levelup

levelup your ...

Affordability & Viability

Jury Brief Report #4

solar decathlon 21-22 europe
WUPPERTAL GERMANY ...goes urban!

Technische Hochschule Rosenheim

A) Affordability

1. Rental costs

Increasing rents are one of the best known problems currently plaguing the housing market. In Nuremberg, just as in most large German cities, there is a shortage of affordable housing. Our aim is to make low-cost housing that is available for everyone.

Therefore, the levelup team is pursing the goal of offering residents a higher quality of life and comfort without raising rental costs. The average rent without utilities in Ludwigsfeld is 9.50€/sqm. Calculations have shown that the rental price for existing buildings of approx. 9.45 €/sqm – 10 €/sqm. This rests between the mid to upper range, and is considered customary and acceptable in this location. Financial gains derived from rents collected from the new apartments in the addition of storeys will be used to finance the overall renovation costs. Furthermore, utility costs will be permanently reduced by the added-value and long-term savings of the plus-energy renovation.

2. Operational cost

Our energy concept offers potential operating cost savings for its residents in several aspects. On the one hand, heating costs are reduced by a ventilation system with heat recovery. Secondly, the façade produces and stores energy, which conditions the old building shell. As a result, existing radiators in the flats can be operated at lower temperatures. Electricity and water-heating costs are reduced by utilizing PV and PVT modules. These not only supply a high proportion of electricity for the operation of the building, but are also designed so that no additional energy and associated costs are incurred for hot water in the summer. Furthermore, the heat from hot wastewater is transferred to the cold water via a heat exchanger in the shower plumbing, freeing the water heater of this task. This means that only potable water need be heated in the water heater.

Furthermore, operating costs are saved by passively intervening in user behaviour through the use of energy and resources. For example, hand-held shower nozzles are installed with digital displays, which show water temperature and the volume of water being used. Water data is sent to an app, which will be used to encourage users to be more energy efficient and that will provide everyday tips on saving resources and money. Wastewater from showers and washbasins is purified in a 'greywater' system similar to a sewage treatment plant, and reused as service water for flushing toilets and washing machines. Furthermore, collecting and using rainwater for the watering of plants has added financial benefits for residents.

Our aim is to encourage residents to adopt climate-friendly and economical behaviour in their homes, while permanently reducing their ancillary costs by counteracting wasted energy and water. Preliminary ancillary-water cost calculations have demonstrated visible savings for a 61 sqm, 2-person household.

Daily water consumption per person	129 – 49 = 80 L
Rental area	61 sqm
Waste water amounts	80L*2 Persons*365 days = 58.400L = 59 Cubic metres 59 Cubic metres * 1,67 = 99 €
Rainwater amounts	61 sqm * 0,43 = 26 €
Total for 3-person household	99€ + 26€ = 125€

	Water consumption	Water fees
Average value	129L	183€
With levelup	80L	125€
Savings	49L	58€

For heat, the useful energy is the energy that the building needs and the final energy, the actual purchase of district heating. Looking at the grid feed-in (315728), it becomes clear that the building generates more electricity (541411.5 PV -Generation AC) than it actually consumes (225683). For each kWh supplied, we receive a legally fixed amount known as the feed-in tariff. This enables us to generate profit and at the same time contribute to climate neutrality. On average, 1911.60 kWh are consumed per flat (196894 kWh Mains supply/ 193 flats). The average annual consumption is between 2000 kWh and 3000 kWh.

This shows very well that we use much less electricity and can therefore also significantly reduce the costs, which depend on the electricity provider. Likewise, the heat per flat amounts to approximately 546.06 kWh (56244.66 kWh total final thermal energy/ 103 flats).

3. Car-Sharing Concept

The sharing offer is intended to be a cost-effective alternative to local transportation and in the best possible way to meet the need of residents. Shared vehicles will pay for themselves, but will not generate a profit. If profits are made, these will be reinvested in the purchase of new vehicles, and the pricing model for residents will be adjusted accordingly. The desired result is a clearly defined vehicle pool, which can be adapted to younger and to older age groups, because younger inhabitants tend to have lower payment capacities than older ones. Thus, we provide options for each social class in order to counteract disputes among residents regarding vehicle types. One of the benefits of the sharing concept is the potential reduction of car traffic, which could result if all residents switched from privately owned vehicles to the sharing pool. A reduction from 161 vehicles to 33 could be achieved, and the vehicle density would be reduced to 8.25 cars per 100 inhabitants.

Depending on electricity generation, a significant CO2 emission reduction can be achieved. Residents also save money that would have been otherwise spent for their cars.

4. Construction costs

Electrical installation costs for the addition of storeys, which includes 42 housing units, amounts to €1.211.323,12. Each residential unit is composed of a total of 4 individual modules. Specifically, these are 2 modules per floor. The electrical maintenance costs for the addition, according to cost group (CG) '440 electrical installations', '450 telecommunications and information technology installations', and '400 building installations', amount to 40.036,34€ annually (cash value of replacement procurement) and extrapolated over 25 years at 1.000.908.49€.

The construction costs for the renovation and addition of storeys are 165.098.328€, as follows:

Total CG 300	12.628.178
Total CG 400	2.479.150
Total CG 300 + 400	15.098.328

Living space (LS) addition	2.520
Cost addition	10.381.793
Addition per sqm LS	4.120

Existing living space	4.450
Costs for renovation	3.453.180
Building stock per sqm LS	776

Total living space	6.970
Costs allocated to overall building	1.263.356
Building stock per sqm LS	181

5. Financing plan

There are no acquisition costs, as the housing association already owns the building. The ancillary construction costs amount to 15 % and thus total 2,264,749.20€. The capital requirement to be financed is 17,363,077.20€. The rent is 9,50€/sqm and is extrapolated at 12 months with a total of 6.385 sqm usable area (727,890€). Maintenance costs in this case are estimated at 105,000€ per year. This financial plan is based on financing with outside capital, which in this case is provided by a bank loan. Financing through the 'Kreditanstalt für Wiederaufbau' would also be an option, except that this type of financing is currently not available by the government. Such financing would enable the investor to generate a profit in the 29th year, and if maintenance costs are higher than estimated, e.g. 150,000€, a profit is generated in the 32nd year. Assuming that the rent without utilities would be increased from 9,50€ to 10,50€, rental income would be 904.510€, maintenance costs 105.0000€, and cash flow 699.510€, resulting in a possible profit in the 25th year.

An additional financing option would be real-estate crowdfunding. Instead of a single person or entity investing a large sum of money to build, renovate, or purchase, a large number of individuals each make a smaller contribution to do the same thing. Depending on what is agreed upon, the crowdfunding investors earn returns corresponding to the amount they invested.

Crowdfunding has a lot of advantages for participants:

- Provides detailed information before decisions are made
- Guarantees attractive interest rates
- Tracks the entire project development up-close
- Supports participation in a sustainable project

Capital	
Input	
Acquisition costs	0,00
Renovation costs	15.098.328,00
Incidental building costs (15%)	2.264.749,20
Total capital requirement	17.363.077,20
Equity capital Siedlungswerk	500.000,00
Equity capital	1.500.000,00
Total equity capital	2.000.000,00
Debt capital requirement	15.363.077,20
Credit amount credit 1	15.363.077,20
Nominal interest credit 1	0,01

Repayment loan 1

Year	Credit amount at the beginning of the year	Annuity	Interest rate	Repayment	Loan amount year end	Remaining cash flow
1	15.363.077,20	622.890,00	153.630,77	469.259,23	14.893.817,97	0,00
2	14.893.817,97	622.890,00	148.938,18	473.951,82	14.419.866,15	0,00
3	14.419.866,15	622.890,00	144.198,66	478.691,34	13.941.174,81	0,00
4	13.941.174,81	622.890,00	139.411,75	483.478,25	13.457.696,56	0,00
5	13.457.696,56	622.890,00	134.576,97	488.313,03	12.969.383,53	0,00
6	12.969.383,53	622.890,00	129.693,84	493.196,16	12.476.187,36	0,00
7	12.476.187,36	622.890,00	124.761,87	498.128,13	11.978.059,24	0,00
8	11.978.059,24	622.890,00	119.780,59	503.109,41	11.474.949,83	0,00
9	11.474.949,83	622.890,00	114.749,50	508.140,50	10.966.809,33	0,00
10	10.966.809,33	622.890,00	109.668,09	513.221,91	10.453.587,42	0,00
11	10.453.587,42	622.890,00	104.535,87	518.354,13	9.935.233,29	0,00
12	9.935.233,29	622.890,00	99.352,33	523.537,67	9.411.695,63	0,00
13	9.411.695,63	622.890,00	94.116,96	528.773,04	8.882.922,58	0,00
14	8.882.922,58	622.890,00	88.829,23	534.060,77	8.348.861,81	0,00
15	8.348.861,81	622.890,00	83.488,62	539.401,38	7.809.460,43	0,00
16	7.809.460,43	622.890,00	78.094,60	544.795,40	7.264.665,03	0,00
17	7.264.665,03	622.890,00	72.646,65	550.243,35	6.714.421,68	0,00
18	6.714.421,68	622.890,00	67.144,22	555.745,78	6.158.675,90	0,00
19	6.158.675,90	622.890,00	61.586,76	561.303,24	5.597.372,66	0,00
20	5.597.372,66	622.890,00	55.973,73	566.916,27	5.030.456,38	0,00
21	5.030.456,38	622.890,00	50.304,56	572.585,44	4.457.870,95	0,00
22	4.457.870,95	622.890,00	44.578,71	578.311,29	3.879.559,66	0,00
23	3.879.559,66	622.890,00	38.795,60	584.094,40	3.295.465,25	0,00
24	3.295.465,25	622.890,00	32.954,65	589.935,35	2.705.529,91	0,00
25	2.705.529,91	622.890,00	27.055,30	595.834,70	2.109.695,21	0,00
26	2.109.695,21	622.890,00	21.096,95	601.793,05	1.507.902,16	0,00
27	1.507.902,16	622.890,00	15.079,02	607.810,98	900.091,18	0,00
28	900.091,18	622.890,00	9.000,91	613.889,09	286.202,09	0,00
29	286.202,09	622.890,00	2.862,02	286.202,09	0,00	333.825,89
30	0,00	622.890,00	0,00	0,00	0,00	622.890,00
31	0,00	622.890,00	0,00	0,00	0,00	622.890,00
32	0,00	622.890,00	0,00	0,00	0,00	622.890,00
33	0,00	622.890,00	0,00	0,00	0,00	622.890,00
34	0,00	622.890,00	0,00	0,00	0,00	622.890,00
35	0,00	622.890,00	0,00	0,00	0,00	622.890,00
36	0,00	622.890,00	0,00	0,00	0,00	622.890,00
37	0,00	622.890,00	0,00	0,00	0,00	622.890,00
38	0,00	622.890,00	0,00	0,00	0,00	622.890,00
39	0,00	622.890,00	0,00	0,00	0,00	622.890,00
40	0,00	622.890,00	0,00	0,00	0,00	622.890,00

6. Effects on unit value

The renovation and addition of storeys allows us to focus on modernisation and energy efficiency, which can permanently increase the value of the building with all associated measures. The flats created by the addition of storeys, in conjunction with our modular construction system, not only create more living space, but also add unit value to the flats and the entire apartment building. A new source of income is generated with flat rentals, which offer highly flexible apartment layouts based on modular construction. Barrier-free accessibility can also lead to an increase in value through flat conversion, in addition to catering to new categories of tenants. The sharing concept coupled with a garage increases the market value, because access to a garage is an important decision criterion for many prospective buyers, and the sharing concept offers a unique social aspect. All measures have a clear value-enhancing effect and make it possible for our building to stand out among the competition.

7.Operating Model

The Business Model Canvas describes the structure of the business model on the basis of nine components and offers a representation of how a company functions as an organisation. On the one hand, it is intended to create clarity in the analysis phase, and on the other hand, to form an innovative starting point for the creative development of new business models. A distinction is made here between housing companies and housing initiatives. The structure of the business model is on the basis of nine components: Users, Value proposition, Channels, User relations, Sources of income, Key resources, Key activities, Key partnerships, and Cost structure.

B) Viability

Besides the problems facing affordable housing, we are attempting to solve another issue: urban densification. The proposed modular “levelup” system can significantly increase the density of neighbourhoods by creating additional living spaces on top of existing buildings. The “levelup” system allows for adaption to individual ways of life and the various needs of different population groups.
„Levelup“ can be applied to almost all buildings in the neighbourhood, which would lead to a significant increase in living space. This could even be accomplished without building upon undeveloped green areas - on the contrary - by integrating roof-top gardens and green roofs, the percentage of green space can be increased in urban areas.

Available space is an increasingly important resource. We have taken these decisive factors into account when we designed our modular and adaptable addition of storeys and renovation method = "levelup" system. Using the addition to storeys methodology could create over 1.1 million housing units on top of existing multi-family buildings from the 1950s - 1980s in Germany. Expanding on existing networks would avert the need to zone for new buildings and transport, which would otherwise consume between 10,200 - 24,600 hectares of undeveloped area. Our system can also be adapted to other building typologies and structures due to its modularity, geometry, and adaptability. The range of housing typologies and communal areas can be adapted and matched to the respective urban quartier. The renewable energy generation of electricity and heating or cooling on a neighbourhood level is also scalable as needed. For many years, the construction of new residential buildings has been the norm. However, if exceedingly more building renovations and refurbishments are realised in the future, additions of storeys or other types of existing building conversions could become the new standard. The success of the energy transition requires not only the use of renewable energy, but also lower energy consumption. In this aspect the building sector has much untapped potential. New buildings already meet strict energy regulations, but existing buildings more than often do not. This is where energy-efficient renovation comes into play, which, in addition to the positive effect on the climate, also have financial advantages and offers modern comfort. Economically viable renovation solutions must be sought for buildings from the 1950s to 1970s, because from a social standpoint, rents should not continue to increase simply for the fact that buildings are to become climate-neutral.

The modular expansion and renovation system "levelup" can offer additional living space with balanced apartment sizes to the neighbourhood. Building and installation time can be decidedly reduced with the use of modular-wood construction. Prefabricated modules arrive at the construction site with preinstalled interior fittings and utility installations even before being positioned on site. The size of the modules depends on the transport dimension. The apartments planned in our additions of storeys consist of 2 or 4 modules. The number of occupants in any given apartment will determine the size and usage. All apartments including the interior design can be adapted to the needs of the residents, and long-term usability is ensured for all potential residents. Lifts and balconies will be added to the existing building, and the entire building and all its flats will be redesigned to be barrier-free. This will permit residents to be able to remain in the neighbourhood until they are elderly, even if physical limitations arise. This will not only benefit physically-limited residents, but will also increase the quality of living for people without physical limitations. There is also the potential for apartments for caregivers to provide assisted living in the neighbourhood. Sustainable construction, with a long service life, is increasingly becoming standard practice.

Common spaces are one of the main focal points of the addition of storeys, because they are available to all residents of the building, and provide meeting spaces, studios, quiet areas, and co-working spaces. They can also be rented additionally for communal or private activities. Furthermore, roof-top terraces, greenhouses, and gardens will be created throughout the addition of storeys and it will promote social interaction between residents and strengthen the sense of community.

The roof top gardens and green roofs will generate positive effects for neighbourhood cooling, water storage during heavy rain periods, the increase of biodiversity, and enhanced local recreation and leisure activities. The Siedlungswerk Nuremberg expressly wishes to improve social interaction and increase a sense of community among the residents in the neighbourhood. The integration of community spaces, greenhouses, and roof-top gardens on the upper floors offer the possibility for private and communal activities. Such areas will significantly improve recreation and leisure activity offers, while having a positive effect on the social cohesion of the residents. The redesign and added value of existing, poorly-utilized green spaces in the neighbourhood could result in the creation of children's playgrounds, meeting areas with seating, installation of sports equipment and playing fields, and urban community gardens. This will have a positive effect on the image of the neighbourhood.

There is currently a lack of parking spaces in the neighbourhood, and residents are not entitled to allocated parking spaces. The increased number of residents will also enlarge the need for mobility. A parking garage is to be built in the neighbourhood for this purpose. The garage will be located in the immediate vicinity of the existing building, and can be reached quickly and easily on foot. The garage will without a doubt support our mobility concept, by serving as the main parking area for all our shared vehicles and primary charging stations. The new garage offers added value, because residents may park at a reduced rate if they share a car with other residents - with shared electric cars even receiving free parking. Similar offers should encourage residents to use our car-sharing concept and promote neighbourhood communication. Residents without the necessary financial means can also enjoy the benefits of driving, and the occasional rental of a car or bicycle makes everyday life easier and increases independence. In addition, the conscience is also rewarded, as each individual resident contributes to producing fewer goods and thus saving resources through the shared use of cars, bicycles, goods, or services. By sharing goods and services, a social network can be established in which individuals can support each other when need arises. Assisting others increases both gratification of those being helped, but also one's own satisfaction and feeling of self-value. In addition, every single resident supports social justice by giving people with lower incomes access to cash-free or money-saving alternatives, e.g., borrowing and lending.

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WUPPERTAL GERMANY ...goes urban!

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