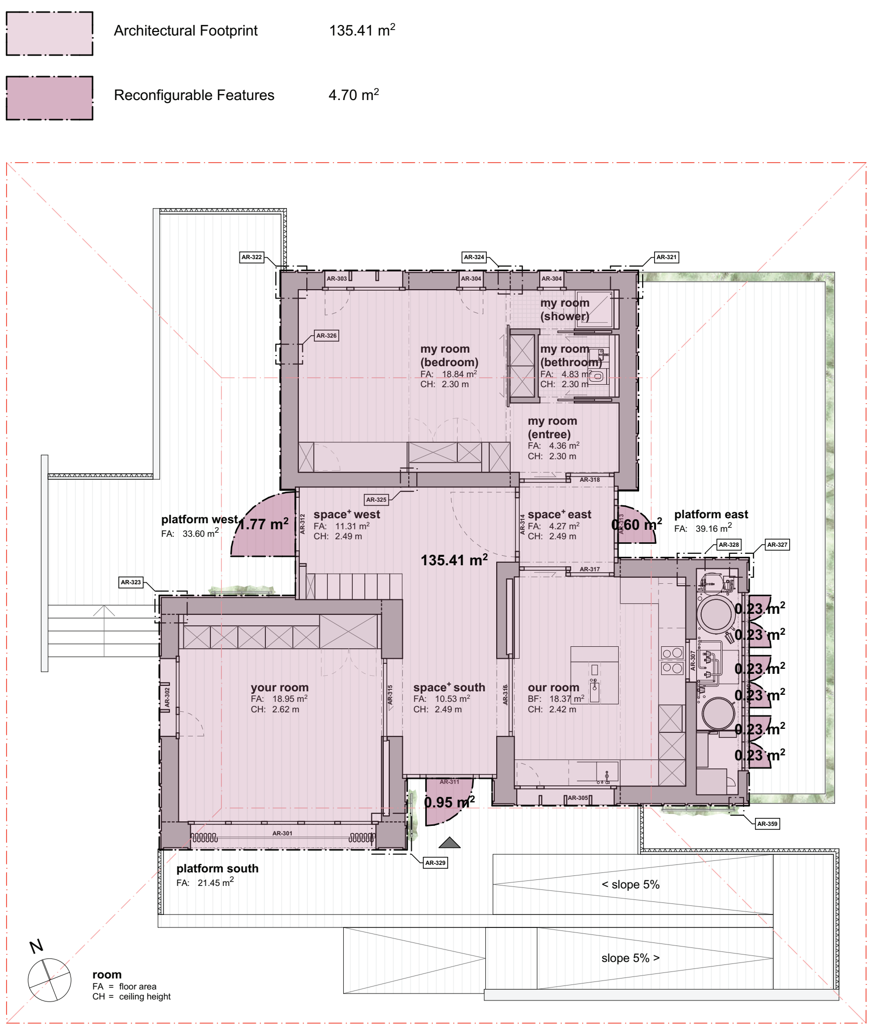
Img. 28 Our booth at Swissbau in Basel

Img. 29 Working together with partners

Img. 30 Building together with partners

2.2 Summary of Reconfigurable Features

The doors entering the space⁺ opens outwards, as do the doors to the technical room. These doors extend the architectural footprint from 134.38 m^2 to 140.15 m^2.
Despite this, the "Maximum Architectural Footprint" does not exceed the limit of 150 m^2 indicated in rule 6.2. *See Img. 31.*
The platform, ramps and objects below 1.00 m are excluded.
In the interior we have flexible furniture, which can change its funkction from a bench to a table or from a side table to a chair.



Img. 31 Reconfigurable Features

2.3 Lighting Design Narrative

The dimensions of the openings and therefore the incoming daylight strongly embody the graduation of the rooms' intimacy and create differed atmospheres in the rooms.
The artificial light supports the usage and focuses on the interconnection between the interior rooms. The users can control the light using an IPAD and react to their needs. Lighting should not only be switched on and off, but be versatile and mobile to serve the multi-purposes and functionalities of the rooms it illuminates.

Daylight

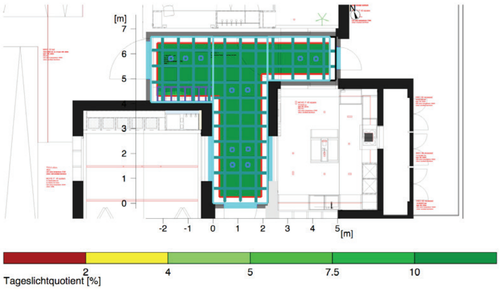
The concept of daylight should support the graduation of the room intimacy and by doing so emphasize the degree of privacy. In the common and more public areas, generous outside views and openings guarantee an equivalently rich flow of light and are therefore the brightest and most light-flooded rooms in the prototype
In the my room the outside views and openings gradually diminish and are therefore adjusted. As these rooms provide space for privacy and withdrawal, with a user's preference to shut away outside disturbances, openings are smaller and designed to suit the purpose of the rooms. With the vertical sliding shutters and their individual perforations it is possible to monitor the daylight and create different atmospheres.
The simulations below (Img. 34 - 41) demonstrate that the average daylight factor in the my room is about 3.2% in the our room at 4.6% in the your room at 7.3% and in the space⁺ at 26%

Artificial Light

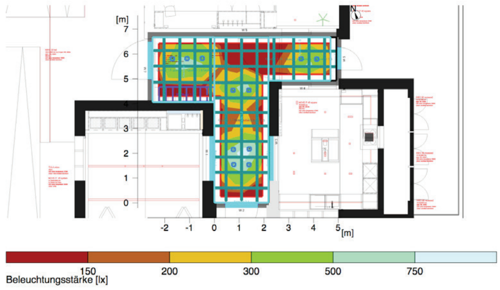
The artificial light shows the connection between the rooms. *See Img. 32 + 33.* The most important medium is again the user, whose needs and demands are the sole indicator of a suitable lighting plan. In order to save energy the lamps illuminance power is adjusted and dimmed depending from the daylight. As we planned our concept out of a cooperative idea, the cooperative it self provides just a part of the whole lights to the users. In my rooms is still enough room for individual lighting.

Img. 32 Light scenario: Dinner for eight persons

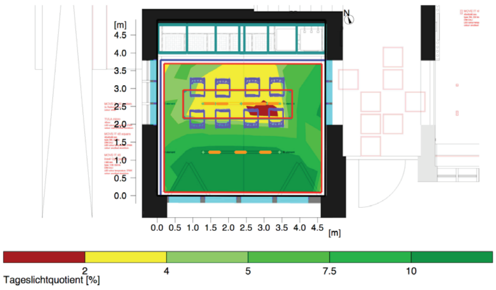
Img. 33 Light scenario: Breakfast for two



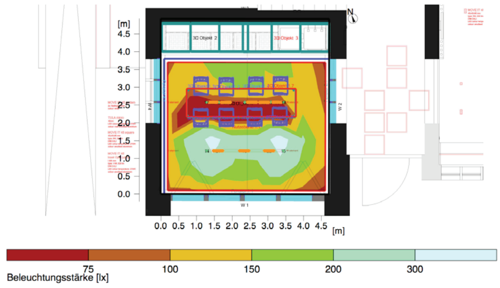
Img. 34 Daylight calculation space+



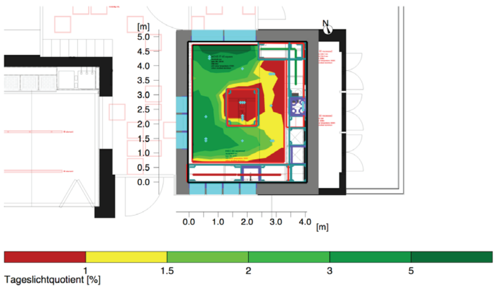
Img. 35 Artificial light calculation space+



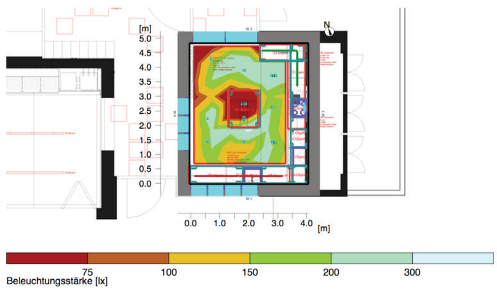
Img. 36 Daylight calculation your room



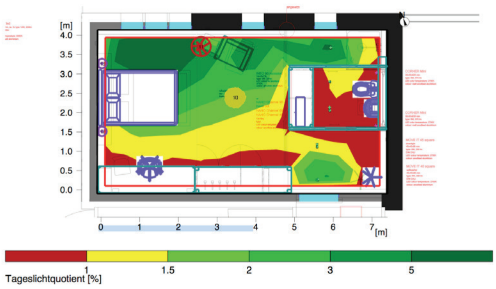
Img. 37 Artificial light calculation your room



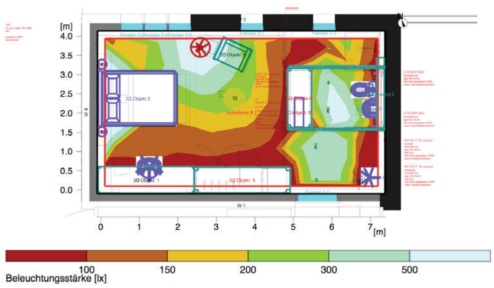
Img. 38 Daylight calculation our room



Img. 39 Artificial light calculation our room



Img. 40 Daylight calculation my room



Img. 41 Artificial light calculation my room

Simulations

We made also Simulations for all the artificial lighting. These results are all with full power and not dimmed lamps. In the my room we reach an average luminous intensity from 250 lux if all the lamps are on and not dimmed. In the our room we reach over all an average luminous intensity from 210 lux. But because of the high luminous power over the work space we reach there more than 500lux. In the your room the average luminous intensity is at about 195 lux. But light there is adjustable according to the situation so it's no problem to change the situation by plug in some more lights in the magnetic plug in system. Average luminous intensity in the space+ is at about 260lux if the lamps are not dimmed.
See Img. 34 - 41 and *further information: Appendix 11 Datasheets lights*

Plug-in Lighting

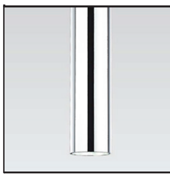
In the your room, lamps are used that are adjustable for maximum flexibility according to usage situations.
The common sharing area uses a magnetic plug-in lighting system. This way maximum flexibility is possible and adjustable according to the situation. The pendant lamps in the public area can be simply and spontaneously adjusted to suit the purposes.
See Img. 42 - 44

Spotlights

Spotlights are installed where light is always needed, for example in the bathroom, kitchen and space+. Removable or adjustable light is not needed in these specific-use rooms. To highlight important points of the prototype like workspaces, we use spot lamps with a small beam angle and a high luminous power. The function of these spots is to underline functions and enhance illumination at the main points of the prototype. This can work in cohesion with general lighting and emphasize important points with higher illumination. When paired with less background lighting, the spots can fully isolate these functional spaces. *See Img. 45 - 46, 48.*

Recessed Lighting

Recessed lights are installed where supporting light is needed, or where a focus is suitable; for example a curtain rail, to support a special effect. *See Img. 47.*



Fabric:	XAL
lamp:	TULA
bulb:	LED
efficiency:	87%
system Perform.:	5W
light Output:	230lm
color temp..	2700K
switching:	Switch / PIR
quantity:	3

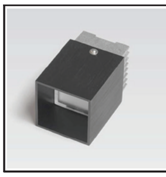
Img. 42 Lighting, your room

Fabric:	XAL
lamp:	Square Adj.
bulb:	LED
efficiency:	87%
system Perform.:	5W
light Output:	230lm
color temp..	2700K
switching:	Switch / PIR
quantity:	4

Img. 43 Lighting, your room

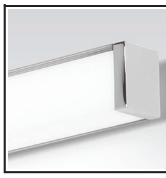
Fabric:	XAL
lamp:	inset opal
bulb:	LED
efficiency:	54%
system Perform.:	22W
light Output:	1100lm
color temp..	2700K
switching:	Switch / PIR
quantity:	4

Img. 44 Lighting, your room



Fabric:	XAL
lamp:	MOVE IT Square
bulb:	LED
efficiency:	87%
system Perform.:	5W
light Output:	230lm
color temp..	2700K
switching:	Switch / PIR
quantity:	28

Img. 45 Lighting, our room and my room



Fabric:	XAL
lamp:	Corner Mini 5W
bulb:	LED
efficiency:	98%
system Perform.:	5W
light Output:	270lm
color temp:	2700K
switching:	Switch / PIR
quantity:	2

Img. 46 Lighting, my room bath

Fabric:	XAL
lamp:	INEO 90 recesed
bulb:	LED
efficiency:	98%
system Perform.:	12W/m
light Output:	600lm/m
color temp..	3000K
switching:	Switch / PIR
quantity:	8m

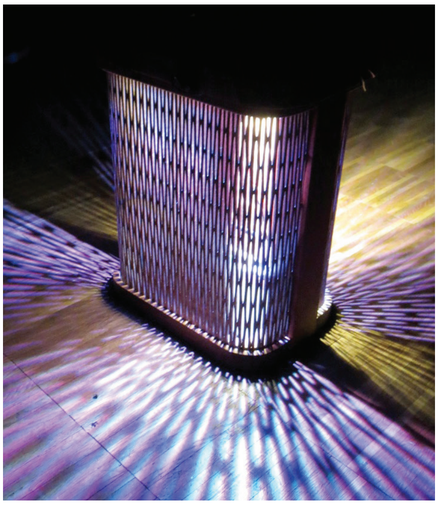
Img. 47 Lighting, our room – work space

Fabric:	XAL
lamp:	cubu 150
bulb:	LED
efficiency:	79%
system Perform.:	11W
light Output:	700lm
color temp..	3000K
switching:	Switch / PIR
quantity:	11

Img. 48 Lighting, space+

Portable Lights

Inspired by the candle or oil lamps, we propose a personal light that is portable, flexible and supports our ideas of "smart sharing". The lights can be connected at various points in the prototype, go where the user wants them to be and are used where and when needed. The light is rechargeable through induction. It can be used without plug-in equipment. In this case, resources are saved and the light source can be placed and shared where light is needed. The battery lasts for four hours without charging. Two different types of lights are installed: for working and for atmospheric light. They differ in their light temperature and light dispersion. The users can share their own light with the others if necessary. *See Img. 49*



Img. 49 The portable light

2.4 Acoustic Concept

The your⁺ concept reacts to the different dB-requirements for the different rooms. There are acoustic room partitions and alignments, as well as sound-insulated windows. Building measures (balcony, green areas etc.) additionally absorb noise. The air conditioning system also makes a contribution since windows do not need to be opened.

Acoustic Situation Context

The values of SIA-Norm 181 (2006) must be adhered to. A distinction is made between two different types of noise. Firstly there are "external sources", including airborne sound and structural-borne sound. Secondly there are "internal sources" consisting of airborne sound and footfall sound.

The various rooms have different noise burdens. my room, our room and the space⁺ produce moderate noise. your room has a noise burden that can be low, moderate or high depending on how it is used. Noise sensitivity is categorised as low, medium and high. Low noise sensitivity is experienced in rooms used by many people or for short periods. In our project, they would be our rooms, the bathrooms in my rooms and some of your rooms depending on their uses.
We experience medium noise sensitivity in rooms such as living rooms, bedrooms and where we need to focus on work. That would be the case in my rooms, the space⁺ and some your rooms depending on their use. We experience high noise sensitivity in places where we need conditions to be especially quiet. That could be the case in your room if it is used as a reading room or library.

Depending on the situation at hand, various minimum dB requirements must be fulfilled. Various measures were carried out to be able to adhere to these. For instance all individually used room types are separated from each other acoustically to avoid requiring an acoustic bridge. Attention was also paid to ensuring that sanitary facilities were not attached directly to a wall adjoining with a bedroom. We have a range of noise burdens from the outside. On the street side, levels are considerable to heavy (due to the traffic and disturbing businesses). On the courtyard side, the level is low to medium (away from traffic, no disturbing businesses). *See Img. 50.*

Here too, depending on the time of day or night, and whether the room is on the courtyard or street side, the defined dB limits must be adhered to. Highly noise sensitive rooms, such as some your rooms, are aligned towards the courtyard. Bedrooms aligned towards the street have sound insulating windows. We also achieve better values through building measures, by allowing balconies and vegetation to absorb the noise. Ventilation to achieve a comfortable climate also means that the sound insulating windows need not be opened to ensure the circulation of fresh air. The room types are also separated by the (concrete) floor slab and walls, which is created using wall brackets. Intersecting ducts are avoided within the concrete ceiling to ensure as large an overlap for cabling as possible. *See Img. 51*

Noise Sensitivity (minimum Requirements SIA 181)

Noise burden

my room / **our room** / **space**⁺
> medium

your room
> low/medium/high

Img. 50 Schema floor

Noise Sensitivity (minimum Requirements SIA 181)

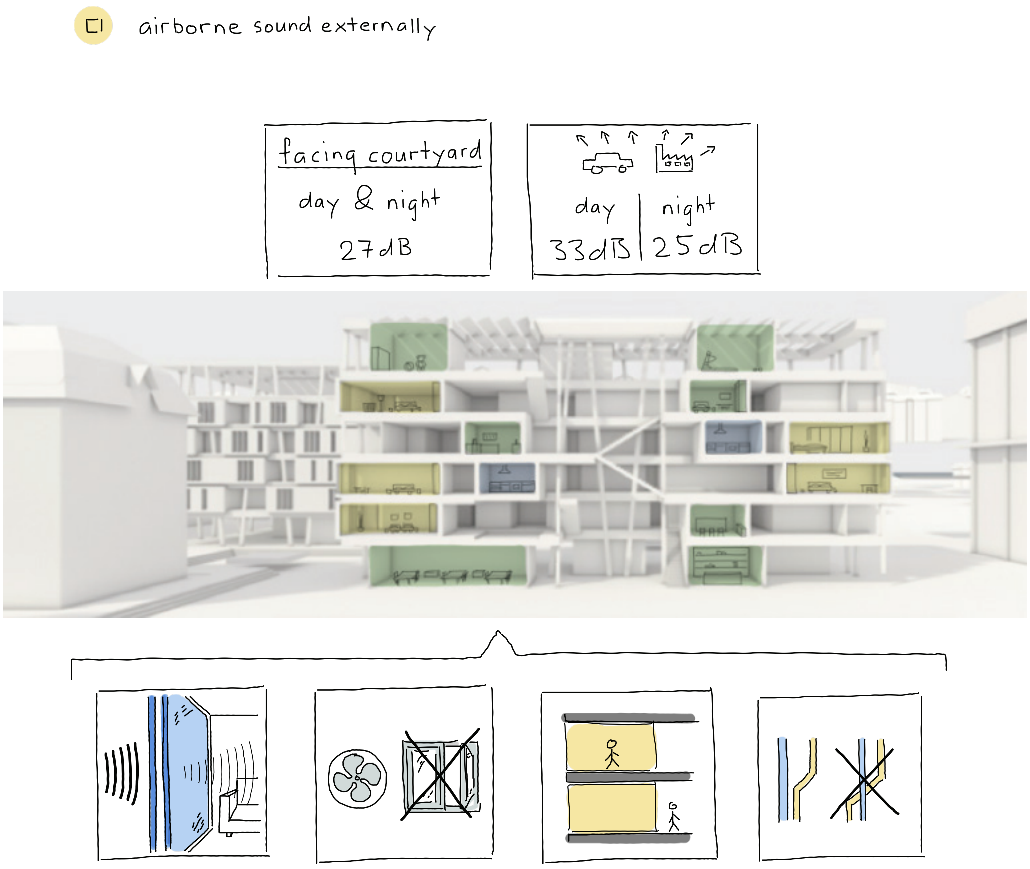
Noise burden

Street side

> Noise burden considerable to high (traffic or disturbing businesses)

Courtyard side

> Noise burden low to moderate (away from traffic, no disturbing businesses)

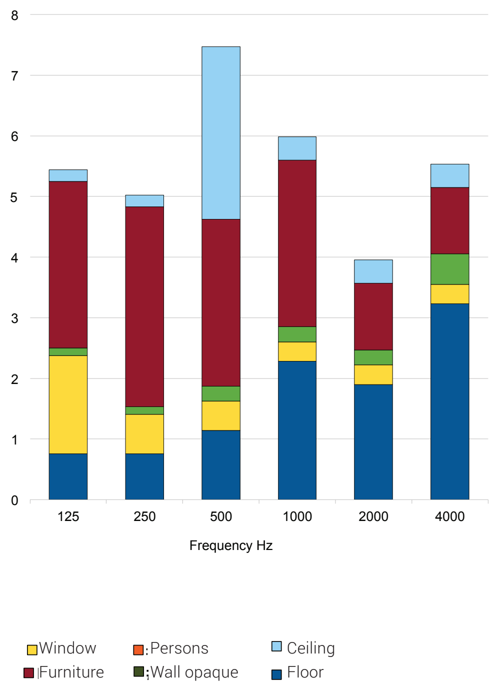


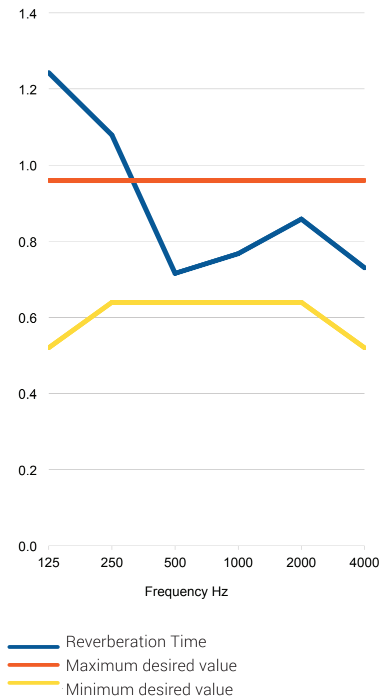
Img. 51 Schema section

Reverberation Time

The acoustic design in our prototype is based on textile elements. In your rooms, where multifunctio-nal use is forseen, the acoustic design should also be flexible and installed appropriate to the temporary usage oft the room. The impression oft he changed room is intensified through acoustic elements.
See Img. 52

Room use	Your Room							
Medium ceiling hight		2.62 [m]						
Room volume		49.78 [m3]						
Reverbertation period target value		0.8 [Sec]						
absorption coefficient		surface	125	250	500	1000	2000	4000
Floor	Parquet pasted with oil	19.00	0.04	0.04	0.06	0.12	0.10	0.17
Window	Window area, isolated	16.15	0.10	0.04	0.03	0.02	0.02	0.02
Wall opaque	Wallpaper painted	12.45	0.01	0.01	0.02	0.02	0.02	0.04
Furniture	Open cupboard	11.00	0.25	0.3	0.25	0.25	0.1	0.1
Cover with slots	Wooden panel with perforation	3.00	0.27	0.25	0.10	0.06	0.06	0.06
Ceiling	Metal ceiling	19.00	0.01	0.01	0.15	0.02	0.02	0.02
Curtain	Curtain folded	7.00	0.04	0.25	0.51	0.63	0.76	0.77
Persons		0.00	0.15	0.25	0.4	0.5	0.25	0.2
absorption surface		Reverberation Time						





3 Engineering and Construction Design Narrative

Project Summary

"smart sharing – our vision is **your⁺**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is “smart sharing”. We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your^{+} suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of “smart sharing” addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

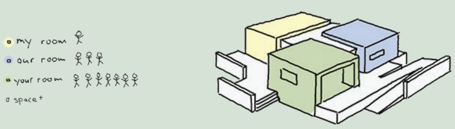
Flexible Room Usage

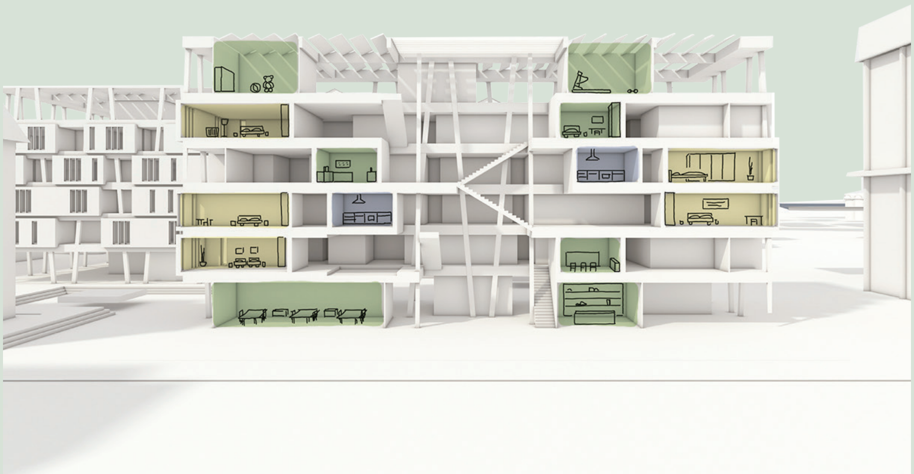
Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space⁺ as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your⁺.





Smart Engineering for a new Lifestyle

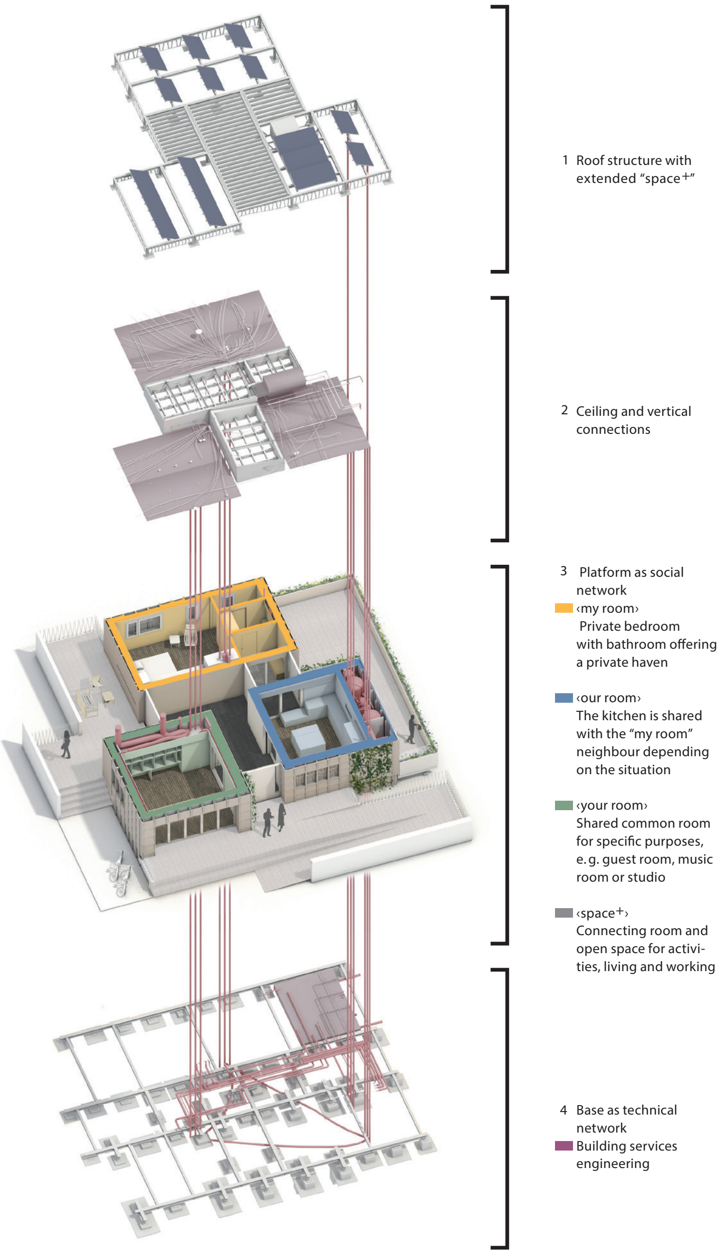
Our main focus of sharing and exchanging, as well as integrating Swiss craftsmanship into the project, can also be seen in the construction elements and the components of the energy systems.
The wooden building is based on a simple post construction which is arranged in a vertical facade structure. Because of the short setting up time the cubes are split in modules and elements depends on their height. The three levels of the prototype are divided into the platform, the three cubes including the space⁺, and the roof structure on the top. These elements can be found in our project. In our energy concept the systems are based on the idea of sharing.

The rooms in the prototype are connected and all the required energy can be transferred in between. Each room has its own heating and cooling energy demand, therefore the system can be adjusted to requirements and only uses as little energy as needed. In addition to thermal conditions, good air quality is also an important part of a pleasant room climate. Decentralised ventilation devices provide each room with fresh air requirements.

Thermal solar collectors provide warm water to the building throughout the year for heating and domestic hot water. The plumbing system integrates various resource-saving concepts and components. The reuse of grey and rain water reduces fresh water consumption. Reducing water consumption eases the burden on the sewage system and wastewater treatment. To reduce input peaks from the PV system, the surplus energy is temporarily stored in the batteries.

The project uses this energy store for various tasks in the building system and for mobility. In addition to the important tasks of the electrical concept, it also plays an important role with respect to mobility. The charged batteries can be used for e-bikes to make cycling easier.

"smart sharing" means balancing out technical and spatial issues



3.1 Structural Design

The prototype for the competition is founded on 64 adjustable steel footings, which are based on derived timber boards to distribute the weight to the soil. The footings are fixed onto a strut-brace steel framework, which gives a level for the prototype and the platform. The building and the steel frame are force-fit connected to each other. The prototype is a modular build-up, highly insulated, wood construction with a glass roof (space+), wooden windows and sliding doors as entrances to the cubes. The roof (urban crown) is designed as an independent steel construction, which is supported by punctual footings on the roof of the living cubes. The wooden deck, ramps and stairs on the outside are designed as a module construction, supported by the foundation steel-frame as well as additional punctual footings. Handrails are steel elements. The urban project is designed with a concrete structure for all static and fire protective relevant elements. The living cubes are similar structures as the prototype. *See Img. 1*

Foundation/Platform

Static System

To show that the prototype is just a part of an urban context, we decided to put the prototype on a steel structure. That steel structure doesn't exist in the urban buildings, it just creates a virtual platform to show the concept. The whole foundation has to be very stiff to avoid the problem of subsidence of the individual cubes as well as the central element of the space+. The size of the elements refers to the maximum transportation size and the single elements will be screwed together into one part. The whole foundation is mounted on 64 Pitzelfeets, which are variable in height to adjust the level very precise.

Function

Due to the fact that we don't know exactly how the soil in Versailles will be, we need to react with different options. The conclusion of these challenges is that we use single platforms, screwed together to a big platform and so avoid a different subsidence of each part of the prototype. If the foundation subsides during the assembly of the prototype, we can adjust the Pitzlfeets under the steel structure to prevent the prototype from being crooked. The Pitzlfeets are adjustable in height, and the load will be distributed by large Kertoplates which allows to level roughly.

Construction materials

The foundation is made out of a steel frame to get a minimal element height with a maximum load. A minimal element height is important to keep the platform as low as possible, so the ramp to the platform doesn't need to be too long. The foundation will be levelled differently in Lucerne and Versailles, so it is important that we have the possibility to adjust the foundation very precisely. *See Img. 2.*

Elementing/logistics

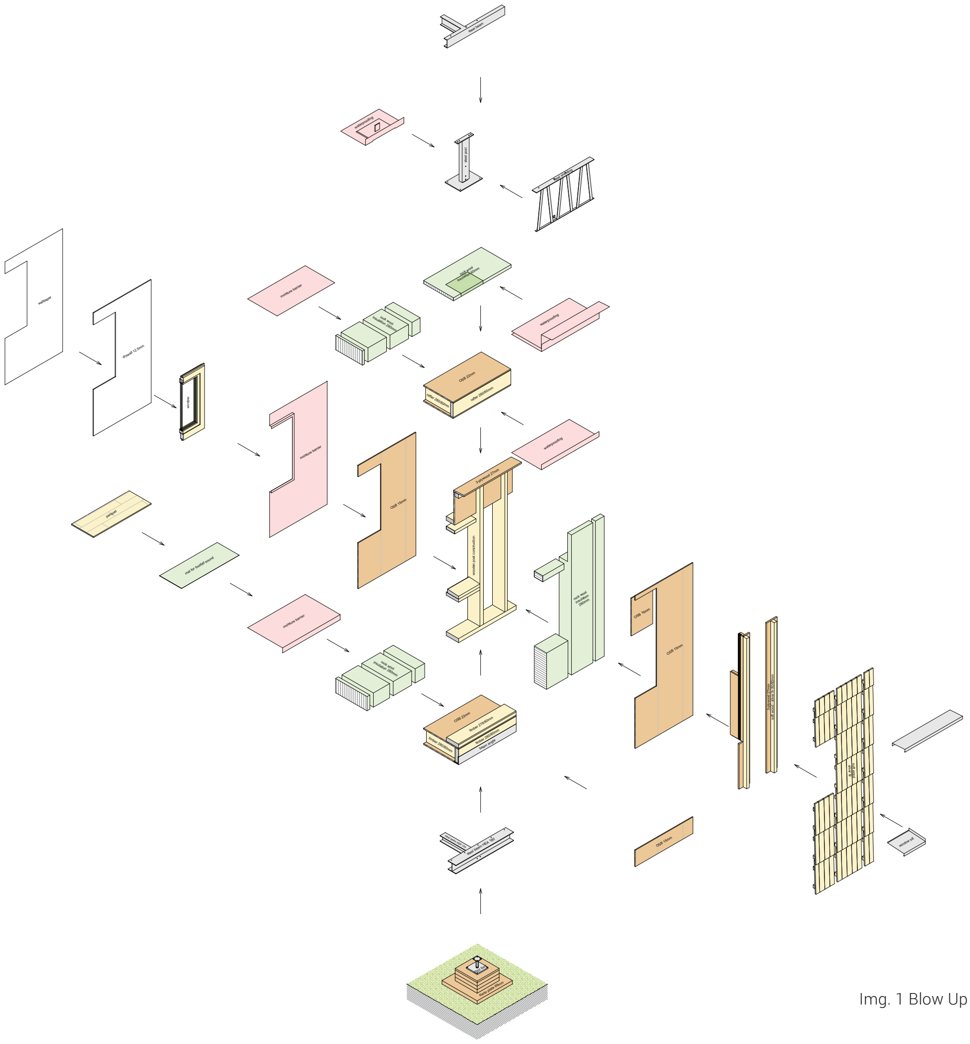
The steel elements have the largest dimensions in accordance to the maximum transportation size for road traffic. These large elements will be connected on site, through smaller steel beams to get one foundation as a whole. The Pitzelfeets are mounted directly on the base of the steel structure on the lowest level to allow a fast assembly of the foundation during the competition in Versailles.

Environmental impact

The steel foundation of the prototype is not part of the urban context and wont' be used again for the prototype after the competition when back in Switzerland. We plan to reuse the steel profiles of the foundation. We only used long industrially produced beams for our construction. The beams will be traced back to the factory, cleaned and can then be reused for some other project.

Design

The foundation, as well as the whole platform shows a level on which the actual prototype will be placed. This part represents the greatest difference between the prototype and the urban context.



Img. 1 Blow Up

Img. 2 Foundation

Prototype (Cubes/space⁺)

Static System

The construction shows the concept of sharing with the wooden frame construction similar to a shelf. Providing both storage and necessary support for the structural design, the shelf is a perfect solution according to the design principle. The prototype design exhibits the load-bearing system, Swiss craftsmanship, Swiss native material, traditionalism, new interpretation and innovation. The entire facade, roof and floor system are based on these constructi-on techniques. The simplicity and new interpretation of the traditional method of construction is our target. *See Img. 3.*

The construction is basically a shelf supportive structure out of wood or wood materials, and is built into the wall, the floor and the roof. The cladding panels, which are the doors to the shelving system, are non-load-bearing. The back walls of the shelves take the task of bracing. Our goal is to use wood connection solutions as used by traditional craftsmen. The front of the sidewall is shown on the forward facing facade and gives us a standard cavity of 62.5cm on roof, wall and floor. The shelving system supports our sharing vision, as we are able to integrate a sharing box behind the sheeting wall. This function exists in the sharing cube, your room.

Function

The collaborative construction described above remained the basis for our prototype because of the excellent possibilities provided for the constructional implementation of our main concerns, such as sharing, Swiss craftsmanship and native Swiss material. However the construction was slightly improved.

The construction still consists of wood or wooden composites only and forms the floor, walls and ceilings. The system still forms a regular pattern grid of pillars, which are stiffened by OSB-plates on the inside. The cladding panels, an oversized interpretati-on of the traditionally used shingles, consist of several planks instead of just one big plate. Partially, those cladding panels are used for the doors of our sharing boxes or as sliding shading panels for the window apertures.
For the shading panels it is planned to cut trenches in the alongside the panel joints as a new interpreta-tion of traditional ornamentation. The insulation remains mineral wool. The clay walls inside the cubes were replaced with different wallpapers because the effort was inappropriate for the benefit of such walls, while a disassembly and reconstructi-on of such walls would also be very costly. In the space⁺ the beams no longer visibly protrude from the wall to achieve a calmer interior. The beams remain in the insulation layer, demonstrated by formed joints on the space⁺ walls. The developing smooth surfaces give the room a calm and soothing look. The coffered ceiling with integrated PCM remains a part of the space⁺ and is painted matt to give it a homogeneous surface.

Construction materials

The prototype is mostly made of wood or wooden materials. Beams in silver fir are used for the main structure. Wooden materials, such as OSB plates are used for constructive matters.

Elementing/ logistics

The my room and our room cubes are built in a modular way, which means the rooms are split into parts, including the floor, walls and roof. The transportation as well as the assembly of these cubes will be very fast. your room and the space⁺ are built using elements, due to the room heights, in accordance to the transportation limits. These parts of the prototype can only be assembled during a non-raining period, otherwise it will rain into the open construction between the floor and the wall or the wall and the roof. The whole building technology is integrated into the modules, and only some small parts between the joints have to be made in Versailles.

Environmental impact

Even if we use a large amount of wood, this main material is sustainable because it regrows. The connections for this wood construction are mostly made with screws that can be recycled after the lifecycle of the prototype.

Design

The prototype shows its structure on the facade, making it easy to read. The whole exterior space is made out of wood, demonstrating Swiss craftsman-ship. *See Img. 4.*

Img. 3 Floor Plan

See PD#6 AR-Floor

Img. 4 Design of the prototype

Roof Structure

Static System

A secondary roof construction of metal is added, stretching over all three cubes and the space⁺. This roof protrudes from the wooden substructure and forms the supporting structure for technical and functional elements. The shading lamellae will be recycled from remainders of a larger project and are formed of thin aluminium sheets. This results in a reduced overall weight above the space⁺ and complies with the carrying capacity of the roof construction. *See Img. 5.*

Function

The roof construction carries the photovoltaic system, solar collectors, the heat exchanger and the automated lamellae shading for the space⁺. The potential of this construction is seen in an urban context, where such a construction can be expressed as an urban roof garden terrace and extended space⁺, as a pergola and a good new way to integrate photovoltaics, solar collectors and other technical elements.

Construction materials

The supportive construction needs to be strong enough to integrate all the heavy technical components into a frame on the top of the prototype. Using metal as the main structural material we have the opportunity create give a light and filigree expression to this part of our project. As in the urban project, the steel construction defines the urban crown of each building.

Elementing/ logistics

The steel frame is designed with the maximum transportation size, similar to the whole prototype. The steel frame will be screwed together to create an integral structure. For assembly, all the technical components must be replaced to protect sensitive parts.

Gutter design

Each of the cubes has its own drainage. Only the rain water from the space⁺ flows directly onto the lower cubes to collect the useful water in a tank under the platform. Because of the size of all the tree cubes, we don't need a height difference. If the water accumulation is to high, it flows through an overflow valve.

Green wall and its function

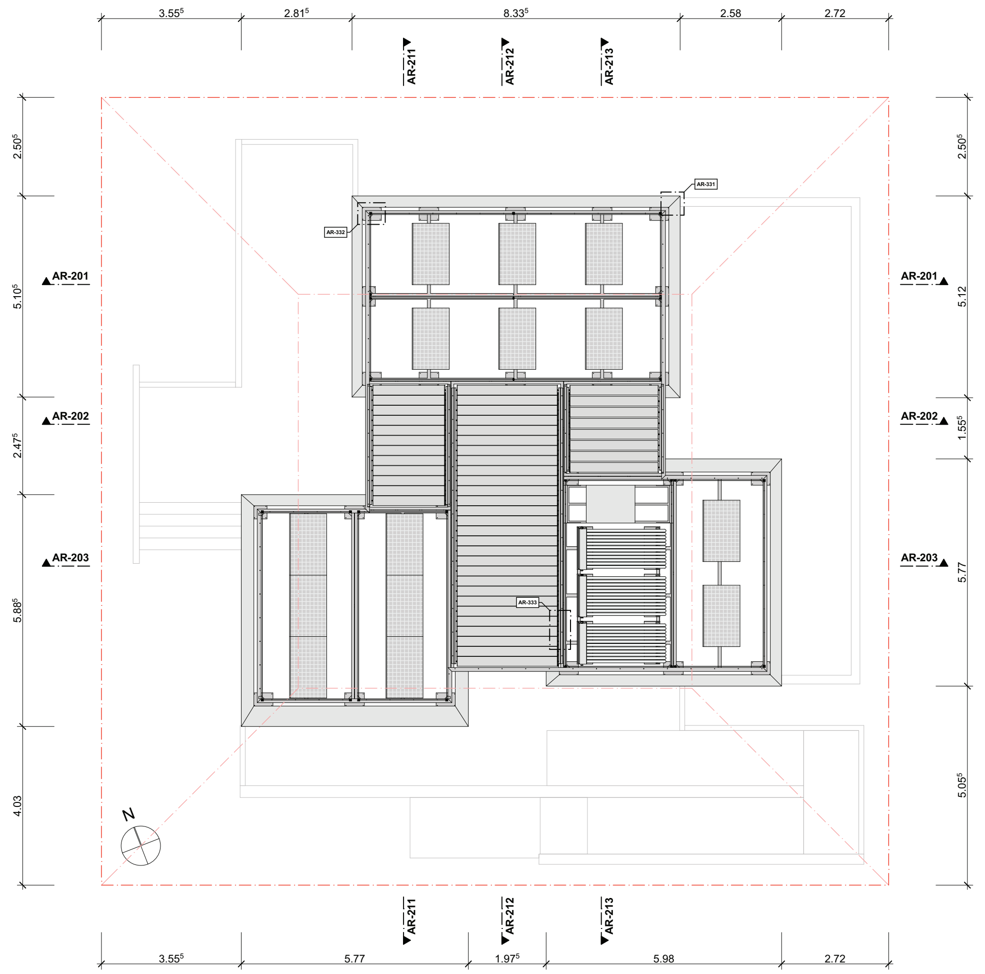
The prototype shows a further connection to the urban context with its green wall on the south, west and east side of the prototype and along the urban crow of the roof. As planned in the urban context, a lively structure is very important to promote good health and regenerate air for a better quality of life. The vertical green area will follow and mark the space⁺ from the ground floor to the roof top garden.

Environmental impact

The roof top garden – as part of the space⁺ – for each building offers a great opportunity for people to relax and recharge their energy. At the same time it is the best place to produce solar energy with photovoltaic panels and solar collectors. So it is a very important part of every city.

Design

We believe the roof design shows very clearly the way every roof should be used. Producing energy and recharging the residents' own energy should go hand in hand. *See Img. 6.*



Img. 5 Roof Plan

Further information: PD#6 AR-Roof

Img. 6 Roof

Development Process

Curtain Facade

Our first construction design was based on a common ventilated facade. We selected three different materials that suited our differently used areas. The sharing room was planned with slate, the semiprivate kitchen cube with a wood material and the private cube consisted of a wooden facade. The three cubes show their degree of public use in the material and their dimensions. Our target was to integrate the slate facade in passive thermal management, based on the fact that we have a black facade, which would heat up. We planned to insulate the slate facade to ensure a quick phase change to balance the night cooling. This was statically based on a supporting wall system, and the insulation was sheep's wool. The visitor wouldn't be able to see our structural system, because it would have been covered by the exterior. The walls and the floor were designed as a concrete composite system. The supporting wall would be required to bear the weight of the concrete composite.

Rejection

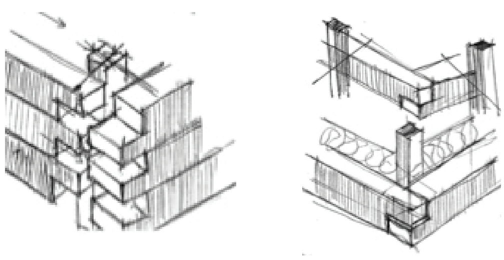
This design would have been interesting for our urban building context, but was not suitable for the competition prototype. Calculations showed that the night-cooling facade system would not work due to the size of the prototype. The structural design was not clearly apparent and the concrete composite system is an inert material that would not allow the cubes to switch climactic modes easily. The weight of the construction was also centrally problematic. The transport would have been very complex and cost-intensive. The manifestation of the Swiss craftwork was not shown in this model, and the structural design did not communicate the vision that we wanted to express to visitors.

Log House Construction

We needed to define what kind of requirements we wanted the prototype to comply with. The prototype needed to show the structural system, Swiss craftwork, Swiss native material, traditionalism, new interpretation and innovation. The entire facade, roof and floor systems should be based on simple construction practices.
Our research and knowledge of Swiss traditional architecture reminded us of the simplicity of the old farmhouse systems. They were built in a log house system out of one material: wood. The visitors would identify the prototype immediately as belonging to Team Lucerne – Suisse. The Swiss craft would be shown in the woodwork, the structural system would be recognizable, and the entire construction would be representative of Swiss workmanship. Interior design and the non-bearing walls would form a symbiosis with the structural walls and everything would be inter-supportive. The concrete composite system in the earlier design wouldn't be possible because the exterior needed to be load-bearing.
See Img. 7.

Rejection

One of the main problems with this construction was the heat transform coefficient. The construction needed internal insulation. This meant that the performance requirements would not be satisfied. We needed 2-3 cm exterior wood cladding for the structural system. The design would have been a fake facade, transforming a log house construction into a cheap weatherboarding look. From this design we took the idea of working with wood and showing the structural principal of dependence on the facade. Although we chose not to use this design, we moved forward with low-tech or no-tech as a basic principle for our further concept.



Img. 7 Sketches Log house construction

3.2 Constructive Design

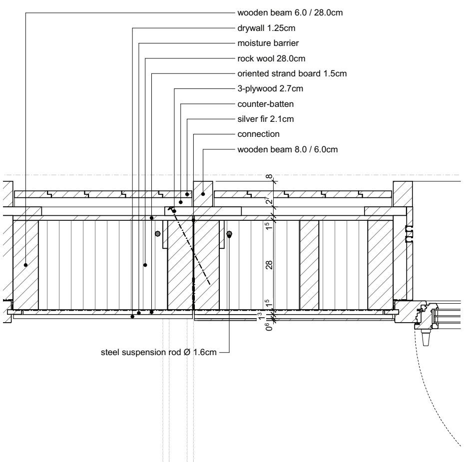
The your⁺ prototype is based on a standard wood frame construction. A precise grid order of the structural elements is consistently translated in the facade as well as the open ceiling of the space⁺. The structural design is a formative element of the prototype. Because of the short setting-up time the cubes are split into modules and elements. my room and our room are built up and transported as volume modules, while your room is transported as ceiling and wall elements due to limited transportation height. The glass roof and floor of the space⁺, the entrance doors and the steel roof are transported in single elements. *See Img. 8.*

Results of Collaboration

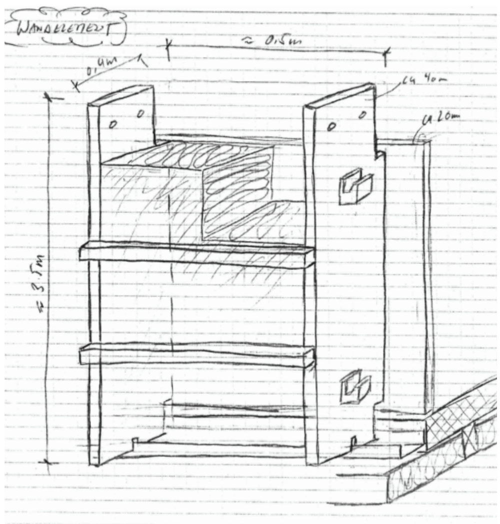
The construction is based on a grid, which makes our job at the building site easier. It supports the modular partition and allows us one system each for the wall, the roof and the floor. This affects all three cubes. Their walls need to fit into the grid, each room must be adjusted into the framework. The interior design is dependent on the structural design. Even the facade celebrates the stringent structure. The supporting construction is visible from the room, the space⁺ and from outside. This shows that the entire design and expression is derived from our collaborative system. It gives us a basic condition to plan the pavilion, and also the urban context.
The design of the space⁺ arose from structural requirements and became an architectural highlight due to its application. *See Img. 9.*

The Reason for this Construction

Starting with the idea of sharing, we searched for an adequate system that could express our concept in connection with structural, sociological and architectural aspects. Our research on traditional architecture and the interdisciplinary work with the engineers was the cornerstone of our structural system. This simple and logical system integrates all of our disciplines. We show our supporting system, built with Swiss native wood and reinterpreted an old decorative element in a new context. The innovation of our system is to limit dependence on high-tech solutions and focus on further development of basic systems, which have been reconsidered and interpreted for our own purposes.



Img. 8 Construction Detail



Img. 9. First sketches of shelf idea

Material Concept

The shelf and the non-bearing facade are built using spruce wood, which grows in our local forest and nurseries. The type is silver fir, the most common softwood in the Swiss forests. The insulating mineral wool is a natural/synthetic product fabricated from minerals and recycled fibres.
The shear supporting back wall is an OSB (Oriented Strand Board) panel. The OSB, unlike the three-layer plate, has a higher bearing load, but cannot act as a vapour barrier in our case due to the modular construction. A gypsum board is fitted into it, and depending on the room, different wallpaper elements are applied. The outer facade is a reinterpretation of the traditional clapboard, composed of over-dimensioned shingles which can handle the swelling and shrinking of the wood.

Energetics

Thermal Insulation

The insulation is mineral wool, a natural/synthetic material. Mineral wool is a very cheap material, and so can be used for larger urban projects with a high cost-benefit. The three cubes are highly insulated, and have no thermal bridges. The walls between the cubes and the non-air-conditioned space+ are reduced to save both, material and space. The space+ is located between the three cubes and is insulated by them.
Mineral wool characteristics are:

- good lambda-calculus around 0.04 W/mK
- highly economic
- non-flammable
- rot protection

space+ PCM

The space+ is not actively air-conditioned. The inside temperature relates very strongly to the outside temperature. For that reason we use Phase Change Materials (PCM) to regulate the temperature. The PCM is integrated into recycled Steico beams and generates a very unique atmosphere. The thermal mass (PCM) is located very near to the skylight to have a maximum heat-gain in winter, while it is located close to the ventilation valve for ideal heat reduction during summer

Shading System

Shading shutters

The flexible wooden sliding shutters, with its perforations and decorative purposes, allows for different openings and gives the correct daily light factor for every room. This solar protection vertically slides into the sidewalls of the shelf supporting structure. With five different settings, the two shutters can react differently throughout the year. Each direction has its own perforation to react on the different altitude of the sun.

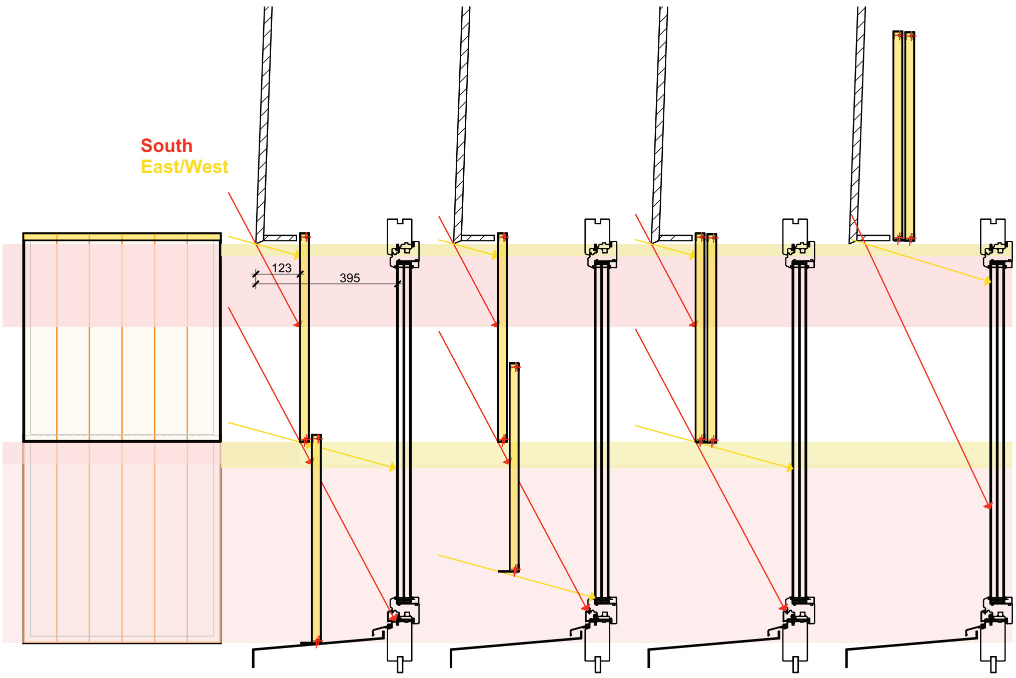
The shading shutters are well integrated into the project due to their similarity with the entire facade. Nevertheless the shutters are own elements and are defined through its back dislocation, as well as the different angle of slope. The architectural design of a uniform design for the whole facade.
See Img. 10 + 11.

The technology for the shutters is kept very simple, to allow simple assembly. A motor adapted from a regular shutter shading system pulls a belt that moves the lower of the two shutters. The lower shutter then pulls the higher one to preserve the visual appearance of the facade and saves an extra motor.

Even if the motor allows infinitely variable adjustment for the shutters, only five main positions make sense to avoid the direct sunlight from heating up the room behind, as shown in *Img. 12.*

Img. 10 Shading shutter down

Img. 11 Shading shutter up



Img. 12 Graphic shading shutter

The shutter fillings are based on a sunlight study for the your⁺ prototype at the versailles location as well as for the final location in Horw/Lucerne for correct alignement. *See Img. 13 + 14.*

This sunlight study in shows the possible positions of useful perforation in the wooden slats. Due to the use of single wooden slats, the perforation must have a very strong effect on the material. The symbolic better has to be horizontal, because of the location of the sun, and at the same time it refers to the your⁺ logo equally. *See Img. 15.*

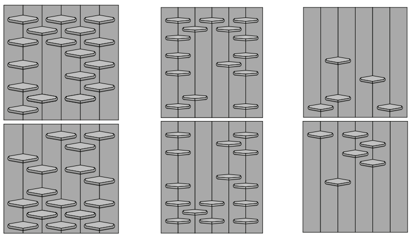
The fillings of the shutters are on each side different, because of the different geographic direction. In the south, the perforation is mostly located on the top and bottom of the shutters because of the steep solar angle. But we have also have a perforation in the middle of the shutters, which is on eye level, to allow the inhabitants to look out. On the west side of the prototype, where the sun is incident flat in the evening, the perforations are smaller than on the other sides. Also the large jamb depth which brings a shading to the sides of the shutters,allows an aditional perforation on the side of the shutters.

Last but not least the shutters have a very aesthetic aspect. The design of the shutters creates a playful lighting atmosphere for the interior of each room when the shutters overlay or move. *See Img. 16*.

The innovation of these shutters are lies in the additi-onal noise absorbing function of the heavy wooden shutter, as well as the complete integration of the shutters into the facade.
The easy cnstruction of the shutter system allows it to be used even in an urban project.

Img. 13 Sunlight study south 15:00 in July

Img. 14 Sunlight study south 18:00 in July

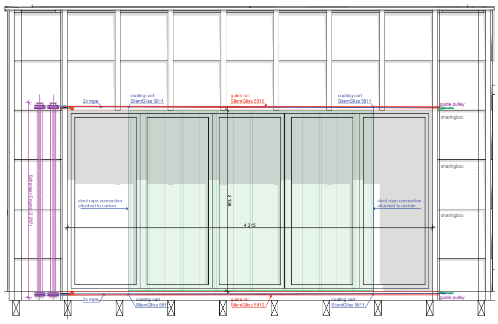


Img. 15 Sun design south, west, north

Img. 16 Atmosphere

Shading curtain

The large opening on the south side of your room shows the outflow and the public nature of this room. This room is the most commonly used room in our prototype. Therefore this room will need a very soft and sensitive shading system such as a curtain. Due to the fact that the south side of our prototype is highly exposed to sunlight, we can use a textile shading system with a g-value of 0.14. The shading curtain is movable on both ends, to give us the opportunity to open the curtain from both sides. When the sun creates shade on one side of the opening, due to the large jambs we have an extra light gain in your room. *See Img.17 + 18 .*



Img. 17 Shading curtain

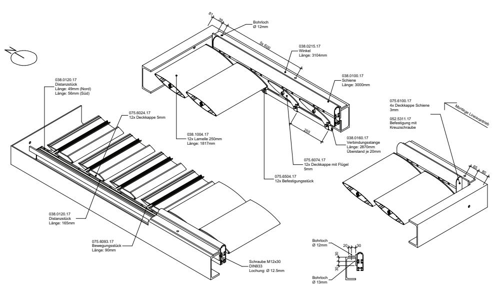
Img. 18 Shading curtain

The contruction of the shading curtain is kept as simple as possible. Two motors, which extend from the bottom to the top of the opening move two coating carts in a guidrail with steelropes. The two engines are the same products as in the shading shutters. The guiderail is adaptet from an automatic curtain system which is used indoors for heavy theater curtains.
The curtain itself is a textile, which is used for regular textile shading systems. With its great g-value of 0.12 and its high transparency, it creates a bright interior with excellent shading properties. The innovation of this automatic curtain system is that it is movable at both ends with only one guiderail. The curtain is also a good noise absorber, which is very useful in an urban project.

Shading fins above the space+

Midday light is the strongest light and has the highest ability for passive solar energy. In summer we use the movable shading fins to prevent the direct sunlight from entering the space+. In winter we use the same fins to reflect even more sunlight into our space+.

This shading system is very important in the urban context, because of the high exposed area it is covers.
We use thin aluminium fins, which are leftovers from a larger project. These fins are motorized by four rod engines and spun together. *See Img. 19.*



Img. 19 Shading fins

Passive energy strategy

The space+ is a central element of our prototype and plays a very important role in the passive energy strategy. In the summer we use the natural cross-ventilation above the ceiling to dissipate the heat. In the winter we use this room to gain maximum solar energy, which can be used for this room or shared with the cubes around it.
See Img. 20.

Environmental

Acoustics

In the interior of the building we use curtains to get better acoustics for each of the rooms.

Fire protection

With numerous doors that lead to the outside we can evacuate the prototype very efficiently in all directions.

Durability

The wooden facade is painted to make it more durable. The natural painting consists of a UV-protection as well as protection against rot. The elements that are in contact with the soil or other moist parts are built in metal to prevent from rotting.

Recycling

For many different parts of our building we used recycled parts from other, larger buildings. The shading fins above the space+ are an excess from a large industrial building. The Steico beams, as used for the ceiling in the space+, are also not new, but have already been used in a residential building.

Building Envelope

Floor

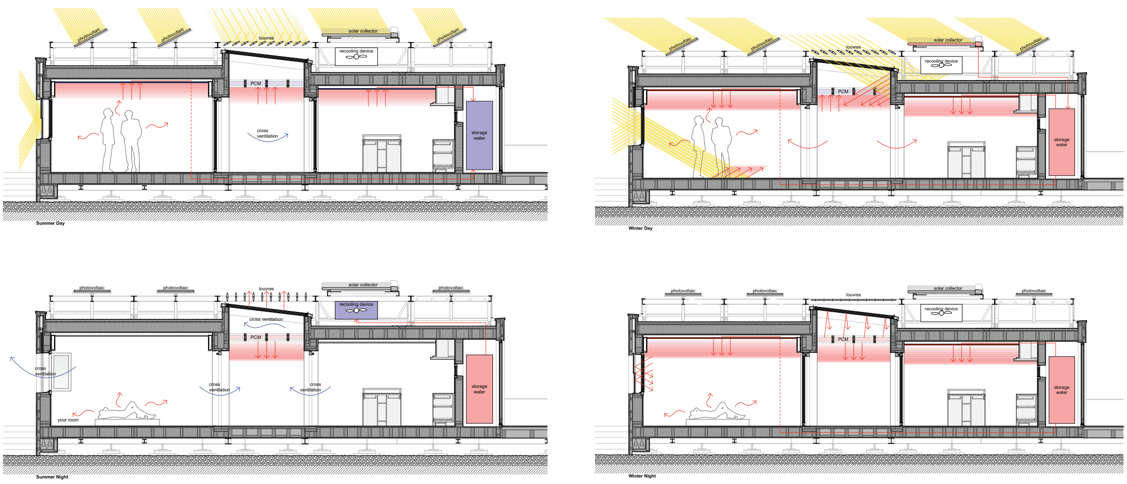
The bottom surface is understood as the flow across the entire surface of the prototype. It will connect the three differentiated spaces and strengthen the spatial circuits. It is constructed from oiled smoked oak. The dark colour will contrast the facade and the colourful forms in the interior spaces. Using the width of the floorboards, interior and exterior space will be differentiated in this way.

Wall

The top coat of the interior walls in the cubes is a plaster plate to improve humidity regulation. The walls are shown differently in each room. The wall colour used relates to the urban context to present the parallels with the prototype.

Roof

We adapt the wall system in the roof. The roof needs to be waterproof so we need a water-repellent film. The skylight will have triple insulated glazing. The sunscreen will consist of photovoltaic panels and the covering will be equipped with PCM. All structural woods are spruce. The secondary patch roof, including photovoltaic systems plus the solar collectors and the shading elements, is integrated in a C-profile steel frame. The shading fins will be produced from the waste product of larger elements. The blades themselves are made from lightweight aluminium sheeting, minimizing the weight of the automated shading system.



Img. 20 Passive energy strategies

Further information: PD#5 BA-011

Facade

The wooden shingles on the facade refer to traditional Swiss houses with smaller shingles. The new interpretation allows us to create a modern expression with vernacular roots. The treatment of the wooden shingles as well as the continuations of the wooden structure show that the facade must react to each context individually. We propose that the wall construction from our prototype is similar in the urban context, but the expression with the facade of each individual building still needs to refer to its own urban context.
The wood we used in our prototype is silver fir like the whole prototype structure. Silver fir is a Swiss native wood and very common in Swiss forests. The bright white painting refers to the urban context and shows a dematerialization effect.

Doors and windows

Doors symbolize a transition from one place to another. The sliding doors, which are used as entrances to the cubes, support the possibility of switching the rooms. The sliding doors generate the largest possible opening with no door leaf standing inside the room or the opening. For the entrances to the space⁺ we use swinging doors to show several situations. The swinging door on the south side, which is the main entrance to the prototype, as well as the swinging door on the east side, look like an apartment's entrance door. Therefore these doors are opaque with two small windows on the side. The large glazed swinging door on the west side consists of one big door without any side windows. This door shows how the space⁺ could continue and gives no visual barriers.
Windows are the connection to the outside of every building. The windows in our prototype support the connection from the space⁺ as a central element and visualize a continuation to the outside.
See Img. 21.

Img. 21 Window south kitchen

space^{+}

In the space^{+} we also integrate visible beams. The beams are an interactive part of the light concept. The space^{+} can be bright and flooded with light, or shadowed with a unique shadow pattern. The windows that are integrated in the roof generate a fabulous atmosphere, and are important for the passive building technology. The ceiling of the building carries vertically placed girders, which results in a covered grid. We intended to place the beam construction at the space^{+} area; however this would result in a girder depth of approximately 50 cm. Currently the load transfer of the ceiling towards the shoring is unidirectional and therefore the shoring would only slightly be statically loaded. *See Img. 22.*

The statically correct direction of the bearer in the space^{+} would head towards the lateral direction and therefore would result in a strong zoning and disturbed pattern of the ceiling. Converting the construction of the ceiling towards a grid-barrier and therefore moving away from the structural system of a simple beam towards a shoring, the entire ceiling can be reduced in height and the load transfer can be subdivided into all shoring, resulting in a homogenous pattern in the ceiling within the space. Beams that are not load-bearing will be PCM and therefore placed in an appropriate area in a non-structural setting. All these technical elements will lead us to the architectural attitude of the space^{+}, which should depict it as our core topic and therefore as a highlight of the project. The space^{+} should be used as a flexible element and thus become a habitable room within an urban context. Furthermore the space^{+} is the connective element among the cubes and therefore reflects this by its artistic structure. Shutters will be placed which will be connected to an integral system consisting of photovoltaic facilities, based on the arrangement of the frontage by adapting vertical sliding shutters of traditional central Swiss architecture. The photovoltaic facilities can be horizontally shifted and, due to their flexibility, result in gorgeous shadow patterns inside space^{+}.

The artificial light will be supported by the structure of the ceiling. It is planned to achieve a warm mood with the lighting system. The light sources are integrated in the room and should support the intended multidimensional event within the prototype. The limited amount of chosen light sources will revert to the mobile luminous elements. The floor of the space^{+} should integrate a homogenous pattern, interacting with the platform. We searched building technology for low-tech solutions and chose to use natural ventilation for a passive system.

Moisture protection

The facade is ventilated to protect the wooden shingles from rotting. With a gap between the exterior wall and the facade shingles, the air dissipates the moisture throughout the year. The roof, as a main exponent to the rain, is sealed with high quality Sarnafil sealing sheets, which overlap with the roof edge. On the interior side of the cubes we use a vapour barrier between the plaster plate and the wooden OSB plate to regulate the moisture.

Img. 22 Visualization of the interior space^{+} in the urban buildings of Lucerne

3.3 Plumbing System Design

The reuse of grey and rain water reduces fresh water consumption. Reducing water consumption eases the burden on the sewage system and wastewater treatment. To achieve ideal operative efficiency, all consumers must be networked with each other. In this way, all devices are only activated when sufficient energy is available and thus the available energy is ideally utilized.

Primary Objectives

The primary goals can be reached directly through plumbing engineering:

- Fresh water requirement (cold water) as limited as possible
- Hot water limit output (50 litres in 10 minutes)
- Hot water temperature below 43 °C / Dishwasher uses 49 °C

Secondary Objectives

Objectives influenced indirectly by the plumbing engineering:

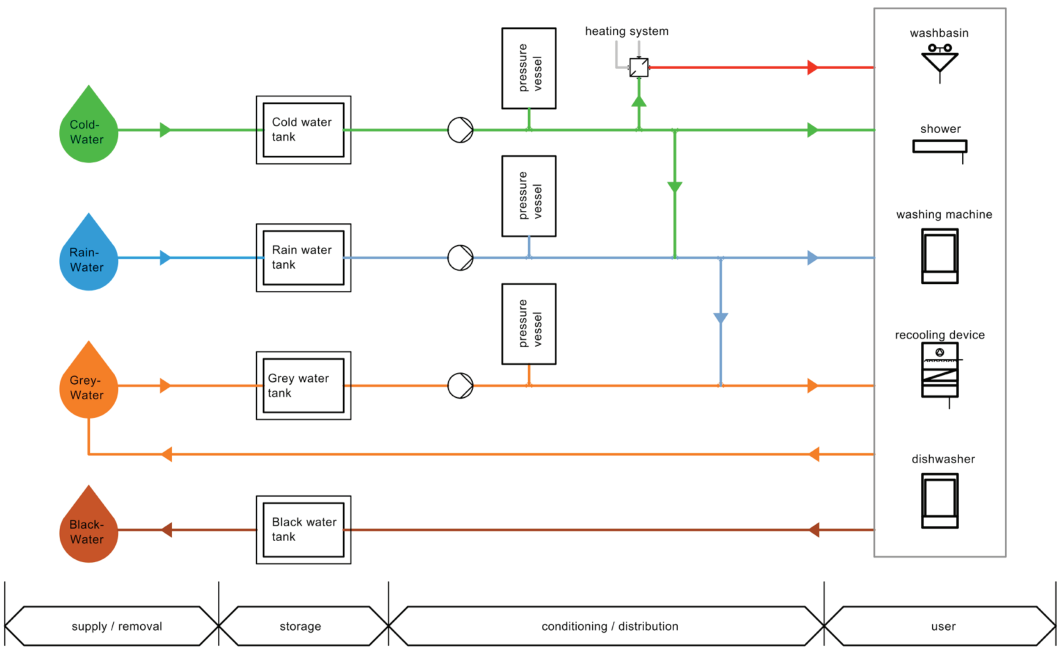
- Acoustic (sound insulation)

Principle

The supply and disposal principle of the water consumption must be kept as low as possible. This is achieved by repeated use of water (recycling). There are four different water quality levels defined in this model.
See Img. 23 and *further information: PD#6 PL-101 + 102.*
The structure of the principle involves four steps. The processing includes filtering and a minimum pressure increase, which transports the water to the usage point. Depending on whether the water can be recycled, it must be stored in a specific holding tank until it is emptied/recycled. *See Img. 24.*

Water type	Quality	Pollution	Recyclable
Fresh water (Cold / Warm)	Potable	Low	Yes
Rain water	Not Potable	Low	Yes
Grey Water	Not Potable	Middle	No
Black Water	Not Potable	High	No

Img. 23 Water Quality levels



Img. 24 Schematic diagram of the water flow

Equipment/ Water Type

Equipment list with associated supply and disposal of water. *See Img. 25.*

Cold Potable Water

The storage of the cold water is under the patio in a plastic tank. By means of a pump, the pressure level of the cold water is increased and stored in a membrane tank. This concept makes it possible to distribute the pump run time, and the resulting energy requirements are optimized. All appliances requiring a high degree of purity (vanity, sink, etc.) are primarily serviced with this water.

Domestic Hot Water Production

The domestic hot water (DHW) system works with a fresh water station. In this system the energy demand of the DHW will be stored in the heating storage tank. When DHW is needed the system ensures its temperature with an included heat exchanger. The heat exchanger is directly connected to the heating storage and a pump will guarantee the circulation. On the side of the DHW production, the fresh water will flow directly through the heat exchanger and will be heated to the desired temperature. The fresh water is obtained from the cold water tank. *Further information: PM#6 chapter 3.7 + 4.1.*

Grey Water

The used hot and cold water, which is collected from the appliances such as shower, wash basin and washing machine, is re-stored in a tank and reused as grey water. A permanent level measurement and alarm when reaching the storage capacity helps prevent overflow and back pressure. Identical to the cold water, the pressure level is increased and the water stored in a membrane tank. The grey water is used for wetting (irrigation) the recooling device and for watering the plants. If the water demand for the return cooler is larger than the grey water stock, the difference is covered by the rain water network. The use of system separation devices prevents a mixing of the circuits. *Further information: PD#6 PL-101 + 102.*

Treatment Process

The dirty grey water (with a high acidity capacity) is used to protect against pump or membrane blockage using a cleanable prefilter (VF) – bag filter – that retains coarse particles and hair. In the following step, true and dissolved colloidal organic contaminants are partially absorbed in powdered active charcoal (AD). Then flocculation using aluminium salts flocculates dissolved colloidal contaminants and very fine particles from the active

Equipment	Supply				Disposal	
	Cold water	Warm water	Rain water	Grey Water	Grey Water	Black Water
Shower	x	x			x	
WC			x			Not connected
Washstand	x	x			x	
Sink	x	x				x
Dishwasher	x	x	x			x
Washing machine	x	x	x		x	
Wetting recooling device			x	x	x	
Garden irrigation			x	x	x	

Img. 25 Apparatus with associated supply and disposal

powdered charcoal, while orthophosphates are extracted (FL). For this process, the pH value of the grey water is maintained for the flocculation process to be ideally effective. Then the mixture of loaded powdered active charcoal, aluminium phosphate and colloids is removed by filtration (UO). In the fifth stage, the filtrate is treated with chlorine-based disinfectant (Cl) and fed into the tank for the hybrid recooler. *See Img. 26.*

Rain Water

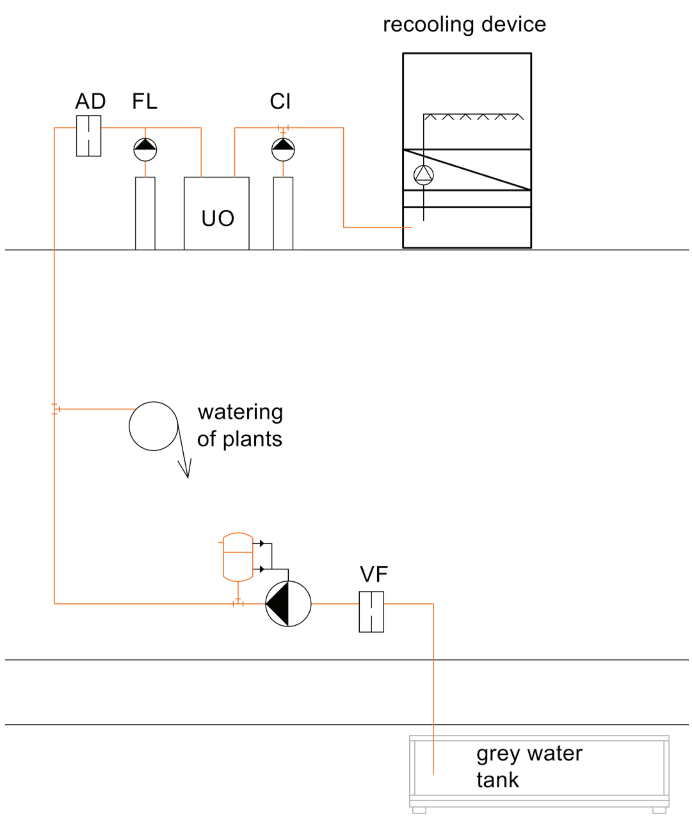
Rain water is collected on the roof and stored in a tank below the terrace. As in the cold and grey water system, the pressure is increased to optimize pump operation. The rain water is used for wetting (irrigation) the recooling device and for watering the plants. At the tank's storage capacity, rain water flows through an emergency overflow to the outside along an escape channel.
Further information: PD#6 PL-101 + 102.

Treatment Process

A cleanable coarse filter is installed for the slightly contaminated rain water to protect against pump blockage, thereby catching coarse particles. *See Img. 26.*

Special Application

After the SDE competition and reconstruction in Switzerland, the rain water is used in appliances (toilet, washing machine) that can be equipped with non-potable water quality requirements. The rain water is used for an initial prewash in the washing machine and dishwasher. This prewash is not a problem for the appliances and hygiene requirements. The main washing cycle of every wash uses heated, clean fresh water.



Img. 26 Treatment process

Black Water

Waste water must be stored in a tank (below the terrace). The tank is periodically emptied by the organizers.
Further information: PD#6 PL- 102.

Tanks

Four tanks form the basis of the prototype's water supply / disposal. These contribute to meeting all water-related needs. Four water-cycles are linked to the four tanks. The characteristics of the tanks:
Further information: PM#6 chapter XI. and *Img. 27.*

Maintenance

Img. 28 shows responsibilities with respect to maintenance and checking work for the plumbing system. These checks can also be taken over by the user / home owner.

Water Delivery and Water Removal

All the water tanks are located under the platform adjacent to my room. *Further information: PD#6 PL-001.*

When the fresh water is delivered, the fresh water tank with a capacity of 1125 litres must be filled. The filling is carried out into the delivery connection of the tank (as indicated *Img. 26* and *further information: PD#6 PL-041*). As the water is removed, the black water tank (capacity 450 litres) must be drained. If the grey water is not used enough and thus the tank is full, the grey water tank (capacity 1125 litres) must be drained as well. If this situation occurs, the water crew from the organisation committee will be instructed on site.
The maximum draining capacity is 1575 litres. The removal will be carried out from the removal connections of the grey and black water tanks (as indicated on *Img. 27* and *further information: PD#6 PL-041*.

Connection pieces

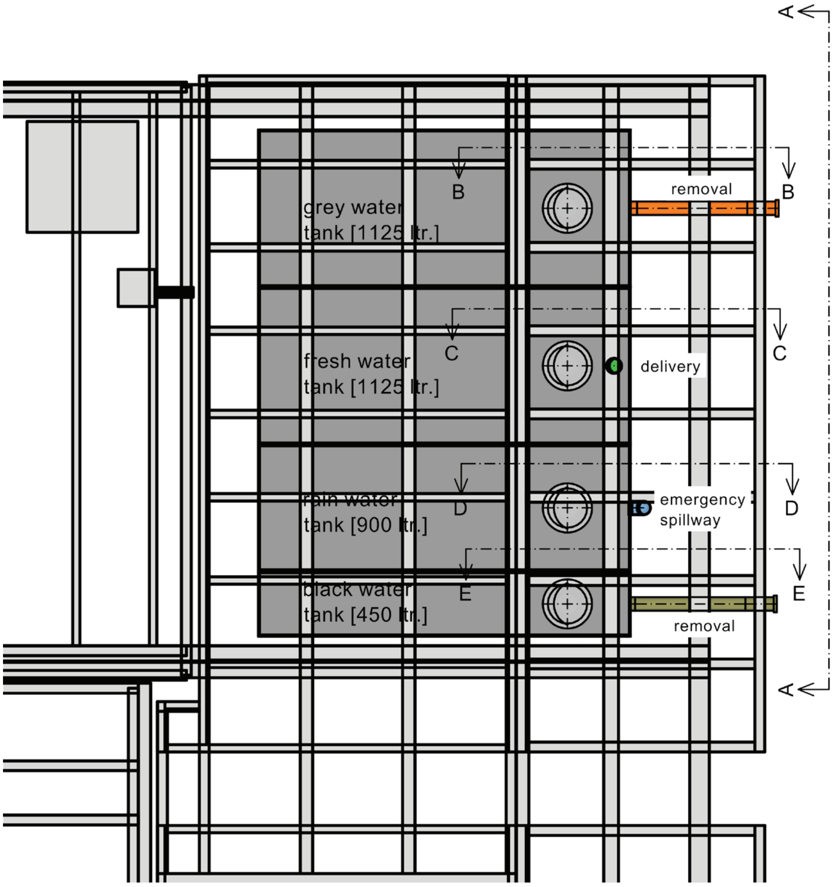
The supply and disposal line of tanks have the following transition:
Type: Guillemin coupling
Diameter of the opening DN 75 with hose nozzle with adjustment and seal of nitrile rubber
All openings are easily accessible and the clearance above the tank is available. *See Img 29.*

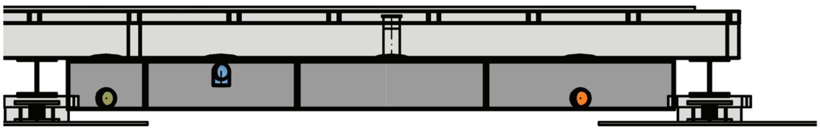
Function	Fresh water tank	Rain water tank	Grey water tank	Black water tank
Size [mm]	3270x1250x335	3270x820x335	3270x1250x335	3270x470x335
Capacity [l]	1125	900	1125	450
Location	below the terrace	below the terrace	below the terrace	below the terrace

Img. 27 Tank size

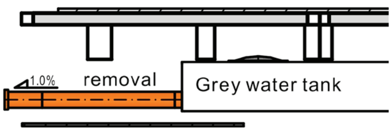
Material	Control Period	To DO
Tanks	Annually	View check, cleaning
Raising Pump	Annually	View check, pressure check
Filter	Annually	View check, replace
Faucets	Annually	Cleaning fine filter

Img. 28 Maintenance material

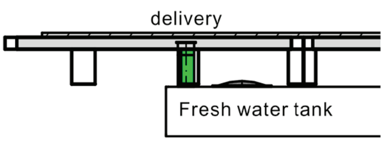




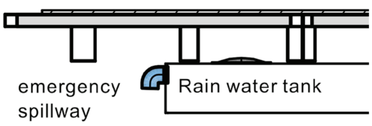
Section A - A



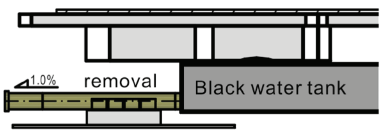
Section B - B



Section C - C



Section D - D



Section E - E

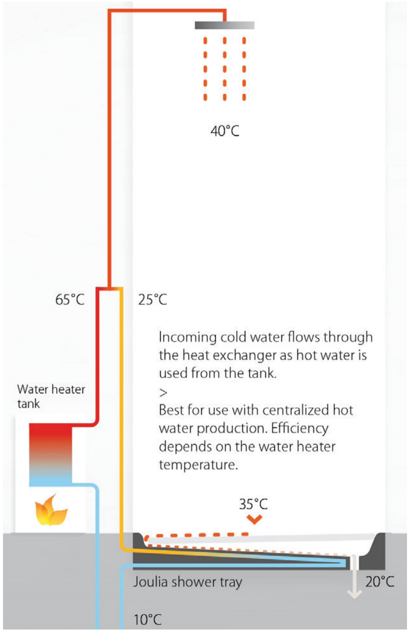
Img. 29 Location of the tanks. Grey and black water removal connections, fresh water delivery connection indicated

Grey Water Heat Recovery System

The shower Joulia has a "batch-type" grey water heat recovery system, but this is not connected now. We will connect it in Switzerland after the SDE competition.

Shower-Joulia

The innovative shower design helps to save energy for the supply of hot water. An included heat exchanger in the platform of the shower retains the heat energy in the used grey water and transfers it to the supply cold water, which will partially be preheated. This results in a direct grey-water heat recovery system in the shower itself. (Joulia.com) *See Img. 30.*



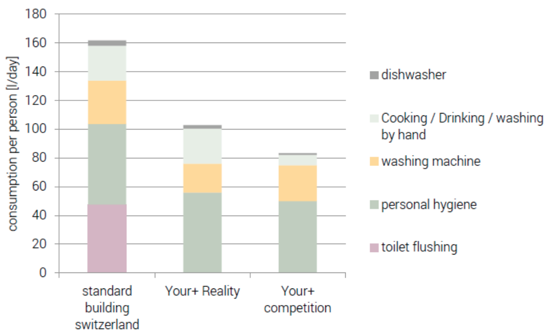
Img. 30 Shower Joulia

Water Saving Technologies

The main goal of the plumbing system is to reduce the fresh water consumption by reusing as much grey water as possible. In addition the rain water from the roofs is collected and will also be used to reduce fresh water consumption.
Eventually not only the fresh water consumption will be reduced, but also the consumption of any water. This will be achieved by water saving technologies such as highly efficient household appliances and by using faucets with economic water consumption.

By using these saving strategies the fresh water consumption will be reduced by 35% compared to a standard residential building in Switzerland.

Due to special consumption during the competitions, the daily demand for fresh water will be slightly lower than in standard use. The water consumption during the competition does not reflect reality because the available water is non-potable and the usage of the water will be carried out according to the rules. So the cooking will be performed with a limited amount of water and a variety of applications will not be used in a daily routine. *See Img. 31.*



Img. 31 Water consumption

Toilet-Roca

The special design of the toilet washstand combination is equipped with a water saving system.
After using the fresh water in the washstand, the water will be stored in a small tank, which is included in the appliance. This stored water can be reused to flush the toilet. This ensures a direct grey water recirculation inside the toilet. *See Img. 32.*

Img. 32 Toilet Roca

Domestic Appliances

The domestic appliances feature high energy-efficiency, as displayed by their EU Energy-Labels. Since Switzerland is the place of manufacture, the energy consumption for transportation is reduced.
To present the sharing concept the washer-dryer will be located in your room and will therefore be shared among several parties in the prototype. All the remaining domestic appliances are located in our room, which is the kitchen in the prototype. *See Img. 33.*

Faucets

All chosen faucets in the prototype ensure economic water consumption through their efficient design. The high quality standard of Dornbracht faucets guarantees a long life and a low pressure demand to work properly.
As in every part of the planning process the concept of sharing plays a major role in choosing the ideal components for a complete system. The faucets of the private room, my room, allow the standard personal hygiene routine . The faucets in our room, where the kitchen is located, help to maintain a working comfort as required to achieve an industrial kitchen standard. This standard is needed because the kitchen will be shared by many different parties in the urban buildings and thus the facility will be used more often, which leads to increased wearing of the faucets.

Domestic Appliances

Appliance	Manufacturer	Model	EU Energy-Label	Location
Washing machine	V-ZUG	Adora SLQ	A+++	**your room**
Drying machine	V-ZUG	Adora TSL WP	A+++	**your room**
Dish washing machine	V-ZUG	Adora 60 SL	A+++	**our room**
Oven	V-ZUG	Combair SL	A	**our room**
Fridge	V-ZUG	Futura	A++	**our room**

Img. 33 Domestic appliances

3.4 Electrical System Design

The electrical installations are designed and constructed to comply with all applicable rules and regulations, ensuring they are ideally integrated into the architecture and have minimum energy loss. The flexible use of electricity and light emphasises the concept of sharing in the electrical system design.

Regulations and Policies

The electrical power needed in the prototype and its appliances is provided by a single-phase supply at 230 V / 50 Hz and the low voltage grounding means system follows a TT configuration.
All facilities in this project are planned according to currently applicable standards and technical regulations. As state-of-the-art technology, in particular, the following standards apply:

- IEC (International Electrotechnical Commission)
- CENELEC (Comité Européen de Normalisation ELECtrotechnique)
- CEN (Comité Européen de Normalisation).

Where no internationally harmonized standards exist, the applicable French standards, policies, guidelines and recommendations apply.

The following requirements apply to all facilities in this project:

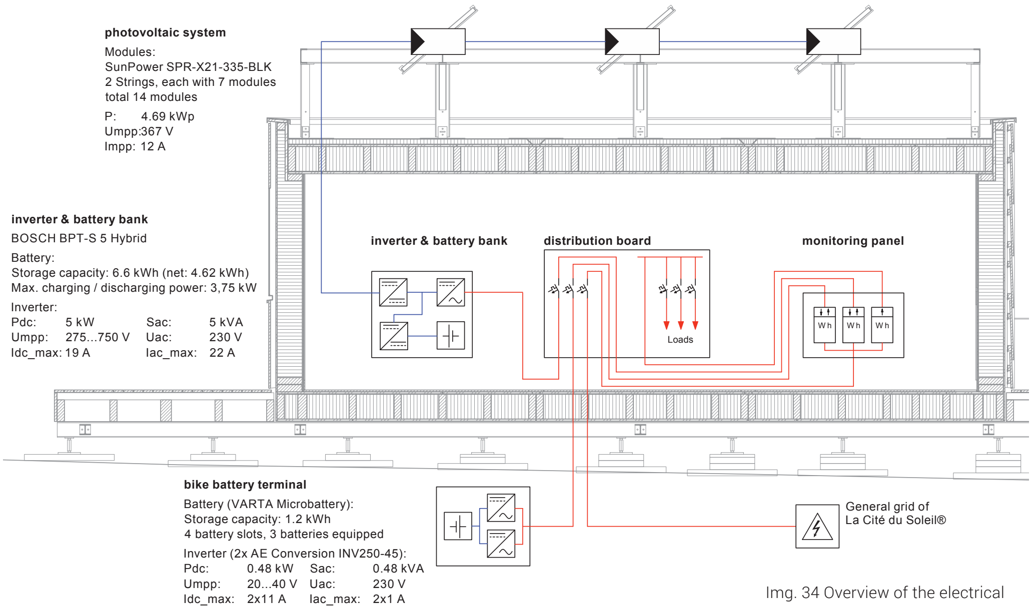
- All connections have separate neutral and protective conductors
- Neither neutral nor earth are reduced
- All lines are installed with wires made of copper, are halogen-free and have a minimum nominal voltage of 450/750 V
- No single insulated conductors are used (except in the electrical distribution board)
- A consistent order separation is provided between heavy and low current lines
- Apart from the utility room all installations are in-wall
- Only Swiss standard "Type 13" sockets with protective contacts and collar and child protection are used
- All electrical equipment is selected to comply with the necessary protection against external influences (dust and water) and have at least an IP-code of IP2X or higher (protection against direct contact)
- If the cover of a device needs to be opened, this is only possible with a key or a tool

Grid Interconnection

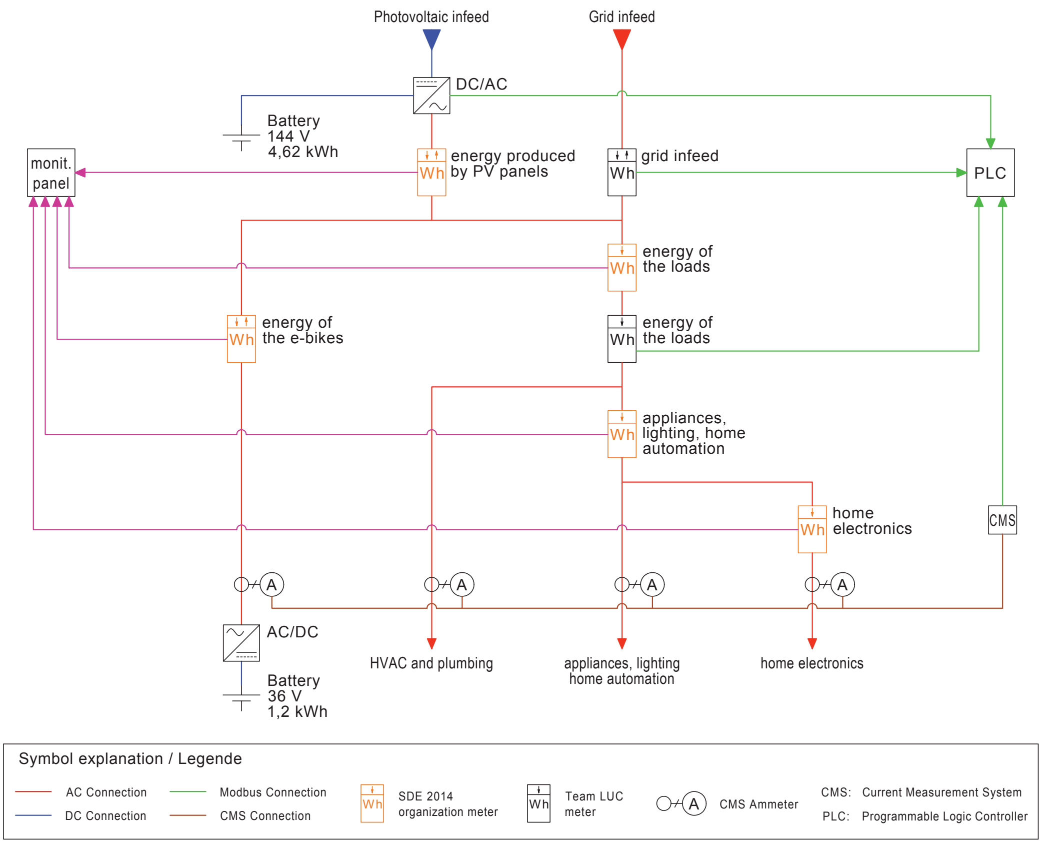
The building is connected to the grid of La Cité du Soleil® by means of a general box on the lot and is connected directly to the distribution board using a 3x16 mm^2 cable (halogen-free and 0.6/1 kV insulation). The supply line is protected by a 63 A MCB with protected neutral and a 63 A RCCB with a sensitivity of 300 mA.
Further information: PD#6 EL-001 + EL-501.

Photovoltaic System and Battery Bank

Detailed information on the photovoltaic system, battery bank and bike battery terminal can be found in the *PM#6 chapter 3.5.*
The PV system is tracked in East-West direction and consists of two strings each with seven modules, with a total installed power of 4.69 kWp. The hybrid inverter with a power of 5 kW is situated in the technical room and forms a unit with the battery charging controller and the battery bank. The batteries have a total net storage capacity of 4.62 kWh and are fed directly from the DC intermediate circuit to minimise inversion losses. *See Img. 34.*
The charging and discharging power of the system is 3.75 kW.
In addition, a second battery charging station for e-bikes, with three batteries of total 1.2 kWh and an inverter output of 0.48 kW is provided. Both systems are protected by an RCBO 30 mA Type A and are connected to the grid through the electrical distribution board. *Further information: PD#6 EL-501.*



Img. 34 Overview of the electrical power supply



Img. 35 Electrical measurement concept

Electrical Distribution

The electrical distribution board of the prototype is situated in the technical room. It contains all the necessary components required to control and protect the electrical systems. All outputs are protected by RCBOs with a sensitivity of 30 mA, whereby the neutral wire is also protected. *Further information: PD#6 EL-501 + EL-601.*
In addition to the electrical distribution board, there is also the hybrid inverter with the battery bank in the technical room, plus space for the "monitoring panel" of the SDE 2014 Organisation. *Further information: PD#6 EL-010* and *Appendix 12 Datasheet electrical system*

your room and my room are connected by tubes from the technical room. Both cubes have an integrated installation zone (riser shaft) from where cables are connected through the ceiling. In our room, the fine cabling is carried out directly in the technical room. *Further information: PD#6 EL-301.*

Electrical Measurement Concept

The following measurements are integrated into the system by the SDE 2014 Organisation:

- Output of the hybrid inverter of the PV and battery system
- Output of the e-bike battery inverter
- Energy of the loads
- Energy of the appliances, lighting and building automation
- Energy of the home electronics

The first three meters are on the monitoring panel, for which enough space is provided in the technical room. The last two meters are integrated into the electrical distribution board. There is enough space for them on the DIN rail.
Further information:PD#6EL-601.
For our own measurements we use a multi-meter for the loads and a four-quadrant meter in the grid infeed, which is required for the energy management of the hybrid inverter.
In addition to the energy, all power outputs are measured using the "Current Measurement System" (CMS). *Further information: PD#6 EL-601* and CMS data sheet in *Appendix 12 Datasheet electrical system*
Electrical and thermal measurements, as well as water measurements, are logged by the programmable logic controller (PLC) by modbus or M-Bus systems. *See Img. 35.*

Grounding

Further information: PD#6 PV-031.

Earth
The organization will execute the grounding system of La Cité du Soleil® with buried plates as grounding connection points.

Equipotential bonding
An equipotential bonding bar for the main equipotential system will be integrated into the technical room, with which all large, conducting building parts are connected.

Surge protection
Cables that lead from outside into the building are connected to the equipotential system, with appropriate surge protection devices directly on the roof or immediately after entering the building. The electrical distribution board has a combined type 1 and 2 protection in the supply line. The PV system has a medium-level protection (type 2) on the roof at the string end and fine protections (type 3) at the input and output of the inverter.

Lighting Installations

Controlling and Regulating

All lighting in the rooms is switched on and off and dimmed conventionally using switches. The combined daylight sensors and presence detectors dim the light to the appropriate intensity compared with the daylight and switch it off when there is no-one in the room. In the space+ and on the platform, the lights are switched on automatically in low light conditions using motion detectors.
Various scenarios can be turned on using an App on smartphones and tablets. *Further information: PM#6 chapter 2.3.* All sensors (switches and presence detectors) in the room are connected by the KNX bus system, while the lights are connected via the DALI bus system.

Lights and Lamps

All lamps use state of the art LED technology that can be controlled via the DALI bus system. A high priority is not only given to artificial light, but also to daylight. Detailed information on the lighting concept as well as calculations and simulations can be found in *PM#6 chapter 2.3.*
Mobile lamp

The mobile lamp is a light we have developed ourselves. It was a project by two students of Electrical Engineering and Interior Design. The aim of the lamp is to have a light that can be used at various places and for different purposes. The your+ prototype has 4 such lamps.

Electrical power supply

The mobile lamp is powered by a rechargeable battery and is completely cordless, even when being charged. It works as follows: In the your+ prototype, a total of three induction plates are integrated into the tables. They act as charging stations for the lamps. By placing the lamp on the induction plate, it automatically charges using inductive energy transfer.

Light and fields of application

The mobile lamp has two different fields of application, namely as a "work light" and as an "atmospheric light". In areas where it is used as a "work light", it uses cold white 4000K LEDs. THe lighting intensity and beam angle have been designed to produce powerful, clear light on a working surface (approx. A3 format), to provide ideal working conditions.
RGB LEDs are used for "atmospheric light". They can shine in a full range of colours. Manual settings or preset colour scenarios allow the lamp to freely create the desired atmosphere.

Additional features of the mobile light

2 x USB-slots: There are two USB slots at the base of the lamp. They can for instance be used to charge a mobile phone or power any other devices connected by USB.

Clock/Alarm function

The mobile lamp also has an integrated clock and alarm function. The control display shows the time and date. It is possible to program an alarm to set off a variety of desired functions at a specific time:

- Switching the lamp on or off
- Atmospheric light (RGB)
- Alarm ringing

Energy display: The display also shows the current energy level of the rechargeable battery. When the battery's power is gradually depleted, the lamp automatically activates a warning signal to inform the user that the lamp needs charging.

Technical data

- Rechargeable battery power: 2x16,7 Wh
- Output voltage: 5 V
- Maximal Current: 1,3 A
- Activation period: The lamp can be used in both modes for 3-4 hours. That depends on how strongly it is dimmed and how many additional features are being used.
- Luminous flux of both modes: approx. 300 Lumen

Power Installations and Appliances

Appliances

All the household appliances should perform in as energy-efficient a way as possible, whereby it should be noted that only a 230 V power supply is available within the prototype. For successful energy management, as many devices as possible should be controlled using the Building Automation System (BAS).

Shutters

All sun-protection systems are controlled automatically via the BAS, depending on the light intensity and the global radiation. The aim is to use as much daylight as possible, while also shielding from global radiation in the summer and using its warmth in the winter. For the sake of convenience, all shutters can also be adjusted by switch or tablet, either manually or integrated into scenarios. The switches are connected via the KNX bus system, while the shutter actuators are placed decentrally in the relevant rooms for reasons of space.

HVAC and Plumbing Installations

All systems are controlled and regulated using the PLC. Each room is equipped with a temperature, a CO_2, a VOC and a humidity sensor. Furthermore, the valves and thermostats for the heating and cooling groups and decentralised ventilation devices must also be connected to the rooms. The other field devices are situated centrally in the technical room. All room sensors are connected to the BAS via the KNX bus system and the other field devices directly via I/0 modules of the PLC.

Heating and Cooling

The heat pump and cooling machine contains its own PLC for controlling and regulating. Commands to heat or cool, as well as to produce operative and fault reports, use binary inputs and outputs. All other reports are communicated to the BAS via a modbus interface.

Ventilation

The decentralised ventilation devices are adjusted in increments via an analogue interface. The fault report is sent using potential-free contacts. The ventilation windows in the Space Plus are directly controlled from the PLC using 24 VDC.

Plumbing

Each water tank is equipped with a level sensor that reports the filling level using an analogue signal to the BAS. The booster pumps are controlled by the PLC.

Communication Systems

Predictive controlling of the building requires weather forecast data. A Wi-Fi network is provided that uses the mobile telephone network to access the Internet. The according Wi-Fi router is placed in the space⁺. Communication with the BAS will also be possible using portable devices (smartphones and tablets) that are connected to the Wi-Fi network.

Safety and Security Systems

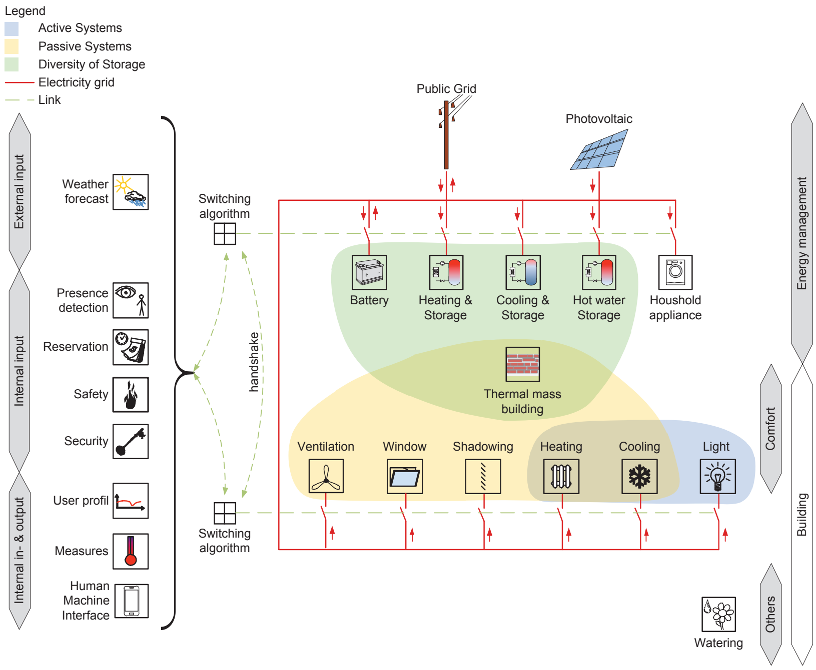
With the exception of the bathroom, all rooms are equipped with smoke detectors. In case of an alarm an acoustic siren signal will be activated. All windows and exterior doors are equipped with magnetic contacts. They are also used to control the HVAC systems. These are also connected via the BAS.

Building Automation System

The building automation system consists of three parts: energy management, comfort management and additional functions. The energy management is responsible for managing the stored energy. The aim is to break down electrical output peaks and store surplus energy for less productive periods. Active and passive systems influence the comfort conditions and are operated according to requirements. The irrigation for example is an additional system. The various switching algorithms process internal and external inputs and work together. *See Img. 36 + 37.* The BAS is controlled via PLC using a Windows 7 server that also administrates all databases such as the energy management system. In addition to I/O modules as interfaces to the field level, other interfaces to various field bus systems are also planned. Access to the server is provided via Ethernet (LAN / WLAN) on a computer, tablet or smartphone. *Further information: PD#6 BAS-102.* The various field devices are controlled using different bus and communication systems. *Further information: PD#6 BAS-201.*

The prototype App

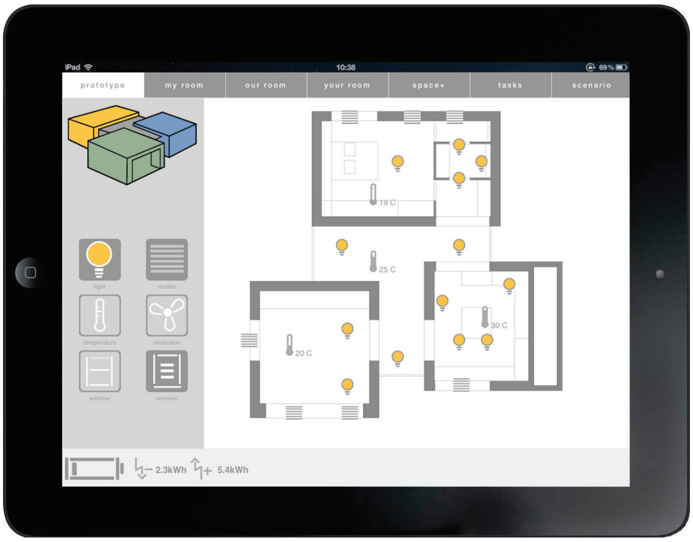
The prototype App has the task of controlling the building. Residents are able to control functions like: temperature, light, shading and ventilation using a tablet. This App informs residents on the status of humidity, CO_2, temperature and the batteries. *See Img. 38.* Lights can be stored and selected in scenarios to manage lighting effectively. *See Img. 39.* Household appliances are used according to recommendations based on weather data to plan periods of maximum energy generation. *See Img. 40.*



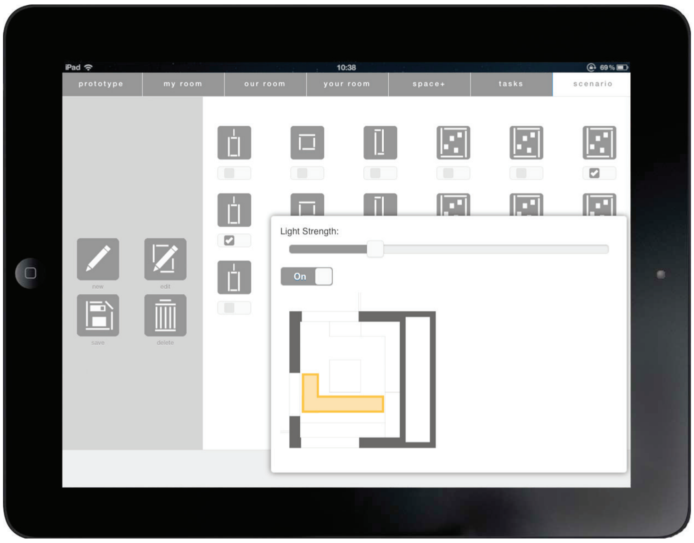
Img. 36 Automatization system

Communication system	System
Ethernet (LAN / WLAN)	PLC server, computer, tablets, smartphones
Analogue and binary inputs and outputs	Sensors, valve drives, pumps, ventilators, door and window contacts, various potential-free contacts
KNX	Switches (lighting and shade), presence detector (presence and light sensors), weather station, blind actuators, room sensors
DALI	Lights
Modbus	Inverters, heat pump, cooling machine, electric measurements
M-Bus	Thermal and water measurements

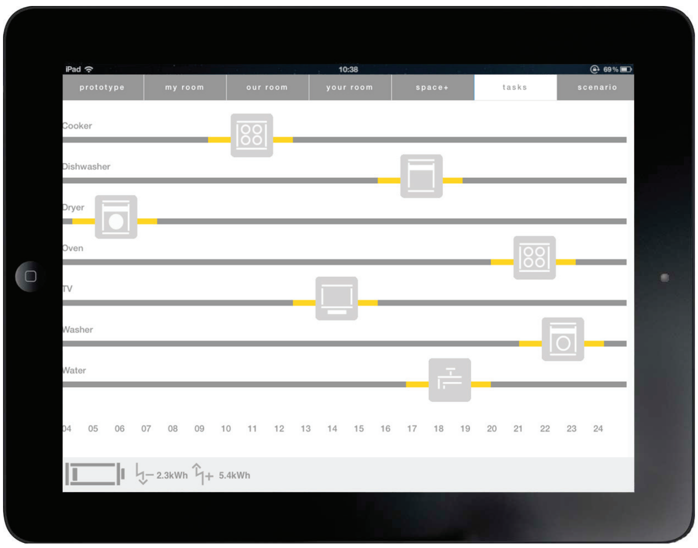
Img. 37 List of all bus systems and the relevant field devices



Img. 38 Home screen



Img. 39 Selection of scenarios



Img. 40 Proposal for the usage of the tasks

Light

The light is controlled using the DALI bus. The programmed logic is presented in *Img. 41.* First the light is initiatilised. Then it switches to Complete OFF state. This means that all DALI controllers completely shut off the power supply. If anyone is detected in the room, the state changes to the OFF State. In this state the DALI controller is activated. When a switch is pressed, the state switches to ON. state. In the ON state, the light is controlled automatically or manually. Manual control means that the light is controlled using the App or the switches in the room. Automatic mode means the light is controlled according to the brightness in the room. Either by a touch of a button, or f no one is detected in the room for five minutes, the state will return to OFF. In the OFF state, if no one is detected after one minute, it switches to Complete OFF.

Shutter

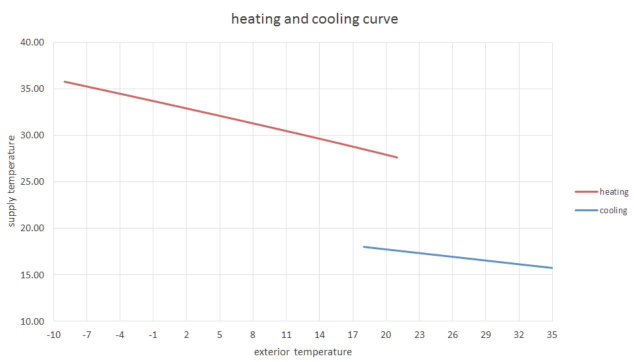
The shutter control uses two modes. Automatic mode is standard. It controls the shutter automatically depending on the global radiation and the sun's position. Completely open, 1/3 closed, 2/3 closed and completely closed. In manual mode the shutter is controlled by the App or the switches.Normally the shutter operates in automatic mode. If a switch is pressed, the shutter changes to manual mode. If no one is detected by the sensor for 15 minutes, the shutter reverts to automatic mode.

Ventilation

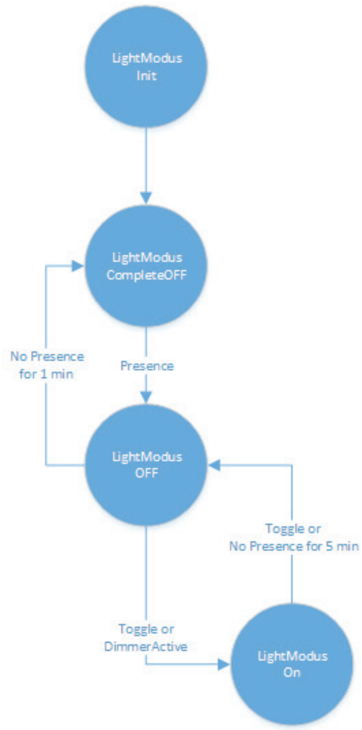
The ventilation control has also two modes: automatic and manual. The automatic mode depends on the CO_2 and VOC value. If this values are over a nominal limit, the ventilation will be started. Depending on how high the CO_2 and VOC values are, the ventilation will be controlled. The second mode is the manual mode. This mode is only used from the App. In the prototype App it's possible to turn the ventilation on and off, and to control the ventilation level. The change from the manual to the automatic mode depends also on the presence in the room. It is changed after 15 minutes if no one is detected.

Heating Cooling

The heating and cooling system is controlled with a PID controller. This controller controls the position of the valves. Depending on the valve position, the flow through the room will be regulated. With this PID controller, the heating and cooling valve is controlled. It's important, that only one valve is active. Otherwise the heating and cooling circuit would be mixed and we work with the heating storage directly on the cooling storage.
The flow control from the heating and cooling circuit are controlled too with a PID controller. The nominal value for this two PID controllers are depending from the temperature outside. This nominal value is defined in a heating and a cooling curve.
See Img. 42 and *further information: Appendix 13 EL-601 AC Circuit*



Img. 42 Heating and cooling curve



Img. 41 State flow lighting control

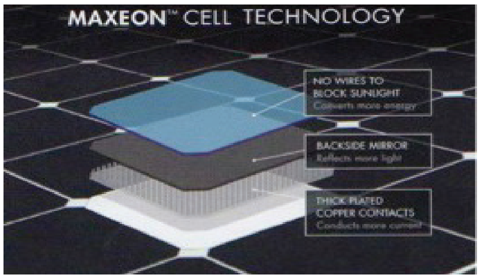
3.5 Photovoltaic System Design

The goal is to achieve the highest possible energy yield utilizing the limited power that we have available. The solar modules should generate a maximum energy yield per installed PV and are to be positioned in such a way that ideally supports the load transfer in the evening hours. The maximum possible solar cell energy should be generated at high temperatures and in diffuse light so that energy production can be integrated as completely as possible into the architecture. We regard the building as a system with the focus "Grid Living and Mobility", encompassing the photovoltaic system, energy-storage efficiency devices, lights, comfort and mobility through the e-bikes.

Photovoltaic System

Solar Cell

The suitable cell for this challenge is a rear-contact mono-silicon solar cell. The Maxeon solar cell is developed on a solid copper base, making it immune to corrosion and cracking. Those effects reduce long-term use in standard cells. Rear-side contact cells also generate exceptional levels of electricity in high temperatures and when there is low radiation. *See Img. 43.*



Img. 43 Maxeon solar cell

Modules

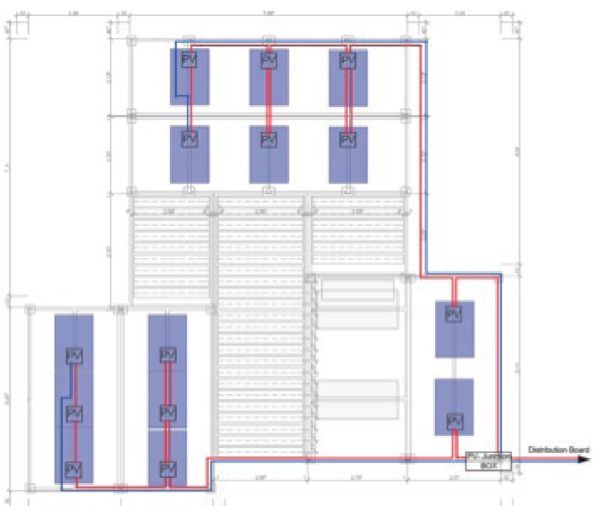
The SunPower (x21 335 BLK) modules we used are based on the Maxeon solar cell. The modules have an effectiveness level of up to 21%. Together, the 96 cells have a surface area of 1,6 m^2 to achieve a nominal output of 335 W. *Img. 44* presents the module's key facts. *Further information: Appendix 14 Datasheet SUNPOWER-X21*

Norm output (Wmax)	335
Max. voltage (Vmpp)	57.3
Max. current (Impp)	5.85
Neutral voltage (Voc)	97.9
Short circuit current (Isc)	6.23
Max. system voltage	1000V IEC & 600 V UL
Temperature (NOCT)	
Temperature coefficient of Pmax	-0.30%/C°
Temperature coefficient of Voc	-167.4mV/°C
Temperature coefficient of Isc	3.5mA/°C

Img. 44 Module's key facts

Orientation

A sun-tracking PV system on the roof achieves a yield that is approximately one quarter higher compared to a 30° south-roof orientation. An additional advantage of tracking is the reduction of power peaks and more energy generation. Possible systems are: a dual-axis sun-tracking PV system, a single-axis north-south or an east-west tracking PV system. A simulation with PVSyst for Paris was carried out for this variation. A nominal output of 4.8 kW was installed. The dual-axis tracking solar system produced the most energy. The problem with the dual-axis tracking PV is that it requires more space and has a more complicated control system. Evaluated over the entire day, east-west shows a more even power yield compared to north-south sun-tracking PV systems. Similarly, the average yield during the summer and also throughout the entire year is greater with the east-west tracking PV system.



Img. 45 Arrangement

Arrangement

In addition to the photovoltaic system, solar collectors will be installed on the roof. To gain a higher power yield, the PV system will track the sun east-west on a single axis. The highly efficient PV-modules only require an area of less than 23 m^2 for an installed nominal output of 4.69 kWp. The modules will be mounted on a rotating frame. The length of the frame corresponds to the width of the modules. The distance is intended to reduce the shade cast by the modules on each other. *See Img. 45.* The modules were connected in 2 strings, each with 7 modules. *Further information: ELEC#4*

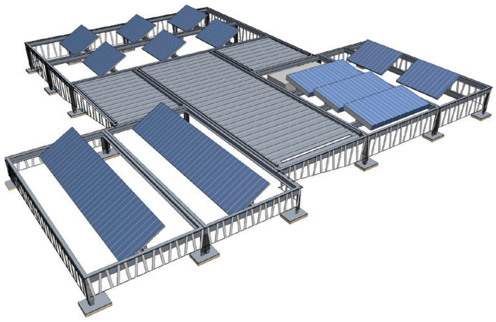
Adjustable photovoltaics Construction

Due to their decomposability and simplicity, each of the 14 solar modules is single-triggered and operated. *See Img. 46*.

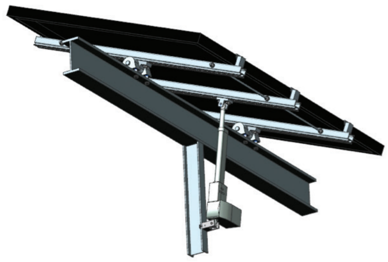
Via an electric linear 24 V motor, which is equipped with a hall sensor, the motor is able to move the solar module into exactly the right position. The gear is hinge-connected with a swing device that orients and fixes the solar module using a hold-down device. Since the motor is also fitted with a trapezoidal spindle, the drive unit is self-locking.
Therefore the solar module is fixed even when the gear is out of action. The gear is only actuated when it is effectively needed, which is approximately 15 minutes in total. *See Img. 47* .

The swing device is pivoted at two points using a ball bearing. Thus the swing device is simply supported by the roof system. Through this construction and the gear hub of 300mm, angles from -55° up to +55° to the horizontal are possible. *See Img. 48.*

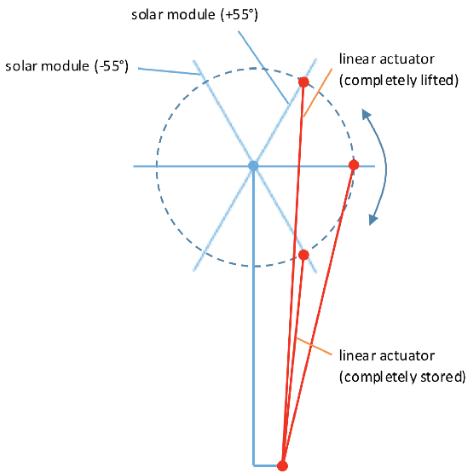
The hole construction is designed for a maximum wind power of 9 beaufort (89km/h). In the dimensi-on-ing phase, motor driving power, different deflections, surface pressures and shear forces of axes were among the required considerations. When the wind power exceeds the, all the solar modules are turned to a horizontal position to reduce the area exposed to wind and prevent mechanical damage. This happens in a maximum time range of 30 seconds. *See Img. 49.*



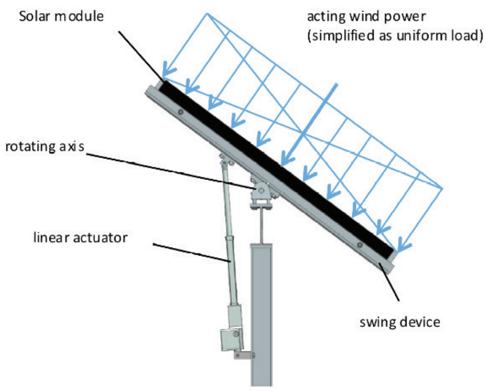
Img. 46 Roof system



Img. 47 Adjustable PV- device



Img. 48 Adjusting mechanism



Img. 49 Intallation oft the device

Typology of the Battery PV-Inverter

Internal DC-coupling has significant advantages over other topologies; higher efficiency than AC-coupling and also the bi-directionality is assured using this technology.
A solar inverter that works on the principle of the internal DC-coupling will be used. The ideal operating point for the intermediate circuit voltage is controlled by the device, providing efficient system operation. Integrating the MPP tracker, inverter and charge controller into a single device also reduces the sources of error and complexity of the overall system. *See Img. 50.*

Hybrid Inverters

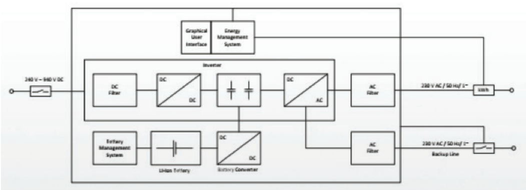
The your⁺ building uses the Bosch BTS 5 Hybrid inverter. The BTS 5 Hybrid was developed from the outset as a fully integrated system. That means all components are perfectly tailored to each other. The DC solar power is fed directly into the battery from the inverter's intermediate circuit. The BTS5 Hybrid therefore only has an inversion loss of 10%, compared to standard systems with batteries using alternating current connections, which have an overall in version loss of 25%. On the AC side, the inverter feeds directly into the electrical distributor, where the line is protected by a 25 A RCBO with a sensitivity of 300 mA fuse. *Further information: Appendix 15 Datasheet bosch inverter*

Powerful lithium ion batteries form the heart of the BTP 5 Hybrid. They have a gross capacity of 6.6kWh. The depth of discharge (DOD) is limited to 70% in the BTP Hybrid by the Bosch manufacturers. That measure significantly lengthens the life of the lithium ion batteries used. Independent institutes calculated 7,000 charging and discharging cycles. Due to the limited DOD, the BTP 5 Hybrid has a net capacity of 4.62kWh. The BTS 5 Hybrid has a system management that controls energy flows and monitors components. *See Img. 51.*

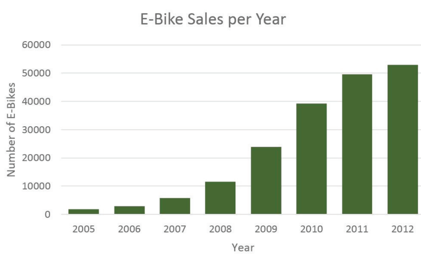
E-Bike Battery Terminal

Indoor Exercising with Energy Recuperation

The e-bike electric motor is able to recuperate power by using braking power to produce energy instead of emitting the heat uselessly into the environment. This is an additional way to charge the e-bike batteries. Charged batteries are connected to the your⁺ prototype via battery terminal and thereby make the produced energy available. Ever more usable e-bike batteries are emerging on the growing e-bike market. The capacity of the e-bikes used also contributes to the house's energy storage. The forthcoming energy turnaround is increasingly focusing on renewable energies. The batteries allow energy to be stored in every house. That can buffer the irregular power output of renewable energy resources, which depend on weather conditions. This vision of integrating electric vehicles into the energy concept is implemented in the your⁺ project using e-bikes. *See Img. 52.*



Img. 50 Internal DC-coupling



Img. 52 Internal DC-coupling

Input dada		Output Data	
Recommended DC output	5kW	Nominal grid voltage (Vac, r)	230V
Max. DC input voltage (Vdcmax)	940V	Max. output electricity (Iacmax)	22A
Min. DC input voltage (Vdcmin)	240V	Power output (Sac,r)	5kW
Max. MPP voltage (Vmppmax)	750V	Nominal frequency (fr	50HZ
Min. MPP voltage (Vmppmin)	275V	Max. / Min. frequency (fmax) / (fmin)	51.5/47.5 Hz
Max. input electricity (Idcmax)	19A	Type of infeed	single-phase
Number of MPP trackers	1	Required grid config	TN grid / TT grid

Img. 51 Hybrid Inverters

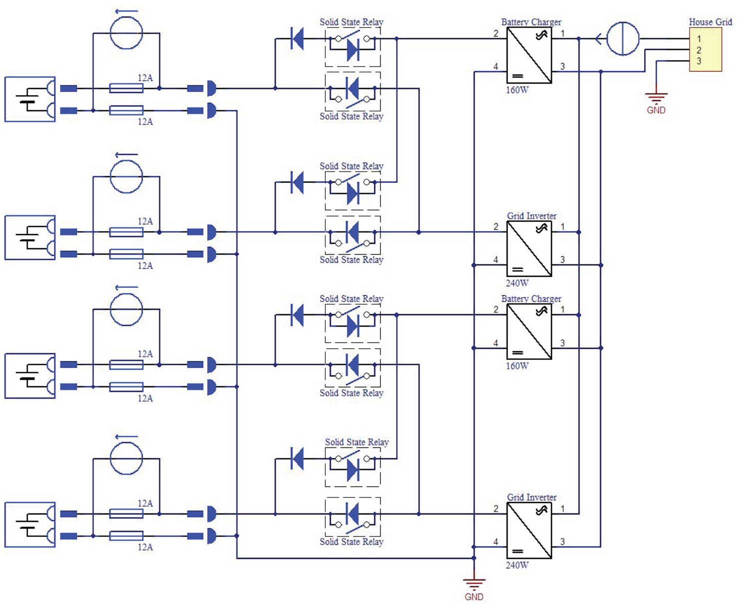
Electrical Implementation of the E-Bike Battery Terminal

The e-bike battery terminal is equipped with two e-bike battery charging devices. That allows parallel charging of plugged batteries. Switching between the charger and the grid inverter is achieved using solid state relays. In the case of a maximum voltage of 42 VDC and a max. current of 20 A, the inverter relays must have a performance of at least 840 VA. The used relays are able to switch 6000W DC-Load. To feed energy into the grid, the battery terminal is equipped with two 240 W inverter.
The batteries are secured by 12 A fuses. It should be noted that these are placed directly beside the batteries. That allows them to securely break the connection between the battery and junction box in the case of a fault. As shown in the principle circuit, every battery is connected separately over two relays to the inverters. This prevents connection of batteries with different voltage levels. Further the current flow between batteries is prevented by diodes. The voltage levels are monitored by the PLC. To prevent batteries being disconnected while charging and discharging, the door to the battery terminal is monitored by limit switch. When the door is open the charging or discharging process will be interrupted. *Further information: PD#6, EL-601* for the implemented circuit diagram.
See Img. 53.

Application Scenario

The following explains our idea for the use of the e-bikes. The charging of batteries through recuperation during the competition is not allowed.
The concept is adapted to conform to the regulations of the SDE and the competition in Versailles. That creates limitations to the use of the bikes and batteries, thereby contrasting with everyday use. This is taken into account however to achieve maximum points in the competitions.

- **Morning**: The entire battery bank is charged using the energy from the PV system. The batteries should not be disconnected from the building until they are fully charged.
- **Midday**: The batteries are made available to visitors to the "Cite de Soleil". That enables bike tours and could also allow people to use the bikes as indoor exercise bikes. So it must be possible to connect batteries with different charge levels to the building. During the competition week, batteries should be returned to the charging station by no later than 15:00 so they can be charged by sunset. By the evening, the entire capacity of 6kWh is therefore made available to the building.
- **Evening**: The energy stored in the batteries is transferred to the building. Empty batteries can be recharged as far as possible by people using the e-bikes for indoor exercises, thereby increasing the house's level of independence. So visitors experience the themes of energy and sharing in a tangible way.

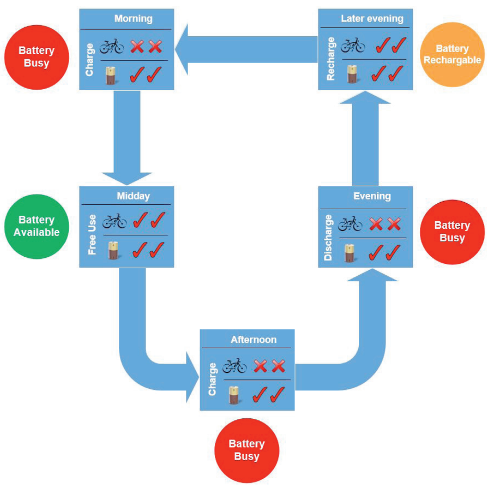


Img. 53 Principle circuit diagram, e-bike battery terminal

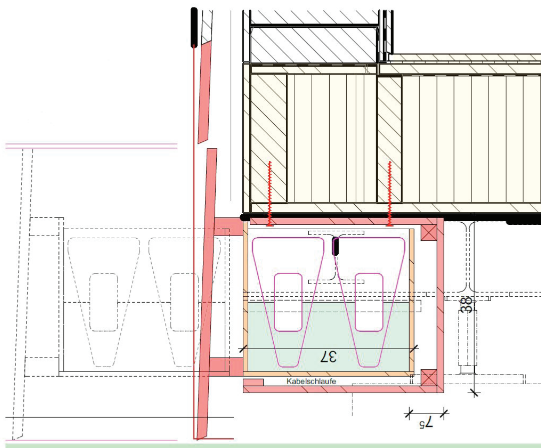
Availability of Batteries and Bikes

Img. 54 presents the availability of the two bikes and their batteries. In the morning, the batteries are discharged after providing energy to the house during the night. So they must be recharged before being used on e-bikes. If energy is required from the house to recharge the batteries, this will take time during the morning.
From the moment the batteries are charged, they can be freely used for the bikes or the building.
In the afternoon, the batteries have to be reconnected to the building to provide maximum charge capacity in the evening as required by the competition. That means the bikes have to be back at the house in the afternoon.
In the evening, the batteries make their energy available to the building's network. If they are discharged, fitness events including spinning sessions using the e-bikes provide additional energy. Additional energy can be made available to the house in this way.

To show the user in which way the bike batteries are available or not, each battery slot in the drawer has a signal light. If the light shines green, the battery is freely available to the user. An orange light tells the user that the battery should be reloaded by recuperation. A red light indicates the battery is not available. It is important to note that the battery's charging state is not shown.
See Img. 55.



Img. 54 Availability of e-bike batteries



Img. 55 E-bike battery terminal drawer

3.6 Electrical Energy Balance Simulation

To reduce input peaks from the PV system, the surplus energy is temporarily stored in batteries. The project uses this energy store for various tasks in the building system and for mobility. In addition to the important tasks of the electrical concept, it also plays an important role with respect to mobility. The charged batteries can be used for e-bikes to make cycling easier. It would also be possible to use the bicycles as home exercise bikes and recharge batteries through recuperation, thereby returning energy to the your⁺ prototype.

Methodology for estimating electrical Production

The electrical production is simulated with PVsyst. This program is designed to estimate production for a detailed study of a PV-installation. It includes a detailed contextual help menu that explains the procedures and models used. PVsyst is able to import weather data from many different sources, as well as personal data. This tool helped us to find the right position and type to produce the most power from the sun. In addition to PVsys we implemented our own program called myPVsim in C#, with the aim to make an exact model of the energy production of our prototype.
This program will be used during the contest to make a forecast of the electrical power production and calculates optimised task start times for the next day. myPVsim will run on the Beckhoff PLC CX2030 daily at 4 AM. The optimised start time for the tasks will be visual on the prototype App.

In the following steps we verified and optimised myPVsim:
1. Simulation with PVsys
2. Simulation with myPVsim
3. myPVsim verification with PVsys

Environmental Benefits

One important aspect of our project your⁺ is to conserve resources. We achieve this by using the most energy efficient equipment available on the market. A further goal is passive air conditioning (HVAC concept). The PV system should have the highest energy yield per installed capacity, meaning that the maximum can be achieved from the resources used. Thus our PV system is sun-tracking and uses maxeon cell technology.

Electrical Loads

List of electrical Loads

Our electricity calculations are based on the premise of a two-person household, where one of the occupants has a 100% workload and is therefore not at home throughout the entire day. The second occupant is somewhat more often at home as this person only has a 70% workload. The consumer's working hours have been taken from the Swiss standard SIA 380/4 which includes the European standards EN 640456 and EN 50242. *Img. 56* provides an overview of the electric energy consumption in the your⁺ building.

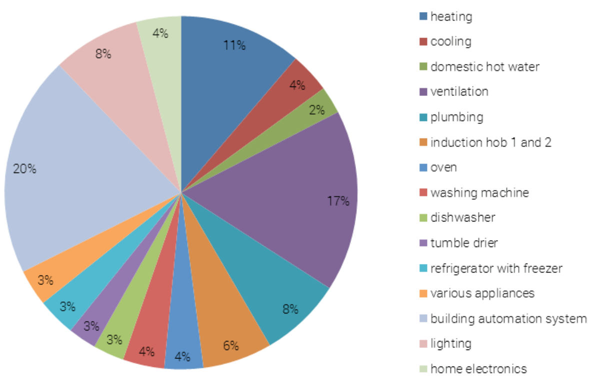
In Img. 57 it can be seen that the building automation with 20% makes an enormous part of the electricity demand. This is due to the fact that our heating and cooling system requires very little electrical energy, but the building technology is designed for the urban concept and not for a building with three rooms.
Considering the electrical energy over the whole year, you can see that in the summer we have a production surplus of about 2110 kWh/a and must purchase electricity from the grid of approximately 1270 kWh/a in winter. Overall, we have a surplus of about 840 kWh/a which corresponds to a self-sufficiency rate of 119 %. *See Img. 58 +59*

Measures

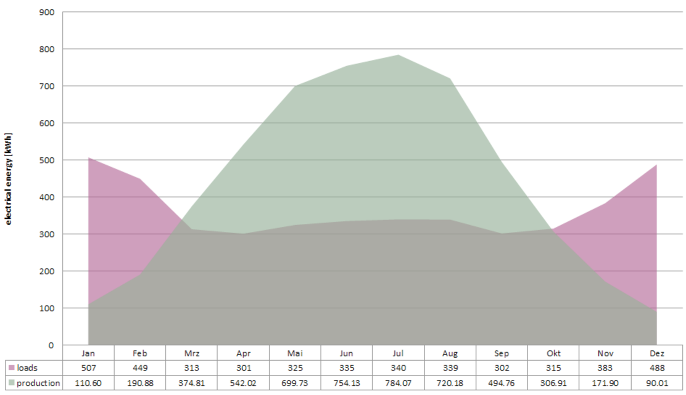
The electrical monitoring system of the prototype is based on the ABB CMS600 (current measurement system). The average over a period of one minute is logged on a mySQL server. To get the effective power, the current is multiplied with the actual voltage and the powerfactor.
See Img. 60 + 61

loads	type	nominal power [W]	determination of the requirements	energy per cycle [kWh/cycle]	energy per year [kWh/a]
			HVAC and plumbing		
heating	various	2'910.00	according to the simulation	-	495.00
cooling	various	includet	according to the simulation	-	162.00
domestic hot water	various	includet	according to the simulation	-	110.00
ventilation your room	Zehnder SL 330	188.00	6000 full load hours at 50% load	-	564.00
ventilation our room	Helios KWL HC 60	28.00	6000 full load hours at 50% load	-	84.00
ventilation my room	Helios KWL HC 60	28.00	4000 full load hours at 50% load	-	84.00
booster pump fresh water	Brunner Pumpen Variomat Silentio	1'550.00	30 minutes per day	-	282.88
booster pump rain water	Brunner Pumpen Variomat Silentio	1'550.00	only replaces another pump	-	-
booster pump grey water	Brunner Pumpen Variomat Silentio	1'550.00	5 minutes per day	-	47.15
			appliances lighting and home automatiom		
induction hob 1 and 2	V-Zug GK26TIMS	7'400.00	annual requirement for 2 persons according to SIA 380.4	-	280.00
oven	V-Zug Combair SL	3'400.00	standard usage according to SIA 380.4 (3 cycles per week)	1.00	156.43
washing machine	V-Zug Adora SLQ	2'300.00	standard program 40° (4 cycles per week)	0.80	166.86
dishwasher	V-Zug Adora SL	2'200.00	program sprint' (3 cycles per week)	0.80	125.14
tumble drier	V-Zug Adora TSL WP	1'300.00	program towelling (2 cycles per week)	1.10	114.71
refrigerator with freezer	V-Zug Prestige P eco	115.00	annual requirement according to V-Zug	-	154.00
PV tracking	various	520.00	12 hours a day every quarter hour plus morning and evening, corresponds to 50 cycles per day (0.4s times 14 PV modules)	0.00	1.10
shutters and shading panels	various	1'860.00	4 cycles per day, 15s per cycle	0.01	11.32
touchpads (2x)	Apple iPad air	24.00	1 hour loading per day	-	8.76
speakers (2x)	B&O Beolit 12	12.00	1 hour loading per day	-	4.38
WLAN accesspoint		7.00	16hours per day, 80% power	-	32.70
docking stations mobile lamp (3x)		48.00	3 hours per day	-	52.56
exhaust hood	V-Zug DIPQ10	138.80	30 minutes per day	-	25.33
power supply building automation system	various	173.00	60% constant load	-	798.91
power supply thermal measurement	NeoVac Superstatic	9.00	constant load	-	78.84
network router		5.00	16hours per day, 80% power	-	23.36
lighting your room	various XAL lamps	123.00	400 full load hours	-	49.20
lighting our room	various XAL lamps	163.00	670 full load hours	-	109.21
lighting my room	various XAL lamps	175.00	750 full load hours	-	131.25
lighting space+	various XAL lamps	117.70	200 full load hours	-	23.54
lighting platform	various XAL lamps	200.00	200 full load hours	-	40.00
			home electronics		
television	LOEWE Content ID 40	95.00	annual requirement for 2 persons according to SIA 380.4 (for all home electronics)	-	180.00
computer	iMac 21,5"	300.00	-	-	-
Total		**28'490**			**4'400**

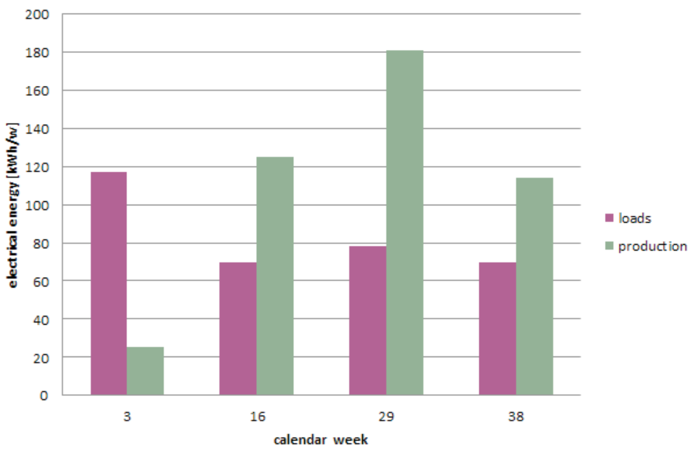
Img. 56 List of electrical loads



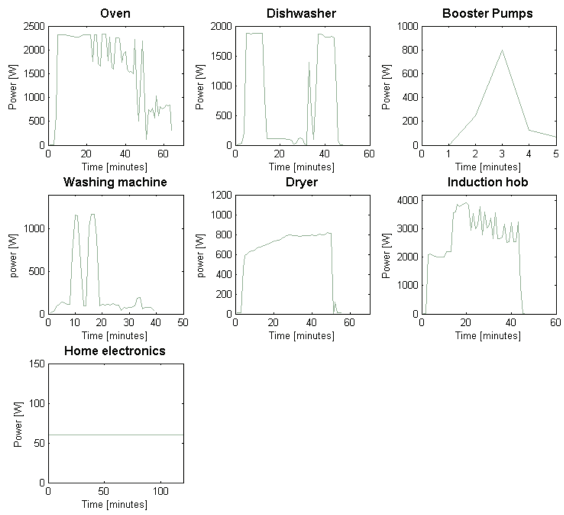
Img. 57 Distribution electrical energy demand



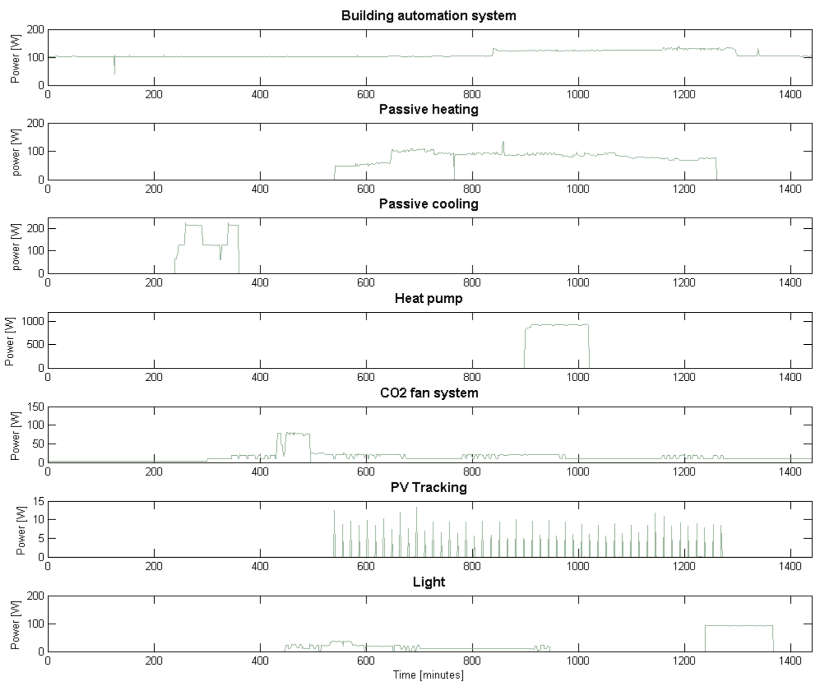
Img. 58 Yearly electrical energy



Img. 59 Electrical energy per week



Img. 60 Task Load Shapes



Img. 61 Daily Load Shapes

Photovoltaic

The photovoltaic system with a total installed power of 4.69 kWp is tracked in east-west direction. Thus, we benefit from the direct sunlight in the morning and in the evening and have over the entire day a very even energy yield. The hybrid inverter forms a unit with the battery charging controller and the battery bank. The batteries have a total net storage capacity of 4.62 kWh and are fed directly from the DC intermediate circuit to minimise inversion losses. In addition, an e-bike battery terminal, with three batteries of total 1.2 kWh, is provided which can be used both as power storage for the house as well as for e-bikes. This bike battery terminal represents an example of the integration of electric vehicles in our project. For the Simulation were used with PVsyst 6.1.2 program and the module type SunPower . The annual energy yield that can be expected is 5240kWh/a. *Further information: PM#6 chapter 3.5*

Simulation Tool and Configuration

PVsys

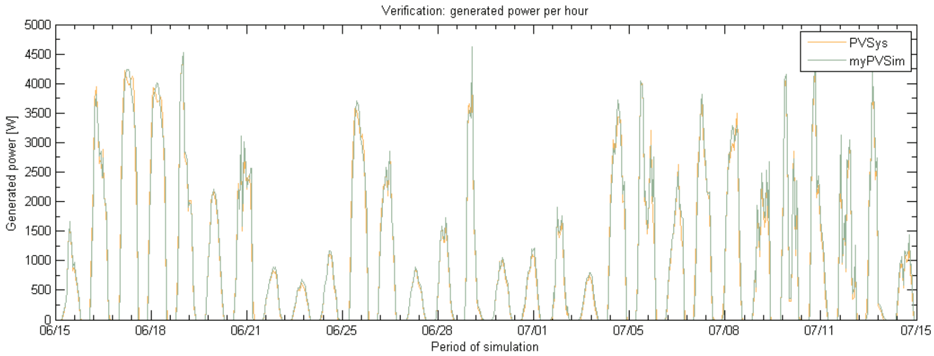
The electrical production is simulated with PVsyst (http://www.pvsyst.com/en/, PVsyst 6.1.9). The results of the simulation from PVsys are to verify myPVsim.

myPVsim

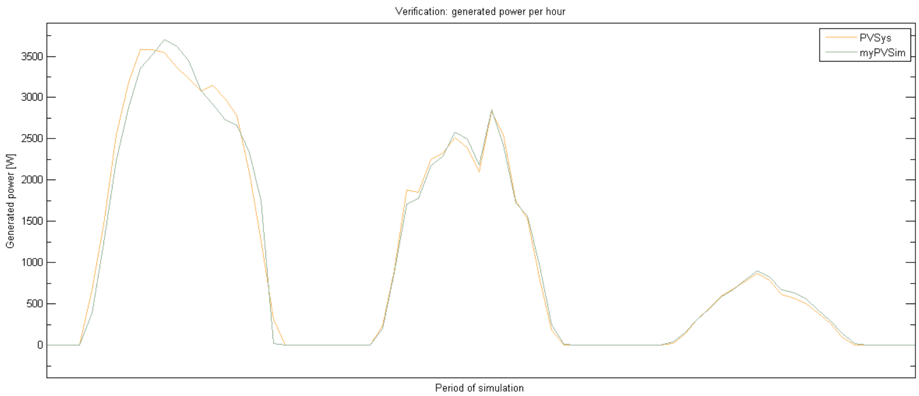
This program is written with C# in Microsoft Visual Studio 2012. The aim is to build an exact model of the electrical production of our prototype. myPVsim will be running on our PLC to calculate the electrical power for the next day.
myPVsim needs the UTC time (Coordinated Universal Time) and the appertaining horizontal sun global radiation [W/m2]. The automation system is connected to the Swiss weather forecast server and delivers data daily at 3 AM for a period of 72 hours. The results are plotted with Matlab version R2013b

myPVsim Verification with PVsys

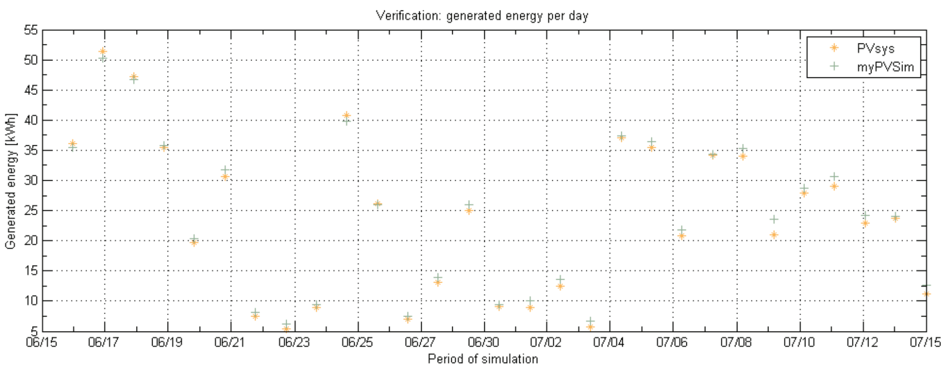
To verify those two programs we feed the same configuration, fourteen photovoltaic panels with 1.6 m2 each, 21.2 % effectiveness and east/west tracking. Both programs were fed with measurement data from Versailles in 2013.
The results are shown in the next three plots: *See Img. 62- 64.*



Img. 62 PVsys verification with myPV Sim- hourly produced energy



Img. 63 PVsys verification with myPVsim - hourly produced energy



Img. 64 PVsys verification with myPVsim - daily produced energy

Conclusion

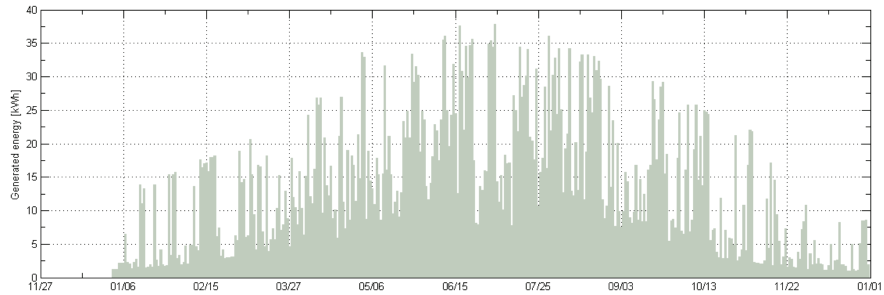
The difference between the two simulations can be seen on early morning and late evening hours. This error is based on the non-implemented shading correction of myPVsim. That's the reason why the daily produced energy is perennially a bit higher in myPVsim. The model is acceptable but could be adjusted with the real measurements from the your+ prototype.

Typical meteorological Year in Paris

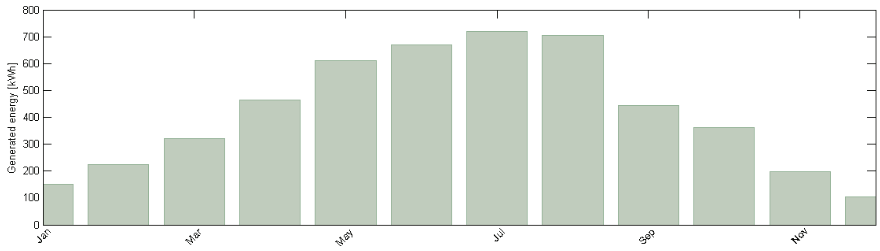
For the day, month and year electrical energy simulation, data were used from ashrae.org. They provide further simulation data, including data on a typical meteorological year in Versailles with hourly global horizontal sun radiation data, direct and diffuse. *See Img. 65 - 67*

Simulation: Contest days in Versailles

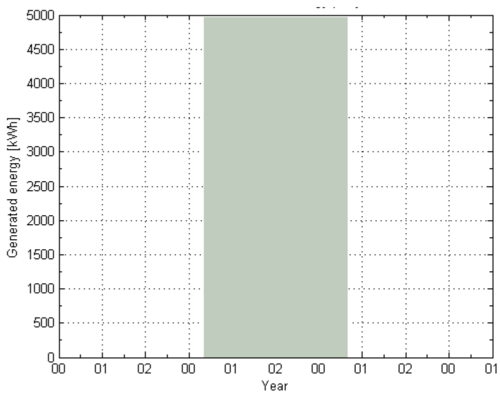
The program myPVsim in combination with an implemented algorithm calculates optimised task start times and sets the maximum power peak for the following day. The next two plots show, how the peak shaving works in combination with the state of charge from the batteries and the power to grid. The states of charge from the batteries are added, bike batteries and house internal batteries. *See Img. 68 + 69*



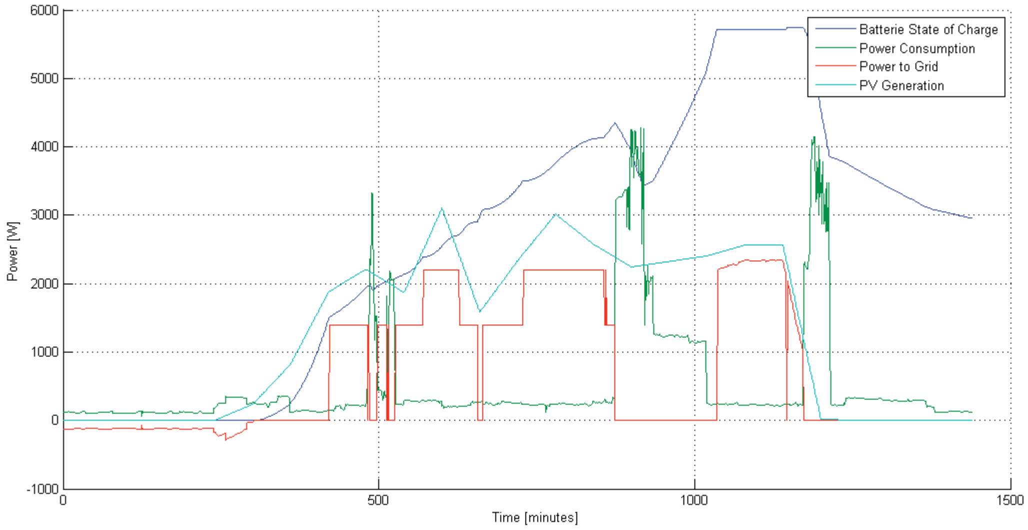
Img. 65 Generated electrical energy per day



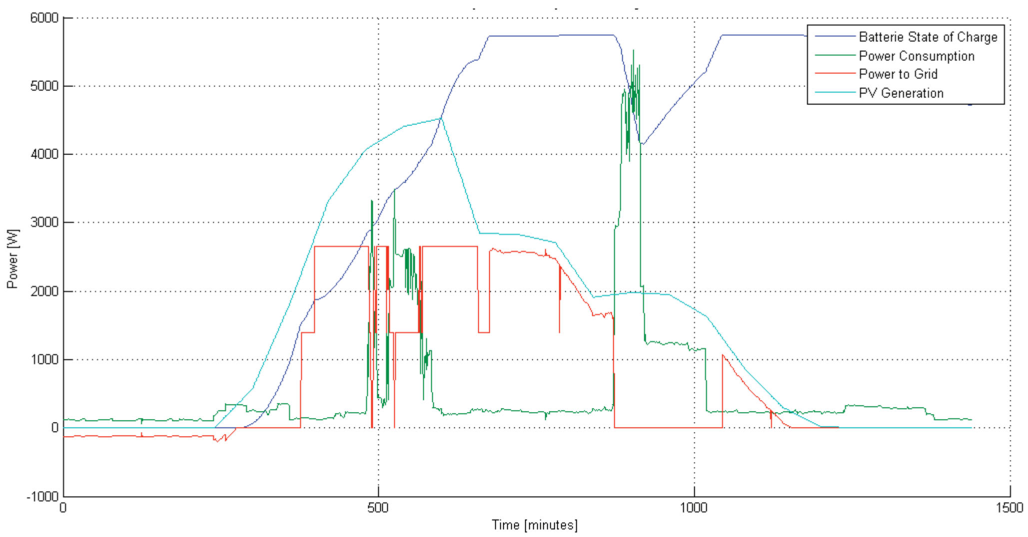
Img. 66 Generated electrical energy per month



Img. 67 Generated electrical energy per year



Img. 68 Example of a competition day



Img. 69 Example of a competition day

Reduction of CO_2

The advantage of a photovoltaic system is that during operation no CO_2 emissions arise.
In the production of modules, cables, inverters and during their transport CO_2 is released. The value for the greenhouse gas emission by the Federal Office of Switzerland for energy is 0.0803kg/kWh. In the Conventional power production Union for the Coordination of Transmission of Electricity (UTCE) has a greenhouse gas emission of 0.594 kg/kWh. The your+ prototype produces an annual electrical energy of 5240kWh/a. *See Img. 70*

Installation Costs for Photovoltaic

Img. 71 shows the cost of the whole photovoltaic installation. These are standard prices without specifying sponsoring and reduction. Because the empirical values can be a reduction 30% of the standard price, the cost for the photovoltaic plant is CHF 24653.

Subsidies for Attached Photovoltaic Plant

The prototype gets subsidies for the photovoltaic in Switzerland. Feed-in remuneration at cost is an instrument that was developed by the federal government for the purpose of promoting electricity production from renewable energy sources. It covers the difference between the production and the market price, and guarantees producers of electricity from renewable sources a price that corresponds to their production costs. *See Img. 72*

Payback Time

The prototype photovoltaic system would generate a profit after 25 years. Despite the high cost for the most efficiency PV-modules and energy storage. For the exact calculation *see Img. 73*

	Consumption per year [kWh]	Factor [kg/kWh]	Calculation annual reduction of co2 [kg]
UTCE electricity mix	5240	0.5940	3112.56
Photovoltaic	5240	0. 0803	420.77
Redaction			2691.79

Img. 70 Reduction of CO_2

Designation	Amount	Price CHF	Sum CHF
Sunpower SPR-335 X21-WHT-D	14	518.10	7253.00
Bosch BPT-S 5 Hybrid 6.6 kWh-System	1	22313.40	22313.40
Huber & SuhnerRadox-Solarkabel 6mm²	2	162.75	325.50
Multi-Contact PV MC4 connection plug	28	1.22	34.16
Bossard substates for photovoltaic	1	1	1722.20
HIWIN actuator PV tracking	14	255	3570
Total			35218.3

Img. 71 Installation costs for photovoltaic

Initial contribution	1400 CHF
Power contribution	850 CHF
Subsidies	1400CHF+ 4.68*850CHF = 5378CHF

Img. 72 Subsidies for Attached photovoltaic plant

photovoltaic data	Installed peak PV power	4.69	kWp
	operating life	25	Year
	specific annual yield	1245	kWh/kWp
	degradation over 25 years	80	%
	specific maintenance costs	0.06	CHF/kWh
investment	total investment cost	24653	CHF
	Subsidies	5378	CHF
	adequate target rate	1	%
payment tariff	return tariff electric utility	0.15	CHF/kWh
	purchasing tariff	0.30	CHF/kWh
	own utilization rate	80	%
key performance indicators	annual energy yield	5240	kWh/a
	annual yield	1413	CHF/a
	cost of equity	-814	CHF/a
	Maintenance costs	-314	CHF/a
	net income	225	CHF/a
	capital value	5033	CHF
	payback	19	years
	kwh cost	0.227	CHF/kWh

Img. 73 Payback time

3.7 Solar Thermal Design

Thermal solar collectors provide warm water to the building throughout the year for heating and domestic hot water. The plumbing system integrates various resource-saving concepts and components.

Heating System

The heating energy will primarily be produced by the solar thermal collectors. Therefore the heat storage tank will be loaded by warm solar water.
In case the solar energy is insufficient, the heating energy will be provided by the heat pump, supplied either by low-temperature solar heat (low radiation) or ambient air (air-cooler). A recooling device (air-cooler) will act as a heat source for the heat pump. So the heat pump will work as a water-air heat pump.

Cooling System

Room cooling will primarily work using passive and/or natural strategies. During cold night hours the cooling storage will be cooled down by the recooling device.
This naturally gained cooling energy will be used during the day to cool the room. If the passive and natural actions are not sufficient to maintain the thermal room comfort, the chiller (heat pump) will actively produce cooling energy and help to cool the rooms.

Heating and Cooling System in the Rooms

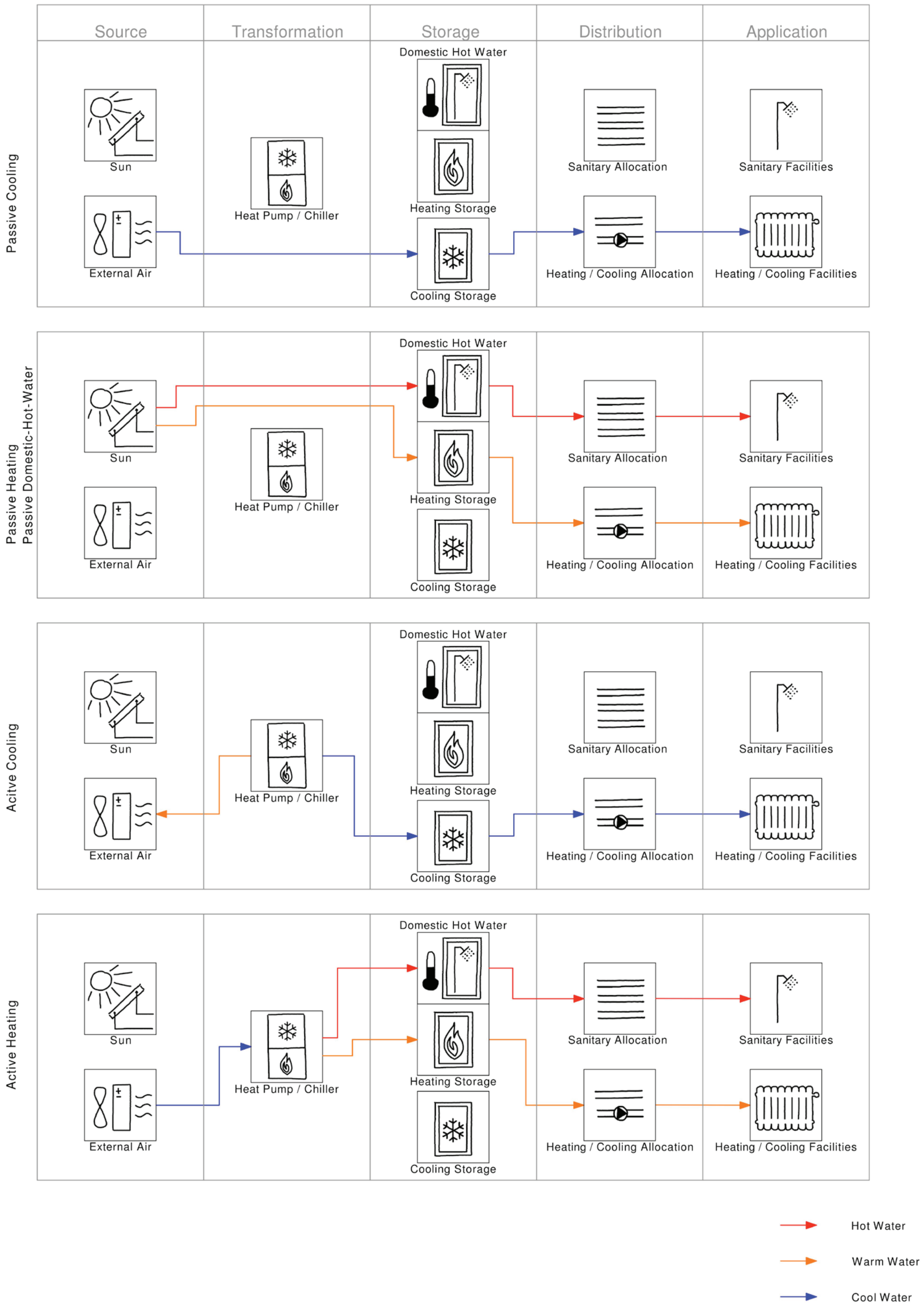
The thermal room comfort is managed by an activated suspended ceiling. The ceiling is comple¬tely made out of aluminium to achieve an excellent heat transfer coefficient. The activation takes place by mounting copper tubes on the aluminium plate. Those tubes will be flown through by hot or cold water to establish the energy flow. The two systems are connected in individual rooms to be able to switch between heating and cooling modes for each room individually. The supply and return pipes of the respective system may be opened or closed using control valves. *See Img. 74.*

Domestic hot Water System

The domestic hot water (DHW) system works with a fresh water station. In this system the energy demand of the DHW will be stored in the heating storage tank. When DHW is needed the system ensures its temperature using an included heat exchanger. The heat exchanger is directly connected to the heating storage and a pump will guarantee the circulation. On the side of the DHW production, the fresh water will flow directly through the heat exchanger and will be heated to the desired temperature. *Further information: PM#5 chapter 3.3.*

Solar thermal Collectors

The solar thermal system consists of 3 vacuum tube collectors on the roof and a heating storage tank in the mechanical room. The storage tank works with two different volumes. The upper part is planned to store the energy that is used for the production of the domestic hot water, whereas the lower part is for the heating system.
To achieve ideal dimensions for the collector area, the solar thermal system is mainly designed to fulfil the domestic hot water energy demand. A change-over valve makes it possible to work either in the upper or lower part of the storage tank.
The heat pump acts as a backup heat source for both systems, namely the heating system and the domestic hot water system. From the heat pump it is also possible to work in either part of the tank.



Img. 74 Modula GT

Solar Thermal Strategy

In high-density housing, the usable facade for solar collectors is limited due to the shade from neighbou¬ring buildings. Therefore solar collectors need to be installed on the rooftop where they bring the highest degree of efficiency. Vacuum tube collectors confirm this requirement. *See Img. 75.*

Details Required

- collector
- storage (hot and cold)
- heat pump / cooling device
- recooling device
- heat exchanger
- pump system
- hydraulic system (included expansion, safety valve, etc.)

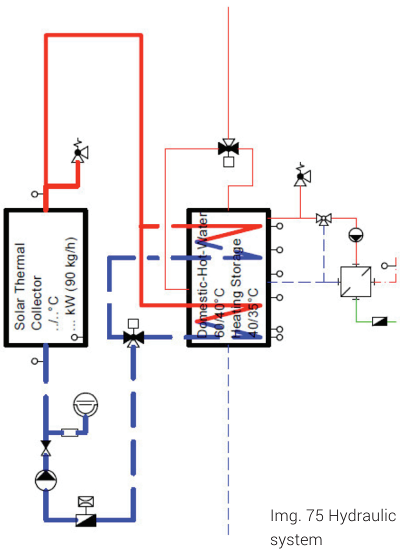
A collector area of approximately 4.53 m^2 is provided. The solar heat storage has a volume of approximately 0.85 m^3. The entire system is separated by two integrated heat exchangers. This reduces the problem of freezing and steam.
To control the system, temperature sensors and the electrical valves are managed by the building automation system. A mechanical valve is also installed which would open in case of excess pressure, so that the hydraulic system is mechanically protected. The maximum temperature in the collector is 160 degrees and so the maximum pressure is approximately 5.0 bar (Viessmann AG). In this case, the collector isn't able to get hotter because the thermal transfer is reduced by steam. A disadvantage of this system is that we need to wait until the steam in the collector is condensed until we are able to activate the pump system to get energy from the sun. We accommodated for this problem by designing the dimensions of the storage accordingly

Expected Contribution

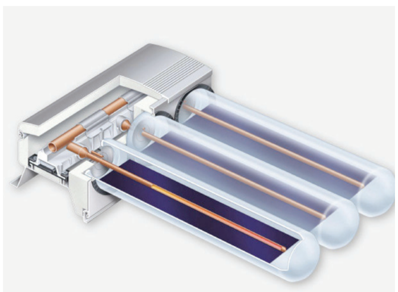
The solar system supplies the domestic hot water system and the room heating system. Therefore the solar system feeds a storage with two heat exchangers, where the hot domestic water and the heating system draw the required heat energy. The advantage of this system is that you can use even a low collector temperature for heating. Moreover, because there are two heat exchangers installed the exchanger area has doubled.

Supporting Structure

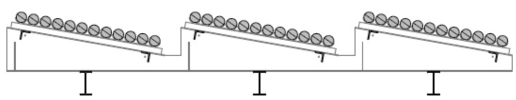
We decided to build a steel construction to integrate the building technology with the architecture. This construction is put on the rooftop of our prototype. In this way, we combine and merge technology with visual appearances. *See Img. 76 + 77.*



Img. 75 Hydraulic system



Img. 77 Solar thermal collector, sectional view



Img. 76 Supporting structure, sectional View

Storage System

The storage is constructed to receive several levels of temperatures and includes two heat exchangers for the solar thermal system. This is used to feed the storage at its proper level. The domestic hot water is always conditioned by the hottest level of the storage. The room heating draws its required energy from the proper level of the storage, as determined by the required temperature

Backup Energy Source

Domestic hot Water

If we can't heat the domestic hot water (approxima¬tely 55 degrees) using the solar thermal system, we need to activate the heat pump, which feeds the same storage. If this happens, the heat pump only works in the upper part of the storage to reduce the water content so we minimize the electricity demand. To guarantee this, we have several temperature sensors that control the heat pump. *See Img. 78.*

Room Heating

If we can't even heat the lowest part of the storage, which is for the room heating (approximately 30 degrees), we also need to activate the heat pump. But this time, the heat pump only works into the bottom of the storage, as shown in the diagram bellow. In this case, we also have several tempera¬ture sensors that regulate the proper temperature in the storage. We can reduce our energy needs for the heat pump in this way. *See Img. 79.*

Accessibility of the Installation

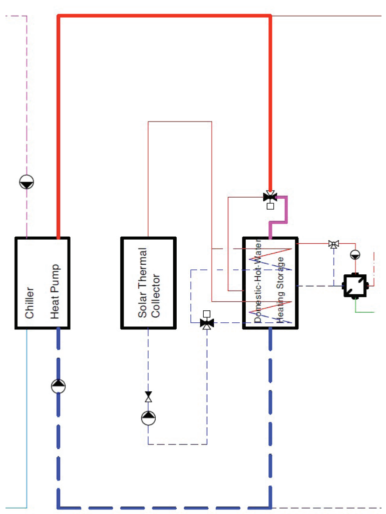
The accessibility of the technical installation is generally ensured from the outside. A ladder is needed to get to the rooftop, where the collectors are installed. The storage and the heat pump are installed in the technical room, which is accessible from the platform.

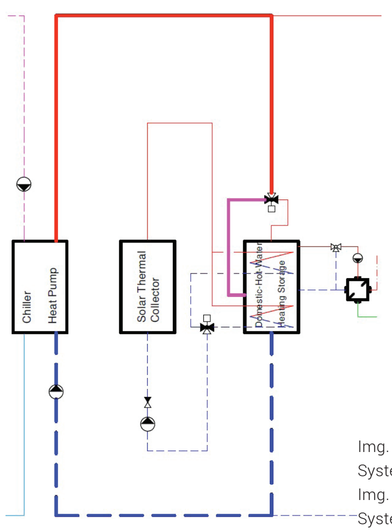
Maintenance Tasks

Solar thermal collectors only need a little main-tenan¬ce. The system is designed for a long life cycle. Generally the control system supervises the entire system. Nevertheless, the water pressure needs checking once a year - at best in the winter when the system is cool, because the pressure rises if the system heats up. The various system parameters should be defined to achieve an overview.

Effectiveness of the Insulation and Control System

Due to the very limited space, we also use minimal insulation in the technical room. This is no problem because we use a very high efficiency insulation that has a very low thermal conductivity (λ = 0.022 W/mK). The control system controls the entire system. Generally the pump, which circulates the water in the system, is activated if the temperature in the collector is higher than in the storage, unless the storage is warm enough.

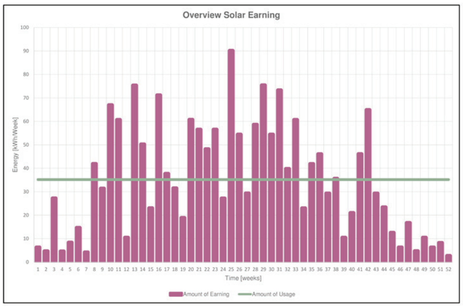




Img. 78 Heat pump hydraulic System – Domestic hot water
Img. 79 Heat pump hydraulic System – Room heating

Costs

The entire system will be sponsored by Viessmann AG. The costs are approximately SFr. 15,000.00.



Img. 80 Solar thermal simulation results

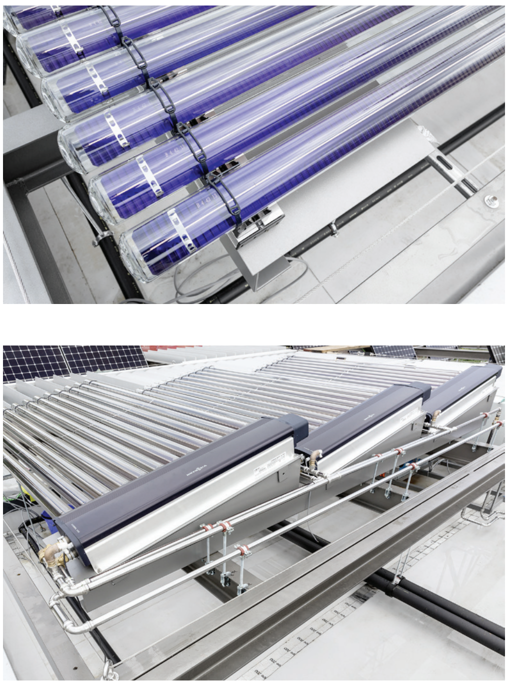
Calculation

The system has the following design parameters:

- Product Viessmann AG
- Type Vitosol 200-T
- Model: Vitosol 200-T, Type SP2A
- Area 3x 1.51 m^2 (absorber area)
- Disposition 30°, -10° south
- Average energy demand 35 kWh per week
- Water Temperature 55° Celsius
- Water need 100 litres

See Img. 80.

Img. 81 Storage



Img. 82 + 83 Solar thermal collectors

3.8 Building Integrated Solar Actice Systems

The solar system is based on a shading system that we have integrated in an exemplary way into our prototype. The photovoltaic systems are organised on the rooftop terrace in an urban development context and thereby create zones for the rooftop garden. The prototype has a limited height due to envelope regulations. The steel construction on the roof has ornamentation for the attached steel rods to integrate their image in the urban development context. The green areas are closely connected to the rooftop gardens in the urban development and the green facades, which can be used as a vertical connecting element of the space+. It also underlines how plants and technology can be integrated.

Concept

The integration of the photovoltaic and the thermal facilities in the prototype will be represented in an abstract form with respect to urban construction. The adjustable PV panels, which are integrated on the roof of the prototype, are located on the roof garden terrace as part of the space+ in our urban construction vision. They provide room for the inhabitants to share their free time beneath the energy-producing and shade-giving panels.

Like the urban construction vision, the prototype aims to feature the integration of those elements with metal sheets, marking an urban roof crown. This illustrates a symbiosis of architecture and technology. *See Img. 84*

The prototype expresses that the space+ is, as our centrepiece, not only a connecting technical element, but also a strong architectural manifestation. The prototype will not feature an accessible roof in the same way as the urban vision will. The visitor in Versailles will have the possibility to view the technological landscape through the transparent space+ roof. The technological landscape will include everything from the PV facility to the thermal collectors with a heat exchanger.

The technical rooftop of the prototype is based on an effficient module called sunpower. We are able to produce 5,538 kWh/y. If we link up with the urban construction we could imagine that the output of

Img. 84 Visualization of the space+ on the roof tops in the urban buildings of Lucerne

solar energy would be incredibly high and we would be able to share our energy with our co-residents.

The collectors are costly, but installation is simple. The impact of the replacement is a little more sophisticated, based on the fact that we use a hand tracking system. The whole system is very effficient and will be integrated in our metal construction, which is also equipped with plants. They should illustrate the combination of technology and nature, both in an urban context and for the prototype situation.
People should enjoy the good fortune of living in a city and sharing nature, energy and a roof top together. In that way we can manage the balancing act between solar systems and architecture, while maintaining a reference to our culture.

4 Energy Efficiency Design Narrative

Project Summary

"smart sharing – our vision is **your⁺**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is "smart sharing". We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your$^+$ suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of "smart sharing" addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

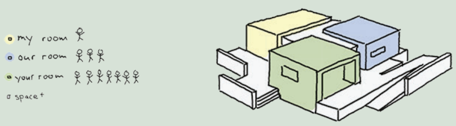
Flexible Room Usage

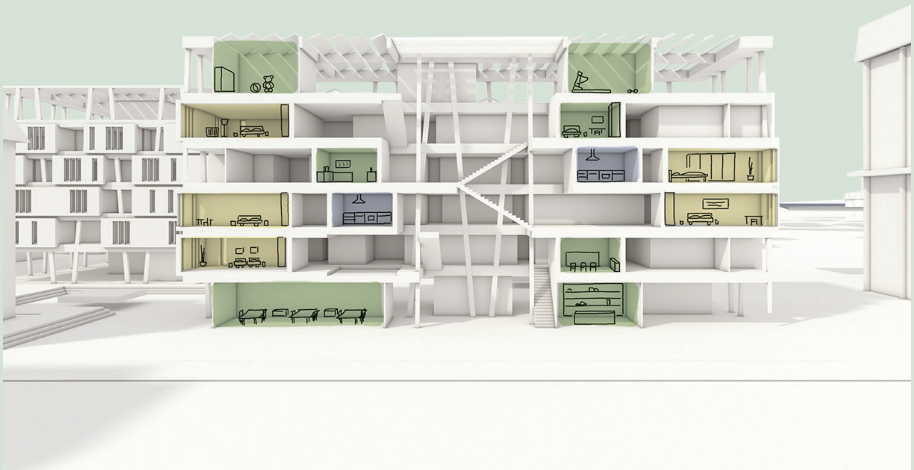
Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space⁺ as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your⁺.





Predictive Control for more Energy Efficiency

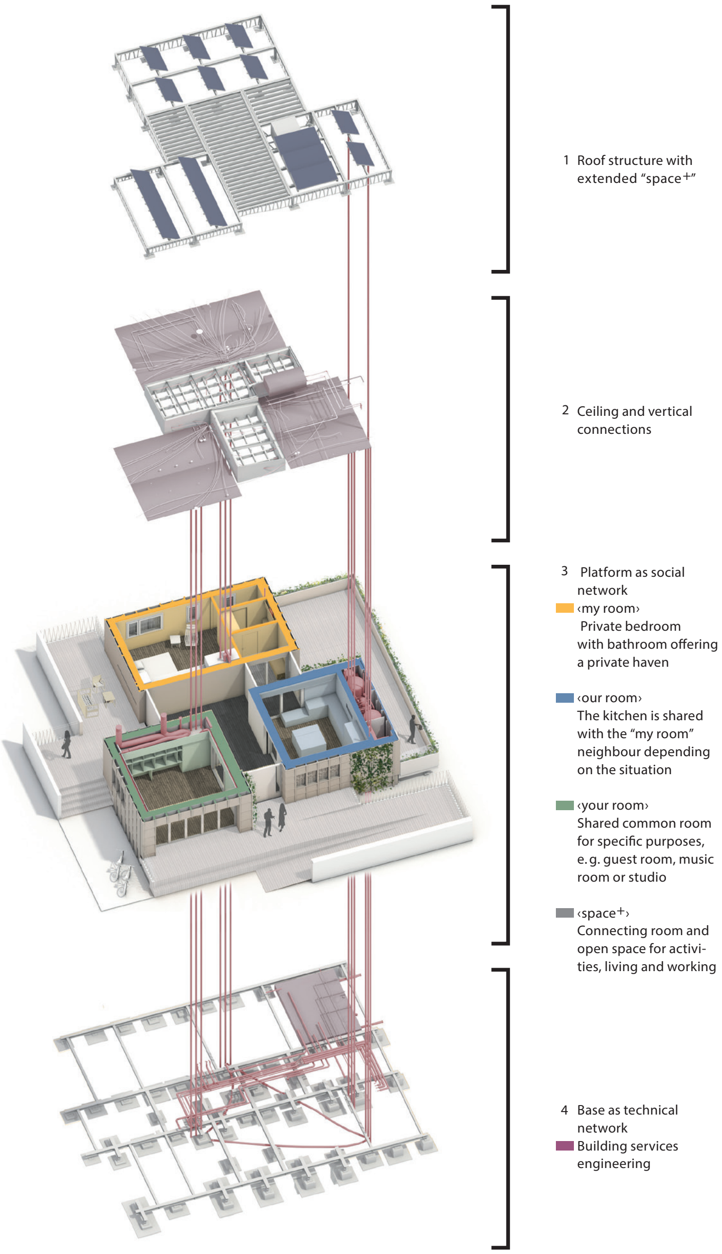
The proposed concept of sharing runs like a common thread through the project. For the urban buildings to function well as an overall system, every part of it must be implemented according to the concept. To fulfil these requirements, the energy systems will be implemented with an energy-sharing concept.

To build energy-efficient buildings, a holistic approach even during the planning process is extremely important. Simulations to estimate the effects of different scenarios and solutions in the individual project stages were made to be able to react accordingly and support the planning process. In the local context the active energy system is optimized to connect the building's thermal and electrical systems to its surroundings. Multiple buildings are assigned roles in the demand and supply management of heating and cooling energy as well as electricity.

The main functions of the active heating and cooling system is developed and optimized for the local context of a large-scale building and its thermal dependency. This plays a major role in the engineering process of the systems and made adaptation into a prototype difficult.

To optimize the passive strategies, the approach is specific to the situation. Important parts of the passive functions of the prototype, such as the place and size of the windows and the solar gain factors of the glazing, are optimized for the prototype.
The different rooms are heated and cooled depending on their relevant uses. That saves resources and energy in a target way according to the rooms' utilization. In addition to social aspects, on the time of year, warmth is extracted or passive cooling is achieved through natural ventilation.

"smart sharing" means producing and providing energy according to the local context and being linked to the regional network.



4.1 Technical Project Summary

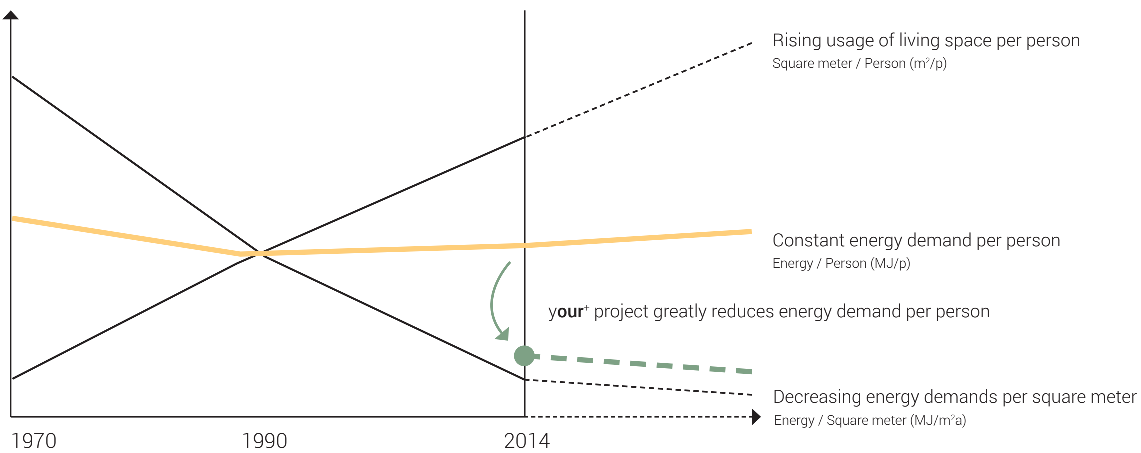
This chapter of the project manual summarises the technical aspects of the project. At first the general idea of the energy systems will be exp-lained. Also the planned supply concept of electrical and thermal energy for the local context will be explained. Furthermore this chapter inclu-des a comparison of the local and competition context, as well as the adaptation of the energy concept for the prototype. In the following part the technical specifications of the prototype will be listed and defined. Finally the two technical project summary tables are presented. All the requested information is gathered in the two tables. The first table includes the information for the local context, where the data describes a proposed situation in the location of the urban design narrative. In the other table the data represents the competition context, so the gathered data shows how the prototype will be built.
This chapter provides an introduction to the more detailed description of the planned technical installations in the prototype for Versailles.

Introduction

Today's buildings continue to improve in efficiency, thus energy consumption per square metre decreases. These savings are counteracted by the increasing demand for space per person. Therefore, energy consumption per person is still rising. your+ looks to change this through the concept of "smart sharing" which includes a flexible use of rooms. Sharing rooms significantly decreases the demand of space per person and thus results in significant savings in energy. *See Img 1.*

Apart from general energy savings from sharing space, the project aims to change the local energy system. Different strategies of the Federal Govern-ment are leading to a transformation in the Swiss Energy System. The electrical power supply of the future will be characterized by an increasing amount of small decentralized energy supply points based on renewable energy sources. These sources, like solar and wind power, feature highly intermittent generating characteristics and a high concurrency. Thus, the desired change is mainly from a central, uni-directional power supply to more decentralized, organized and bi-directional energy system.

Buildings, neighbourhoods and entire re-developed areas are transformed to create a maximum benefit for the energy systems of Switzerland. The building potential at the systemic level integrates efficient and highly-adaptive buildings, storage and conver-ters in power systems with distributed generation. The potential is derived through energy hubs and multi-energy grids in local areas. The organization of these two new elements in the future system ensures the effective development of an operational and decentralized energy supply. The concept of your+ demonstrates this transformation.



Img. 1 Forecast of average demand for living space and energy per person

Classification of local Context and Competition Context

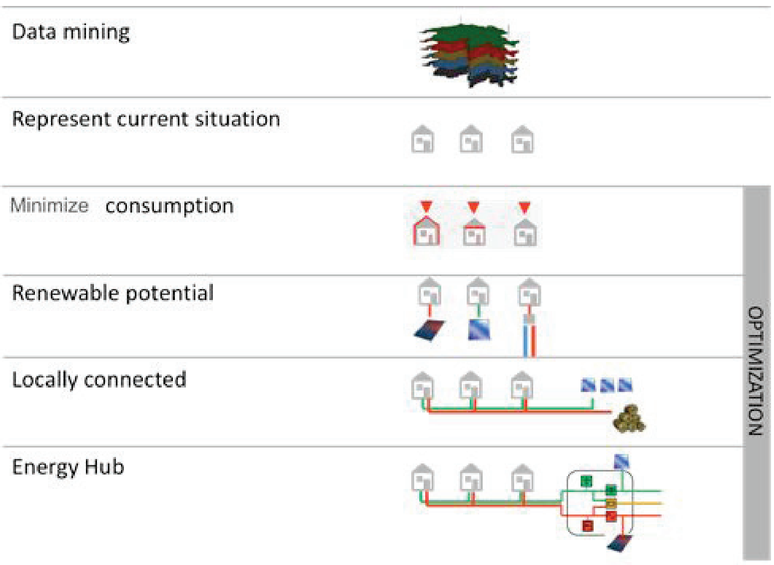
The competition context is subsequently referred to as “Prototype” and the local context is subsequently referred to as “Project”.
The whole project concept is worked out for a local context. Sharing, as the main idea of the concept, establishes a basis for every function and systems included in the building. Therefore technical systems are mainly designed for the local context and the planned buildings will not be separated from the existing surrounding buildings, since the whole area will be developed into a holistic energy system. Because of the complex room division in the project, an extracted section of the building will not work as a building itself.

The prototype for the competition context is not a piece taken out of the large-scale concept, but is instead a combination of the major room types as well as the space+. Since the technical installations need to work by themselves in the prototype, they had to be adapted to the competition context in Versailles and will not have all of their functions. So the energy system will be different from the proposed energy concept for the area. Some of the planned installations will be shown as an example, but will not work the same way as they would do in the local context. The infrastructure of the area will not even be presented in the prototype.

General Idea of the Energy Systems

The proposed concept of sharing runs like a common thread through the whole project. For the house to function well as an overall system, every part of it must be implemented according to the concept. To fulfil these requirements the energy systems will be implemented with an energy-sharing concept.
In the local context the whole energy system is optimized to connect the building’s thermal and electrical systems to its surroundings. Multiple buildings receive a role in the demand and supply management of heating and cooling energy as well as electricity.

Img. 2 shows how the your+ building will be connected to other buildings in the area. Electrical connection of buildings is widely known, but this connection needs to be smarter. Buildings in an area must not only be electrically and thermally connected, but must also communicate with each other. A coordinated strategy of demand and supply management allows the areal connection of built structures to adjust their energy systems to work together in an overall way. The entire area develops into an energy hub, which can provide various energy services.



Img. 2 Transformation of the existing building stock into energy hubs

In the concept of your+ the connection of buildings will not only remain in the electricity grid, but will expand to heating and cooling energy as well. This creates a multi-energy grid for a whole area. To optimize the functions of this multi-energy grid, enough buildings in the perimeter must be connected to the planned urban buildings of your+.

Every building in the perimeter will receive its own task in the multi-energy grid. For example the hybrid solar collectors on one building's roof produce heating energy and electricity. Another building may work as a heat store, while yet another building may be an energy hub. All the buildings are connected by underground wiring and piping. To increase the efficiency of the whole system, thermal storage will be included in the multi-energy grid. Such thermal storage will be constructed underground and may be designed as geothermal probes. The storage capacity allows a shift in thermal energy between summer and winter. *See Img. 3 + 4.*

Multi-Energy Grid

The proposed multi-energy grid includes the known electricity network and also the thermal network for the heating and cooling energy. But it also includes the already existing gas network. Therefore all energy in the area, electrical, thermal and also the energy of the gas will be distributed and controlled by the multi-energy grid management.
In addition to the communication between buildings and the entire network the management of the grid also executes a coordinated strategy of demand and supply. This is only possible if energy shifting is implemented perfectly. Not only the annual energy shift of thermal energy needs to be controlled, but also the energy shift between the energy networks. This results in a perfect implementation of the energy sharing concept.

For example the high electricity production during a summer day cannot be fully used by all the energy consumers. For instance the surplus electricity may be used to produce synthetic methane through to process of power-to-gas and this methane will be stored in the gas network. Furthermore the connection of all three networks will be carried out by a combined heat and power plant.. By using a gas motor this plant generates both electricity and heating energy.This is an ideal addition for winter times, where the sun does not shine enough for the continuous production of electricity and heating energy through hybrid solar cells.

In conclusion the buildings in the area will be connected on all levels of energy. The networks interact with each other by communicating and through energy shifting. A management station such as an energy hub ensures a coordinated strategy of demand and supply and controls the functions of the system. *See Img. 3.*

Supply Concept of the Energy System

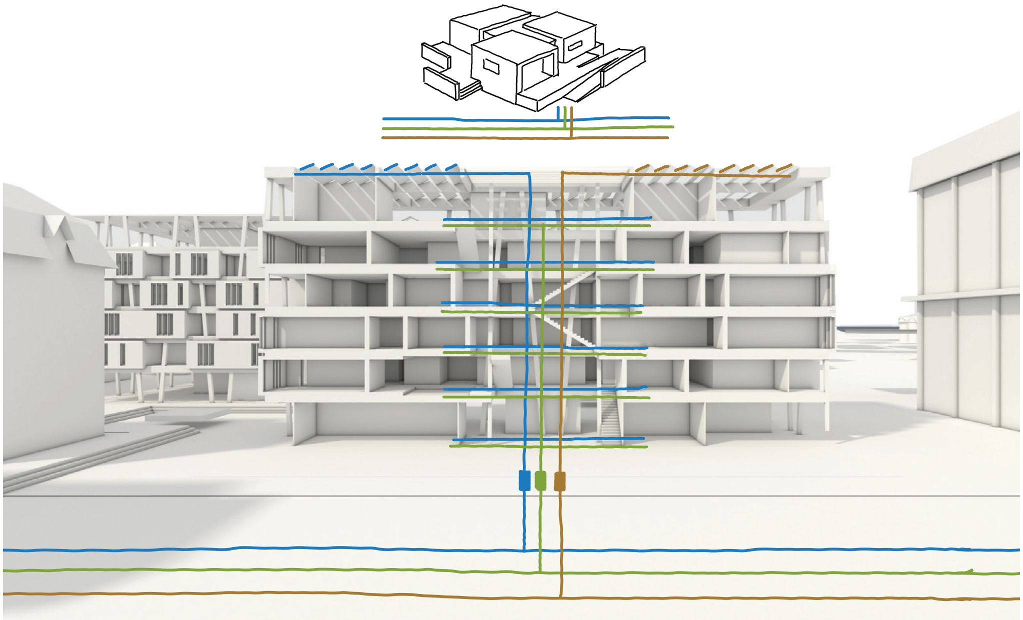
This supply concept is developed for the local context. To construct the prototype, several adaptations must be made. The following section explains how the energy concept is adapted to the prototype.

The development of the supply concept for the local context takes place according to the exemplary development of the urban design. The neighbourhood area where the project is located is Industriestrasse in Lucerne.
Further information: PM#6 chapter 1. The section "Implementation as an Urban Design Concept" describes the area and its residents.

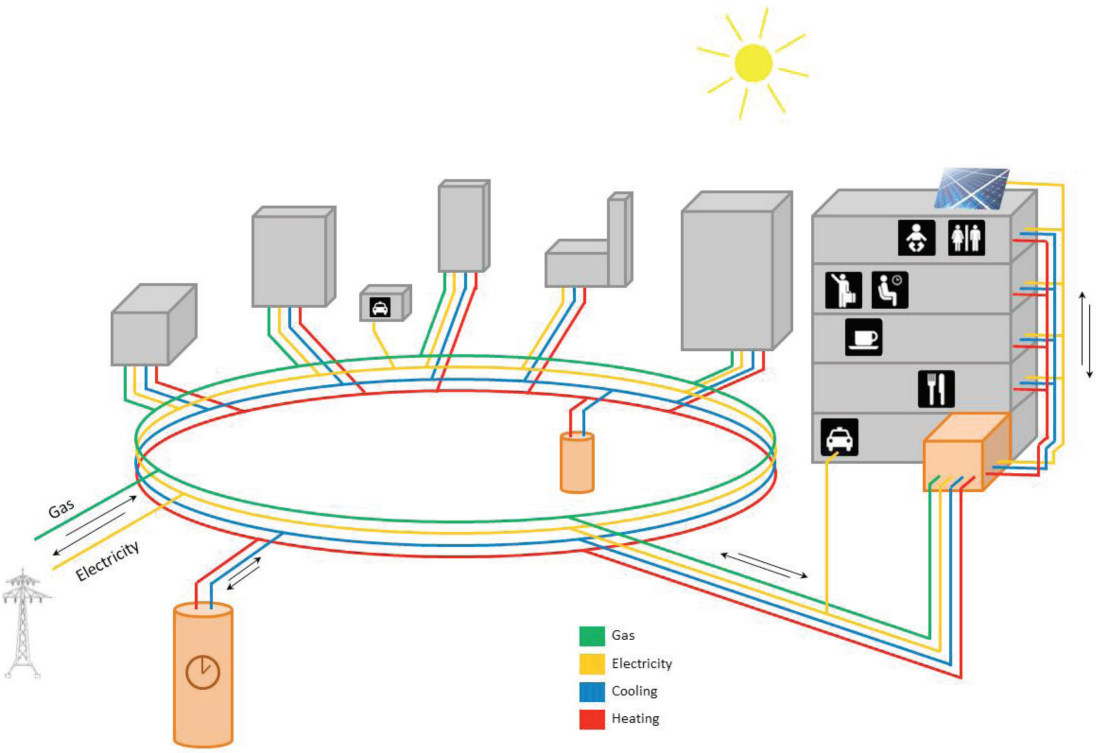
Thermal Energy grid

An underground thermal network consisting of two pipes will be built to connect the various buildings. The two circuits have contrasting temperatures and will be called "warm conductor" and "cold conductor". Each building chooses the supply depending on its demand. During heating periods the warm conductor will be the supply and the return will be carried out in the cold conductor. When cooling energy is required, the system will change its direction and will be supplied from the cold conductor and the warm conductor will work as return.

Through the bidirectional energy system each building will choose whether the thermal grid is its heat source or its heat sink. An ideal balance of heating and cooling energy throughout the whole year guarantees a constant temperature of the energy storage, such as geothermal probes. If the energy demand of either cooling or heating energy is higher than the other, the temperature of the whole system needs to be ensured through an additional energy source. For example the higher heating energy demand may be compensated through an industrial process with its waste heat.
The temperature of the two conductors will fluctuate between 4 – 20°C. This ensures the possibility of freecooling most of the time and also permits



Img. 3 Local context with the thermal and electrical connection



Img. 4 Multi-energy grid for the area

excellent COPs for heat pumps or chillers. For the distribution of the heating and cooling energy, several buildings will be connected to a single energy hub. In this district heating and cooling station, the heat exchangers for freecooling, the heat pumps and chillers provide a useful temperature for the building supply.

Img. 5 shows the proposed lot for the implementation of the your+ urban buildings into the neighbourhood (marked in blue). The thermal energy grid (red) is connected to the geothermal probes (green) and the energy source provided by industrial waste heat (yellow). .

Subsequently the schematic drawing of the thermal system is shown. The warm and cold conductors are carried out as ring topology. Whilst only one energy hub is shown, multiple hubs may be connected to the thermal grid. Also several energy storages of different kinds may be connected. An energy hub supplies several buildings with heating and cooling energy, so the connection to the buildings is a small district heating and cooling system. The shown energy hub includes a heat pump for the heat production and a heat exchanger for the possibility of freecooling. Other hubs can be equipped with different components and are therefore able to suit the varying demand of thermal energy. *See Img. 6.*

Electrical Energy Grid

A reliable electricity supply forms a decisive basis for a highly developed society. High utilization levels and low flexibility in the power grid threaten the current system. In the years ahead, demand for electricity will continue to rise in Switzerland and Europe. Today's power grid was built to ensure a standard power supply to population centres, therefore using direct connections between major power stations and consumers. All these requirements mean that the European power network faces challenges for which it was not constructed.

In addition to the primary desire for a secure supply, there is also demand from society for the integration of environmentally friendly energy production within the power grid. The efficient use of new sources of energy such as the sun, wind and geothermal energy leads to networks with much smaller decentralized power plants.
A renewal of the power grid is unavoidable.

The grid should also be made more intelligent. That allows processes in the network to be automated, replacing the traditional centralized control with a dispersed system. This new type of network is called a Smart Grid. Based on autonomously active, strongly networked nodes, the Smart Grid offers the chance to administrate a future electricity supply in a new way. The European Smart Grids Technology Platform defines four main points for the future power grid and we want to develop the your+ quarter's network based on those points:.

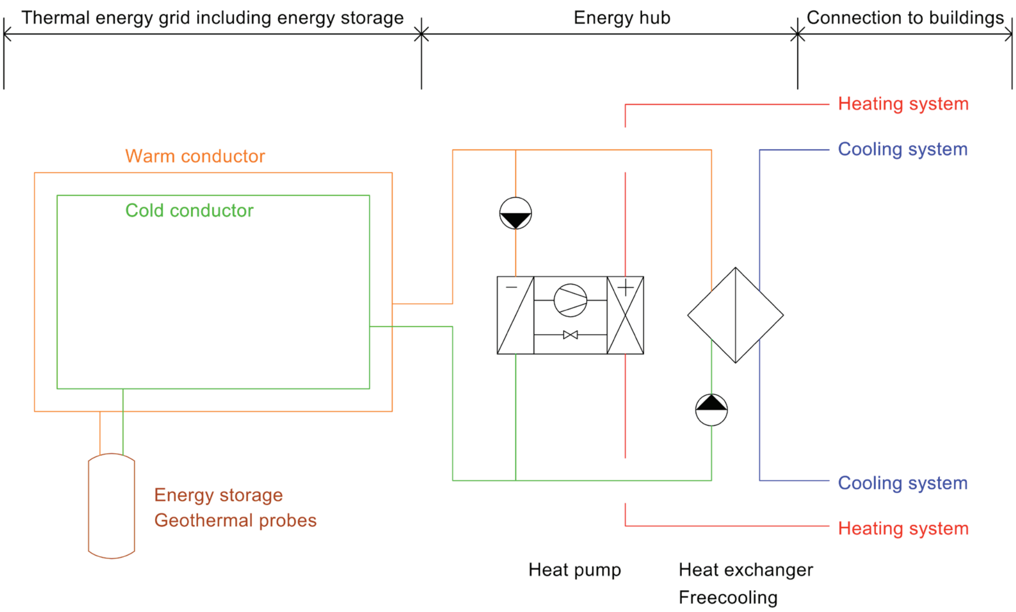
• Flexibility: The electricity grid of the future should be as flexible as possible, both for providers and consumers. Customers should be able to choose from several providers. Power generators should be able to react to changes and problems in a simple way.
• Uniform access: All users should have a uniform access to the system, especially small local power generators and plants using renewable energy resources. Fossil fuel resources should be replaced by renewable energy (PV and wind).

• Reliability: The quality and security of the power grid should always be guaranteed, even when unforeseen problems occur on the network.

• Economy: A healthy economic environment should be created to encourage innovation and efficiency in the energy sector.

The electric part of the your+ Multigrid will function as an autonomous microgrid and communicate with an external, superordinate Smart Grid. The your+ microgrid acts as an independent unit. In the your+ grid, various nodes are pooled to create dynamic cells. The nodes communicate with each other using a broadband connection. Local sensors monitor the operational status and are analyzed by the operating system. The control unit is only informed in the case of an emergency. The grid allows new nodes to be integrated, thereby achieving a flexible, simple extension of the network to include new components. Such nodes can be anything from a private household to a power plant. The your+ microgrid is a low voltage network consisting of several power generators (combined heat and power unit and photovoltaic system), an energy store and consumers. Although the your+ grid is connected to the superordinate main power grid, it is possible in exceptional cases to completely separate them. That is possible because the energy requirements of local generators and stores is covered, so the microgrid

Img. 5 Ground plan of the thermal grid



Img. 6 Diagram of thermal system

can act both as a power consumer and as a supplier to external contacts. This simplifies the organization of a Smart Grid, since the microgrid is considered as the only unit. The your⁺ grid is therefore "Smart Grid ready".

Advantage of the Microgrid in the Industrie-strasse Quarter

The bottleneck in the quarter lies in the public power grid. A 630 kVA power transformer is usually used for the transition from Network Level 5 to Network Level 7. The transformer not only supplies one quarter, but can also supply a second similarly sized quarter. If the second quarter has the same PV performance, both quarters must share the same transformer, which cannot however be overloaded. So the maximum power fed into the grid is limited to 300 kW. The limitation forces the power to be stored in the quarter's own batteries in order to feed the grid when the level has fallen below the critical level. This store can also incorporate electromobility. In our quarter, we assume 50 cars, with which 12 kWh, or half of the maximum storage space, would be available. Another idea envisages e-vehicles returning power to the system.

An intelligent control system must be used to control the power store. The microgrid administrates the storage and limits consumers that are not required at specific times. Weather data is also used to develop a charging and discharging timetable. Based on global radiation, the gains from the PV systems can be predicted three days in advance. In this way, all power stores can be discharged before a fine summer day to provide sufficient capacities. Alternatively, if poor weather is expected the next day, the batteries are only discharged then.

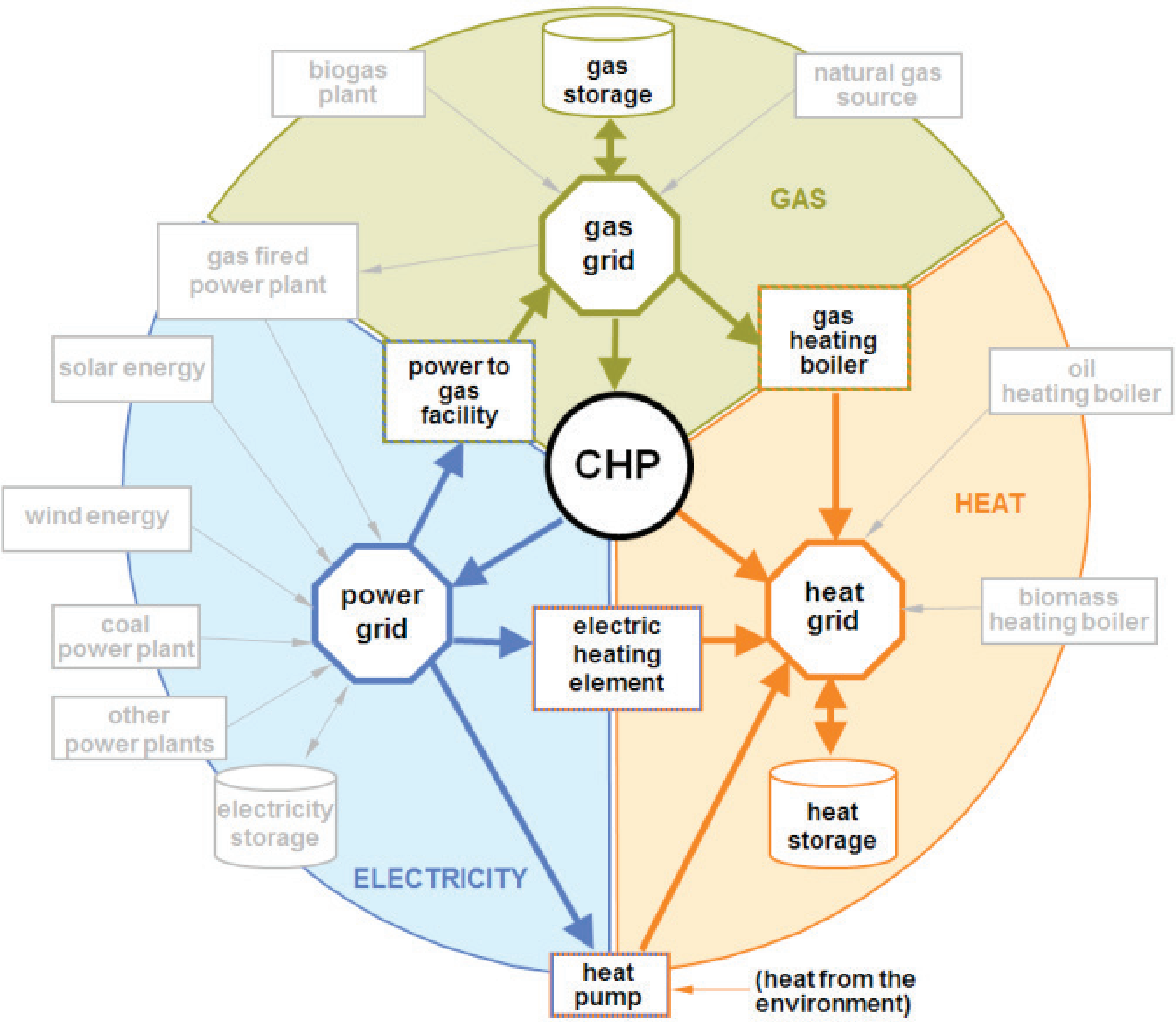
Gas Energy Grid

The third energy source which is provided by the multi-energy grid is gas. Natural gas is an important part of the energy supply and needs to be included in the planning of a holistic energy concept. Nevertheless this energy source will not be implemented in the proposed energy concept of your⁺ in the competition context. Due to the restrictions in the competition it is impossible to use natural gas. Therefore this source will not be explained in this report.
However it is important to include the grid of natural gas to optimise the whole system in the local context. This integration allows the use of synergies that are provided by the combination of the three grids: electricity, thermal energy and natural gas.

Synergies

Many synergies will only be available if the three grids are combined. *Img. 7,* many connections between two grids can be used to transfer energy between one network and the other. The perfect connection of the three networks is the combined heat and power (CHP), which provides thermal energy and electricity through a gas motor. If a power-to-gas concept is added to the system there is practically every connection between networks carried out with only two components. Another advantage of the power-to-gas facility is the possibility to store electrical energy in the synthetic methane. This is the solution to energy shifting between times of high demand and times of high production of all three energy types.

Img. 7 shows the possible interactions between the three energy sectors as well as some possible energy conversion technologies.



Img. 7 Interaction between the three energy grids (source: http://www.bremer-energie-institut.de)

Adapting the Energy Concept to the Prototype

The proposed energy concept of thermal connection forms the basis of the design process with respect to the prototype's energy concept in the competition context. However in the competition context it is not possible to lay something directly in the ground, since the rules do not permit such construction work. Due to this restriction we are unable to construct geothermal probes. Also each team's prototype must work for itself, making it impossible to construct a thermal and/or electrical connection between prototypes in the perimeter.

For these reasons the planned energy concept for the prototype must be adjusted to the new circumstances. Such adjustments downgrade the general efficiency of the whole system (no synergies can be utilised among buildings). The annual energy shift in the geothermal storage will be presented using the daily shift in the cooling energy. In the prototype the cooling storage will be cooled down during the night by freecooling with the recooling device. Therefore the increasing cooling demand during the day may be partially covered by the full cooling store.
In the local context the solar energy systems may be implemented very efficiently by combining the solar thermal panels and the photovoltaic cells into hybrid solar panels. Electrical efficiency will be improved by the cooling character of the thermal part. Also the low-temperature heat may be restored in the thermal network and operates as an ideal heat source for heat pumps. Often the heat from the hybrid solar cells also acts as regenerative energy from the geothermal probes in the summer.
Because the produced heat of the hybrid solar panels may not be restored in the thermal network, it must be restored in the heating storage tank in the mechanical room. The low temperature of the heat provided by hybrid panels is not sufficient for the supply of domestic hot water, therefore solar thermal panels must be implemented by all means. Due to the limited size of the storage tank the system would not be able to store much heat provided by the hybrid solar panels, which leads to a shutdown of the cooling system in the photovoltaic part and neutralises the improvement in electrical efficiency. The system will therefore be implemented without hybrid solar panels. Due to the restrictions of the competition it is not possible to use gas in any way. Therefore this energy source is not implemented in the concept of the prototype

Comparison Between the Local and Competition Contexts

The following table compares the local context "project" to the adapted competition context "prototype". The exact transformation of the energy concept to the prototype is not possible, because the building's connection to its neighbourhood cannot be carried out. Therefore the adaptations made for the prototype are visible in the list.

	Local context "Project"	Competition context "Prototype"
Heating / Cooling system		
Heat production	Heat pump	Heat pump
Heat source	Geothermal probes	Air (Recooling device)
Temperature heat source (min. / max.)	8°C / 20°C	-12°C / 16°C
Estimated COP (Min. / max.)	4.92 / 7.00	2.89 / 6.15
Cooling production	Chiller / Freecooling	Chiller
Heat sink	Geothermal probes	Air (Recooling device)
Temperature heat sink (min. / max.)	4°C / 16°C	26°C / 40°C
Estimated COP (min. / max.)	>10 / no maximum due to freecooling	4.14 / 6.02
Solar systems	Hybrid solar cells	Solar thermal panels / Photovoltaic cells
Plumbing system		
Fresh water supply	Fresh water system	Tank
Black water drainage	Sewage system	Tank
Rain water collection	Tank for reuse	Tank for reuse
Grey water collection	Tank for recycling	Tank for recycling
Toilet flush	Rain water / Grey water	Not connected to system
Washing machine / Dish washing machine	First washing cycles executed by rain water, further cycles by fresh water.	Only supplied by fresh water
Air-conditioning system		
Your room	Central air-conditioning device for all rooms	Small central air-conditioning device
Our room	Peripheral air-conditioning device for each room	Peripheral air-conditioning device
My room	Peripheral air-conditioning device for each room	Peripheral air-conditioning device
Space+	Connection to central air-conditioning device, as well as passive strategies	Passive ventilation
Electrical system		
Solar systems	Hybrid solar cells	Photovoltaic cells
Energy storage	Connection to the grid / Power-to-gas	Batteries

Technical Specifications of the Prototype

This part provides the technical specifications of the prototype. It includes the same information as in the technical project summary table for the competition context but the data will be explained as well.
The two technical project summary tables are located in the following part of the chapter.

Project Dimensions

Gross area:	134.36 m²	Conditioned rooms and unconditioned space⁺
Net floor area:	73.33 m²	Conditioned rooms (does not match with measurable area)
	27.64 m²	Unconditioned space⁺
Conditioned volume:	186.51 m³	Conditioned rooms

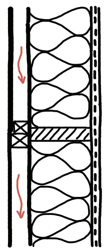
House Envelope

Glazing area:	19.16 m²	Glazing of the conditioned rooms
	30.08 m²	Glazing of unconditioned space⁺
Roof area:	108.69 m²	Roof of the conditioned rooms incl. technical room
Floor area:	80.30 m²	Floor of the conditioned rooms incl. technical room
	26.67 m²	Floor of the unconditioned space⁺
Wall area:	117.59 m²	Walls of the conditioned rooms to the outside atmosphere
	51.46 m²	Walls of the conditioned rooms to the unconditioned space⁺

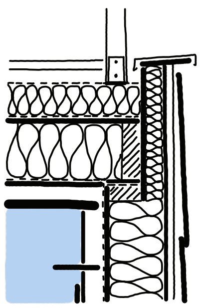
Thermal Transmittance

Glass only	0.5 W/m²K
Glazing	0.82 W/m²K

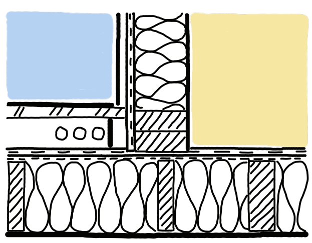
Wall – Conditioned rooms to outside	λ	thickness
	W/(mK)	m
Osb wood	0.13	0.015
Back ventilation	0.21	0.027
Osb wood	0.13	0.015
Insulation rock wool	0.035	0.28
Osb wood	0.13	0.015
total		0.352
thermal transmittance	W/m2K	0.144



Roof – Conditioned rooms	λ	thickness
	W/(mK)	m
Insulation rock wool	0.038	0.11
Osb wood	0.13	0.022
Insulation rock wool	0.036	0.28
Osb wood	0.13	0.022
total		0.434
thermal transmittance	W/m2K	0.101



Floor – Conditioned rooms	λ	thickness
	W/(mK)	m
Osb wood	0.13	0.022
Insulation rock wool	0.034	0.28
Osb wood	0.13	0.022
Acoustic decoupling	0.04	0.002
Parquet oak	0.18	0.19
total		0.516
thermal transmittance	W/m2K	0.121



HVAC Systems in the Prototype

Heating System

The heating energy will primarily be produced by the solar thermal collectors. Therefore the heat storage tank will be loaded by warm solar water.
In case the solar energy is not enough, the heating energy will be supplied by the heat pump, either using low-temperature solar heat (low radiation) or ambient air (air-cooler). A recooling device (air-cooler) will act as a heat source for the heat pump. So the heat pump will work as a water-air heat pump.

Cooling System

Room cooling will primarily work with passive and/or natural strategies. During cold night hours the cooling storage will be cooled down using the recooling device.
This naturally gained cooling energy will be used during the day for room cooling. If the passive and natural actions are not sufficient to maintain the thermal room comfort, the chiller (heat pump) will actively produce cooling energy and help to cool the rooms.

Heating and Cooling System in the Rooms

The thermal room comfort is managed by an activated suspended ceiling. For an excellent heat transfer coefficient, the ceiling is completely made out of aluminium. Activation takes place by mounting copper tubes on the aluminium plate. Those tubes will be flown through by hot or cold water to establish the energy flow. To be able to change between heating and cooling mode for each room on its own, the two systems are connected in the room. By operating control valves the supply and return pipes of the respective system may be opened or closed. *See Img.8*

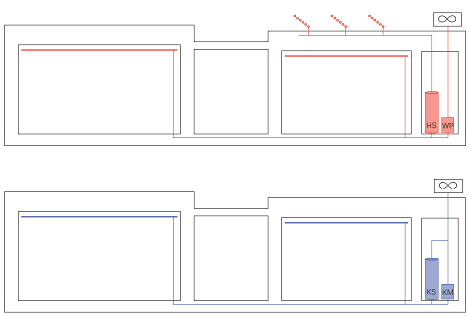
Air-Conditioning System

The three rooms are equipped with different air-conditioning systems.
In my room and our room the air-conditioning system consists of peripheral devices installed in the outside walls. The devices include heat recovery.
By contrast, the system in your room is implemented with a small ventilation device installed in the closet.

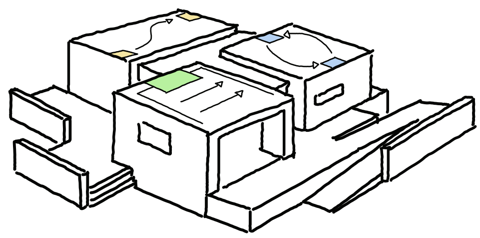
In the project the system will be implemented according to the execution in the prototype.
your rooms will mostly be captured rooms in the inside of the building, therefore the air supply will be achieved by a central air-conditioning device.
The other two room types, my room and our room, will be located at the facade. Therefore the air supply will be ensured by peripheral devices in the outside walls.

Through this system every room may be supplied according to its needs and this results in energy savings for conditioning. *See Img. 9.*

In the project the system will be realized according to the execution in the prototype.
your rooms will mostly be captured rooms in the inside of the building, therefore the air supply will be achieved by a central air conditioning device.
The other two room types, my room and our room, will be located at the facade. Thereby the air supply will be ensured by peripheral devices in the outside walls. This concept results in a combination of two different air-conditioning systems.



Img. 8 Heating and cooling system



Img. 9 Air-conditioning system in the prototype

Energy Production Equipment

A heat pump and cooling machine produces the heating and cooling energy for the system.

Type:	Heat pump / Cooling machine
Manufacturer:	KWT (Viessmann)
Model:	RV-WP-2HES-2Y-1-1-SO-P5.31
Refrigerant (Type):	R-134a
Heating Capacity:	6'290 W
Heating Efficiency:	642%
Cooling Capacity:	5'310 W
Cooling Efficiency:	539%

Terminal Unit

Connection of the heat pump / cooling machine to the outside air.

Type:	Recooling device – air to water
Manufacturer:	Mountair
Model:	Monobloc S2 – H-Form
Heating & Cooling Capacity	6'290 W

Heat Recovery Ventilation or Energy Recovery Ventilation

The ventilation systems consists of peripheral devices including heat, energy and humidity recovery.

Type:	Small ventilation device – installed in closet
Manufacturer:	Zehnder
Model:	Zehnder ComfoAir SL 300 E
Volume flow:	50 – 300 m³/h
Efficiency heat recovery:	80%
Efficiency humidity recovery:	70%
Filtration:	Supply air F7, Exhaust air G4

Type:	Peripheral ventilation device – installed in facade
Manufacturer:	Helios
Model:	Helios Ecovent KWL EC 60
Volume flow:	15 – 60 m³/h
Efficiency heat recovery:	70%
Filtration:	Supply air G4 (optional F7), Exhaust air G4

Domestic hot Water in the Prototype

Domestic hot water System

Type:	Fresh water station (Energy storage in heating storage tank)
Manufacturer:	Danfoss
Model:	EvoFlat FSP-A2
Capacity DHW:	45 kW
Peak supply:	11 ltr./min.
Demand DHW 1 day (max):	220 ltr. (Maximal demand for 1 day during the competition)
Demand DHW 10 days:	1668 ltr (Demand for the 10 days during the competition)

The domestic hot water (DHW) system works with a fresh water station. In this system the energy demand of the DHW will be stored in the heating storage tank. When DHW is needed the system ensures its temperature with an included heat exchanger. The heat exchanger is directly connected to the heating storage and a pump will guarantee the circulation. On the side of the DHW production, the fresh water will flow directly through the heat exchanger and will be heated to the desired temperature. *Further information: PM#6 chapter 3.3.*

Solar Thermal Collectors

Type:	Vacuum tube collectors, medium water
Manufacturer:	Viessmann
Model:	Vitosol 200-T, Type SP2A
Area (m^2):	4.53 m² (Net area)

The solar thermal system consists of 3 vacuum tube collectors on the roof and a heating storage tank in the mechanical room. The storage tank works with 2 different volumes. The upper part is planned to store the energy which is used for the production of the domestic hot water, whereas the lower part is for the heating system.
To achieve optimal dimensioning of the collector area the solar thermal system is mainly designed to fulfil the energy demand of the domestic hot water. Through a changeover valve it is possible to work either in the upper or the lower part of the storage tank.
The heat pump acts as a backup heat source for both systems, namely the heating system and the domestic hot water system. From the heat pump it is also possible to work in either part of the tank.
Further information: PM#6 chapter 3.7.

Electrical Energy Production in the Prototype

PV-Modules PC panels area	Sunpower X-21 SPR 335
PC panels area	22.82 m^2
Installed PV power	4690 Wp
Estimated energy production	
Versailles	5240 kWh/year

Energy Consumption in the Prototype

Estimated energy consumption	
Versailles	4400 kWh/year
Estimated electrical	
consumption per conditioned	64.67 kWh/year per m^2
Energy Use Characterization	
Heating (%)	11 %
Cooling (%)	4 %
Ventilation (%)	17 %
Domestic Hot Water (%)	2 %
Lighting (%)	17 %
Appliances and Devices (%)	58 %

Energy Balance for the Prototype

Estimated energy balance	+840 kWh/year
Estimated CO_2	
emissions (Tn/year)	2.1069 Tn/year

Housing and Transport Coupling

The role of energy storage in the field of mobility will cause significant changes in the foreseeable future. The age of the combustion engine as the sole vehicle drive is ending, since it will clearly be replaced by e-vehicles. Vehicles for individual transport stand unused for most of the time. If only part of them were already electric vehicles, there would be an enormous energy-storage capacity that could be freely used. In the energy system of the future, storage will play an important role and this is where the potential of the "rolling energy store" will become significant. By connecting electrically driven cars and bicycles, a variably available energy store becomes available to the power system. These power units can balance out the variable production of renewable energy and therefore serve to support such energy resources.

Our project uses e-bikes as an example of integrating e-vehicles. The e-bike batteries are integrated into the building system. If the rechargeable batteries are mounted to the appropriate bank, they are connected to the system and can be used as energy stores. To make it easier for users to mount and remove batteries, we plan accesses and simple operation.
This newly available power storage represents an important element of the electricity concept. If the rechargeable batteries are charged, they can be used for the e-bikes and thereby make cycling easier. The e-bikes can also be used as indoor exercise bikes that charge the batteries by means of recuperation (this is not permitted during the competition). The energy produced can use the e-bikes to provide power to the your+ prototype. Our concept used 2 Stöckli e.t. e-bikes and 3 batteries with an overall capacity of 1,200 Wh.
Further information: PM#6 chapter 3.5.

List of singular and innovative materials and systems of the Concept and the Prototype

• Energy System:
The energy system is optimized for the thermal and electrical connection of multiple buildings in a local context. This large-scale system has been adapted for use in the small-scale prototype for the competition in Versailles. Due to the connection of the building to its neighbourhood it is possible to share energy, which allows us to establish energy balancing through the synergy of the buildings.

• Water Reuse System:
All the different water qualities will be used according to their pollution level. Every process will receive the water with the highest possible pollution to reduce the consumption of the fresh water compared to a normal plumbing system.
For example grey water will be reused for wetting the recooling device and the vegetation. Rain water will be used for the first washing cycle of the washing machine and the dish washing machine.
Further information: PM #6 chapter 3.3 and chapter XI

• Flexible Use of the Rooms:
The conditioned area changes according to the flexible use of the rooms. Therefore the capacity of the systems will be adjusted according to the need. Because the idle rooms do not need to be in comfort condition, this results in energy savings for heating, cooling and air-conditionining.
Further information: PM#6 chapter 4.2.

• Two Different Air-Conditioning Systems:
The combination of two different air conditioning systems results in an additional benefit. A properly planned system can easily be extended and this ensures savings in time and investment costs.
Because the systems for the public (captured) and the private (facing facade) rooms are strictly separated, the different areas can be supplied according to their needs which also generates a benefit for the user. The consistent use of individual room controls allows an exact adjustment to the demands of the rooms.
Each resident can adjust the ventilation of their own rooms, especially the private rooms. This increases the satisfaction and well-being of the residents. The separation of the system according to the rooms also shows advantages relating to the use of the windows. Because the user can adjust the amount of air, the windows will not be opened as often which reduces the energy loss through window ventilation. The resident also has the possibility to set his devices in an automatic operation mode, which guarantees an ideal air renewal according to the CO_2 pollution in the rooms.
In the public rooms the residents will not have access to controls of the ventilation system. The supply with fresh air will be managed automatically for an ideal and energy-efficient operation of the system. Thereby the run-time and the energy consumption of the air-conditioning devices will be reduced to a minimum.
Further information: PD#6 ME 201.

• Domestic hot Water Production through a fresh Water Station:
The fresh water station is connected to the heating storage tank. When DHW is needed, the fresh water flows through a heat exchanger in the station and will be heated up to the desired temperature by the mechanical function of the modulation only. The heat exchanger will be supplied by heating water directly from the heating storage tank. Therefore no energy will be stored on the DHW side of the system. The energy storage in the heating tank decreases energy losses and reduces the risk of legionella in the hot water to a minimum in reference to the usual DHW-system with a DHW storage tank.
Because the fresh water sstation only works mechanically, the only auxiliary energy used for the whole cycle is the power supply of the heating pump from the tank to the station.
Further information: PM#6 chapter 3.3.

• Toilet Flush with Grey Water:
The toilet and the washstand of the bathroom are connected to one part in the system. The toilet washstand combination includes a direct grey water recirculation. Fresh water used for hands washing will be stored in a tank beneath the washstand. This collected water will be used for the toilet flush.
In the project the toilet will also be connected to the rain water distribution. When no grey water from the washstand is stored in the tank the remaining demand for the flush will be supplied by rain water. With this system no fresh water will be consumed for the flush. *Further information: PM#6 chapter XI.*

• Shower with Heat Recovery System:
The installed shower includes a direct grey water heat recovery system. Already used water will be used to heat up the fresh water coming from the distribution pipe. The fresh water flows through a heat exchanger in the base of the shower while the used hot water flows over this heat exchanger to transfer its energy. After the preheating process the warm fresh water will mix with the hot water to guarantee an ideal shower water temperature.
Further information: PM#6 chapter XI.

• PCM in Construction of the Roof of the space+:
In the space+ PCM (phase change material) is used in the construction of the roof. This light material works as thermal mass and helps the passive cooling strategy. During a summer day the energy from solar radiation will heat up a room and the PCM will absorb energy without warming up. Thus the temperature in the room remains comfortable for a longer period. To bring the heat out of the room, windows will be opened during the night hours. The ideal placement of the windows allows passive ventilation with cold night air, which will cool down the room with the PCM. This mechanism works as a daily energy shift from day to night and helps to maintain a comfortable temperature in the room.
In the local context, project PCM might be used in every room to ensure a light construction while having thermal mass to prevent the building from heating up and cooling down. *Further information: PM#6 chapter 4.2.*

• Connection of the Heating and Cooling System
The hydraulics of the heating and cooling system are fully connected. In the rooms the heating and cooling ceiling will be connected in a changeover system. Each room will be supplied by either heating or cooling water for its room temperature management.
Even the energy production part of the hydraulic system is connected, which allows a reversible use of the whole system. The heat pump / chiller can be used in either way, for heating only, for cooling only and as well for heating and cooling simultaneously.
See PD ME 211 + 221.

• Electrical Network:
LED lighting
Energy storage
Mobility included in the electrical network
Mobile lamp which can be charged by induction plates
Further information: PM#6 chapter 3.4.

• Photovoltaics:
HIT (heterojunction with intrinsic thin-layer) technology, very efficient PV system, efficiency factor of 21.5%
Tracking PV system for an almost maximum yield. The uniaxial tracking of the photovoltaic cells increases the electricity production by 20% compared to a non-tracked system.
Further information: PM#6 chapter 3.5.

• Automation and Management:
Energy management with peak shifting in electrical and thermal energy.
Further information: PM#6 chapter 3.6.

• Building Control Application:
In the prototype Application, comfortable conditions are integrated, providing the user with advice on how to better use the energy. For example when the resident wants to change the set temperature for the cooling of his rooms, the application gives advice when the temperature is set too low.
Further information: PM#6 chapter 3.4.

• Predictive Controls:
The predictive controls of the building automation anticipate the weather conditions and the solar radiation for the following hours and days. With this prediction the controls of tthe building controls can adjust according to future circumstances.
Further information: PM#6 chapter 3.6.

Technical Project Summary Table Local Context

1. Project Dimensions	Data	Location of detailed information in PM/PD
Gross area (m2)	27'591 m2	-
Net floor area (m2)	24'832 m2	-
Conditioned Volume (m3)	63'155 m3	-
2. House envelope		
Insulation types and thickness (m)	Rock wool, 0.28m	-
Walls area (m2) and Thermal Transmittance (W/m2.K)	14'016 m2 / 0.118 W/m2K	-
Floor area (m2) and Thermal Transmittance (W/m2.K)	6'900 m2 / 0.116 W/m2K	-
Roof area (m2) and Thermal Transmittance (W/m2.K)	6'900 m2 / 0.084 W/m2K	-
Glazing area (m2) and Thermal Transmittance (W/m2.K)	2'284 m2 / 0.82 W/m2K	-
Glazing Solar gain (SHGC)	48%	-
3. HVAC Systems		
Heating system		
Energy Production Equipment		
Type	Heat pump – brine-water	PM Technical Project Summary
Model	RV-WP-2HES-2Y-1-1-SO-P5.31	-
Heating Capacity	474 kW / 19.1 W/m²	-
Heating Efficiency	800%	-
Cooling Capacity	237 kW / 9.5 W/m²	-
Cooling Efficiency	700%	-
Terminal Unit		
Type	N/A	PM Technical Project Summary
Model	N/A	PM Technical Project Summary
Refrigerant (Type)	R-134a (Heat pump)	-
Heat Recovery Ventilation or Energy Recovery Ventilation		
Type	Central air-conditioning device and peripheral ventilation devices	PM Technical Project Summary
Model	Zehnder ComfoAir SL 330 E / Helios Ecovent KWL EC 60	-
Efficiency	80% / 70%	-
4. Domestic Hot Water		
System (Type, capacity)		
Solar thermal Collectors	Vitosol 200-T, Type SP2A	-
Type	Vacuum tube collectors and hybrid solar collectors	PM Technical Project Summary
Area (m2)	1026 m2	-
5. Electrical Energy production		
PV Modules (Type)	Hybrid solar collectors	PM Technical Project Summary
PV panels area (m2)	1550 m2	-
Installed PV power (kWp)	318 kWp	-
Estimated energy production (MWh/year)	364 MWh/a	-
6. Energy consumption		
Estimated energy consumption (MWh/year)	324 MWh/a	-
Estimated electrical consumption per conditioned (kWh/year per m2)	13 kWh/m2a	-
Energy Use Characterization (% of total energy consumption)		
Heating (%)	41 %	-
Cooling (%)	3 %	-
Ventilation (%)	7 %	-
Domestic Hot Water (%)	41 %	-
Lighting (%)	5 %	-
Appliances and Devices (%)	14 %	-
7. Energy Balance		
Estimated energy balance (MWh/year)	+40 MWh/a	-
Estimated CO2 emissions (Tn/year), C02 equivalent for construction	14.3 Tn/year	PM Sustainability Report
8. List of Singular and Innovative materials and systems		
See list at the end of Technical Project Summary		PM Technical Project Summary

Technical Project Summary Table

Competition Context

1. Project Dimensions	Data	Location of detailed information in PM/PD
Gross area (m2)	134.36 m2	AR-021
Net floor area (m2)	73.33 m2	AR-021
Conditioned Volume (m3)	186.51 m3	AR-021, AR-201/202, AR-203
2. House envelope		
Insulation types and thickness (m)	Rock wool, 0.28m	AR-341
Walls area (m2) and Thermal Transmittance (W/m2.K)	117.59m2 / 0.118 W/m2K	TEE
Floor area (m2) and Thermal Transmittance (W/m2.K)	80.3 m2 / 0.116 W/m2K	TEE
Roof area (m2) and Thermal Transmittance (W/m2.K)	108.69 m2 / 0.084 W/m2K	TEE
Glazing area (m2) and Thermal Transmittance (W/m2.K)	19.16 m2 / 0.82 W/m2K	TEE
Glazing Solar gain (SHGC)	48%	TEE
3. HVAC Systems		
Heating system		
Energy Production Equipment		
Type	Heat pump – air-water	PM Technical Project Summary
Model	RV-WP-2HES-2Y-1-1-SO-P5.31	PM Technical Project Summary
Heating Capacity	2'000 W / 27.3 W/m²	PM Technical Project Summary
Heating Efficiency	617%	PM Technical Project Summary
Cooling Capacity	5'310 W / 72.4 W/m²	PM Technical Project Summary
Cooling Efficiency	539%	PM Technical Project Summary
Terminal Unit		
Type	Recooling device – air-water	PM Technical Project Summary
Model	Monobloc S2 – H-Form	PM Technical Project Summary
Refrigerant (Type)	R-134a (Heat pump)	PM Technical Project Summary
Heat Recovery Ventilation or Energy Recovery Ventilation		
Type	Peripheral ventilation device	PM Technical Project Summary
Model	Zehnder ComfoAir SL 330 E / Helios Ecovent KWL EC 60	PM Technical Project Summary
Efficiency	80% / 70%	PM Technical Project Summary
4. Domestic Hot Water		
System (Type, capacity)		
Solar thermal Collectors	Vitosol 200-T, Type SP2A	PM Solar Thermal Design
Type	Vacuum tube collectors, medium water	PM Solar Thermal Design
Area (m2)	4.53 m2	PM Solar Thermal Design
5. Electrical Energy production		
PV Modules (Type)	Sunpower X-21 SPR 335	PM Photovoltaic Systems Design
PV panels area (m2)	22.82 m2	PM Photovoltaic Systems Design
Installed PV power (kWp)	4.69 kWp	PM Photovoltaic Systems Design
Estimated energy production (kWh/year)	5240 kWh/a	PM Photovoltaic Systems Design
6. Energy consumption		
Estimated energy consumption (kWh/year)	4400 kWh/a (Versailles)	PM Electrical Energy Balance Simulation
Estimated electrical consumption per conditioned (kWh/year per m2)	64.67 kWh/m2a	PM Electrical Energy Balance Simulation
Energy Use Characterization (% of total energy consumption)		
Heating (%)	11 %	PM Electrical Energy Balance Simulation
Cooling (%)	4 %	PM Electrical Energy Balance Simulation
Ventilation (%)	17 %	PM Electrical Energy Balance Simulation
Domestic Hot Water (%)	2 %	PM Electrical Energy Balance Simulation
Lighting (%)	17 %	PM Electrical Energy Balance Simulation
Appliances and Devices (%)	58 %	PM Electrical Energy Balance Simulation
7. Energy Balance		
Estimated energy balance (kWh/year)	+840 kWh/a	PM Electrical Energy Balance Simulation
Estimated CO2 emissions (Tn/year), C02 equivalent for construction	2.1 Tn/year	PM Sustainability Report
8. List of Singular and Innovative materials and systems		
See list at the end of Technical Project Summary		PM Technical Project Summary

4.2 Comprehensive Energy Analysis and Discussion Report

Designing an energy-efficient building is an ongoing process. With fundamental and comprehensive analysis and assisting simulation it was possible for us to support this process and find an efficient solution.
First of all the conditions in the local context had to be analysed. With the insights of this analysis it was possible to create a strategy. This strategy and the resulting building elements can then be checked continually and optimised by using simulations.

Section I – Influence of Energy Analysis on House Design and Competition Strategy

Introduction

a) Energy analysis Objectives and Methodology

In light of the actual energy transition, new tasks for the building industry are developing:

- To build highly efficient buildings and plus-process technologies with lower consumption of primary energy
- To increase the use of renewable sources such as solar energy for the production of thermal or electrical energy
- To share energy with surrounding buildings either as a producer, storage, manager or consumer
- Increased standards with more stringent enforcement through continuous on-site energy performance assessments

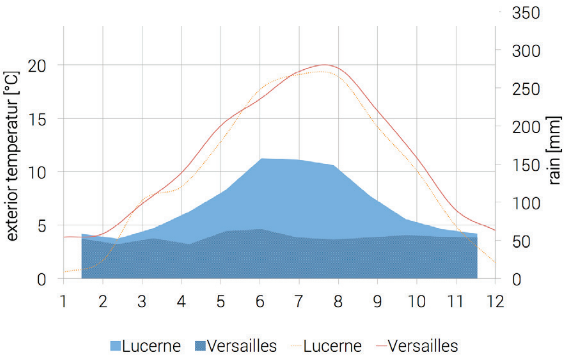
The main goal of the project your⁺ is to develop and evaluate different design features for adding and developing new housing elements/buildings for compacting the existing building stocks.
The overarching objective of this task in the context of Solar Decathlon Europe is to develop optimized strategies considering their spatial (urban, sub-urban, rural), geographic (location) and usage context. To do this, a methodology for design features on the urban scale is developed. The solutions can not only apply to residential buildings (which have been the main focus), but also to the appropriate mixture of all types of construction and use, including the retrofitting and adaptation of industrial buildings. This holistic methodology also takes into account the various usage profile typologies in the existing building stock.

Furthermore, new materials, components and building systems should be used in an integrated approach that combines knowledge from building physics and building technology. Combined solar systems, heat pumps and storages are among the most promising types of building heating systems for achieving significant energy savings. Their efficiency is closely related to the temperature lift. Since future retrofitted buildings are expected to have low heating temperatures, there is a great potential for considerable energy savings using such systems with a low temperature lift. To develop these small, highly efficient, low temperature-lift heat systems, several major challenges must be solved. Integrating the heat systems in efficient low-temperature heating and high-temperature cooling systems will lead to a considerable reduction in energy consumption and operating costs.

The your⁺ energy concept is based on such an above-mentioned heating system. The prototype is a low-energy building that must ideally operate in both Versailles and Lucerne. Due to this, climate and weather conditions from both places influence the project. Based on thermal simulations we want to find the ideal building construction and equipment. With the analysis of various simulations and their results, we will be able to modify parameters and cohesive functions of the system to find the most appropriate solution.

b) Climate Data and Weather Analysis

To create a house that uses little energy it is imperative to integrate the climate and weather of the environment in which it's built. Therefore we analyzed the two climate contexts. The weather analysis generates the following diagram. The left side with the red lines shows the average temperature curve over a year. The blue surfaces, with the scale on the right side, show the amount of rainfall in Versailles and Lucerne during a month. *See Img. 10.*



Img. 10 Climate diagram (temperature and rain) Lucerne and Versailles

Temperature

Aside from the rain, the weather in Lucerne and Versailles (Paris) is very similar. From April to August the temperature difference is lower than one degree Celsius. This allows us to optimize the thermal aspect of the building at a single site.

Solar Radiation

Compared to Versailles, Lucerne has more solar radiation. Despite this, Versailles has more sun hours, which results in nearly equal yields for photovoltaic and thermal solar systems.

Rain Water

There is a constant minimum of 50mm of rain in both places. With such normal, but constant water gains, it makes sense to utilize it to the fullest. Although in Switzerland water is rarely difficult to obtain, we want to show people how to use water consciously.

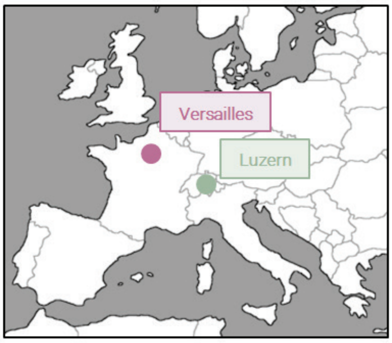
Earth Storage

In both places it is theoretically possible to build earth storage. With such technology, the energy gains in Lucerne are greater than in Versailles. As described in the your⁺ concept, we want to use this store to shift the heat from summer to winter and the other way round. But for the competition we will simulate this fact by using different types of storage.

Wind

There is not enough wind in either place to use it to generate power, especially if we focus on the local urban context. Therefore wind energy is not integrated into our concept.

Overall we can say that, aside from rain water, the climate in Versailles and Lucerne is very similar. We can therefore apply insight from the simulations and measurements from Versailles to Lucerne and the other way round. *See Img. 11.*



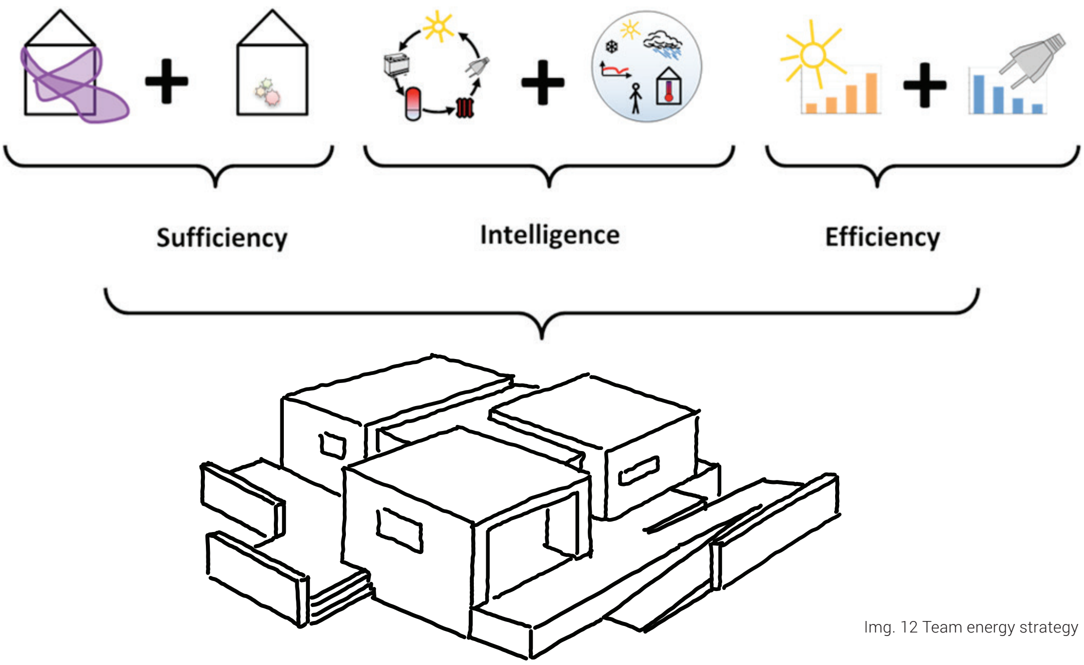
Img. 11 Location Lucerne and Versailles

c) Team Energy Strategy

Basic

The energy strategy of the your+ prototype focuses on self-sufficiency, intelligence and efficiency. Self-sufficiency refers to all the passive strategies that make it possible to use a minimum of technology. For efficient operation, all the passive and active strategies must also be managed in a holistic way. All these networks combine with the knowledge of future energy production and energy consumption to provide maximum insight. Equally, we achieve an efficient system by minimizing the energy consumption and optimizing the energy production.
See Img. 12.

The strategy of flexible use of the rooms (as written i the next section) reduces the used area and also the energy demand.

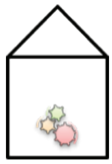


Img. 12 Team energy strategy

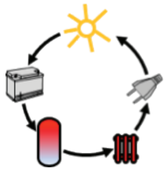
Maximizing passive strategies:
With our passive strategies we want to optimize the idle temperature of the building. The goal is to achieve as comfortable a temperature as possible without any active system, for example by optimizing the building envelope with thermal storage materials and intelligent sun protection.

Minimizing Technology:

A small and simple technology allows us to use little operation energy and also hardly embodied energy. That's how we want to install as little technology as possible but as much as is necessary.
To show the concept of "smart sharing" we adapted the technical system as it would work in the urban context. That's why the technology seems not to be minimised at first sight.



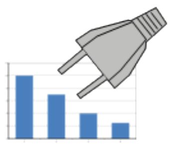
Networking the Building Technology:
In a networked system it is possible to use synergies between the different systems. For example a washing machine can run when the photovoltaic system produces enough energy and not all household appliances run at the same time to reduce the peak load.



Predictive Energy Management:
Weather forecasts and knowledge about the use of different systems help save energy in the building technology. On a sunny day, the weather forecast can tell us that the following day will be rainy. Therefore the energy management system can adjust the schedule to save more energy during the sunny hours in order to minimize use for the next day without sun.

Optimizing Energy Production:
The sun delivers a lot of energy every day. We want to maximize our utilization of it, i.e. we want to produce as much energy from the sun as possible, but only as much as makes sense in the context (embodied energy, energy grids, etc.).

Minimizing Energy Consumption:
By minimizing the energy consumption, it is possible to use more passive systems. This means optimising the building envelope and reducing operation without usage. But the users' behaviour is often the biggest energy consumer. To save energy we need to show them how much energy they really need and give them advices hot they can save it.



Strategy of flexible Use of the Rooms

Once a building is built, there is only one parameter (apart from user behaviour) with which the building can reduce the energy losses of a room – namely the temperature. The following formula presents energy transmission losses.

$$Q_T = (\theta_i - \theta_e) \cdot \Delta t \cdot \left(\sum_{k=1}^{k_{tot}} A_k \cdot U_K + \sum_{j=1}^{j_{tot}} l_j \cdot \psi_j + \sum_{i=1}^{i_{tot}} z_i \cdot \chi_i \right)$$

Q_T Transmission heat losses
θ_i Interior temperature
θ_e Exterior temperature
Δt Time
A_k Area of the k componente (wall,window,roof,etc.)
U_K Coefficient of the heat permeability of the k componente
l_j Length of the j longitudial thermal bridge (ex.roof or wall connection)
ψ_j longitudial coefficient of the heat permeability of j thermal bridge
z_i Number of i punctual thermal bridge(ex.pillar)
χ_i punktional coefficient of the heat permeability of the i thermal bridge

For this reason we developed a strategy to change the interior temperature by maintaining comfortable conditions. The idea is that we only need comfortab-le conditions when there are people in a room or when they plan to come in. Therefore we defined three conditions for the rooms.

Comfortable Condition

For people to feel cosy, we need a certain tempera-ture range. The temperatures are the following for the Swiss location and norm.

Living room and bedroom:	21°C winter
	28°C summer
Kitchen:	20°C winter
	26°C summer

Stand-by condition

When there is nobody in a room, the temperature doesn't need to be comfortable. The building then needs less energy because the temperature can assimilate closer to the exterior temperature, thereby reducing the energy losses.

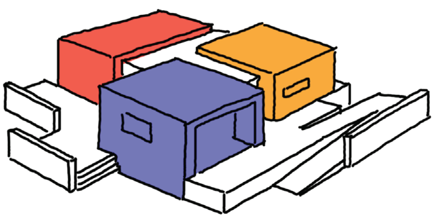
Building protection condition

During vacancies, holidays and nights there are no people in certain rooms for a longer time. In this time the temperature can go further away from the comfortable level because we don't have to be back at the right temperature quickly.
The temperature just needs to be on a level that protects the building from freezing, mould etc.

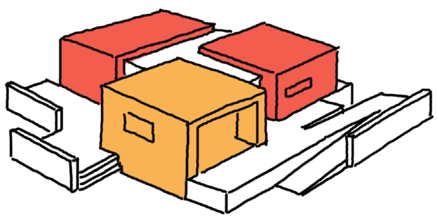
Example

During the night the users are in the private area where they sleep. That's why only this room has to be in a comfortable condition. The kitchen is in a stand-by condition because the users will go to the kitchen to drink their morning coffee soon. No one uses the sharing room and no one booked it for the early morning. That's why it is in building protection condition. *See Img. 13.*

At lunchtime someone is cooking and the other user is taking a short shower. That's why these two rooms are in comfortable conditions. For the afternoon someone has booked the sharing room. That's why it is already on standby. It will then quickly achieve the right condition when the user arrives. *See Img. 14.*



Img. 13 NIght



Img. 14 Lunchtime

In order to follow this strategy we need to have an intelligent building (as above). The building needs to know what the user usually does and which rooms he needs. So everyone knows when the room is taken and the system knows when the room needs which condition (yoga, office, concert, etc.).

Because of the rules of the Solar Decathlon Europe 2014, it is not possible to follow this strategy. During the competition we cannot use this strategy and will have to have a "comfortable condition" in all the rooms. But we built a HVAC system that is able to manage every room separately. Even single rooms can be cooled while others receive heating energy.

Building Management System

With the building management system it is possible to control the building automatically and efficient. Especially with the predictive energy management as explained in the next section. For example the management system closes the sun protection when there is too much energy on the facade and the openings in the space+ get open when the temperature outside is low enough to be able to activate free cooling in the night. Also the temperature and air quality in the rooms are controlled by the building management system.

But we don‘t want to exclude the user in its own building. So it is possible for the user to decide what should happen and how it should happen. Normally the behavior of the user is not very efficient. That‘s why we train its behavior with our prototype App. With this App the user can choose everything he wants. But the system will tell him whether that it is efficient or not. For example the user chooses to have a room temperature of 28 °C in my room during winter time. It is possible to generate this. But the system says that this is inefficient, why it is inefficient and what would be the best choice.

Predictive Energy Management

Model Predictive Control has become an almost standard control strategy in areas like Chemical Process Engineering. Several attempts have been made in the past to apply this strategy to HVAC systems in buildings. Different approaches have been pursued to build the mandatory dynamical model, to receive forecasts of the weather and users' needs. Predictive controllers perform better than classical PID controllers when the building posses¬ses important thermal masses. They can "anticipate" and play with these masses to improve the comfort while minimizing energy consumption.

In your+ a very simple model structure is used to describe the thermal behavior of each zone (my room, your room and our room). The model parameters of each zone are estimated automatically by exploiting measurements collected in the zones. Weathers forecasts are provided by MeteoSwiss on a daily basis with a very high temporal and spatial resolution. The reference temperatures can be programmed individually for each zone and can vary in the course of the day to account for a programmed (using the user interface) or a learned presence.

At night, once weather forecasts for the current day are available, ideal heating and cooling profiles are computed in advance. These computed profiles combine with expected temperature profiles in the zone for use as feed-forward commands and optimized reference temperature profiles for a classic feedback controller. This classic controller guarantees a reasonable degree of user comfort when weather forecasts are inaccurate or if the model fails to simulate the thermal behavior of the house.

Optimization is repeated each time updated forecasts (weather or presence) are available.
Such predictive controllers are currently being implemented and tested in different projects (hotel and individual house) at the Lucerne University of Applied Sciences and Arts, including the your+ prototype.

Influence of the Energy Analysis in the Project Design (Project design optimization)

Influence of the Climate Analysis

Heating and cooling system

The analysis of the weather data over a year shows that in Switzerland we have cold winter and hot summer days. Therefore our building must be able to use passive strategies or produce heating energy in the winter and cooling energy in the summer. The detailed passive strategies we want to use to reduce the active cooling and heating demands are described in the following.

Rain water

In Switzerland, especially in Lucerne, we have a lot of rain. Because we have no smog or other air pollution, the rain water has a high purity. That's why we want to use the rain water in our concept. Generally we have enough water in Switzerland because of all the mountains and lakes. That's why drinking water is very cheap and we use it for flushing toilets and washing cars. Saving drinking water is not a critical issue in Switzerland.

Regardless of this abundance of water, we want to reduce the drinking water consumption to a minimum. Therefore in the prototype we use rain water for irrigation, as well as prewashing in the dishwasher and the washing machine.

Orientation

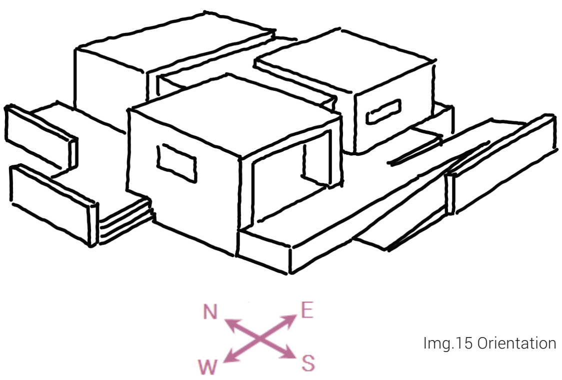
By analyzing the environment we checked the natural shading (tall trees and buildings in the neighbourhood, mountains, etc.). As a result, we don't have any relevant shading. That's why we can orientate the building in an ideal north-south direction. *See Img. 15.*

Influence of the Thermal Simulation

Goals and procedure

Simulations help us get to know the building better and optimize its components. Using the thermal simulations we supported decisions concerning the building envelope and the HVAC system. The simulations accompanied the project design process and helped with special decisions. The following sections present how we supported the design process with the simulations and show examples of such investigations.

To optimize the building and use as many passive strategies as possible, we started to simulate the building without any active energy system. We optimized the idle time. That means the building should stay in comfortable conditions as long as possible after switching off all the active systems. In this way we can investigate the thermal transmission and the thermal mass of the building envelope. The results helped us to define the first design and values of the building envelope. In another more detailed investigation we looked at the windows. There is always a conflict between the thermal gains, the thermal losses and the daylight transmission. By simulating the different options we found the ideal window values for our building.



Img.15 Orientation

After fixing the envelope, we started to simulate the building with some active systems like ventilation and heating or cooling appliances to find predicted energy loads. In this phase we also started to look at the competition conditions because they are very different to the local comfort conditions in Switzerland. So we simulated monthly and yearly demands for the sites of Lucerne and Versailles and also for both competition and normal conditions.

Furthermore we simulated the behaviour of the building in different situations. For example we analyzed the situation when there are a lot of people in the prototype during the public tours. Which is the best size for the groups and what do we do with the building during this time? We also analyzed the great size of the project in the local context compared to the prototype for Versailles. Another investigation studied the thermal mass of the building during the competition in Versailles. We will present this study as an example in the following section:

Example simulation: Phase change materials

Question

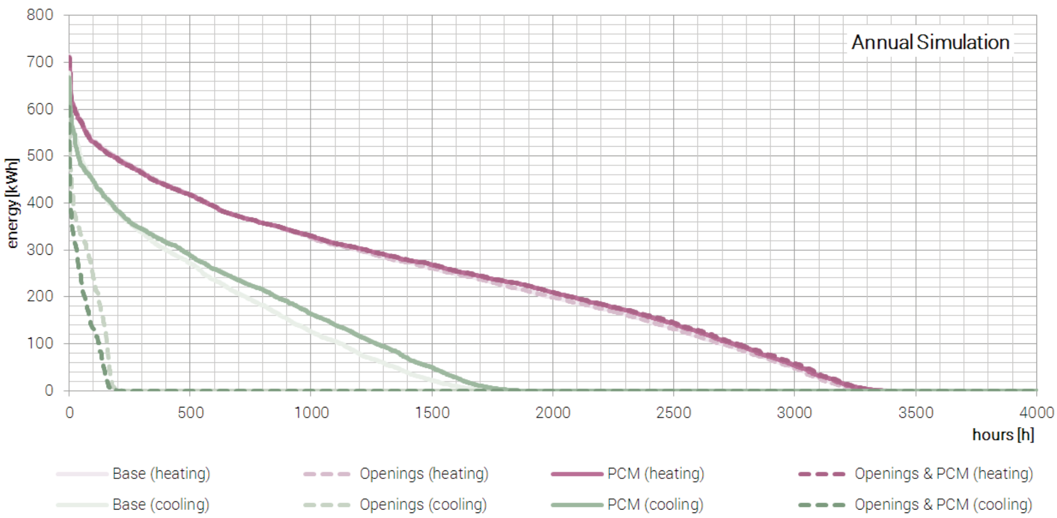
A transportable building, like our prototype, which we have to bring to Versailles and back to Lucerne, must be light. And light buildings normally have low thermal masses. This lack of thermal mass lets the temperature inside the prototype fluctuate with the outside temperature. That makes it difficult to control the inside climate of the building. As the thermal mass increases, the fluctuations get smaller and the inside and outside temperatures get phase shifted. We want to use this effect as a passive strategy. So we want to use phase change materials (PCMs) instead of concrete. They are smaller, easier to transport and have the same effect.
But for the competition in Versailles we need to be in a tight temperature range (+/- 1K) during day and night. The question is now: Is it still possible for the PCMs to achieve the desired effect using this small temperature range?

Procedure

To find out which effect the thermal mass has during the competition in Versailles, we simulated the building with and without PCMs. The set values for the yearly simulation were 20-26°C and we simulated a whole year. The competition simulation is calculated with the variable set values according to the rules. We also simulated the effect of opening windows on the heating or cooling power because PCMs normally need such opening to work.The phase change material is integrated in all possible areas (walls, roof and floor) to achieve the maximum possible effect.

Results and analysis

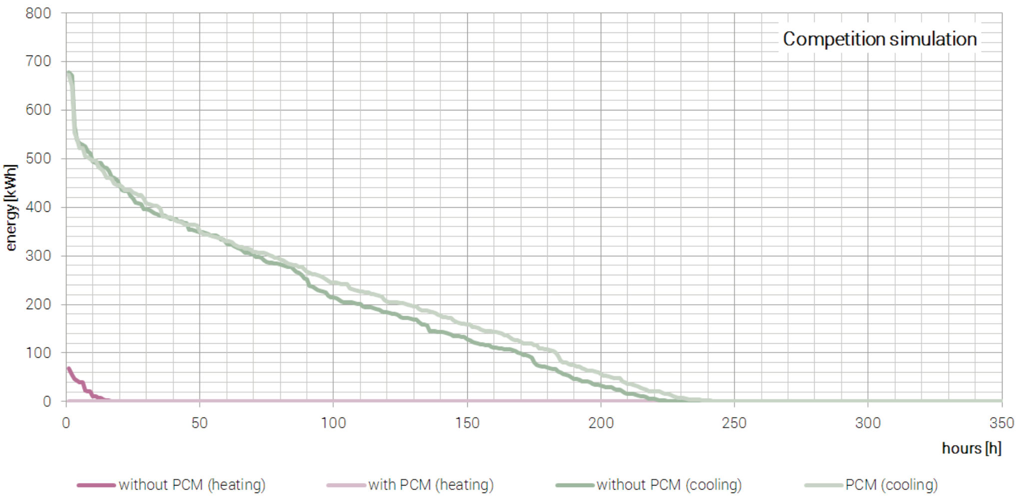
With this simulation we could prove that the influence of opening a window (1.04, 1.06) is much greater than the use of some additional thermal mass. If the windows are closed (1.03, 1.05) the influence of the PCMs is not measureable. On the contrary: We need more energy than without PCMs. That's why PCMs are not able to regenerate using the outside temperature. So the thermal mass absorbs the cooling energy instead of cooling down the room directly. If the windows get opened, the thermal mass has a small effect. There is nearly no influence in the heating case, because the PCMs don't work in this temperature range.
Img. 16 on the left side shows the difference between the variations. This cumulative frequency diagram shows how many hours in a year we will need a special amount of power. The area below the curve shows the heating or cooling energy for a year.



Img.16 PCM annual simulation

To find out if we should use PCMs during the competition we defined the simulation more precisely. The effect is shown *in Img 17.*

Finding for the competition
Due to the tighter temperature goals during the competition the advantage of PCMs with open windows gets lost. The PCMs cannot work with these temperature ranges. In the competition we need to use as little energy as possible and to be as close to the set temperature as possible. That's why we decided not to use PCMs in our conditioned rooms.
In our unconditioned space+ where we show our passive strategies we have a wide temperature range. This makes it possible for the phase change materials to liquefy and harden again, thereby storing the thermal energy with it.



Img. 17 PCM competition simulation

Influence of the Energy Analysis in the HVAC Systems

(Conditioning system optimization)
The strategy of flexibly using the rooms leads to a flexible HVAC system. Therefore we planned combined heating and cooling panels that can be controlled separately in every room. We can generate the ideal climate in every room, and in the worst case, it is possible to cool one room and heat another. There will be different levels when there are more or fewer people. To reduce the losses in the system with this irregular use in this small building we decided to use decentralized air-conditioning units.

To control all these HVAC systems and react to the environmental changes we need intelligent and predictive energy management. This system helps us to see how the gains and losses during the future days will be and we can decide which strategy we need. With this system it is possible to generate long-term instead of short-term solutions.

A simple technical system should be targeted in view of self-sufficiency and usability. However, we are convinced that a single one-house HVAC system is no longer sustainable and efficient. That's why we planned an area system where energy can be shared. One building, or one part of a building, needs more cooling energy (e.g. an office, industry), while another needs more heating energy (e.g. living, hotel). By producing cooling energy we get heating energy as waste and the other way round. We want to use this waste to save energy.

To maximize the efficiency of the building all appliances should need as little energy as possible. That's why we only install the best household appliances with at least energy label A+.

Influence of the Thermal Simulation

The thermal prototype simulation shows the behavior of the building in different situations. For example the time and amount of heating, cooling energy and power can be established. These analyses let us indicate the following aspects.

Due to the high cooling peaks after the public tours, we need a fast and efficient cooling system in the rooms. We don't want to use air for cooling, because the heat capacity of air is significantly smaller than that of water. To transport the same energy in air you need about 200 times of the volume compared to water. That's why we decided to heat and cool the rooms with water instead of air. Also the energy transportation is easier because of the smaller volume of the pipes. A heating system in the floor is comfortable. Regrettably, it is also inert and we need a fast system, so we decided to install a radiant heating and cooling system in the ceilings in the rooms. These metal panels allow an efficient heat-cooling emission.

Due to the energy demands of the building we need to install an active heating and cooling device. The passive systems cannot provide all the necessary energy. Especially in the start phase of the building and in extreme situations the passive system needs support. We will provide such support with a reversible heat pump that uses the outside air as a source.

The competition simulation demonstrates how important it is to control the public tours. All the guests in the prototype bring warmth inside which we must cool down after the tours to reach comfortable conditions. And according to the SDE organization, up to 21,000 visitors are expected every day. We are using thermal simulations to optimize the strategies for the public tours and the whole competition. These strategies should help us react to the specific circumstances during the competition.

Section II – Projected Performance of the final Housing Unit Design

Introduction

The whole design process was supported by simulations. We first had the idea of an energy-efficient building the way we would like to build it in Switzerland, in view of the local context and the local comfort conditions. In the process we had to adapt our idea step by step to the rules and competition conditions. These decisions to reach the prototype system were supported by simulations. That's why we submitted Section II and Section III. Here in Section II we show you how we designed the ideal prototype for Versailles. In Section III we list the points that we would change for the project building in Switzerland.

Housing Units and System Description

Project Description

Built area: 137.5 m^2
Volume: 443.9 m^3

your room: public room for living, working
our room: semi-private room, kitchen
my room: private room with bath and bedroom.

See. Img 18.

As described above, the energy concept consists of self-sufficiency, intelligence and efficiency. In this chapter we want to present some of the other components of the your⁺ concept.

House Envelope

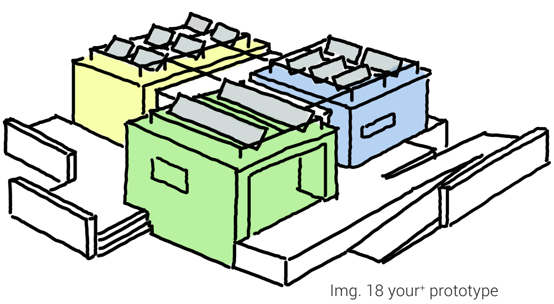
Minimizing energy consumption means we need to build an ideal building envelope. This envelope must reduce the heat losses in winter and protect from heat gains in summer

To show how the quality of our prototype is compared to the Swiss context, we applied for the Minergie-A-ECO label. Minergie is a renowned Swiss energy label for buildings.
The label requests a good building envelope in winter and also summer time and a technology which allows producing more energy over the year then it needs. Moreover the amount of embodied energy is limited. *Further information: PM#6 chapter 6* and *Appendix 16 Zertifikat.*

Opaque components

The opaque components (walls, roofs and floors) need to have a low energy transmission. This is also meant for the thermal bridges.
Because the building will be built of wood and has to be light for transportation, we don't have thermal mass (bricks, concrete, etc.) in the construction. No thermal mass means that the temperature inside the prototype fluctuates with the outside temperature. That makes it difficult to control the inside climate of the building.

With thermal mass, the fluctuations get smaller and the inside and outside temperature phase shift. We



Img. 18 your⁺ prototype

want to use this effect as a passive strategy. We need to install some thermal mass in our building. It is neither efficient nor sustainable to build a concrete house for this competition. That's why we use phase change materials (PCM) as thermal mass. Due to the competition conditions we will only install it in the space⁺.

Transparent components

There is always conflict concerning the correct window selection. In summer no energy should pass through, to prevent the room from heating up. During the winter, as much energy should pass into the room while no energy should escape through the window.
With intelligent shading, we will install windows with a high energy transmission. We can close the shading in summer, resulting in hardly any energy coming in, and in winter we can open the shading, resulting in large heat gains.

Air tightness

Also an important part of the houses envelope is the air tightness. A tight envelope reduces a lot of problems. For example it reduces the sound and smells from outside and prevent energy losses and uncontrolled air exchange. Moreover it reduces the risk of damage the construction by condensate.
The your⁺ prototype reaches an air tightness of n50< 0.6h-1. The certificate of the blowerdoor test, which we needed for the Minergie-A-ECO, *please see Appendix 16 Minergie certicicate.*

Passive Systems for Energy Efficiency

As a passive building technology system we use the power of the sun and the energy of the air to heat and cool our building. Intelligent management makes this possible. With a highly efficient heat recovery system in the ventilation system, it is also possible to reuse the energy in the exhaust air.

Active System for Energy Efficiency

We have a combined heat pump and cooling machine in an active system. It generates the used heating or cooling energy if the passive systems don't produce enough. The energy comes over a heating/cooling ceiling into the different rooms. This ceiling is not only active, but also has some PCMs integrated that help us reach comfortable conditions without active systems.

User Guide

To minimize the energy consumption, we want to influence the building users. We want to influence them by showing how much energy is available and how much they require for various tasks. To accomplish this, we use the intelligence of the building. With weather forecasts and building measurements, the automation system can calculate what strategy is best. Current energy consumption or production should be shown to sensitize the user to energy efficiency.

space⁺

The space⁺ is the space between the rooms and the outside. It's the place that connects the different rooms, families, leisure and business places. It also connects the rooms energetically. space⁺ is like a buffer zone between the outside and inside. Especially in winter, this room with its glass roof can receive large solar gains. This makes the room another thermal shield between the inside and outside. It is then also a semi-comfortable room in which you can sit with a warm pullover and enjoy the winter sun. In summer, the space⁺ is like a covered terrace. The open doors and windows, together with an intelligent solar protection, make the climate comfortable.
For the competition we can use this room to show our passive strategies. Due to the narrow temperature band, it's hardly possible to use our passive strategies in the conditioned rooms. The passive strategies need a wider comfort band to make full use of their potential.

Passive Design Strategies

Exchanging energy

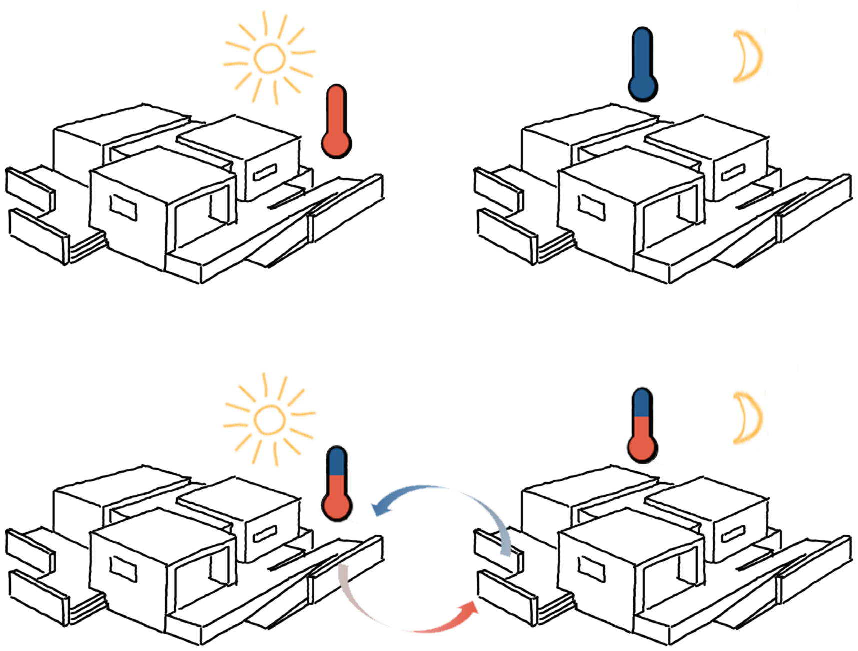
The concept of exchanging and sharing also suits the passive and hybrid energy strategies: During a warm summer day we have high temperatures outside and would like to have a lower temperature inside. During the night it's the other way round. If we can transport this cooling energy from the night to the day and the warmth from the day to the night, we can generate more comfortable room conditions without using more active energy. *See Img. 19.*

Saving energy by sharing energy

We want to reach this exchange of energy by developing passive and hybrid strategies. For the passive strategies we use phase change materials as latent heat storage. They can store the warmth of the day and regenerate the storage during the night with cool outside air (night cooling). In the prototype we can only use this strategy in the space+ as you can see in the following chapter.

During the competition we need a hybrid system to exchange the energy. We take the storage out of the rooms and put it into a tank in the technical room. With the re-cooling device we cool water during the night and put it into the storage. During the night we need this energy to cool the rooms using the radiation ceiling.

Also in the project in Lucerne, when we connect several buildings we will use the concept of exchanging energy. The different uses in the buildings will often need heating and cooling energy at the same time. By producing cooling energy we get warmth as a waste and the other way round. We can use these wastes by exchanging the energy and turn them into gains. We can also store the energy in the project in Lucerne. The ground is a huge energy store and we can use it to store the warmth from the summer and vice versa in the winter. More about this concept will be presented in the following.

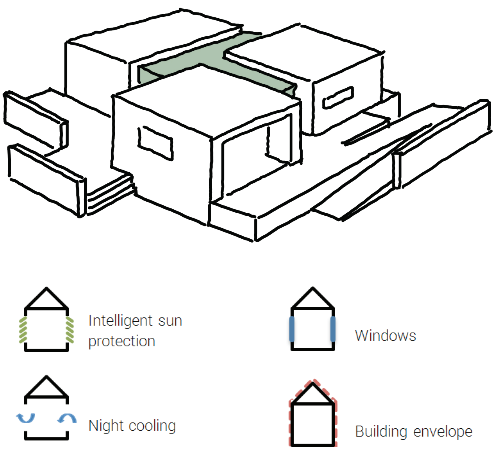


Img. 19 Saving energy by sharing energy

Passive space – space⁺

In view of the comfortable competition condition, it is difficult to show passive strategies and achieve those temperatures at the same time. For example maintaining the temperature in the rooms plus minus 1 degree Celsius is not possible according to our simulation. We planned our prototype for the competition in Versailles. Nevertheless we want to show the passive strategies that we plan to use in the greater context here in Switzerland. Therefore we have our space⁺. This room need not reach the competition temperature all day long. So we can show and use passive strategies the way we want to use them in the larger building in Switzerland.

The passive strategies we wish to present you can *see in Img. 20.* Intelligent sun protection helps us to protect the room from too much energy gain in summer. And at the same time enough daylight must enter the room so that no artificially powered light is required. Furthermore, we planned openings that can be opened during the night to cool the room down and save this energy in PCM-panels to generate a comfortable climate during the warm summer day. Tall glass surfaces enable a thermal energy gain in the wintertime. To minimize the energy losses, the building envelope including windows must be well insulated. These points compete with each other. If a window lets a lot of energy through and heats the room, the room will also be heated in summer time when we don't want this energy in the room. Therefore we did thermal simulations to find the best way to solve these conflicts of interest.



Img. 20 Passive strategies

House Appliances and HVAC Simulations (Annual Simulation)

Thermal Simulation Program

For the thermal building simulations we use the IDA Indoor Climate and Energy (IDA ICE) 4.2, 4.5 and 4.6 programs. IDA ICE is an innovative and trusted annual, detailed, and dynamic multi-zone simulation application to study the thermal indoor climate as well as the energy consumption of entire buildings. The physical models of IDA ICE reflect the latest research and best models available, and the computed results compare well with measured data. *See Img. 21.*

Assumptions and External Conditions for the Thermal Simulation

Annual simulation

We carried out annual simulation using typical Swiss set points for the internal loads according to the norms of the Swiss Society of Engineers and Architects (SIA). We focused on the norm SIA 2024 and SIA 382-1 with set points and schedules below for the different rooms. We adapted the set points for the air quality and temperature to the competition conditions. *See Img. 22 - 24.*

Competition simulation

For the competition simulation we tried to simulate the competition as closely as possible with the following assumptions.

Climate: The climate file is Paris Orly and we looked at the days from June 30th to July 11th.

Set temperature: The set temperature conforms to the formula in accordance with competition rule 19.5

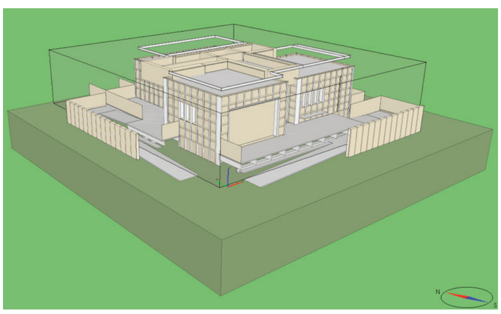
Daily routine: The utilization of the rooms is planned according to the event calendar V1.0.

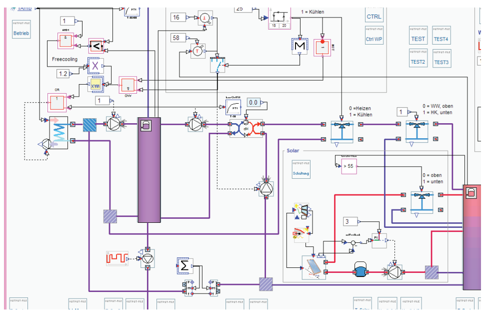
Public tours: The public tours according to the event calendar are simulated with 17 persons who are permanently in the prototype.

Simulations are based on assumptions and simplification. The prototype is an ideal object to verify our thermal simulations. To verify our simulation we used the little time after finishing construction till the deconstruction. For the thermal simulation we did a AUFHEIZVERSUCH. That means we did an ideal heating into the room and analysed the temperature to see how the room reacts. The same situation we simulated in the program and compared the results. The built construction is very similar to the simulated situation. With some little adaption we can built a precise picture of the building with the thermal simulation.

Electrical Simulation Program

PVsyst is designed to estimate energy production for a detailed study of the PV-installation. It includes a detailed contextual help menu that explains the procedures and models used. PVsyst is able to import weather data from many different sources, as well as personal data. This tool helped us to find the right position and type to produce the most energy from the sun.

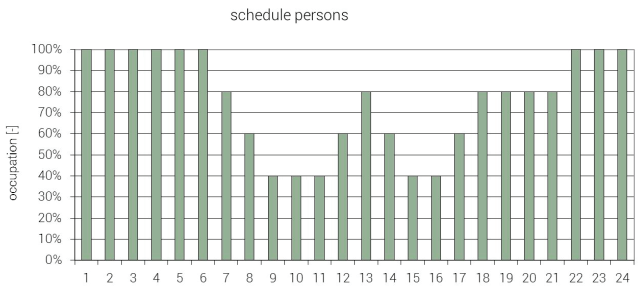


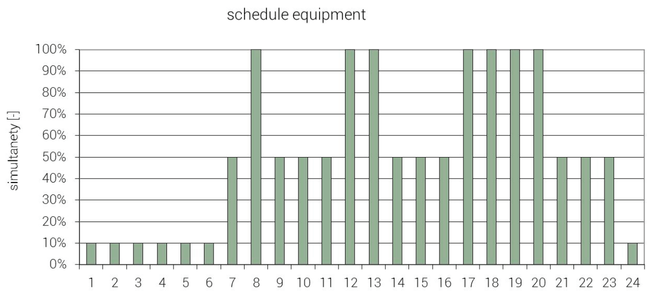


Img. 21 Thermal simulation model with IDA ICE 4.5

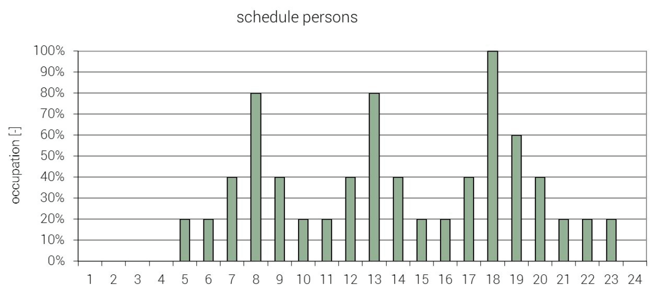
	your room	our room	my room
use	living room /bedroom	kitchen	Living /sleeping room
persons	50 m^2/pers 1.2 met 1.0 clo	25 m^2/pers 1.2 met 1.0 clo	50 m^2/pers 1.2 met 1.0 clo
equipment	2 W/m^2	40 W/m^2	2 W/m^2
light	200 lx 9.4 W/m^2	200 lx 9.4 W/m^2	200 lx 9.4 W/m^2
temperature	*21-28 °C (SIA)* 20-26 °C (SDE)	*20-26 °C (SIA)* 20-26 °C (SDE)	*21-28 °C (SIA)* 20-26 °C (SDE)
CO_2	*950-1350 ppm (SIA)* 750-800 ppm (SDE)	*950-1350 ppm (SIA)* 750-800 ppm (SDE)	*950-1350 ppm (SIA)* 750-800 ppm (SDE)
humidity	*30-60% r.F. (SIA)* 44-55% r.F. (SDE)	44-55% r.F. (SDE)	*30-60% r.F. (SIA)* 44-55% r.F. (SDE)

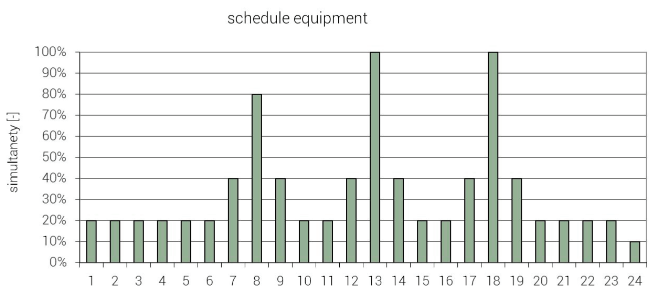
Img. 22 Table of assumptions for thermal simulation





Img. 23 Schedule – my room and your room





Img. 24 Schedule – our room

Results and Discussion

Annual Thermal Energy Requirements

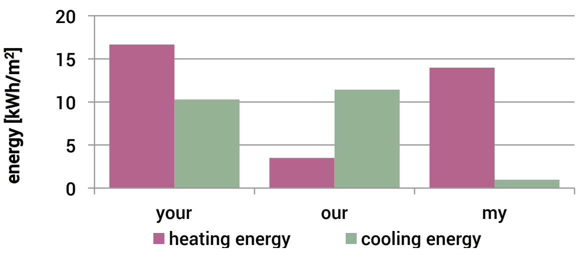
To analyze the annual energy requirements the prototype was simulated for the site of Versailles. As written above we used the set values adapted from the competition conditions to an annual simulation (marked with SDE). The simulated annual energy requirements you can *see in Img. 25*.
The results are in absolute energy and related to the total floor area ("Energiebezugsfläche", EBF). This value is used in Switzerland to compare buildings. The total floor area is measured in gross area. We didn't calculate the space+ to the total floor area although it is possible according to Swiss norms because it is a connective area.

We split up the energy demand into different room types and also into heating and cooling demand. This shows that the your room needs the most energy compared to the other rooms. That's because this room has tall openings on three sides. Especially the tall window to the south side is critical. But to show the idea of our open and shareable room concept we decided to install this window. The cooling energy in the my room is so small respecti¬-vely the heating demand so high because the my room is very private and the openings are orientated towards the north. The our room has high cooling loads because of all the equipment in the kitchen. With this internal gains it does only need little heating energy in wintertime.

We also calculated the prototype as we built it for Versailles with the requirements of the Swiss norms (SIA 380/1) and fulfil them. This is necessary to get the permission to build a building in Switzerland. We also fulfil the requirements of the MINERGIE-A-ECO standard (as written above) that demands a maximum of 90% of the maximal permissible energy requirements. The prototype needs only 69%.

demands a maximum of 90% of the maximal permissible energy requirements. The prototype needs only 69%.

annual simulation Prototype Versailles				index (per EBF)	
your	max. heating power	[W/a]	575,1	[W/(m²*a)]	20,0
	max. cooling power	[W/a]	746,9	[W/(m²*a)]	26,0
	heating energy	[kWh/a]	478,3	[kWh/(m²*a)]	16,7
	cooling energy	[kWh/a]	295,2	[kWh/(m²*a)]	10,3
our	max. heating power	[W/a]	277,4	[W/(m²*a)]	10,8
	max. cooling power	[W/a]	449,9	[W/(m²*a)]	17,6
	heating energy	[kWh/a]	89,8	[kWh/(m²*a)]	3,5
	cooling energy	[kWh/a]	292,9	[kWh/(m²*a)]	11,4
my	max. heating power	[W/a]	497,7	[W/(m²*a)]	12,6
	max. cooling power	[W/a]	304,9	[W/(m²*a)]	7,7
	heating energy	[kWh/a]	550,6	[kWh/(m²*a)]	14,0
	cooling energy	[kWh/a]	38,0	[kWh/(m²*a)]	1,0
total	max. heating power	[W/a]	1.350,2	[W/(m²*a)]	14,4
	max. cooling power	[W/a]	1.501,8	[W/(m²*a)]	16,0
	heating energy	[kWh/a]	1.118,7	[kWh/(m²*a)]	11,9
	cooling energy	[kWh/a]	626,1	[kWh/(m²*a)]	6,7

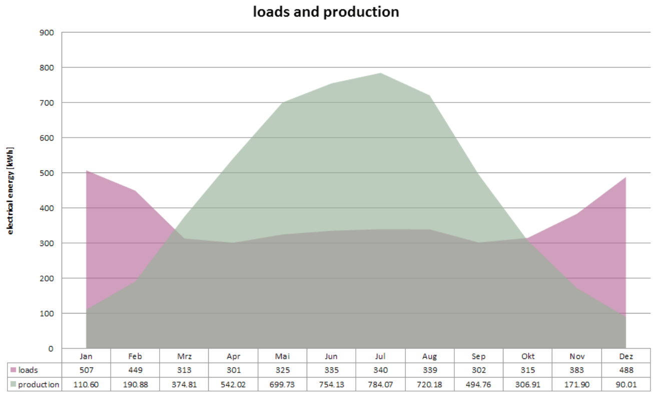


Img. 25 Annual simulation, Versailles

Annual Electrical Energy Requirements

Over a full year, the building produces a surplus of 1.546kWh/a, representing 140 % of its requirements. Between mid-February and mid-October, the building produces more energy than it consumes. It is clear that energy demands increase in the winter, resulting from the heating and longer lighting hours. The small peak in the summer is caused by cooling.
See Img. 26.

Img. 27 shows a list of the used household appliances and their electrical characteristics. The appliances used comply with the latest energy standards and are the most efficient in its class that are currently available on the market. If possible, we want to directly connect the appliances (washing machine and dishwasher) with a hot water supply heated by the solar collectors. To save more energy, we turn off as many devices as possible, if nobody is in the room. In addition, we want the user to be aware, by giving him information over the integrated APP about the consumption and the optimal time for performing tasks such as clothes washing.
A complete list of the electrical loads, their estimated consumption and the estimated electrical energy production, as well as more details on the strategy of the energy management can be found in *PM#6 chapter 3.6.*



Img. 26 Loads and production
Img. 27 Appliances

loads	**type**	**nominal power** [W]	**energy lable**	**determination of the requirements**	**energy per cycle** [kWh/cycle]	**energy per year** [kWh/a]
induction hob 1 and 2	V-Zug GK26TIMS	7'400.00	-	annual requirement for 2 persons according to SIA 380.4	-	280.00
oven	V-Zug Combair SL	3'400.00	A	standard usage according to SIA 380.4 (3 cycles per week)	1.00	156.43
washing machine	V-Zug Adora SLQ	2'300.00	A+++	standard program 40° (4 cycles per week)	0.80	166.86
dishwasher	V-Zug Adora SL	2'200.00	A+++	program sprint' (3 cycles per week)	0.80	125.14
tumble drier	V-Zug Adora TSL WP	1'300.00	A+++	program towelling (2 cycles per week)	1.10	114.71
refrigerator with freezer	V-Zug Prestige P eco	115.00	A+++	annual requirement according to V-Zug	-	154.00

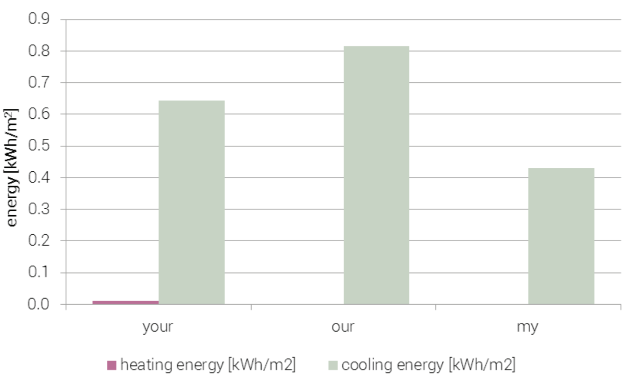
Competition thermal Energy Requirements

The competition energy requirement is simulated in Versailles with the competition conditions. The simu¬lation lasts ten days during the same dates as the real competition (June 30 to July 11). The ten days correspond to normal competition days with public tours. *See Img. 28.*

In the our room we need the most cooling energy when there are no public tours. That is because the kitchen requires the highest energy loads from all the household appliances. The your room is taller, with more people, especially during the public tours. It is orientated with tall windows to the south side. The my room is in the north of the building an that's why it has the smallest cooling energy demand.
To show the influence of the public tours on our building we also simulated different public tours situations. The following three variants show example situations. The first one, the basic simulation, is without any public tour and windows openings. The second one has public tours during the normal competition times with a total of 17 persons in the house. The third is an optimized version of the second. By opening the windows at the right moment we can reduce the energy demand in the prototype. *See Img. 29.*

With this table *(Img. 29)* the influence of the public tour on the energy demand is visible. The third version has the lowest energy demand, but at the same time a high cooling power compared to the basic version. This is due to the peaks we have after the public tours. Generally we have half an hour after the public tours to reach the set tempera¬ture again. That's why we need a fast system to reach the set temperature in the predetermined time.
To reduce the energy demand during the public visits we tried to find the best management of the doors and flow of the people.

			Public tour optimazed	index (per total floor area)	
your	max. heating power	[W]	-	[W/m^2]	-
	max. cooling power	[W]	1.015,1	[W/m^2]	35,4
	heating energy	[kWh]	-	[kWh/m^2]	-
	cooling energy	[kWh]	22,6	[kWh/m^2]	0,8
our	max. heating power	[W]	-	[W/m^2]	-
	max. cooling power	[W]	1.000,0	[W/m^2]	39,1
	heating energy	[kWh]	-	[kWh/m^2]	-
	cooling energy	[kWh]	17,5	[kWh/m^2]	0,7
my	max. heating power	[W]	50,3	[W/m^2]	1,3
	max. cooling power	[W]	550,3	[W/m^2]	14,0
	heating energy	[kWh]	0,2	[kWh/m^2]	0,0
	cooling energy	[kWh]	8,9	[kWh/m^2]	0,2
total	max. heating power	[W]	50,3	[W/m^2]	1,3
	max. cooling power	[W]	2.565,4	[W/m^2]	88,4
	heating energy	[kWh]	0,2	[kWh/m^2]	0,0
	cooling energy	[kWh]	49,0	[kWh/m^2]	1,7



Img. 28 Competition simulations

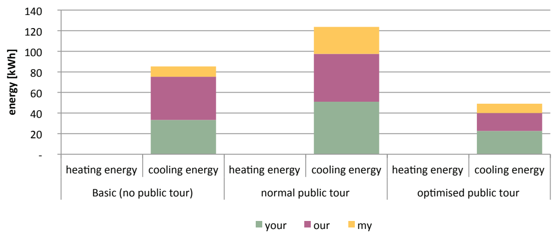
Competition electrical Energy Requirements

The following image presents the daily energy yield during the ten-day competition. The simulation program used weather data from 1990. The simulation calculated a poor energy yield at the start of the competition. In that case, the building would require energy from the public grid. The likelihood that less than 13.2kWh/d will be produced on the first day next summer is 15%. The red area shows the average consumption of 13.2kWh/d. The overall yield above the red area is fed into the grid. The expected surplus is between 6 and 8kWh/d. It is therefore higher than the positive energy balance required by the competition (5.6kWh/d), which would achieve maximum points. See Img. 30.

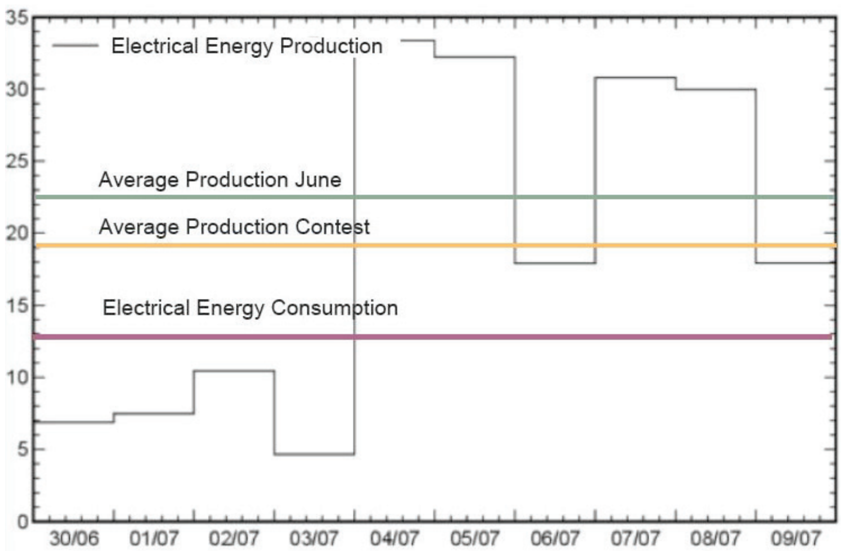
Conclusion

The results of the simulations show that we planned a low energy building. The your+ building needs much less thermal energy compared to a normal new building in Switzerland. With the electrical energy production the prototype needs less energy than it produces over the course of a year. That makes it a plus energy building.
After finishing our building in Lucerne we plan a test period in which we can analyze the real electrical energy consumption and production of our building. Also the thermal simulation will be evaluated with the building to achieve more precise results.

			Basic (no public tour)	normal public tour	optimised public tour
your	max. heating power	[W]	0,3	-	-
	max. cooling power	[W]	650,8	1.155,4	1.015,1
	heating energy	[kWh]	0,0	-	-
	cooling energy	[kWh]	33,3	50,9	22,6
our	max. heating power	[W]	-	-	-
	max. cooling power	[W]	509,2	1.132,9	1.000,0
	heating energy	[kWh]	-	-	-
	cooling energy	[kWh]	41,9	46,6	17,5
my	max. heating power	[W]	-	-	50,3
	max. cooling power	[W]	307,1	1.034,5	550,3
	heating energy	[kWh]	-	-	0,2
	cooling energy	[kWh]	10,1	26,1	8,9
total	max. heating power	[W]	0,3	-	50,3
	max. cooling power	[W]	1.467,1	3.322,7	2.565,4
	heating energy	[kWh]	0,0	-	0,2
	cooling energy	[kWh]	85,4	123,7	49,0



Img. 29 Competition simulations - public tours



Img. 30 Competition electrical energy requirements

Section III – Adaptations by the Team in the House for the Prototype in Versailles

Introduction

During the entire design process we supported our decisions with simulations. We first had the idea of an energy-efficient building as we would like to build it in Switzerland, with the local context and the local comfort conditions. In the process of the project we had to adapt our idea step by step to the rules and competition conditions. And all these decisions to reach the prototype system were supported by these simulations. That's why we present Section II and Section III. In Section II we show you how we designed the ideal prototype for Versailles. And here in Section III we explain the points that would be changed for the project building in Switzerland.

House Adaptation

The energy concept for the project in Switzerland is different from the prototype for Versailles. The two main reasons for this are:

1. The project in Switzerland is not a single-family house. Due to the high use of living area per person in Switzerland, the meagre resources and other reasons relating to the future community, we plan a whole district in a "block". In this district space, equipment and energy can be shared. Sharing reduces energy needs per unit and also technical equipment requirements.

2. The competition has high demands on the houses. These are comprehensible for the competition but extreme for normal use. By looking at this normal situation we find more possibilities for using our passive strategies.

For these two reasons we would change these aspects of the building for our urban buildings in Switzerland.

Night Cooling and solar Gains

We want to use the passive strategies we have in the space+ in the prototype in all rooms of the project building. This means mainly the night cooling in the summer and solar gains in winter.

Passive Ventilation

Due to the size of the project building, it is possible to use effective passive ventilation. With this system we can at least ventilate the space+. The space+ is a partial atrium. A suitable ventilation system in the rooms as well as on the facade can generate an efficient passive ventilation system.

Phase Change Materials

We need phase change materials in all the rooms to support the passive strategies of night cooling and solar gains. With wider temperature set points it is possible to use the advantage of phase change materials.

Cooling System

In a normal living unit, there is no need for an active cooling system. With passive strategies and hybrid systems we can generate comfortable conditions.

Radiation Ceiling

Due to the competition conditions we need these highly efficient ceilings in the rooms. For normal use we don't need so much energy in the rooms. That's why a normal integrated heating and cooling system, for example in-floor heating, is sufficient. Moreover for residential use, floor heating is more comfortable than radiant ceiling heating.

Grid Adaptation

The on-site building should be connected to the electricity grid as it is during the competition. We will also connect it to the thermal and sewage grid, so that there is no need to store waste water. Energy can also be exchanged through the thermal grid.

Exchange Thermal Energy

By adapting to include a thermal grid we can exchange energy in the district. It is also possible to exchange the energy in the same building by mixing its uses.

Thermal Energy Storage

In the project concept we not only share energy between day and night, but also between summer and winter. Therefore we store the energy from the summer with geothermal probes in the earth and can use it in winter as source for the heating system.

Photovoltaics

The prototype has normal photovoltaic cells on the rooftop. The competition conditions demand that we try to get the most electrical energy out of the limited number of cells. Therefore we constructed the system with the following photovoltaic cells. In a dense city we have other conditions. The space is limited. That's why we will also install hybrid collectors to produce hot water and electricity. In the city there is also a demand for hot water on a low temperature level that is not provided for in the prototype.

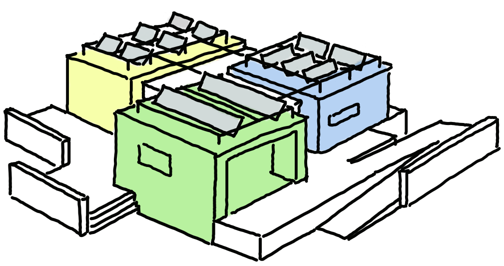
House, Appliances and HVAC Simulations

Our prototype isn't a specific part of a big building. The idea of the three room types will be the same in the local project building, but the order and amount is different. That's why it isn't possible to simulate the whole project in the way we would build it in Lucerne. But to show the energy demand of it anyway we adapted the prototype as if it were part of the building. *See Img. 31+ 32.*

For the project building we change the outside south and west walls and floors to inside walls and floors. This adapted prototype for Lucerne, now called the project, is simulated with the Swiss set values as described above (marked with SIA). *See Img. 33.* But only this aspect is changed. All the components written above in the house adaptation chapter remained unchanged. So the differences between the variations remain clear. *Img. 34 presents the results of this simulation for this building.*

As expected the heating energy is much lower than in the prototype in Versailles. Because some walls are now connected to another room instead of the outside air, the energy loss is smaller. At the same time the cooling energy demand rises because the energy of the internal gains can't go away and it's not possible to simulate the exchange with the atrium. Our prototype doesn't have a lot of mass due to the competition, but for the project in Lucerne it is planned to install phase change materials or other materials to generate mass. But for these simulations we didn't add thermal mass or any other of the points above, to ensure that the buildings can be compared more easily. Unfortunately it wasn't possible to simulate the passive cooling through windows to the space+. This would reduce the cooling energy demand in the rooms, which now don't have openings to the outside (our and your room).

We didn't only carry out the simulation for the

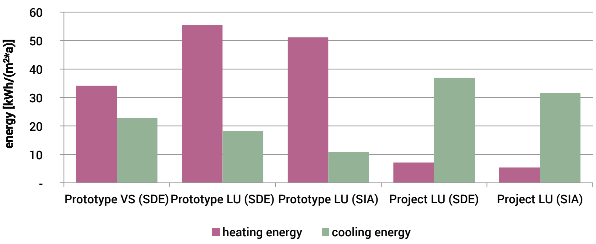


Img. 31 Prototype

Img. 32 Project

prototype in Versailles and the project in Lucerne. We wanted to know which influence the different comfort conditions from the SDE and the SIA has on the energy demand and the sites. Compared to these different sites and set values, we get *Img. 33.* VS means the site of Versailles and LU the site of Lucerne. The prototype is the building we built for the competition in Versailles and the project is the prototype adapted to the building concept we want to build in Lucerne. SIA signifies the Swiss norms and SDE the competition conditions according to which we set values and the internal load course.

Our vision of "smart sharing" does have an important influence on energy resources. By sharing the rooms every person needs less space and with that less energy. We calculated this situation exemplary with the floor plan *see Img. 32* compared to the single family situation in the prototype. *See Img. 34.* With our project we can reduce the energy demand per person to a quarter of the usual living situation.



Img. 33 Prototype and project simulation

			Prototype VS (SDE)	Prototype LU (SDE)	Prototype LU (SIA)	Project LU (SDE)	Project LU (SIA)
your	max. heating power	[W/(m²*a)]	20,0	24,2	23,3	0,0	0,0
	max. cooling power	[W/(m²*a)]	26,0	27,0	22,7	9,9	8,8
	heating energy	[kWh/(m²*a)]	16,7	27,8	26,1	0,0	0,0
	cooling energy	[kWh/(m²*a)]	10,3	7,4	4,4	13,2	11,3
our	max. heating power	[W/(m²*a)]	10,8	12,9	12,1	0,0	0,0
	max. cooling power	[W/(m²*a)]	17,6	19,3	15,6	17,8	15,9
	heating energy	[kWh/(m²*a)]	3,5	7,1	6,3	0,0	0,0
	cooling energy	[kWh/(m²*a)]	11,4	9,7	6,2	23,1	20,2
my	max. heating power	[W/(m²*a)]	12,6	15,3	14,4	9,0	7,8
	max. cooling power	[W/(m²*a)]	7,7	7,9	5,2	6,4	2,6
	heating energy	[kWh/(m²*a)]	14,0	20,6	18,8	7,1	5,4
	cooling energy	[kWh/(m²*a)]	1,0	1,1	0,2	0,7	0,0
total	max. heating power	[W/(m²*a)]	43,5	52,5	49,8	9,0	7,9
	max. cooling power	[W/(m²*a)]	51,3	54,2	43,4	34,1	27,3
	heating energy	[kWh/(m²*a)]	34,1	55,5	51,1	7,1	5,4
	cooling energy	[kWh/(m²*a)]	22,7	18,2	10,9	36,9	31,5

Img. 34 Prototype and project simulation

	number	room type	heating energy	cooling energy	energy per person
	[-]	[-]	[kWh/(m²*a)]	[kWh/(m²*a)]	[kWh/pers]
Prototype	1	your	16,7	10,3	
	1	our	3,5	11,4	
	1	my	14,0	1,0	
	2				28,4
Project	1	your	0,0	11,3	
	3	our	0,0	20,2	
	12	my	5,4	0,0	
	20				6,8

Img. 34 Prototype and project simulation – comparison per person

5 Innovation Report

Project Summary

"smart sharing – our vision is **your+**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is "smart sharing". We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your+ suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of "smart sharing" addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

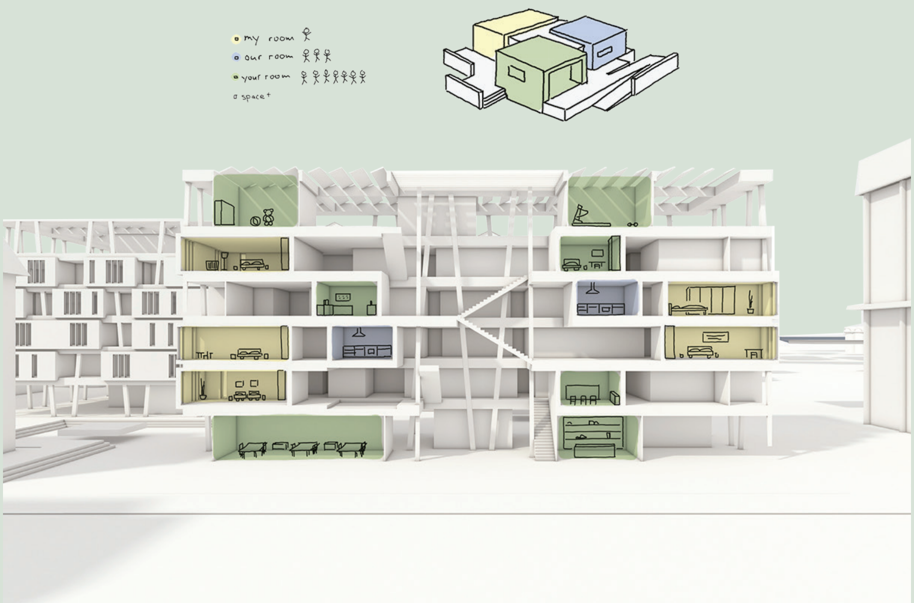
Flexible Room Usage

Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

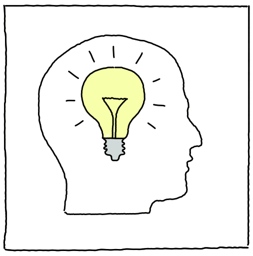
That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space^{+} as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

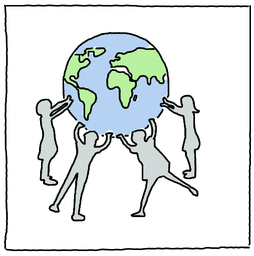
The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your^{+}.



New powerfull Ways to face urgent Challenges

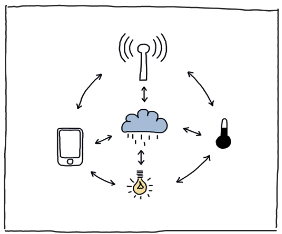
The key innovation in the your+ project is conceptual and focuses on a new approach to living, combined with the sustainable use of space. The social aspects of sustainability are well balanced and linked to economic and ecological aspects. Less is more: Combined with high quality, it provides added value.



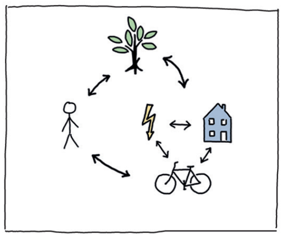


The architectural innovations focus on reinterpreting traditional building typologies and structures and adapt them to current needs and trends. The openly accessible space+, shows visitors the concept of "smart sharing" and demonstrate the added value in terms of the quality of living that this residential form offers.

In the field of energy efficiency, we generate solutions based on newly or further developed technologies. State of the art photovoltaic systems ensure longer operative periods while consuming fewer resources. Our prototype is able to balance out generation and consumption peaks, thereby significantly easing the burden of extreme loads on the urban network. However, the concept of "smart sharing" for sustainable living should not only be addressed in our prototypes, but will also be spread over a wide range of communication and sensitization measures.



Our concept shows that living quality can not only be achieved by maximizing individual space and increased consumption of resources, but also by "smart sharing" that results in a high level of added value.



"smart sharing" means optimizing use of space and resources.

The Term "Innovation"

How do we define innovation? Opinions on this topic vary widely. If used in a public context, innovation may describe a new approach to problems. Ideas, concepts or creative thoughts are often labelled or considered as innovation. The Team Lucerne – Suisse is based on campus at the Lucerne University of Applied Sciences and Arts. In this scientific and economic culture the term innovation is only used if the original creative idea gets turned into a new invention that is then diffused in the relevant market or society. This definition is important for management decisions and investors. *See Img. 1.*

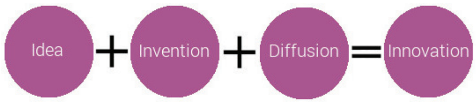
Such technologies often need several years of development, prototyping and execution and their budgeting is a demanding task in businesses supporting sustainable developments. Only a successful technology that prevails will finally produce a return on investment. Therefore only few technologies can be developed specifically for this competition. As a consequence, our team focuses on combining known technologies with new strategies of usage. The aim is to show those new sustainable products and solutions to a wider public and prove their virtual implementation in the context of the Solar Decathlon 2014. For that reason we use the term innovation equally for applied new technologies and technologies or concepts specifically developed for this competition.

Strategies to enhance evelop Innovation

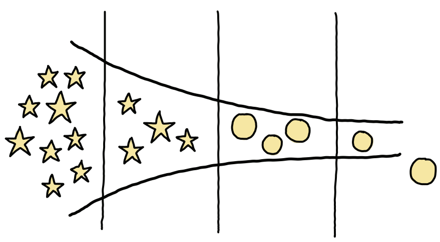
We applied different innovation processes during the development of our concept. Initial efforts consisted of generating 5 different urban concepts, which were then selectively reduced to 3 and finally our current concept of your⁺. Matters of innovation were discussed at each stage.

Different brainstorming and concept events collected useful ideas for the project. The communication team continuously keeps in touch with the students to integrate their thoughts as well as raise awareness of the opportunities that sustainable building projects provide. One example of motivating students to contribute to the innovation process of the your⁺ project was to gather ideas in exchange for sponsored energy drinks. This successful event sensitized broad numbers of students to our project and the Solar Decathlon. *See Img. 2.*

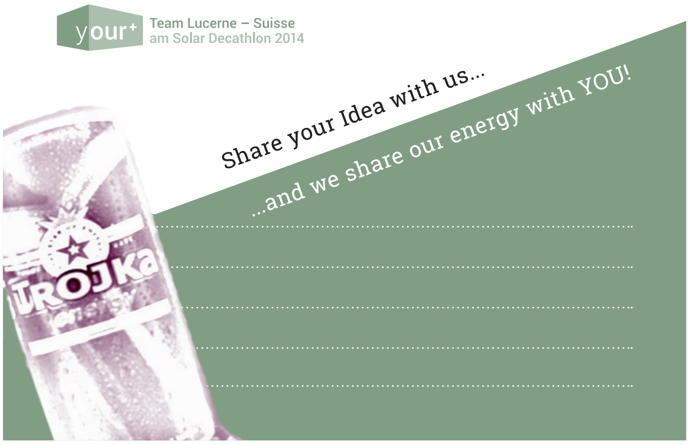
Another innovative innovation process we applied is called "Open Innovation". This boundary-breaking concept of organizing ideas and thoughts by various people is helping to develop sophisticated, feasible concepts. The main way to get such results is to organize workshops in which many different people from different backgrounds can come together to communicate their own ideas and further develop the thoughts of others. *See Img. 3.*



Img. 1 The definition of "Innovation" shown in a scientific and economic context



Img. 3 Input and ideas have been collected and further developed with help of creative funnel concepts



Img. 2 "Share your ideas" was a successful information campaign to involve a broad number of students in ideas and awareness

5.1 Innovation in Architecture

The Team Lucerne – Suisse has developed a concept that allows sustainable urban evolution far beyond the common borders of architectural tradition. To express the concept of "smart sharing" in the architectural layout for the visitors, the team implemented the vision into the prototype presented in Versailles. The concept of sharing and flexibility of living became manifest in different parts of the prototype. One of them is the space⁺ in the centre of the building. The aim is to let the visitors feel welcomed by the additional values contributed by the shared space and other other implemented measures.

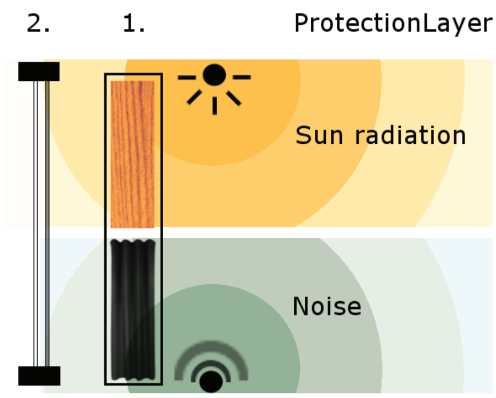
Explanatory Reminder: Vision of **your⁺** and "smart sharing"

The architectural vision of the Team Lucerne – Suisse is to face current and future challenges of the growing demand of living space in Switzerland by applying new concepts of living and architecture. This concept goes far beyond current perception of architecture and allows sustainable developments in social, technical and economical matter in the local urban concept or in a national implementation. More information about the vision of your⁺ can be found in *PM#6 chapter. 5.5. See Img. 4.*

Img. 4 The covering of landscape due to the increasing construction activities has caused major discourse throughout the country. Source: http://upload.wikimedia.org/wikipedia/commons/4/47/View_from_Pilatus,_retouched.jpg

Innovation Focus: Newly Applied Woodcraft Traditions

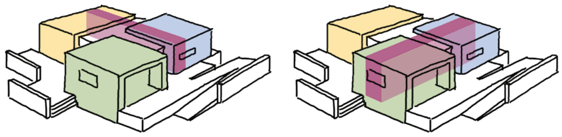
We see wood as a key resource: a sustainable and regrowing material. That's why, why we don't use any chemical and unhealthy treatment to the shingles and let them age or decompose. Many traditional buildings in Switzerland used untreated wooden shingles and these facades are still working. We bring back these traditions in a new and innovative way, by using an easy and replaceable mounting system and a very light coat of organic paint. *See Img. 5.* The Swiss government has introduced new measures and prevention campaigns to reduce the population's exposure to noise. To reduce the exposition of the population to noise the Swiss government introduced new measures and prevention campaigns. Currently often used flexible blinds don't protect significantly protect against noise and are not strong enough to sustain storms. The costs of damage in this field are disporportionally high. Our combination of newly developed exterior curtains and strong wooden shingles provide ideal protection and are made of strong, exchangeable materials. *Further information: PM#6 chapter 2.4.*



Img. 5 Exterior curtains [top 1], strong wooden shingles [bottom 1] and modern triple glazing (2) provide ideal protection from noise and radiation.

Innovation Focus: Connectable Space

In recent years, the percentage of single households has doubled to almost 50% in our cities. Nevertheless, only flats with traditional, inflexible floor plans are built. Demand for small-scale or flexible living space is great, but the supply is limited. The result is an undesirable increase in the number of singles living in oversized apartments. *See Img. 6.*

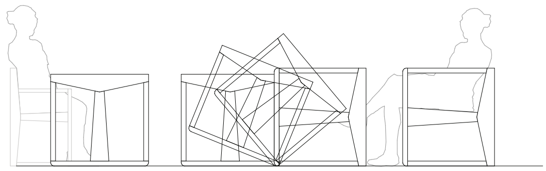


Img. 6 Traditional inflexible floor plans are replaced with a flexible connectable concept of space.

By using the concept of sharing, we can connect rooms and use them together to gain more space when we need it. We can extend our private space into the so called space⁺ which can also be used communally. The space⁺ is an interrelated space, with cross-ventilation that supports the passive air conditioning. This unique architectural concept covers comfort, the needs of inhabitants and energy efficiency in an ideal way.
Further information: PM#6 chapter 2.1.

Innovation Focus: Interior Architecture

Increasing numbers of people have an increasingly flexible life. Furniture is often brought from previous housing situations and will not be adapted to the new situation. In many situations, high value objects don't match in functionality, colour or size. Today's situation forces poeple to buy new furniture and store old ones in temporary stock.



Img. 7 The high quality furniture can be used in different ways and by various inhabitants.

In our concept we differentiate between the my room in which furniture is organised by the inhabitants and shared rooms in which we implement built-in solutions. This saves resources by sharing them and allows people to use them when needed. Most of the furniture can also be used in different ways. The table can be transformed into a bench. The chairs can be switched into a coffee table. *See Img. 7.* A newly developed electric lamp can be transported or shared with others and serves as an efficient way of illuminating our direct environment instead of keeping all lamps switched on in the whole apartment. All these measures are implemented to enhance the flexibility of space and the possibility of all inhabitants to use the shared space immediately. *Further information: PM#6 chapter 2.1 + 2.4.*

Innovation	Main benefit type	Responsible internal branch	Reference (in report)
Our Definition of Innovation	More information in the Report introduction.		
Vision of your+ and Smart Sharing	More information Explanatory Reminder above.		
Newly Applied Woodcraft Traditions	More information in innovation focus above.		
Connectable space	More information in innovation focus above.		
Interior Architecture	More information in innovation focus above.		
Integrated ventilation systems Integration of a smart ventilation system into room construction to increase comfort and energy efficiency. Today standards often implement the ventilation as foreign body or the architectural designs are inefficient in terms of energy consumption.	Comfort (Energy efficiency)	Architecture	3.2 Constructive design
Shutter shading system The shutters refers to the traditional Swiss architecture, but uses modern technologies for functioning	Energy efficiency	Architecture (Building Technologies)	3.2 Constructive Design
Urban crown The rooftop should be used to gain electrical-, thermal- and humanlife-energy. Using the roof as a garden and as an energy producing system brings an additional surplus tour urban project.	Energy efficiency (Comfort)	Architecture (Building technologies)	3.1 Structural design
Smart Sharing platform The architecture forms the platform of smart sharing which enhance sharing space, objects or services. This holistic implementation allows saving resources, space and enhancing social sustainability.	Sustainability (Affordability)	Architecture	1.3 Individual or collective Housing Building Concept

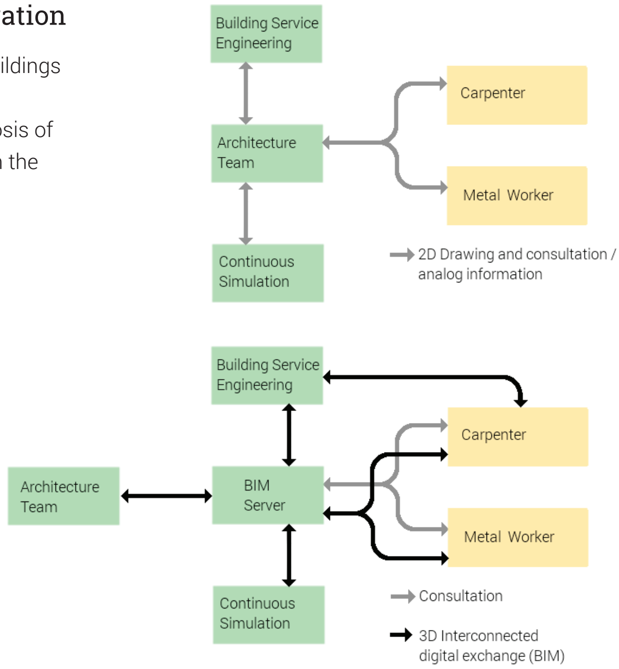
Light and Colour concept Colours and light are important factors to feel cosy in a room. In many current buildings these factors are not considered well enough. Especially in normal flats, the walls are white and the floor of some wooden material, without observing the influence of colours to the mood of the inhabitants. Due to the shared space, we simulated every colour and light implementation to optimize inhabitant's perception.	Comfort (Energy Efficiency)	Architecture	2.3 Lighting Design Narrative
Shading curtain The use of an exterior shading curtain, brings comfort and energy savings to the interior of each room. The newly developed textile has an optimized G-value and is especially strong and long lasting. At the same time we have a noise barrier with the soft textile, which is very important in the urban project.	Energy efficiency (Comfort)	Architecture (Building Technologies)	3.2 Constructive design
3D BMI Cooperation	More information in "5.2 Innovation in Engineering and Construction"		
Space+ Concept	More information in "5.3 Innovation in Energy Efficiency"		
Info- graphic	More information in "5.4 Innovation in Communication and Social Awareness"		
3D Presentation	More information in "5.4 Innovation in Communication and Social Awareness"		
Shaded rooftop patio	More information in "5.5 Innovation in Urban Design, Transportation and Affordability"		
Optimized sustainable lifestyle	More information in "5.5 Innovation in Urban Design, Transportation and Affordability"		
Exchangeable Façade solutions without fungicide	More information in "5.6 Innovation in Sustainability"		
Highest Swiss Minergie label achieved	More information in "5.6 Innovation in Sustainability"		
Powder Coating	More information in "5.6 Innovation in Sustainability"		

5.2 Innovation in Engineering and Construction

In Engineering we focused on the one hand on the practicability of the static solution to ensure an easy reassembling of the building, while keeping the required material to the essentials. On the other hand we focused on integrating the technological solutions into the architecture of the building. Our team of engineers and architects have been working together on a daily basis to implement holistic solutions which are compliant with the sustainability, comfort and design of our prototype.

Innovation Focus: 3D BMI Cooperation

The complexity of planning highly efficient buildings is known. The additional efforts of integrating various specialists to benefit from the symbiosis of architecture and engineering are significant in the effort to achieve greater sustainability.
See Img. 8.



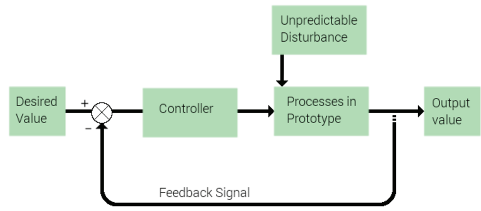
Img. 8 2D plans and verbal consultation are the standard methods of exchanging information between cooperating specialists.

The Team Lucerne Suisse trained partners to use 3D systems to increase planning efficiency and reduce mistakes during planning. Such planning systems allow our engineers and architects to work simultaneously on the same document from different places. Another advantage is to work closer with various external specialists without increasing cost or risk. Our consistent and effectively applied 3D cooperation with partners is unique and pioneering. It has led professionals to honor our exemplary work. *See Img. 9.*

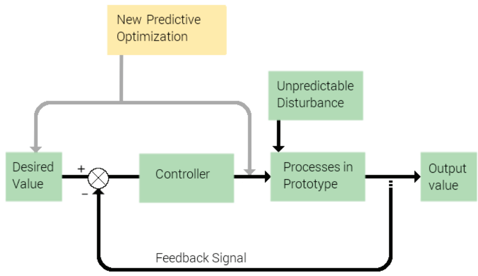
Img. 9 IDC honoured our work

Innovation Focus: Smart Building Automation System

Building automation systems are increasingly important. This new method of comfort management can also be used to increase the efficient use of energy and other additional functions.
Our innovative approach is a novelty called predictive optimization. In this system we implement and analyse augmented factors of disturbances and environmental change before they actually happen. Automated exchange of weather forecast data is implemented before the weather change takes place. This allows us to ideally use storage capabilities while maintaining the highest comfort standards and improving efficiency. *Further information: PM#6 chapter 3.4* and *see Img. 9 + 10.*



Img. 9 Traditional schematic procedure in building automation

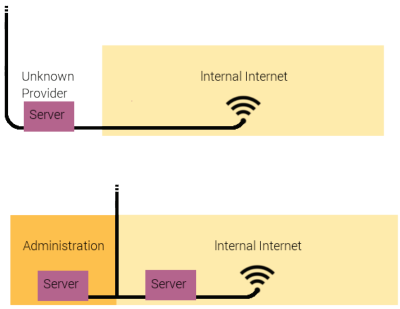


Img. 10 Our new approach allows adapting housing systems before events happened

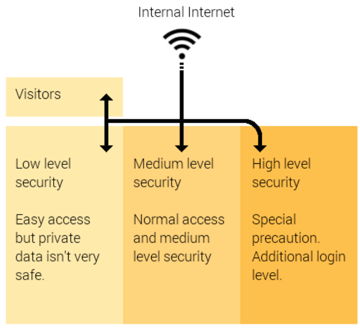
Innovation Focus: Smart Privacy Solutions

The security of personal is a modern issue that also affects our urban buildings. Smart automations systems make it possible to track any resident behavior. Three main aspects are relevant to our project. There are three main aspects which are relevant for our project. First of all, we gather data to be able to improve energy consumption and be compatible with the future national smart grid infrastructure. Furthermore, data reveals personal details personal details of the inhabitant's life. Another important part is controlling data. In current systems, the ddata is exported to building automation providers or producers of housing devices without sufficient encryption. *See Img. 11.*

Our holistic approach is to provide solutions to ensure a smart and safe sharing base. On the first level, we want to ensure that data is not archived and accessible to outsiders. Instead, it is sent encrypted to the administration server in which the information is deleted as soon as possible.(Current encryptions are on a 256 Bit level, while all the services would need special certified SSL protocols). Another important aspect is to provide the inhabitants with different safety settings. A low safety level allows an easy access by any device, which results in a less safe connection. On a second level the user needs to pass special safety barriers for verification. On a third level the procedure to access the your⁺ system is extended. Considered are TAN or Fingerprint safety concepts. *See Img. 12.*



Img. 11 Instead of losing control of our personal automation data to external companies, we keep the information in the system and delete it as soon as possible



Img. 12 The inhabitants have the choice of how sophisticated their data security level

Innovation	Main benefit type	Responsible internal branch	Reference (in report)
Our Definition of Innovation	More information in the Report introduction.		
3D BMI Cooperation	More information in innovation focus above.		
Smart house automation system	More information in innovation focus above.		
Smart privacy solutions	More information in innovation focus above.		
Heat recovery in the shower Special shower trays gather the hot water. A special heat exchanging system allows us to keep the energy inside the housing system, instead of losing the warmth to the canalisation.	Energy efficiency (Sustainability)	Building service engineering	XI Detailed Water Budget
Water management System In Switzerland currently almost no rain- and grey water is reused. We implemented a smart management system, which allows using this water for non-potable purpose for example for irrigation, cooling of devices or other purposes. This results in significant fresh water savings for the whole settlement. Our focus wasn't only to implement big innovations, but also small improvements for everyday implementations for example water with which we wash our hands, that is immediately used to flush the toilette.	Sustainability	Buildings service engineering	3.3 Plumbing System Design and XI Detailed Water Budget.
Peak shifting concept The peak stress of the energy infrastructure is a great burden for every system on a small or large scale. Due to the smart interconnection of different equipment, the internal peak production or consumption is significantly reduced and contributes reducing the local and national grid peak load.	Urban solutions	Building services engineering	3.4 Electrical System Design and 3.6 Electrical Energy Balance Simulation

Sun tracking Photovoltaic Currently no efficient and practical solutions are available keeping photovoltaic systems following the sun to improve efficiency. We developed such a system and implemented it as a shaded rooftop patio with which we are about 20% more efficient than comparable systems. The innovative concept behind these efforts is to gain the additional energy when it is consumed internally: In the morning and especially in the evenings. The main conceptual difference in this approach is trying to increase electricity production per m^2 of panels instead of increasing electricity production per m^2 of roof surface. This results in using fewer resources to produce PV panels.	Energy efficiency (Comfort)	Architecture (Technical Mechanics)	3.4 Electrical System Design
Newly Applied Woodcraft Traditions	More information in “5.1 Innovation in Architecture”		
Urban crown	More information in “5.1 Innovation in Architecture”		
Space+ Concept	More information in “5.3 Innovation in Energy Efficiency”		
Unique photovoltaic facilities	More information in “5.3 Innovation in Energy Efficiency”		
Shaded rooftop patio	More information in “5.5 Innovation in Urban Design, Transportation and Affordability”		
Exchangeable Façade solutions without fungicide	More information in “5.6 Innovation in Sustainability”		
Highest Swiss Minergie label achieved	More information in “5.6 Innovation in Sustainability”		

5.3 Innovation in Energy Efficiency

There are many innovative and efficient devices on the market. Our focus was on the one hand to ensure the local ability of our system to interconnect with the urban context and to be smart-grid compatible. On the other hand we used the latest simulation technologies to assess available and newly developed products and to implement only what is needed. In the end we coordinated the devices with a newly developed home automation system, which takes more influencing factors into account than any other comparable systems. This holistic approach, using building service engineering combined with different technologies, results in a higher efficiency while saving resources, than if we had only used modern devices separately.

Innovation Focus: Smart Administration of Rooms

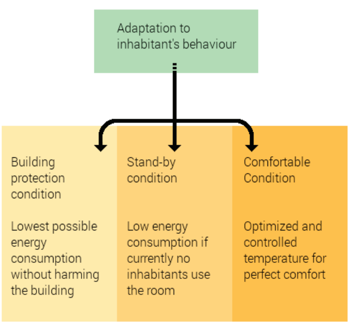
Currently many modern buildings in Switzerland want to offer perfect comfort conditions throughout the day and year. Even if the building is empty or inhabitants are on holiday, the rooms are perfectly air-conditioned. It is rare that holiday settings can be chosen automatically. *See Img. 13.*
In our project we want to air-condition rooms only when they are used. Therefore we developed a three stage system to adapt to current needs. This results in a high level of comfort in spaces that are currently used, while reducing electricity consumption.
Further information: PM#6 chapter 4.2.

Innovation Focus: space⁺ Concept

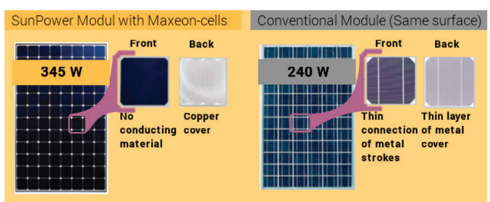
The holistic view on space and interdisciplinary work of various engineers and architects allowed us to develop the space⁺ experience. Due to combination of integrated PCM materials, architectural adjustments, blinding systems and passive ventilation systems, the space⁺ has maximum comfort qualities without additional insulation or active systems. Usability throughout the year is ensured through passive heating and cooling. To enable this system, intensive radiation studies and simulation have been conducted. *Further information: PM#6 chapter 4.2.*

Innovation Focus: Unique photovoltaic Facilities

Sustainable solutions in decentralized energy production are increasingly important. Currently used photovoltaic systems often show an inefficient production of energy due to their big amount of grey energy used for production and their declining production capability on the long run. *See Img. 14.*
We have chosen newly developed systems which produce more electrical energy per m^2 than other comparable photovoltaic systems. Special consideration has been given to use the most long lasting solution on the market. In our evaluation we decided to use Maxeon Sunpower solutions due to high and their long lasting efficiency. Even in 25 years we will produce 36% more energy than comparable products.
Further information: PM#6 chapter 3.5 and *Appendix 14 Datasheet sunpower X21 PV module.*



Img. 13 In our project we want to condition rooms only if they are actually used.



Img. 14 We use highly efficient and long lasting photovoltaic systems.

Innovation	Main benefit type	Responsible internal branch	Reference (in report)
Our Definition of Innovation	More information in the Report introduction.		
Space+ Concept	More information in innovation focus above.		
Unique photovoltaic facilities	More information in innovation focus above.		
Annual Energy Shifting Currently buildings are often seen as separate systems. We focus on connecting the buildings to enhance synergies. Low temperature storage allows us to simulate the annual storage systems in the soil without using additional resources. This allows us to store summer heat for use in the winter. In our house we implement low temperature water tanks to show the possibilities of energy shifting and to balance out day and night temperature differences in Versailles.	Energy efficiency (Sustainability)	Building service engineering	4.2 Comprehensive Energy Analysis and Discussion Report
New Energy Storage Management Currently the produced DC electricity of photovoltaic systems are converted into AC electricity which is adapted to the local grid. Only than an in house converter changes the AC into DC to safe it in internal batteries. Our BPT-S5 Hybrid system brings DC electricity directly to the batteries and converts the remaining electricity to AC current. This improves efficiency factors from 75% to 95%.	Energy efficiency	Building services engineering	3.4 Electrical System Design and Appendix 07

Transportation as integrated batteries. Currently electrical vehicles like bikes and electro- cars are plugged in once they are parked at home without considering smart efficiency optimization. In our system we implement these vehicles as an integral part of the battery storage. Therefore their storage capacity is used to cut peak loads and to support smart grid functions without increasing the total amount of resources or batteries.	Energy efficiency	Building services engineering	3.6 Electrical Energy Balance Simulation
Integrated ventilation systems	More information in “5.1 Innovation in Architecture”		
Smart house automation system	More information in “5.2 Innovation in Engineering and Construction”		
Heat recovery in the shower	More information in “5.2 Innovation in Engineering and Construction”		
Peak shifting concept	More information in “5.2 Innovation in Engineering and Construction”		
Sun tracking Photovoltaic	More information in “5.2 Innovation in Engineering and Construction”		
Optimized sustainable lifestyle	More information in “5.5 Innovation in Urban Design, Transportation and Affordability”		

5.4 Innovation in Communication and Social Awareness

Active and continuous implementation of communication concepts has always been a very important part of the team's work. Swiss people are generally aware of the need to find sustainable solutions in the building and energy sector. Our main focus was to enable an interaction between stakeholders, neighbours, schools, students and the general public, and to show the time has come to not only "talk the talk" but "walk the walk" – to really apply the technology.

Innovation Focus: Interconnected Multiplier

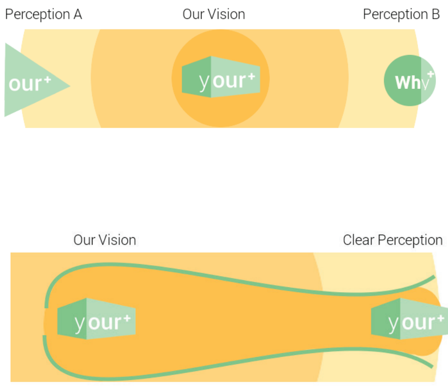
Normally, information channels are used separately. Presentations and concepts developed by others like the SD Europe Committee were reused on our channels to enhance their effect.
One example of this is the Speed-Peer-Review, for which we made a clip that had one of the most successful audience ranges. *See Img. 15.* It should be noted that our, that our presentation on this review itself can be labelled as innovation due to its combination of technologies to allow a combined live outdoor transmission.
Further information: PM#6 chapter 7.1.

Img. 15 Enhanced interconnectivity on our channels increases interest in sustainable living and the solar decathlon competition.

Innovation Focus: Focused Communication

Currently the internet and social media offer a wide range of channels to communicate content. To use as many channels as possible might result in blurry information perception by the audience. Normally it is not possible to maintain quality standards if the content is adapted to different audiences, due to the extensive human resources needed. We are focusing the communication channels, but increase their quality. *See Img. 16.*

A good example of these efforts is the extensive special brochure included in "Hochparterre", one of the most important construction and architecture magazines in Switzerland and Europe.
Further information: PM#6 chapter 7.1.



Img. 16 Focused communication with clear messages replaces a wide, but insufficiently clear communication

Innovation	Main benefit type	Responsible internal branch	Reference (in report)
Our Definition of Innovation	More information in the Report introduction.		
Interconnected multiplier	More information in innovation focus above.		
Focused Communication	More information in innovation focus above.		
Info- graphic The complex rendering of our urban context in terms of architecture, technology and interconnectivity with the environment is unique. Today's standards are mostly presented separately. This interconnected communication was enhanced on all levels and on every period of the project.	Concept understanding	Architecture (Communication)	1 Urban Design, Transportation and Affordability Report
3D Presentation Swissbau is one of the most important exhibition in Europe and the biggest in Switzerland. Thanks to smart cooperation, we have been one of the most important exhibitors. Our concept inspired the visitors of which more than 100'000 attained the event. It was presented with a unique combination of projection, models and sound surround system.	Sustainability awareness	Communication	7 Communication Plan (With pictures)
Unique presentation in Versailles Our Design and Arts students are realizing a unique tour experience in our prototype. The understanding of the complex and society changing concept is increase by showing everyday situations and integrating, every day tools, objects sound and smell into the explanatory part. Additionally an App gives the visitors interactive possibilities and explains the concept from a different perspective.	Sustainability awareness	Communication	7 Communication Plan

Continuous Communication Since the beginning of the project, a wide range of public was informed about the project by Flyers, Brochures, Prime TV-Contributions, Info- Centres (Infobox) and various other media.	Sustainability awareness	Communication	7 Communication Plan
Interactive Communication It is an important focus to get people involved into the matter of sustainability in the construction sector. To enhance to "walk the walk" instead of "talk the talk" we organized various events with direct involvements of stakeholders. For example in open innovation forums, children school visits, business people workshops or student events as well as public platforms at the building site.	Sustainability awareness	Communication	7 Communication Plan
Sustainable Communication Our efforts on promoting sustainable housing solutions go beyond the competition period. We made agreements to present our concept on exhibitions all over Switzerland in the next years. In fall 2014 we are present at the "OLMA" expo. Furthermore an artist is currently working on a children booklet to explain how to live a more sustainable life and how our concept works.	Sustainability awareness	Communication	Non
3D BMI Cooperation	More information in "5.2 Innovation in Engineering and Construction"		

5.5 Innovation in Urban Design, Transportation and Affordability

The main concept of "smart sharing" was further developed in these fields and can be applied in a network all over Switzerland. This increases the potential usable added value while reducing costs and resources when applied to urban design/urban planning as well as transport systems between cities.

Innovation Focus: Vision of **your⁺** and "smart sharing"

Current traditional buildings often increase the inefficient use of space and don't consider the urban environment and its interconnection in terms of transportation and the social behaviour of inhabitants. "smart sharing" significantly saves costs, resources and space, while also increase the quality of life. This main innovation affects urban development, transport and affordability in an extensive way. *See Img. 17.*

The vision of Team Lucerne – Suisse is to face current and future challenges of growing demand for living space in Switzerland by applying new concepts of living and architecture. This concept goes far beyond comparable projects and allows sustainable developments in social, technical and economic aspects in local urban concepts or on the level of national implementation. *Further information: PM#6 chapter 1.1.*

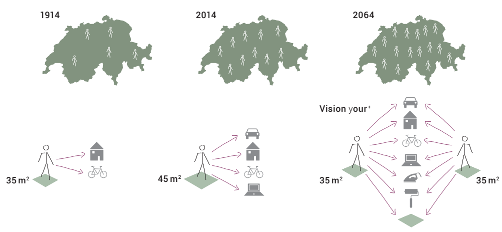
Innovation Focus: Sustainable Affordability

Today's efforts of higher densification are often overshadowed by investors aiming for short-term profit without considering the long-term relationship of housing with the urban environment. Therefore we based our concept on cooperatives, which are keen to take long-term responsibility and which are considered very trustworthy and attractive for inhabitants. *Further information: PM#6 chapter 1.5.*

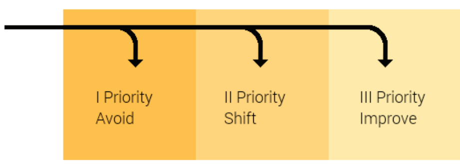
Innovation Focus: Applied Avoid-Shift-Improve Principles

Today many planning processes in Switzerland are blocked due to disputes between environmentalists and investors. The majority of projects only consider economic aspects but neglect the urban context or the social or urban sustainability. Environmental protection organisations try to limit the amount of parking lots and total covered surfaces while investors want to increase space used.
In our concept we implement infrastructure into the living situation of the people to increase the number of more sustainable alternatives. In first priority we want people to have the opportunity to avoid traffic at all. The housings shall be a mix of flats, offices, shops and social meeting spots with which people can conveniently do their everyday task without traveling waste distances. In a second step we provide infrastructure and impulses to shift towards better solutions. *See Img. 18.*

Instead of using the car, they might use the bus station which is places directly in front of the urban buildings. Or they might suddenly use a bike. If the first and second priority doesn't work out, we appeal to improve the way of transport. Cars might be used in a group on the way to work. Or buses are running with sustainable electricity. A car and e-bike sharing system is also part of of the mobility concept and network. *Further information: PM#6 chapter 1.4.*



Img. 17 Evolution of demography with its needs



Img. 18 We apply the concept of avoiding, shifting or improving traffic.

Innovation	Main benefit type	Responsible internal branch	Reference (in report)
Our Definition of Innovation	More information in the Report introduction.		
Vision of your+ and Smart Sharing	More information in innovation focus above.		
Sustainable Affordability	More information in innovation focus above.		
Applied Avoid-Shift-Improve Principles	More information in innovation focus above.		
Shaded rooftop patio Currently rooftops of buildings are seldom used. On most buildings in Switzerland traditional roofing tiles are installed. Modern solutions do have photovoltaic systems but they have a rather bad accessibility. We combine the rooftop space and the photovoltaic construction to a living space for the inhabitants for gardening and recreation. Shading and protection is provided by the Photovoltaic systems applied above the patio.	Comfort	Architecture	1.1 Urban Design Strategy
Optimized sustainable lifestyle Due to the smart infrastructure we provide a platform for inhabitants to make their lifestyle more sustainable. One example is transport: Due to smart sharing of cars and bikes and the direct interaction with public transport in Switzerland, the daily CO2 accumulation will reduce from today's normal 7,400 Kg/(day*person) to 3,284 Kg/(day*person) An additional aspect is to enhance daily shopping routines to be done locally to reduce the distance travelled.	Transportation	Urban Design	1 Urban Design, Transportation and Affordability Report

Continuous reverse adaption Currently we have to adapt us to the environment. With our concept, the urban realization can adapt itself to the people, instead of revers. In the current situation, many housing concepts are orientated by normal ways of planning the whole footprint along old concepts of housing. Our innovative and flexible concept breaks of many of those habits and can be adapted to the current development in one's life. Our concept covers needs for which a big demand exists, but no offers.	Affordability	Urban Design	1.2 Market Viability of the Product
Clear financial benefits Different concepts allow the application and implementation of the your+ concept in an urban context. The idea and philosophy of sharing and contributing to the collective is financially rewarding. Due to the higher added value while reducing cost we provide an unique offer to both, customer and investor.	Affordability	Urban Design	1.2 Market Viability of the Product
National city network The current flexible lifestyle of an increasing number of people imposes a great challenge on individuals and infrastructure. It is getting more difficult to find new housing possibilities and to transport the whole household after a short period of time. A network of collectives can reduce these problems, by allowing individuals to easily exchange their apartments over a short period of time. This increases flexibility and reduces computing frequency and distances.	Transportation	Urban Design	1.4 Mobility Strategies

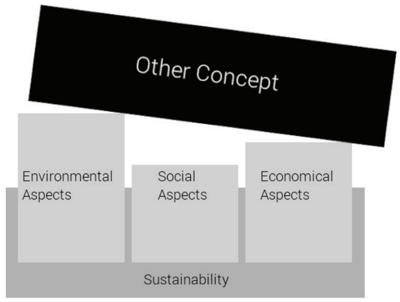
Platforms instead of Houses With our Concept we provide a platform to enhance social, material and organisational matter. This platform can be used and developed as much the inhabitants want to, but nobody is forced to use it. This allows a maximum in flexibility and individual initiative.	Added value	Urban Design	1 Urban Design, Transportation and Affordability Report
Urban crown	More information in “5.1 Innovation in Architecture”		
Smart Sharing platform	More information in “5.1 Innovation in Architecture”		
Water management System	More information in “5.2 Innovation in Engineering and Construction”		
Space+ Concept	More information in “5.3 Innovation in Energy Efficiency”		
Holistic applied sustainability	More information in “5.6 Innovation in Sustainability”		
Exchangeable Façade solutions without fungicide	More information in “5.6 Innovation in Sustainability”		
Social Sustainability	More information in “5.6 Innovation in Sustainability”		

5.6 Innovation in Sustainability

On a conceptual level we break with common habits and illustrate practical global and national solutions. In terms of construction and transport we do the opposite. Our aim is to work with local resources that can regrow and do not need to be moved over great distances.. It needs great effort and manpower to carry out meticulous research on the origin of the products we use in our prototype and local products help us in this respect.

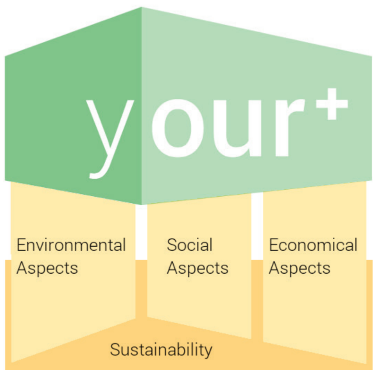
Innovation Focus: Holistically Applied Sustainability

Sustainability is an important aspect of many current projects in Switzerland. Nevertheless often only one or two aspects of sustainability are considered. If future urban developments are to maintain real quality for many generations, all three aspects have to be considered. If new long-lasting materials are implemented it might be more environmentally friendly, but if it is too expensive, it will not solve our problems. If current housing is extended and its density increased, and density increased, it might be financially interesting, but might not improve at all the social behaviour and needs of inhabitants at all. *See Img. 19.*



Img. 19 Current projects in Switzerland are not well- balanced.

The innovative your+ concept does have a direct impact on all three aspects even without considering additional sustainability efforts. Reducing the consumption of resources and space also has a financial benefit in addition to improving the quality of life. *See Img. 20.*
Worth to mention is that we considered the social needs of inhabitants and based many practical implementations on this aspect. More information can be found in the list below.
In terms of sustainable materials implementation, we took new paths based on shared, renewable and exchangeable materials. More information can be found in "5.2 Innovation in Architecture"
Economic advantages are critical to increase the probability of concept implementation. To ensure this, we used implemented projects in Zurich as inspiration, since they show the problem of great demand for flexible living space, despite the almost complete lack of supply. Due to high density and high life quality which is offered in our concept.
We are attractive to investors due to the great density and high quality of life provided by our



Img. 20 The your+ concept offers realistic solutions for all aspects of sustainability.

concept. we are attractive for investors. investors mainly focus on making as much short-term profit as possible. The main challenge is to find an organization that shows sustainable commitment towards the maintenance of such a complex concept. We planned our concept with cooperatives to ensure sustainability with respect to such social aspects. *Further information: PM#6 chapter 1.3.*

Innovation Focus: Facade Solutions without Fungicide

Currently the new built housings are increasingly insulated to increase energy efficiency. This results in a loss of thermal mass in the outermost layer of the buildings, which increase wetness through condensation water. As a consequence more and more moss and fungi settle on the walls after only five to ten years, which are fought with chemicals implemented in the plaster. In recent years studies have proved that such chemicals flow into the environment and affect biological habitats, especially rivers and lakes.
Due to disclaim of fungicide treatment or other harmful chemical protection to cover the facade exposed to rain and sun, the wooden parts will experience great stress. Therefore the facade is put into smaller elements of easily disposable wooden plates that can easily be replaced using locally grown materials.
Further information: PM#6 chapter 3.2.

Innovation	Main benefit type	Responsible internal branch	Reference (in report)
Our Definition of Innovation	More information in the Report introduction.		
Holistic applied sustainability	More information in innovation focus above.		
Exchangeable Façade solutions without fungicide	More information in innovation focus above.		
Social Sustainability In Switzerland we have one of the highest standards of living. But also one of the highest suicide rates in the world. These developments are difficult to investigate, but it is assumed that increased independency, loss of social meeting zones and isolation are important factors. For many centuries, big families of up to 20 people lived together. Additionally many meeting zones in the centre of villages and urban areas allowed inhabitants to meet each other. Many of these places are rationalized, not maintained or they disappeared. Studies in this field emphasize that cities and buildings shouldn't be built without considering the social responsibility of architecture. Especially the loss of social encounter zones in favour of more profitable densification is criticised. Our concept does have new answers to these questions.	Social Sustainability	Architecture	Non
Locally grown wood Almost 80% of our wood is local. It is grown, cut, stored, dried and processed within 40 km from the construction site. Today's standards are fare away of such efforts. On the building side of Switzerland most wood comes from Scandinavia, Russia and even rainforest regions.	Sustainability	Construction	6 Sustainability Report

Make use of every kind of wood If only the best quality Swiss wood were used, almost all of the tree would be wasted. Therefore we use highest quality wood for visible parts while non-visible parts are built with lower classes of wood. Other comparable prestige buildings don't take this into account.	Sustainability	Construction	6 Sustainability Report
Smart recycling concept The recycling standards in Switzerland are high. We decided to go beyond the standards with separate collection of almost any materials on any place of work whether outdoor or in the atelier.	Sustainability	Project management	Non
Highest Swiss Minergie label achieved With our Prototype we achieve the highest possible Minergie standard. The Minergie-A-Eco Certificate exceeds by far the requirements of other international labels. We also work on the national level of SNBS.	Sustainability	Architecture	6 Sustainability Report
Powder Coating Today many furniture are covered with a layer of protection paint which is made of unsustainable materials. Mostly used are nitrocellulose or polyurethane covers. We have the opportunity to work with Ramseier Woodcoat for our furniture, the winner of the 2013 MATERIALICA Gold Award. Our surfaces are therefore verifiable more sustainable. They consist of solvent- free wood- coating. Nevertheless they are long lasting and of high quality.	Sustainability (Architecture)	Architecture	6 Sustainability Report
Smart Sharing platform	More information in “5.1 Innovation in Architecture”		
Smart house automation system	More information in “5.2 Innovation in Engineering and Construction”		
Water management System	More information in “5.2 Innovation in Engineering and Construction”		

Heat recovery in the shower	More information in "5.2 Innovation in Engineering and Construction"
Smart privacy solutions	More information in "5.2 Innovation in Engineering and Construction"
Unique photovoltaic facilities	More information in "5.3 Innovation in Energy Efficiency"
Space+ Concept	More information in "5.3 Innovation in Energy Efficiency"
Annual Energy Shifting	More information in "5.3 Innovation in Energy Efficiency"
Sustainable Communication	More information in "5.4 Innovation in Communication and Social Awareness"
Vision of your+ and Smart Sharing	More information in "5.5 Innovation in Urban Design, Transportation and Affordability"
Sustainable Affordability	More information in "5.5 Innovation in Urban Design, Transportation and Affordability"
Applied Avoid-Shift-Improve Principles	More information in "5.5 Innovation in Urban Design, Transportation and Affordability"
Optimized sustainable lifestyle	More information in "5.5 Innovation in Urban Design, Transportation and Affordability"

6 Sustainability Report

Project Summary

"smart sharing – our vision is **your⁺**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is "smart sharing". We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your⁺ suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of "smart sharing" addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

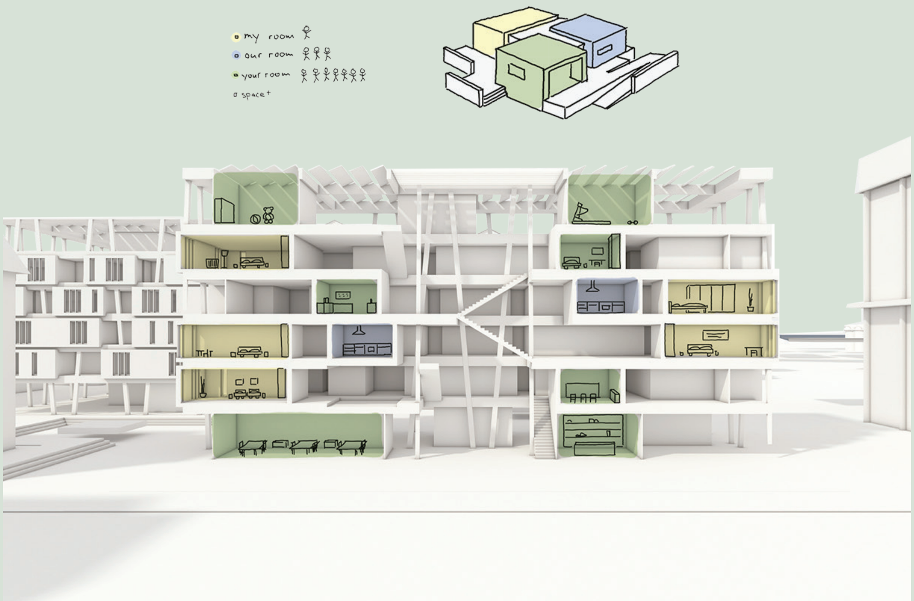
Flexible Room Usage

Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space⁺ as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your⁺.

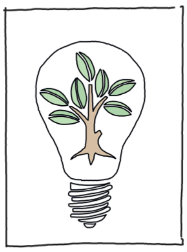


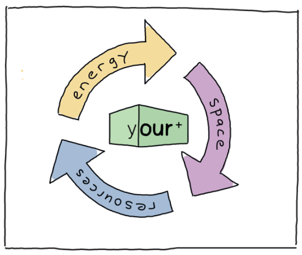
Sustainable Living with your+

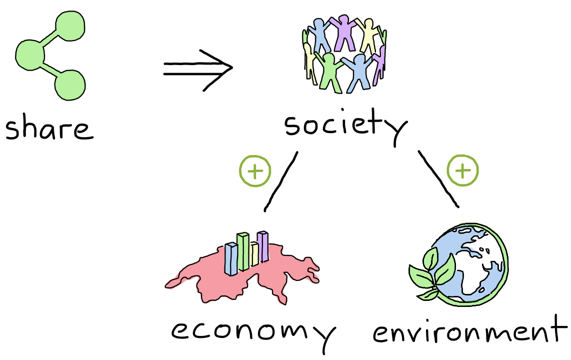
Sustainability is the foundation on which the Solar Decathlon has been built. Promotion of new technologies, higher efficiency ratios and alternative energy all relate to the goal of being more sustainable. Team Lucerne – Suisse takes this to a new level by proposing an entirely new living concept in the your+ prototype: "smart sharing". As an answer to the limited living space and growing population of Switzerland, the team has developed the concept of sharing non-essential living space and objects with others in their cooperative.

This is significant because of the limited effects that advanced technology has in terms of saving resources when the individual demand of a growing population is rising. The achievements of this project include, among others: living space reductions by roughly 30%, higher exergy efficiency, and increased access to mobility.
The your+ concept achieves the highest Swiss/ European standard for sustainable building, Minergie-A-ECO (an integral part of the Swiss Standard for Sustainable Construction SNBS), and improves on space, energy and resource consumption – all while maintaining the high level of comfortable living expected by Swiss citizens.

"smart sharing" means global long-term thinking and local direct acting.







6.1 General Concept of the Project and Sustainability

Sustainability is fundamental to the goal of the Solar Decathlon. We believe that beside material and process footprints, the social attitude among inhabitants influences the sustainable performance of our building. With technology and building improvements developing quickly, we choose to look deeper at the fundamental understanding of sustainability for a long-lasting solution. Our solution: "smart sharing". Through "smart sharing" people can share their living space and resources with others. This reduces up to 10 m² per living space per inhabitant. Switzerland aim for an average energy demand of only 2000 W per person by 2150 compared to 6000 W today. 2000 W emerges from a calculation stating that this amount of primary energy can be supplied from sustainable resources for one person. We believe that our new housing and living concept supports this goal and helps to achieve the intermediate target of 3500 W by 2050 *See Img 1.*

What do we understand as a Sustainable Built Environment?

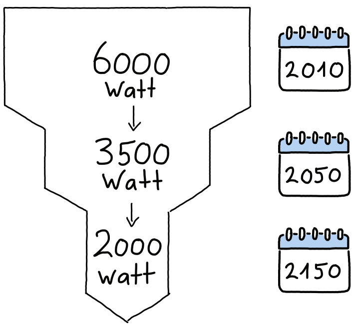
Sharing our living resources notably decreases the negative impact we have on our environment. Our platform for sharing, called your⁺, brings like-minded people together to share living and kitchen space while increasing mobility, recreation and networking.

Smart Sharing Base

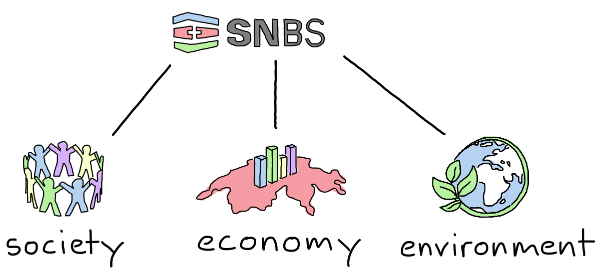
The Swiss Standard for Sustainable Construction (SNBS) differentiates between three dimensions - society, environment and economy – all of which must be considered during the planning, construction and operation phase of a building. Primarily, "smart sharing" changes how people live together, but it also has a positive impact on the remaining two dimensions of economy and environment. Sharing reduces expenses and lowers the overall required space for living, which in turn can be used as green surfaces. The building standards used can be seen *in Img. 3.* We believe social aspects are integral to achieving a truly sustainable living system and use the following SNBS ideals to guide us in our process. *See Img 2.*

Observe

This is achieved in your⁺ with the interactive building management app.
Observing their impact, users can make the reduction of consumption an interactive game between neighbours.



Img. 1 Idea of 2000 Watt per person



Img. 2 Dimensions of sustainability according to SNBS

Society	Context and Architecture	Context analysis	Requires a systematic context analysis
		Specifications	Requires the findings of the analysis to be formulated into guidelines for the project
	Planning and Target Group	Planning	Requires that the target groups should be involved in the projects development
		Diversity	Requires an appropriate occupation density to the usage and a variety of users to be targeted
	Usage and Urban Design	Semi-Private space	Defines the projects adaptability and the utility quality
		Private space	Requirements on the adaptability of the space and the range of usage possibilities
	Comfort and Health	Visual, acoustic and thermal comfort	Defines the main factors for a high comfort with focus on sound insulation and air temperature
		Interior Air Quality	Requirements for the protection of the user from harmful emissions
Economy	Cost	Lifecycle Costs	This criteria evaluates all costs from planing to the decommission
	Tradability	Object Sites and Ownership Relations	Criteria for tradebility of real estate with respect to the size and the ownership relations
		Building material	The state, the quality and the way it was built have great influence on its tradability
		Rental Situation	The rental situation is regarded as an indicator for the tradabliity of the real estate
	Profitability	Accessibility	Criteria for evaluating the accessibility of the real estate with respect to the regional and the national context
		Population and labor market	A positive development of the population and of the labor market influence the demand for estates positively
		Regional Rent Level	Evaluation of the profit potential on the basis of the regional rental level
		Utilization Potential of Land	Evaluation of the aptness of the land for the specific usage
		Quality of Location and Future Potential	Evaluation of the location with relevant factors and expected development of the location
	Regional economy	Potential of Regional Economy	Evaluation of the real estates contribution to the regional economy proportionally to the size of the regional economy
Environment	Energy	Non-Renewable Primary Energy	This criteria evaluates the required energy from a required non-renewable source during the construction, operation, and mobility
	Climate	Greenhouse gas emissions	This criteria evaluates the emitted greenhouse gases during the construction, operation, and mobility
	Climate	Environmentally Friendly Construction Process	This criteria portrays if a building is built in an environmentally compatible manner
		Environmentally Friendly Usage	This criteria evaluate if the conditions for a environmentally friendly usage are provided
		Environmentally Friendly Mobility	This criteria show which steps were taken in order to enable a environmentally friendly mobility
	Nature and Landscape	Biodiversity	This criteria evaluates whether the potential in flora and fauna is fully used
		Urban Sprawl	The urban sprawl and land use are evaluated with appropriate indicators

Img. 3 SNBS criteria

Catch and Store Energy
From photovoltaic panels taking advantage of the peak sunshine hours to our rain water collection and storage system, your+ takes advantage of available collectable energy and resources. Using bike batteries as storage units allows us to collect energy if the bikes are used at home as exercise bikes.

Obtain a Yield
The increase in users brings more available resources to the sharing platform, increasing its attractiveness.

Apply Self-Regulation and accept Feedback
The your+ App will allow us to track user behaviour and we can work together to discourage unsustainable behaviour. Examples include limited energy usage competitions, or minimal waste production weeks.

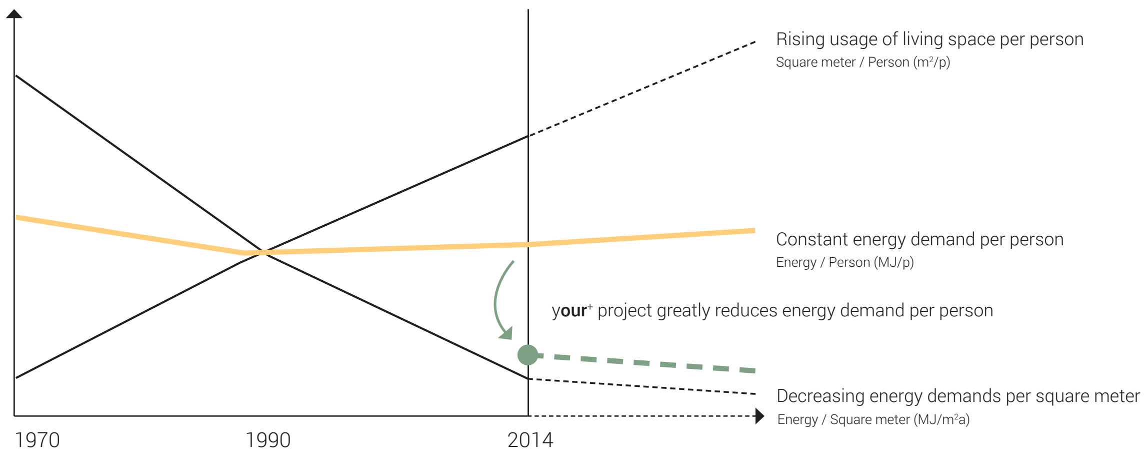
Societal Design
Innovation has often originated from exchanging ideas and a proximity of need. This promotes the basic concept of sharing and a turnaround towards minimalism in design and lifestyle.

Integrate rather than segregate
Combining different demographics and creating a symbiotic relationship between inhabitants, your+ brings people together for an optimal experience.

Use simple Solutions
Utilizing sharing concepts is simple, but effective. The complexity appears when attempting to explain the concept to citizens who find the concept of sharing alien or unappealing.

Use and value Diversity
We depend on the diversity of our residents to be the catalyst for individual and collective growth. Together they will grow and evolve into a cohesive living community.

Creatively Use and Respond to change
Our concept is our intervention and the time is now. We need to act post-haste to improve our living habits and way of life. "smart sharing" reduces consumption and influences human behaviour.



Img. 4 Forecast of average demand for living space and energy per person

See PM#6 chapter 1.1

6.2 Urban Design, Transportation and Affordability

Urban space is scarce. With the your⁺ project this scarce resource is used much more efficiently. Car sharing and convenient access to public transport in combination with shared e-bikes provide sustainable solutions regarding the transport. Sharing resources means shares costs, which is advantageous to everyone.

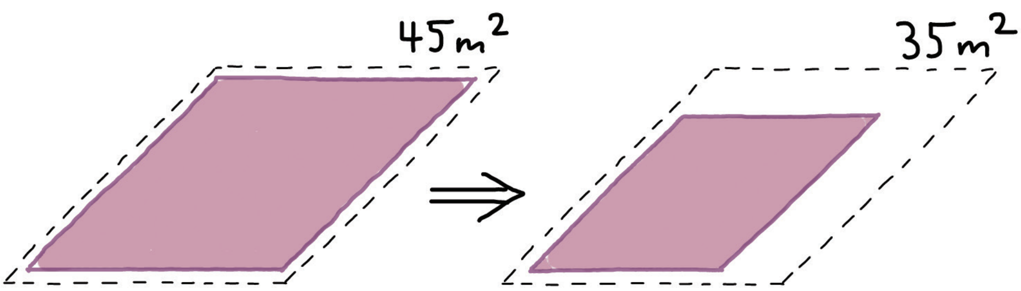
Urban Design

Sharing reduces the resources needed. This concept also holds for urban design and transport aspects. The your⁺ concept allows density in living conditions without reducing the ability of having private areas to retreat to if desired. This is achieved by placing the private rooms (my room) further away from the usual circulation and walking paths than the semi-private (our room) and the public areas (your room). We want to optimize the duration in which a room is occupied by accommodating people with different time requirements. To give an example, a senior citizen will most likely use the kitchen over lunch whereas a student spends this time at university. A balanced mix of people can help to avoid overlapping by distributing the individual room-time requirements over a day. *Img 5* shows which room is used by whom during a sample day. This drastically reduces the total space needed. The square-meterage per person can be reduced from 45 m^2 per person in an average Swiss household to 35 m^2 with the your⁺ project. In other words, the your⁺ concept saves over 20% space per person while offering the same or even more Area for use. *See Img 5.*

High adaptability and flexibility towards innovative technology and future changes is a trait our prototype embodies. A dense way of living can prevent people from commuting long distances by giving them the opportunity to live closer to their workplace. In addition, the project is equipped with a room type that can be rented on a daily basis by your⁺ inhabitants, by people from other citites or provided to guests. The adaptability also allows the your⁺ concept to serve all kind of people form different social groups. This cultural mix already exists in the Industriestrasse, the area for which the concept was developed for. Therefore the living space and culture existing now can be sustained even though it is a radical approach. *See Img 6 - 8.*

Transportation

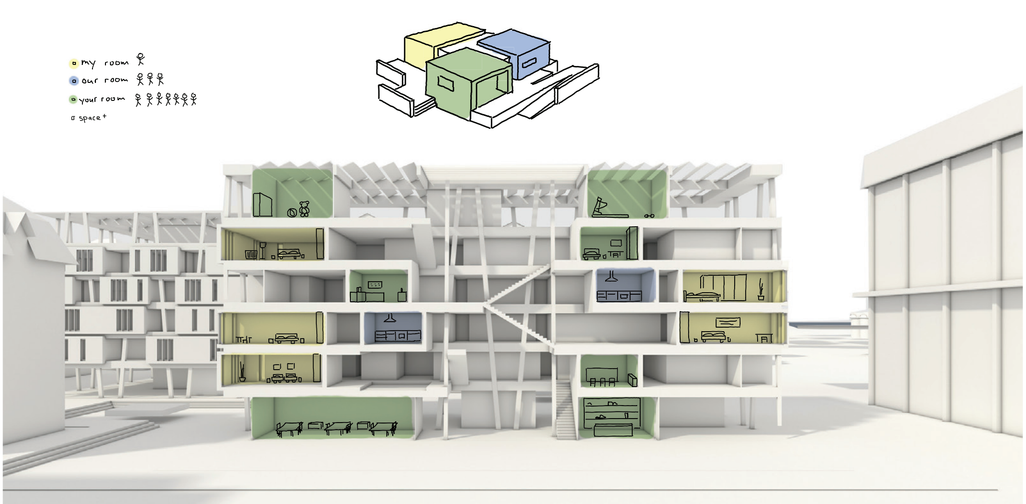
Switzerland has a well-established public transport system. The distance between the Industriestrasse quarter, the local region for which our project has been developed, and the train station amounts to a fifteen-minute walk or 5 minutes by bus. An e-bike fleet allows an energy and time efficient way to



Img. 5 Area Comparison

Img. 6 Room occupancy over a sample day in the your+ project – a smart mix of daily routines improves the utilisation of rooms

Img. 7 Six user groups with individually adapted living possibilities are offered



Img. 8 Building cross-section of te urban buildings showing room-types and the space+ compared to the prototype

commute in Lucerne and its suburbs. Also, there already is a car sharing location by Mobility where the your+ is planned. Additional cars from the Mobility cooperative would be situated in the underground parking garage. This way cars are shared between the your+ residents and other people. Efficient cars help to lower transport emissions. In addition, a car-sharing system reduces the required parking space and splits the costs for vehicle acquisition and maintenance between the users. The Canton of Lucerne supports the concept of sharing by offering free or low-interest leases for land to housing cooperatives. Our mobility strategy reduces transport-related $C0_2$ emissions per person and day by 4,250g. Extensive information on the your+ transportation approach can be found in the UDTA report. *See Img 9 + 10.*

Affordability

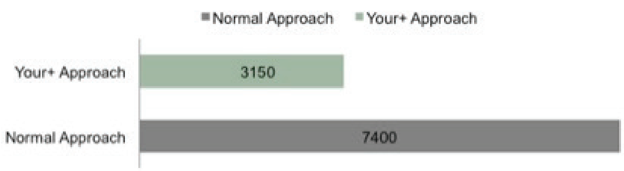
Several factors are financially beneficial for the residents of the your+ project. The most significant ones are the rental cost reduction and the subsidy from the canton for socially beneficial cooperative residential buildings.

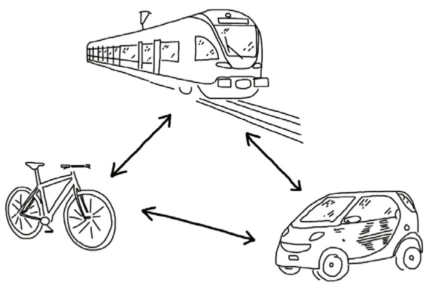
Support from the Canton

The land on which the your+ project is planned on is owned by the Canton of Lucerne and would be granted for the use of a cooperative including planning permission. This can drastically decrease the cost of implementing the project.

Savings through Sharing

Since the your room and the our room are used by several people, the costs per m^2 are also shared and therefore significantly reduced. To make living in a your+ building also affordable for people with little or no income, residents can perform services for the community in order to reduce their rent. For example a student who is studying could keep an eye on the children of a family or an unemployed resident could be in charge of maintenance. This cooperative approach to labor that is by definition non-profit oriented, is also an important factor in reducing costs. *Further information: PM#6 chapter 1.4.*





Img 9 Transport-related CO_2 emission with and without the your+ concept (g/day/pers.)

Img.10 Transport mix

6.3 Bioclimatic Strategies

The spatial concept of the space⁺, a hot and cold water tank, phase-change materials (PCMs) and adjustable shading, build the foundation of our passive energy system. The tanks act as thermal energy capacities and balance out temperature differences in the interior. The interior, PCMs support passive cooling by absorbing heat and the adjustable shading regulates incoming radiation. SIA regulations for our project require energy used for heating to not exceed 239 MJ/m^2 for one year. The applied measures contribute to achieving a heating energy consumption that amounts to 165 MJ/m^2, which is 31% less than the maximum. The space⁺, the central buffer zone, provides a channel for air and controlled daylight to the interior living spaces.

Project`s Envelope

The envelope of the prototype is an important barrier to protect the comfort conditions from exterior influences. Composed of glass, wood, steel and insulation, it is aesthetically pleasing and architecturally recognizable while providing a sealed, thermally sensible barrier. The wood in the envelope is silver fir, a locally sourced Forest Stewardship Council (FSC) certified wood. This allows us to reduce transportation costs and limit our CO_2 footprint. *Further information: PM#6 chapter 6.5.* and *see Img 12.*

Glazing

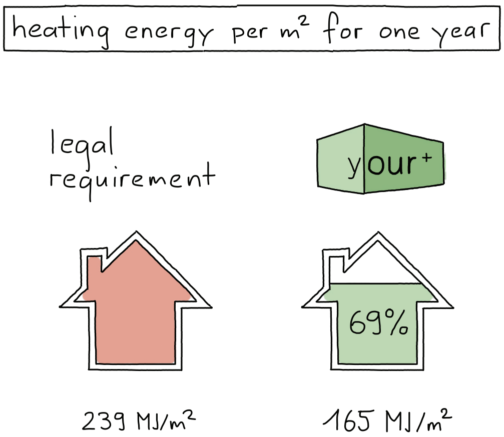
All windows and doors are WoodStar WS1® by our sponsoring company EgoKiefer. For the exterior triple glazed openings, an energy loss factor of only 0.5 W/m^2 is achieved. Triple glazing was used due to its superior insulation and thermal stability factors. Openings inside the structure are double-glazed. The interior glass has a higher energy loss factor of 1.1 W/m^2. The lower reflection rates of the interior windows make for a more comfortable living environment and cost less than triple glazing without sacrificing significant sound insulation or performance.

Daylight Use

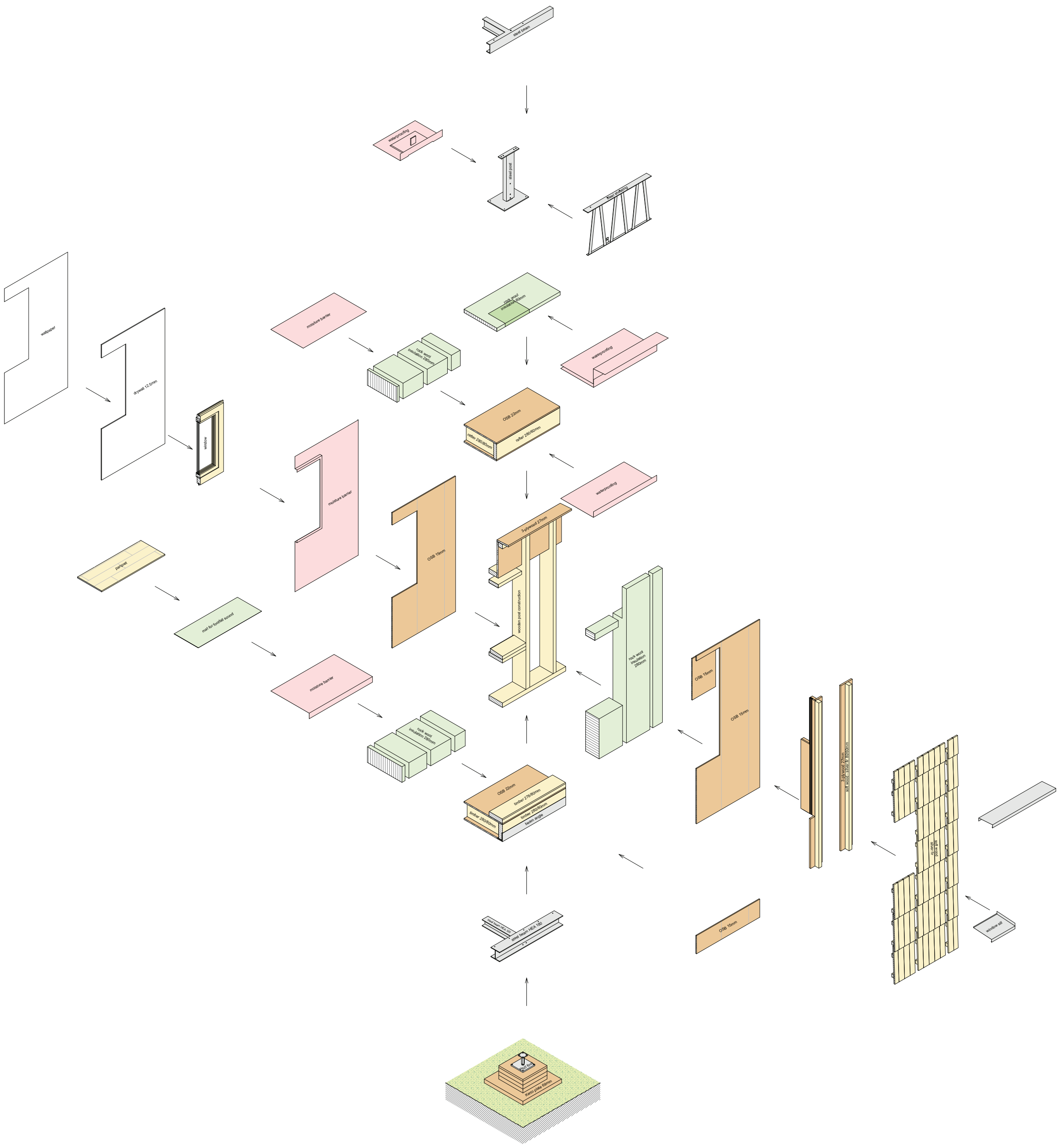
With the sun providing solar energy in the form of radiation, daylight plays a significant role in managing both interior lighting, and passive heating/cooling.

Sun Hours

The prototype is arranged in a way that limits the amount of light into my room, and maximizes light into the space⁺, your room, and our room. This promotes a relaxing atmosphere in my room and energizes public areas such as the space⁺, your room, and our room.



Img. 11 Heating energy



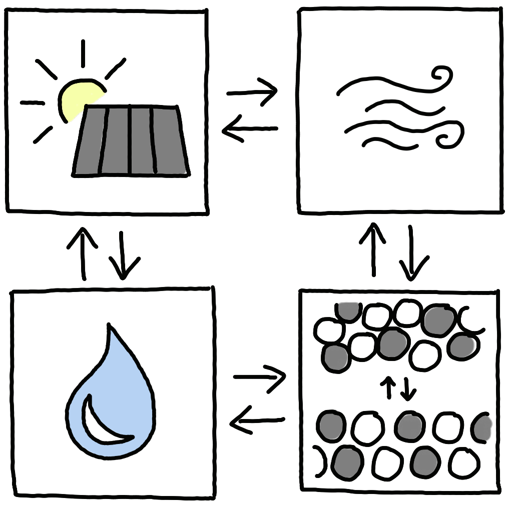
Img. 12 Blow up of structural and constructive components

Passive Heating

The sun provides us with passive heating power in the form of radiation, which is utilized effectively in our prototype. The adjustable shading system in the space⁺ ceiling allows us to regulate the amount of solar irradiance into the interior. If the temperature in the rooms drops, hot water from the storage tank can run through a piping system in the ceiling to release heat. The hot water is mainly heated up through solar collectors and in the case of additional heating requirements, a heat pump is operated. However, our prototype will focus more on cooling as we are more likely to maintain our comfort temperature with passive internal heat sources such as: humans, animals, cooking, etc.

Passive Cooling

Cold water from the storage tank can run through a piping system, *as mentioned in 3.4* Passive Heating, in the ceiling to absorb heat from the interior during warm days. It is released to the en
vironment during the night to restore its capacity and provide us with free cooling. If additional cooling power is required, a heat pump is operated. PCM material installed in the ceiling of space⁺ is utilized to facilitate passive cooling by absorbing heat from the inside. The space⁺ also allows users to open doors and windows to the interior of the building and allow cool breezes to flow throughout the living area, while the shading system can be set to reduce incoming solar radiation.



Img. 13 Passive elements

Space Planning

Our concept revolves around spatial planning. Sharing common areas significantly reduces users' environmental impact while not sacrificing square metres of liveable space. With the space⁺ and your⁺, everything is designed around the platform of sharing.

Thermal Energy Storage

Thermal energy will be stored using phase change materials (PCMs), which capture and store thermal energy passively. PCMs will only be used in the space⁺ of the prototype because small temperature ranges prevent the material to work effectively in the remaining rooms. In the urban building context, however, PCMs will be installed in all rooms.

Due to the nature of the different building materials, PCMs will only be used in the space⁺ of the prototype. In the urban project we will use a geothermal system which allows us to store excessive heat in the ground and use it during winter months. *Further information: PM#6 chapter 6.5 and chapter X.*

Ventilation

Each room can be separately regulated by opening doors and the space+, giving users greater control over their comfort conditions.

Our buffer zone space+, allows air circulation and passive conditioning. On warm days the roms can be left open to allow for a cooling breeze to disperse the warm air. During winter, the zone can chanel warm air into the rooms to balance the temperature. The heat flow between rooms can be regulated by opneing or closing connecting doors. Additionally, a decentralized air system allows us to control air ventialtion between rooms.

Hybrid or semi-passive Systems

Joulia

Developed and designed in Switzerland, the "Joulia" shower in our prototype transfers remaining heat from the warm water that runs down the drain to warm up incoming water, reducing electrical power consumption. An average family of 4 in Switzerland saves 990 kWh in one year (daily showers, with 15l/min water flow), (joulia.com). *See PM#6 chapter 3.3*

Exterior Design

Aiming for a minimal environmental footprint, the exterior was designed to use locally sourced wood cladding and other local materials. Above the buffer zone is a movable blade system that controls the desired light penetration. The wooden panels are easy to replace individually, allowing a saving in material waste and optimizing the maintenance of the prototype.

6.4 Construction System

While construction is a one-off occurrence in the life-time of a building, it is vital in terms of sustainability. With our modular and prefabricated building system we eliminate unnecessary waste and improve construction processes.

Social Aspects

The outside of the prototype has different elements to promote social activities. For example, the sharing boxes containing toys, bike helmets and other things are integrated in the buildings' envelope. A large slate surface where residents can share their ideas acts as a catalyst l for discussions and social activities.

Resources

Initially a construction with concrete, bricks and slate was considered. Several reasons lead to the final wooden construction. After realizing the extent of inertial properties of mass-intensive materials like concrete with respect to heat storage, a different solution had to be found. Also, the incorporated energy and the energy required for transportation would have been too high. This was also the reason why a pure steel construction was rejected. Vacuum insulation elements were considered, but their high amount of embodied energy presented a huge disadvantage. The focus was then directed to a wooden construction. Wood is a logical choice as a core material for the construction because it is a renewable resource of which an adequate supply exists in Switzerland. In addition, Switzerland has strict regulations to ensure sustainable forest management. In the wood industry large amounts of waste material occur since customers expect the best quality and pure surface structure for boards. Such waste can be avoided by using different wood qualities in different parts of the construction. All the wood we used originates from local sources with sustainable forest management certified by the FSC (Forest Stewardship Council) label, guaranteeing a source with sustainable forest cultivation. The construction is supported by steel beams. For a comparison of the environmental impact of the different material options. *See PM#6 chapter 6.5*

Economic Benefits

Having local materials and manufacturing yield is both ecologically and financially beneficial. The setup takes place next to the university campus and a local contractor executes the pre-production of the wall, ceiling and floor elements. At the urban project at Industriestrasse the building shell is constructed following a similar process. The outermost layer is built in a way that allows relatively simple replacement of small parts, reducing the waste occurring if an element is damaged.

Transportability

The house will be constructed in a manner that allows us to dismantle it into several flat elements as well as seven building-modules. This allows us not only to transport the house efficiently in only five trucks (excluding equipment), but also to have an efficient construction in the Solar Village. Reducing the empty space in the trucks is important to decrease the CO_2 impact of transportation, since any additional truck would drastically increase the total emission.
Further information: PD#6 IX

6.5 Materials

Sharing space allows us to significantly reduce the material needed per person. Instead of building an office and a living room per household, we build one room, which can be utilized by different users for various tasks. Material selection is based on longevity and source location, as well as the ability to perform its required task. The incorporated energy per person will distribute more evenly in the urban concept since more people can live in the appartments than in the prototype.

Green Materials

When selecting our materials, we focused on renewable and recyclable materials. We limit the embodied energy of the material by using Swiss wood cladding and inner elements. The following materials are evaluated against options that were considered alongside the designing process. The reason for the final decision is explained.

Wooden elements/cladding

Wood, in our case silver fir, is used for all elements and cladding. Acquisition costs of locally sourced wood exceed alternative options, but perform significantly better in terms of transportation efforts and CO_2 emissions. In comparison to fabricated materials, wood is cheap and ecological, as well as easy to replace and maintain. Our outer structure allows individual elements to be removed and replaced if needed.

Steel frame/foundation

Steel is a sensible choice for the prototype due to its high tensile strength and flexibility. It is easier to transport than concrete, and with adjustable steel feet, easier to level and use on an unknown terrain such as Versailles. For our urban building concept, concrete made from recycled concrete from local demolition would be used. Concrete is recycled at a rate of more than 80% in Switzerland. (FOEN)

Plasterboard/PCMs

In the prototype, Alba Rigips phase change material(PCM) is used inn the space^{+} lattice ceiling to store thermal energy and passively assist in a stable comfort temperature. Locally produced in Switzerland,the plaster/PCM is the best choice for use in the prototype.

Rockwool

Rockwool is an affordable, light insulating material. Because of the modular design of our prototype, we used rockwool as an insulating material due to its flexibility and durability. Sections can be removed and replaced with ease. In comparison, cellulose blown in fibre insulation is difficult to maintain if elements are changed or moved, but superior in terms of insulating properties and ecological impact. For the long term urban concept, cellulose would be used.

Incorporated Energy

The incorporated energy varies greatly between proposed materials. As material choice differs between the Urban concept and the prototype, we have shown some of the differences in energy and impact. The main materials as listed in the materials section are compared using the tool SimaPro.
Further information: Appendix 17 Simapro graphics

Incorporated CO_2

Strategies to reduce CO_2 rely heavily on material choices and reducing the living area per person. Using a modeling of various Swiss built structures we calculate the CO_2 of the m^2 living space. Our calculations leaves us with a reasonable estimate of 30kg CO_2 per m^2 per annum. Using recycled material and sustainable construction techniques will reduce this, but we wanted to be able to use a Swiss standard value as a benchmark.
Further information: Appendix 18 CO_2 Emission analysis

Maintenance Plan

Heating / Cooling

Material	Control Period	to do
Re-cooling Device	annually	Visual check
Heat Pump / Cooling Device	annually	Visual check, refrigerating medium check (pressure), function check
Solar Collectors	annually	Visual check, pressure check
Domestic Hot Water Station	five years	Scaling heat exchanger, function check
Circulation Pumps	three years	Visual check, motor check, electrical check
heat/cold meter	annually	read out => optical check

Air Conditioning

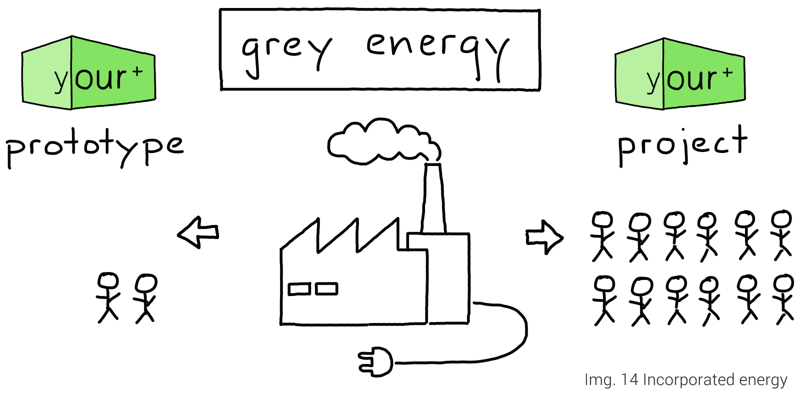
Material	Control Period	to do
Filters	annually	replace, Visual check
Air Conditioning device	annually	Visual check, function check
Air duct	five years	cleaning with a brush, Visual check
Air inlet	annually	Visual check, maybe cleaning
Air outlet	annually	Visual check, maybe cleaning

Sanitary

Material	Control Period	to do
Tanks	annually	Visual check, cleaning
Raising Pump	annually	Visual check, pressure check
Filter	annually	Visual check, replace
Faucets	annually	cleaning fine filters

Structure

Material	Control Period	to do
Facade	anually	Visual check
Beams	anually	Visual check
Foundation	anually	Visual check-level check
Roof	anually	Visual check-waterproofing test



Img. 14 Incorporated energy

6.6 Active Systems and Equipment

An automated active system leads to efficient energy mangement. Software solutions specifically designed for your+ control not only the HVAC system, but also other equipment such as our high efficient household appliances.

HVAC

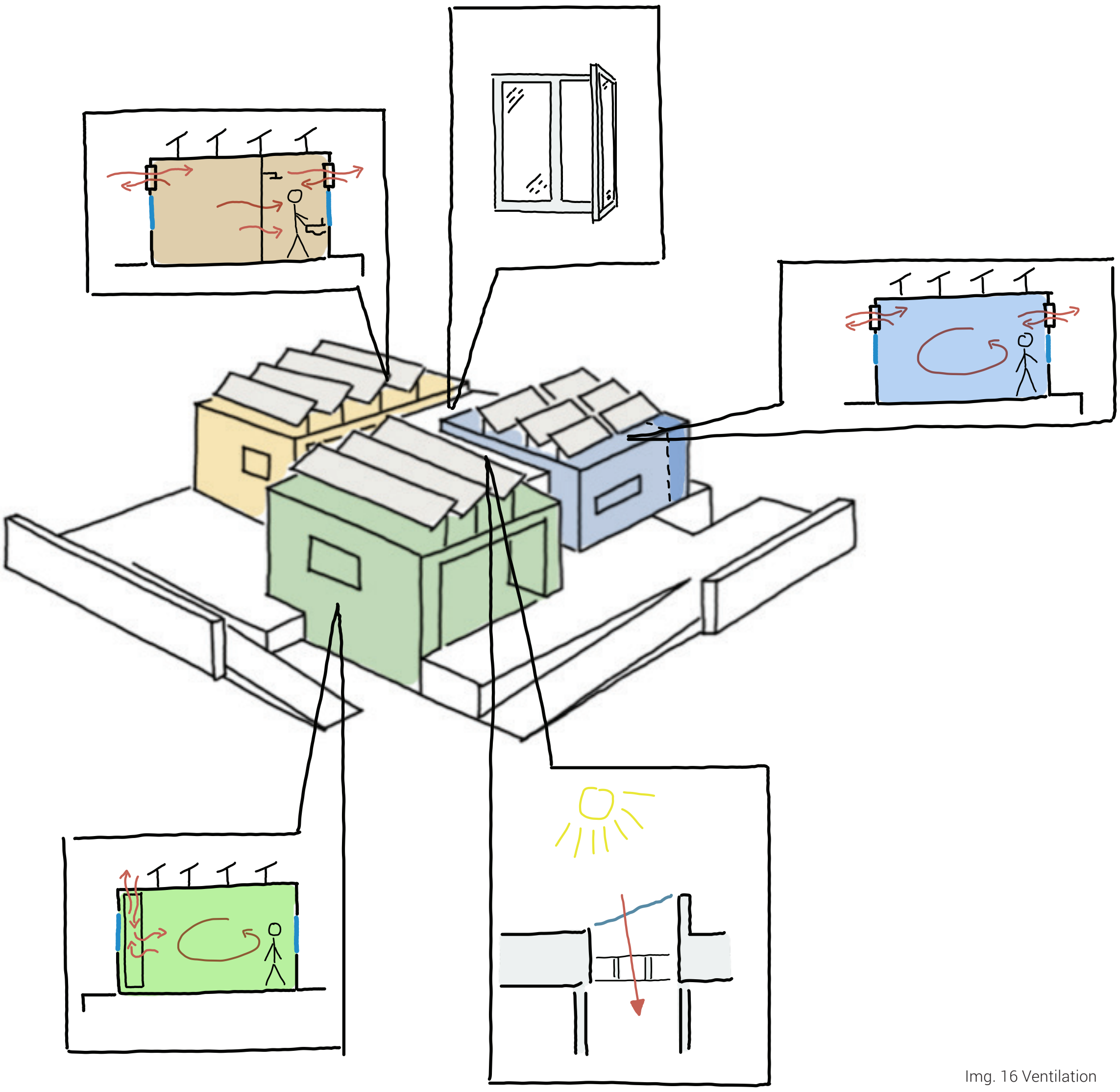
Ceiling elements perform heating and cooling functions. The system used allows fast and flexible adaptation. The rooms are individually controlled, which allows processes where one room is cooled while the other is heated. This is necessary since our sharing concept results in a high variety of use cases. A room containing an active group of people requires less heating or more cooling than a less occupied one. The heat for heating up the room is gained from the solar thermal collectors and, if needed, using a heat pump. Similarly, the cooling is executed by a re-cooling device on the roof, utilizing evaporation cooling. If this does not suffice, a chiller is connected. The stored fluid is exposed to the cold air at night, releasing the absorbed heat to the surroundings. The energy required for heating is 165 MJ per square meter and year. This is 31% less than the limit of 239 MJ from SIA (Swiss Society of Engineers and Architects).
A decentralized ventilation system is used. This avoids a system of pipes throughout the house, reducing the required space and material. All ventilation elements contain heat recovery in the form of a cross heat exchanger. The element in your room additionally recovers the humidity. Decentralized ventilation also allows us to adapt the ventilation easily in different rooms to avoid unnecessary efforts in individual rooms. This is especially important since the performed activities in our rooms differ from person to person. Rooms where several people are active require more ventilation compared to a room with one person reading a book.
The heating and the ventilation system is subject to an automated process. Sensors measuring the temperature control the heating and cooling. Sensors for CO_2, VOC (volatile organic compounds) and the humidity deliver the data that is used to control the ventilation system. *Further information: PM#6 chapter* and *see Img. 15.*

Household Appliances

The washing machine installed is the model Adora SLQ WP from VZUG. Besides being very energy efficient (EU Energy-Label: A+++), the machine is produced in Switzerland, reducing transportation energy. The same applies to the dryer Adora TSL WP (EU Energy-Label: A). The machines are placed in your room, indicating that in the case of the conceptual project, one washer and one dryer are shared between several individuals. *See Img. 15.*
The warm water the appliances consume requires no electrical power, as the water is heated up

Appliance:	Location:	Model:	Energy label:	Performance:
Washing machine	Your Room	V-Zug Adora SLQ WP	A+++	2300 W
Washer dryer	Your Room	V-Zug Adora TSL WP	A	1300 W
2 induction hobs	Our Room	V-Zug GK26TIMS		3700 W
Exhaust hood	Our Room	V-Zug DV Minair Comfort 120cm		400 W
Oven	Our Room	V-Zug Combair XSL	A	3300 W
Dishwasher	Our Room	V-Zug Adorina 45-Svi	A++	2200 W
Refrigerator-freezer	Our Room	V-Zug Prestige P eco	A+++	154 W
Television	Our Room	LOEWE Content ID 40		95 W
2 speakers	flexible	B&O Beolit 12		6 W

Img. 15 Household appliances



Img. 16 Ventilation

centrally. *Further information: PM#6 chapter 6.7.* The different household appliances are listed *in Img 13*. Since the power supply is limited to 230V it is important to schedule the use of the household appliances to prevent blackouts. This is done using a building automation system. *Further information: PM#6 chapter. 3.4*

Artificial Lighting

Our concept of sharing leads to a great variety of activities to be performed in the rooms. This poses a challenge as different activities require variable lighting. Therefore, a flexible lighting system had to be developed. Two basic concepts were discussed; portable lamps and hanging lamps with adjustable height and intensity.
A room-specific solution was chosen. your room is equipped with a system of adjustable light fixtures. The position and intensity of the lamps can be set depending on the current need. Places like the kitchen, bathroom or workspaces, which do not experience a high variety of use-cases, are equipped with fixed lights. For the my room and space⁺, a portable lighting system was developed. Using near field magnetic resonance, the batteries of the portable lights can be powered and charged easily. The lamps can be mounted on a charging station or, once charged, taken to where they are currently required. They are also equipped with USB ports with which mobile phones can be charged. For the production of the portable lamps LEDs with an exceptionally high efficiency of 100 lm/W were used. The lamps have two states to run in, a bright white with a light temperature 4000K and an RGB state with adjustable color. The states and colors are controlled by a touchscreen interface. The light temperature of the fixed lighting is 2700K for all rooms except for the kitchen where the temperature is 3000K. Being slightly higher than a regular bulb 2700K corresponds to a comfortable late-afternoon sunlight.

All our lamps are LED luminaries. LEDs are not only very efficient light sources but have also a exceptional high life expectancy. The switches we use are based on PIR (Passive infrared) which are turned on by a switch and then automatically turn off after 10 minutes of inactivity if the lamp was not turned off manually before. This avoids having sensory which run constantly and helps decreasing the energy consumption while providing a high level of comfort and control.
See PM#6 chapter 2.3 and *Img. 17.*

Model	MOVE IT 45 square	INEO 90 Recessed	INEO 90 Recessed	INEO 90 Recessed	MOVE IT 45 system INSET OPAL	MOVE IT 45 system INSET SIMPLE	MOVE IT 45 system INSET TULA	CUBU-150	portable laps (Special creation)
Room	**my room, our room**	**our room**	**our room**	**our room**	**your room**	**your room**	**your room**	**space⁺**	**all rooms**
Quantity [pcs.]	25	1	2	4	4	4	3	11	4
Consumption per piece at full brightness [W]	5	3	9	12	11	5	5	11	4 OR 16
Light output [lm]	230	203	609	812	520	230	230	700	400
Efficiency	46	68	68	74	47	46	46	64	100 OR
[lm/W]									25
Color temperature [K]	2700	3000	3000	3000	2700	2700	2700	2700	4000 OR adjustable

Img. 17 Table of lighting used

Domestic hot Water

The your⁺ prototype and the project do not have a hot water tank. In the prototype all freshwater is stored in one tank, in the project all water is drawn directly from the fresh water supply. The water for the appliances requiring hot water is heated up instantaneously with heat from the solar thermal collectors. If the collected heat does not suffice a heat pump is used to deliver the required heat. Not storing the water primarily saves space, which should be used as efficiently as possible in your⁺. Even highly efficient storage products have losses. These can be avoided with direct heating. Also the risk of legionnaire´s disease, as no water is stored in the case of the project, while the prototype only uses fresh water. *Further information: PM#6 chapter 3.3 and 4.1.*

Information Technology

Producing IT products uses a considerable amount of resources. Especially materials like rare earths are barely recycled in today's IT products. This emphasizes the importance of choosing high end products with a long life expectancy. This is valid for computers, audio and video equipment. This led to the following product range:
Computer: Two iPad tablet computers from Apple.
Audio: Portable speakers from Bang & Olufsen.

Power Storage

Excessive power produced by the PV system is stored in the following batteries. The main storage is a hybrid inverter by Bosch (model: Bosch BTS 5 Hybrid Inverter) with a capacity of 6.6 kWh. Almost 1.2 kWh are stored in e-bike batteries. There are 3 e-bikes from Stöckli (model: ET) with a capacity of 396 Wh each. Additional 0.2 kWh will be stored for later use in portable devices such as lamps, laptops and other small electrical devices. The total storage capacity amounts to 8 kWh.

6.7 Solar Systems

A combination of solar-thermal and photovoltaic systems is installed for a sustainable energy supply. With those, the prototype can create enough energy to have a net-zero average annual consumption..

Photovoltaic

Solar facilities are an important part of our energy strategy. When deciding for a photovoltaic (PV) system, a compromise between the complexity of the system and its power yield per m² PV panel had to be made. We chose a single-axis system that tracks the sun from east to west. With a higher power yield, the tracking also has advantages for grid stability, as it flattens peaks occurring during the daily cycle. A multi-axis system was not chosen due to space requirements. PV on the side of the building envelope was considered, but later discarded because shadows cast by other buildings decrease the power yield. *See Img. 20 + 21.*
14 PV panels (model: X21 335 BLK, SunPower) are installed on the prototype. With an efficiency of up to 21%, a panel yields a nominal output of 335W. The total installed panel area is 16.3 m². The following table shows selected key data for the used model.
In case of the project, static horizontally mounted PV elements would be used. This way the maximum power output per m² coverage is achieved which is weighted higher in such an application. Especially since the total power produced is the key factor for most labels or certifications.

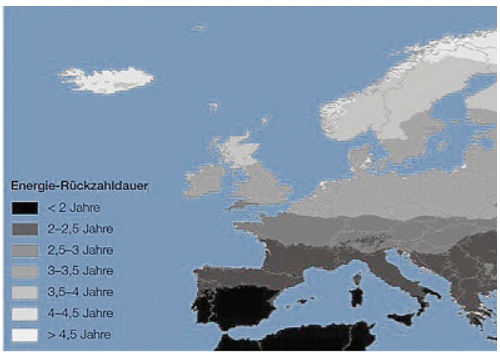
Energy Recovery Time

Sunpower was not able to provide figures on the energy consumption and CO_2 emissions occurring during production. Therefore, standard figures are used for the calculation.
Img. 18 (created by ESU-services GmbH) shows the energy recovery time of PV systems with 1KWp.

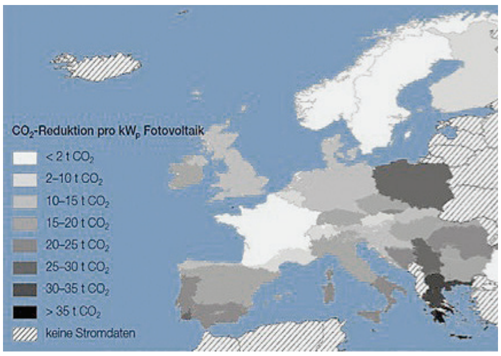
CO_2 Recovery Time

Img. 16 shows the average CO_2 savings potential with respect to the country's energy production average is depicted. The numbers are calculated for a system with 1kWp over a period of 30 years.

Switzerland's CO_2 emission in electricity production is relatively low. About 55% of the electricity production originates from hydropower (natural and pump storage) and 38% from nuclear power plants. Therefore, as visualized figure 16 CO_2 reductions are not as significant as for other countries, but nevertheless considerable.
Further information: PM#6 chapter 3.5.



Img. 18 Energy recovery time in Europe



Img. 19 $C0_2$ savings with PV in Europe (1kWp, 30 years)

Power output per day	kwh/day
Annual average	13.6
Summer average	22.6
Maximum output	43.3
Minimum output	4.7

Img. 20 Table of performance simulation

Nominal output (W_{max})	335
Peak power per Area (W/m^2)	210.9
Rated voltage (V_{mp})	57.3
Max. current (I_{mpp})	5.85
Open circuit voltage (Voc)	97.9
Short circuit voltage	1000V IEC & 600 V UL
Temperature coefficient of Pmac	-0.3 %/°C
Temperature coefficient of Voc	-167.4 mV/°C
Temperature coefficient of Isc	3.5 mA/°C

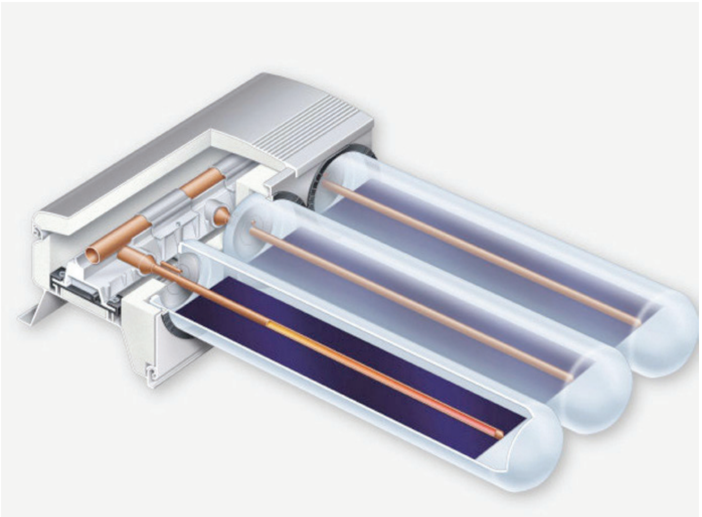
Img. 21 Table with key figures

Solar thermal Collectors

Solar thermal collectors are used in addition to the photovoltaic system. For the prototype vacuum tube collectors from Viessmann will be used. A total of 4.5m^2 of thermal collectors will be installed. The collected heat is used for heating and for heating up the domestic hot water. The thermal storage into which the heat is transferred amounts to 0.85 m^3. The storage system automatically starts pumping water through the system if the temperature in the collectors is higher than in the storage tank.
In the project, the additional heat generated with the hybrid PV cells will be used during summer to -regenerate the geothermal probes. Therefore the annual energy shift reappears in the solar thermal concept. This technology cannot be used for the prototype, as the heat cannot be stored geothermally. *Further information: PM#6 chapter 3.7.* and *see Img 22.*

Accessibility

The single axis system reduces maintenance requirements to a minimum. A main switch blocks the motors and shortens the circuit so that maintenance and cleaning can be done in a more convenient and secure way. The panels are accessible with a ladder leading onto the roof. In the urban concept, stairs lead to the roof.



Img. 22 Solar thermal collector sectional

6.8 Water

Although the local context water is plentiful, maximum water savings were an incorporated into our design. The reduction of more than one third makes your+ more viable for areas with more water concerns.

Global Water Strategy

Switzerland usually does not lack water; only the Canton of Ticino, the most southern part of Switzerland, experiences a shortage in especially warm and dry summers. Therefore, Swiss people often tend to behave carelessly with respect to water consumption. Due to the low price of fresh water, the economic benefits for a private person to save water are hardly noticeable

Grey Water and Rain Water Systems

The following information is meant with respect to the project and the post-competition use of the prototype, since the extent to which our water is reused exceeds the limitations for the competition Our goal was to use as little fresh water as possible. Four tanks are used in the your+ prototype. One tank is used for the collection of rain water. Due to an average rainfall in Lucerne of 117.1 cm per month we built a water plan around utilizing this precipitation. Rain water will be used in several parts of the household. Having relatively clean air with only little pollution in Switzerland allows us to use the collected water with only little prior filtering. Rain on the glass roof is led onto one of the three other roofs where all water is collected and filtered for rough particles.
In addition, rainwater is used for wetting the recooling device for cooling purposes using heat absorption during the evaporation process.
The dishwasher and washing machine use recycled water from the rain water tank and for the first washing cycle. However, during the competition this will be prevented in order to meet the regulations. All grey water (i.e. water from the dishwasher, washing machine, shower and sink) is filtered and collected in a tank beneath the space+, ready for reuse for the wetting of the re-cooling device and watering the plants. The toilet is a special model (W+W by rocca) that uses water from the washstand for flushing, resulting in direct grey water reuse. The fresh water tank supplies the washer, the dishwasher, the shower, the sink and the washstand.
See Img. 25.

The washer and dishwasher are water-saving products from V-Zug.
Water coming from the toilet, dishwasher, and kitchen sink are led directly to the black water tank.
Further information: PM#6 chapter 3.3.

The water system of the your+ prototype and also the project would drastically decrease water consumption, especially since the largest influence, flushing of the toilet, will no longer use fresh water *See Img. 23 + 24.*

Waste Water Management

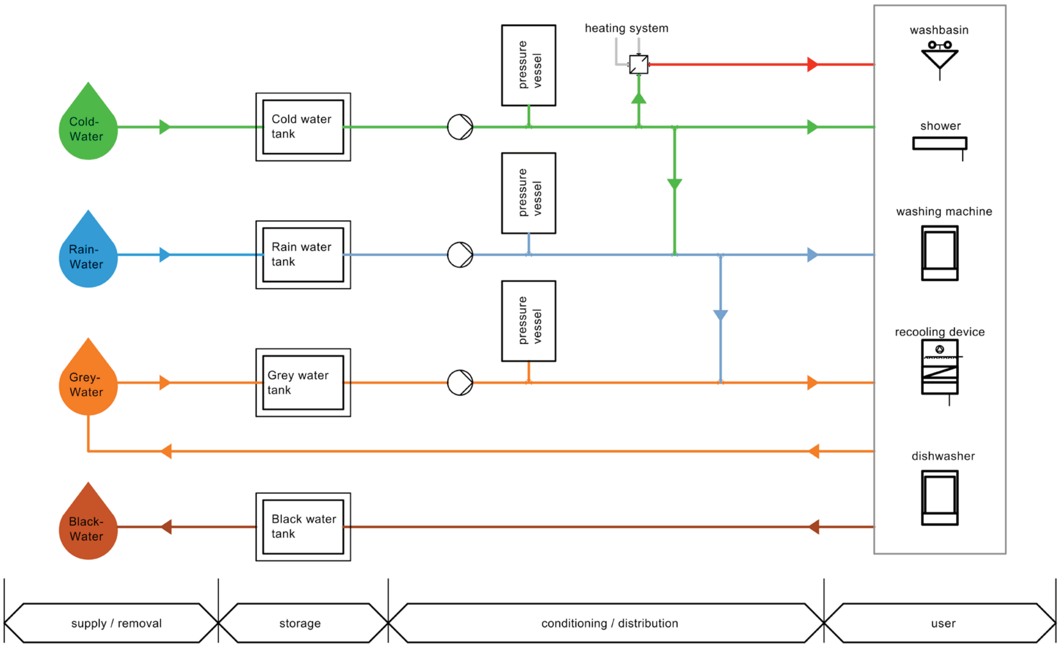
Water from the toilet is led to the black water tank. The other lines flow to the grey water tank. If the grey water tank is full, there is an overflow line also leading to the black water tank.

Total consumption	162 l/day
Toilet flush	47.7 l/d (29.5%)
Showering/Bathing	52.4 l/d (32.5%)
Washing machine	30.2 l/d (18.6%)
Cooking, drinking, dishwashing by hand	24.3 l/d (15%)
Other	3.8 l/d (2.3%)
Dishwasher	3.6 l/d (2.2%)

Img. 23 CO_2 Average water consumption in a Swiss household

Total consumption	106 l/day (-35%)
Toilet flush	0 l/d (0%)
Personal hygiene	52.4 l/d (49%)
Washing machine	22.5 l/d (21%)
Cooking, drinking, dishwashing by hand	24.3 l/d (23%)
Other	3.8 l/d (4%)
Dishwasher	3 l/d (3%)

Img. 24 CO_2 Average water consumption in a your+ household



Img. 25 Schematic diagram of the water flow

6.9 Solid Waste

An important goal of our construction team will be to reduce the construction waste while building your+. Pre-cut materials and modular building ensure efficiency in the construction process and limit waste. Switzerland currently recycles more than 50% of its produced waste according to FOEN (Federal Office for the Environment).

Construction Phase

We aim to keep the amount of solid waste produced during the construction phase to a minimum. Several useful methods of waste reduction are:

Pre-cut and size-specific material

Construction is optimized to standard industrial dimensions of building products like facade panels and wooden panels. Bearing structural components are limited to an economic use of materials. No complex structural details have been developed to stick with standard dimensions wherever possible.

Comprehensive project planning

Excessive orders can be prevented by following a clear and comprehensible planning approach for the construction process.

Proper storage and care

By ensuring proper care of construction materials we achieve a higher rate of efficiency and have no losses or damaged material.

Trained professionals

Many of the students have a technical background that proves to be a further asset in limiting waste. Recycled construction materials, like gravel sand, concrete granulate and mixed granulate from demolition waste, can be produced from mineral construction waste or sludge from street cleaning through the separation of impurities, crushing and classification in defined particle sizes. Reclaimed asphalt paving with a high tar content must undergo thermal pre-treatment.
Another interesting option for our project is to cooperate with abfallboerse.ch, a waste management website that allows users to acquire materials that are being disposed of by others.

Project Use

The recycling sector is a specialized sector that recovers products and raw materials from waste and reintroduces them into the production cycle. Bulk waste is recycled for the most part in Switzerland. If there are no suitable domestic recycling plants (e.g. non-ferrous metallurgy), the recycling is carried out abroad.
The waste management routes for different categories of materials are described by FOEN:

1. Green waste can be processed into compost following quality control or fermented with other biogenic waste, e.g. used cooking oil, to produce biogas. This waste is collected free of charge by the city twice weekly.

2. Metal waste like scrap iron and steel, but also other metals like aluminium and copper from industry and households, is collected separately and, following pre-sorting, processed into crude metals at steelworks or metal works.

3. Waste glass, paper and paperboard, plastic waste, waste wood, waste oil and solvents are generated during production or as a result of consumption and use. Following user driven collection, they are processed and reintroduced into the materials cycle.

4. Undamaged and functioning tires and textiles are sorted from separately collected waste and sold as second-hand goods.

5. Objects and devices with complex structures such as used vehicles, electrical and electronic devices, batteries and discarded chemicals undergo several treatment steps aimed at stripping the waste of hazardous substances and separating the recoverable fractions.

End of Life

Wood

Our building mostly consists of wood. Since we are using boards containing only natural adhesives, the wood is biodegradable and can be used for the production of biogas in a compost and fermentation plant. Wood without pollutants can also be used for the production of chipboards. Any other wooden products (i.e. plywood, painted wood, or similar products) have to be disposed of in a waste incinerator plant. The heat generated from combusting wood amounts to 21 MJ/kg and can either be used for district heating or to create steam and run a turbine that generates electricity.

Metals

All metals will be collected and recycled by the city. The energy consumes for recycling amounts to about 20% of its initial production energy. Primary production of low alloyed steels consume 31-34 MJ/kg. This would lead to 6.2-6.8 MJ/kg for recycling. Non-hazardous metals are sent to refinery and reintroduced to the supply chain. Any hazardous metals will be recycled following strict Swiss standards.

Household Appliances

According to the Swiss provisions of the Ordinance on the Return, Take-Back and Disposal of Electrical and Electronic Equipment (ORDEE), customers are obliged to return all machines in the category consumer electronics, office equipment, communications and household appliances at a collection station of the Foundation for Disposal Switzerland (Stiftung Entsorgung Schweiz , SENS) or the Swiss Association for the Information, Communication and Organisation Technology Industries (Schweizerische Wirtschaftsverband der Informations-, Kommunikations- und Organisationstechnik, SWICO). These associations are then responsible for environmentally friendly disposal/recycling.

Batteries

In order to lower the amount of batteries needed, we decided to use second life lithium-ion batteries (e-bike batteries) for the internal electrical energy storage . In Switzerland all batteries are defined as hazardous waste. However, a significant amount of the materials in batteries can be extracted during the recycling process and reused as raw material. According to Batrec, the leading battery recycling company in Switzerland, the following materials can be extracted: chrome-nickel steel, cobalt, manganese oxide, non-ferrous metals and plastic.

Management of domestic Waste

Switzerland enjoys high rates of recycling from its citizens, which is calculated in our domestic waste plan. Recycling rates according to FOEN in 2012 are:

• polyethylene terephthalate (PET)	81%
• glass bottles and jars	96%,
• tin plate	86%,
• aluminum	92%,
• paper	92%
• batteries	73%

Recycling stations for any material not picked up from the door are 5 minutes walking distance from our urban Industriestrasse location in Lucerne. There is a free collection service for paper, cardboard and organic waste. Paper is collected every fourth week, while cardboard and organic waste is collected weekly. Because these recycling services are free for the consumer and any remaining waste is charged by volume, all households have an economic interest in recycling waste. IGORA, the community for the optimization of recycling of aluminium packaging, offers free aluminium collection for businesses.

6.10 Life Cycle Analysis

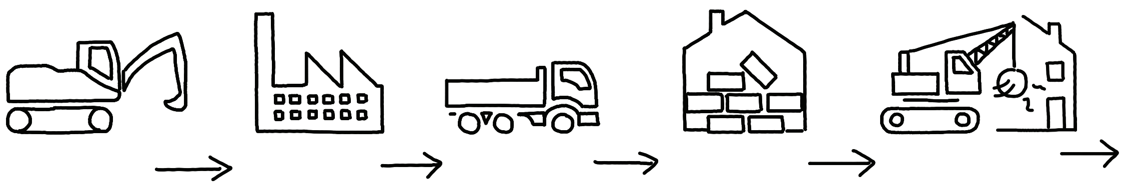
The results shown in the LCA are values for the Prototype built for competition in Versailles, and therefore not usable in terms of our concept, the urban buildings. We make a connection between our prototype and the building, but certain materials and innovations are not possible on a small prototype. We want to draw attention to the sustainability of space sharing and our sharing platform, not the specific materials used in the house. Nonetheless, we have compiled our data to provide a breakdown of our Prototype. Using a lifecycle of 50 years, our prototype has the following impacts and results based on Simapro and using the Ecoinvent database for information.

Parameters include:
• Distance to travel (km)
• Lifetime
• Total Mass over the whole lifetime (t)
• Transportation Impact (tkm)
• Landfill/Incineration/Reuse
• Transportation impact of reuse (tkm)
• Energy for Reuse (MJ)

The following values have been calculated from our data.

• Energy cumulative demand (especially non-renewable energies)
• Climate Change indicator
• Results per year, m^2 of floorspace and by occupant

Further information: Appendix 17 Simapro graphics



Img. 26 Life Cycle

Swiss Tools concerning Sustainability

Labels are a good way to compare a building to others. The highest standard for sustainable building in Switzerland is Minergie-A-eco. We take steps to assure our prototype is compliant with this standard, as detailed in the following chapter.

Standard for Sustainable Building in Switzerland

The Standard for Sustainable Building in Switzerland (SNBS) is a guideline on how to design sustainable buildings. Its criteria are split into the three dimensions: society, economy and environment. Each of these contains four sections with one to five sub-parts. The SNBS is not a label assigned to a building, but rather a reference for real estate owners and architects to evaluate the performance of their building. The criteria also contain the relevant factors for the Minergie label, but the scope is much broader since it also deals with social aspects and the context in which the building is implemented. The SNBS is reflected in most aspects of the sustainability of the your+ project and the prototype.

Minergie

The your+ prototype will have a Minergie-A-ECO label as well as perhaps other labels. The certification process started on February 26th, 2014 with the submission of documents to the Minergie Association Switzerland. A provisional certificate was granted, proving that the prototype is built according to the expected regulations. The final certificate could not yet be assigned as the measurements, such as the blower test proving the air density could only be performed shortly before the contest.
Further information: Appendix 16 Minergie certicicate

Minergie and Minergie-P

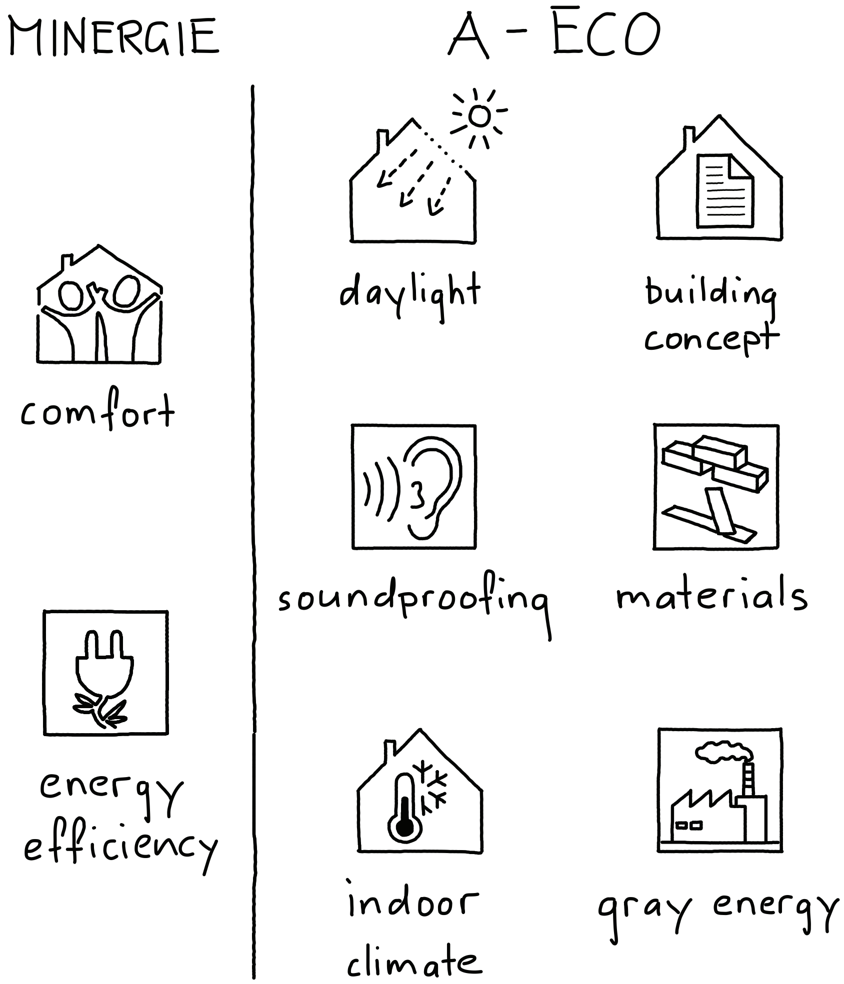
Minergie is the most influential label in Switzerland. Residential buildings aiming to be awarded the Minergie label must have a weighted energy indicator less than or equal to Minergie-P. In this indicator, electricity is weighted twice as high as fossil fuels and solar energy is not counted at all. A ventilation system is required. In addition, at least 20% of the energy required for the DHW must come from renewable sources. The building envelope must contain at least 20-25 cm insulation. The energy required for heating must not exceed 90% or 60% for Minergie and Minergie-P respectively, of the maximum consumption required by law. This is currently the case. With respect to the Minergie label, household appliances with an efficiency label of at least (A) are recommended, and compulsory for Minergie-P. Minergie-P buildings must not exceed the costs of a building with a comparable size by 15%. In order to support innovative and economical solutions, the Minergie label is only assigned to buildings that exceed the cost of a building with similar scale by no more than 10%.

Minergie-A: Net zero or plus energy building

Minergie-A: Net zero or plus energy building
Most the criteria of Minergie-P also apply to Minergie-A. Having an average net consumption of zero or even feeding energy into the grid is a main criteria for Minergie-A certification. Since it is self-supplying, the importance of the energy consumed is reduced and therefore the energy required for heating must not exceed 90% of the maximum consumption required by law. At 69%, the prototype performs much better than required. In absolute values, the maximum allowed consumption for heating is 239 MJ per square meter and year. The prototype only uses 165 MJ per suqaremeter and year. The air tightness must meet the requirement of a maximum air exchange rate of 0.6/h. All household equipment must be from the highest available label class. Unlike the other Minergie classes, Minergie-A has no limitations regarding the additional costs resulting of the efforts made to meet the energetic requirements, allowing more innovative solutions.

Minergie-Eco

The Eco extension has two main parts: health and building ecology. The health part defines a minimal amount of daylight entering the building, the maximum sound level entering, the maximum amount of pollutant emissions from the used materials, and the limitation of ionizing (radon gas) and non-ionizing radiation (electro-smog).
See Img. 27.



Img. 27 Minergie / A-Eco

7 Communications Plan

Project Summary

"smart sharing – our vision is **your⁺**"

The growing consumption of resources, increasing use of space and inefficient use of energy are currently a major issue in Switzerland. Our solution is "smart sharing". We create a platform that allows us to distribute and exchange services, space, objects, devices, mobility, energy and other items. In our housing concept, inhabitants can get as much privacy as they need, but can share everything that makes sense for them to be shared. your⁺ suits the increasing demand for flexibility and individuality, while creating added value on various levels.
On a social level we enable exchange, trust, integration, identification with the local environment and other significant surpluses optimizing social synergies. Such benefits are generated through the technical interactive platform consisting of databases, clouds and apps. On a structural level the infrastructure and architecture is adapted to the functionality of our concept and the needs of the inhabitants.
Therefore our prototype is an example of how the concept can be implemented in a dense urban context by remaining connected to the environment on different social and technical levels.

Space and Energy

Although energy efficiency is continuously improving in the field of construction in Switzerland, the overall energy balance remains poor. The reason for this is the growing population and constantly emerging requirements, especially ever-increasing living-space demand per person, which already stands at an average of 45 m^2 today. So our vision of "smart sharing" addresses current challenges: population growth, increased land use and the burden on resources and the environment. Our vision cleverly shares rooms and creates a smart sharing base for exchanging objects and services, as well as using mobility in a flexible way. The principle of the cooperative, which has been firmly anchored in Swiss culture for centuries, serves us as our conceptual basis and focuses on the principle of common wellbeing. So we are leaning on the economic, organisational and communal principles of cooperatives.

Excellent Urban Location in Lucerne

For urban planning implementation, we chose the exemplary location of a heterogeneous quarter in Lucerne with an ideal infrastructure. The concrete site in Lucerne provides insight into local and cultural aspects of implementing the general idea of "smart sharing". Our new replacement construction plans four different buildings that densify and network the surroundings in a complementary way.

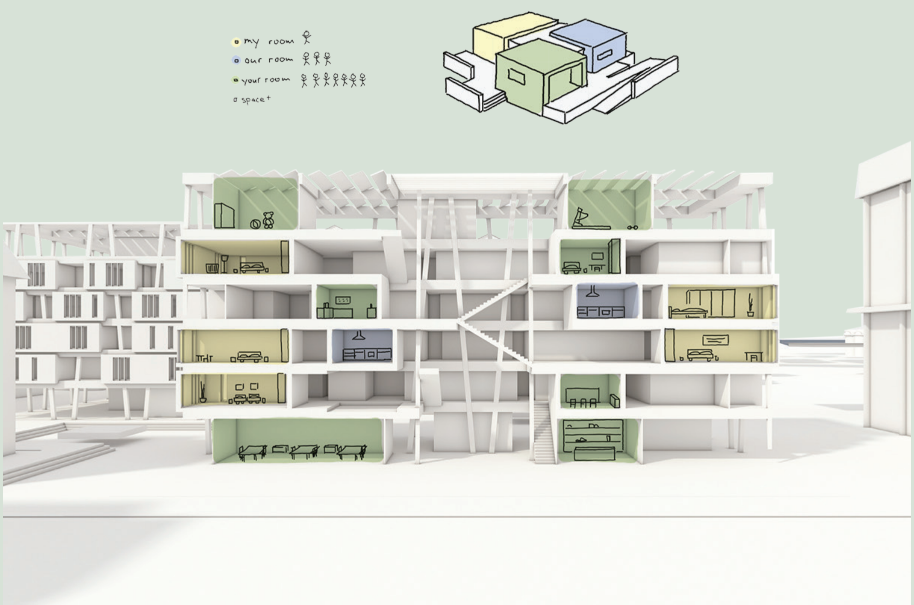
Flexible Room Usage

Our project shows three example types of rooms as part of an urban building, each room with different uses:
my room – the private bedroom with bathroom as an individual retreat for one or two people.
our room – the kitchen shared with the my room-neighbours, depending on the target group and living situation, e.g. family (private), shared apartment (communal), commuters (no kitchen).
your room – the communal shared space with specific use, e.g. guest room, music room or a studio. It is public for all members of the cooperative – since everyone is able to rent it according to his/her requirements.

Social, Economic and Ecological Added Value

That creates added value such as the efficient use of space, social synergies, flexible use potential and low overall rent costs. The three different room types are connected by the space^{+} as an accessing and communal area for living, staying and working. It is a public meeting area from the ground floor to the rooftop terrace.
On the technical level we plan an area network that includes anergy (heating and cooling) and a smart grid (electricity) to create an open, adaptable infrastructure. From that urban planning context, we present one example of each room type and developed them in our prototype for the competition in Versailles. We want to demonstrate the structural, social and technical levels with various communication elements and present our vision:

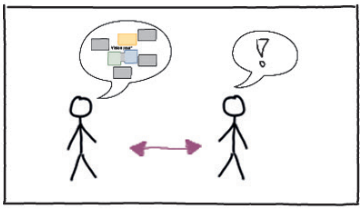
The "smart sharing" of space, objects, energy, services and mobility is our innovative, sustainable vision – and your^{+}.

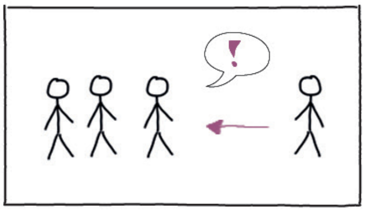


Interaction through Communication

Our vision is to create a new living concept and to establish a platform for "smart sharing". We thereby provide a better living standard with less wastage of resources.
To establish this vision and announce the project, we use a wide range of channels to communicate the participation of Team Lucerne – Suisse at the Solar Decathlon Europe 2014 in Versailles.
To ensure a consistent communication we evolved a styleguide and guidelines. Our main means of communication is our website with a live cam of our building site. Internal and external university events are held by our interdisciplinary team to raise awareness of our project. On the building site next to the campus we have a visitor platform to show our current status and provide information. Another highlight is on campus, where we present our project to other students and lecturers using our infobox, which communicates our latest activities.
Through our Public Tour Description concept we aim to present information playfully and easily, conducting 4 types of tours to cater to the individual requirements of our target groups.
The Sponsorship Manual shows how we accredit sponsors and project partners to implement the project.

"smart sharing" means an active and interactive know-how transfer.





7.1 Communication Project

This part of the project manual shows the communication project of Team Lucerne – Suisse for the Solar Decathlon 2014 in Versailles (France) in detail and how the team communicates before and during the contest. It involves an analysis of the situation by using a SWOT diagram. Furthermore, the communication objectives are selected and elaborated further on.

These objectives include the vision as well as the mission. To reach the different target groups of the whole project the communication varies within using different media platforms and content. The different media platforms are explained in the message establishment. For the contest in Versailles a public tour description is detailed as well. The visual identity has been defined as a general guideline when preparing visual communication matters of the team.

Our efforts to promote sustainable housing solutions go beyond the competition period. We are negotiating agreements to present our concept at exhibitions all over Switzerland in the next years. At our school, we will prepare for a science project and a publication with in-depth research on the potential of sharing. Furthermore an artist is currently working on a children's booklet to explain how to live a more sustainable life and how our concept works.

It is an important focus to get people involved in the matter of sustainability in the housing construction sector. To enhance activity and awareness, we organized various events that directly involved the stakeholders, for instance in open innovation forums, children's school visits, business people's workshops or student events, as well as visitor platforms at the building site.

Img. 1 Communication

Analyses of the Situation

To analyze the situation at the beginning we performed a SWOT analysis, to see potential problems and strengths in our team. *See Img. 2.*

Strengths

First of all, we are the only team at the Solar Decathlon Europe coming from Switzerland, built by only Swiss students. This situation provides us with lots of opportunities. All our partners are with us due to this status. Media is highly interested in our project due to our outstanding placement and also to generally promote the contest Solar Decathlon in Switzerland. Finally we also focus on topics such as sustainability, innovation, new networks and sharing, which are of common interest.

Our strengths are driven by an interdisciplinary mixture of people and various interests within our team. We also have got a dynamic media platform, which helps to address partners and sponsors always in the right way. Our image is also built by the use of future oriented technologies and the way we combine it within the project.

Weaknesses

We are challenged in matters of organizational aspects, e.g. the size of the team. It is an ongoing task to improve the internal communication. Another challenge is the lack of experience in building and in competitions such as Solar Decathlon.

Opportunities

The ongoing big shifts such as sustainability, innovation and sharing provides us with a great opportunity to get our vision accepted. By using those opportunities as strengths we spread this new living model to the general public.

Threats

The threats regarding supervision are complex problems, which we must provide answers to, as well as the way we communicate the concept. There are two levels of complexity for that matter. First, the fact, that the prototype can only show one module of the whole concept. Second, that we offer a complete new living model and not just a new house. It should be understood, that our concept is a new living and housing model, which can be reality by the placement and the construction of the concept your⁺.

Strengths • interdisciplinary team and network • dynamic media stage • use of future oriented technology • young academics • identification with topic ststainability • nonprofit strength-credibility • autonomy	**Weaknesses** • large team-organisation • heavy internal communication • loss of information • no experience with this competition • little experience in building
Opportunities • the only swiss team • high attention (first team from CH) • Trends (sustainability, innovation, sharing, networks, social model change)	**Threats** • budget • complex subject • Solar Decathlon is rather unknown • realization of the plans • time constraints

The Communications Objectives

Team Lucerne – Suisse represents the values that Solar Decathlon Europe 2014 embodies. Our project your⁺ focuses on the actions and requirements of our users and target groups. Life situations change and new spatial and mobility requirements arise. The high degree of flexibility within the model of "smart sharing" allows fast, user-specific adaptation. We envision a new lifestyle, which releases flexibility, new opportunities and community synergies. With our idea of "smart sharing" we offer a new way of thinking about ownership and the use of things.

We aim to:
- Share our mission in mobile device – "smart sharing" as concisely as possible
- Utilize the cultural tradition in our concept your⁺ and interpret the idea of cooperatives in a new way
- Gain more flexibility in life planning
- Create a new social community
- Develop solidarity and social networks
- Establish a platform to save resources and raise living standards in the same time

Message Overview

The Project Name your⁺ illustrates our vision of "smart sharing" by the combination of "our" and "your". It shows the positive added value by minimizing the resource consumption and raising living standards.

First stage: The eye-catcher – The eye-catcher is our prototype and a visual representation to garner attention and spark curiosity.

Second stage: Explanation – Our explanation should follow the saying "keep it simple", which means we try to explain our project through visualizations and simple statements.

Third stage: Knowledge – The stage knowledge is made for potential inhabitants who are interested in living in the house, therefore the potential future inhabitants. For this stage we provide detailed information about the your⁺ prototype including background information, supporting documents and proven arguments.

Using these stages of information we aim to deliver our concept to the public. Our goal is to increase awareness about sharing, sustainability, energy efficiency, and responsible resource management.

Identification of the Target Groups

Sinus groups separate people in stakeholders about their lifestyle and habits. The Sinus Groups theory is a scientific based model invented by a German research institute, called Sinus Institute. They are continuously monitoring socio-cultural trends and habits in the society by surveys and interviews. We used results about the swiss public analyzed by the Sinus Institute to build our potential target groups.

General Public and Inhabitants

Potential inhabitants have been chosen by the demographic trends of the Swiss population, which had been analyzed by the Swiss Federal Statistical Office. Students, commuters, senior citizen, families and single parents are the groups that will grow the most in the future. Families and single parents bring children to the your⁺ prototype, and the future generation is raised in an environment focused on sharing, sustainability and energy efficiency. We will use online communication, radio, television, newspaper, and word-of-mouth.

Students and Teenagers

To students and teenagers we need to communicate in their tonality. Our goal is to provoke curiosity about innovation, sustainability and energy efficiency. If our plan attracts more and more young professionals and future business leaders, it will build conciousness in the daily actions and choices. For the younger ones we use facebook and twitter to spread our messages. On these online forums we provide them with short messages, photos and videos about our project.

Sponsors and Partners

For our project we require financial support and knowledge transfer from professionals. We contact regional and sustainable companies. To contact professionals we have a brochure and a newsletter regularly for our partners. Online communication, radio, television, newspaper and exhibitions helps to catch attention and connect with this target group.

Message Establishment

To create a clear message and to spread the idea of our vision we need to inform our target groups through several channels. Our message needs to be adapted to the different target media.

Website

Our website is one of our main communication instruments. Our web design is logically structured, has an attractive design and invites navigation. It is regularly updated and optimized by usability standards. Our webpage offers a direct link to our facebook profile to promote cross platform information. The website includes information about the Solar Decathlon, our vision your⁺, our partners, and the team members. A live cam shows the process at the construction site.
See Img. 3.

Soial Media

Our facebook profile is the main communication instrument for younger people. A big part of our facebook friends are interested students and friends. We post weekly short messages and photos of our project and our team, promoting discussion and presenting relevant current events. On facebook we analyze quantitative results and by the online conversation we receive qualitative feedback.

Vimeo

For the audiovisuals we choose Vimeo, an online platform for videos and short movies.

Traditional Media

Through press releases we serve the press, radio and television with the most current information on the Solar Decathlon and our project. We aim to get attention in regional and national media. An external company called ARGUS controls our press appearance. They clip all media presences of the your⁺ project. *Further information: Appendix 19 Medienspiegel*

Newsletter

For sponsors and partners we publish a newsletter regularly, informing them in detail of the project status.

Projector and TV Screen Combination

For the Swissbau Trade Fair in Basel and for the University Campus we built a Projector TV Screen display to explain our project. The interactive display shows the prototye in context to the urban concept.
See Img. 4.

Img. 3 Website

Img. 4 Swissbau projector

Actions before the competition

To announce our project to our target groups, we ran several communications actions. On one hand we use various media platforms such as our website, facebook, radio, TV and print medias, on the other hand we host events to promote our project. In the following pages we document our actions categorized in press, events, previously and during the competition.

All our published press text is listed in the ARGUS info for an overview and of what communication activities we are involved in. Refer to the appendix for the ARGUS info. The budget for communications activities is included in the project budget plan.

Review of Events

16. September 2013
KKL (cultural center) in Lucerne at greetings ceremony for new Students *See Img. 5+6*

Action:	Information desk to present our project using posters and flyer explaining our concept.
Goal:	Promotion of the Solar Decathlon Project within the Hochschule Luzern
Message:	We are competing at the Solar Decathlon 2014 as the first Swiss core team
Target Group:	Students, professionals, alumni
Cost:	Aprox. CHF 200 Postcards + CHF 50 Poster print pasted on hardboard
Impact:	Some face-to-face talks, first time our corporate design is seen in the public
Team:	3 team members

Img. 5 and 6 KKL Greetings cerem

16. September 2013
Information booth at the alumni reunion at the Culture and Convention Centre of Lucerne

Action:	Promote the project to the alumni (potential sponsors)
Goal:	Promote the project
Message:	Team Lucerne-Suisse is competing at the Solar Decathlon Europe 2014
Target Group:	Professionals, alumni
Cost:	Free
Impact:	120 alumni heard about our project
Team:	4 team members

September 2013 til July 2014
Solar Decathlon 2014 – Info Box *See Img. 7*

Action:	Three standard working containers are set on the campus right next to the cafeteria with information about the project, partners, links and information about the current project state on the outside.
Goal:	Information of current state and provide space for meetings during the design process.
Message:	Work in progress and we compete at the Solar Decathlon.
Target Group:	Students, partners, general public
Cost:	Aprox.: CHF 2`000.– Material + 15`000.– Container setup and rent
Impact:	All students and lecturers came across the pavilion, the idea of the Solar Decathlon gets widespread, also multifunctional room for meetings and workshops
Team:	complete team

Img. 7 Infobox on Campus HSLU

18. September til 20. September 2013
Team building event - Monte Rosa hut *See Img. 8+9*

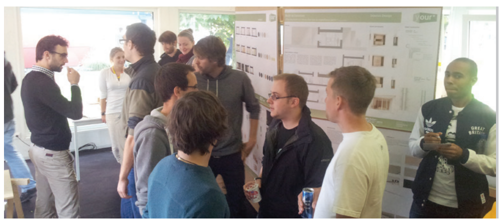
Action:	Semester start team building event
Goal:	Build a strong, interconnected team
Message:	Good teamwork is essential for a successful project
Target Group:	Team
Cost:	Fr. 3'000 travel and accomodation
Impact:	Positive working environment, team members trust each other.
Team:	Complete team and lecturers



Img. 8 and 9 Monte Rosa - team building

16. September til 24. September
Sharing Promotion - share your idea, we share our energy with you *See Img. 10+11*

Action:	Promotion of our project with the idea of sharing energy. Free energy drinks as a reward for innovative ideas. Media include facebook, flyers and posters on campus.
Goal:	Promote the project on campus and connect with the other students
Message:	We live our sharing concept
Target Group:	Students on the campus
Cost:	Aprox.: CHF 200 for Postcards + sponsored free Troika energy drinks
Impact:	Everybody on the campus heard about the project and our concept.
Team:	5 team members


Img. 10 and 11 Sharing promotion

26. September 2013,
Barbecue Event at the University *See Img. 12*

Action:	Barbecue event on Campus
Goal:	Evening with interesting discussions and socializing
Message:	Social event: work hard–play hard
Target Group:	Team
Cost:	Free, pot-luck style
Impact:	Cosy and amusing evening with lots of discussions
Team:	Complete team


Img. 12 Barbecue event

22. November 2013
BM Information Day *See Img. 13*

Action:	Presentation of our project
Goal:	Promote the project
Message:	Show how a student project could look like, and what we do
Target Group:	Future students
Cost:	none
Impact:	450 pupils
Team:	2 team members


Img. 13 BM Information Day

30. November 2013
Exhibition of the Interior Design Department
See Img. 14

Action:	Exhibition at the Neubad Lucerne with a project presentation
Goal:	Promote the project and present the Interior Design
Message:	Team Lucerne-Suisse is competing at the Solar Decathlon Europe 2014,
Target Group:	Students, professionals (architects, designers), general public
Cost:	none
Impact:	about 100 visitors
Team:	2 team members


Img. 14 Interior Design Exhibition

6. December 2013
Solar Töggathlon *See Img. 15*

Action:	Table Soccer tournament at the Campus
Goal:	Promote the project
Message:	Enjoyable tournament before the end of the semester
Target Group:	Students
Cost:	350 CHF
Impact:	50 students
Team:	5 team members


Img. 15 Solar Töggathlon

29. November 2013

Swisscleantech Presentation *See Img. 16*

Action: Presentation at a workshop of Swisscleatech organisation
Goal: Promote our project, acquisition of new partners
Message: What is our project about focusing on building technology
Target Group: Professionals
Cost: none
Impact: Interested feedback
Team: 6 team members

Img. 16 Swisscleantech presentation

9. December 2013

Swisscleantech congress *See Img. 17*

Action: Participation at a congress about the Future Energy Policy
Goal: Networking, acquisition of new partners
Message: Team Lucerne-Suisse is competing at the SDE 2014
Target Group: Professionals and politicians
Cost: none
Impact: no direct feedbacks
Team: 3 team members

Img. 17 Swisscleantech congress

12. December 2013

Raclette Dinner *See Img. 18*

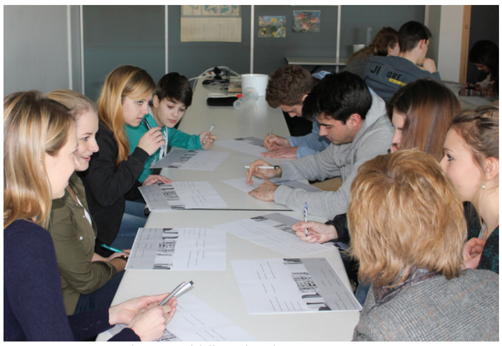
Action: Dinner party at the SDE atelier
Goal: Strengthen the team spirit
Message: Social event
Target Group: Team Lucerne-Suisse
Cost: none
Impact: Social bonding
Team: Complete team members

Img. 18 Raclette dinner

16 th December 2013

Interior design presentation at "Kantonsschule Obwalden" (middle school) *See Img. 19*

Action: Speech about our your^{+} project and interior design, workshop and project exhibition for a few weeks
Goal: Promoting the project, show our concept to a younger generation
Message: What is interior design, what is our project
Target Group: Young students
Cost: none
Impact: 100 students at the presentation,
Team: 2 team members



Img. 19 presentation at middle school

21. – 25. January 2014
Swissbau trade fair in Basel *See Img. 20 + 21*

Action: Exposition stand at the Swissbau in Basel, with mock-up of wooden facade, model of prototype, 5 Posters illustrating the main selling points of our project in simple graphic and textural messages.
Goal: Promote our project, showing our current state and explain our vision and concept
Message: Team Lucerne–Suisse representing Switzerland at the SDE 2014
Target Group: Professionals, general public
Cost: 20'000 CHF sponsored by the Swissbau
Impact: Up to 150'000 visitors
Team: Complete team


Img. 20 Swissbau


Img. 21 Swissbau

21. – 25. January 2014
Project Presentation at the Swissbau trade fair
See Img. 22

Action: A half day of final semester presentations from each related department
Goal: Getting critical feedback to our goals and test our communication skills
Message: "our vision is your+" – we aim for a holistic approach to sustainability
Target Group: Private and commercial house owners, professionals, investors
Cost: 800 CHF for material mock-up and transportation, infrastructure in Basel, sponsored by Swissbau
Impact: Aprox.: 50 people attended, great feedback, stimulating discussion
Team: Student Team


Img. 22 Swissbau

21. – 25. January 2014
Postcard promotion at the Swissbau trade fair
See Img. 23

Action: Free sharing the your+ postcards sent from the Swissbau.
Goal: Promote the project to a broader public.
Message: Share our Project with your friends and to send one's regards
Target Group: All public from Switzerland
Costs: 500 CHF for printing, postage sponsored by Die Post
Impact: Up to 1000 visitors sent a postcard to their friends or families
Team: 2 team members


Img. 23 Swissbau

26th February 2014
Workshop at the future-day at the Kantonsschule Wohlen (middle school) *See Img. 24*

Action:	4 Workshops about our project
Goal:	Raising awareness about future problems.
Message:	"smart sharing" as a lifestyle model
Target Group:	Pupils (18-19 years old)
Cost:	none
Impact:	80 pupils
Team:	2 team members

Img. 24 Wohlen workshop

11th April 2014
Put-Up-Event (Aufrichte Fest) *See Img. 25*

Action:	Construction Celebration, many partners and the team shared a barbecue and a presentation
Goal:	Presenting the prototype to partners and the public within the process of the structural work
Message:	Final sprint on the building site
Target Group:	Team, partners, media
Cost:	500 CHF
Impact:	40 journalists, many partners
Team:	Complete team

Img. 25 Put up event

24th April 2014
Event Café auLait *See Img. 26*

Action:	Free coffee and baguette's for one day. Visit the construct on site and see the progress.
Goal:	Presenting the prototype to students and lecturers of the campus
Message:	Final sprint on the building site
Target Group:	Students, lectureres
Cost:	120 CHF
Impact:	Very high
Team:	Complete team

Img. 26 Café au lait

Actions during the competition

During the time in Versailles we communicate through different medias and architectural elements. With special sunshades and large scale letterings on the southside wall of the ramp we aim to get attraction. On the westside wall of the prototype we have an overview about our project and vision. Using media such as models, everyday objects and graphics we inform people during the tour.

An information Brochure or a Button can be given to the public. The Information Brochure conduces to give detailed information and the buttons as a give-away should animate people to start with the sharing idea directly and easily.

Southside wall and Sunshade

Visitors get attraction from distance to the Team Lucerne-Suisse through the southside wall. The writing "SHARE!" together with our claim "smart sharing – our vision is your^{+}" generates curiosity and shows directly the idea of our project. Integrated to this wall is a box for the Information Brochure for the visitors and as well a system to attach the Sunshades when they aren’t in use.

Sunshades

As a eye-catcher, our mobile sunshades convey directly the idea of sharing to the visitors when they’re queuing. The sunshades are devided in two parts, the panel and the shaft and can be attached at the wall.

Buttons (Give-Away)

Eight different buttons in the special color Signal Red will animate the visitors of the tour directly to start practizing the idea of sharing and carry on the message. The icons on the buttons are daily objects which the visitors are up to share with others, for example a lighter or a pen. The visitors of our prototype can go to a sharing community space on the exhibition area.

Information Brochure

The information brochure is placed in two boxes, one on the south wall and one on the west wall. The Brochure is designed like a newspaper and contains 8 pages with information about "smart sharing" and our prototype, it includes different graphics and pictures. Its printed in two colors – black and signal red and should provide the main information about our project to the public.

Schedule Versailles

FRIDAY	SATURDAY	SUNDAY
27.06.2014	**28.06.2014**	**29.06.2014**
Official Opening Ceremony Media and Institution visits	Open for visitors 10 am to 10 pm Instrumentation Testing	Open for visitors 10 am to 10 pm Instrumentation Testing
MONDAY	TUESDAY	WEDNESDAY
30.06.2014	**01.07.2014**	**02.07.2014**
Contest activities Open for visitors Speed Peer Review "Bonanza" 3.5 Minute Live Presentation	Contest activities Open for visitors Jury Visits	Contest activities Open for visitors Jury Visits Architecture Contest Award
THURSDAY	FRIDAY	SATURDAY
03.07.2014	**04.07.2014**	**05.07.2014**
Contest activities Open for visitors Jury Visits Partner Visits (20 pers.) Engineering Contest Award	Contest activities Open for visitors Jury Visits Communication Contest Award Partner Visits (20 pers.)	Open for visitors 10 am to 10 pm Architecture Contest Award Dinner, Projectleader SDE and 5 students from each faculty Delegation of HSLU
SUNDAY	MONDAY	TUESDAY
06.07.2014	**07.07.2014**	**08.07.2014**
Swiss Day with swiss embassy Open for visitors 10 am to 10 pm	Contest activities Passive Day not open for visitors Jury Visits	Contest activities Open for visitors Jury Visits French embassy visit
WEDNESDAY	THURSDAY	FRIDAY
09.07.2014	**10.07.2014**	**11.07.2014**
Contest activities Open for visitors Jury Visits UDTA Contest Award	Contest activities Open for visitors Jury Visits Energy Efficiency Contest Award	Contest activities Open for visitors Jury Visits Sustainability Contest Award
SATURDAY	SUNDAY	MONDAY
12.07.2014	**13.07.2014**	**14.07.2014**
Open for visitors 10 am to 7.30 pm Contest's Awards, Final Comptetition Awards Ending Ceremony	Open for visitors 10 am to 10 pm firework at Chateau de Versailles	Open for visitors 10 am to 10 pm

Campaign Timeline

The shown timeline below gives an overview of the various activities. Press publications are not included and can be found in the *ARGUS info in the appendix.*

Date	*Action*	*Message*	*Instrument*	*Target Group*
whole period	Report the Project of Team	News & Informations	Website	General public, students, partners, SDE committee
18 th january 2012	- Press release - Fundraising Event	Team Lucerne- Suisse is in the qualification for the SDE 2014	Press release Event	General public, students, partners
9 th january 2013	- Press release	Team Lucerne- Suisse is qualified for the SDE 2014	Press release	General public, students
28 th may 2013	- Press release	Diploma exhibition with special SDE presentation	Press release	General public, students
12th february 2014	- Course in presentation skills	Improve of presentation skills of the Team Lucerne - Suisse	Course	Team Lucerne - Suisse
18th february 2014	- Intensive week SDE for the semesterstart	Review of the intesive week	Newsletter	Students
7th march 2014	- press release	Del. #4 - current state	Press release	Press & students
7th march 2014	- preliminary building works	Insight Team Lucerne - Suisse and Partners	Newsletter	students, partners
1th april - 20th april 2014	- Building the prototype, several media work	Team Lucerne is building the prototype.	Press release, Livecam, Audiovisual	Students, general public
12th may 2014	Interior Design & House testing	Insight the prototype	Newsletter	students, partners
june 2014	Special magazine in the Hochparterre	Insight the Team Lucerne- Suisse	Magazine	Professionals, Students, General Public
2th june 2014	Transportation of the prototype	Insight transportation & building technology	Newsletter	students, partners
26th june - 14th july 2014	Competition / media work & press realeases	Team Lucerne - Suisse is competing at the SDE 2014 in Versailles	Press release , audiovisuals,	General public, students, partners
30th june 2014	Competition	Insight SDE at Versailles	Newsletter	students, partners
14th july 2014	End of competition	Endletter Versailles	Newsletter	students, partners

Campaign Budget

Date	*Action*	*Budget (CHF)*
16th Septemeber 2013	KKL greetings ceremony	250
September 2013 - July 2014	Infobox	17‘000
18th September 2013	Team building event	3‘000
16 - 24 September 2013	Share your idea promotion	200
October 2013	Partner brochure print	990
October 2013	Audio-visual	2‘500
6th December 2013	Solar Töggathlon - Table soccer event	350
December 2013	Invitations for the Swissbau trade fair	500
January - June 2014	Translations, Language education	3‘000
January 2014	Business cards for the team	500
21 January - July 2014	Project presentation	800
March 2014	Sponsor brochure	990
March 2014	Flyer "smart sharing"	500
March 2014	Building site printing wall & utensils	1‘500
April 2014	Audiovisual	3‘000
April 2014	Team uniform	5‘000
11th April 2014	Put up event	500
24th April	Café au lait event	120
June 2014	Partner give away	1‘500
June 2014	Banners for presentations	1‘000
June 2014	GIve away - buttons	1‘800
June 2014	South & west wall	2‘000
June 2014	Information brochure	5‘000
June 2014	Material for the tours (acoustics, visualisations)	3‘500
June 2014	Urban design model for the tour	150
June 2014	Sun shades	500
June 2014	Hochparterre extra magazine (8‘500 copies)	30‘000
June 2014	Audio-visual	3‘000

Total Communications costs	CHF 89‘150

7.2 Public Tour Description

The Public Tour is one of the most important communication tools. Our main aim is to fascinate visitors from the complete beginning of their tour. In the waiting area we already want to attract our visitors' attention by providing in different places. The communicating of our concept is important and the most difficult part of our tour. In Versailles we communicate through different medias in our new special contest colour and architectural elements. During the waiting time, the visitor will receive information on the concept of sharing and the implemention of the urban design in relaxed conversations with the three guides, who alternate between the starting tours. A clear route guides the visitors through the prototype and prevents people from crossing each other. A separate exit helps us organize group flows.

Waiting Area

The parasols for do-it-yourself and sharing activities inspire and attune the waiting visitors to the idea of "smart sharing". Our free newspaper at the south wall provides visitors with advance information on our concept.

Information Brochure

The Information Brochure for the visitors is placed in two boxes, one on the south wall and one on the west wall. The Brochure is designed like a newspaper and contains 8 pages with information about "smart sharing" and our prototype and includes different graphics and pictures. Its printed in two colors – black and signal red and should give the main information's about our project to the public.

Southside wall and Sunshade

Visitors get attraction from distance to the Team Lucerne-Suisse through the southside wall. The writing "SHARE!" together with our claim "smart sharing – our vision is your+" generates curiosity and shows directly the idea of our project. Integrated to this wall is a box for the Information Brochure for the visitors and as well a system to attach the Sunshades when they aren't in use.

Sunshades

As a eye-catcher, our mobile sunshades convey directly the idea of sharing to the visitors when they're queuing. The sunshades are devided in two parts, the panel and the shaft and can be attached at the wall. The panel shows a part of our logo so it fits perfect to our styleguide.

The Tour

The tour is kept as clear and natural as possible. Guides play the role of residents and show participants their home in a highly personal manner. It should feel as though the visitors have been invited to a house viewing. The tour thereby has a narrative and theatrical note and distinguishes it from others. As soon as it comes to facts on the project, the guides talk in the 3rd person, referring to Team Lucerne – Suisse. They explain the team's ideas to the visitors. ("The sanitary concept of Team Lucerne – Suisse plans…" or: "Team Lucerne – Suisse solved the room air-conditioning like this…" etc.). Instead of presenting themselves as members of the team, guides should be perceived as real residents of the project. The tour is based on five stages that are embedded into a START and an END input. These inputs each take place outside the prototype, while the five tour stages are distributed between the three room types (your room, our room and my room) as well as the connecting space+.

Everyday Objects as Guiding Elements

To describe the different aspects of the project, everyday objects are highlighted at specific points of the tour and combined with one-sided info-graphics. On the side with the information, the objects are coloured in bright red to give them a striking appearance. They are therefore immediately recognisable as "guiding elements", creating a "red trail" through the tour while retaining the everyday atmosphere of the rooms. The other side of the objects remains untreated and thereby merges with the rest of the scenery. The tour guide reveals the objects at the relevant points of the tour and shows the info-graphics to the visitors. Depending on the material, these objects are either varnished or printed.

Signage for the Greater Context
In the space+, the signage is applied directly onto the walls. Arrows with text indicate other rooms. That creates the impression of a larger building situation. Different font sizes differentiate between private and communal areas.

Room-Specific Acoustics
In your room and our room, sounds support the guides during the tour. In your room, the recordings play sounds of a table tennis game, a group of people at the table and a party atmosphere. In our room, kitchen noises can be heard in the backg-round. Small loudspeakers powered by rechargeable batteries are used for this purpose, which can be operated by smartphone.

Urban Development Model in the space+
To design the urban development model in a very tangible and yet legible way for the guided tours, it was built to a scale of 1:300. That allows guides to hold in one hand a section that includes part of the perimeter development. Birch plywood is used for the floor slabs, while lime wood is used for the room volumes. Lime wood is bright, reserved, light and can be nicely combined with other materials. The colouring of the three room types uses acrylic-based pigments, which allow the wood to shine through and reveal its ring pattern. To distinguish the exterior (terraces and balcony) from the interior, slatted frames are engraved for the outside areas.

Interior western wall
To indicate further flow in the urban context and to allow visitors to understand the west walls on the inside the space+ is fitted with representations which indicate continuation. Used as a corridor as well as living space, the images illustrate a lively residential area. Pictured are a cat, a plant, and various objects as well as a sliding door, which would lead to a further my room. The objects are deliberately shown in reduced, two-dimensional imagery.

Buttons (Give-Away)
While the free newspapers are a medium for extensive information, the give-away buttons are aimed at animating people. Interested people can live out the principle of sharing in an instant, uncomplicated way.
Eight different buttons in a bright red colour animate the tour visitors directly to start living out the idea of sharing and spreading the message. The icons on the buttons are everyday objects, which the visitors can share with others, for example a handkerchief, a lighter or a pen. In this way, visitors to our prototype become a sharing community in the exhibition area.

Exterior Walls West
The two walls on the western side provide adequate information to visitors who cannot take part in a guided tour. The left wall presents the initial situation (population growth) and the principle of sharing. The right hand wall demonstrates the urban develop-ment concept and the most important technical aspects of the prototype. Unlike the south wall, these walls are deliberately given a calm appearance so they don’t upstage the building. The black surface should remain as coherent as possible and only be covered sparingly with white text and graphics. This gives the impression of a blackboard.

Applications for the Inhabitants
For our project we develop two apps, one to control the building and the other to explain our concept to the visitors. Both apps are web based and have been developed explicitly for the competition, to show how controlling and managing will be realized in the urban buildings.

Visitor App
The visitor app helps interested people understand the concept of sharing and exchanging, through reservation of rooms, objects or vehicles. With this app visitors can experience life according to the your+ concept and learn more about the project. The goal is to motivate inhabitants to share, therefore the main function of the app is a sharing calendar, which facilitates: space, vehicle and object sharing.

Important Manual Points

1 defined entrance & exit
2 continuous flow though the house
3 no traffic jams
4 the delivery of our concept is the most important thing
5 to leave a positive impression of the "smart sharing" concept
6 activity during waiting periods for the visitor
7 comprehension of the concept
8 good first and last impression

Tour Times

The tours begin every 10 minutes and last 15 minutes (or 10 minutes for the short "normal" tour) inside the prototype. Three tour guides always stand at the front of the queue and entertain the waiting visitors with "smart sharing small talk". That buys time in which to explain that this building is part of a larger system, rather than a single-family home. The next guide takes the first seven people, stands in front of the entrance and explains that this is a section of his home in Lucerne. The maximum number of 7 visitors per tour allows us to ensure that no more than 16 people are in the building at once, thereby fulfilling all the safety and energy regulations.

Tour Types

We expect a varying visitor group at our prototype in Versailles. Therefore we offer differentiated tours to cater to the individual desires of our tour groups.

A Guided Jury Tours

Time: 20-30 minutes
Content: focus on the evaluation topic of the specific jury

B Guided Public Tours

Type 1: Short "normal" tour
Time: 10 minutes in the prototype
Content: Deliver the concept of "smart sharing" with the urban context and the implementation as the prototype with its room types

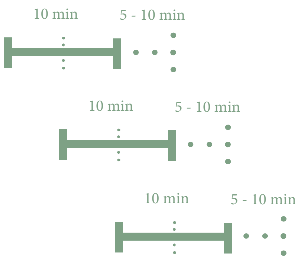
Type 2: Short "normal" tour PLUS special theme of architecture
Time: 15-20 minutes in the prototype
Content: See in Type 1 PLUS special topics of the prototype with respect to architecture, construction and interior design

Type 3: Short "normal" tour PLUS special theme of technology
Time: 15-20 minutes in the prototype
Content: See in Type 1 PLUS special topics of the prototype with respect to of technology, energy efficiency and HVACs

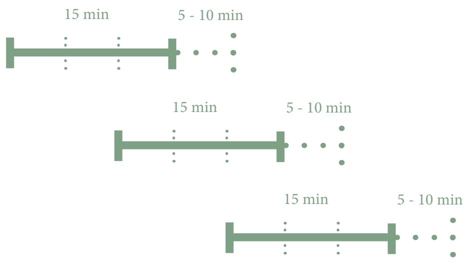
C Sponsors Extra

Content: renting the your room for a presentation of participations

Short "normal" tour
- 10 minutes inside the prototype / group
- 7 persons / group
- 84 persons / hour
- 1008 persons / weekend day (12h of giving tours)
- A new tour begins every 5 minutes

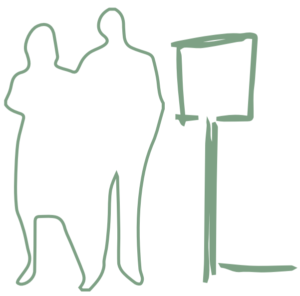


Short "normal" tour PLUS special theme
- 15 minutes inside the prototype / group
- 7 persons / group
- 42 persons / hour
- 210 persons / weekday (5h of giving tours)
- A new tour begins every 10 minutes



Progress of the short "normal" Tour

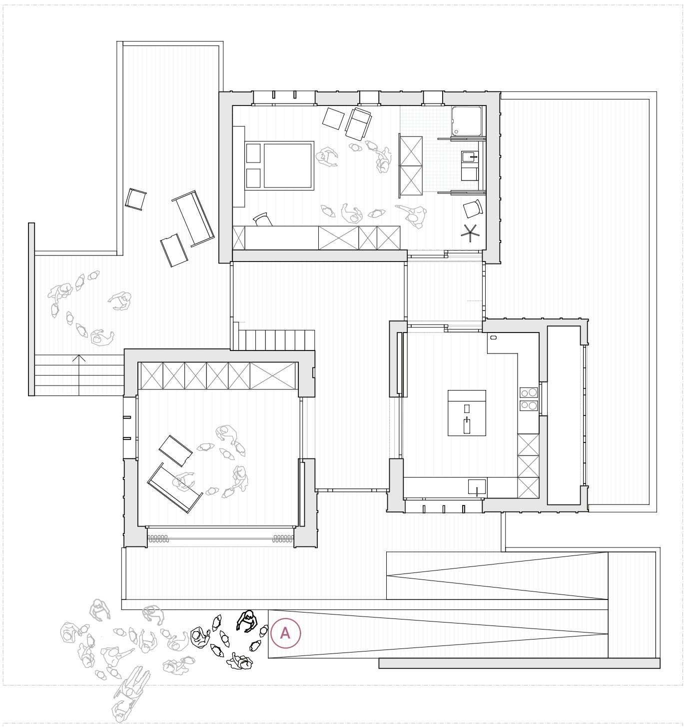
(A) Waiting



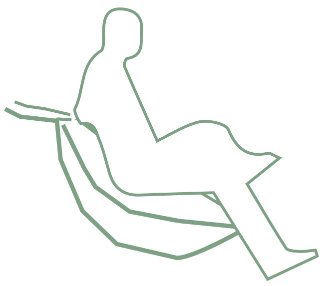
Goal: prime the visitors' interest
Position: before the ramp
Activity: active
Content: introduction to our topic of "smart sharing"
Number of people: variable
Number team members: 3

Small Talk about sharing!
Before the start of the tour two guides should mingle and talk while the 3rd prepares and starts the next tour:

- *Hi, would you like to grab a section of one of our sharing umbrellas and find someone with another section to put it together?*
- *Where are you from, and what do you share in your life?*
- *5 points to the person who can tell me three things which they share the fastest!*
- *Have you ever loaned your car to someone? Is it a friend that has shared things with you as well?*
- *Can we share some of our sunscreen here with you, it's sunny out!*
- *Do you teach your children about sharing? What do you tell them? Why do you think we stop sharing as adults even though we tell our kids how important it is?*



1 Start



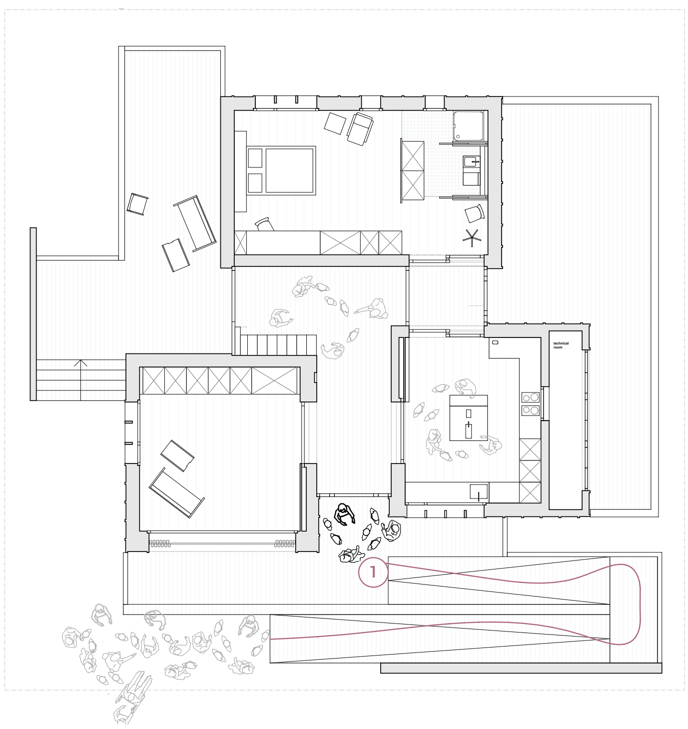
Goal: Build Rapport! Help them understand the "drama" you will be acting out.
Position: in front of the main entrance
Content: introducing – the guide who started the tour, your "neighbour", has just left, now time to separate the 7 people who are next and begin preparing them to enter the prototype
Number of people: 7
Number team members: 1

Introducing!

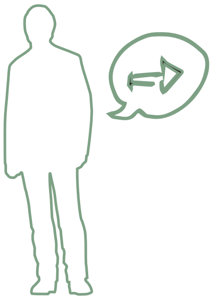
Hello friends, my name is Luc, and I am so glad you are all came here to get a tour of my home! We are here as the first Swiss Team partaking in SDE, and excited to be here! As you can see here behind me there is a prototype, which is only an example from the city building which we live in in Lucerne, Switzerland. This building has a few of the rooms that I live in put together so that I can show YOU how I live and work in Switzerland. My neighbour has just gone in as you can see with some of his/her friends, so lets chat here a few minutes until we know he has had a chance to show them around.

So, you told me before that you have a car, how would you like having a car and a boat, and a scooter and van, all for the same cost? But how can that work!? Well, if you had a car, you have a boat, her a scooter, him a motorcycle, and I have a van, if all of us share our items, we all have access to many more things for the same cost!

- *How much space do you think you really need to live comfortably?*
- *How much better would you feel if you had access to more things, while needing to maintain and worry about less?*
- *Alright! I think my neighbour is done with his friends there, lets head in so I can show you around!*



2 Tour



Goal: To understand why we are doing this?
Position: your room
Number of people: 7
Number team members: 1
Content: Gather in room, and take natural action – *move chair, arrange something on shelf ect.* – to show you live there

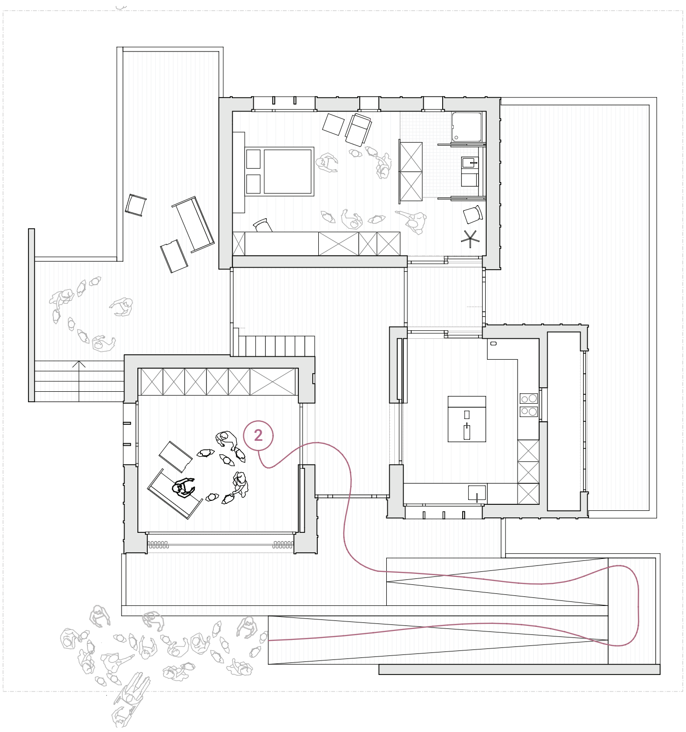
Why do I live here?

- *Here, I live and share the space with my neighbours and friends. We watch movies at night, do yoga in the mornings, and have sporting activities and play with the kids here during the day. Down the hall in our building we have a meeting room, gym, and music room.*

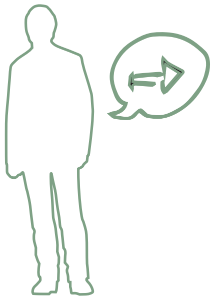
- *Team Lucerne – Suisse designed this sharing idea to give users like me MORE options, and in response to the growing density problem in switzerland.*
  (pull down screen to show infograph)

- *Our furniture here is also multi-use, as it can be a table or chair, away or central in the room. Having all the furniture put away really allows us to use the space for anything! I love playing ping-pong here…. (here the acoustic..) and if I ever need to reserve the room for something I can do that on our App, it over here in my kitchen, lets go!*

(as you walk through space+)
Notice the solar collectors and PV panels on the roof, thats were we heat our water and generate electricity!



③ Tour



Goal: How does it work?
Position: our room
Content: Gather around the island, *have the app pad there*, and act as if entering something in to the app
Number of people: 7
Number team members: 1

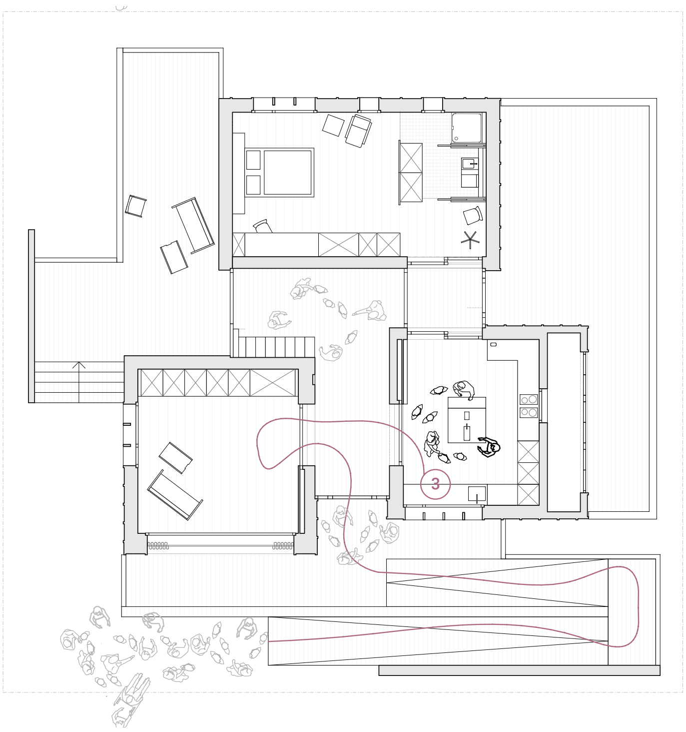
The daily schedules!

- *Now I have reserved the room for some friends and I to play ping pong later this evening.*

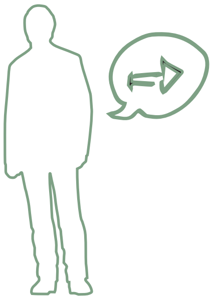
- *What time do you get up in the morning>>? Ah at 6am? I am up at 7.30, and my neighbor there ahead of us is a student and usually sleeps until 9, we could share the kitchen really well! It's nice to have it all to yourself sometimes, but as you can see we often share it at the same time and there is plenty of space! (turn around the cutting board) In our building back home we can often cook together, or separately at the same time. We are actually having some friends from other countries coming over later this week and are cooking some specialties from Switzerland for them!*

- *As you can see behind the window here, our technical room is pretty complex. It manages all the functionings of our building here, and keeps things functioning!*

- *Lets head over to my room now, I will show you where I can go to get away from the hustle and bustle of the house, and sleep or relax.*



4 Tour



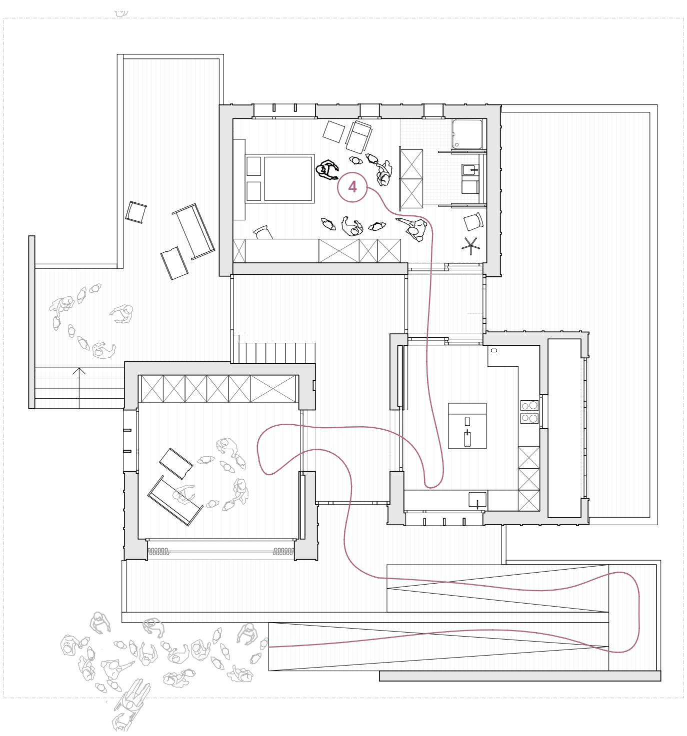
Goal: The interior concept for sharing
Position: my room
Content: *important to let the guests walk in, and close the door behind yourselves creating a calm, quiet space. Speak a little more softly as if someone is sleeping in the next room here!*
Number of people: 7
Number team members: 1

The private room!

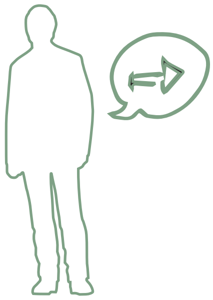
- *So this is my room, where I sleep, work, and relax after a long day working. Sometimes when I get home from work I relax here for an hour or so before cooking dinner and seeing what my friends and neighbours are up to. I really like how separated and comfortable it is here, so cozy feeling!*

- *Here you can see my bathroom, which is pretty neat! My shower recaptures heat from the water which runs across the basin, it's a new swiss design! The sink and toilet are connected, so I can reuse the water used for washing hands in flushing the toilet.*

- *Lets head out to space+, so I can show you a little more about our building in Switzerland, and how the sharing concept works on an urban scale.*



5 Tour



Goal: The implementation in the urban context
Position: space+
Content: *Gather around the model*
Number of people: 7
Number team members: 1

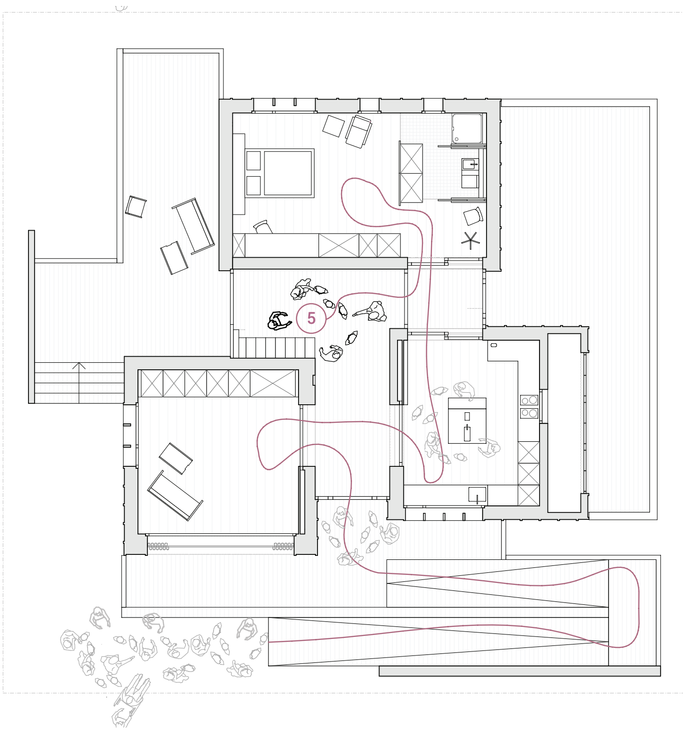
The urban situation!

- *The space+ is the area that ties all of our rooms together here in the house. As you can see there, it can be configured to give more direct/private access to certain rooms in the case that I need it. (may close the door between my room and our room) my room can be connected to the our room, which is especially nice if I have guests visiting.*

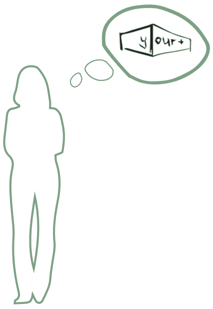
- *As you can see here on the model of my building, we even share our energy with neighbouring buildings in Switzerland. I really like the idea that our production of electricity doesn't need to be wasted if it's more than we can use. You can also see how the rooms are configured in the building... look, thats my room there! (show in the model)*

- *We get to share our space, but even get benefits from increased options in mobility and added value in our living cost because of the shared space. We save on resources, money, and increase our quality of life!*

- *Lets head outside now, and if any of you are interested in our sharing concept, I would love to give you a pin that represents what you would be willing to share!*



(B) Goodbye

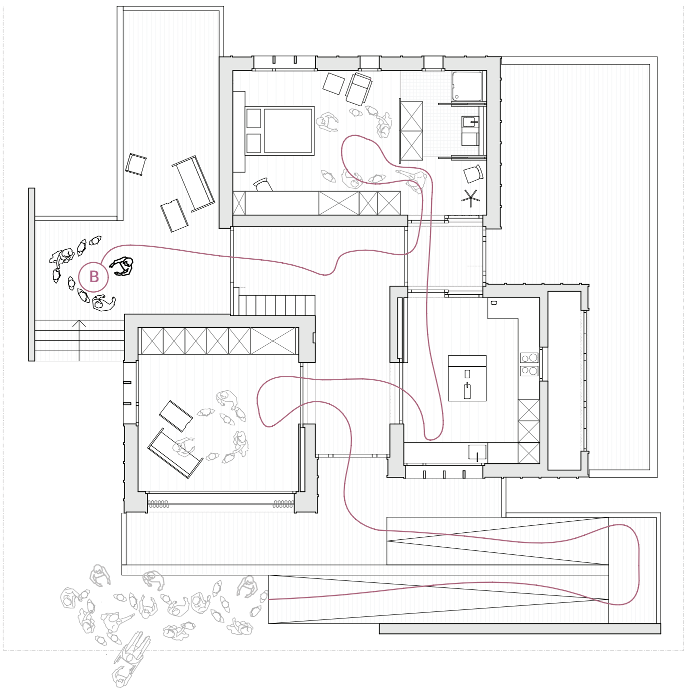


Share it!

• *Does anyone have any questions?*

• *I need to head up front and see how my neighbours are doing with their guests! Thank you all so much for coming, see you all later, enjoy your day!*

Goal:	leave an impression and spread the "smart sharing" concept within La Cité du Soleil and throughout Versailles
Position:	space+
Content:	Take group outside to pin wall, and *let them choose/select a pin of something they would share*
Number of people:	7
Number team members:	1



7.3 Visual Identity Manual

The signature of Team Lucerne – Suisse is a combination of a symbol and an element of text. It combines a building's perspective with the idea of sharing by the typographic conversion of the word your⁺.

Development and processing of the Logo and the visual Identity

The team and project logo were created and developed in several steps.
The first step was brainstorming to develop a significant short word, which represents our philosophy and vision. We came up with the idea of y**our⁺**. You can read the y**our⁺** as "your" or as "our". The plus (+) represents the additional value of our vision and the project. The y in y**our⁺** is written in normal text, and the our+ is written bold to show combination of your and the our. To show the architectural context in our logo, the y**our⁺** is on two levels. The y on the left level and the our+ on the right. These two levels represent the cube of a building. In the beginning these two levels were linear, later in the workshop we decided to make it to two surfaces as the corner, or corner stone of a house.

Regarding font we narrowed the field to two contenders, Roboto and Avenir. In the end the general applicability led us to choose Roboto as our general font for the flyer's, website and other written communication etc.

Color schema was based on our school colors of dark and light green. Choosing two colors which harmonize together we decided on green and the striking light red-purple. In our minds the green represents the freshness of our project and purple the classy style we designed into our pavilion.

Logo

The signature of Team Lucerne – Suisse is a combination of a symbol and an element of text. In some cases the symbol is used singularly, but in most cases this combination is used on all communication materials. It represents the visual identity of the team prior to the competition as well as during the Solar Decathlon 2014 in Versailles.

Signature

your+

Team Lucerne – Suisse
Solar Decathlon Europe '14

Symbol

Text Element

The symbols meaning is based on two ideas. The first idea is the visualisation of a buildings perspective. The second idea expresses the idea of community ans sharing by the word your+. It represents two entities – the we and you.

The overall message is:
Our plus is your plus and our vision is your positive vision of life in the future.

The text elements expresses the identity of the team. It is the name of the team Lucerne as representive of Switzerland at the Solar Decathlon 2014 in Versailles.

The official name is:
Team Lucerne – Suisse
Solar Decathlon Europe '14

your+

Symbol

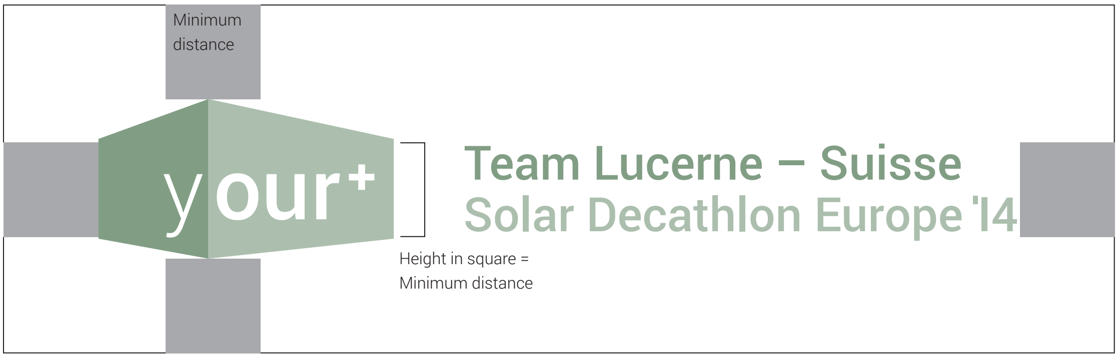
The symbol singularly is used e.g. on project drawings or on exhibition plans.

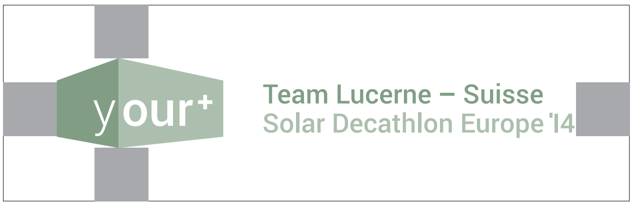
Minimum Size 40 mm

The minimum size of the logo is considered, due to legibility of the text. The logo is not used smaller than 40 mm in width.This also is applied, when the symbol is used singularly.

Logos' Tabu Zone

The tabu zone of Team Lucerne – Suisse is a minimum distance around the logo which has to be clear of any other graphical element. This distance is an element of the symbol and it will scale accordingly to the actual size of the logo.





Scaling the tabu zone scales the minimum distance proportionaly. In this way the minimum distance will be always the same to the logo an its elements.

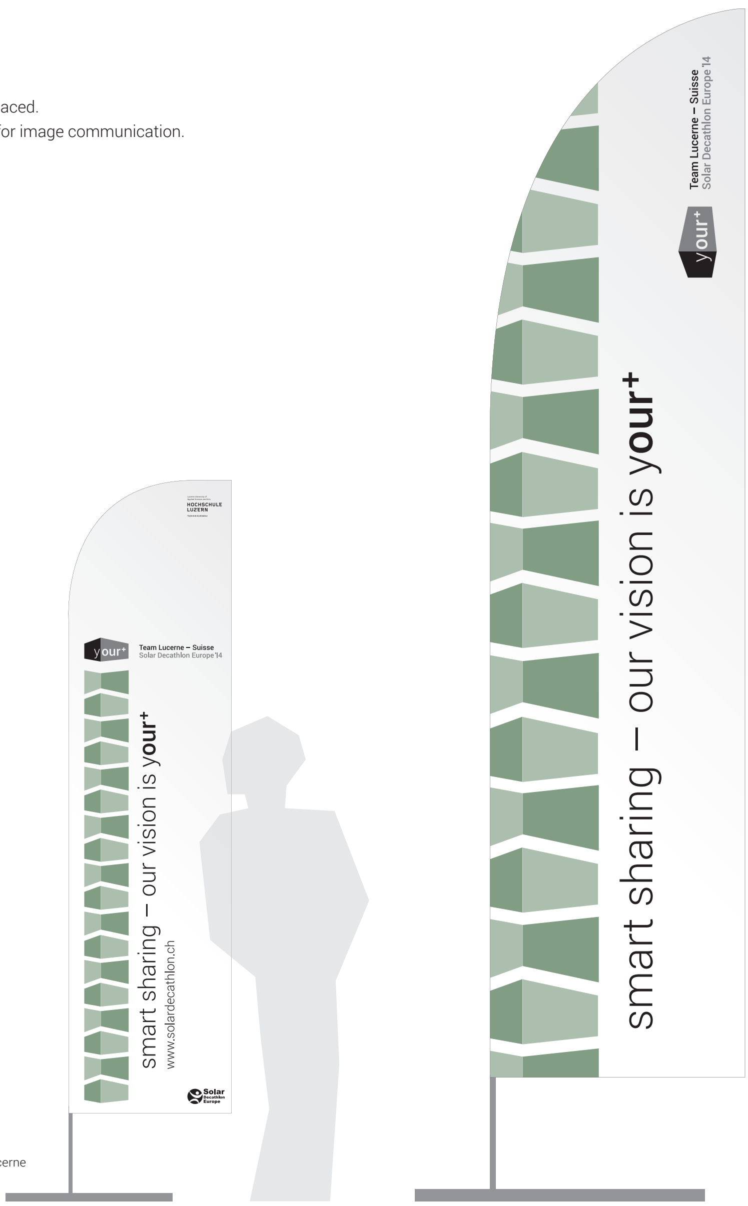
Tagline

An extract of our vision and the overall message is the tagline:
smart sharing – Our vision is your+.
The tagline is used as claim on all communication materials.

smart sharing – Our vision is **your**+

Tagline

Example, where the tagline is placed.
Indoor and outdoor flags used for image communication.



Solar Decathlon Europe 2014 Team Lucerne

Technical Versions of the Logo

Logo with text right – on white background

Original

Grey

Black

Logo with text left – on white background

Original

Grey

Black

Logo with text right – on colored background

On primary color

On primary color shade 1

Negative

Logo with text left – on colored background

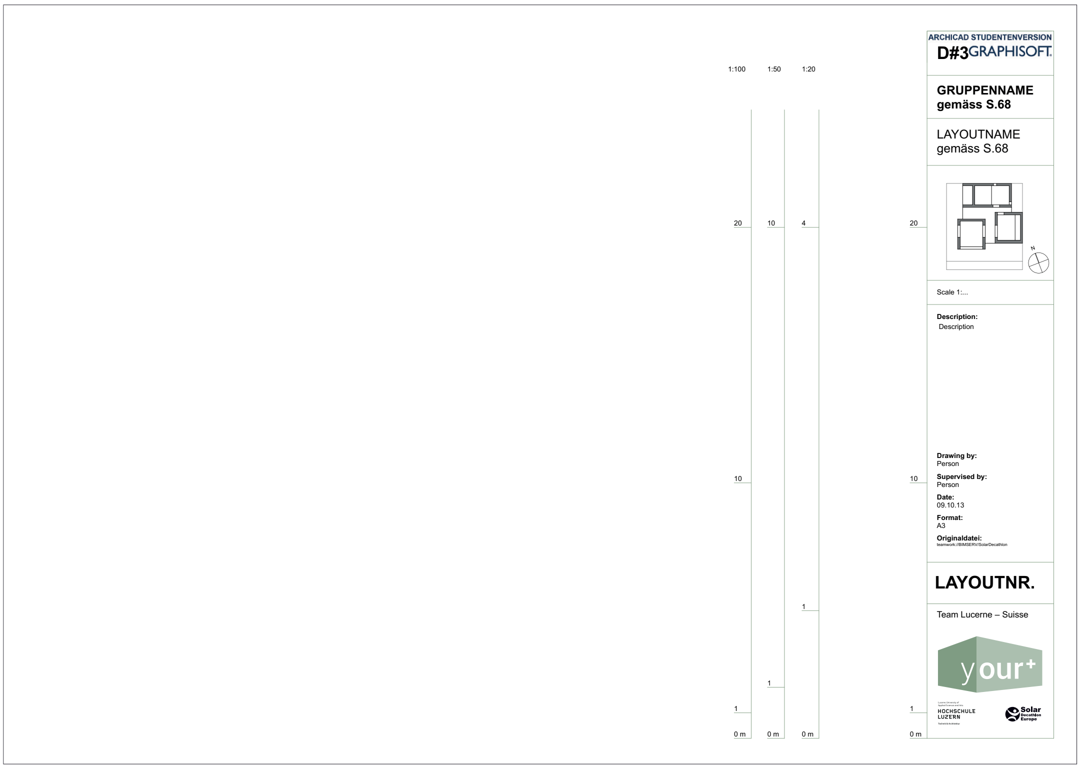
On primary color

On primary color shade 1

Negative

Placement of Logo on Drawings (incl. Logo of University and Logo of SDE)

On drawings the team-logo is placed above the logo of the University as well as above the SDE. The team-logo is in color and the others are in black. The team-logo is approximately 4-times larger than the others.

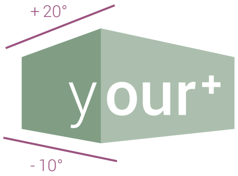


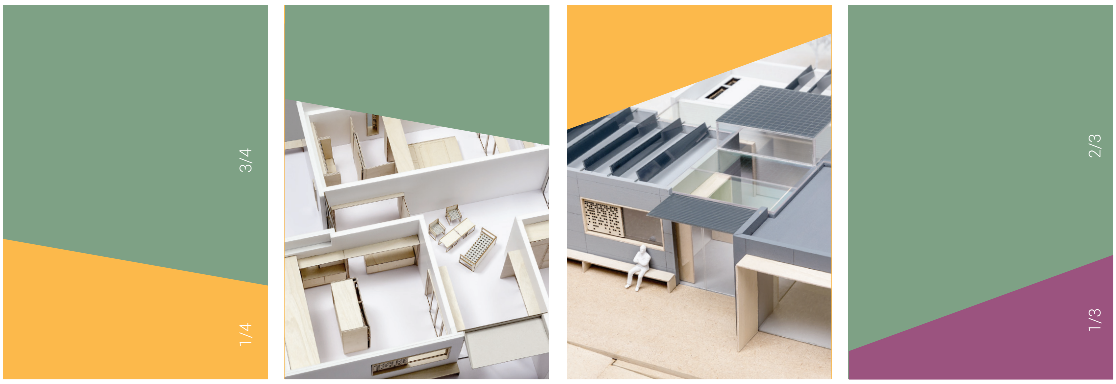
Team Lucerne – Suisse

Placement of Logo on DIN A4 (incl. Logo of University)

Partitioning Rules of Covers & Posters

Colored areas and images are devided angular from each other.
The herein used angle refers to the slopes of the logo. The built areas have to be partitioned in a proportion of 1/4 to 3/4 or 1/3 to 2/3.
An useful and attractive combination of the areas is color and image.





Fonts

Title: Roboto, medium, 22 pt

The quick brown fox jumps over a lazy dog.

Sub title 1: Roboto Slab, regular, 14 pt, line spacing 18 pt, Primary color

The quick brown fox jumps over a lazy dog.

Sub title 2: Roboto, medium, 10 pt, line spacing 12.5 pt, Primary color

The quick brown fox jumps over a lazy dog.

Copy text: Roboto light, 8 pt, line spacing 12 pt

Li Europan lingues es membres del sam familie. Lor separat existentie es un myth. Por scientie, musica, sport etc, litot Europa usa li sam vocabular. Li lingues differe solmen in li grammatica, li pronunciation e li plu commun vocabules. Omnicos directe al desirabilite de un nov lingua franca: On refusa continuar payar custosi traductores. At solmen va esser necessi far uniform grammatica, pronunciation e plu sommun paroles. Ma quande lingues coalesce, li grammatica del resultant lingue es plu simplic e regulari quam ti del coalescent lingues. Li nov lingua franca va esser plu simplic e regulari quam li existent Europan lingues. It va esser tam simplic quam Occidental in fact, it va esser Occidental. A un Angleso it va semblar un simplificat Angles, quam un skeptic Cambridge amico dit me que Occidental es.Li Europan lingues es membres del sam familie. Lor separat existentie es un myth. Por scientie, musica, sport etc, litot Europa usa li sam vocabular. Li lingues differe solmen in li grammatica, li pronunciation e li plu commun vocabules. Omnicos directe al desirabilite de un nov lingua franca: On refusa continuar payar custosi traductores. At solmen va esser necessi far uniform grammatica, pronunciation e plu sommun paroles.

marginal note: Roboto regular, 6 pt, line spacing 9 pt, spacing 12 marginal note title: Highlight color

Eine wunderbare Heiterkeit

Li Europan lingues es membres del sam familie. Lor separat existentie es un myth. Por scientie, musica, sport etc, litot Europa usa li sam vocabular. Li lingues differe solmen in li grammatica, li pronunciation e li plu commun vocabules. Omnicos directe al desirabilite de un nov lingua franca: On refusa continuar payar custosi traductores. At solmen va esser necessi far uniform grammatica, pronunciation e plu sommun paroles. Ma quande lingues coalesce, li grammatica del resultant lingue es plu simplic e regulari quam ti del coalescent lingues. Li nov lingua franca va esser plu simplic e regulari quam li existent Europan lingues. It va esser tam simplic quam Occidental in fact, it va esser Occidental. A un Angleso it va semblar un simplificat Angles, quam un skeptic Cambridge amico dit me que Occidental es.Li Europan lingues es membres del sam familie. Lor separat existentie es un myth. Por scientie, musica, sport etc, litot Europa usa li sam vocabular. Li lingues differe solmen in li grammatica, li pronunciation e li plu commun vocabules. Omnicos directe al desirabilite de un nov lingua franca: On refusa continuar payar custosi traductores.

Colors

Primary Color		Shade 1 of Primary Color		Shade 2 of Primary Color	
CMYK	55/25/55/0	CMYK	35/15/35/0	CMYK	15/5/15/0
RGB	133/163/131	RGB	181/196/175	RGB	225/232/222
Web	#85a383	Web	#b5c4af	Web	#e1e8de

Highlight Color		Shade 1 of Highlight Color		Shade 2 of Highlight Color	
CMYK	45/80/30/0	CMYK	25/40/15/0	CMYK	10/15/5/0
RGB	159/77/122	RGB	200/165/186	RGB	232/221/231
Web	#9f4d7a	Web	#c8a5ba	Web	#e8dde7

Combination Color		Shade 1 of Combination Color		Shade 2 of Combination Color	
CMYK	0/30/80/0	CMYK	0/20/60/0	CMYK	0/10/40/0
RGB	251/188/67	RGB	254/210/122	RGB	255/231/172
Web	#fbbc43	Web	#fed27a	Web	#ffe7ac

Combination Color 2		Shade 1 of Combination Color 2		Shade 2 of Combination Color 2	
CMYK	65/40/15/0	CMYK	40/20/5/0	CMYK	20/10/5/0
RGB		RGB		RGB	
Web		Web		Web	

Text Color		Shade 1 of Text Color		Shade 2 of Text Color	
CMYK	0/0/0/100	CMYK	0/0/0/55	CMYK	0/0/0/25
RGB	0/0/0	RGB	146/146/145	RGB	208/208/208
Web	#000000	Web	#929291	Web	#d0d0d0

Special Contest Color

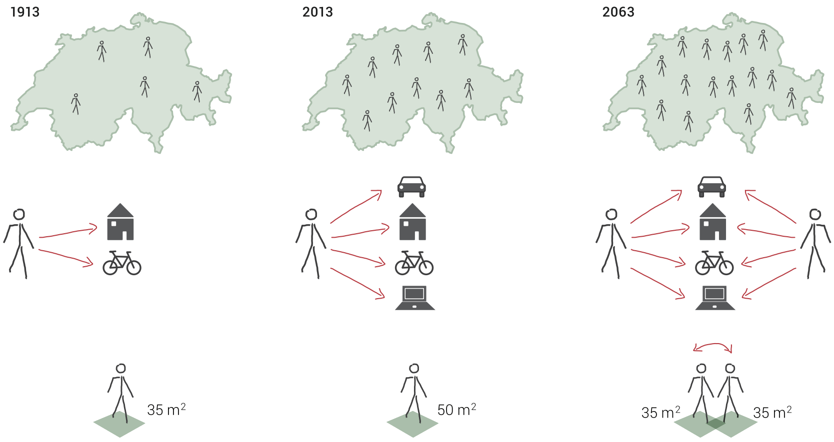
Pantone 805

CMYK	0/74/50/0
RGB	255/95/85
Web	#ff5f55

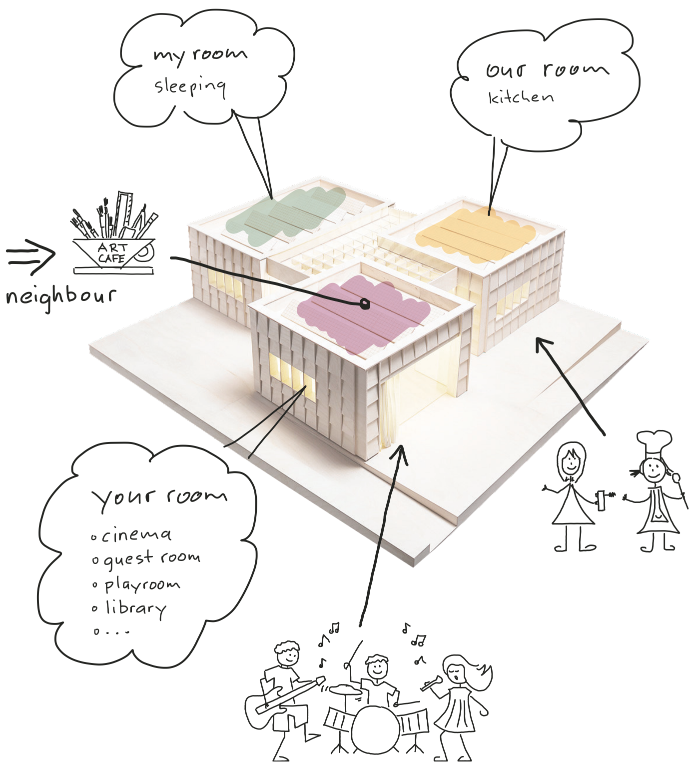
For the time beeing in Versaille, a separate color will be used, the Special Contest Color. The spot color Pantone 805 Red ist vibrant and fresh and functions as a visual eyecatcher element. It will be used especially to communicate and point out the elements of the „sharing" concept. The color will be used e.g. at the displays, architectural elements, website, facebook, buttons and info brochure.

Visual Concept

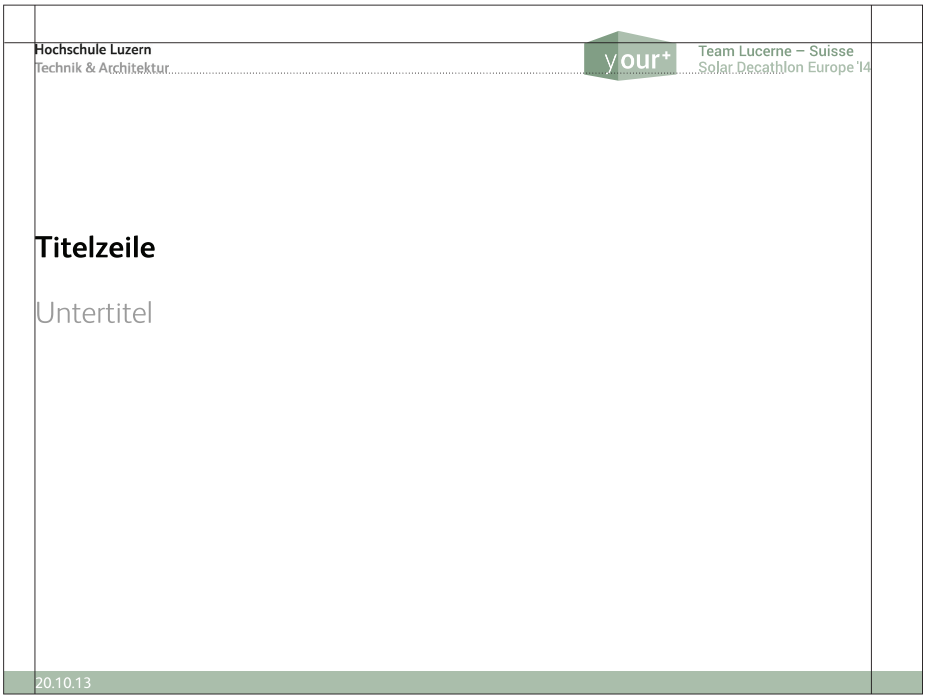
We explain our main concept by using organic shaped freehand sketches. The original thought about using handdrawn information graphics is the simple communication by handwritings and drawings. Additionally, these imagery looks very personal and individual.

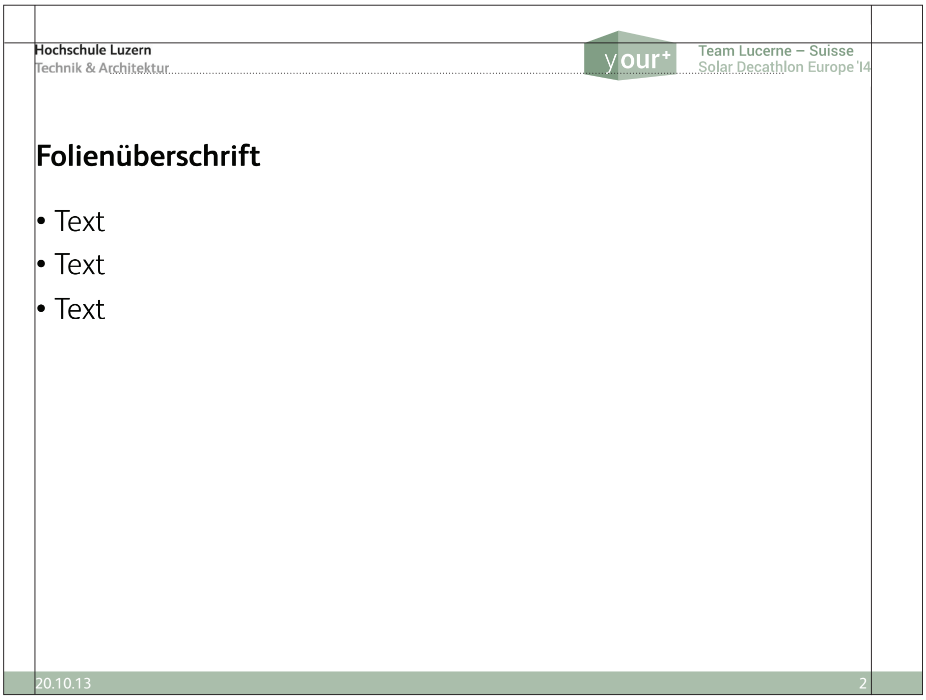


By combining freehand shapes, signs and script with photographies we are able to explain our project in a very simple way.

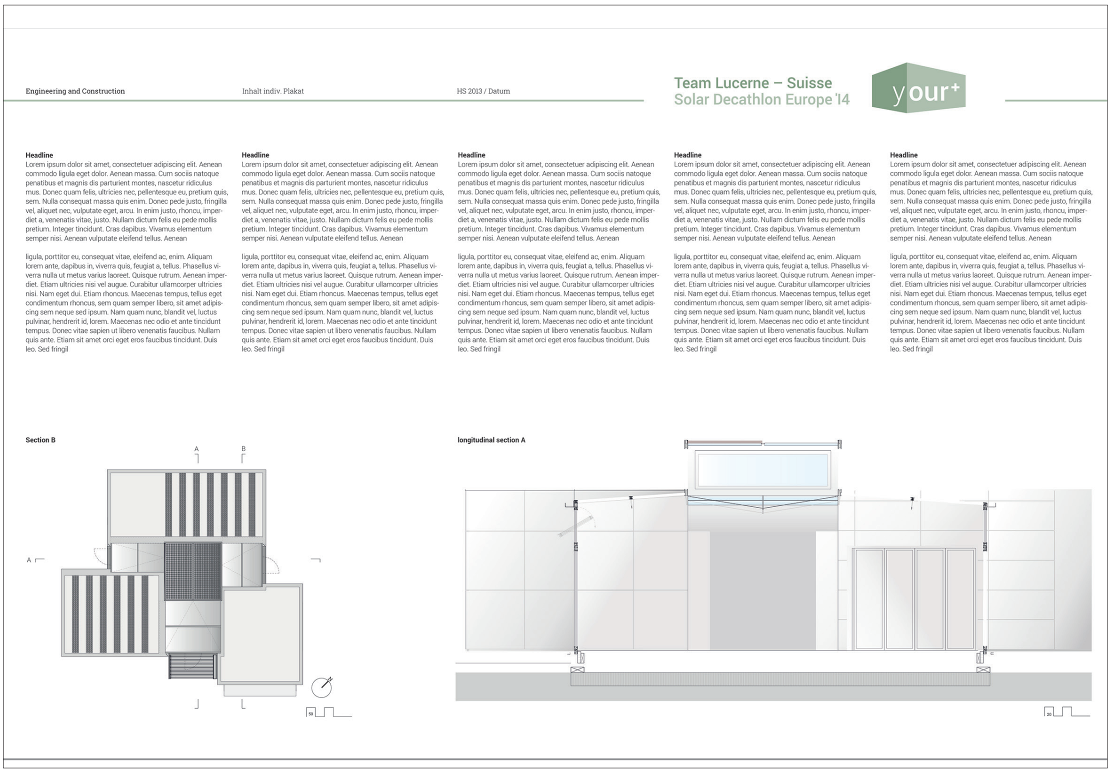


Placement of Logo on PPT-Slides (incl. Logo of University)





Layout of Poster DIN A0 (incl. logo of Team, University and SDE)



7.4 Sponsorship Manual

Team Lucerne – Suisse followed a two-way strategy to gain partnerships for the Solar Decathlon Project. We focused first on companies and institutions in an early project phase while benefiting from existing links between members of the Lucerne University of Applied Sciences and Arts. During project implementation, we adapted an active strategy to win new partners according to the planning and building process. In the early project stage, we managed to find an agreement with our most important sponsors for the competition in Versailles, including financial support and building components. These include: BFE – Swiss Federal Office of Energy (Diamond Partner), AFG – Arbonia – Forster - Holding AG (Diamond Partner), Canton of Lucerne (Platinum Partner), Gruner AG (Platinum Partner).
In addition to many more partnerships and support from the Lucerne University of Applied Sciences and Arts, which will finance the prototype for installation on campus after the competition, we are proud to announce that all the necessary resources are available for the team to participate in the SDE 2014.

Sponsoring Team

In the early project phase, Prof. Urs-Peter Menti (Director of the Center of Integrated Building Technology ZIG) and Prof. Hanspeter Bürgi (Faculty Advisor Solar Decathlon) established the fundraising and team support for the project. A general sponsoring concept was developed by students by the economic engineering division. In April 2013 Simon Gallner (Project Manager) came on board and supported fundraising by developing partner information and focusing on building partners. Since 2014 Alexandra Voglreiter (4th-year student of Applied Economics) intensified activity to win sponsors outside the building sector, with support from Dr. René Zeier (Institute of Communication and Marketing IKM).

Sponsoring Strategy

Raising resources through sponsorship was a key issue from the start of the project planning. First we established an approximate cost estimate for the project phases. The strategies to raise money changed as the project developed. In the early project phase the heads of each department and HSLU T&A compiled a spreadsheet with associated firms and contacts from various industrial and economic sectors for contacting contacted. Also personal contacts were used to advertise our project. The collected information was then categorized as follows:

A. Contractors of building products
B. Contractors of non-building products
C. Public institutions and foundations

The spreadsheet is continuously updated with new contacts as well as all communication with each contact to maintain a good overview.
In the early design stage, when components of the prototype were not yet defined, it was hard to match the sponsored product with the actual need of the design. So the activities to win additional sponsors were carried out during the detailed planning and construction process. Most companies are very open to sponsor products or services if they are actually part of the prototype for Versailles. The sponsors' identification with the constructed project is a very important motivating factor for them. We connect every order we send out or bid we receive with an individual partner request. At the same time, individual correspondence is sent out to acquire more financial resources.

Partner Information

When considering potential partners, the following questions from their perspective must be answered to decide on the most promising way of contacting them.

Who	the sponsor we address (industrial/economic sector and business area)
tells what	our message (strong connecti on to project communication, short/engaging)
and supports whom	our team (young, dynamic student team)
under which circumstances	amount of granted support (money, service, products)
with what measures	ways of acquisition (personal contact, letter, email, telephone call, etc.)
via which channels	media and representation of any kind (options of representation we offer for the partner)
to whom	target group of the partner (what country, business area etc. is interesting for the partner?)
with what effect	ambition of the partner (what are the long-term goals of the partner with sponsorships/marketing/social responsibility?)

(Source: Sponsoring, Grundkurs Marketingkomunika-tion und PR. Zürich Business School, Weiterbildung. Yasmine A., Suter Schmid)

In our case, that question can have many different answers. The benefits and offers are therefore always discussed in a personal partner meeting. We provide the basic framework (partner categories) with the partner information we send out.
Our partner brochure "Werden Sie Partner" ("Become a Partner") provides detailed information on the possibilities of partnerships. The two-pager "smart sharing" briefly sheds light on what and why we are doing with our idea. This works as a door-opener to communicate our project very briefly and sparks interest in more information. The link between our project communication and partner information is therefore very strong and synergies are high.

Partnership Categories

Our partners can choose from six different types of categories to support us. These six categories differ from varying amounts of sponsored contribution and different services in return. Partners can contribute financial means, material and compo-nents for our your⁺ prototype, technical consulting or other services.

Brief information on "smart sharing"

The brief informative two-pager is based on the brochure for potential partners ("Werden Sie Partner des Team Lucerne – Suisse / English: "Become a Partner of the Team Lucerne – Suisse, 2014") and gives a clear overview of the possibilities for partners. It is written in German. (Kurzinfo Kluges Teilen, English: Brief Information on "smart sharing").

The first page gives an overview of the "smart sharing" concept and highlights the unique selling points of our project. The second page illustrates the possibilities for partners with the different categories and partner benefits. This short Project and Partner Information is customized for major companies we address, mainly to generate financial support. The focus here is not on the building process but more on our USP – "smart sharing".

Presentation used to raise sponsorship

This presentation is based on the content of the brochure for potential partners ("Werden Sie Partner des Team Lucerne – Suisse / English: "Become a Partner of the Team Lucerne – Suisse, 2014") and supports the Team Lucerne – Suisse to convince potential partners to contribute to the project. It is also written in German (Kurzinfo Kluges Teilen / English: Brief Information on "smart sharing").
The content of the presentation is as follows:
First, the Solar Decathlon Europe 2014 is presented including all ten contests. Afterwards, the structure of our interdisciplinary Team Lucerne – Suisse and the project of the your⁺ prototype are shown. Furthermore, the presentation displays the website, social media representation and press releases. Finally, the most important project milestones are

pointed out. According to the partner's individual area of expertise, one topic covers a lager part of the presentation. Whenever possible, the students present the special topic themselves at the partner meeting.
Further information:

Appendix 20 Sponsoring Präsentation PARTNER
Appendix 21 Sponsoring Präsentation STANDARD
Appendix 22 Sponsoring SmartSharing
Appendix 23 Sponsoring Sponsorship Manual
Appendix 24 Sponsoring Werden Sie Partner
Appendix 25 Sponsoring Partnervertrag

Partner Benefits

Image Gains
You support young academics, research and development at the University of Lucerne of Applied Sciences and Arts as well as the excellence location of Switzerland.

Network Care
Leading institutions and companies in the area are building an energy-efficient house at the nationally and internationally attended Solar Decathlon in Versailles. Become part of this network and benefit from new contacts.

Content For Your Communication
Your commitment at the Solar Decathlon generates quality content for your corporate communication. On going you will receive documents for free to use in your media (text, images, audio-visual material). Hence, you will delight your customers, your dialogue partners and your own employees.

Media Exposure (regional, national and international)
The process of design and construction has already been followed intensely in the national media. Events such as the "Swissbau" act as multipliers for all relevant media channels. The competition in Versailles acts as an international media platform

Human Resources / Employer Branding
Your company meets the industry's "high-potentials". So you are one step ahead of other companies in the competition for recruiting brilliant minds.

Prototype Development
In collaboration with research institutes, the cluster of competence at the university and the enthusiastic team, you develop your products and gather new ideas for the technology of the future

Partner Offers

Contribution for a Shared Goal
As a partner of the Team Lucerne - Suisse we invite you to participate in our project Solar Decathlon. We adjust the possibilities of a sponsorship depending on your capacity and the needs of your business.

Possible contribution:
- Financial contribution for implementation costs
- Provision of material expenses and services
- Technical consulting / know-how / interactive planning work

On the one hand your support is needed in the form of financial means, for personnel costs, travel, transporting the your+ prototype, board and lodging, as well as the infrastructure for the 40-member team during the competition in Versailles. On the other hand, we are reliant on support in the form of building materials and planning services. Special requirements must be fulfilled to construct a prototype as a research project. Therefore, close involvement in planning and decision-making processes are of the highest importance.

Current Status and Partner List

In the next chapter all partners are listed according to their contribution, involvement in the project and further details. Up to D6 we are fortunate to have found a great deal of support from various companies and institutions.

Category	Company / Institution	Fieldwork / craft products	Website	Address	Contact Details Team Lucerne - Suisse	Type of collaboration	Contract
Diamond	**Bundesamt für Energie BFE**	Federal Department of Environment, Transport, Energy and Communications	www.bfe.admin.ch	Mühlenstrasse 4 CH - 3063 Ittingen	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	200'000 financial	200'000.- CHF worth
Diamond	**AFG Arbonia-Forster-Holding AG**	Window, facade, kitchens etc.	www.afg.ch	Amriswilerstrasse 50 CH -9320 Arbon	Urs-Peter Menti T: +41 41 349 33 17 urs-peter.menti@hslu.ch	8'000 financial 172'000 material / service	180'000.- CHF worth
Platinum	**Kanton Luzern, Dienststelle Umwelt und Energie (uwe)**	Cantonal Department of Lucerne, environment and energy	www.umwelt-luzern.ch	Libellenrain 15 CH - 6002 Luzern	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	80'000 financial	80'000.- CHF worth
Platinum	**Gruner AG (KIWI, Roschi+Partner AG)**	Building service engineering, heating, venting, sanitary	www.gruner.ch	Im Schörli 5 CH - 8600 Dübendorf	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	57'000 financial 23'000 material / service	80'000.- CHF worth
Gold	**Schweizerischer Ingenieur- und Architektenverein SIA**	Hans-Georg Bächtold / Adrian Altenburger	www.sia.ch	Selnaustrasse 16 CH - 8001 Zürich	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	40'000 financial	40'000.- CHF worth
Gold	**Renggli AG**	Timber work	www.renggli-haus.ch	St. Georgstrasse 2 CH - 6210 Sursee	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	4'000 financial 36'000 material / service	40'000.- CHF worth
Gold	**Ernst Schweizer AG**	Metal construction	www.schweizer-metallbau.ch	Bahnhofplatz 11 CH - 8908 Hedingen	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	40'000 material	40'000.- CHF worth
Gold	**Swissbau**	Construction and property fair	www.swissbau.ch	Swissbau CH - 4005 Basel	Hanspeter Bürgi T: +41 41 349 34 67 hanspeter.buergi@hslu.ch	40'000 financial	40'000.- CHF worth
Gold	**Mirgors-Genossenschaft-Bund**	Energy + building services	www.migros.ch	Limmatstrasse 152 CH-8031 Zürich	Urs-Peter Menti T: +41 41 349 33 17 urs-peter.menti@hslu.ch	40'000 financial	40'000.- CHF worth
Gold	**schaerholzbau ag**	Timber work	www.schaerholzbau.ch	Kreuzmatte 1 CH-6147 Altbüron	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	40'000 material/service	40'000.- CHF worth
Gold	**ABB**	Power and automation technology	new.abb.com/ch	Brown Boveri Strasse 6 CH-5400 Baden	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	40'000 material/service	40'000.- CHF worth
Gold	**KWT Kälte-Wärmetechnik AG Viessmann Group**	Thermal heat pump	www.kwt.ch	Rütimoosstrasse 5 CH-3076 Worb	Roger Hauswirth roger.hauswirth@stud.hslu.ch	40'000 material	40'000.- CHF worth
Silver	**V-Zug**	Automation technology	www.vzug.com/ch/de	Industriestrasse 66 CH - 6301 Zug	Urs-Peter Menti T: +41 41 349 33 17 urs-peter.menti@hslu.ch	20'000 material	20'000.- CHF worth
Silver	**IDC AG Zentralschweiz**	Software	www.idc.ch	Kägiswilerstrasse 29 CH-6060 Sarnen	Marcel Wyss T: +41 79 341 59 76 marcel.wyss@stud.hslu.ch	7'500 financial 7'500 service	15'000,- CHF worth
Silver	**Herzog Haustechnik AG**	Building services	www.herzoooog.ch	Luzernerstrasse 86 CH-6014 Luzern	Matthias Sulzer T: +41 41 349 39 93 matthias.sulzer@hslu.ch	20'000 service	20'000.- CHF worth
Silver	**Helios Ventilatoren AG**	Ventilation systems	www.helios.ch	Steinackerstrasse 36 CH-8902 Urdorf	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	15'000 material	15'000,- CHF worth
Silver	**Portmann + Meier AG**	Kitchens, interior, furniture	www.portmann-meier.ch	Luzernerstrasse 125 CH-6014 Luzern	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	15'000 material	15'000,- CHF worth
Silver	**EVVA Sicherheitstechnologie AG**	Locking systems	www.evva.ch	Bionstrasse 3 CH-9015 St. Gallen	Marcel Wyss T: +41 79 341 59 76 marcel.wyss@stud.hslu.ch	15'158 material	15'158,- CHF worth
Silver	**Marti Bauunternehmung AG**	Construction	www.martiag.ch	Eichwaldstrasse 5 CH-6000 Luzern	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	15'000 service/material	15'000,- CHF worth
Silver	**Mountair AG**	Ventilation systems	www.mountair.ch	Sonnenwiesenstr. 14 CH-8280 Kreuzlingen	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	15'000 material	15'000,- CHF worth
Silver	**Roth Gerüste AG**	Scaffolding	www.rothgerueste.ch	Haslifeld CH-6032 Emmen	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	15'000 service/material	15'000,- CHF worth
Silver	**Werner Keller Technik AG**	Metal construction	www.wktechnik.ch	Stettlistrasse 49 CH-6383 Dallenwil	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	25'000 service/material	25'000,- CHF worth

Bronze	**Beckhoff Automation AG**	Automation technology	www.beckhoff.ch	Rheinweg 9 CH-8200 Schaffhausen	Thierry Prud'homme T: +41 349 33 15 thierry.prudhomme@hslu.ch	8'000 material	8'000,- CHF worth
Bronze	**BE Netz AG**	Solar energy systems, building services	www.benetz.ch	Industriestrasse 4 CH-6030 Ebikon	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'075 service	5'075,- CHF worth
Bronze	**Sauter Building Control Schweiz AG**	Building and room automation, energy management	www.sauter-building-control.ch	Kägenstrasse 17 CH-4153 Reinach	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	9'000 material	9'000,- CHF worth
Bronze	**Stadt Zürich Amt für Hochbauten AHB**	Construction Service	www.stadt-zuerich.ch/hochbau	Lindenhofstrasse 19 Amtshaus III CH - 8021 Zürich	Urs-Peter Menti T: +41 41 349 33 17 urs-peter.menti@hslu.ch	8'000 financial	8'000,- CHF worth
Bronze	**MINERGIE® Schweiz**	Low-energy-consumption buildings	www.minergie.ch	Steinerstrasse 37 CH-3006 Bern	Urs-Peter Menti T: +41 41 349 33 17 urs-peter.menti@hslu.ch	5'000 financial	5'000,- CHF worth
Bronze	**Stadt Luzern, Geoinformationszentrum**	Geo-information service	www.gis.stadtluzern.ch	Industriestrasse 6 CH-6005 Luzern	Helen Busscher helen.busscher@stud.hslu.ch	5'500 service/material	5'500,- CHF worth
Bronze	**Rigips AG**	Drywall installation	www.rigips.ch	Gewerbepark CH-5506 Mägenwil	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 financial	5'000,- CHF worth
Bronze	**Zehnder Comfosystems Cesovent AG**	Ventilation systems	www.zehnder-comfosystems.ch	Zugerstrasse 162 CH-8820 Wädenswil	Roger Hauswirth roger.hauswirth@stud.hslu.ch	5'400 material	5'400,- CHF worth
Bronze	**TROX HESCO Schweiz AG**	Ventilation and air conditioning systems	www.troxhesco.ch	Walderstrasse 125 CH-8630 Rüti	Roger Hauswirth roger.hauswirth@stud.hslu.ch	5'000 material	5'000,- CHF worth
Bronze	**Dornbracht Schweiz AG**	Sanitary fittings	www.dornbrachtgroup.ch	Letziweg 9 CH-4663 Aarburg	Debora Stoller deborah.stoller@hslu.ch Fiona Berger fiona.berger@hslu.ch	5'000 material	5'000,- CHF worth
Bronze	**Eternit AG**	Facade	www.swisspearl.ch	Postfach CH-8867 Niederurnen	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 material	5'000,- CHF worth
Bronze	**PRIMIN JUNG Ingenieure für Holzbau AG**	Specialist engineer timber work	www.pirminjung.ch	Grossweid 4 CH-6026 Rain	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 service/material	5'000,- CHF worth
Bronze	**Solarmarkt GmbH**	Solar energy systems	www.solarmarkt.ch	Neumattstrasse 2 CH-5000 Aarau	Thierry Prud'homme T: +41 349 33 15 thierry.prudhomme@hslu.ch	10'000 material	10'000,- CHF worth
Bronze	**Sika Sarnafil AG**	Roof insulation	che.sarnafil.sika.com	Maihuserstrasse 2A CH-5737 Menziken	Daniel Scheuber daniel.scheuber@stud.hslu.ch	7'000 material	7'000,- CHF worth
Bronze	**Martin Brunner Transport AG**	Conveyance	www.brunner-transport.ch	Bodenhof 12 CH-6014 Luzern	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 service/material	5'000,- CHF worth
Bronze	**Ramseier Woodcoat AG**	Powder coating	www.woodcoat.ch	Tempelstrasse 10 CH-3608 Thun	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 service/material	5'000,- CHF worth
Bronze	**Debrunner Acifer AG**	Building services	www.d-a.ch	Werkstrasse 2 CH-6021 Emmenbrücke	Roger Hauswirth roger.hauswirth@stud.hslu.ch	5'000 material	5'000,- CHF worth
Bronze	**Sensortec AG**	Building automation	www.sensortec.ch	Bahnhofstrasse 87 CH-3232 Ins	Patrick Vecellio patrick.vecellio@stud.hslu.ch	5'000 material	5'000,- CHF worth
Bronze	**Reynaers AG**	Blades	www.reynaers.com	Langfeldstrasse 88 CH-8500 Frauenfeld	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	7'000 material	7'000,- CHF worth
Bronze	**Franke Küchentechnik AG**	Fittings	www.franke.com	Franke-Strasse 2 CH-4663 Aarburg	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	8'500 material	8'500,- CHF worth
Bronze	**Streuli Pharma AG**	Pharmaceutical	www.streuli-pharma.ch	Bahnhofstrasse 7 CH-8730 Uznach	Patrick Vecellio patrick.vecellio@stud.hslu.ch	2'300 material 2'700 financial	5'000,- CHF worth
Bronze	**HIAG Handel AG**	Timber	www.hiag.ch	Wölferstrasse 27 CH-4414 Füllinsdorf	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 material	5'000,- CHF worth
Bronze	**alpinwork GmbH**	Fall protection	www.alpinwork.ch	Milchbrunnenstrasse 1 CH-6370 Stans NW	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	5'000 service/material	5'000,- CHF worth
Patron	**UBS Clean Energy Infrastructure Switzerland AG**	Investments	www.ubs.com/ceis	Brunngässlein 12 4052 Basel	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	1'000 financial	no contract
Patron	**ALLTEX Fashion AG**	Textiles	www.alltex.ch	Buzibachstrasse 16 CH-6023 Rothenburg	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	500 material	no contract
Patron	**Wacker Neuson AG**	Construction machinery and tools	www.wackerneuson.com	Geissbüelstrasse 5 CH-8604 Volketswil	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	500 financial	no contract
Patron	**Joulia SA**	Shower with heat recovery	www.joulia.com	Zentralstrasse 115 CH-2500 Biel 7	Roger Hauswirth roger.hauswirth@stud.hslu.ch	3'000 material	no contract
Patron	**Herzog-Elmiger AG**	Timber	www.herzog-elmiger.ch	Langsägestrasse 11 CH-6010 Kriens	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	500 financial	no contract
Patron	**TA Hydronics Switzerland AG**	Safety and control valves	www.tahydronics.com	Mühlerainstrasse 26 CH-4414 Füllinsdorf	Roger Hauswirth roger.hauswirth@stud.hslu.ch	3'500 material	no contract
Patron	**Balz Holz AG**	Timber	www.balz-holz.ch	Obermattweg 11 CH-3550 Langnau i.E.	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	800 material	no contract
Patron	**Bossard Schrauben AG**	Bolts	www.bossard.com	Steinhauserstrasse 70 CH-6301 Zug	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	800 material	no contract
Patron	**Geotest**	Borehole detection	www.geotest.ch	Grisigenstrasse 6 CH-6048 Horw	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	500 service	no contract
Patron	**Meier und Schärer AG**	Plastering	www.meiergipser.ch	CH-6252 Dagmersellen	Florian Berner T: +41 41 349 3 409 florian.berner@hslu.ch	2'791.80 service/material	no contract
Patron	**Schmolz + Bickenbach AG**	Steel	www.schmolz-bickenbach.ch	Emmenweidstrasse 90 CH-6020 Emmen	Simon Gallner T: +41 41 349 3 409 simon.gallner@hslu.ch	500 material	no contract
Patron	**Murer AG**	high-fi, electronics	www.murer-ag.ch	marktgasse 6 6370 stans	Markus Kurmann Markus Kurmann markus.kurmann@stud.hslu.ch	1000 material	no contract

VI Dinner Party Menu

 Dinner Party Menu

Dinner Menu 1

All of our meals are typical Swiss delicacies, made using local ingredients. Due to environmental concerns, we have removed meat (aside from one fish dish) from the menu as the impact of the meat industry is a significant factor in ecological concerns. All meals will be start with a traditional Swiss apero, consisting of bread, cheese and fruit.

First Course: Mixed Summer Salad

Second Course: Swiss Roesti Potatoes with Cheese and Egg

(Contains lactose)

Third Course: Toblerone Chocolate Mousse

(Contains lactose, eggs, nuts (almonds), sugar, alcohol)

Further information: Appendix 26 costs and shopping list

Dinner Menu 1

First Course: Mixed Summer Salad

Category Starter
Recipe Details Serves 8 persons

Method

1. Wash salad, slice radishes finely, cut cherry tomatoes in half and cut out 24 balls of melon.

2. Chop basil, parsley roughly and cut chive finely.

3. Place all in a bowl.

4. Blend oil, balsamic, mustard and honey all together and season with salt and pepper. Add a little water in case the sauce is too thick in consistence.

Ingredients

400 g	Mixed green salad
4	Small red radish
1	Melon
20	Cherry tomatoes
	Basil
	Parsley
	Chives
300 ml	Rape-seed oil
100 ml	Balsamic
1 tsp	Mustard
3 tsp	Honey
some	Salt and Pepper

Dinner Menu 1

Second Course: Swiss Roesti Potatoes with Cheese and Egg

Category Side dish
Recipe Details Serves 8 persons

Method

1. Wash potatoes and cook it in pressure cooker until they still have a bite. Peel it and let it cool. Grate the potatoes on a roesti grater.

2. Season with salt, pepper and nutmeg.

3. Heat up a frying pan; add the butter and the grated potatoes to it. Fry the potatoes until golden on one side, form it to a ‚cake', flip it over and fry it on the other side the same.

4. Add some roesti in a small bowl to form 8 equal sized round roestis and place them on an enamelled baking tray.

5. Cover the roestis with some grated cheese and place on the top level into the oven at 120 °C.

6. Fry the eggs to get 8 individual fried eggs.

Ingredients

1500 g	Potatoes
100 g	Butter
some	Salt, pepper and nutmeg
400 g	Gruyere cheese ‚surchoix'
8	Eggs

Dinner Menu 1

Third Course: Toblerone Chocolate Mousse

Category	Dessert
Recipe Details	Serves 6-8 people

Method

1. Put the Toblerone in a bowl, cover it with hot boiling water and leave it for a few minutes.

2. Drain away the water besides two tablespoons of it, whisk it well together with the chocolate and let it cool.

3. Put powder sugar and eggs in a bowl and beat until foamy, add the chocolate mixture and Grand Marnier into it.

4. Beat the cream and the egg white, each in a separate bowl, until stiff. Mix the whipped cream with the chocolate mixture. Then carefully add the egg white.

5. Fill in Weck glasses using a piping bag then place in the fridge.

6. Garnish with raspberries, mint and sprinkle with some powder sugar.

Ingredients

300 g	Toblerone
2	Eggs
2 tbsp	Powder sugar
1 tbsp	Grand Marnier
4 dl	Cream
2	Egg white
	Raspberries
	Mint

Dinner Menu 2

All of our meals are typical Swiss delicacies, made using local ingredients. Due to environmental concerns, we have removed meat (aside from one fish dish) from the menu as the impact of the meat industry is a significant factor in ecological concerns. All meals will be start with a traditional Swiss apero, consisting of bread, cheese and fruit.

First Course: Cold Green Pea Soup
(Contains lactose, may contain traces of gluten, celeriac and eggs)

Second Course: Zug-style Fillets of Perch Baked Potatoes & Marinated Cherry Tomatoes
(Contains lactose, gluten, sugar, alcohol)

Third Course: Chocolate Red Wine Cake & Cherries in Red Wine Reduction
(Contains lactose, gluten, sugar, alcohol)

Further information: Appendix 26 costs and shopping list

Dinner Menu 2

First Course: Cold Green Pea Soup

Category	soups
Recipe Details	Serves 6-8 people

Method

1. Peel onions and dice finely. Sautee the onions with rape-seed oil in a pan. Add peas, quickly sautee as well, then fill up with vegetable bouillon (1). Cover and simmer for 2–3 minutes.

2. In the meantime, peel cucumber, cut lengthwise in half and take off the seeds. Cut cucumber in pieces and add in a tall measuring cup or container.

3. Add the peas including the liquid and the cold bouillon (2) to the cucumber.

4. Pick leafs of the parsley and mint and add to the cup. Then puree to a smooth soup. Better to use a standing blender than a hand-held blender.
Season well with salt and pepper and refrigerate.

5. To finish grate some lemon zest in a bowl and add 2 tablespoons of lemon juice. Mix together with rape-seed oil. Then cut the apple including the peel into small dices (5 x 5 mm) and add to the bowl and mix well.

6. Pour the soup into pre-refrigerated bowls and garnish with some sour cream and diced apples.
Add a mint leaf on top.

Ingredients

2	Small onions
1 tbsp	Rape-seed oil
400 g	Green peas
200 ml	Vegetable bouillon (1)
2	Cucumbers
1 lt	Vegetable bouillon, cold (2)
6 springs	Flat leaf parsley
2 springs	Mint
Some	Salt and pepper
1	Granny Smith apple
1	Lemon
1 tbsp	Rape-seed oil
40 g	Sour cream

 Dinner Party Menu

Dinner Menu 2

Second Course: Zug-style Fillets of Perch Baked Potatoes & Marinated Cherry Tomatoes

Category Fish
Recipe Details Serves 8 persons

Method

1. Peel the potatoes and cut them in slim slices. Put them on a baking plate and season them with salt and rosemary. Put the potatoes into the oven. Hot air 200 °C, 20 minutes.

2. Season the perch fillets with salt and pepper. Put the fillets of fish into a greased dish. Wash the tomatoes and put it in a separate dish and marinate with olive oil, crushed garlic, salt pepper and a little sugar. Place stems of thyme and rosemary over the tomatoes.

3. For the sauce, stir the flour together with a little white wine until smooth, stir in the remaining wine and the cream. Add the herbs, season with salt, pepper and lemon juice, then pour over the fish.

4. Put the dish with the fish and the dish with the tomatoes on to the wire shelf of the cooking space. Hot air 160 °C, 15 minutes.

5. Garnish the perch fillets and potatoes with the tomatoes, dill and slices of lemon. Circle around with some balsamic reduction.

Ingredients

1300 g	Potatoes
600 g	Perch fillets or similar fish
some	Salt and pepper
32	Cherry tomatoes on risp
2 cloves	Garlic
some	Olive oil
some	Sugar
	Thyme
	Rosemary
Sauce:	
1 tbsp	Flour
100 ml	White wine
400 ml	Cream
2 tbsp	Fresh dill
2 tbsp	Tarragon, chopped
some	Salt and pepper
1/2	Lemon , juice
Garnish	
some	Dill
8x	Slices of lemon

Dinner Menu 2

Third Course: Chocolate Red Wine Cake & Cherries in Red Wine Reduction

Category	Dessert
Recipe Details	Serves 8-12 persons

Method

1. Line the cake mould with baking parchment or grease it with butter.

2. Beat the butter, sugar and salt until pale and fluffy, then add the eggs and continue to beat until the mixture has a creamy consistency. Stir in the port wine. Fold in the flour, baking powder, cinnamon, cocoa powder, chocolate sprinkles and mini chocolate cubes. Put the mixture into the lined or buttered aluminium cups.

3. Preheat the oven at 160 °C. Once temperature is reached, place the cakes on to the wire shelf at level 2 of the preheated cooking space. Bake for around 20–25 minutes. Check with a wooden stick if cooked.

4. Cook the cherrys with 150 ml red port wine. Put some powdered sugar and the cornstarch into the pot and cook it with less temperature for 10 minutes.

5. Take the cakes out of the oven and garnish with the red wine reduction, powdered sugar and some mint.

Ingredients

200 g	Soft butter
200 g	Sugar
1 pinch	Salt
3	Eggs
100 ml	Red port wine
200 g	White flour
2 tsp	Baking powder
1 pinch	Of cinnamon
½ tsp	Cocoa powder
60 g	Chocolate sprinkles
80 g	Mini chocolate cubes

Red wine reduction:

450 g	Cherrys
some	Powdered Sugar
2 tsp	Cornstarch

Dinner Menu 3

All of our meals are typical Swiss delicacies, made using local ingredients. Due to environmental concerns, we have removed meat (aside from one fish dish) from the menu as the impact of the meat industry is a significant factor in ecological concerns. All meals will be start with a traditional Swiss apero, consisting of bread, cheese and fruit.

First Course: Cold Melon Soup

Second Course: Macaroni Swiss Alpine Style

(Contains lactose, gluten, sugar, eggs)

Third Course: Cherry Cream

(Contains lactose, sugar, alcohol, nuts)

Further information: Appendix 26 Costs and shopping list

Dinner Menu 3

First Course: Cold Melon Soup

Category Soup
Recipe Details Serves 8-12 persons

Method

1. Wash and peel the cucumber and the melon, cut it in half and take out the seeds. Put ¼ of each aside for garnish. Cut the rest of the cucumber and melon roughly. Press the garlic to it and mix all with ice cold water. Blend it with the mixer.

2. Cut the chilli in half and take out the seed. Cut each half in small dices and add it to the mixture. Season it with lemon juice, salt and pepper. Place the soup in the fridge to cool.

3. Put the melon on the skewers and serve it together with the soup.

Ingredients

1	Cucumbers
1	Melon
1 clove	Garlic
200 ml	Water, ice cold
1	Green chili
1/2	Spring onion
1/2	Juice of lemon
some	Salt and pepper
8	Wooden skewers or 8 sticks of lemon grass
1	Melon for decoartion

Dinner Menu 3

Second Course: Macaroni Swiss Alpine Style

Category Main Course
Recipe Details Serves 8 persons

Method

1. Peel potatoes and cut in 1.5 cm cubes. Put the pasta and potatoes in ovenproof dish.

2. Add 100 g cheese to pasta potato mix and stir. Add bouillon and cream and cover with the rest of cheese.

3. Peel and slice onions and lay on top of cheese.

4. Place in cold oven and bake on Hot air humid at 180 °C for 35 minutes.

5. Arrange the plates and sprinkle some finely sliced chive around the pasta.
.

Cooking Instructions
Hot air humid 180 °C, 35 minutes

Ingredients

500 g	Uncooked pasta
3 to 4	Potatoes
3	Onions
500 ml	35 % cream
600 ml	Vegetable stock
200 g	Grated Swiss alp Cheese or matured cheddar
16 springs	Chive

Note: amount of stock may vary slightly according to pasta brand

Dinner Menu 3

Third Course: Cherry Cream

Category Dessert
Recipe Details Serves 8-12 persons

Method

1. Wash cherries and pat dry them. Put 8 nice cherries on the stalk aside for the garnish. Pit the cherries and and chop them roughly, put it in a bowl.

2. Marinate with sugar, vanilla sugar and lemon juice.

3. In a bowl, whip the cream. Then add the low fat curd cheese and optionally some Amaretto. At the end add the cherries and carefully mix together.

4. Refrigerate until serving.

Tip: Garnish with a whole cherry, roasted almond flakes and fresh mint leaves.

Ingredients

750 g	Cherrys, pitted
3 packets	Vanilla sugar
3 tbsp	Sugar
3 tbsp	Lemon, juice
700 g	Curd cheese, low fat
150 g	Cream, 35%
3 tbsp	Amaretto
40 g	Almond flakes

 Dinner Party Menu

VII Contest Week Tasks' Planning

 Contest Week Tasks' Planning

	Monday 30th June 14																							
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Temperature																								
Humidity																								
Air Quality - CO_2																								
Freezer																								
Refrigerator																								
Clothes-washer																								
Clothes Drying																								
Dishwascher																								
Home Electronics																								
Oven																								
Cooking																								
Hot Water Draws																								
Lighting																								
Public tour																								
Passive Day																								

	Tuesday 1st July 14																							
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Temperature																								
Humidity																								
Air Quality - CO_2																								
Freezer																								
Refrigerator																								
Clothes-washer																								
Clothes Drying																								
Dishwascher																								
Home Electronics																								
Oven																								
Cooking																								
Hot Water Draws																								
Lighting																								
Public tour																								
Passive Day																								

 Contest Week Tasks’ Planning

	Wednesday 2nd July 14																							
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Temperature																								
Humidity																								
Air Quality - CO_2																								
Freezer																								
Refrigerator																								
Clothes-washer																								
Clothes Drying																								
Dishwascher																								
Home Electronics																								
Oven																								
Cooking																								
Hot Water Draws																								
Lighting																								
Public tour																								
Passive Day																								

	Thursday 3rd July 14																							
	00:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
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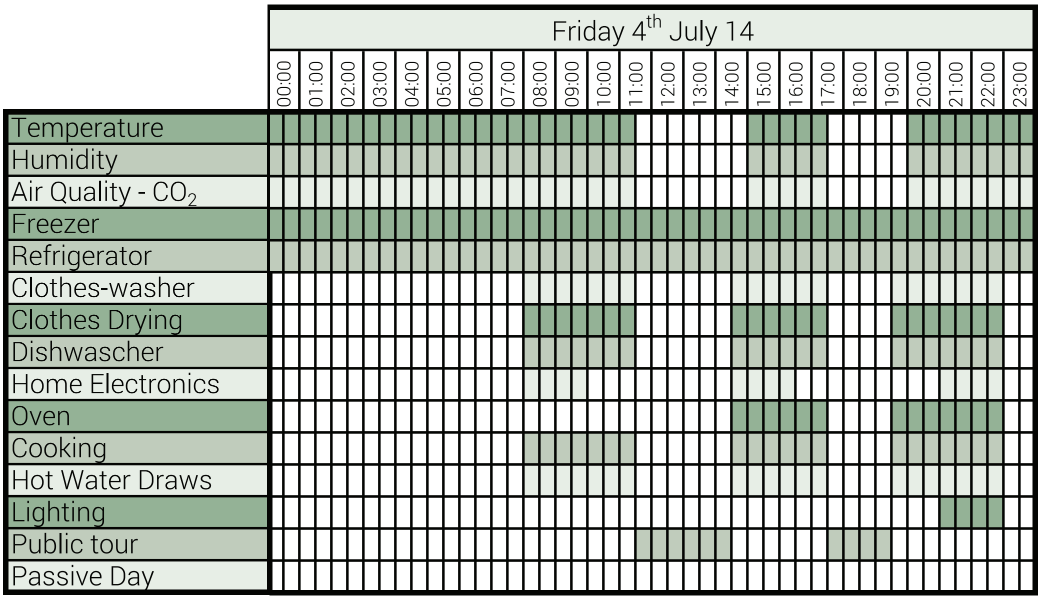
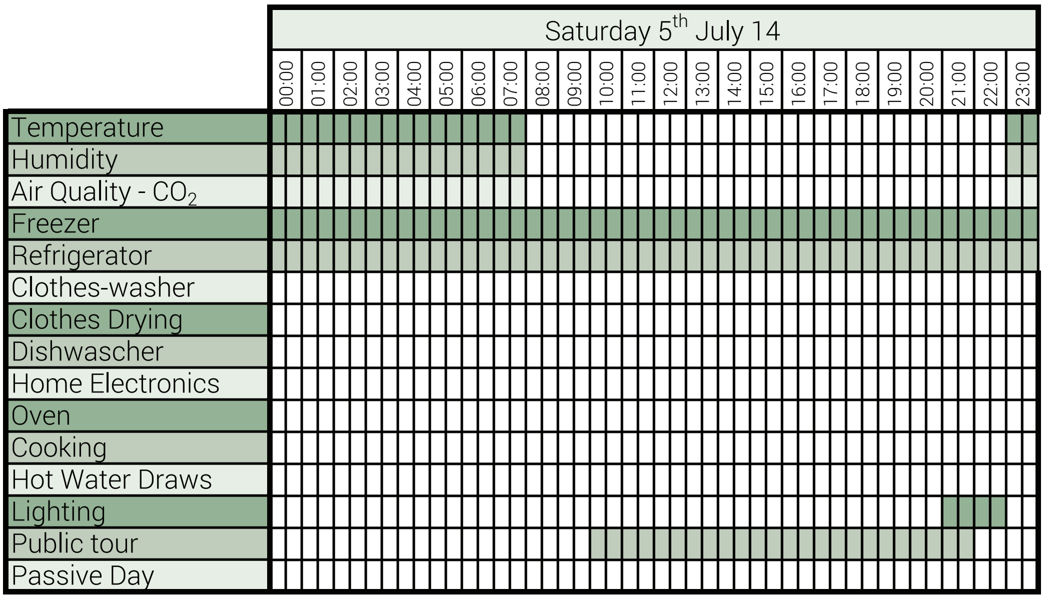
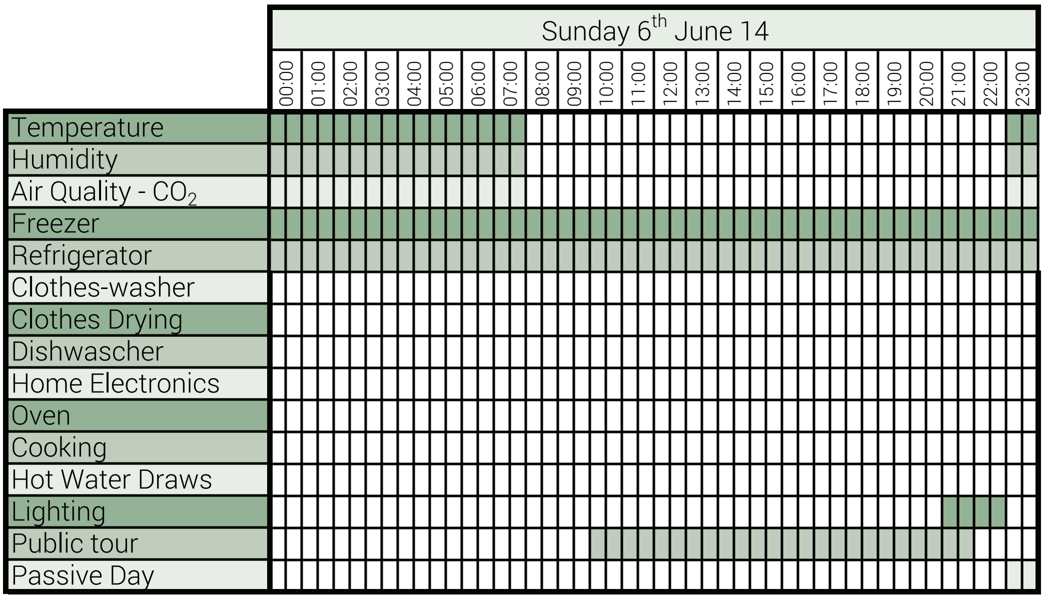
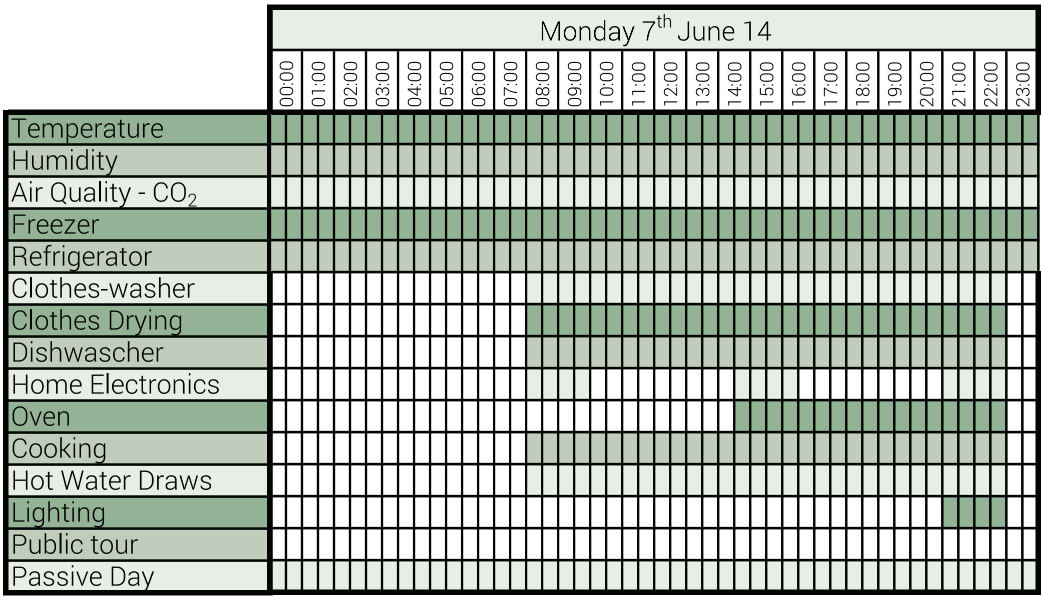
 Contest Week Tasks' Planning



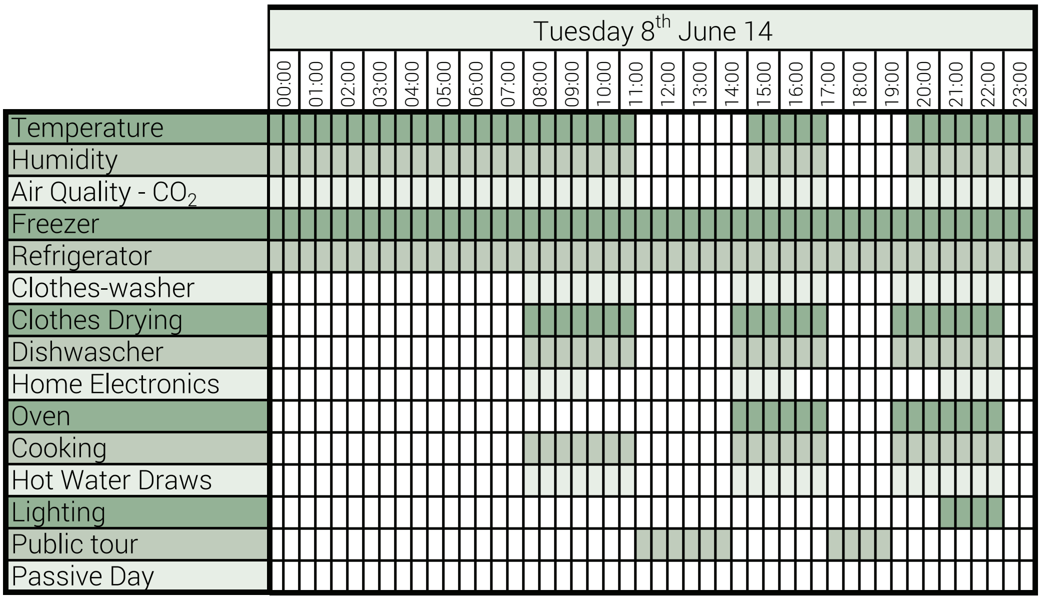


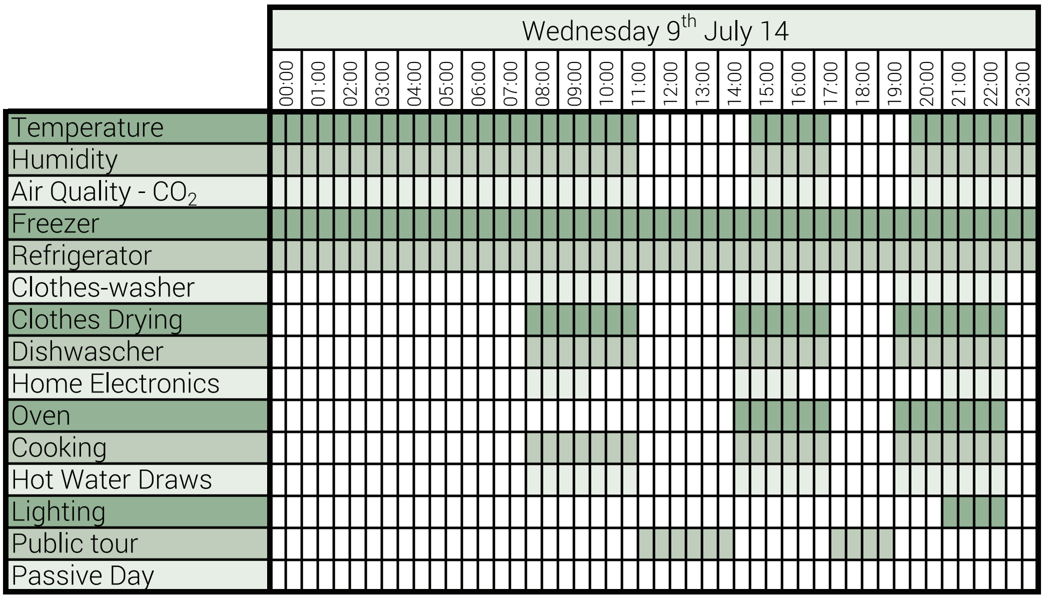
Contest Week Tasks' Planning



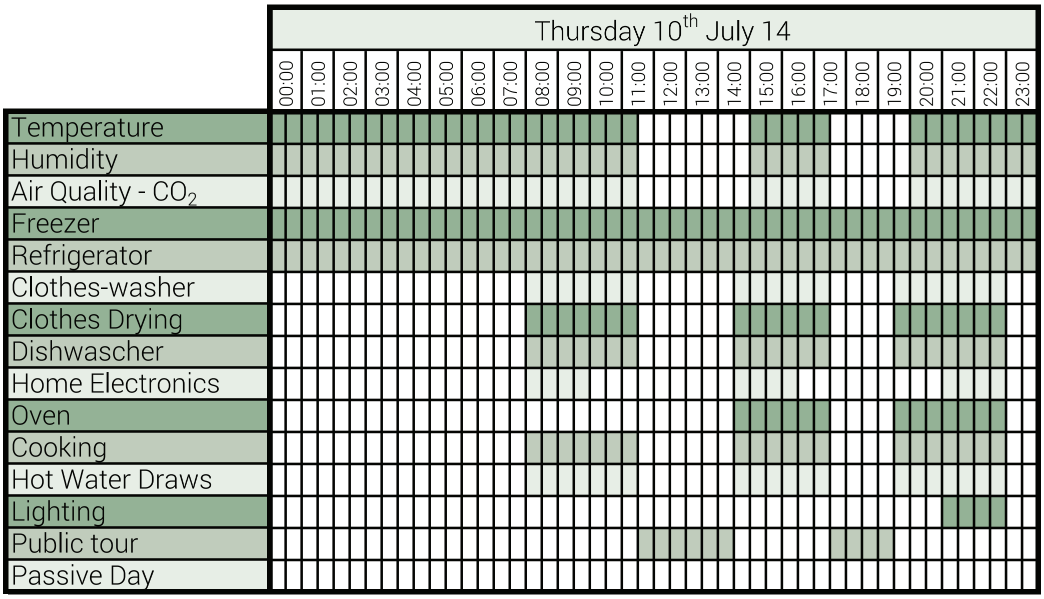


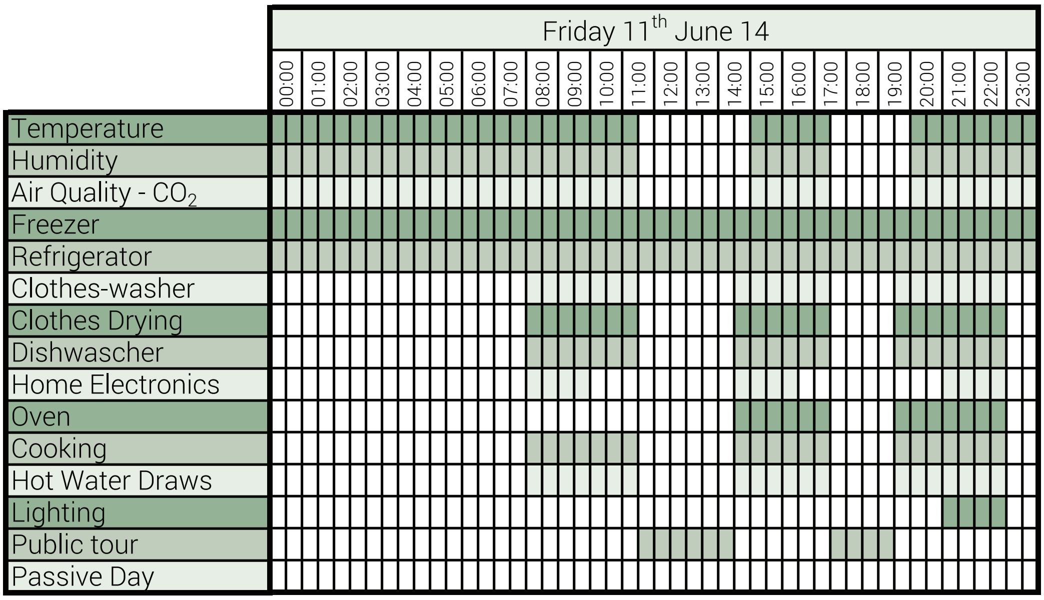
Contest Week Tasks' Planning





 Contest Week Tasks' Planning





VIII Cost Estimate and Project financial Summary

 Cost Estimate and Project financial Summary

Solar Decathlon Europe 2014 EN FRANCE

25.04.14

SDE 2014 COMPETITION EN FRANCE

Team's Abbreviations	LUC
School's Name	Hochschule Luzern – Technik & Architektur
Team's Name	Team Lucerne – Suisse

Nº	Name			Description	Budget ex VAT	VAT	% Total on ex VAT
A. DEVELOPMENT PHASE_COST ESTIMATE							
A.1	**Personnel HSLU (Details in Chart Estimate Workload)**		Estimated Hours	Hourly Rate			
	Lecturer Student Team		214	CHF 125.00	CHF 21'935.00	CHF 1'754.80	1%
	Lecturer Project Support		108	CHF 90.00	CHF 9'720.00	CHF 777.60	0%
	Research Assistant (WissAss 2 od 3)		3317	CHF 60.00	CHF 199'008.00	CHF 15'920.64	9%
	Administrative Assistant (Admin 3)		622	CHF 40.00	CHF 24'880.00	CHF 1'990.40	1%
				Personnel	**€ 209'545.26**	**€ 16'763.62**	9%
A.2	**Communication**						
	Architectural Models				CHF 10'000.00	CHF 800.00	0%
	Videos				CHF 5'000.00	CHF 400.00	0%
	Web Page (creation and maintenance)				CHF 5'000.00	CHF 400.00	0%
	Communication documentation				CHF 10'000.00	CHF 800.00	0%
	Exhibitions				CHF 15'000.00	CHF 1'200.00	1%
	Team Trikots				CHF 6'000.00	CHF 480.00	0%
	Special edition Hochparterre Magazine				CHF 50'000.00	CHF 4'000.00	2%
				Communication	**€ 82'820.00**	**€ 6'625.60**	4%
A.3	**Events & Travels**	Days	Team Members	Unit Costs			
	First Workshop Paris, April 2013						
	Travel & Transport		3	CHF 250.00	CHF 750.00	CHF 60.00	0%
	Lodging	2	3	CHF 150.00	CHF 900.00	CHF 72.00	0%
	Expenses Allowance						0%
	Miscellaneous Expenses				CHF 300.00	CHF 24.00	0%
				First Workshop	**CHF 1'950.00**	**CHF 156.00**	0%
	Second Workshop Paris/Versailles, Nov 2013						
	Travel & Transport		10	CHF 250.00	CHF 2'500.00	CHF 200.00	0%
	Lodging	3	10	CHF 150.00	CHF 4'500.00	CHF 360.00	0%
	Expenses Allowance	3	10	CHF 50.00	CHF 1'500.00	CHF 120.00	0%
	Miscellaneous Expenses				CHF 500.00	CHF 40.00	0%
				Second Workshop	**CHF 9'000.00**	**CHF 720.00**	0%
	Team Building Hike, Monte Rosa Hut, Sept 13						
	Travel & Transport		30	CHF 120.00	CHF 3'600.00	CHF 288.00	0%
	Lodging	2	30	CHF 100.00	CHF 6'000.00	CHF 480.00	0%
	Expenses Allowance	2	30	CHF 30.00	CHF 1'800.00	CHF 144.00	0%
	Miscellaneous Expenses				CHF 500.00	CHF 40.00	0%
							0%
				Monte Rosa	**CHF 11'900.00**	**CHF 952.00**	1%
	Trade Fair SWISSBAU Basel, January 2014						
	Travel & Transport		5	CHF 250.00	CHF 1'250.00	CHF 100.00	0%
	Lodging	2	5	CHF 100.00	CHF 1'000.00	CHF 80.00	0%
	Expenses Allowance	2	5	CHF 50.00	CHF 500.00	CHF 40.00	0%
	Miscellaneous Expenses				CHF 500.00	CHF 40.00	0%
							0%
				Swissbau	**CHF 3'250.00**	**CHF 260.00**	0%
				Events & Travels	**€ 21'402.00**	**€ 344.40**	1%
A.4	**Administrative and miscellaneous**						
	Consumables and office supplies				CHF 10'000.00	CHF 800.00	0%
	Administrative expenses				CHF 5'000.00	CHF 400.00	0%
				Administrative and miscellaneous	**€ 12'300.00**	**€ 984.00**	1%
				Sub-Total_Development Phase Cost Estimate	**€ 326'067.26**	**€ 25'249.22**	14%

Nº	Name			Description	Budget ex VAT	VAT	% Total on ex VAT
B. HOUSE CONSTRUCTION_COST ESTIMATE							
B.1	**Direct Materials & Direct Labor (Details in Chart House Construction & Transport)**						
10	Preperation				CHF 28'700.00	CHF 2'296.00	1%
20	construciton site preperation				CHF 72'900.00	CHF 5'832.00	3%
213	mounting STEEL construction				CHF 150'678.26	CHF 12'054.26	6%
214	mounting TIMBER construction				CHF 466'131.05	CHF 37'290.48	20%

Cost Estimate and Project financial Summary

Solar Decathlon Europe 2014 EN FRANCE

SDE 2014 COMPETITION EN FRANCE

Team's Abbreviations	LUC
School's Name	Hochschule Luzern – Technik & Architektur
Team's Name	Team Lucerne – Suisse

25.04.14

Nº	Name			Description	Budget ex VAT	VAT	% Total on ex VAT
221	Window, Doors, Glasroof				CHF 195'158.00	CHF 15'612.64	8%
222	Plumber works				CHF 64'205.50	CHF 5'136.44	3%
228	Sunscreen				CHF 28'500.00	CHF 2'280.00	1%
23	electrical systems				CHF 104'764.85	CHF 8'381.19	4%
24	Heating Ventilation Air				CHF 172'348.47	CHF 13'787.88	7%
25	Sanitary				CHF 62'122.40	CHF 4'969.79	3%
258	Kitchen				CHF 40'000.00	CHF 3'200.00	2%
27	fitting out 1				CHF 75'791.80	CHF 6'063.34	3%
28	fitting out 2				CHF 60'767.75	CHF 4'861.42	3%
				Total Direct Materials	€ 1'248'095.83	€ 99'847.67	54%
B.2	Material Overhead						
	withing B.1	% Estimated Rate * Total Direct Materials					0%
				15%		CHF 0.00	0%
				Total Material Overhead		CHF 0.00	0%
B.3	Personnel HSLU (Details in Chart Estimate Workload)		hours	Unit Costs			
	Lecturer Student Team		400	CHF 125.00	CHF 50'000.00	CHF 4'000.00	2%
	Lecturer Project Support		716	CHF 90.00	CHF 64'476.00	CHF 5'158.08	3%
	Research Assistant (WissAss 2 od 3)		2287	CHF 50.00	CHF 114'360.00	CHF 9'148.80	5%
	Administrative Assistant (Admin 3)		644	CHF 40.00	CHF 25'744.00	CHF 2'059.52	1%
	construction workers as support		200	CHF 100.00	CHF 20'000.00	CHF 1'600.00	1%
				Personnel HSLU	€ 225'155.60	€ 18'012.45	10%
				Sub-Total_House Construction Cost Estimate	€ 1'473'251.43		63%
C. HOUSE DISASSEMBLY IN ORIGIN AND TRANSPORTATION							
C.1	Disassembly in origin						
	House Dissassembly in Horw - Renggli Holzbau				CHF 20'000.00	CHF 1'600.00	1%
						CHF 0.00	0%
						CHF 0.00	0%
	....						0%
				Disassembly in origin	€ 16'400.00	€ 1'312.00	1%
C.2	House Transportation						
	Crane Assembly/Dissassembly				CHF 8'000.00	CHF 640.00	0%
	Transportcover				CHF 8'000.00	CHF 640.00	0%
	packing material				CHF 10'000.00		0%
	low-loading trucks, Horw-Versailles-Horw, incl. Fees - Brunner				CHF 77'000.00		3%
				House Transportation	€ 84'460.00	€ 1'049.60	4%
				Sub-Total_House Disassembly in Origin Cost Estimate	€ 100'860.00	€ 2'361.60	4%
D. FINAL PHASE IN LE CITE DU SOLEIL:COST ESTIMATE							
D.1	Travels & Costs Final Phase in Versailles	Days	Team Members	Unit Costs			
	Travel & Transport		40	CHF 200.00	CHF 8'000.00	CHF 640.00	0%
	Lodging	33	40	CHF 80.00	CHF 105'600.00	CHF 8'448.00	5%
	Expenses Allowance	33	40	CHF 20.00	CHF 26'400.00	CHF 2'112.00	1%
							0%
							0%
				Total Travels & Costs for Final Phase in Versailles	€ 114'800.00	€ 9'184.00	5%
D.2	Assembly and Disassembly Processes						
	Cranes				CHF 15'000.00	CHF 1'200.00	1%
	Equipment and machinery				CHF 15'000.00	CHF 1'200.00	1%
	Assembly in Le Cité du Soleil © - Renggli Holzbau				CHF 20'000.00	CHF 1'600.00	1%
	Disassembly in Le Cité du Soleil © - Renggli Holzbau				CHF 20'000.00	CHF 1'600.00	1%
	construction workers as support		100	100	CHF 10'000.00	CHF 800.00	0%
				Total Assembly, Transport, Disassembly Processes	€ 65'600.00	€ 5'248.00	3%
D.3	Personnel HSLU (Details in Chart Estimate Workload)		hours	Unit Costs			
	Lecturer Student Team		324	CHF 125.00	CHF 40'500.00	CHF 6'080.00	3%
	Lecturer Project Support		140	CHF 90.00	CHF 12'600.00	CHF 4'308.48	2%

 Cost Estimate and Project financial Summary

Solar Decathlon Europe 2014 EN FRANCE	**SDE 2014 COMPETITION EN FRANCE**		
	Team's Abbreviations	LUC	
	School's Name	Hochschule Luzern – Technik & Architektur	
25.04.14	**Team's Name**	Team Lucerne – Suisse	

Nº	Name		Description	Budget ex VAT	VAT	% Total on ex VAT
	Research Assistant (WissAss 2 od 3)	842	CHF 50.00	CHF 42'080.00	CHF 9'048.00	5%
	Administrative Assistant (Admin 3)	174	CHF 40.00	CHF 6'960.00	CHF 2'059.52	1%
			Personnel HSLU	**€ 83'754.80**	**€ 17'626.72**	41%
D.4	**Insurance Policies**					
	Liability Insurance	- covered by mandatory insurance of university			CHF 0.00	0%
	Transport Insurance	- included in C.2 "low loading trucks - Brunner"			CHF 0.00	0%
	Accident Insurance					0%
	Medical Insurance					0%
	...					0%
			Total Insurance Policies	**CHF 0.00**	**CHF 0.00**	0%
	Sub-Total_Final Phase in La Cité du Soleil® Cost Estimate			**€ 264'154.80**	**CHF 14'432.00**	11%

E. POST EVENT COST ESTIMATE						
E.1	**House Permanent Assembly**					
	Machinery and Equipment			CHF 10'000.00	CHF 800.00	0%
	Foundation and outdoor Installation at Campus Horw			CHF 25'000.00	CHF 2'000.00	1%
			Sob-Total House permanent Assembly	**€ 28'700.00**	**€ 2'296.00**	1%
E.2	**Personnel HSLU (Details in Chart Estimate Workload)**					
	Lecturer Student Team	152	CHF 125.00	CHF 19'000.00	CHF 6'080.00	3%
	Lecturer Project Support	186	CHF 90.00	CHF 16'740.00	CHF 4'308.48	2%
	Research Assistant (WissAss 2 od 3)	1223	CHF 50.00	CHF 61'140.00	CHF 9'048.00	5%
	Administrative Assistant (Admin 3)	538	CHF 40.00	CHF 21'504.00	CHF 2'059.52	1%
	...					
			E.2 Personell HSLU	**€ 97'074.88**	**€ 17'626.72**	4%
E.3	**Post Event Communication**					
	Publication			CHF 50'000.00	CHF 4'000.00	2%
			Post Event Communication	**€ 41'000.00**	**€ 3'280.00**	2%

Sub-Total_Post Event Cost Estimate		**€ 166'774.88**	**€ 19'922.72**	7%
Total Price / Cost Estimated		**€ 2'331'108.37**	**€ 61'965.54**	**100 % Total**
Please CHECK (X) your status >>>	If you benef		€ -61'965.54	
	x If you don't	€ 61'965.54		
Total Price / Cost Estimated included VAT		**€ 2'393'073.91**	**€ 2'331'108.37**	

Solar Decathlon Europe 2014 EN FRANCE

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RÉPUBLIQUE FRANÇAISE

 Cost Estimate and Project financial Summary

 Cost Estimate and Project financial Summary

25.04.14	**SDE 2014 COMPETITION**		
	Team's Abbreviations	LUC	
	School's Name	Hochschule Luzern	
	Team's Name	Team Lucerne – Suisse	

Company Name		**Collaboration Details**	**Amount of support**	**% Total**
Institutional Support				
Bundesamt für Energie BFE	Federal Department of Environment, Transport, Energy and Communications	200'000 financial	CHF 200'000.00	8.5%
Solar Decathlon Europe		60'000 financial 60'000 service	CHF 120'000.00	5.1%
Kanton Luzern, Dienststelle Umwelt und Energie (uwe)	Cantonal Department of Lucerne, environment and energy	80'000 financial	CHF 80'000.00	3.4%
Schweizerischer Ingenieur- und Architektenverein SIA	Hans-Georg Bächtold / Adrian Altenburger	40'000 financial	CHF 40'000.00	1.7%
Swissbau	Construction and property fair	40'000 financial	CHF 40'000.00	1.7%
Mirgos-Genossenschaft-Bund	Energy + building services	40'000 financial	CHF 40'000.00	1.7%
Hochschule Luzern _ invest real estate			CHF 900'000.00	
Hochschule Luzern _ in negogiation			CHF 650'000.00	
			€ 1'697'400.00	72%
Industrial Partners & Sponsors				
AFG Arbonia-Forster-Holding AG	Window, facade, kitchens etc.	8'000 financial 192'000 material / service	CHF 180'000.00	7.6%
Gruner AG (KIWI, Roschi+Partner AG)	Building service engineering, heating, venting, sanitary	57'000 financial 23'000 material / service	CHF 80'000.00	3.4%
Renggli AG	Timber work	4'000 financial 36'000 material / service	CHF 40'000.00	1.7%
Ernst Schweizer AG	Metal construction	40'000 material	CHF 40'000.00	1.7%
schaerholzbau ag	Timber work	40'000 material/service	CHF 40'000.00	1.7%
ABB	Power and automation technology	40'000 material/service	CHF 40'000.00	1.7%
KWT Kälte-Wärmetechnik AG Viessmann Group	Thermal heat pump, thermal Collectors	40'000 material	CHF 40'000.00	1.7%
V-Zug	Automation technology	20'000 material	CHF 20'000.00	0.8%
IDC AG Zentralschweiz	Software	7'500 financial 7'500 service	CHF 15'000.00	0.6%
Herzog Haustechnik AG	Building services	20'000 service	CHF 20'000.00	0.8%
Helios Ventilatoren AG	Ventilation systems	15'000 material	CHF 15'000.00	0.6%
Portmann + Meier AG	Kitchens, interior, furniture	15'000 material	CHF 15'000.00	0.6%
EVVA Sicherheitstechnologie AG	Locking systems	15'158 material	CHF 15'158.00	0.6%
Marti Bauunternehmung AG	Construction	15'000 service/material	CHF 15'000.00	0.6%
Mountair AG	Ventilation systems	15'000 material	CHF 15'000.00	0.6%
Roth Gerüste AG	Scaffolding	15'000 service/material	CHF 15'000.00	0.6%
Werner Keller Technik AG	Metal construction	25'000 service/material	CHF 25'000.00	1.1%
Beckhoff Automation AG	Automation technology	8'000 material	CHF 8'000.00	0.3%
BE Netz AG	Solar energy systems, building services	5'075 service	CHF 5'075.00	0.2%
Sauter Building Control Schweiz AG	Building and room automation, energy management	9'000 material	CHF 9'000.00	0.4%
Stadt Zürich Amt für Hochbauten AHB	Construction Service	8'000 financial	CHF 8'000.00	0.3%
MINERGIE® Schweiz	Low-energy-consumption buildings	5'000 financial	CHF 5'000.00	0.2%
Stadt Luzern, Geoinformationszentrum	Geo-information service	5'500 service/material	CHF 5'500.00	0.2%
Rigips AG	Drywall installation	5'000 financial	CHF 5'000.00	0.2%
Zehnder Comfosystems Cesovent AG	Ventilation systems	5'400 material	CHF 5'400.00	0.2%
TROX HESCO Schweiz AG	Heating & Cooling systems	5'000 material	CHF 5'000.00	0.2%
Dornbracht Schweiz AG	Sanitary fittings	5'000 material	CHF 5'000.00	0.2%
Eternit AG	Facade	5'000 material	CHF 5'000.00	0.2%
PRIMIN JUNG Ingenieure für Holzbau AG	Specialist engineer timber work	5'000 service/material	CHF 5'000.00	0.2%
Solarmarkt GmbH	Solar energy systems	10'000 material	CHF 10'000.00	0.4%
Sika Sarnafil AG	Roof insulation	7'000 material	CHF 7'000.00	0.3%
Martin Brunner Transport AG	Conveyance	5'000 service/material	CHF 5'000.00	0.2%
Ramseier Woodcoat AG	Powder coating	5'000 service/material	CHF 5'000.00	0.2%
Debrunner Acifer AG	Building services	5'000 material	CHF 5'000.00	0.2%
Sensortec AG	Building automation	5'000 material	CHF 5'000.00	0.2%
Reynaers AG	Blades	7'000 material	CHF 7'000.00	0.3%
Franke Küchentechnik AG	Fittings	8'500 material	CHF 8'500.00	0.4%
Streuli Pharma AG	Pharmaceutical	2'300 material 2'700 financial	CHF 5'000.00	0.2%
HIAG Handel AG	Timber	5'000 material	CHF 5'000.00	0.2%
alpinwork GmbH	Fall protection	5'000 service/material	CHF 5'000.00	0.2%
Atelier Ritter AG	Printing, Boards	5'000 service/material	CHF 5'000.00	0.2%
Felber Keramik AG	Floor tiling	7'000 service/material	CHF 7'500.00	0.3%
Keimfarben AG	Paints	5'000 material	CHF 5'000.00	0.2%
Josef Hodel AG	Painter	5'088,90 service/material	CHF 5'088.90	0.2%

 Cost Estimate and Project financial Summary

Solar Decathlon Europe 2014 EN FRANCE

25.04.14

SDE 2014 COMPETITION	
Team's Abbreviations	LUC
School's Name	Hochschule Luzern
Team's Name	Team Lucerne – Suisse

Company Name		Collaboration Details	Amount of support	% Total
UBS Clean Energy Infrastructure Switzerland AG	Investments	1'000 financial	CHF 1'000.00	0.0%
ALLTEX Fashion AG	Textiles	500 material	CHF 500.00	0.0%
Wacker Neuson AG	Construction machinery and tools	500 financial	CHF 500.00	0.0%
Joulia SA	Shower with heat recovery	3'000 material	CHF 3'000.00	0.1%
Herzog-Elmiger AG	Timber	500 financial	CHF 500.00	0.0%
TA Hydronics Switzerland AG	Safety and control valves	3'500 material	CHF 3'500.00	0.1%
Balz Holz AG	Timber	800 material	CHF 800.00	0.0%
Bossard Schrauben AG	Bolts	800 material	CHF 800.00	0.0%
Geotest	Borehole detection	500 service	CHF 500.00	0.0%
Meier und Schärer AG	Plastering	2'791,80 service/material	CHF 2'791.80	0.1%
Schmolz + Bickenbach AG	Steel	500 material	CHF 500.00	0.0%
Murer AG	High-fi, electronics	1'000 material	CHF 1'000.00	0.0%
NeoVac ATA AG	Heat meter	3'000 material	CHF 3'000.00	0.1%
maxon motor ag	DC motors, transmissions	500 financial	CHF 500.00	0.0%
SPAETER Zug AG	Steel	1'000 material	CHF 1'000.00	0.0%
Kuhn Rikon AG	Pots and pans	500 material	CHF 500.00	0.0%
			€ 665'523.23	28%
			€ 2'362'923.23	100 % Total

Solar Decathlon Europe 2014 EN FRANCE CSTB SOLAR

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Cost Estimate and Project financial Summary

Estimate and Project Financial Report Evaluation Table
rect Materials & House Construction

cathlon Europe 2014

ty of Applied Science & Arts Lucerne Team Lucerne – Suisse 25.04.2014

s exkl. VAT

BKP Nr.	type of cost	responsible	MATERIAL	Realization	prediction	assigned		sponsored		cost effective		Budget Project start	
		HSLU			Estimated amounts not offered yet, sum with assigned	140.28	%	56.31	%	83.47	%	100	%
12	**Building**					**CHF 1'522'068.08**		**CHF 610'910.35**		**CHF 905'657.74**		**CHF 1'085'000.00**	**100**
						€ 1'248'095.83		€ 500'946.48		€ 742'639.34		€ 889'700.00	
10	**Preperation**					**CHF 28'700.00**	**1.9**	**CHF 0.00**	**0.0**	**CHF 28'700.00**	**3.2**	**CHF 30'000.00**	**2.8**
101	Surveryor	Florian Berner		Heini Geomatik, Willisau	CHF 1'200.00		0.1		0.0	CHF 1'200.00	0.1		
x	Building Application	Florian Berner		Florian	CHF 500.00		0.0		0.0	CHF 500.00	0.0		
x	Tools and Mobile Store room	Yves Dusseillier		Yves	CHF 20'000.00		1.3		0.0	CHF 20'000.00	1.3		
x	personal protective equipment	Yves Dusseillier		Yves	CHF 7'000.00		0.5		0.0	CHF 7'000.00	0.5		
							0.0		0.0	CHF 0.00	0.0		
20	**construciton site preperation**					**CHF 72'900.00**	**4.8**	**CHF 15'000.00**	**2.5**	**CHF 57'900.00**	**6.4**	**CHF 15'000.00**	**1.4**
114	BUILDER	Florian Berner	Marti AG	Marti AG			0.0		0.0	CHF 0.00	0.0		
	_working container, rent for 3 month					CHF 2'500.00				CHF 2'500.00			
	_Building crane, rent for 1.5 month					CHF 12'000.00				CHF 12'000.00			
132	_crane operator, 15 working-days					CHF 14'400.00				CHF 14'400.00			
	_building site preperation, 600 sqm					CHF 3'000.00				CHF 3'000.00			
	_worksite distribution board, temporary ramp/stairs					CHF 1'500.00				CHF 1'500.00			
										CHF 0.00			
										CHF 0.00			
135	Development electricity, water, to the construciton site	Florian Berner		HSLU Hausdienst	CHF 10'000.00		0.7		0.0	CHF 10'000.00	0.7		
	Internet cable to the construction site	Simon Gallner		??	CHF 1'500.00					CHF 1'500.00			
130	hoarding and scaffold	Florian Berner		Roth Gerüste		CHF 27'000.00	1.8	CHF 15'000.00	1.0	CHF 12'000.00	0.8		
x	Surveryor	Florian Berner		?	CHF 1'000.00		0.1		0.0	CHF 1'000.00	0.1		
							0.0		0.0	CHF 0.00	0.0		
							0.0		0.0	CHF 0.00	0.0		
							0.0		0.0	CHF 0.00	0.0		
213	**mounting in steel construction**					**CHF 150'678.26**	**9.9**	**CHF 61'000.00**	**10.0**	**CHF 89'678.26**	**9.9**	**CHF 65'000.00**	**6.0**
x	Steal Construction - structural components	Simon Schneider	Später Zug	Keller Metallbau			0.0		0.0	CHF 0.00	0.0		
	_steel components for mounting timber constr. For Renggli					CHF 13'759.00	0.9		0.0	CHF 13'759.00	0.9		
	_steel frame for foundation					CHF 30'685.00	2.0	CHF 25'000.00	1.6	CHF 5'685.00	0.4		
	_Roof Frame - Steel construction					CHF 37'509.00	2.5		0.0	CHF 37'509.00	2.5		
	_corrotion protection Roof Frame construiciton					CHF 9'862.00	0.6		0.0	CHF 9'862.00	0.6		
	_cutting Aluminum Profiles (shading louvers on roof)					CHF 920.00	0.1		0.0	CHF 920.00	0.1		
	_substructure thermal collectors/heat exchanger roof					CHF 5'964.00	0.4			CHF 5'964.00	0.4		
										CHF 0.00			
	Steel Construction - constructive componenets	Andrea Brönnimann	Schweizer Metallbau	schweizer Metallbau						CHF 0.00			
	_handrail Deck					CHF 20'170.26		CHF 36'000.00		CHF -15'829.74			
	_side facing roof frame "urban crown"					CHF 11'556.00				CHF 11'556.00			
	_metal frame for wooden shutters					CHF 6'346.00				CHF 6'346.00			
	_apprentice for construction site support					CHF 11'907.00				CHF 11'907.00			
										CHF 0.00			
	_support steel for railing walls wooden deck				CHF 2'000.00					CHF 2'000.00			
214	**mounting in timber construction**					**CHF 466'131.05**	**30.6**	**CHF 85'000.00**	**13.9**	**CHF 381'131.05**	**42.1**	**CHF 200'000.00**	**18.4**
	Upper deck wood flooring (oak)	Andrea B., Yves	Holz Bachmann	Schär, Team SDE		CHF 31'150.75	2.0		0.0	CHF 31'150.75	2.0		
	deck wood boiler preassure steaming - treatment weather ressistance	Andrea B., Yves	Balz Holz	Schär, Team SDE		CHF 7'385.10				CHF 7'385.10			
	Under deck construction material	Andrea B., Yves	schärholzbau	Schär, Team SDE	CHF 13'000.00		0.9		0.0	CHF 13'000.00	0.9		
										CHF 0.00			
	Support construction Deck and Constructioon Site	Andrea B. Simon G.	schärholzbau	schärholzbau		CHF 40'000.00		CHF 40'000.00		CHF 0.00			
							0.0		0.0	CHF 0.00	0.0		
x	pressure distribution plates from wood-based panels	Florian Berner	Balteschwiler	Team Lucerne – Suisse		CHF 17'070.20	1.1		0.0	CHF 17'070.20	1.1		
										CHF 0.00			
	PROTOTYP: Building shell timber construcion	Marcel W, Simon S.	RENGGLI	RENGGLI Holzbauweise			0.0	CHF 40'000.00	2.6	CHF -40'000.00	-2.6		
	_hours Projectmanagement					CHF 22'875.00	1.5		0.0	CHF 22'875.00	1.5		
	_detail Planning					CHF 20'250.00	1.3		0.0	CHF 20'250.00	1.3		
	_working Peperation					CHF 37'800.00	2.5		0.0	CHF 37'800.00	2.5		
	_structural engeneering					CHF 8'100.00	0.5			CHF 8'100.00			
	_Production					CHF 99'750.00	6.6		0.0	CHF 99'750.00	6.6		
	_assembly in Horw					CHF 30'000.00	2.0		0.0	CHF 30'000.00	2.0		
	_Inventar					CHF 9'600.00	0.6		0.0	CHF 9'600.00	0.6		
	_Material					CHF 110'000.00	7.2		0.0	CHF 110'000.00	7.2		
	_Transport from Schötz to Horw					CHF 19'150.00	1.3		0.0	CHF 19'150.00	1.3		
										CHF 0.00			
	_Material wooden construction	Renggli	HIAG					CHF 5'000.00		CHF -5'000.00			
									0.0	CHF 0.00	0.0		
221	**Window, Doors, Glasroof**					**CHF 195'158.00**	**12.8**	**CHF 195'158.00**	**31.9**	**CHF 0.00**	**0.0**	**CHF 70'000.00**	**6.5**
	SPACE PLUS Glassroof Structure	Stefan Keller	Forster Profile (AFG)	Forster Profile (AFG)		CHF 180'000.00	11.8	CHF 180'000.00	11.8	CHF 0.00	0.0		
	SPACE PLUS Glassroof Panes	Stefan Keller	Schollglas (AFG)	Schollglas (AFG)			0.0		0.0	CHF 0.00	0.0		
	SPACE PLUS Entrance Doors	Stefan Keller	RWD Schlatter (AFG)	RWD Schlatter (AFG)			0.0		0.0	CHF 0.00	0.0		
							0.0		0.0	CHF 0.00	0.0		

Cost Estimate and Project financial Summary

							0.0		0.0	CHF 0.00	0.0			
	CUBES Windwos, Doors	Stefan keller	Ego Kiefer (AFG)	Ego Kiefer (AFG)			0.0		0.0	CHF 0.00	0.0			
							0.0		0.0	CHF 0.00	0.0			
	Locking System	Stefan Keller	EVVA	EVVA		CHF 15'158.00	1.0	CHF 15'158.00	1.0	CHF 0.00	0.0			
							0.0		0.0	CHF 0.00	0.0			
							0.0			CHF 0.00				
222	**Plumber/Tinner works**					**CHF 64'205.50**	**4.2**	**CHF 27'000.00**	**4.4**	**CHF 37'205.50**	**4.1**	**CHF 50'000.00**	**4.6**	
222	Tinner Works, flashing Material, waterproofing works	Daniel Scheuber	Herzoooog Spenglerei	Herzoooog Spenglerei		CHF 40'000.00	2.6	CHF 20'000.00	1.3	CHF 20'000.00	1.3			
		?					0.0		0.0	CHF 0.00	0.0			
224	Insulation and roof skin MATERIAL	Daniel Scheuber	Sika Sarnafil			CHF 24'205.50	1.6	CHF 7'000.00	0.5	CHF 17'205.50	1.1			
							0.0		0.0	CHF 0.00	0.0			
							0.0		0.0	CHF 0.00	0.0			
							0.0		0.0	CHF 0.00	0.0			
							0.0		0.0	CHF 0.00	0.0			
							0.0			CHF 0.00				
228	**Sunscreen**					**CHF 28'500.00**	**1.9**	**CHF 15'000.00**	**2.5**	**CHF 13'500.00**	**1.5**	**CHF 50'000.00**	**4.6**	
	Glassroof SpacePlus	Daniel Scheuber			CHF 15'000.00		0.0	CHF 15'000.00	1.0	CHF 0.00	0.0			
	motors,equipment for flexible wooden shades	Stefan Keller	Schenker Storen	Schenker Storen, Team?		CHF 8'500.00	0.6		0.0	CHF 8'500.00	0.6			
	Curtain YourRoom FABRIC	Stefan Keller	Creation Baumann	..?	CHF 2'000.00		0.0		0.0	CHF 2'000.00	0.1			
	Curtain YourRoom MOUNTING MATERIAL		Silent Gliss		CHF 3'000.00		0.0		0.0	CHF 3'000.00	0.2			
23	**electrical systems**					**CHF 104'764.85**	**6.9**	**CHF 40'000.00**	**6.5**	**CHF 64'764.85**	**7.2**	**CHF 90'000.00**	**8.3**	
										CHF 0.00				
230	Installation Prototype supervision professional	Patrick vecellio	Elektro Peter	Elektro Peter	CHF 5'000.00		0.0	CHF 5'000.00	0.3	CHF 0.00	0.0			
	Installation Photovoltaics supervision professional	Patrick Vecellio	-	BE Netz						CHF 0.00				
231.2	switchgear and controllgear combination	Patrick van Briel	ABB, MB Systembau	Team Lucerne – Suisse	CHF 10'000.00			CHF 10'000.00		CHF 0.00				
										CHF 0.00				
231.5	Solar Engery Components	Thierry Prud`homme	Solarmarkt							CHF 0.00				
	_Solar Panels Sunpower, incl. Fittings					CHF 8'364.00				CHF 8'364.00				
	_intelligent Storage System Bosch					CHF 24'400.85		CHF 10'000.00		CHF 14'400.85				
	(sponsoring Solarmarkt as cash contribution via Faktura HSLU!)									CHF 0.00				
										CHF 0.00				
										CHF 0.00				
231.6	motorisation for PV-panels	Alain Bangerter	??		CHF 7'000.00					CHF 7'000.00				
231.6	E-Bikes lended from company	Patrick Vecellio	Stöckli							CHF 0.00				
										CHF 0.00				
231.5	lighting installation fittings	Vecellio, Bieri	Swisslux		CHF 2'000.00					CHF 2'000.00				
										CHF 0.00				
232.5	Home Electronics	Markus Kurman, IA			CHF 6'000.00					CHF 6'000.00				
	_Ipad Dockingstation	Vecellio			CHF 3'000.00					CHF 3'000.00				
	_Ipad 2x	Vecellio, IA			CHF 1'500.00					CHF 1'500.00				
										CHF 0.00				
231.6	battery inverter for battery ebike	Vecellio, Bieri			CHF 1'500.00					CHF 1'500.00				
										CHF 0.00				
232	Building Automation				CHF 12'000.00		0.0		0.0	CHF 12'000.00	0.8			
233	lamps - see fitting out 2						0.0		0.0	CHF 0.00	0.0			
										CHF 0.00				
232.6	plug sockets and switches	Patrick von Briel	ABB		CHF 3'000.00					CHF 3'000.00				
										CHF 0.00				
232.7	sensing devices HVAC	Vecellio	Sensortec	Team	CHF 2'000.00					CHF 2'000.00				
										CHF 0.00				
233	portable lamp batteries and charging station	Ivo Bieri, Vecellio	Duracell Powermat		CHF 1'000.00					CHF 1'000.00				
	portable lamp LED and touch panel	Bieri, Vecellio			CHF 3'000.00					CHF 3'000.00				
										CHF 0.00				
237	building automation technology, SPS	Thierry Prud`homme	Beckhoff		CHF 10'000.00					CHF 10'000.00				
										CHF 0.00				
237	building automation technology, KNK	Patrick Von Briel	ABB	Team	CHF 5'000.00			CHF 5'000.00		CHF 0.00				
236							0.0	CHF 10'000.00	0.7	CHF -10'000.00	-0.7			
							0.0		0.0	CHF 0.00	0.0			
24	**Heating Ventilation Air**					**CHF 172'348.47**	**11.3**	**CHF 91'026.45**	**14.9**	**CHF 81'322.03**	**9.0**	**CHF 165'000.00**	**15.2**	
242	Heat generation, thermic collectors, heat and cold storage	Simon Fuchs	Viessmann			CHF 28'689.95	1.9	CHF 14'344.98	0.9	CHF 14'344.98	0.9			
242	Savety fittings	Simon Fuchs	TA Hydronics			CHF 3'526.00		CHF 3'526.00		CHF 0.00				
										CHF 0.00				
										CHF 0.00				
										CHF 0.00				
243	Heat distribution, Heating-/Cooling Ceiling	Simon Fuchs	Trox Hesco	Deckisol AG		CHF 38'232.00	2.5	CHF 5'000.00	0.3	CHF 33'232.00	2.2	CHF 15'000.00		Deckenverkleidu
	circulation pump	Simon Fuchs	Grundfos		CHF 0.00					CHF 0.00				
	testing device building conditions	Simon Fuchs	Sauter			CHF 11'299.00		CHF 11'299.00		CHF 0.00				
										CHF 0.00				
243	heat measuring	Simon Fuchs	Neovac		CHF 10'745.05					CHF 10'745.05				
243	combi ventiles	Simon Fuchs	Danfoss			CHF 1'849.00		CHF 1'849.00		CHF 0.00				
243	high quality pipework	Roger Hauswirth	Nussbaum		CHF 15'000.00					CHF 15'000.00				
243	incedetials for pipework and installations	Roger Hauswirth	Debrunner Acifer		CHF 8'000.00			CHF 5'000.00		CHF 3'000.00				
										CHF 0.00				
										CHF 0.00				

Cost Estimate and Project financial Summary

Cost Estimate and Project Financial Report Evaluation Table

Chart: Estimate of Personnel-Workload

Solar Decathlon Europe 2014

Team Suisse – Lucerne

_within Staff of Lucerne University of Applied Science and Arts only (Workload Curriculum to be checked)

		A. DEVELOPEMENT PHASE					
		spring semester 2013					
		weeks	16	18.02. - 20.07.13 (Semester)			
			8	20.07. - 16.09.13 (Summer Break)			
Position	Name	Workload PROJECT h/week	weeks	estimate total	in fact SAP	Workload contingent CURRICULU	Comment
Lecturer Student Team							
Faculty Advisor	**Hanspeter Bürgi**	4	16	64		400	
Jury/Coaching	**Dieter Geisbühler**	0	16	0			
Lecturer IA	**Dominic Haag**	0	16	0		50	
Lecturer GT	**Matthias Sulzer**	0	16	0		200	
Lecturer WI	**Petra Müller**	0	16	0			
Lecturer BT	**Andreas Luible**	0	16	0		50	
Lecturer E	**Thierry Prud`homme**	0	16	0			
Lecturer I	**Ruedi Arnold**	0	16	0			
	total			**64**		**700**	check HP?
Lecturer Project-Support							
Communication	**Lukas Kauz**	0	16	0			
Coaching Sponsoring	**René Zeier**	0	16	0			
planning Curriculum	**Franziska Mattle**	0	16	0			
Coaching Materials/Constru	**Yves Dusseiller**	0	16	0			
Webdesign and Photograph	**Markus Käch**	0	16	0			
Coaching Partner-Network	**Urs-Peter Menti**	3	16	48			
Supervision HVACR	**Benno Zurfluh**	0	16	0			
Support Lighting Design	**Björn Schrader**						
	total			**48**			
Research Assistant							
Simultion HVACR, Jan/Feb	**Franz Sider**	0	16	0			
Construciton Management	**Florian Berner**	0	16	0			
IA Student	**Deborah Stoller**	0	16	0			
IA Student	**Fiona Berger**	0	16	0			
Graficdesign	**Linda Bär**	1	16	16			
Motion Picture	**Sara Stäuble**	0	16	0			
GT Stundent/ZIG	**Claudia Bless**	0	16	0			
Project Management	**Simon Gallner**	42	13	546			contr. 100%
Assistant Project/Curriculur	**Alexander Lempke**	16.8	16	268.8			contr. 40%
	total			**830.8**			
Administrative Assistant							
Student Team A	**Marcel Wyss**	45	4	180			Aug/Sept 13
Student Team IA	**Fabienne Maritz**	45	4	180			Aug/Sept 13
Student Team GT	**Patrick Vecellio**	45	4	180			Aug/Sept 13
Translations	**stud. Diverse**						
Student Team WI	**Randy Cotten**						
Student Business	**Alexandra Voglreiter**						
Stundent Team E	**Markus Kurmann**						
	total			**540**			
				64	Lecturer Student Team		
				48	Lecturer Project Support		
				830.8	Research Assistant (WissAss 2 od 3)		
				540	Administrative Assistant (Admin 3)		

explanation:

School of Engeneering and Architecture

A	Architecture
IA	Interiour Architecture
GT	Building Services Engineering
WI	Business and Innovation
BT	Civil Engeneering
E	Electrical Engineering
I	Computer Science

fall semester 2013

weeks 20 16.09.13 - 31.01.14 (Semester)
2 31.01.13 - 17.02.14 (Summer Break)

Workload PROJECT h/week	weeks	estimate total	in fact SAP	Workload contingent CURRICUL	Comment
7.5	20	150		400	
0	20	0			
0	20	0		50	
0	20	0		200	
0	20	0			
0	20	0		50	
0	20	0			
0	20	0			
		150		**700**	check HP?
0	20	0			
0	20	0			
0	20	0			
0	20	0			
0	20	0			
3	20	60			
0	20	0			
		60			
0	20	0			
0	20	0			
21	20	420			
21	20	420			
8.4	20	168			
8.4	20	168			
2.5	20	50			
42	22	924			contr. 100%
16.8	20	336			contr. 40%
		2486			
		0			
		0			
		0			
		0			
20	2	40			
8.4	5	42			contr. 20%
		0			
		82			

150	Lecturer Student Team
60	Lecturer Project Support
2486	Research Assistant (WissAss 2 od 3)
82	Administrative Assistant (Admin 3)

B. HOUSE CONSTRUCTION + C. HOUSE DISASSEMBLY IN ORIGIN AND TRANSP.

spring semester 2014

weeks 20 17.02.14 - 16.06.14 (Semester)

Workload PROJECT h/week	weeks	estimate total	in fact SAP	Workload contingent CURRICUL	Comment
8	16	128		520	
2	16	32			
0	16	0		20	
0	16	0		315	
0	16	0		120	
0	16	0		20	
15	16	240		200	
0	16	0		80	
		400		**1275**	
10	20	200			
4.2	16	67.2			
4.2	16	67.2			
17	16	272			
1.5	16	24			
0	16	0			
4	14	56			
		30			
		716.4			
30	4	120			
16.8	17	285.6			
21	17	357			
21	17	357			
8.4	17	142.8			
8.4	17	142.8			
0	0	0			
42	17	714			contr. 100
8.4	20	168			contr. 20%
		2287.2			
0		0			
0		0			
0		0			
200	1	200			
15.0	2	30			
8.4	29	243.6			contr. 20%
10.0	17	170			
		643.6			

400	Lecturer Student Team
716.4	Lecturer Project Support
2287.2	Research Assistant (WissAss 2 od 3)
643.6	Administrative Assistant (Admin 3)

D. FINAL PHASE IN CITE DU SOLEIL					E. POST EVENT					
final phase Versailles					post Event estimate					
16.06.14 - 20.07.2014					weeks	4	20.07.14 - 15.08.14	(Assembly in Horw)		
						15	15.08.14 - 31.12.14	(Events in Horw)		
16. - 26.06. Assembly 10 d	**27. 06. - 13.0 Competition 17 d**	**14.07.-19.07. Dissassembly 5 d**	**Comment**		**Workload PROJECT**		**estimate**	**in fact**	**Workload CURRICU**	**Comment**
h	**h**	**h**			**h/week**	**weeks**	**total**	**SAP**		
70	119	35			8	19	152		0	
0	0	0			0	19	0		0	
10	0	0			0	19	0		0	
10	10	0			0	19	0		0	
10	10	0			0	19	0		0	
10	0	0			0	19	0		0	
10	10	0			0	19	0		0	
10	10	0			0	19	0		0	
130	**159**	**35**	check HP?				**152**		**0**	check HP?
30	30	0			4	19	76			
0	0	0			2	19	38			
0	0	0			2	12	24			
10	0	0			0	12	0			
20	10	0			2	12	24			
10	0	0			0	12	0			
30	0	0			6	4	24			
100	**40**	**0**					**186**			
0	0	0			0	0	0			
80	0	0			0	0	0			
42	71.4	21			21	6	126			
42	71.4	21			21	6	126			
50	51	0			4	12	48			
30	51	0			2	12	24			
0	0	0			0	0	0			
84	142.8	42	contr. 100%		42	19	798			contr. 100%
42	0	0	contr. 20%		8.4	12	100.8			contr. 20%
370	**387.6**	**84**					**1222.8**			
0	0	0			42	4	168			
0	0	0			42	4	168			
0	0	0			42	4	168			
0	0	0			0	12	0			
0	0	0			0.0	12	0			
30	0	0	contr. 20%	contr. 20%	8.4	4	33.6			contr. 20%
144	0	0			0.0	12	0			
174	**0**	**0**					**537.6**			

324	Lecturer Student Team	**152**	Lecturer Student Team
140	Lecturer Project Support	**186**	Lecturer Project Support
841.6	Research Assistant (WissAss 2 od 3)	**1222.8**	Research Assistant (WissAss 2 od 3)
174	Administrative Assistant (Admin 3)	**537.6**	Administrative Assistant (Admin 3)

 Cost Estimate and Project financial Summary

IX Site Operations Report

 Site Operations Report

General Data

One of our main targets is to assembly and disassemble the pavilion as quickly and efficiently as possible, and to ensure the safety of our team. When we use the word safety, we don't only mean the safety for the Team Lucerne – Suisse while working on the prototype, we want to protect the other teams, especially the teams close to our platform. And last but not least: The safety of the visitors.

Our safety concept influences every step on the building lot, the organization and the drawings. The construction is discussed and developed with our professional partners, which have years of experience in assembly wooden pavilions. Our partners support us with their knowledge and teach us, in how to connect the elements.

All of the student's participating in the project have attended a workshop with theme of workplace safety. They have also received instruction for the tools that will be used on the jobsite. In this stage SUVA, the Swiss Institute for Safety is going to help us by observing the Swiss safety rules, to ensure that everyone's secure. Using safety clothes and helmets, gloves and ear protection on construction site while working is a standard for us.

For the erection of large or heavy timber elements, the help of professional carpenters will be enlisted. Summary: We rely on professionals in situations to be able to maintain the safety of our Team and surrounded people. The assembly and disassembly should be completely on our own.

Site Operation Coordinators

We want to work with different teams. Most of the people completing a apprenticeship as a carpenter, bricklayer plumber or electrician. We are using their competences in our favor. 10 students will have the training of ropes course to be certified to work in higher places, such as the roof of the prototype. The decoration team do safe work without dangerous machines.

Within the dayshift most professional will coodinate the main works on our site.
The third team contains some team is called professionals, mentioned in point General Data.

Student Team Leader:

Marcel Wyss +41 79 341 59 76, marcel.wyss@stud.hslu.ch

Site Operation Coordinator:

Shift 1: Florian Berner, +41 76 740 71 95, florian.berner@hslu.ch

Site Operation Coordinator:

Shift 2: Daniel Scheuber, +41 78 728 45 84, daniel.scheuber@stud.hslu.ch

Site Operations Coordinators:

Shift 3: Patrick Frutig, 079 355 12 09, patrick.frutig@stud.hslu.ch

Outside Cité du Soleil® Logistics

The exact truck route is up to the professional driving team. The transport company is Brunner in Lucerne. We are looking forward to planning the route via: Basel, Belfort, Vesoul, Paris, approx. 620 km from location to location. We have planned our load with three lowboy trucks, and seven normal trucks. We plan to come with all ten trucks at the same time. So we are looking for a place to park them around Paris. We plan to park three trucks in PION, one truck in Allßee des Matelots and on at la Cité du Soleil.
We plan to use a minibus with a magazine trailer with construction equipment. This trailer will be installed next to the platform (see lot plan). The car is parked outside the area.
The list specifies the weight of each element. You can see that we plan to work with prefabricated elements for the floor, wall and roof in your room. my room and our room are made as finished boxes. The load per axle of each vehicle, turn ratios and weights of the elements are presented in the attached "Elements and Load" list.

Inside Cité du Soleil® Logistics

Infrastructures

As mentioned there will be a material container and 5 waste bags. We will bring the waste to the big waste container of the organization, after speaking with them on the site.

Construction Work Teams

Health and Safety Coordinator:

Daniel Arnold, +41 78 808 66 16, daniel.arnold@stud.hslu.ch

Health and Safety Officer:

Shift 1: Helen Busscher, +41 79 714 35 26 helen.busscher@stud.hslu.ch

Health and Safety Office:

Shift 2: Patrick Frutig, 079 355 12 09, patrick.frutig@ stud.hslu.ch

Health and Safety Officer:

At every stage of assembly and dismantling, we have students who lead and organize the relevant work for that task.

Foundation:

Shift 1: Randy Cotten, 079 782 39 33, randy.cotten@ hslu.ch

Foundation:

Shift 2: Andrea Brönnimann, 077 442 24 11, andrea. broennimann@stud.hslu.ch

Woodwork, Prototype:

Shift 1: Phillip Arnold, 062 748 22 22, Phillip.Arnold @ renggli-haus.ch

Roof:

Shift 1: Yannik Keller, 078 876 64 74, yannik.keller@ stud.hslu.ch

Roof:

Shift 2: Simon Schneider 076 305 35 11, simon. schneider@stud.hslu.ch

Steel Frame on the Roof:

Shift 1 Fabienne Maritz, 079 457 96 37, fabienne. maritz@stud.hslu.ch

Steel Frame on the Roof:

Shift 2: Simon Schneider 076 305 35 11, simon. schneider@stud.hslu.ch

Electrical Installations:

Shift 1: Patrick Vecellio, 079 707 91 47, patrick. vecellio@hslu.ch

Electrical Installations:

Shift 2: Alain Bangerter, 076 411 83 45, alain.banger-ter@hslu.ch

HLKS Installations:

Shift 1: Mathias Heckelmiller, 077 492 50 64, mathias. heckelmiller@stud.hslu.ch

Interior Woodwork:

Deborah Stoller, 079 451 11 29, deborah.stoller@hslu. ch

Interior Other Work:

Fiona Berger, 079 377 35 06, fiona.berger@hslu.ch

Doors, Shadow:

Stefan Keller, 076 331 23 84, stefan.keller@stud.hslu. ch

Platform:

Shift 1: Andrea Brönnimann, 077 442 24 11, andrea. broennimann@stud.hslu.ch

Platform:

Shift 2: Randy Cotten, 079 782 39 33, randy.cotten@ hslu.ch

 Site Operations Report

Phase Description: Assembly

Day:	Type of Work	Machines	Timing	Members
1	Foundation Kerto	Drilling machine Measuring, laser, marking, spraying	08:00-23:00	Randy Cotten, Leader 1 Andrea Brönnimann, Leader 2 Simon Schneider Mario Kümin Patrick Frutig Hanspeter Bürgi Samuel Bieri
2	Foundation steel	Drilling machine Laser	04:00-23:00	See Foundation Kerto
3	Prototype, woodwork	Drilling machine Wood machine	08:00-18:00	Phillip Arnold, Renggli (Professional), Leader Ulrike Glien, Renggli (Professional) Felix Schmitt, Renggli (Professional) Veronika Melber
4	Doors	Drilling machine	08:00-17:00	Stefan Keller, Leader Phillip Arnold, Renggli (Professional) Ulrike Glien, Renggli (Professional) Felix Schmitt, Renggli (Professional)
	Interior	Wooden machine Painting Stuff	04:00-23:00	Deborah Stoller, Leader 1 Fiona Berger, Leader 2 Stefan Keller Christiane Prieth Fabienne Maritz Yannik Keller Veronika Melber
	Roof	Drilling machine Tape Safety harness	04:00-23:00	Yannik Keller, Leader 1 Fabienne Maritz, Leader 2 Simon Schneider Marcel Wyss Christiane Prieth Benjamin Kathriner Cora Völlnagel
	Water tanks /Platform East	Drilling machine	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Marcel Wyss
	Steel frame on the roof	Drilling machine Safety harness Safety material	04.00-23:00	Yannik Keller, Leader 1 Fabienne Maritz, Leader 2 Simon Schneider Marcel Wyss Christiane Prieth Benjamin Kathriner Cora Völlnagel

 Site Operations Report

	Installations	Installation material	04:00-23:00	Patrick Vecellio, Leader Electrical Mathias Heckelmiller, Leader HLKS 1 Markus Kuster, Leader HLKS 2 (Professional) Alain Bangerter, Leader Electrical 2 Thomas Dovoda (Professional) Patrick von Briel Samuel Bieri Marco Fischlin Mario Kümin Markus Kurmann Fabian Diesler (Professional) Simon Gallner Mathias Müller Roger Hauswirth
5	Foundation Platform South and West	Drilling machine Laser	04:00-23:00	See Foundation
	Shadow	Safety harness Drilling machine	04:00-23:00	Stefan Keller, Leader
	PV installation	Safety harness Drilling machine Installation material		See Installations
6	Platform South, ramp	Drilling machine Laser	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
7	Platform West, ramp	Drilling machine Laser	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
8/9	Testing Prototype		04:00-23:00	See Installations
	Handrails	See platform	04:00-23:00	Andrea Brönimann, Leader Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
10	Cleaning	Cleaning material	04:00-23:00	All

 Site Operations Report

Phase Description: Disassembly

Day:	Type of Work	Machines	Timing	Members
1	Platform South, ramp	Drilling machine Measuring, laser, marking, spraying	08:00-23:00	Randy Cotten, Leader 1 Andrea Brönnimann, Leader 2 Simon Schneider Mario Kümin Patrick Frutig Hanspeter Bürgi Samuel Bieri
	Platform West, ramp	See Platform South	04:00-23:00	Andrea Brönimann, Leader Randy Cotten Marcel Wyss Phillip Arnold, Renggli (Professional)
2	Foundation Platform South and West	Drilling machine Laser	04:00-23:00	Andrea Brönimann, Leader Randy Cotten Marcel Wyss Phillip Arnold, (Professional)
	Shadow	Safety harness Drilling machine	04:00-23:00	Stefan Keller, Leader
	PV Reinstallation	Safety harness Drilling machine Installation material		Patrick Vecellio, Leader
	Steel frame away from roof	Drilling machine Safety harness	12:00-23:00	Fabienne Maritz, Leader Simon Schneider Chrisitane Prieth
3	Reinstall doors	Drilling machine	04:00-23:00	Stefan Keller, Leader
	Interior fixing for transport	Wooden machine	04:00-23:00	Deborah Stoller, Leader Fiona Berger, Leader Stefan Keller Christiane Prieth Fabienne Maritz Yannik Keller Veronika Melber
	Roof cutting	Drilling machine Tape Safety harness	04:00-23:00	Yannik Keller, Leader Simon Schneide
	Water tanks /Platform East Reinstallation	Drilling machine	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
4	Prototype, wooden work	Drilling machine Wood machine	04:00-23:00	Phillip Arnold, Renggli (Professional), Leader Ulrike Glien, Renggli (Professional) Felix Schmitt, Renggli (Professional) Veronika Melber
5	Foundation Kerto / steel	Drilling machine Measuring, laser, marking, spraying	04:00-23:00	Randy Cotten, Leader 1 Andrea Brönnimann, Leader 2 Simon Schneider Mario Kümin Patrick Frutig Hanspeter Bürgi Samuel Bieri

The prototype is planned and prefabricated for easy assembly and screwing together. This helps us to build the prototype in 10 days. So we often only use screws and tape. Due to the fact we constructed the whole prototype before in Switzerland, all the specific changes and optimizations have already been carried out. In case of changes, we can react by using some wood cutting machines. These machines will be used only by professionals and students with a former apprenticeship as carpenters or steelworkers.

Respect of Assembly Plan

Action	dates
Planned deadline for wind-and-water tight	20.06.14
Planned deadline for electrical connection to village grid	22.06.14
planned deadline for house delivery	25.06.14

Assembly and Disassembly Schedules

Further information: PD#6 Assembly and Disassembly Schedules

Waste Management

We plan to put 5 waste bags next to the prototype. We separate the waste in types such as: wood, packing material, metal, paper and carton, mixed materials. During the exhibition we bring the bags outside the area.
These bags can also be used by other teams. "smart sharing" should also be part of the assembly and dismantling period, including the waste management.

Equipment Requirement Chart

EQUIPMENT RENTAL CHART
TEAM LUC

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RÉPUBLIQUE FRANÇAISE

CATEGORIE 1 : MOBILE CRANE

PLEASE COMPLETE THE ASSEMBLY & DISASSEMBLY CHARTS

CATEGORIE 2 : CONSTRUCTION EQUIPMENT

HANDLING

DESIGNATION	REFERENCE	U	QUANTITY NEEDED
Forklift	H.FL.01	u	0
Telehandler	H.TH.01	u	0

ELEVATION

DESIGNATION	REFERENCE	U	QUANTITY NEEDED
Boom Lift	E.BL.01	u	0

CATEGORIE 3 : OTHER EQUIPMENT

EQUIPMENT

DESIGNATION	REFERENCE	U	QUANTITY NEEDED
Pallet Truck	O.OE.01	u	1
Individual Platform 2,90m to 3,60m	O.OE.02	u	3
Scaffolding 5 m	O.OE.03	u	0
Fences HERAS (including plots)	O.OE.04	m	10

 Site Operations Report

Assembly Chart

DAY 1 - 16.06.2014	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®	T10															
Cranes	50 To															
Trucks in Matelots																

DAY 2 - 17.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																								
Cranes									50 To															
Trucks in Matelots																								

DAY 3 - 18.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®											T7					T4	T5							
Cranes									50 To															
Trucks in Matelots									T7					T4										

DAY 4 - 19.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®									T8					T1	T2	T3								
Cranes									50 To															
Trucks in Matelots							T8					T1		T2	T3									

DAY 5 - 20.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®									T9															
Cranes									50 To															
Trucks in Matelots							T9																	

DAY 6 - 21.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®									T6															
Cranes									50 To															
Trucks in Matelots							T6																	

DAY 7 - 22.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																								
Cranes									50 To															
Trucks in Matelots																								

DAY 8 - 23.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																								
Cranes									50 To															
Trucks in Matelots																								

DAY 9 - 24.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																								
Cranes																								
Trucks in Matelots																								

DAY 10 - 25.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																								
Cranes																								
Trucks in Matelots																								

DAY 11 - 26.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
	INSPECTION DAY																							

Disassembly Chart

DAY 1 - 15.07.2014	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																
Cranes	50 To															
Trucks in Matelots	6															

DAY 2 - 16.07.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®																	T9	9						
Cranes									50 To															
Trucks in Matelots																								

DAY 3 - 17.07.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®									9															
Cranes									50 To															
Trucks in Matelots																								

DAY 4 - 18.07.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®									9								8		7		4	5		
Cranes									50 To															
Trucks in Matelots																T8		T7		T4	T5			

DAY 5 - 19.07.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Trucks in CDS®									1	2	3	T10												
Cranes									50 To															
Trucks in Matelots								T1	T2	T3	T10													

Trucks in Matelots **Trucks which are waiting in Allée des Matelots along la Cité du Soleil®**

USAGE OF THE CRANE during **ASSEMBLY**	
Crane capacity	*Usage time*
50 Tn	109 hours

USAGE OF THE CRANE during **DISASSEMBLY**	
Crane capacity	*Usage time*
50 Tn	75 hours

 Site Operations Report

Site Operation Chart

SITE OPERATION CHART
TEAM LUC

0. GENERAL INFORMATION		FUNCTION	CONSTRUCTION WORKING TEAM	NAME	TELEPHONE NUMBER
	1	Site Operations Coordinators	Working Team A	Daniel Scheuber	078 728 45 84
	2		Working Team B	Florian Berner	076 740 71 95
			When A/B is resting	Patrick Frutig	079 355 12 09

1. MODULES AND MAIN COMPONENTS		NAME	DIMENSIONS [m]	WEIGHT [kg]	MACHINERY USE FOR UNLOADING/LOADING
	1	See Modullist			
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	...				

2. VEHICULES (Trucks, Vans, etc.)		TYPE	DIMENSIONS [m] (Tractor unit + Trailer)	WEIGHT [kg] (Truck + Loading)
	1	DOLL 800 not covered	18 / 4 / 3	10`000
	2	Low-Bed covered	18 / 4 / 3	10`000
	3	Low-Bed covered	18 / 4 / 3	10`000
	4	Low-Bed not covered	18 / 4 / 3	12`000
	5	Megatrailer covered 13.60 m	18 / 4 / 3	10`000
	6	Outliner covered	18 / 4 / 3	10`000
	7	Innenlader covering by LUC	18 / 4 / 3	10`000
	8	Innenlader covering by LUC	18 / 4 / 3	10`000
	9	Outliner covered	18 / 4 / 3	10`000
	10	Megatrailer covered 13.60 m	18 / 4 / 3	10`000

3. CRANES		CAPACITY	USAGE TIME
	1	Assembly 50 Tn	109 Hours
	2	Disassembly 50 Tn	75 Hours

4. GENERAL DESCRIPTION OF THE PHASES			PHASE	MATERIAL AND EQUIPMENT RESOURCES	HUMAN RESOURCES	DURATION
	ASSEMBLY	1	Fundation Kerto	Timber Machine, Installation Equipment	10	08:00-23:00
		2	Fundation Steel	Timber Machine, Installation Equipment	10	04:00-23:00
		3	Timber Work / Fundation Steel and West	Timber Machine, Installation Equipment	6	04:00-23:00
		4	Timber Work / Interior Instaltions	Timber Machine, Installation Equipment	10	04:00-23:00
		5	Space+ / Doors	Timber Machine, Installation Equipment	12	04:00-23:00
		6	Platform East / Interior Finish Ceiling	Timber Machine, Installation Equipment	20	04:00-23:00
		7	Platform South and West / Instaltions roof	Timber Machine, Installation Equipment	20	04:00-23:00
		8	Interior Furniture / Instaltions roof	Timber Machine, Installation Equipment	15	04:00-23:00
		9	Interior Furniture / Cover Roof	Timber Machine, Installation Equipment	15	04:00-23:00
		10	Cleaning	Cleaning Stuff	20	04:00-23:00
	DISASSEMBLY	1	Platform / Roof	Timber Machine, Installation Equipment	20	08:00-23:00
		2	Interior	Timber Machine, Installation Equipment	20	04:00-23:00
		3	Fundation / Timber	Timber Machine, Installation Equipment	20	04:00-23:00
		4	Our Room / Your Room / Space+ / Doors	Timber Machine, Installation Equipment	20	04:00-23:00
		5	My Room / Fundation	Timber Machine, Installation Equipment	20	04:00-23:00

Further information: Appendix 27 Modulelist

 Site Operations Report

Storage Area Chart

STORAGE AREA CHART
TEAM LUC

COMPONENTS TO BE STORED DURING COMPETITION PHASE		DESIGNATION	DIMENSIONS (m) (L/B/H)	WEIGHT (kg)
	1	25 Palets filled with packing material	25x(1.2/0.8/1.4)	25 x 200 (c)
	2	Wood-Cover My Room 1	5.05 / 0.03 / 3.5	200 (c)
	3	Wood-Cover My Room 2	5.05 / 0.03 / 3.5	200 (c)
	4	Wood-Cover My Room 3	5.05 / 0.03 / 3.5	200 (c)
	5	Wood-Cover Our Room 1	5.8 / 0.03 / 4	200 (c)
	6	Wood-Cover Our Room 2	5.8 / 0.03 / 4	200 (c)
	7	Wood-Cover Space+ 1	7.6/3/1.2	400 (c)
	8	Wood Cover Space+ 2	4.2/2.3/1.2	400(c)
	9	Palet Innenlader Nr. 8	16/1.6/4	2000(c)
	10	Steelframe to set wooden Elements	6/4/0.9	1000 (c)
	11	Container Team LUC	6 / 3 / 3	2000
	12	Container TimberTeam/CONT TI	2.5/2.5/3.5	2000(c)
	13	Wood-Cover Roof Your room 1	5.3/2.6/0.3	100 (c)
	14	Wood-Cover Roof Your room 2	5.3/2.6/0.3	100 (c)
	15	Replacement Material	4 / 4 / 4	2000(c)
	16	Container 01 / CONT 01	2.3/2.6/2.4	1000(c)
	17	Container 02 / CONT 02	2.3/2.6/2.4	1000(c)
	18	Container 03/ CONT 03	2.3/2.6/2.4	1000(c)

(c): We need the cran to load and unload this Element.

The Designations without the (c) are Moved by the Truck.

Turnover in Pion

TURNOVER IN PION
TEAM LUC

Day 1 - 13.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1														T7										
Parking 2																								
Day 2 - 14.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1														T7										
Parking 2														T4										
Day 3 - 15.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1												T5					T8							
Parking 2											T4					T1								
Day 4 - 16.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1										T1			T3											
Parking 2											T2								T9					
Day 5 - 17.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 6- 18.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1				T6																				
Parking 2																								
Day 7 - 19.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 8 - 20.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 9 - 21.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 10 - 22.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 11 - 23.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 12 - 24.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 13 - 25.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								
Day 14 - 26.06.2014	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Parking 1																								
Parking 2																								

ASSEMBLY

X Health & Safety Report

Table of Contents X Health & Safety Report

10.1. Health and Safety Checklist
10.2. General Project Data
10.3. Health and Safety Plan Objectives
10.4. Conditions of the Site where Construction will take Place and interesting Data related to Risk Prevention during the Construction Process
10.5. Activities for Risk Prevention
10.6. Critical Work Phases for Risk Prevention
10.7. Risk Identification and Efficacy Evaluation of the adopted Protection Measures
10.8. Collective Protection to be use
10.9. Individual Protection Resources to be used
10.10. Safe Working Procedures for every Team Members
10.11. Machinery and auxiliary Resources
10.12. Planned Measures in case of Accident
10.13. Risk Identification for possible later Work
10.14. Useful Plans and Information for possible later Work
10.15. Adopted System for the Level of Health and Safety Control during Work
10.16. Formation and Information on Health and Safety
10.17. Emergency Evacuation Plan during the Assembly and Dismantling Periods

10.1. Health and Safety Checklist

Event Promoter:
Solar Decathlon Europe 2014 Organisation
CSTB Solar
cours Louis Lumière 10
94300 Vincennes - France
Tel.: 0033 (0)1 40 50 2934
Fax: 0033 (0)1 40 50 2910
jerome.mat@solardecathlon2014.fr

Health and Safety Coordinator:
(SPS Design Coordinator)
Bureau Veritas
avenue Robert Schuman 17A
13235 Marseille Cedex 2 – France
Tel.: 0033 (0)4 96 17 1350
Fax: 0033 (0)4 91 56 1873
christophe.peyronel@fr.bureauveritas.com

Health and Safety Team Coordinator:
Daniel Arnold
Tel.: 0041 78 808 66 16
daniel.arnold@stud.hslu.ch

Helen Busscher
Tel.: 0041 79 714 35 26
helen.busscher@stud.hslu.ch

Patrick Frutig
Tel.: 0041 79 355 12 09
patrick.frutig@stud.hslu.ch

(SPS Design Coordinator):
Bureau Veritas
Boulevard Vauban 2
78180 – Montigny le Bretonneux - France

Prevention Authorities:
EKAS - Eidgenössische Koordinationskommission für Arbeitssicherheit

FCOS -Federal Coordination Commission for Occupational Safety
Fluhmattstrasse 1
CH - 6002 Lucerne
Tel.: 041 419 51 11
Fax: 041 419 58 28

Suva - Schweizerische Unfallversicherungsanstalt
Prevention, Insurance and Rehabilitation
Suva Hauptsitz
Fluhmattstrasse 1
CH - 6002 Lucerne
Tel.: 041 419 51 11
Fax: 041 419 58 28
www.suva.ch
www.ekas.admin.ch

ILO -International Labour Organization
4 route des Morillons
CH – 1211 Geneva 22

CARSAT - La caisse d'assurance retraite et de la santé au travaille
Rue Porte de Buc
78035 Versailles Cedex 20 - France
Tel.: 0033 (0)1 61 37 1000
Fax: 0033 (0)1 61 37 1001
dd-78.direction@direccte.gouv.fr

Prototype Builder:
your+ / Team Lucerne – Suisse
Lucerne University of Applied Sciences and Arts
School of Engineering & Architecture
(Hochschule Luzern – Technik & Architektur)
Technikumstrasse 21
CH 6048 Horw / Switzerland

Number of Workers:
- 41 workers during assembly
- 33 workers during disassembly

Site Operations Coordinator:
Daniel Scheuber
Tel.: 0041 78 728 45 84
daniel.scheuber@stud.hslu.ch

Description of Works:
Assembly, maintenance and disassembly of the prototype your+, for the Solar Decathlon Europe 2014.
Further information: PD#6 SO-drawings.

First Aid Procedure
In case of evacuation it is very important to prepare for the arrival of the ambulance, to assure a fast arrival and to neutralize all possible barricades. (A detailed description is presented in chapter 10.1. "Health and safety checklist" in the section "First Aid Procedure").
The same conditions count for the evacuation of possibly injured. Team members wait for the ambulance at the exit of the Solar Decathlon exhibition site. An evacuation plan of the exhibition site and the "Cité du Soleil" will be delivered to the ambulance.
Those plans and all further information can be examined at any time during all operation modes.

 Health & Safety Report

A map with the fastest route from the exhibiton site to the next hospital will be placed in the construction site next to the Health and Safety general indication plan.
Further information: Appendix 28 Route to the hospital.

The followign infomration has been extracted from the General Coordination Plan and must be used in case of an accident victim evacuation:

1. This is the construction site:
Address: CITE DU SOLEIL 2014
Domaine du château de Versailles
Allée des Matelots
VERSAILLES
Telephone No: ?

2. Specify the nature of accident:
For example: fall, a collapsed construction, asphyxiation etc.

The position of the injured person:
On the patio, on the ground, or in a cavity etc… Also state if they need to be released because they are trapped.
Specify if the accident occurred in the water.

3. Report the number of injured persons and their condition. For example: Three workers injured including one who is bleeding a lot and is not talking.

4. Arrange a meeting place
Send someone to the entrance of the construction site to direct emergency services.
- Never end the call first.
- Immediatly inform the control room.

For each call, someone must be designated to proceed to first aider's meeting point and wait for the firemen and then lead them to the place of accident.

Emergency services
Police 17
SAMU 15
Fireman 18 land line – mobile: 112
Versailles Hospital Tel.: 01.39.63.91.33
177, rue de Versailles
78157 LE CHESNAY
Numbers of SDE Organisation: To be updated
Emergency calls:
To call for help from the construction site:
Call the hospital (to be updated).
We will carefully follow the call instructions outlined in the document "in the event of an accident" attached in Appendix 4, which will be clearly posted next to all construction site telephones.

Information given to emergency services must be provided as shown:

What to do if there is an accident:
Protect / alert / provide first aid / think before acting

To avoid worsening the situation:
Protect: - Yourself
- The victim(s)
- Others
(for example by informing those around, marking out the area, cutting off electricity etc.)
Leave someone near the injured person(s).
Inform or get someone to inform:
- Whoever the Project Supervisor has put in charge of HSE
- First aiders on site

Immediatly: Alert emergency services.

First aid:
While awaiting the arrival of emergency services, do not move any injured persson(s) except if there is an imminent danger, comfort the victim(s), cover the victim(s), and do not give them anything to drink.
Further information: Appendix 29 Emergency procedures.

First aid certificated workers:

1. Daniel Arnold
2. Daniel Scheuber
3. Florian Berner
4. Marcel Wyss
5. Simon Gallner
6. Simon Schneider
7. Cora Völlnagel
8. Veronika Melber
9. Andrea Brönnimann
10. Janick Staub
11. Helen Busscher
12. Patrick Frutig
13. Mathias Heckelmiller
14. Randy Cotten
15. Christiane Prieth
16. Yannik Keller
17. Stefan Keller

First aid kit description:

- Adhesive strips (assorted sizes) for minor wound dressing
- Non-allergenic adhesive tape for securing dressings and strapping
- Eye pads for emergency eye cover
- Triangular bandage for slings, support and/or padding
- Hospital crepe or conforming bandage to hold dressings in place
- Wound/combine dressings to control bleeding and for covering wounds
- Non-adhesive dressings for wound dressing
- Safety pins to secure bandages and slings
- Scissors for cutting dressings or clothing
- Kidney dish for holding dressings and instruments
- Small dressings' bowl for holding liquids
- Gauze squares for cleaning wounds
- Forceps/tweezers for removing foreign bodies
- Disposable latex or vinyl gloves for infection control
- Sharps disposal container for infection control and disposal purposes
- Sterile saline solution or sterile water for emergency eye wash or for irrigating eye wounds. This saline solution must be discarded after opening
- Resuscitation mask to be used by qualified personnel for resuscitation purposes
- Antiseptic solution for cleaning wounds and skin
- Plastic bags for waste disposal
- Note pad and pen/pencil for recording the injured or ill person's condition and treatment given
- Re-usable ice-pack for the management of strains, sprains and bruises

Hygiene Conditions

Places of waste or rubbish storage on the construction site will be specified on the installation site map. Sorting bins will be sufficiently labeled and all explanation for correct waste separation will be available to all companies and workers for the cleanliness and safety of the project. The Project Supervisor also ensures the proper disposal of waste and rubble in a public dump during the entire construction period. Identification signs indicating different types of waste are affixed to the right bins.

The use of closed dumpsters or bins is required when the waste might be dispersed by the wind. Each company is required to provide daily cleaning of its work areas and to bring all of its waste and rubbish to the dumpsters/bins placed at its disposal. Storage or illegal dumping of waste or rubbish will not be tolerated on the construction site.

Changing room

The store supporter can be used as a changing room. Two students are in charge of cleaning and looking after the store supporter.

Rest room

A tent (more or less open, according to the weather conditions) situated on-site will be used as a rest room.

Description of Operating Modes

Assembly: Well prepared students and professional workers, divided in two working shifts, construct the prototype and and carry out all affordable construction site organization. Working with or beside different vehicles and machines, as well as time preassure to complete the work, they require maximum concentration, consideration of all participants and the best possible safety conditions.

Maintenance: Different works done everyday by a small amount of students assures the best conditions for all other operating modes.

Assessment: Several periods are booked for the evaluation and for different measurements due to the competition. Best hygiene and safety conditions and well prepared students are mandatory.

Guided tours and similar activities: Several periods are booked for evaluation and for different measurements due to the competition. Best hygiene and safety conditions and well prepared students are mandatory.

Dinners and similar activities: Several periods are booked for evaluation and for different measurements due to the competition. Best hygiene and safety conditions and well prepared students are mandatory.

Disassembly: A high amount of well prepared students and workers, divided in two working shifts, construct the prototype and carry out all affordable construction site organization. Working with or beside different vehicles and machines, as well as an extremely tight window of time to complete the work, they require maximum concentration, consideration of all participants and the and the best possible safety conditions.

Phase Description: Assembly

Day:	Type of Work	Machines	Timing	Members
1	Foundation Kerto	Drilling machine Measuring, laser, marking, spraying	08:00-23:00	Randy Cotten, Leader 1 Andrea Brönnimann, Leader 2 Simon Schneider Mario Kümin Patrick Frutig Hanspeter Bürgi Samuel Bieri
2	Foundation steel	Drilling machine Laser	04:00-23:00	See Foundation Kerto
3	Prototype, woodwork	Drilling machine Wood machine	08:00-18:00	Phillip Arnold, Renggli (Professional), Leader Ulrike Glien, Renggli (Professional) Felix Schmitt, Renggli (Professional) Veronika Melber
4	Doors	Drilling machine	08:00-17:00	Stefan Keller, Leader Phillip Arnold, Renggli (Professional) Ulrike Glien, Renggli (Professional) Felix Schmitt, Renggli (Professional)
	Interior	Wooden machine Painting Stuff	04:00-23:00	Deborah Stoller, Leader 1 Fiona Berger, Leader 2 Stefan Keller Christiane Prieth Fabienne Maritz Yannik Keller Veronika Melber
	Roof	Drilling machine Tape Safety harness	04:00-23:00	Yannik Keller, Leader 1 Fabienne Maritz, Leader 2 Simon Schneider Marcel Wyss Christiane Prieth Benjamin Kathriner Cora Völlnagel
	Water tanks /Platform East	Drilling machine	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Marcel Wyss
	Steel frame on the roof	Drilling machine Safety harness Safety material	04.00-23:00	Yannik Keller, Leader 1 Fabienne Maritz, Leader 2 Simon Schneider Marcel Wyss Christiane Prieth Benjamin Kathriner Cora Völlnagel

	Installations	Installation material	04:00-23:00	Patrick Vecellio, Leader Electrical Mathias Heckelmiller, Leader HLKS 1 Markus Kuster, Leader HLKS 2 (Professional) Alain Bangerter, Leader Electrical 2 Thomas Dovoda (Professional) Patrick von Briel Samuel Bieri Marco Fischlin Mario Kümin Markus Kurmann Fabian Diesler (Professional) Simon Gallner Mathias Müller Roger Hauswirth
5	Foundation Platform South and West	Drilling machine Laser	04:00-23:00	See Foundation
	Shadow	Safety harness Drilling machine	04:00-23:00	Stefan Keller, Leader
	PV installation	Safety harness Drilling machine Installation material		See Installations
6	Platform South, ramp	Drilling machine Laser	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
7	Platform West, ramp	Drilling machine Laser	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
8/9	Testing Prototype		04:00-23:00	See Installations
	Handrails	See platform	04:00-23:00	Andrea Brönimann, Leader Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
10	Cleaning	Cleaning material	04:00-23:00	All

Further information: PD#6 SO-drawings .

 Health & Safety Report

Phase Description: Disassembly

Day:	Type of Work	Machines	Timing	Members
1	Platform South, ramp	Drilling machine Measuring, laser, marking, spraying	08:00-23:00	Randy Cotten, Leader 1 Andrea Brönnimann, Leader 2 Simon Schneider Mario Kümin Patrick Frutig Hanspeter Bürgi Samuel Bieri
	Platform West, ramp	See Platform South	04:00-23:00	Andrea Brönimann, Leader Randy Cotten Marcel Wyss Phillip Arnold, Renggli (Professional)
2	Foundation Platform South and West	Drilling machine Laser	04:00-23:00	Andrea Brönimann, Leader Randy Cotten Marcel Wyss Phillip Arnold, (Professional)
	Shadow	Safety harness Drilling machine	04:00-23:00	Stefan Keller, Leader
	PV Reinstallation	Safety harness Drilling machine Installation material		Patrick Vecellio, Leader
	Steel frame away from roof	Drilling machine Safety harness	12:00-23:00	Fabienne Maritz, Leader Simon Schneider Chrisitane Prieth
3	Reinstall doors	Drilling machine	04:00-23:00	Stefan Keller, Leader
	Interior fixing for transport	Wooden machine	04:00-23:00	Deborah Stoller, Leader Fiona Berger, Leader Stefan Keller Christiane Prieth Fabienne Maritz Yannik Keller Veronika Melber
	Roof cutting	Drilling machine Tape Safety harness	04:00-23:00	Yannik Keller, Leader Simon Schneide
	Water tanks /Platform East Reinstallation	Drilling machine	04:00-23:00	Andrea Brönimann, Leader 1 Randy Cotten, Leader 2 Simon Gallner Tristan Imgrüth (Professional)
4	Prototype, wooden work	Drilling machine Wood machine	04:00-23:00	Phillip Arnold, Renggli (Professional), Leader Ulrike Glien, Renggli (Professional) Felix Schmitt, Renggli (Professional) Veronika Melber
5	Foundation Kerto / steel	Drilling machine Measuring, laser, marking, spraying	04:00-23:00	Randy Cotten, Leader 1 Andrea Brönnimann, Leader 2 Simon Schneider Mario Kümin Patrick Frutig Hanspeter Bürgi Samuel Bieri

Risk Assessment - Risks generated by Others

Nearly everyone of the 25 risks which are established in the SDE Rules can be caused by others, especially by the teams with their own construction sites next to our or by vehicles.
The best preventive measures to avoid any additional risks which can be caused by others, is to stay in caring contact with others as well as to follow constantly working processes of others and to be carefully arranged during their work phases in connection with following risks:

3. Fall of objects because of collapse
4. Fall of objects because they come loose
6. Stepping on objects
7. Colliding with still objects
8. Colliding with objects in motion
9. Knocked by objects or tools
13. Trapped by turned over machines, tractors or vehicles
17. Exposure to electric connections
21. Explosion
22. Fire
23. Run over or hit by vehicles
25. "In itinere"

Preventive measures and *further information is located in the Health and Safety Plan, chapter 10.7.b.* Risk Identification and Efficiency of the Adopted Protection.

Risk Assessment - Risks generated by the Environment

It is important to be aware of the risks of sudden and violent gusts of wind, high temperatures and storms. Daily weather reports wil be obtained from the French national meteorological service (METEO France station – Tel.: 0892.680.213).

A subscription to receive meteorological conditions and storm alert bulletins is mandatory for Project Supervisors and such bulletins will be posted in the construction site office.
Nonetheless, the managers of the various intervening construction companies are obliged to keep themselves informed about weather forecasts when organising their respective work schedules. Each manager can select from a range of available servers.
In principle, one or several wind speed direction devices are set up at the construction site by the Project Owner at the beginning of the assembly of prototypes. The display table of wind speed will be positioned so that company employees can easily read it. If necessary, information reports will be posted in the organisation area.
Working under constant sunshine for long time will unavoidably apply to dehydration. To avoid headache, deficit of concentration, a sunstroke or other effects caused by sunshine, the Health and Safety team coordinator will delegate short pauses depending of the weather conditions after more ore less one hour. All workers shall drink water in that time and will be able to refresh themselves.
To prohibit a sunburn, suncream has to be applied and will be detectable at the rest room area at any time.Heavy rain can make surfaces slippery. Wet objects do slip out of the hands more easily. Therefore, every working step that can be made at dry conditions will be done that way. Otherwise for all working steps, additional amounts of security and calmness will turn on each workers attention. Working at wet conditions combined with possible stressful situations can incrase the plausibility to get cold. In that case, hot tea and towels, located at the rest room area, will be delivered if needed. Strong wind is able to take smaller or larger peaces and objects away, depending on intensity. Everything that may get in motion by the wind, will be taken away or immediately secured. Safety glasses has to be worn to prevent small particles to reach the eyes.
All works will stop instantly if any worksteps with crane loads are influenced by the wind.

Uncontrollable circumstances as earthquakes, will activate the same procedure like the one in case of a fire.

Risk Assessment - Risks generated on Others

Following risks may have a plausibility to be caused by us on others:

3. Fall of objects because of collapse
4. Fall of objects because they come loose
6. Stepping on objects
7. Colliding with still objects
8. Colliding with objects in motion
9. Knocked by objects or tools
13. Trapped by turned over machines, tractors or vehicles
17. Exposure to electric connections
21. Explosion
22. Fire
23. Run over or hit by vehicles
25. "In itinere"

However, the procedures that have been developed and established by the aformentioned prevention authorities will be executed at any time during assembly, maintenance and dismantling to minimize the chance for all risks occurring to any participant, worker or visitor.

Preventive measures and *further information is located in located in the Health and Safety Plan, chapter 10.7.b.* Risk Identification and Efficiency Evaluation of the Adopted Protection

Risk Assessment - Self-generated Risks

1. Fall of persons at a different level
2. Fall of persons at the same level
3. Fall of objects because of collapse
4. Fall of objects because they come loose
6. Stepping on objects
7. Colliding with still objects
8. Colliding with objects in motion
9. Knocked by objects or tools
11. Accidents caused by living beings
12. Trapped by or between objects
13. Trapped by turned over machines, tractors or vehicles
14. Overexertion
15. Exposure to extreme environmental temperatures
17. Exposure to electric connections
19. Exposure to harmful substances
22. Fire
23. Run over or hit by vehicles
24. Non traumatic pathologies
25. "In itinere"

Preventive measures and *further informations is located in the Health and Safety Plan, chapter 10.7.b.* Risk Identification and Efficiency Evaluation of the Adopted Protection

Procedures to adapt collective Protection

The Project Supervisor and each team are responsible for providing, implementing and maintaining collective protection up to its final dismantling or until the end of construction.
For both the Project Supervisor and each team, the HSE Coordinator implements and maintains these tools. Sub-contractors can implement collective protection in agreement with and under the responsibility of the Project Supervisor and of each team.
All of the collective protection implemented by the company on the construction site are described in detail in the Health and Safety Plan.
Collective protection is designed and constructed to meet the following general principles:

- Always implemented prior to the onset of any risk
- Adapted and sufficient to allow for the safe completion of various types of work and without dismantling by the Contractor, by its sub-contractors or by companies called on to succeed him on the portion of the work in question

Unless prior special agreement, only the contractor in charge of maintenance of a temporary collective protection measure will be authorised to dismantle it. However, collective protection can only be dismantled in the following situations:

- Elimination of the risk related to the advancement of work
- Definitive collective protection of the overall work is in place and is sufficient for the remaining work
- Another temporary device of equal efficiency is implemented. (A procedure should be established in the ISHPP by the company that falls into this category.)

If at the conclusion of the contractor’s work, one or more risks still remain on the structure, the conditions set forth above will apply. The latter implements collective protection in consultation with the project supervisor or the team concerned, which are called on to succeed.
All construction workers whose interventions require the removal of collective protection implemented by the Project Supervisor or by each team implements, after receiving agreement from the Project Supervisor and the team involved, replacement equipment that is suitable to carry out its work, ensuring effective collective protection. It also ensures maintenance until the end of the construction or until the replacement of initial protection.
Safety devices implemented by a company for its personal use (scaffolding, nets, barriers, etc.) or collective protection shared with other companies can only be moved or changed by those who originally installed them.
Any modifications are joined as an addendum to the Health and Safety Plan before work commences

Training for the Team Workers

- Machinery course instructed by the industrial partner "Schär Holzbau" on 12.02.2014
- First aid instructed by "Samariter Stans" on 26.03.2014
- General Health and Safety course instructed by the Health and Safety Team officer Daniel Arnold
- Defibrillator course on 23.04.2014
- Height activity and anti-fall guard instructed by "alpinworks" on 28.03.2014

Location of specific Plans, Documents, Drawings and additional relavant Informations

Further information: Appendix 30 Work and summer
Appendix 31 Dangerous products
Appendix 32 Lifting attachments system
Appendix 33 Individual protection
Appendix 34 Detailed lifting plan

10.2. General Project Data

Event Promoter:
Solar Decathlon Europe 2014 Organisation
CSTB Solar
cours Louis Lumière 10
94300 Vincennes - France
Tel.: 0033 (0)1 40 50 2934
Fax: 0033 (0)1 40 50 2910
jerome.mat@solardecathlon2014.fr

Prototype Builder:
your+ / Team Lucerne – Suisse
Lucerne University of Applied Sciences and Arts
School of Engineering & Architecture
(Hochschule Luzern - Technik & Architektur)
Technikumstrasse 21
CH 6048 Horw / Switzerland

Site Operations Coordinator:
Daniel Scheuber
Tel.: 0041 78 728 45 84
daniel.scheuber@stud.hslu.ch

Florian Berner
Tel.: 0041 76 740 71
florian.berner@hslu.ch

Health and Safety Team Coordinator:
Daniel Arnold
Tel.: 0041 78 808 66 16
daniel.arnold@stud.hslu.ch

Helen Busscher
Tel.: 0041 79 714 35 26
helen.busscher@stud.hslu.ch

Patrick Frutig
Tel.: 0041 79 355 12 09
patrick.frutig@stud.hslu.ch

Nature of the project:

Architectural footprint:	140m^2
Measurable area:	69m^2
Platform height:	0.80m
Prototype height:	4.31m
Length:	13.50 m
Width:	13.50m

Description of Works:
Assembly, maintenance and dismantling of the prototype your+, for the Solar Decathlon Europe 2014 competition.

10.3. Health and Safety Plan Objectives

The motivation of the competition participants is enormous. Stress situations can lead to accidents if the appropriate measures and precautions aren't taken. The participants focus on the challenge of the competition and on this unique life experience. This life experience shall be amazing and thrilling, but could turn into a nightmare if the drive to succeed leads to unforgivable mistakes. The seriousness of the dimensions of this project must be clearly defined to every participant of our team. In order to achieve the highest possible safety level, we want to develop and conduct safety concepts for the entire project. One important step towards the best possible safety level is to analyse and reduce risks during the assembly and dismantling, transportation, the time during the Solar Decathlon Europe 2014 competition in Versailles and the time thereafter.

This Health and Safety Report, which is requested to participate at the competition, is a useful and important tool to achieve complete and funded preparation and the Team Lucerne – Suisse aim to provide the required documentation. The entire team and possible construction partners must respect the measures defined in this report. Everyone participating in construction and transport work must be informed on this safety concept. Every Health and Safety Team Coordinator and Site Operator will have his own folder with all Health and Safety contents of that report, including the checklist, the drawings and appendix contents.
Moreover it is each member's responsibility to pay full attention to the safety aspects of the project and to the order and cleanness of the work places.
Copies of the safety documents shall be available on the construction site at any time and participants must comply with the safety rules of this report and the national realities.
It is of primary importance to guarantee the safety of all participants and to fulfil all requirements made by the SDE Organization, the general coordination plan and the SUVA.
The your+ Team is producing a Health & Safety plan that ensures the condition of all team members and prevents the following incidents:

- Injury of a person who stays on or off the construction site
- Damage to or destruction of any part or material of the project
- Shutdown of any activity

The Risk Analysis cover all the activities of the SDE Competition: project development, previous works at university, decathletes training, transport, assembly, maintenance during competition, disassembly, etc.

10.4. Conditions of the Site

(Conditions of the site where construction will take place, and key data related to the prevention of risks during the construction process.)

a. Constructive process
The assembly of the prototype takes place in individual cubes. At first the our room will be built completely, followed by the my room and the your room. The our and the my room will be built in modules. The your room is the only one of the three cubes that will be built from bottom upwards.

First the truck with the installation workspace, wastebag, tents and magazines will enter the solar village.The kerto plates will be unloaded to guarantee stability for the foundation. These materials will be reloaded by crane. The kerto plates need to be installed precisely. After adjusting the height using the Pitzl feet, we will start to raise the steel foundation. The scaffolding for the HLKS and sanitary installation will be installed. The truck even includes the setting foundation for the tanks. The setting element of the south and west are the last elements of truck number 10.

Further trunks will subsequently deliver the modules. We start with the our room. Therefore we unload the wooden setting. Each setting of the our and my room has it own truck. For unloading each module we need a crane.

When we have finished the modular cubes, we will build the your room. For that we will install the two floor elements to ensure that no one is fallen from the. Two of the walls are brought together with the floor elements. To unload the truck we need the crane. The eighth truck delivers the two roofs and two wall sections. The cubes are now secure and statically and can stand autonomously. .

The ninth truck will unload the space⁺ by crane. Before we unload the glass roof we assemble the doors to ensure that the roof won't collapse. At that point, we will send team members with climbing certificates to examine the roof. We will start interior finishing at the same time as assembling the platform. At the end we will need the crane for raising the steel construction on the roof. The steel construction is a base for the photovoltaic system. The electricity and other small works will follow.

b. Type and characteristics of the materials and elements
Further information: Appendix 345 Type and characteristics

c. Site description
The Cité du Soleil will be located within the Versailles Castle domain, on the site referred to as Mortemets. The site is accessible via the D10 roadway, then by the Allée des Matelots. Our construction site is located there, almost to the north

d. Climate description
The climate in Versailles is temperate. Versailles has an annual average temperature of 10.3° C. During the course of the year, July is the hottest month, with an average temperature of 18.1° C. January is the coldest month with an average temperature of 2.7° C. In certain conditions, some summer days have maximum temperatures exceeding 30° C.
Rains falls throughout the year in Versailles. Even the driest month still has high rainfall levels. The annual average rainfall is 665 mm. May has the most rainfall with 61 mm. 46 mm of rain falls in April, making it the month with the least rainfall in the year. The unfavourable conditions of the location constantly allow western winds to blow into the valley from the Atlantic and therefore maintain temperatures that are always 3° C lower than in Paris.

e. Accesses and paths for vehicles
The route of the origin will be :
Horw-Lucerne-Basel-Bellfort-Luxeuil les Bains-Chaumont-Sens-Evry-Cité du Soleil.
We are going to pass the boarder after Basel. The route is 626 km long and we will drive around 6 hours and 15 minutes, not including any problems. We are prepared for some time delay.
Further information: Appendix 36 Route Horw-Versailles

During the trip, the carrier is exposed to various risks that can be grouped into three categories:
- Work accidents (traffic accidents, fall from height, (up and down the cabin, interventions on semi-trailer etc.), accidents associated with handling materials transported (falling objects), handling wheels in case of puncture, lumbago, aggression etc.)
- Ambiance and physical constraints (vehicle vibrations, handling of deliveries, noise, prolonged sitting or visual constraints

- Organizational contstraints and related night work (taking permanent information, vigilance, psychological constraints (delivery time, GPS tracking of vehicles, cargo theft prevention, etc.) irregular hours, sleeping in the trucks, irregular meals, etc. To reduce those risks, preventive action should be set up:
- Collective prevention (regular compliance with driving and rest time, choice of the vehicle, ergonomics of the driver (cabin suspended, suspension seat, accessibility of the cabin, heating and air conditioning etc.), regular maintenance of the vehicle etc.
- Individual prevention (personal protective equipment for maintenance of handling)
- Awareness (information about the danger of driving with alcohol , drugs certain medication, traveller advice etc.)

Route to the city of the SDE competition:
Further information: Appendix 37 Img. Truck arrival procedure and *PD#6 SO-101*

f. Decisive factors for the house placement
The most decisive factore for our house placement has been solar orientation, to ensure the most efficient use of PV panels. This meant the building must be placed at the north side of the site.
Other determining factors for the house placement:
- border demarcation according to the range limit setted by the organization;
- ensure a safe distance between the lots and the building of all teams, to avoid overlaps with the affected services and other circumstances or activities of the environment which is able to cause labour risks during the construction.

Soil characteristics:

Soil type	Compacted stand
Lots topography	About 20 cm of slope in the direction south to north
Specifics	No natural shadowing elements, possibly uneven brash ground

g. Overlaps with the affected services and other circumstances of environmental activity that could cause risks during the construction
Our construction site is very close to three other construction sites. Additionaly there will be a lot of traffic accessing the site at the same time. To prevent any unwelcome dangerous events, we have to pay special attention to our neighbours and the accesses around us.
It is possible that organizers or representatives of other teams come to our construction site. In this case, they must respect our health and safety plan.

h. Planned activities
Further information: PD#6 SO-drawings.

i. Trades whose intervention is affected by risk prevention

Trades whose tasks are affected by health and safety aspects are only implemented under strict observance of the prevention procedure.
They include:
- Visitors and Guests
- Guides
- The jury and the officers
- Workers
- Visiting workers
- Vehicle drivers

j. Auxiliary resources planned for construction
1. Manual equipment
Miter-box saw big 87 x 382mm Makita
Miter-box saw small 52 x 300mm Makita
Mobile table 36kg Makita

2. Hand machines
Mafell buzzsaw with 1.6m and 3.1m chain guide Mafell
Pad saw Mafell
Router to 12mm Mafell
Cordless screwdriver 14.4V, 3Ah, 44Nm Makita
Battery wheel gun 14.4V Makita
Drill, 73Nm Makita
Super finishing Festo
Angle grinder adjustable Suhner
Battery Multimaster Fein

3. Cable
Cable roll 50m
Multiple socket outlets Steba
Rubber connector 230V
3-pole cable, 3 x 1.5mm
Halogen spotlight 400W

4. Hand tool
Ratchet set big, steel ankle
Ratchet set small, steel ankle
Bessey 125-er screw clamp full steel 80cm
Bessey 80-er screw clamp full steel 60cm
Softhead blowback proof 5kg
Scabbing pick Picard

Joiners hammer Picard
Geiss-foot to raise the terrace
Mortise axe
Carpenter hand-axe
Shovel
Garden haw
Stamp iron to flatten the ground
Rice straw broom
Hand wiper
Dustpan
Water level BMI Nivostar 688

5. Ladder, buck, scaffold material
Working buck Iller, Aluminium, B 700mm, H 800mm, usable as a small scaffold with a three layer plate, 300kg force Iller 3 pairs

6. Webbing, lifting remedy
Webbing set, 50mm x 8m, 5t bail pull
Laggeage webbing set, 25mm x 3m
Container bag webbing set

7. Protective equipment
Head protection Montana Roto polycarbonate
Protection glasses colourless Montana Roto
Protective shoes S2 Uvex motion
Protective gloves Activ Grip CE Kat.II Activ Grip
First aid valid
Fire protection blanket K.A.B.
Fire extinguisher
Safety jacket

k. Machinery planned for construction
1 crane 50t
1 pallet truck

Equipment we ordered from the SDE
2 safety ladders
2 individual Platform 2,90m to 3,60m
10 fences HERAS (including plots)

l. Construction site installations
Further information: PD#6 SO-drawings.

m. Table of stock characteristics
Further informations: Appendix: 38 Table of Stock Characteristics:

10.5. Activities for Risk Prevention

Our team consists of a diverse range of students from engineering and architectural fields. The majority of the members has had prior professional education on the level of a practical apprenticeship, since this is very common in Switzerland. They are therefore professionally educated brick layers, carpenters, electricians etc. All students and participants on our construction site have visited different courses and have been trained on several techniques to be aware of risks, prepared for special work steps and prepared in case of accidents or unexpected situations.

We are cooperating with the largest insurance and accident prevention institution in Switzerland. SUVA is an insurer in the private and public sector, with a total revenue of CHF 4.1 billion, insuring almost two million employees. The institution is well known in Switzerland for its prevention campaigns and efforts to perfect safety education in work places, as well as during apprenticeships. Thanks to the provided information, we aim to educate all participants on the construction process for our prototype.
The team commits itself to respecting security rules and regulations as well as reporting any dangerous unforeseen incidents during the assembly and dismantling stages, as well as during the public visit and other time periods during the competition.
Further information: Appendix 39 Safety training

a. Construction plan: Determination of work-effective timing
Further information: PD#6 SO-201 and *Appendix 40 Layer plane*

b. Overlaps and incompatibilities in construction
Further information: Appendix: 41 Overlaps and incompatibilities in construction

c. Number of team members taking part in construction
- 41 workers during assembly
- 33 workers during disassembly

d. Contracting planned

Construction Companies:
Renggli AG
St.Georgstrasse 2
6210 Sursee
Tel. +41 41 925 25 25
Fax. +41 41 925 25 26
mail@renggli-haus.ch

schaerholzbau ag
Kreuzmatte 1
6147 Altbüron
Tel. +41 62 917 70 20
Fax. +41 62 917 70 21
office@schaerholzbau.ch

Herzog HaustechnikAG
Luzernerstrasse 86
6014 Luzern
Tel. +41 41 259 50 00
Fax.: +41 41 259 50 01
haustechnik@herzoooog.ch

Elektro Peter AG
Hauptgasse 28
6130 Willisau
Tel. +41 41 972 70 30
Fax. +41 41 972 70 31
info@elektropeter.ch

Logistic company:
Martin Brunner Transport AG
Bodenhof 12
CH- 6014 Luzern
Tel. +41 41 259 5338
Fax. +41 41 259 5334$

Scaffolding:
Entrepose échafaudages
165 boulevard de Valmy
92707 Colombes cedex
Tél. 01 57 60 94 05
Fax. 01 57 60 94 10
info@entrepose-echafaudages.fr

10.6. Critical Work Phases for Risk Prevention

Further informations: Appendix: 42 Risks Identification and causes

10.7. Risk identification and efficiency evaluation of the adopted protection

a. Location and identification of the areas where the works involving special risks will be developed.

- Areas with special risks on the site are indicated in the construction plan or with signs on the building site.
- Staying in hazardous areas is prohibited.
- It is forbidden to enter the hazardous crane zone and all vehicle operation areas.
- Truck stop and traffic areas must be entered with maximum caution and at a safe distance from all vehicles in movement.

b. Risk identification and efficiency evaluation of the adopted protection

- Areas with special risks on the site are indicated in the construction plan or with signs on the building site.
- Staying in hazardous areas is prohibited.
- It is forbidden to enter the hazardous crane zone and all vehicle operation areas.
- Truck stop and traffic areas must be entered with maximum caution and at a safe distance from all vehicles in movement.

Identified risks in processing and related preventive and prottective measures

The 25 risks
1. Fall of persons at a different level
2. Fall of persons at the same level
3. Fall of objects because of collapse
4. Fall of objects because they come loose
5. Fall of objects because of manipulation
6. Stepping on objects
7. Colliding with still objects
8. Colliding with objects in motion
9. Knocked by objects or tools
10. Flying fragments or particles
11. Accidents caused by living beings
12. Trapped by or between objects
13. Trapped by turned over machines or vehicles
14. Overexertion
15. Exposure to extreme environmental tempera-

tures
16. Thermal contact
17. Exposure to electric connections
18. Exposure to radiation
19. Exposure to harmful substances
20. Contact with caustic or corrosive substances
21. Explosion
22. Fire
23. Run over or hit by vehicles
24. Non-traumatic pathologies
25. "In itinere"

RISK 1: Fall of person at a different level
Preventive and protective measures:
- Check that the ladders do not show defects.
- Do not work on the ladder astride.
- No lateral movement of the ladder if a worker is above.
- Do not climb on the top step of the ladder.
- Always face the ladder when descending and ascending.
- It is not allowed to have more than one worker on the same ladder.
- The ladder must be provided with a suitable device that will prevent opening beyond the limit set.
- If the ground is unstable a scale is placed on a single breakdown table.
- The rungs of the ladder should be slip resistant.
- The ladders must be stably placed or must be steadied by the feet of the person performing the operation during the entire time of use.
- Ensure the good condition of all elements of scaffolding.
- Ensure that the scaffolding is assembled in all its parts and with all the components provided by the manufacturer.
- Never install any machinery on the scaffold.
- Before moving the scaffolding make sure that no one is above it.
- Scaffolding must be wide enough to withstand the required load, and be immune to tipping danger as a result of oscillation. (from wind, moment of structure, etc.)
- The security parapet running around the work plan must be accompanied by toe board at least 20 cm high.
- Access to the floors of the scaffolding must be made by ladders presenting an angle not exceeding 75 °.
- Personnel should be provided appropriate protective equipment such as helmets and safety shoes (non - slip) and harnesses attached to the elements of the scaffolding.
- Indicate access to coverage and indicate the paths to reach the work area indicating overload permitted on the coverage.
- Define procedures for implementing the anchoring system of the PPE fall arrest.

RISK 2: Fall of person at the same level
Preventive and protective measures:
- Well defined pedestrian walkways, maintained in good repair and free of materials and obstructions that may present a risk of tripping or slipping.
- Provide non-slip footwear to the workers.
- Provide lighting on all 4 sides of construction site to avoid low visibility caused by shadows or darkness.
- The storage area of all materials and positioning of fixed machinery must be performed outside of transit routes so as not to create obstacles to working.

RISK 3: Fall of objects because of collapse
Preventive and protective measures:
- In areas where machinery will be placed, temporary structures and stored materials shall be maintained in good condition and free from materials and obstructions that may present a risk of loss of balance.
- Check the routes and areas of operation machinery.
- Stabilize elements using special devices for machine stability and if necessary extend the support base provided by adequate strength.
- After using the crane, do not leave suspended loads.
- Correctly attach loads to lifting and transport means.
- After installing, verify the efficacy of the attachment of each element on the roof to avoid a fall.
- Ask for cooperation from workers on the ground if you have to maneuver in confined spaces.
- Verify that the load is stable on the forklift and avoid the loss of components during transportation.
- The load should not be placed on the end of the forks.
- You should never exceed the maximum load allowed.
- Announce the start of the lifting and transportation by appropriate acoustic signal.
- Check all audible warning devices.
- Make sure that the visibility from the driving position is excellent.
- Check the paths and maneuvering areas.
- Proceed at reduced speed.
- Operate the Rotating light during the maneuvers of positioning of the vehicle and lifting.
- Delimit the radius of action of the medium.
- During night work, use the special lighting devices.
- Follow the rules of the personnel on the ground during lifting and moving cargo.

RISK 4: Fall of objects because they come loose
Preventive and protective measures:
- Before lifting maneuvers make sure that the cargo has been properly restrained.
- Workers must move away while loads are lifted.
- It is forbidden to stand in the path of the load.
- It is permitted to approach to the load only to guide it towards the area of destination.
- The advance of stability for every load must be checked before lifting.
- After commanding the operation of retrieving the hook it must be be guided away from the involved area for equipment or materials to avoid accidents.

RISK 5: Fall of objects because of manipulation
Preventive and protective measures:
- Tools or equipment must be kept in bags or attached to a belt to avoid dropping. After using any tools, they must be placed neatly in the appropriate containers.
- Avoid lifting heavy loads (> 25 kg.).
- Avoid lifting loads that are bulky or difficult to grasp.
- Avoid lifting loads in unstable equilibrium. Stabilize and then unload.
- If the lifting of the load requires twisting or tilting, avoid turning your torso trunk and prefer a rotation of
the entire body during the activity.
- Don't cover too great distances with heavy weights.
- During lifting, bend your legs and not your back; do not lift the load above the head.
- Use steps or platforms during the removal of the load from the vehicle if the load is higher than shoulde height.

RISK 6: Stepping on objects
Preventive and protective measures:
- Well defined pedestrian walkways maintained in good repair and free of materials and obstructions.
- Provide safety footwear.
- Where necessary, provide lighting on all 4 sides of the construction site to avoid low visibility due to shadows.
- The storage area of all the materials needed to carry out the work and position of the fixed installations must be performed away from transit routes.

RISK 7: Colliding with still objects.
Preventive and protective measures:
- Reporting steps at eye level with appropriate signage.
- Stairs, pedestrian walkways shall be well maintained and free of obstacles and materials that present risk.
- present a risk impact.
- Wear safety footwear.
- Avoid leaving tools in passages.
- Provide lighting on all 4 sides of the construction site to avoid low visibility caused by shadows.
- The working site will be closed to unauthorized people during the construction and disassembly phases.
- Signs indivating prohibited areas, danger, requirements and the area limits shall be present at access areas.
- The storage area for all materials for implementing the tasks and placing fixed installations must be away from transit routes in so as not to create obstacles to work, and requires a suitable agent to handle loads.
- Proper defined traffic ways.
- Means, kept in good condition and free of obstacles view to reduce the risk of bumping into objects.

RISK 8: Colliding with objects in motion
Preventive and protective measures:
- Check all acoustic devices.
- Ensure that the visibility from the driving position is excellent.
- Check the paths and maneuvering areas.
- Proceed at reduced speeds.
- Intervention of workers due to maneuvers have to be followed.
- The rotating light is activated during the maneuvers for positioning and lifting.
- Delimit the radius of action of the medium.
- Provide a pedestrian crossing zone and arrange for its relative safety measures.
- Announce lifting maneuvers using the special beeper.
- During night work use the proper lighting devices.
- Observe the works during the lifting and shifting of loads.
- Avoid, when possible, moving the load above workstations.
- It is forbidden to carry out maintenance on moving parts.
- Don't leave suspended loads.
- The departure, the subsequent movements and stopping must be gradual and not abrupt.
- The suspended load should not be guided by hand but with ropes and hooks.
- Test all audible warning devices.

 Health & Safety Report

- Ensure that the visibility from the driving position is excellent.
- Use the handbrake during the loading or unloading process or parking position.
- Keep a safe distance from vehicles in lifting and moving.

RISK 9: Knocked by object or tools
Preventive and protective measures:
- Ensure the good condition of the working tool.
- Use appropriate buffers while using drills or chisels.
- When using impact tools remove third persons nearby.
- Take a stable and correct position.
- Use gloves.
- Ensure the lighting on all 4 sides the construction site to avoid low visibility caused by shadows.
- Tools or equipment must be kept in bags or attached to a belt to avoid dropping.
- After using any tools place them in the appropriate place.

RISK 10: Flying fragments or particles
Preventive and protective measures:
- During process, pay attention to the activity that is taking place with respect to procedures.
- Use protective glasses for the eyes.
- Use gloves.
- Wear clothes suitable to the work on site.

RISK 11: Accidents caused by living beings
Preventive and protective measures:
- Check physical and mental health of workers.
- Handle with care all the compounds used in the processing.
- Use protective glasses for the eyes, wear gloves, wear overalls.
- Follow all devices at any time.
- Don't aggravate any living beings, for example wasps...

RISK 12: Trapped by or between object
Preventive and protective measures:
- Only use suitable work clothing and if it is equipped with belts or laces, make sure they fit snugly and do not hang out freely.
- Never open or remove the doors and/or protection screens with shelter function and all devices for collective protection with shelter function.
- Only carry out maintenance to machines when they are switched off, when they are not bootable by third parties and when the machine has finished its operation.
- After delivery of items by crane, the crane attachment is to be accompanied out of the working area to ensure no accidental impact.
- Holes or other trapping incidents have to be well tagged and all dangers minimized with adequate measures.

RISK 13: Trapped by turned over machines, tractors or vehicles
Preventive and protective measures:
- Control all the lights and acoustic devices.
- Make sure that the visibility from the driving position is excellent.
- Check the paths and maneuvering areas.
- During maneuvers it is necessary to obey all intervention of workers.
- Delimit the radius of action of the medium and have a zone of pedestrian crossing.
- Stabilize the vehicle using the proper equipment and if necessary extend the support base equipped with adequate resistance.
- Announce lifting maneuvers using the appropriate acoustical signal.
- During night work use the proper lighting.
- Observe the workers during the lifting and displacement of the medium.

RISK 14: Overexertion
Preventive and protective measures:
- Avoid lifting heavy loads (>25 kg.).
- Avoid lifting builky loads or loads that are difficult to grasp on your own.
- Avoid lifting loads in unstable equilibrium. Stabilize and then unload.
- If the lifting of the load requires twisting or tilting, avoid turning your torso trunk and prefer a rotation of the entire body during the activity.
- Don't cover too great distances with heavy weights.
- During lifting, bend your legs and not your back; do not lift the load above the head.
- Use steps or platforms during the removal of the load from the vehicle if the load is higher than shoulder height.
- Take enough short breaks.

RISK 15: Exposure to extreme environmental temperatures
Preventive and protective measures:
- Wear protective helmet (preferably white).
- Frequently wet your head to avoid a heat stroke.
- Sufficient quantities of drinking water should be available at any time.
- Use sunscreen to avoid skin burns.
- Take enough short breaks.

RISK 16: Thermal contact
Preventive and protective measures:
- Avoid coming in contact with engine parts as they may be hot and cause burns and scalds.
- Use protective gloves when using machines with heat, or harsh chemicals.
- Avoid contact with surfaces such as those from photovoltaic modules.
- Removed screws may cause burns.

RISK 17: Exposure to electric connection
Preventive and protective measures:
- Plug sockets should be protected by residual current devices operating no more than 30mA, or be powered by SELV circuits, or be protected by electrical separation of circuits, with each outlet plug powered by a separate transformer.
- Cables must be water resistant.
- Power lines should not need to pass through vehicle or pedestrian thoroughfares, or, if laid in earth, must be adequately protected against mechanical damage.
- The disconnecting power supply must be able to be locked in the open position or by padlock or locked in a case.
- In the yard, an effective earthing system is required whose electrical resistance is coordinated with protective equipment.
- Take a suitable position when installing in hard to reach places while maintaining the vertical position;
- Be provided with appropriate tools for lifting and transport.
- Have terminals suitable for repeated connections;
- Have the cables coming out of the framework at a distance from the ground sufficient to ensure a correct radius of curvature.
- Underground elements must be made of a corrosion-resistant material.
  To avoid direct contact, it is necessary to verify that the active parts have adequate insulation at the rated voltage of the system. To avoid coming in contact with internal engine parts, in case of failure to rely on skilled workers, notify the person responsible in the case of any malfunctions or dangers that could occur during the use of the machinery. During maintenance operations ensure that the engine is off. Training and information on first aid measures is required.
- In case of electrocution of the operator operator, avoid touching him/her directly and instead use insulated rods or sticks to try to remove the power source. Seek with rods or sticks of insulating material and try to remove it from power source.
- Check the bearing surface of the generator set and and fasten it them necessary.
- Install the generator set and the spotlight at a safe distance from excavations and from flammable materials.
- Install the generator set and the spotlight as far as possible from jobs (noise) and keep the hood closed.
- Entrust the electrical connections by a qualified or adequately trained worker.
  To avoid direct contact verify that the active parts have adequate insulation and the system has a rated voltage. Wear dielectric gloves. Components of electrical systems should have a differential switch on occasions, no provision for the grounding of the system.
- Avoid coming into contact with internal engine parts. In case of failure rely on skilled workers. Notify the person responsible for any malfunctions and dangers might occur during the use of machinery. Make sure that the engine is turned off during maintenance operations.
- Only use fire extinguishers that can be used on electrical appliances.
- Do not throw water on exposed electrical parts.
- Stop work if the loss is facing electrical parts.
- Ensure the good condition of of elements that constitute the electrical system.
- Report every failure of electrical components.
- Indicate the presence of exposed wires.
- Ensure that there are no power lines interfering with the movement area of the vehicle.
- Check the wear of tools and their use.
- Make sure beforehand that the equipment is fit for manual work and in good condition.

RISK 18: Exposure to radiation
Preventive and protective measures:
- Wear protective helmet and clothes
- Use sunscreen to avoid skin burns.

RISK 19: Exposure to harmful substance
Preventive and protective measures:
- Avoid direct contact with all chemicals used in processing.
- Do not inhale the product and use a protective mask for respiratory purposes, with a dust cover and filter.
- Use protective glasses for the eyes.
- Wear gloves and other adequate clothes.
- Pay attention to weather.
- Keep all cleaning products and chemicals used in processing away from heat sources and open flames.

RISK 20: Contact with caustic or corrosive substance

Preventive and protective measures:
- Avoid direct contact with all chemicals used in processing.
- Do not inhale the product and use a protective mask for respiratory purposes, with a dust cover and filter.
- Use protective glasses for the eyes.
- Wear gloves and other adequate clothes.
- Keep all cleaning products and chemicals used in processing away from heat sources and open flames.

RISK 21: Explosion

Preventive and protective measures:
- Turn off the engine when refueling.
- Smoking on the construction site is forbidden.

RISK 22: Fire

Preventive and protective measures:
- Smoking on the construction site is forbidden.
- Perform all maintenance of the machine as shown in the owner's manual and only after making sure that the engines are turned off and not bootable by third parties accidentally.
- Make sure beforehand that the equipment is fit for manual labor, working and in good condition.
- Take flammable substances away from the sun or hot places and engines.

RISK 23: Run over or hit by vehicles

Preventive and protective measures:
- Control all the lights and acoustic devices.
- Ensure that visibility from the driving position is excellent.
- Check paths and maneuvering areas.
- The rotating light is activated during maneuvers for positioning and lifting of loads.
- Delimit the radius of action of the loads.
- Create a pedestrian crossing zone.
- Stabilize the vehicle using the proper equipment and if necessary extend the support base equipped with adequate resistance.
- Announces lifting maneuvers using the appropriate acoustical signal.
- During night work use the proper lighting.
- Listen to workers on the ground while lifting and displacing items.

RISK 24: Non traumatic pathologies

Preventive and protective measures:
- Avoid working near machinery that is turned on to avoid inhaling exhaust gas.
- Wear protective masks for the rspiration if needed.
- Pay attention to substances which may have a reaction with water.
- Keep cleaning products and chemicals used in manufacturing away from sources of heat. do
- In the case of extremely bad conditions (wind, repeated movements of vehicles in the construction site ...) wear glasses and masks.
- Use hearing protection when works are tot noisy.

RISK 25: "in itinere"

Preventive and protective measures:
- Get enough sleep.
- Avoid taking alternative routes.
- Make sure you have plenty of time to reach the place where you work.

Security Risks

1. Risks from structural deficiencies in the working environment
- Transfer zones
- Workspaces
- Environment surface
- Environment volume
- Lighting (ordinary and emergency)
- Exits (insufficient number in function of workers)
- Doors (insufficient number of personnel in operation)

2. Risks of lack of machinery and equipment safety
- Machines with CE branding
- Machines meeting the regulations and legislation requirements
- Flammable substances

3. Risks from a lack of electrical safety
- Suitability of the system's project
- Suitability of use
- Intrinsically safe installations in hazardous atmospheres of fire and/or explosion

4. Fire and/or explosion hazard
- Presence of flammable materials
- Presence of deposits of combustible materials
- Lack of fire protection systems
- Lack of safety signs

Health Risks

1. Chemical agents
- Exposure risks associated with the use of chemical substances, toxic or harmful in relation to ingestion, skin contact, inhalation for the presence

Health & Safety Report

of airborne pollutants in the form of dusts, mists, fumes, gases, vapours

2. Physical agents
- Noise: the presence of noisy equipment during the operating cycle and functioning with the propagation of sound energy in the working environment
- Handling charge of loads
- Handling of equipment, machinery and materials
- Excessive physical workload
- Aggravating environmental conditions
- Incorrect posture during the operations of handling charge and operations
- Vibration: the presence of equipment and/or vibrating tools with propagation of vibrations direct or indirect transmission
- Non-ionizing radiation: the presence of equipment that uses radio frequencies, microwaves, infrared radiation
- Microclimate: deficiencies in the air environment with regard to temperature, relative humidity, ventilation, radiant heat, air conditioning
- Lighting: deficiencies in the levels of environmental lighting and workplaces

3. Biological agents
- Risks associated with exposure (ingestion, skin contact, inhalation) to non-pathogenic organisms and microorganisms, cell cultures, human endoparasites, in the environment as a result of issuing, processing and manipulation: involuntary emissions (emissions of organic powders)

Transversal and organizational Risks

1. Work Organization
- Strenuous work processes
- Planning issues relating to safety and health
- Maintenance of equipment, including safety equipment
- Procedures for dealing with accidents and emergencies
- Manual handling of loads
- Mental workload

2. Psychological effects
- Intensity, monotony, loneliness, repetitive work
- Deficiencies of contribution in decisional process and controversial situations
- Tasks complexity and lack of control
- Abnormal reactivity to emergency conditions

3. Ergonomics Factors
- Security systems and reliability of information
- Knowledge and skills of staff
- Rules of conduct. Satisfactory communication and proper instructions under varying conditions

4. Difficult working conditions
- Difficult climatic conditions
- Ergonomics of personal protective equipment and the workplace

10.8. Collective Protection

Every team member will be trained in each of his specific duties and responsibilities due to the fact that the collective protection may only be ensured when every individual is well prepared.

The following courses have been visited by all participants:
- Machinery course (instructed by the HSLU)
- First aid
- Course: Health and Safety

The following courses have been visited by some participants who are included in specific working stage:
- Height activity and anti-fall guard
- Defibrillator course

Collective security arrangements include:
- Tents used for sun shelter
- Site fences to prohibit accessing from unauthorized persons to the construction site
- Fire extinguisher
- Handrails and railings wherever needed
- Lifelines and attachment points for height activities
- Safety ladder
- Large scale lighting for work at knight
- Working surface

10.9. Individual Protection Resources

During the time of assembly and disassembly, all team members remaining on the construction site must wear the required protective equipment, which consists of:

- Yellow helmet
- Slip-resistant boots with steel toes
- Long, cut resistant work pants
- Safety jacket
- Safety glasses
- Hearing protection
- Gloves
- T-Shirt

Team members working on specific jobs with special protection measures must wear several other items of protection equipment, depending on what is needed. Those items are:

- Climbing equipment
- Headlight
- Walkie-talkie

10.10. Safe Working Procedures for every Team Member

All safe working procedures are developed in accordance with SUVA and the "Plan Général de Coordination Sécurité et Protection de la Santé".
It is guaranteed that each member of the your+ Team is familiar with all important safety measures and will respect all Health & Safety rules at any time in Versailles and in Lucerne.
Detailed description of all safe working procedures with following topics are:

10.11. Machinery and Auxiliary Resources

All team members know and will obey the safe user's manual by the manufacturer of every machine, tool and/or auxiliary resource.

10.12. Planned Measures in Case of Accident

Although all arrangements and the most possible concentration of each team member is ensured, it is still possible that an accident happens. The following prevention methods will be taken by the Team your+ in case of a labour accident:

a. First aid
What to do if there is an accident:
Protect / alert / provide first aid / think before acting

To avoid worsening the situation:
Protect:
- Yourself
- The victim(s)
- Others
  (for example by informing those around, marking out the area, cutting off electricity etc.)

Leave someone near the injured person(s).
Inform or get soeone to inform:
- Whoever the Project Supervisor has put in charge of HSE
- First aiders on site

Immediatly: Alert emergency services

First aid:
While awaiting the arrival of emergency services, do not move any injured persson(s) except if there is an imminent danger, comfort the victim(s), cover the victim(s), and do not give them anything to drink.
Further information: Appendix 29 Emergency procedures

 Health & Safety Report

b. First aid kit

The contents of the First Aid Kit is stored in a sterilised condition.
It is green and has a white cross on it.
Its content includes:

- Adhesive strips (assorted sizes) for minor wound dressing
- Non-allergenic adhesive tape for securing dressings and strapping
- Eye pads for emergency eye cover
- Triangular bandage for slings, support and/or padding
- Hospital crepe or conforming bandage to hold dressings in place
- Wound/combine dressings to control bleeding and for covering wounds
- Non-adhesive dressings for wound dressing
- Safety pins to secure bandages and slings
- Scissors for cutting dressings or clothing
- Kidney dish for holding dressings and instruments
- Small dressings' bowl for holding liquids
- Gauze squares for cleaning wounds
- Forceps/tweezers for removing foreign bodies
- Disposable latex or vinyl gloves for infection control
- Sharps disposal container for infection control and disposal purposes
- Sterile saline solution or sterile water for emergency eye wash or for irrigating eye wounds.
  This saline solution must be discarded after opening
- Resuscitation mask to be used by qualified personnel for resuscitation purposes
- Antiseptic solution for cleaning wounds and skin
- Plastic bags for waste disposal
- Note pad and pen/pencil for recording the injured or ill person's condition and treatment given
- Re-usable ice-pack for the management of strains, sprains and bruises

c. Preventive medicine

Before travelling to Versailles, all members of your+ will be checked by a doctor for physical performance. Certifications and copies of vaccination cards will be located in the tool container on the construction site and can be brought wherever needed in case of an emergency.

d. Accident victims evacuation

In case of evacuation it is very iimportant to prepare for the arrival of the ambulance, to assure a fast arrival and to neutralize all possible barricades. (A detailed description is presented in chapter 10.1. "Health and Safety Checklist" in the section "First Aid Procedure").

The same conditions count for the evacuation of victims. Team members show the way to the exit or attend the ambulance to the exit of the Solar Decathlon exhibition site. A evacuation plan of the exhibition site and the "Cité du Soleil" will be delivered to the ambulance.
Those plans and all furhter information can be examined at any time during all operation modes.
Further information: PD#6 HS-101 and *Appendix 28 Route to the hospital*
A map with the fastest way from the exhibiton site to the next hospital will be placed at the construction site next to the Health and Safety general indication plan.

The following information has been extracted from the General Coordination Plan and must be used in case of an accident victim evacuation:

Emergency calls:
Call the hospital from the construction site:
Call the Infirmary Dial (to be updated)
Call from a land line, Dial 18
Call from a mobile phone, Dial 112

We will carefully follow the call instructions outlined on the "In the event of an accident" document attached in Appendix 29 Emergency procedures , which will be clearly posted next to all construction site telephones.
Information provided on emergency numbers must be given as shown:

1. This is the construction site:
Address: CITE DU SOLEIL 2014
Domaine du château de Versailles
Allée des Matelots
VERSAILLES
Telephone No.: To be updated

2. Specify the nature of accident:
For example: fall, a collapsed construction, asphyxiation etc.

The position of the injured person:
They are on the patio, on the ground, or in a cavity etc… and if they need to be released because they are trapped.
Specify if the accident occurred in the water.
3. Report the number of injured persons and their condition.
For example: Three workers injured including one who is bleeding a lot and is not talking.

Health & Safety Report

4. Arrange a meeting place
Send someone to the entrance of the construction site to direct emergency services.

Never end the call first.

Immediatly inform the control room.

For each call, someone must be designated to meet the first aiders' point and wait for the firemen, before lading them to the place of accident.

Emergency services
Police 17
SAMU 15
Fireman 18 land line – mobile: 112

Versailles Hospital Tel.: 01.39.63.91.33
177, rue de Versailles
78157 LE CHESNAY
Numbers of SDE Organisation: Numbers of SDE Organisation: To be updated

10.13. Risk Identification for possible later Work

Possible risks during cleaning of the prototype or the site:

2. Fall of persons at the same level
6. Stepping on objects
11. Accidents caused by living beings
15. Exposure to extreme environmental temperatures
20. Contact with caustic or corrosive substances
25. "In itinere"

Possible risks during cleaning of PV-panels and other works on roof:

1. Fall of persons at a different level
6. Stepping on objects
9. Knocked by objects or tools
11. Accidents caused by living beings
12. Trapped by or between objects
15. Exposure to extreme environmental temperatures
16. Thermal contact
17. Exposure to electric connections
19. Exposure to harmful substances
20. Contact with caustic or corrosive substances
25. "In itinere"

Possible risks during service or repairing of any installation:

6. Stepping on objects
9. Knocked by objects or tools
11. Accidents caused by living beings
12. Trapped by or between objects
13. Trapped by turned over machines, tractors or vehicles
14. Overexertion
15. Exposure to extreme environmental temperatures
16. Thermal contact
17. Exposure to electric connections
19. Exposure to harmful substances
20. Contact with caustic or corrosive substances
21. Explosion
25. "In itinere"

Preventive measures and further iinformation are presented in the Health and Safety Plan, chapter 7.b. Risk Identification and Efficiency Evaluation of the Adopted Protection

 Health & Safety Report

10.14. Useful Plans and Information for possible later Work

Prototype and site cleaning:
Each day before public tours or other activities happen, team members will clean our site and the prototype to assure a charming and hygienic atmosphere, as well as to afford the highest standard of safety. This includes amongst others:

- The disposal of any waste or debris.
- To control the height of the wooden grill slats on floor, to avoid any stumbling.
- To check for possible slippery places after heavy rainfall or due to leaves.
- Check the davailability of safety installations such as the defibrillator or smoke detectors.
- etc...

Different works on roof
A daily control of the roof contains following points:

- Cleaning and repairing of PV-panels will ensure the best performance of the photovoltaic system.
- Cleaning of drainage holes and drains to prevent blockages or flooding.
  (safety ladder, burns, two persons,safety harness...)

Electrical maintenance
The electrical maintenance provides periodic processes that allow proper system operation.
The objective is to ensure safety from electrocution and fire hazards for all persons. (remove the second sentence, does not fit here).
The documents for the purpose of a good management of the system are:

- The user manual of every single installation or product
- The document "Maintenance General Indications"

Water system maintenance
The maintenance provides periodic processes that allow proper system operation.
A scheduled maintenance of all the components of the system can ensure the safety of the same, for example with periodic inspections to the system.

10.15. Adopted System for the Level of Health and Safety control during Works

In each shift there will be one Health & Safety team officer in charge. Next to the principal duty of supervision at the construction site with respect to all Health and Safety requirements, additional tasks for the Health & Safety team officer are to prepare all workers on the construction site before start of work. This includes to organize, check and distribute all safety equipment, going through all working steps of the shift, giving information on all risks and to answer any questions concerning Health & Safety.
In each shift there are at least two people that have visited a First Aid refresher course and are therefore well trained.

10.16. Formation and Information on Health and Safety

Due to different circumstances, we don't have all students signatures. We do our best to hand in all signatures as soon as possible.
Signatures from external contractors, will be collated in the next days and will be send as soon as possible to the SDE organisation. Thank you for understanding. These are tasks where a team member confirms agreement with a signature.

- I commit to avoid or minimize the risks derived from work porcess.

- I commit to envisage the health and safety demands from all poeple taking part in the project.

- I have read the Health and Safety Plan and I agree with all contents.

- Team Lucerne Suisse has informed me about the work I'm going to develop.

- I have received information about the possible risks associated with the work.

- I have received all afordable training concerning collective protection, its correct usage and its maintenance procedure.

- I have received training in order to develop safe work procedures and avoid or resolve the risks associated.

- I have passed specific medical examinations for the work I will carry out and I have the necessary qualifications.

Further information: Appendix 43 Formation and Information on Health and Safety

 Health & Safety Report

10.17. Emergency Evacuation Plan

Situation considered for starting evacuation are fire, explosion, smoke generation and the danger of collapse.

In case of an emergency during the assembly or disassembly it will be easy to get out of the danger zone because the lot will be opened on the side, whe-re the delivery side and additionaly open for emergency reasons on one corner, which will be properly signed.
During maintenance, single persons or groups will find simply the way out oft he prototype because ther are three large glass doors next to every room. Each room as at least one large ntrance. All doors will be open at the time of public tours.
A maximum of 16 people for each visit shall be permitted inside the house. People will attend in the safety area of the 1.5 m wide lots' easements to enter to visit the house.
During the evacuation, team members will be in charge to help poeple find their way out rapidly and to calm them down to avoid any additional risks. Outside the prototype, team members will order visitors to have a safe distance from the building. People may be involved in accidents such as falls, injuries, burns, etc..
Because of this, there will be always a team member in charge of first aid procedures.

Measures to be adopted once the evacuation starts:
- Inside the house:
  not create panic and try to stay calm, to show visitors the way out by guiding them. Evacuate any victims and make sure that the house is empty.
- Outside the house:
  Request people to move away from the house as fast as possible and reach the nearest safety area. If needed, the use of fire extinguishers has to be performed.

Further information: PD#6 FP-001. This plan will be located during every operation mode in the prototype or on the construction site. This plan is also located in Health and Safety Drawings.

Further information: Appendix 44 General instruc-tions in case of fire

Health & Safety Report

 Health & Safety Report

XI Detailed Water Budget

 Detailed Water Budget

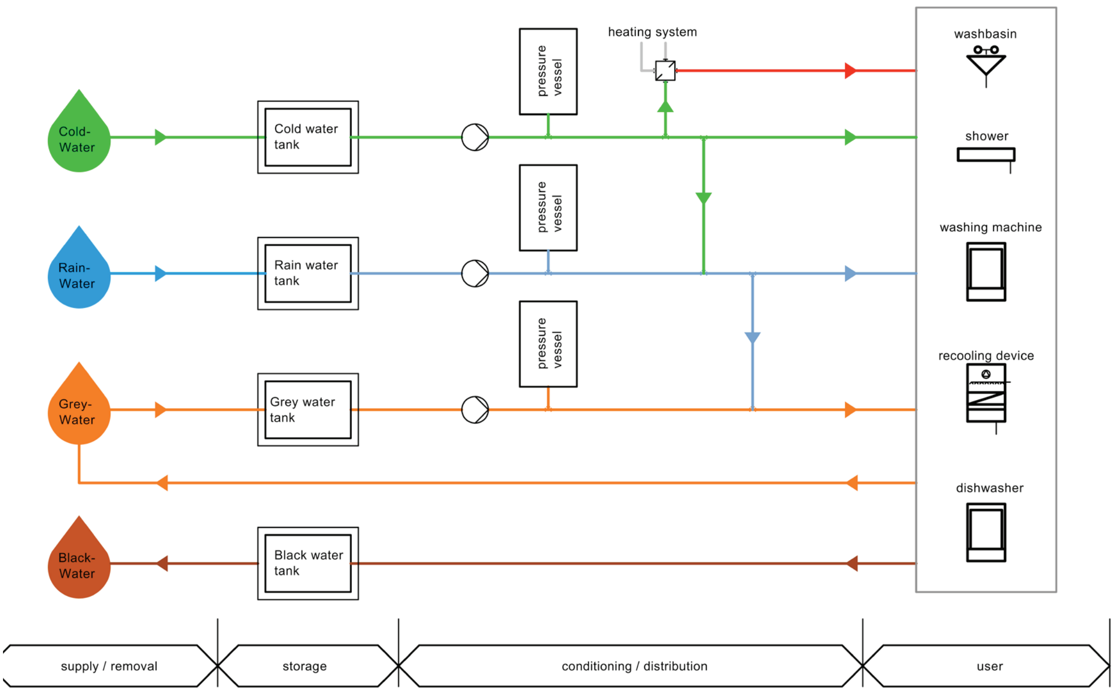
The system is designed to meet water demand during all events. Because water used throughout the competitions must be stored from the beginning, it is crucial to implement effective consumption and water storage solutions. The tanks will be placed outside the prototype, under the terrace, while the majority of the equipment will be located in the mechanical room. The heating and cooling circuits are found in the prototype and are also located in the mechanical room. The water supply system is integrated in both the prototype interior and exterior.

Principle

The supply and disposal principle of the water consumption must be kept as low as possible. This is achieved by repeated use of water (recycling). There are four different water quality levels defined. *See Img. 1.*
The structure of the principle involves four steps. The processing includes filtering and a minimum pressure increase, which transports the water to the usage point. Depending on whether the water can be recycled, it must be stored in a specific holding tank until it is emptied/recycled. *See Img. 2.*

Img. 1 Water quality levels
Img. 2 Schematic diagram of the water flow

Water type	Quality	Pollution	Recyclable
Fresh water (Cold / Warm)	Potable	Low	Yes
Rain water	Not Potable	Low	Yes
Grey water	Not Potable	Middle	Yes
Black water	Not Potable	High	No



 Detailed Water Budget

Calculation of Water Consumtion

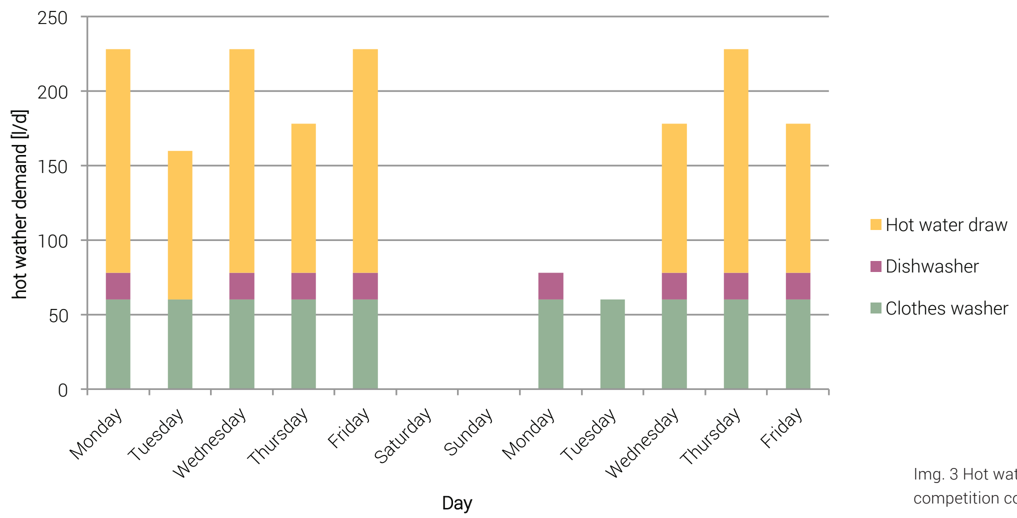
The Event Calendar v.2.0, Feb. 2, 2014, serves as the basis for calculating water consumption.

Fresh Water

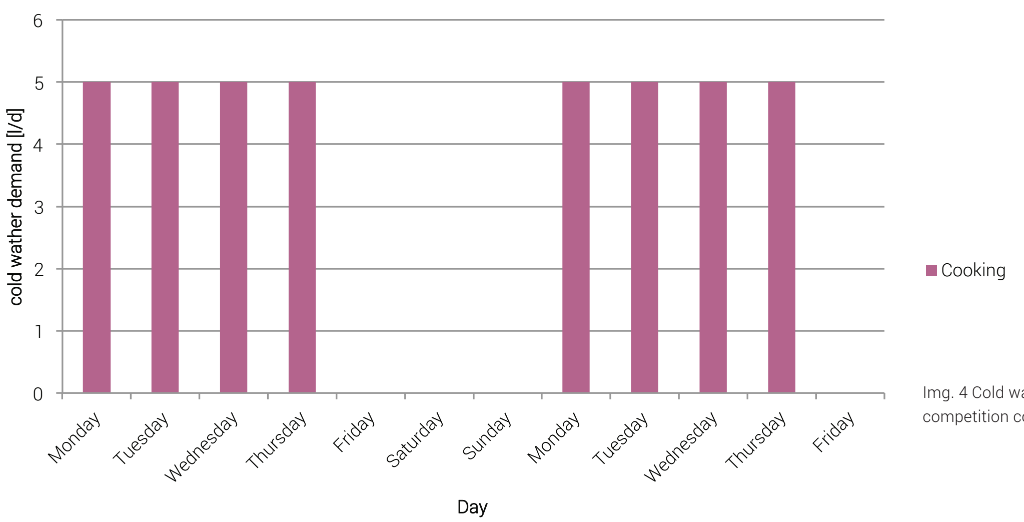
Subsequently the fresh water demand for the 10 days of the competition will be presented and split into a hot water plan and a cold water plan. More information on the treatment process and functions of the whole system can be found in the plumbing system design. *See PM#6 chapter 3.3*

The hot water plan includes the water demand of the competition's hot water supply, dishwashing and washing machine. For these applications the fresh water station in the mechanical room will produce the hot water. Therefore the appliances do not need to heat up cold water and the energy use for this process will be reduced. *See Img. 3*

The cold water plan includes the cooking contest. For this contest, 5 litres of cold water may be taken from any faucet in the house. *See Img. 4*



Img. 3 Hot water plan of the competition context



Img. 4 Cold water plan of the competition context

Img. 5 shows the total demand for cold and hot water. This amount of water must be ensured by fresh water filling at the beginning and during the competition.
It can be seen in the diagram that the capacity of the fresh water tank (as indicated by the purple line) will not be entirely consumed by the competitions.

Grey Water

The incoming grey water will be stored in a separate tank and will mainly be reused to irrigate vegetation and wet the recooling device. The subsequent diagram indicates the grey water inflow from the consumers and the usage of the grey water for recycling purposes. As shown in the diagram, the inflow is sufficient to cover the consumption.
See Img. 6.

Rain Water

The incoming rain water on the building roofs will be collected and stored in its own storage tank. The rain water is used for wetting (irrigation) the recooling device and for watering the plants. After the SDE Competition the rain water is used in appliances (toilet, washing machine) that can be equipped with non-potable water quality requirements.

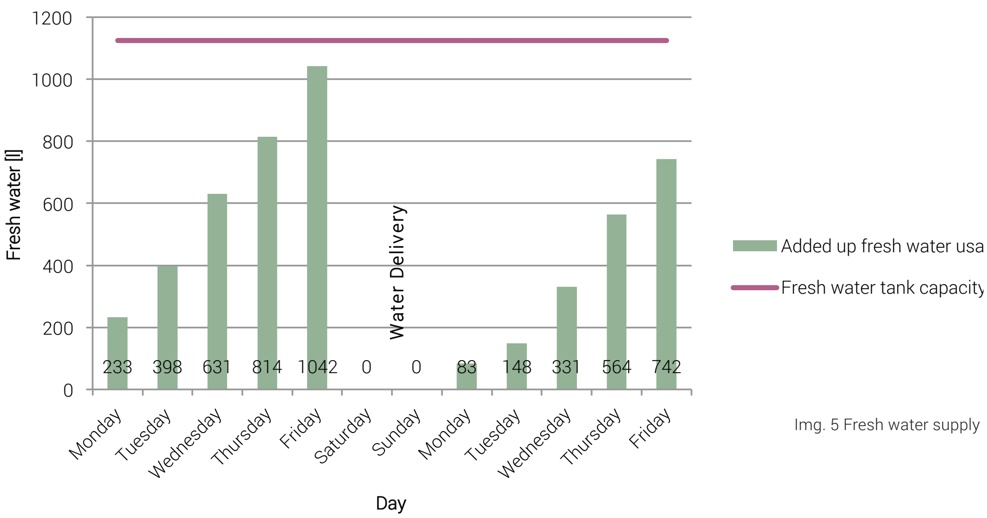
Black Water

The incoming water with the highest pollution is black water. our room has the only black water connection, because the discharged water from the kitchen sinks and the dishwasher, as well as the blow-down water of the recooling device, are all considered black water.

The following diagram shows the total black water inflow and indicates the black water tank capacity. The tank is large enough not to need emptying during the competition, although the organisation committee allows the possibility of emptying tanks during this period. *See Img. 7.*

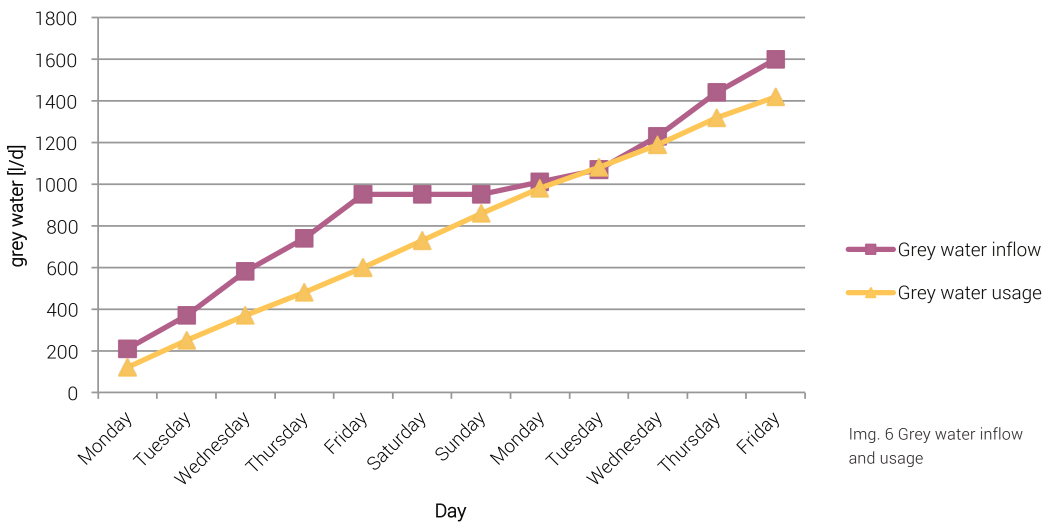
Size of the Tanks

All tanks are optimised for the prototype's operation during the competition.
Img. 8 indicates the capacity, size and location of each tank.

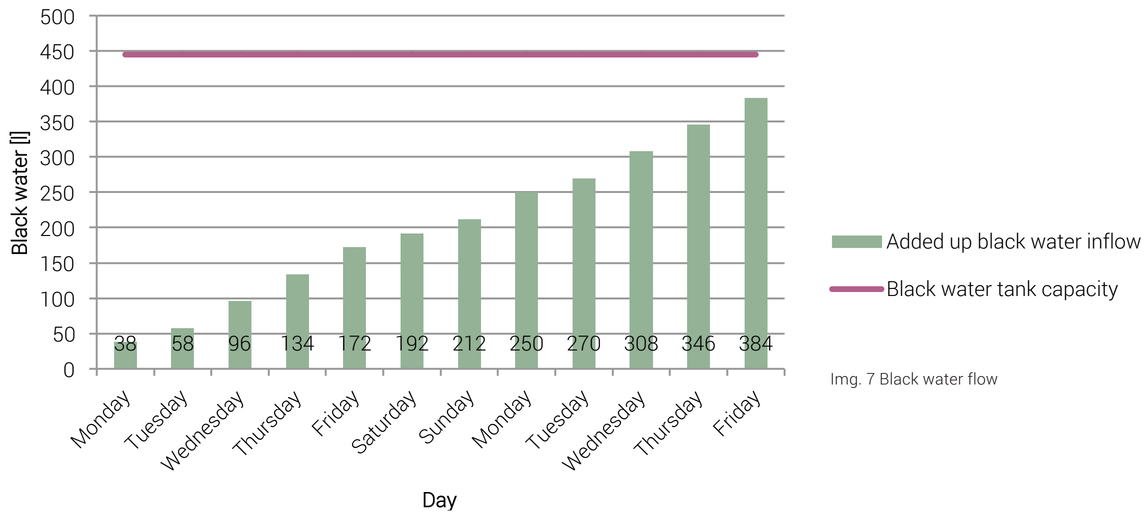


Img. 5 Fresh water supply

 Detailed Water Budget



Img. 6 Grey water inflow and usage



Img. 7 Black water flow

Function	Fresh water tank	Rain water tank	Grey water tank	Black water tank
Size [mm]	3270x1250x335	3270x820x335	3270x1250x335	3270x470x335
Capacity [l]	1125	900	1125	450
Location	below the terrace	below the terrace	below the terrace	below the terrace

Img. 8 Size of the tanks

 Detailed Water Budget

Water Supply on behalf of the Competition

At the beginning of competition
The following list indicates the water demand that must be fulfilled at the beginning of the competition.

Water system	Volume [l]	Percent [%]
Fresh water system	1380	40.7
Rain water system	120	3.5
Grey water system	140	4.1
Cooling tank	800	23.6
Hot water tank	800	23.6
Heating / cooling system	110	3.2
Solar thermal system	40	1.2
Total demand	3390	100.0

Water system storage percentages
The rain and grey water systems must have a minimum water inventory. This ensures the function of the booster pumps.

During the competition
During the competition the cold water tank is refilled once with a volume of 1125 litres. *See Img. 9.*

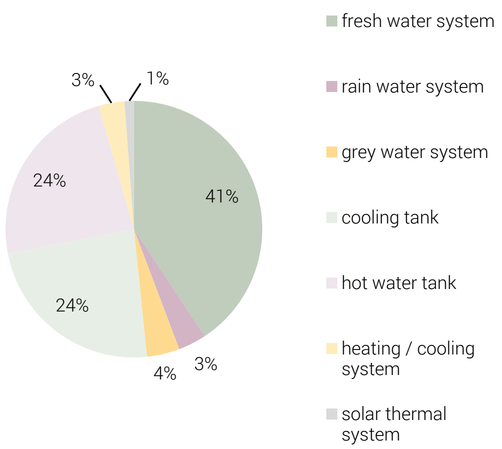
Water Savings Technologies

The main goal of the plumbing system is to reduce the fresh water consumption by reusing as much grey water as possible. In addition the rain water from the roofs is collected and will also be used for reducing fresh water consumption.
Eventually not only the fresh water consumption will be reduced, but also the consumption of any water. This will be implemented by water saving technologies such as highly efficient household appliances and by using faucets with economic water consumption.
By using these saving strategies, the fresh water consumption will be reduced by 35% compared to a standard residential building in Switzerland.

Due to the special consumption during the competitions, the daily fresh water demand will be slightly lower than in a standard routine. The water consumption during the competition does not reflect reality because the available water is non-potable and the water usage will depend on the rules. So cooking will be performed with a limited amount of water and a variety of applications will not be used in a daily routine. *See Img. 10.*

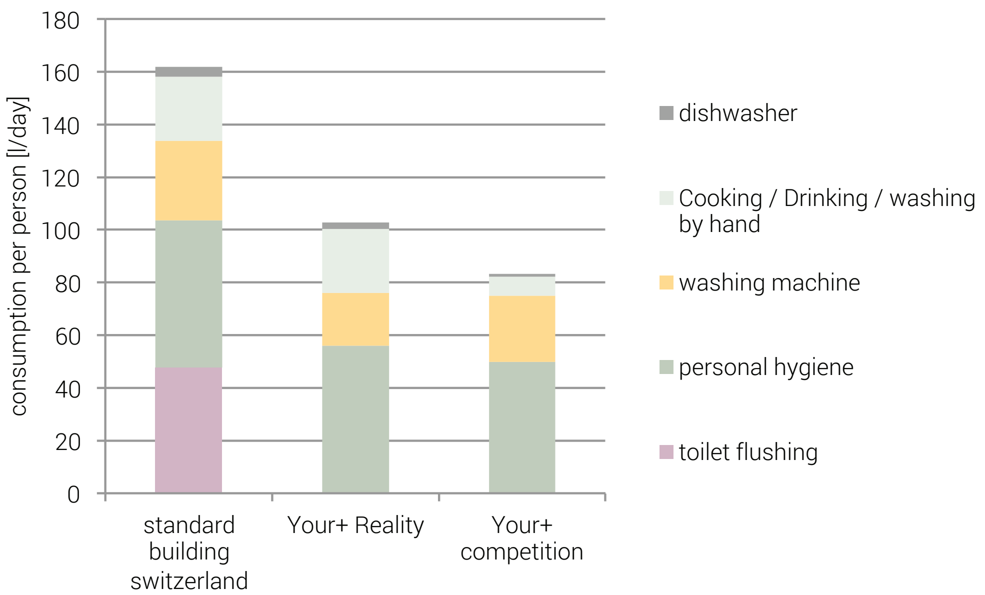
Shower – Joulia

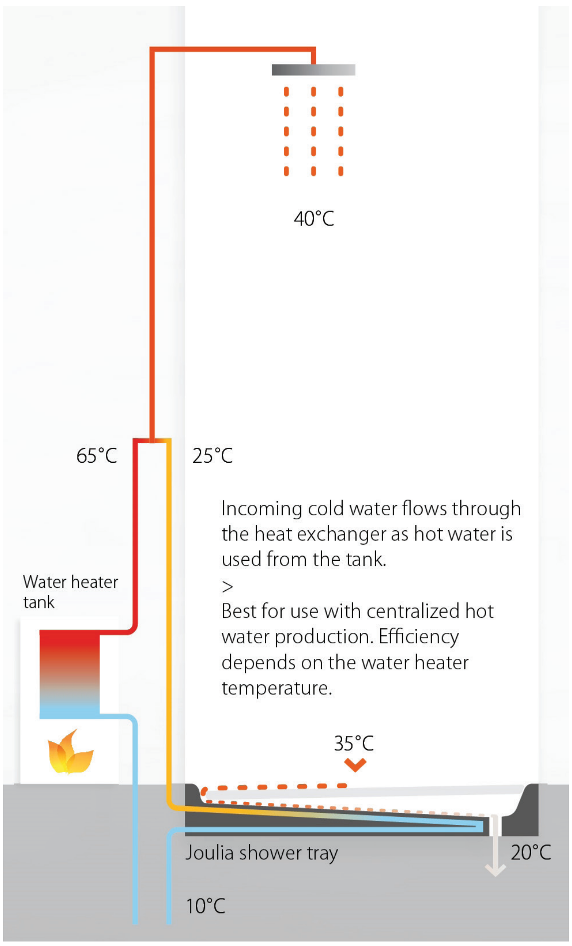
The innovative shower design helps save energy for the hot water supply . An included heat exchanger in the platform of the shower retains the heat energy in the used grey water and transfers it to the cold water supply, which will partially be preheated. This results in a direct grey-water heat recovery system in the shower itself. (Joulia.com) *See Img. 11.*



Img. 9 Water system storage percentages

Detailed Water Budget





Img. 10 Water consumption
Img. 11 Shower Joulia

Toilet - Roca

The special design of the toilet washstand combination is equipped with a water saving system.
After using the freshwater in the washstand, the water will be stored in a small tank, which is included in the appliance. This stored water can be reused to flush the toilet. This ensures direct grey water recirculation inside the toilet. *See Img. 12.*

Img. 12 Toilet Roca

Domestic Appli^ances

The domestic appliances feature high energy efficiency, as shown by their EU energy labels. Since Switzerland is the place of manufacture, the energy consumption for transportation is reduced.
To present the sharing concept the washer-dryer will be located in your room and will therefore be shared among several parties in the house. All the remaining domestic appliances are located in our room, which is the kitchen in the prototype. *See Img. 13*.

Faucets

All chosen faucets in the prototype ensure economic water consumption through their efficient design.s in every part of the planning process the concept of sharing plays a major role in choosing the ideal components for a complete system. The faucets of the private room, my room, allow the standard personal hygiene routine .

The faucets in our room, where the kitchen is located, help to maintain a working comfort as required to achieve an industrial kitchen standard. This standard is needed because the kitchen will be shared by many different parties in the house and thus the facility will be used more often, which leads to an increased wearing of the faucets.

Appliance	Manufacturer	Model	EU Energy-Label	Location
Washing machine	V-ZUG	Adora SLQ	A+++	your room
Drying machine	V-ZUG	Adora TSL WP	A+++	your room
Dishwasher	V-ZUG	Adora 60 SL	A+++	our room
Oven	V-ZUG	Combair SL	A	our room
Fridge	V-ZUG	Futura	A++	our room

Img. 13 Domestic appliances

XII Project Specifications

1. Structure

Foundation
PD#6 ST-001 to ST-002
Appendix 46 Structural Design Approval (signed)

Structural Floors and Sections
PD#6 ST-011, PD#6 ST-101 to ST-103, PD#6 V ST-111 to ST-113
Appendix 46 Structural Design Approval (signed)

2. Architecture

Enclosure
PD#6 AR-000 to AR-002, PD#6 AR-101/102, PD#6 AR-103/104
Appendix 01 Codes Design Compliance (signed)

Openings
PD#6 AR-301 to AR-319
Appendix 01 Codes Design Compliance (signed)

Partitions
PD#6 V
Appendix 01 Codes Design Compliance (signed)

Finishes
PD#6 IN-211 to IN-214, PD#6 IN-311 to IN-314, PD#6 IN-411 to IN-415,
Appendix 01 Codes Design Compliance (signed)

Furnishings
PD#6 IN-702 to IN-707, PM#6 2.1, PM#6 5.2
Appendix 01 Codes Design Compliance (signed)

 Project Specifications

3. Systems Installations

Fire Suppression
PD#6 FP-001, PD#6 IN-102

Plumbing
PM#6 5.2, PM#6 3.3, PM#6 XI, PM#6 6.8
PD#6 VII (PL)

HVAC
PM#6 6.6, PM#6 5.2, PM#6 3.7, PM#6 4.1
PD#6 IX (ME)

Electrical
PM#6 3.4 to 3.6, PM#6 4, PM#6 5.3, PM#6 6.6 to 6.7, PM#6 5.2
PD#6 X (EL)
Appendix 13 EL-601 AC Circuit Layout
Appendix 47 Electrical and Photovoltaic Design Approval

Solar Systems – photovoltaic and thermal
PM#6 3.5, PM#6 3.7 - 3.8, PM#6 5.3, PM#6 6.7, PM#6 6.7, PM#6 5.2
PD#6 XI (PV)
Appendix 13 EL-601 AC Circuit Layout
Appendix 47 Electrical and Photovoltaic Design Approval

Telecommunications and Building Automation
PD#6 BAS XII (BAS)

4. Safety Information

PM#6 X
PD#6 XV (HS)

- Fire Safety Table *(following pages)*
- Safety in Use Table *(following pages)*

Fire Safety Table

1. Interior propagation spreading (Rules 51.3)

Type of material	Class	Location in Specifications in PD and PM
Covering (See Rule 51.3 Note 1)		
Chrome steel (working surface in kitchen)	BKZ 5.1	IN-321 Our Room Detail 1
Furniture ; Powder coated	not specified	IN-321 Our Room Detail 1
Furniture, white oiled graying	BKZ 4.3	PD
Ceiling (See Rule 51.3 Note 2)		
Cooling-/Heatingceiling Finish aluminium; Construction Mounting with Durlum S4	BKZ 6.3	AR-346 Wall - Ceiling Inside
Insolationglas (Space+)	BKZ 5.3	AR-345 Wall - Ceiling Inside
Walls (See Rule 51.3 Note 2)		
Three layer plate painted (Space+)	BKZ 5.1	PD
White fir massiv (facade)	BKZ 4.3	AR-342 Floor - Wall outside
Plasterboard with Wallpaper	BKZ 6.3	AR-346 Wall - Ceiling Inside
Plasterboard with Wallpaper Glasfiber	DIN 4102 B1	AR-346 Wall - Ceiling Inside
Plasterboard with Wallpaper synthetical	strong acrid Gas	AR-346 Wall - Ceiling Inside
Flooring		
Parquet made of oak (in the cubes) Massive oak laths (space + & platform)	BKZ 5.3 BKZ	AR-344 Floor – Wall Inside AR-344 Floor – Wall Inside
Pipes and ducts (running through flooring, walls & ceilings)		
Cooling/Heating, stainless steel tubes, Optipress Aquaplus	BKZ 6	AR-346 Wall - Ceiling Inside
Sanitary installation	not specified	PL-201 Supply and Removal Isometric
Freshwater, plastic material (JRG Sanipex)	BKZ 5.2	PL-201 Supply and Removal Isometric
Gray/ rainwater, plastic material (Geberit Silent)	EI 90	PL-201 Supply and Removal Isometric
Ventilation installations		
Your-room: Zehnder comfoair	not specified	ME-001.1 HVAC Distribution Plan Floor
Piping: Schmidlin	BKZ 6q.3	ME-001.1 HVAC Distribution Plan Floor
My/ Our room, Helios Ecovent (no piping necessary)	not specified	ME-001.1 HVAC Distribution Plan Floor
Textile cover elements integrated into building		
Curtain our room -	DIN 4102 B1	PM - capture 2.1 Interior Material
Curtain my room-	DIN 4102 B1	PM - capture 2.1 Interior Material

Curtain your room -	DIN 4102 B1	PM - capture 2.1 Interior Material
Thermal screen of thermal and acoustic insulation products	Fire resistance time	Location in Specifications in PD and PM
Flumroc Insulation Roof Flumroc Insulation Wall Typ 1	BKZ 6q.3 A1	AR-343 Wall outside - Ceiling
Insolationglas	not specified	AR-302.1 Window Your Room, West

2. Evacuation of occupants

Evacuation element	Width (m)	Specifications in PD and PM
Doors and doorways		
04.4 Door, intern	1.53m	FP-001 Fire Protection
04.3 Door, south	1.20m	FP-001 Fire Protection
04.1 Door, west	1.49^5m	FP-001 Fire Protection
Hallways and ramps		
Access Ramp	1.40m	FP-001 Fire Protection
Exit Ramp	2.63^5m	FP-001 Fire Protection
Hallway Space+	Minimum 1.74m	PT-001 Site Accessibility

Safety in Use Table (Rule 51.4)

1. Safety against falls

Floor class slipperiness

Type of floors	Where (Location in the project)	Floor classification - Specifications in PD and PM
Dry interior area: Surface's slope less than 5%	all interior areas are even slip resistant Parquet R9	AR-021 Floor Plan
Dry interior area: Surface's slope equal or greater than 5%. Stairs included	-	-
Humid interior area: Surface's slope less than 5%	stoneware slip resistant R11 Shoe barefoot C	AR-021 Floor Plan
Humid interior area: Surface's slope equal or greater than 5%. Stairs included	-	-
Exterior areas	slip resistant Lath floor R9	AR-021 Floor Plan

Differences in the floor level, holes and opening (limit the risks of falling)

Where (in the project) and difference in floor level, holes and opening that represent a risk of falling	Type of protective barriers	Height of protective barriers where the difference in the floor level are more than 400mm - Specifications in PD and PM
no risk	-	FP-001 Fire Protection

Restricted Areas stairs

	Value	Specifications in PD and PM
Width of the tread	0.600m	ST-011 Structural Floor Plan
Height of the riser	0.243m	isn't apparent
Depth of the tread	0.290m	ST-011 Structural Floor Plan
Height of handrails	no handrail	-

Public Areas staircases

	Value	Specifications in PD and PM
Width of the tread	2.670m	FP-001 Fire Protection
Length of the tread	2.670m	FP-001 Fire Protection
Height of the riser	5x 0.172m	FP-001 Fire Protection
Depth of the tread	4x 0.300m	FP-001 Fire Protection
Height of handrails	1.000m	FP-001 Fire Protection

Ramps

	Value	Specifications in PD and PM
% slope value	5%	AR-021 Floor Plan FP-001 Fire Protection
Length of ramp	Slope 1: 6.520m Slope 2: 10.000m	AR-021 Floor Plan FP-001 Fire Protection
Width of ramp	Slope 1 and 2: 1.400	AR-021 Floor Plan FP-001 Fire Protection
Height of handrails	1.00m	AR-353 Rail
Size of the resting landings	1.400m x 3.120m	AR-021 Floor Plan FP-001 Fire Protection

2. Safety for avoiding trapping and impact risk

Impact due to fixed elements (House Tours area)

	Minimum Value	Specifications in PD and PM
Clearance height in house	2.300m	ST-101 Structural Longitudinal Section 1
Height of the doors threshold	2.040m	ST-113 Structural Transversal Section 3
Height of fixed elements projecting from facades	nothing	-
Projection of fixed elements in the walls which do not start from the ground	perhaps plants or paintings	isn't apparent

Impact due to opening elements (public tours areas)

	Value (circular freespace)	Specifications in PD and PM
Sweep of the doors on the sides of the hallway	1.53m	FP-001 Fire Protection, in the middle of space[+]

Impact due to fragile elements and not very perceptible elements.

Location in the project	Type of glazing (safety)	Specifications in PD and PM
Dishes	Pottery, glass	PM 2.1 Interior Materials
Vases	Glass, clay	PM 2.1 Interior Materials
lamps	-	PM 2.1 Interior Materials
i-Pads / TV	-	PM 2.1 Interior Materials

Trapping

	Value (distance)	Specifications in PD and PM
Distance of manual sliding door to the nearest fixed element	1.72m 1.08[5]m 0.82m	FP-001 Fire Protection, in the middle of space[+]

3. Safety against the risk of inadequate lighting

	Where- min. illumination level	Specifications in PD and PM
Light fittings for exterior areas	13x 51cm, Vario LED, Venus SVW840, 2800 K, 10 W/m, 360 lm/m	AR-351 Wall Platform
Light fittings for interior areas	TULA micro 3x d= 45mm LED colour temperature: 2700K MOVE IT 45 Inset Opal jut out 4x 305 mm type: 11W, 520 lm DIM DALI LED colour temperature: 2700K MOVE IT 45 Inset single spot 4x 45x45x86 mm type: 5W, 220 lm DIM DALI LED colour temperature: 2700K CORNER Mini 2x 30x30x626 mm type: 5W, 370 lm LED color temperature: 2700K MOVE IT 45 square downlight 25x 45x45x86 mm type: 5W, 230 lm DIM DALI LED colour temperature: 2700K CUBU downlight 11x 150x150x150 mm type: 11W, 700 lm DIM DALI LED colour temperature: 3000K INEO 90 recessed	IN-103 Artificial Light Plan

	4x 905 mm type: 9W, 609 lm LED colour temperature: 3000K 1x 305 mm type: 3W, 203lm 2x 605 mm type: 6W, 406 lm 2x 905 mm type: 9W, 406 lm	

5. Appliances and Home Electronic Equipment Specifications and User Manuals

Monitoring Checklist
PM#6 3.4,

PD#6 X EL-301 to EL-303, PD#6 IV IN-105
Appendix 45 User Manuals

XIII Structural Calculations

The Foundation contains adjustable steel footings, which are based on derived timber boards to distribute the weight to the soil. The footings are fixed onto a strut-brace steel framework, which gives a level for the prototype and the platform.

The prototype floor elements and the steal frame are force-fit connected to each other. The prototype is a modular build up, highly insulated wood construction with a glass roof (space+), wooden windows and sliding doors as entrance to the cubes.

The roof structure (urban crown) is designed as an independent steel construction, which is supported by punctual footings on the roof of the living cubes. The steel element supports the follow-up casing of the solar panels and the horizontal shading for the glass roof.

The wooden deck, ramps and stairs on the outside are designed as a module construction, supported by the foundation steel-frame as well as additional punctual footings. Handrails are steel elements.

Structural calculations of each main component are referenced in the following with the company and name of the engineer who carried out the calculation and singed for their part.
The complete structural calculations are reviewed and approved buy the engineer PIRMIN JUNG. Calculations are based on the construction drawings titled *ST-001 - ST-304.*

The structural calculations related in the following were conducted and certified by the following Engineering firm:

PIRMIN JUNG
Ingenieure für Holzbau AG
Grossweid 4 CH - 6026 Rain
Tel.: +41 41 459 70 40 / Fax: +41 41 459 70 50
info@pirminjung.ch
www.pirminjung.ch

Elmar Kunz
ekunz@pirminjung.ch / Direktwahl: +41 (0)41 459 70 44

Further information: Appendix 46 Structural Design Approval

Adopted structural Solutions

For our prototype for the competition in Versailles the structural solution has been achieved for each its main structural components:

1. Roof Steel-Structure
Steel frame supported on roof building for adjustable PV-Panels, thermal Collectors, Heat exchanger and shading lamellas

2. Prototype Home Timber-Structure
Wood frame construction as prefabricated modules and elements for transport, Steel enhancement for cranes.

3. Foundation Steel-Structure
Load distributing steel frame to connect timber structure with foundation, with height adjustable steel feet.

4. Load Distribution
Derived timber boards adapt to greater height differences of the building site and enlarge the load distributing area to the soil, boards are fixed onto each other and are strut diagonally with wooden beams.

5. Wooden Deck
The Foundation Steel-Structure supports prefabricated wood-frames as substructure of the deck; buy mountings on the Prototype Timber structure and partly by own Foundations. Handrails are made of steel connected with the deck-construction and wooden balustrade walls at ramps and stairs are supported by the deck construction.

General Design values

For the Solar Decathlon competition a residential unit in lightweight construction is to be built. All Components are designed in a Wood-Frame or Steel structure. For the construction following codes has been followed.

Codes used for Construction
Structural bearing loads engineer standards Switzerland: SIA 260 ff.

Structural Safety and Serviceability verification corresponding to SIA standards
No. 260 – load assumptions
No. 261 – load combinations
No. 265 – timber constructions
No. 267 – steel construction

Live Loads
Building function: Housing
• Live loads building according to Category A2
• Live loads wooden deck according to Category C

• Live Loads Floor and Deck: 3.0 kN/m^2 (Admission Control required for Deck and Building)

Wind loads
• Reference Value dynamic preassure: 0,9 kN/m^2
• Wind exposition of building: normal
• Building Height above Terrain: 4.5 m

Snow loads
• Altitude: 450 + 200 = 650 meter absolute altitude, 1,2 KN/m^2

Seismic loads
• Seismic zone: Z1

Dead Loads
1. Roof Steel-Structure: 3095 kg

2. Prototype Home Timber Structure
-> See Apenndix STR_CAL_3

• Roof Prototype:	1.23 kN/m^2
• Roof Space Plus:	0.70 kN/m^2
• Middle Roof Space Plus:	0.39 kN/m^2
• Exterior Wall:	2.00 kN/m^2
• Exterior Wall Technikroom:	2.00 kN/m^2
• Exterior Wall Prototype:	2.65 kN/m^2
• Floor Prototype:	0.77 kN/m^2
• Floor Space Plus:	0.92 kN/m^2

3. Foundation Steel Structure: 4481 kg

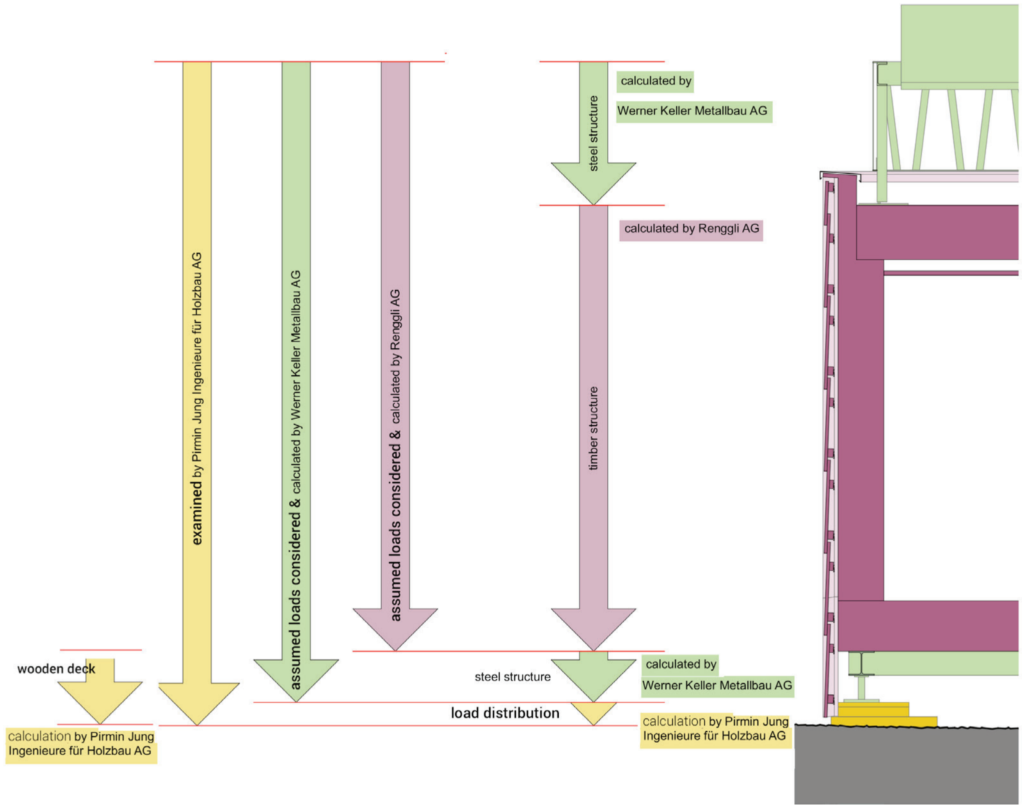
4. Load Distribution: neglected

5. Wooden Deck: 0.50 KN/m^2

Fire resistance justification

According to SIA regulation______ one storey buildings have no requirements.

Overview house bearing system



Foundation

Steel Framework Foundation
Dimensioning, Advisory and Realization by

Keller Werner Metallbau AG
Stettlistrasse 49 - 6383 Dallenwil
http://www.kellermetall.ch
Markus Christen
Dipl. Fassaden Ing. FH/MAS BA Entwicklung & Engineering
Tel.: +41 41 632 62 70 / Fax.: +41 41 632 62 53
markus.christen@wktechnik.ch

Planning by Student Team Lucerne – Suisse.

Adjustable Steel Footings and Load Distribution
Dimensioning, Planning and Realization by Student Team Lucerne – Suisse.

Supervision and approval by Elmar Kunz, Primin Jung Engineering

Soil pressure analysis for Site in Lucerne Horw
Supervision and approval by

GEOTEST
Grisigenstrasse 6 – 6048 Horw
horw@geotest.ch
Lynn Burkhard
Tel.: 041 439 24 50 / Fax. 041 349 24 51

Prototype Home
Dimensioning, Advisory and Realization by

RENGGLI AG
Gleng - 6247 Schötz
www.renggli-haus.ch

Andreas Keller
Technischer Projektleiter
Tel.: + 41 62 748 22 89/ Fax.: +41 62 748 22 24
andreas.keller@renggli-haus.ch

Planning by Student Team Lucerne – Suisse and Renggli AG

Roof Structure
Dimensioning, Advisory and Realization by

Keller Werner Metallbau AG
Stettlistrasse 49 - 6383 Dallenwil
http://www.kellermetall.ch
Markus Christen
Dipl. Fassaden Ing. FH/MAS BA Entwicklung & Engineering
Tel.: +41 41 632 62 70 / Fax.: +41 41 632 62 53
markus.christen@wktechnik.ch

Planning by Student Team Lucerne – Suisse.

Wooden Deck
Dimensioning, Planning and Realization by Student Team Lucerne – Suisse.

Supervision and approval by Elmar Kunz, Primin Jung Engineering

Hochschule Luzern – Technik & Architektur
Technikumstrasse 21
CH-6048 Horw

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