Architectural Brief Report

MED in Italy

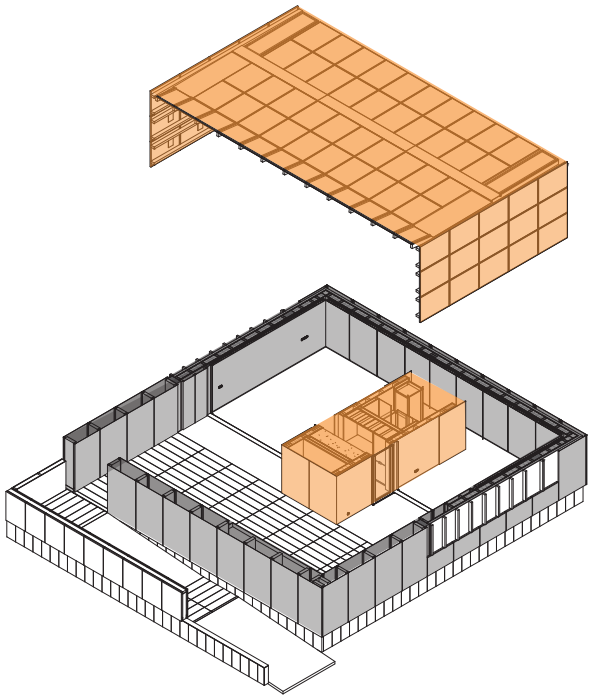
Architectural Brief Report

Tradition and innovation are the two fundamental criteria behind the "MED in Italy" house. The former is the inspiration of the project and provides a bioclimatic model suited to the Mediterranean latitudes. The latter is prompted by the necessity to adapt the traditional model to modern needs and technologies.

Following the tradition we dealt with the Mediterranean climate of the Italian peninsula, where the defense from heat acquires the same importance as the defense from cold, and in many cases even higher. The basic strategies to avoid heat in such contexts provide: protection from solar radiation, heat inertial storage and thermal dissipation by using temperature alternation between day and night, and the culture of living the outdoor spaces.
The past predominant architectural models in the Mediterranean areas, despite of their variety, are linked by a strong integration between open spaces – generally delimited- and closed built volumes. Additional architectural elements such as loggias or porches, have always played a role in moderating climates, and their association with moving dimming systems and openings for the control of ventilation, has enabled the creation of intermediate spaces and mediation between inner and outer space, producing ante litteram buffer zones.

Then in our design, the outdoor space is an integral part of the residential area and accomplishes precise bioclimatic functions to mediate the temperature between inside and outside, highly reducing the psychometric problems of the building envelope.

Vegetal sensors in the outdoor manifest the presence of pollutants and highlight which biological damage living organism may be subject to in actual situations of air pollution.
The whole house image is based on the contrast between low-tech and hi-tech construction.
The exterior image of the low tech part is related to a textile layer obtained with a hemp canvas (the same used for the sails of the historical ship Amerigo Vespucci, the Italian Navy training ship) stretched over wooden frames. This casing reinterprets an ancient Mediterranean building tradition, which historically precedes the use of stone. Hemp canvas, belongs to an important Italian tradition and it is a cultural must to try to give to this material a new chance to became useful. We employ hemp also for shading the patio.
Textile is actually an uncommon finishing for building wall. The research on this topic are on the cutting hedge now, and we believe that textile, if properly explored, could give high performances, right for building envelopes in temperate to hot climate. Furthermore the modular cladding system of the MED in Italy prototype can generate future housing that can employ many other finishing, much common and suitable from a marketing point of view, such as: laminated, TRESPA, brick, metal sheets, wood panels, depending on the construction environment.



High-tech

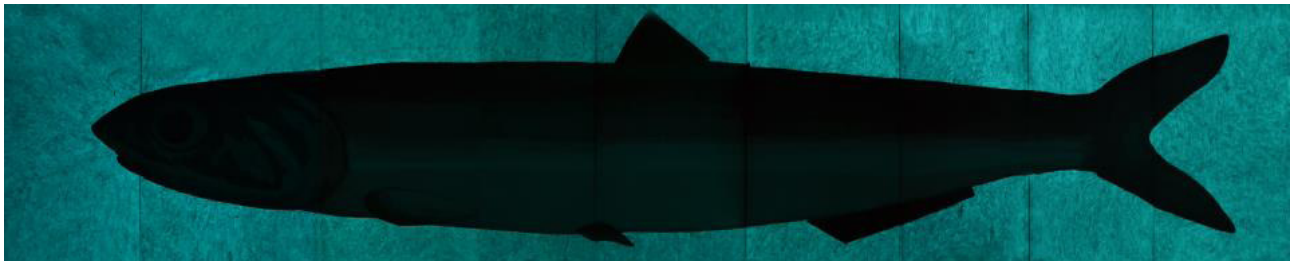
Low-tech

These textile formworks, made strong thanks to wooden structures, are filled with loose inert, available in the building area, such as sand, soil, rubble… The infilling heavy materials follow a feature common to all buildings in the Mediterranean area: the wall thermal inertia in sharp contrast to the lighter North European systems (framed). Walls act as thermal fly-wheels both in Winter and Summer. In the prototype for the contest the massive material is wet sand, contained in aluminum tubes, in order to be transported and easy assemble and disassemble.

The high tech is divided in an external and an internal one.
The PV envelope is the external high tech side. It protects the roof surface and the East and West facades, and shades from the direct solar radiation the South facade. This kind of solution is perfectly integrated in the image of the building, transforming the photovoltaic panel from an appliance to a building component.
The internal one, is the "3D core" of the house, that hosts kitchen and bathroom as well as the HVAC technical room. It concentrates all the technical appliances avoiding electrical dispersion, reducing water distribution length and facilitating assembling phases.

The interiors present the same contrast between tradition and innovation, low tech and high tech of the architectural design. Besides it is important to underline that the house architecture points at the recovery of ancient building tradition. The competition requirements ask the possibility not only to assembly but also to disassembly the building. This kind of requirement complicates the construction. In fact this requirement is not common in housing belonging just to temporary equipment. To recovery the tradition requires an innovation, primarily related to the construction solutions, but also in the functionality, shape and organization of the internal living space, that needs a morphological simplification in order to permit easy assembly operations.
At the spatial level the house is conceived as a traditional one, in which the living room and the bedroom are strongly separated. The kitchen as well is confined in a properly dedicated room. But the continuity and fluidity of the space is assured by an "art gallery", a corridor large and lighted that change is role in the different zones: from living room to laundry, from bathroom, thanks to the sliding doors, that can close the toilet as a separated room, to home office and bedroom. The artwork lining on the corridor wall gives and assures the continuity of the space.

But not only. The artwork helps to enhance positive behavior of the dwellers, avoiding them to equip the northern wall with furnishings and letting in that way that the wall exploits his thermal gain function. Furthermore the wall is painted with a special bright material, that accumulates light and releases it in the night. In this way the wall is not only a scenography, but gives also safety in use with a nocturnal lightened path.



The painting by night

The concept behind the furniture design and prototyping is the same of the house: to be assembled and disassembled with easiness and few steps many times. Dry joints (thanks to the sole presence of mechanical joints, excluding the use of glues and reducing formaldehyde emissions to zero) and traditional materials are combined with high tech and contemporary design, for the chairs, the table, the bed, the desk and the kitchen.

This last belongs to the Made in Italy most flexible products for the interior design: its system has been conceived to be constructed around the absence of matter, on empty spaces, using only shelves and jumbo drawers to achieve a light and modern style of furniture thanks to de-materialization. Even the innovative wooden and metal doors are de-materialized thanks to their very slim panels and to the materials used: a faced frame for the former and a 2mm thick panel for the latter.

House floor plan and kitchen rendering

To recall one of the excellence of the expression and production typical of the Mediterranean area we redesigned classical tiles. From Turkey to Italy trough France and Greece, tiles represent in all the possible declinations of shape and type, the meeting between tradition and modernity since the simpler clay firing. We performed a research on the tile square shaped in 20cm on which we insert different objects (bowls, cups, hooks, of different nature) in order to create new accessories.

Ceramic also apply at the lighting design project, creating biomorphic lamps that transform themselves from sculpture to lighting emitting object. Natural and artificial lighting, in our project, are based on the following concepts:
- day-lighting comes from windows and skylights, designed to have light from different directions with a perfect balance of luminance on different surfaces, with particular attention to visual tasks and the painted surface;
- electrical lighting and home automation integrate perfectly with day-lighting, with minimum energy consumption and maximum visual comfort;
- high efficiency light sources (last generation led) and high performances optics minimize energy consumption without renouncing to visual comfort and perception;
- spectral performances of led define a pleasant and relaxing visual environment to give the best appearance to materials and textures;
- long life technologies minimize maintenance operations;
- custom design of luminaries and feeding system allows to reach optimal performances with different furniture layout.

Ceramic tiles

In the inner part we explore also the possibilities given by the conductivity of textile with a new material named Texsteel, that matches the metal easiness to be worked with the fabric softness and aesthetic. We perform a research on its main characteristics, among which the innovation, the sustainability, the industrialization, the low cost, the high sensitive performance, the electrical conductivity in order to design interactive components. It is possible to print, punch, ply, drawing press, this materia. Furthermore Texsteel is magnetic and electrical conductive. This gave the idea to coat the office desk with it, adding to its natural properties (lightness, self-standing, texture) also the energy transmission at low voltage (12v) in any point of its surface. In that way it is possible to employ the entire desk as an energetic plug for small appliances (watches, smart phone, lamps, cordless phone).

Engineering and Construction Brief Report

MED in Italy

Engineering and Construction Brief Report

Constructive Design
Advanced Prefabrication

The Med in Italy housing prototype is based on a highly prefabricated construction.

Prefabrication does not have a great appeal to architecture, since in the past all its advantages in terms of speed and efficiency were paid as standardization and often low control on performance.

With this project we want to show that through a careful use of prefabrication it's possible to reduce cost while at the same time maintain control, increase quality and add a great variety of outputs. We are trying to transfer as much as possible manufacturing to the factory and leave for the site only assembling of parts, as much finished as possible.

Wall prefabrication at Rubner Haus, Bozen

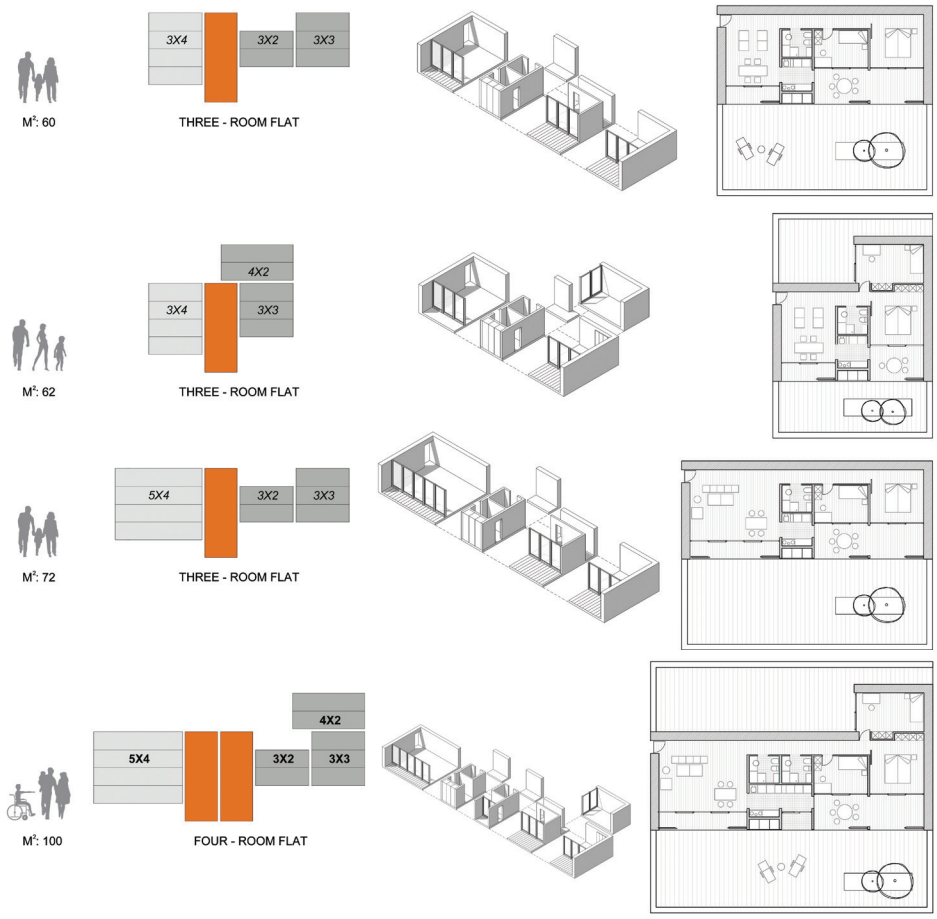
The logic behind this is to increase precision and therefore quality of the manufactured parts, by fabricating them into the best available environment, but also reduce production time, because efficiency is higher and can benefit from computer-controlled-machinery for automated or semi-automated manufacturing. In this way not only assembly time, but also costs are reduced.

According to this strategy, we designed a system, rather than a single object.
The basic building elements of the system are: 3D modules, 2D elements (walls, roofs and floors), photovoltaic surfaces.

All of them are dimensioned to fit into standard transportation vehicles.

Even if we fit into the scenario of mass customization of building components, we intentionally chose to keep the elements of the construction simple and therefore easily adjustable, in order to get a greater flexibility also for multi-storeys configurations.

By conceiving the house as a kit of parts, we also allow those parts to be used in the existing context: extensions, partial demolitions, retrofitting can all use elements of our system, each time adjusted to the particular singular configuration.



Modular flexibility

Building Elements - A 3D Core

Concentration of hi-tech parts in one object

The Med in Italy housing prototype is based on a central, three-dimensional module, that we called "3D core", hosting all the main technical and mechanical parts of the construction. This core will be completely assembled in the factory as a three-dimensional element.
The 3D core contains the bathroom with all the accessories and finishes, a fully equipped kitchen including appliances and a technical closet (mechanical room).

The ceiling of the 3D core will host all air supply, return ducts for ventilation, post-heating and cooling batteries for air supply, the ducts of water supply and return for static climate control, and all the electrical system, including power lines to supply the electrified rails embedded into the ceiling.

The ground slab of the 3D core hosts all the needed plumbing for bathroom and kitchen.
This central module will also work as reference for the rest of the prefabricated macro-components of the house construction: ground slabs, exterior walls and roof slabs.
We contained the width of this element into 2.4 meters, that allows it to be carried on by standard transportation vehicles, with the only constraint of height.

Building Elements
Light Walls that become heavy

Cavity in the wall with sand

All the rest of the house uses standard components of wood houses construction, that means wood lumber frames cladded with sheets and panels to build walls, floor and ground slabs. This gives to the system a great flexibility in terms of possible layouts, to which we are adding a new layer of efficiency with the concentration of building systems into the “3D cores”.
What we are adding to the typical walls of wood houses is a cavity, that we infill with sand.
The idea behind this is that we transport light elements, and once on site, we fill them with humid sand in order to get the inertial mass we need to optimize thermal behavior and simulate the one given by heavy masonry.

Depending on the particular site where the house can be installed, sand can be substituted with similar materials to be found locally.
Since the contest requires the house to be disassembled, we translated this concept into a series of alluminum tubes, infilled with humid sand, that are hosted in the same cavity we would have used to infill sand. They will be brought to the site separately and installed into the walls once they are assembled.

PV Surfaces as envelopes

In our design PV Surfaces are not juxtaposed on the roof of the house: they are deeply integrated in the architectural image. The building would lose its meaning by removing them.
We use the PV surfaces as shading devices: cantilevers have been fine-tuned to protect glass surfaces (skylight and south windows) from direct solar radiation in the hot season. They are designed as a separate element, detached from the waterproof envelope of the house, this way allowing for an adequate ventilation of the interspace between the two roofs, preventing a decrease in efficiency of panels due to overheating.

A particular feature of our project is the multi-orientation of the PV surfaces: horizontal (roof), east and west walls. The multi-orientation is linked to the architectural integration of the panels, but also helps the optimization of the temporary relationship between energy production and consumption since the surfaces will produce energy in the different times of the day, this way minimizing the need for energy storage.

PV Surfaces are designed to maximize production fitting into the constraints of the contest.
The installed power is 9.62 KWp, divided in 4 strings for a total of 64 polycrystalline (c-Si) panels.

Even from the energy production perspective, the design is flexible and allows for different PV technologies to be used by always maintaining an aesthetic coherence with different optical and technical options. We tested and integrated in the design solutions based based on either diffuse or direct solar radiation.

The most fascinating, but also expensive solutions we tested are based on CIS (Copper, Indium and Selenium, together with Gallium and Sulfur), with either black, coloured and serigraphed panels, but we also simulated the less efficient thin film (a-Si). Since the roof shape is made partially independent from the number and type of panels, the house can be configured coherently according to different budgets, contests and energy needs.

Different panels proposals

Structural Design

Since our prototype is designed to be an energy efficient Mediterranean prototype, we configured a structure able to sustain seismic forces, even if not directly requested by the Madrid location. The task has been challenging, due to the particular configuration of the structure with a 12 meters continuous skylight, the presence of the sand infill and to the need to assemble and disassemble the prototype at least two times after the contest. In particular we developed a detailed model for the base constructive element: the panel that is the backbone of the entire structural system. Seismic force is also the main reason for the introduction of steel plates and brackets all along the house and in particular in special nodes.

Energy Efficiency Brief Report

MED in Italy

Energy Efficiency Brief Report

Our prototype of a contemporary Mediterranean house aims at developing and efficient strategy for hot climates. Timber frame structures, which represent the established standard of the preassembled wooden made houses of small and medium size, perfectly fit to cold weathers with heating requirements during most part of the year. It is demonstrated that they reach the same thermal characteristic, U-value transmittance, with the tiniest thickness of boundary wall. Nowadays, the real technical challenge for these wooden structures lies in hot weather conditions and during summer time. As in the last decades the attention has been focused on the reduction of the heating energy needs in steady-state conditions, the envelope dynamic behaviour has been neglected because it is not crucial in the winter period. Among the recent growth of the energy consumption for cooling purposes the peculiarities of the summer problem have been analysed.
At the present time, wooden structures in the Mediterranean area suffer the comparison with heavy brick and concrete buildings. The lower thermal capacity decreases the thermal inertia, speeds the dynamic response and therefore seems to be the main cause of the worsening of the indoor comfort. The direct solution which is the increase of the internal mass up to achieving the required levels will lead to an unavoidable growth of the whole structure mass and thence to a decay of its seismic behaviour. Briefly, the answer to one issue will spoil the main characteristic of the timber structures.

Passive strategies

According to the main purpose of design strategies, the improvement of thermal capacity across envelope elements has been deeply investigated. The main strategy included an increased mass across walls respecting the lightness of structures typical of wood technologies.
Different configurations of mass distribution have been tested by a hot box in order to identify the best one. The chosen solution foresees a cavity with aluminium pipes filled by wet sand which reduced the total weight of structures up to 30% less compared to a homogenous layer of dry sand. Thanks to increased surface exchanging heat, due to a ventilation of the mass itself, it has been possible to strongly increase the whole thermal capacity of walls (at least up to 20% higher than a homogenous layer of dry sand).

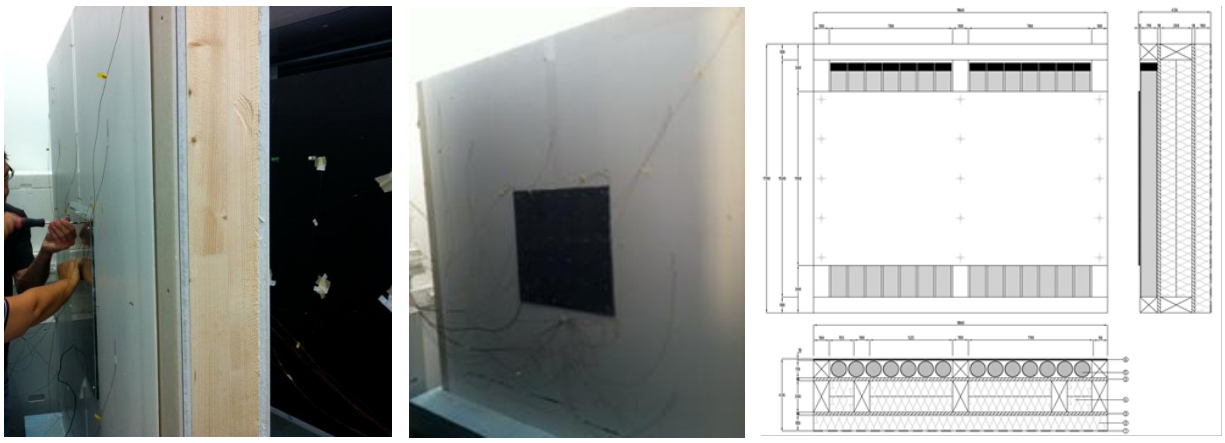


Figure 1 - Wall prototype made by aluminium pipes ready for the hot box tests

This mass solution combined with a high thickness of the thermal insulation reaches an average value of the opaque envelope thermal transmittance equal to 0,149 [W/m2K] and an average value of time shift equal to 19,85 [h] which makes the wooden wall comparable with a traditional insulated brick structure.
Appropriate design features regarding night mass ventilation and solar shadings have emphasized such potential given by the adopted solution.

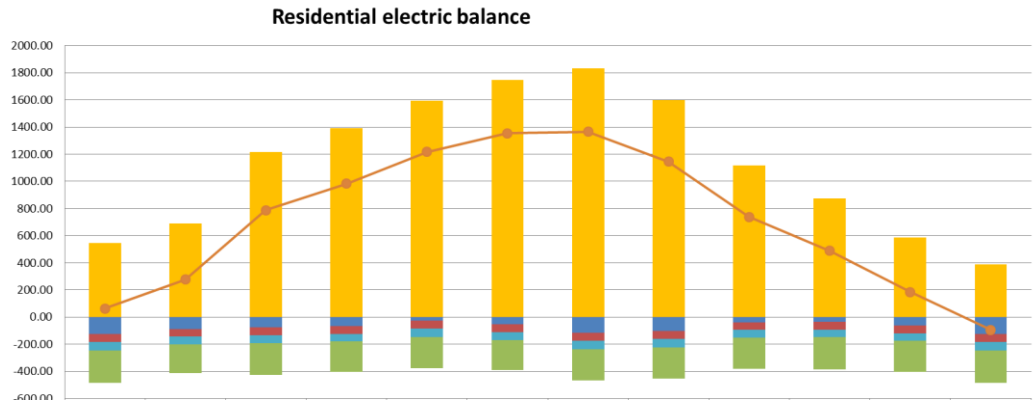
Active system strategies

The HVAC systems have been divided in two main active circuits. Considering that the main thermal generator is a heat pump air-to-water, a radiant system installed on the inner layer of roof structures has been adopted as first active circuit to control sensible heating and cooling loads. This system has been designed to guarantee the best comfort condition for a standard residential occupancy of the building.
In order to control peaks due to extraordinary occupancy during the contest and the latent loads in both the residential and contest use, the air-exchange system (standard equipment for a high energy efficiency building) has been upgraded to an air-treatment system (becoming the second active circuit) in order to satisfy the humidity and CO2 monitored requirements during the contest. An intelligent bypass of heating recovery system has been adopted: when external conditions are close to the comfort ones, the system allows natural ventilation across the building.
Instead adopting batteries (too expensive from the point of view of installation, maintenance and environmental impacts), to reduce the electrical power demand and strongly improve the contemporaneity of energy production and energy requests, thermal storage systems have been adopted. Considering the energy demand both for heating and cooling, three different tanks has been designed:

- 200 l of 55 °C hot water for sanitary, shower and kitchen uses;
- 100 l of 35 °C hot water for heating purposes;
- 100 l of 15 °C cold water for cooling purposes.

Expected energy performance

A complete set of hourly base simulations are developed in order to quantify the future behaviour in Madrid and Rome during a standard residential year and during the contest fortnight.
The following graph shows a monthly evaluation of the electrical balance for a typical residential use in Madrid.

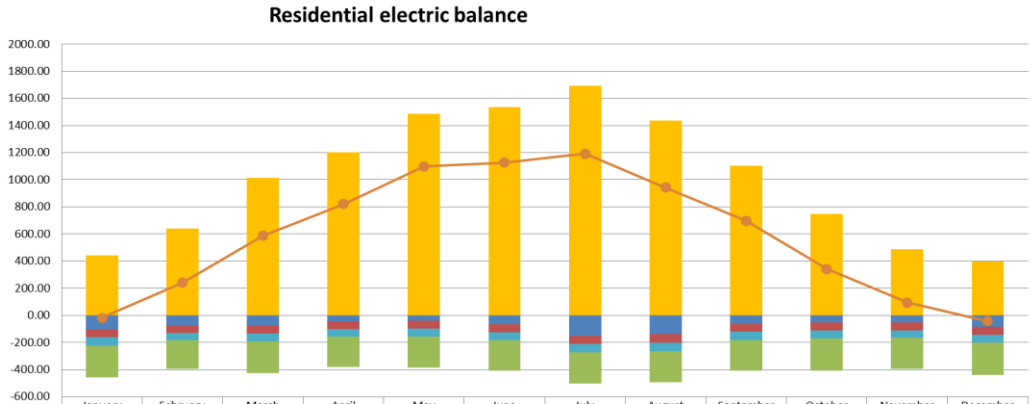


	January	February	March	April	May	June	July	August	September	October	November	December
PV production [kWh]	544.95	690.07	1213.98	1389.10	1592.33	1745.80	1830.49	1598.65	1117.69	874.26	586.19	388.26
Lighting and appliances electrical demand [kWh]	-237.59	-213.94	-234.77	-224.92	-229.78	-220.50	-229.02	-231.52	-226.86	-236.31	-229.78	-237.76
Auxiliaries Electrical demand [kWh]	-61.40	-54.86	-58.43	-57.83	-59.14	-58.67	-62.12	-61.88	-58.07	-54.86	-53.67	-61.05
Hot Water electrical demand [kWh]	-59.71	-53.93	-59.71	-57.78	-59.71	-57.78	-59.71	-59.71	-57.78	-59.71	-57.78	-59.71
HVAC tot. electrical demand [kWh]	-124.60	-90.91	-74.88	-65.43	-27.26	-54.16	-114.65	-100.61	-38.28	-34.91	-61.94	-124.67
Monthly delta (Production-Demand) [kWh]	61.65	276.43	786.19	983.13	1216.43	1354.69	1365.00	1144.93	736.70	488.48	183.02	-94.92
Total annual delta (Production-Demand) [kWh]												8501.74

During the standard year use, the MED in Italy house:

- generates 13.571,77 kWh of electrical energy thanks to the PV generator;
- consumes 5.070,03 kWh for lighting and appliances, HVAC, DHW and auxiliaries demands;
- provides 8.501,74 kWh to the electrical net, more than 165% of the yearly electrical demand.

The following graph shows a monthly evaluation of the electrical balance for a typical residential use in Rome.

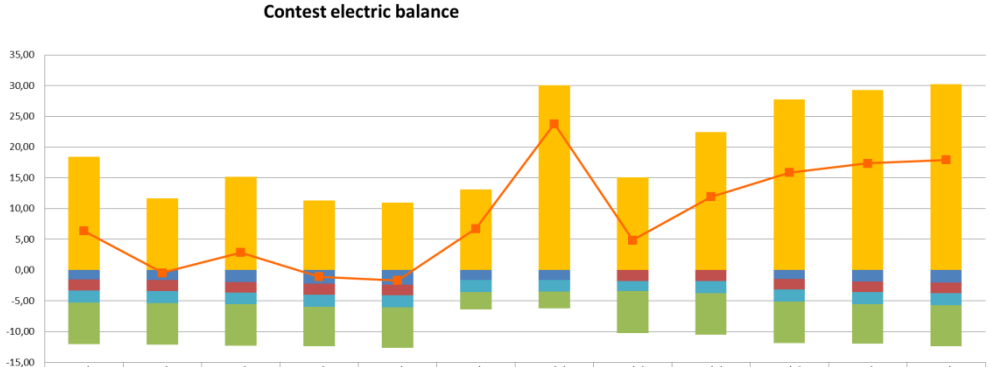


	January	February	March	April	May	June	July	August	September	October	November	December
PV production [kWh]	441.60	637.97	1012.67	1203.23	1483.69	1533.41	1694.18	1438.04	1104.21	749.64	488.15	395.24
Lighting and appliances electrical demand [kWh]	-237.25	-212.95	-234.21	-224.56	-229.37	-221.10	-228.92	-231.49	-226.38	-235.89	-228.66	-237.35
Auxiliaries Electrical demand [kWh]	-60.81	-54.03	-58.43	-54.62	-57.12	-60.09	-62.71	-62.71	-59.86	-59.98	-54.14	-57.00
Hot Water electrical demand [kWh]	-59.71	-53.93	-59.71	-57.78	-59.71	-57.78	-59.71	-59.71	-57.78	-59.71	-57.78	-59.71
HVAC tot. electrical demand [kWh]	-102.26	-76.19	-74.47	-45.91	-39.48	-67.99	-151.43	-140.90	-63.94	-52.27	-53.02	-84.95
Monthly delta (Production-Demand) [kWh]	-18.43	240.88	585.85	820.35	1098.01	1126.44	1191.41	943.23	696.24	341.80	94.54	-43.76
Total annual delta (Production-Demand) [kWh]												7076.57

During the standard year use, the MED in Italy house:

- generates 12.182,04 kWh of electrical energy thanks to the PV generator;
- consumes 5.105,47 kWh for lighting and appliances, HVAC, DHW and auxiliaries demands;
- provides 7.076,57 kWh to the electrical net, close to 140% of the yearly electrical demand.

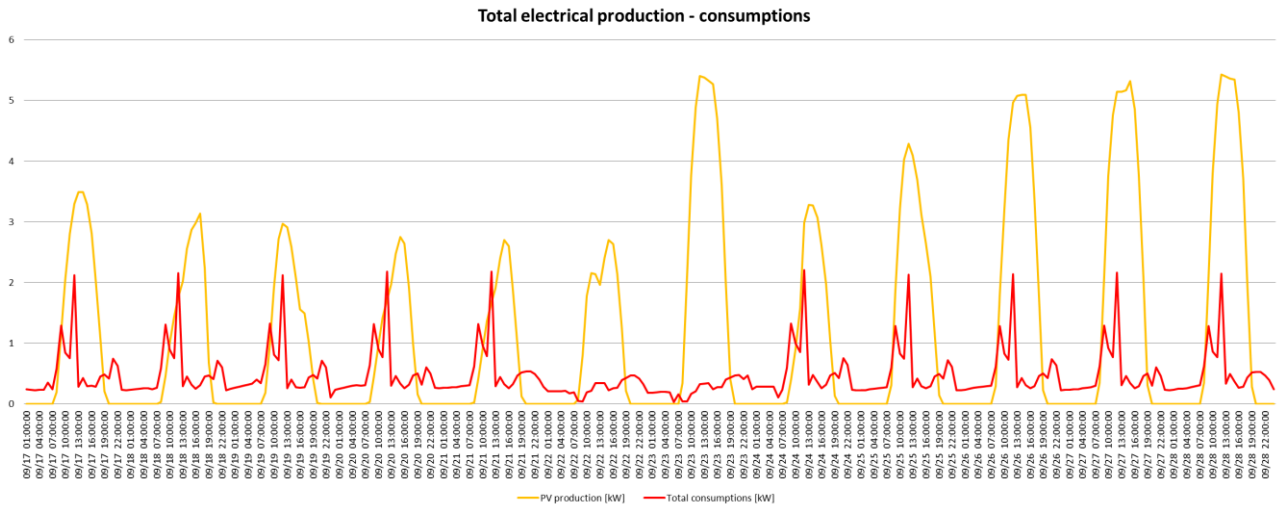
The following graph shows a daily evaluation of the electrical balance during contest weeks including two consecutive days for the passive contest during which the HVAC system will be switched off except for the fan and pumps.



	17/9	18/9	19/9	20/9	21/9	22/9	23/9*	24/9*	25/9*	26/9*	27/9	28/9
PV production** [kWh]	18,40	11,65	15,18	11,31	10,96	13,14	30,02	15,09	22,44	27,78	29,28	30,26
Lighting and appliances electrical demand [kWh]	-6,76	-6,77	-6,76	-6,43	-6,61	-2,79	-2,75	-6,79	-6,77	-6,77	-6,43	-6,62
Auxiliaries Electrical demand [kWh]	-1,98	-1,92	-1,86	-1,97	-1,91	-2,01	-1,89	-1,67	-1,97	-1,96	-1,90	-1,96
Hot Water electrical demand [kWh]	-1,77	-1,77	-1,77	-1,77	-1,77	0,00	0,00	-1,77	-1,77	-1,77	-1,77	-1,77
HVAC tot. electrical demand [kWh]	-1,51	-1,64	-1,92	-2,21	-2,33	-1,59	-1,58	-	-	-1,39	-1,84	-2,00
Daily delta (Production-Demand) [kWh]	6,38	-0,44	2,87	-1,06	-1,65	6,75	23,79	4,86	11,93	15,89	17,35	17,92
Total contest delta (Production-Demand) [kWh]												104,59

During the contest, the MED in Italy house:
• generates 235,51 kWh of electrical energy thanks to the PV generator on the fortnight following the contest compute rule;
• generates 343,79 kWh of electrical energy considering the real production of the PV generator on the fortnight;
• consumes 130,92 kWh for lighting and appliances, HVAC, DHW and auxiliaries demands on the fortnight;
• provides 104,59 kWh to the electrical net, 80% of the contest electrical demand on the fortnight;
• produces a daily average of 8,72 kWh as extra electrical energy to be delivered to the net.
According with the rule 18.4, it comes out that:
• even though the selected climatic data foresee some rainy days, the electricity autonomy results very high, often higher than -1,00 kWh of delta between demand and production;
• with a daily average energy demand of 10,91 kWh during contest and a measurable surface of 56 m², the use of electricity per measurable area reaches a notable value of 0,19.

The following graph shows an hourly trend of electrical generation and consumption during contest weeks. Due to calculation approximations there is not a perfect temporary correspondence but more detailed input data will easily demonstrate a better behaviour of whole systems.



Nevertheless, according to the rule 18.4, during the monitoring period, the temporary correlation between electricity generation and electricity demand (x factor) is often equal to 100%.

Conclusions

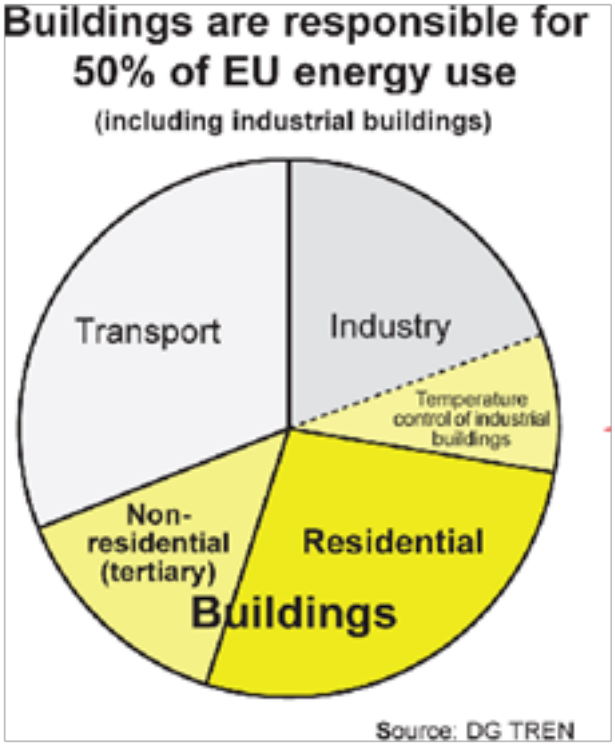
The ratio between envelope surface and conditioned volume is extremely disadvantageous to obtain passive or high energy performance building. Nevertheless all the efforts put in the passive design let the MED in Italy house reach 90 [kWh/m2 year] of primary energy consumption which stands below 120 [kWh/m2 year] limit fixed for a passive house.
This result has been possible by the combination of the mass solution, shading strategy, daylighting and natural ventilation which has led any other choice.
The contest requirements in terms of occupancy stress the house mostly in terms of latent loads. This impacts the sizing of the AHU and of the cooling battery particularly.

Sustainability Brief Report

MED in Italy

Introduction

Buildings are responsible for half of the European energy consumption. Afterward dealing with the reduction of CO2 emission involve sustainable housing, with the aim of minimizing energy needs to reach comfort conditions, and to build a system of production of alternative energy able to feed entirely those needs.
The MED in Italy project focuses then on natural materials, reusable or recyclable components and products. Both, materials and components-products, were chosen assessing the amount of energy required for their production, such as the global quantity of primary energy embodied and global warming potential in all material, component and process included in manufacturing, transportation and building construction.
The complete building function, as well as its components, is part of this vision.



Materials

A special attention has been paid to the sustainability of the house materials, mostly renewable, such as wood (constructive and structural system), hemp (shading, facade finishing and fence walls) and a bioplastic employing as raw material the exhausted olive oil pomace (patio deck).
All the house structure, pillars and foundation, and finishing layers, such as floors and interior walls, are in wood, a renewable resource, harvested from sustainably managed forests. Wood contributes fewer greenhouse gas emissions than non-renewable steel and concrete. To employ wood as building and furniture material allows to store carbon. In particular the wood employed for the foundation belongs to the Rubner's company building waste.
The thermal insulation contributes positively to the CO2 reduction of building sector. Wool wood although the greater quantity of primary energy needed for its production, transport and disposal, helps in reducing carbon emission, because its primary energy is mostly renewable. It is also the only insulating material recyclable, reusable, and lastly compostable, producing heat energy.
Seal air save more than 500 oil liters for every oil liter employed to produce it and is 100% recyclable.
The outdoor flooring employs plastic panels (family polyolefin) from recycled postindustrial and / or post-consumer fiber, filled by vegetables (exhausted olive pomace), giving origin t a 100% recyclable material.
The cladding system is 100% natural, coming from hemp: to cultivate it there is no need for herbicides, it is fast growing, it stifles all other plants serving as a cleansing of the land, it adapts everywhere, allowing the recovery of areas unsuitable for other crop, in the same area produces in three months 4 times the amount of biomass of a forest in years.

Components and products

A special attention has been paid to the sustainability of the house components and products, reusable or recyclable.
A white reflecting solar radiation and heat waterproofing membrane has been selected, in order to reduce summer gain and to employ a component coming from natural source. This allows energy savings and reduce production of CO2 during the building life.
The bathroom furnishings employs a finishing called Cataglaze that creates a smooth and flat surface, eliminating the micro-depressions of ceramics, and not allowing dirt to stick on it anymore, guaranteeing: maximum hygiene, quick and easy cleaning, less use of detergents, less pollution for the environment, perfect smoothness, more brightness, limestone-proof.
The kitchen represents in itself the sustainable philosophy of MED in Italy's: dismantling ease; 100% recyclable and 90% reusable; sole presence of mechanical joints excluding the use of glues and reducing formaldehyde emissions to zero; long technical and aesthetic life, cause could be extremely customized, flat transport, minimal packaging, easy to move, dematerialisation and lightness.
The PV panels lean on a recycled light aluminum structure that provides a fast and easy installation of panels. The MED in Italy project use polycrystalline solar panel with efficiencies of up to 14.7% and high nominal power capacity. In this way they can guarantee optimal usage of space and a high annual output of energy. Even under weak illumination, solar current will still be generated.
The large surface of the photovoltaic field, on one hand allows a high production of electrical energy to operate the climate control systems, for all household appliances as well as for charging the electric car. On the other hand, the photovoltaic field is also the system of protection and shading of the roof, walls and windows of the building and therefore allows large energy savings during the summer period since it prevents overheating of the house.

Building passive behavior

A prevalent passive behavior is the aim of the project, although the HVAC provides the high comfort performances required by the Solar Decathlon Europe' contests. Anyway for a large period of the year the house, thanks to its passive behavior, could well function without switching them on. The passive behavior consists in a mix of past tradition and contemporary solutions, such as for example the insulating thick layer and the heavy mass of the external wall.
The internal comfort control derives from Mediterranean tradition the typological and morphological solutions to manage in a "passive" way the temperature of the inside and of the intermediate areas, courtyards or patios. Mediterranean climate implies some complications for energy efficiency due to a combined necessity of a summer cooling and a winter heating. This duality implies the necessity of a changing functioning to adapt the building to various external dynamic stress.

Building active behavior

Even if the project is aimed to optimize the passive behavior of the building, to maintain the level of comfort desired a climate control system, powered by a heat pump with controlled mechanical ventilation and active heat recovery, is provided.
The indoor climate control is achieved, with the integration of forced ventilation, mainly with radiant ceiling to optimize the functioning of the house in the predominantly Mediterranean hot climates with short mild winters. The use of a large radiant area allows a great exchange surface, that could operate with a very small thermal jump increasing greatly the efficiency of the heat pump.

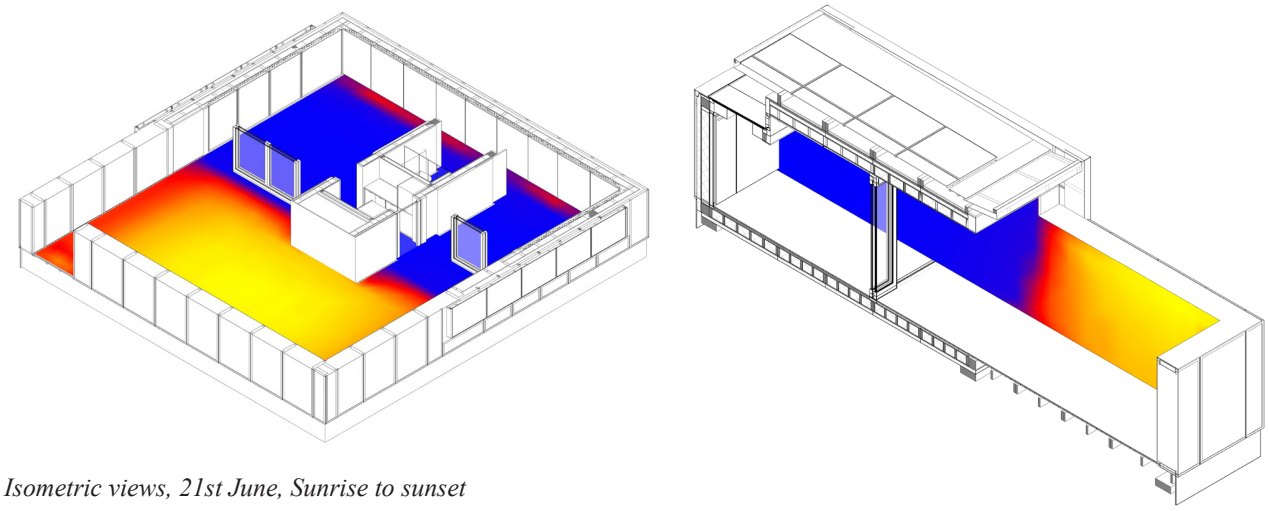
The ventilation relies on an active and dynamic heat recovery to correct peak loads.
The heat pump generates hot and cold fluid. It is customized for small building with little surface and a great performance required.
A monitoring and control system of all the parameters related to hygrothermal and visual comfort allows to optimize energy consumption in every working condition, thus improving the sustainability of the building during its whole period of life. The system is able to modulate his power in order to adapt it to the request of the home automation sensors and optimize the use of energy.
Two thermal buffers of water optimize the energy produced by the photovoltaic field. When the energy produced is not required for domestic function it is stored in two buffer tanks, one for hot and one for cold storage. This thermal energy can be used directly when the climate control system requires it, allowing in this way to save energy of the grid.

Water saving

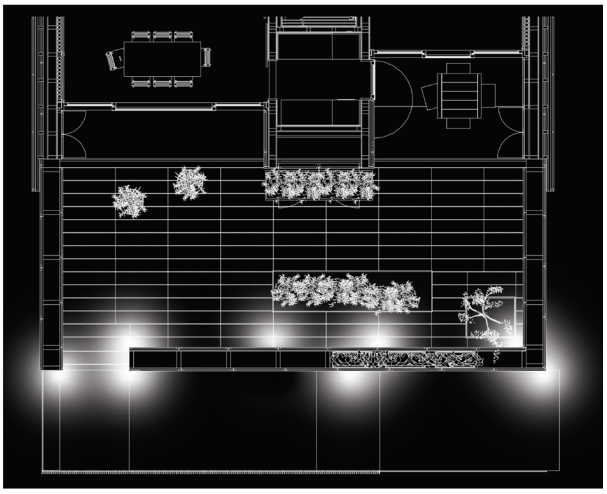
Lack of water characterize many areas of the Mediterranean: to save water is therefore very important in the housing design. MED in Italy provides wastewater treatment and a rainwater reuse, by: diffuser heads for mixer taps and shower head; water reduction system for dishwasher and clothes washer; accurate toilet design and controlled toilet flushing system; special glaze furnishing of the toilet sanitary in order to allow few water to clean them; grey water reuse for watering plants and flushing toilet.

Lighting system

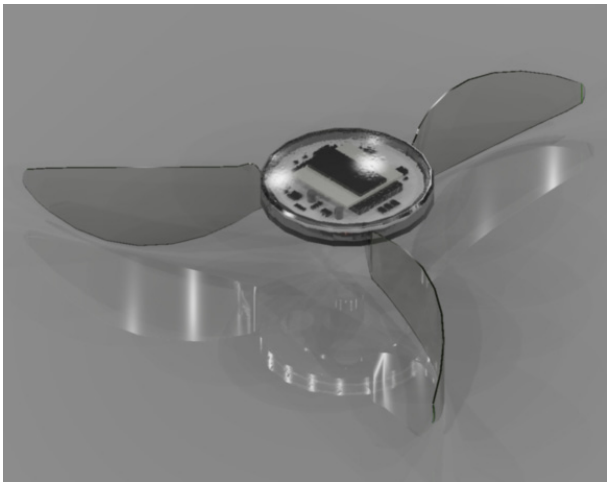
The project is aimed primarily to exploit natural light, positioning all work areas under the skylight or next to the windows. The simulations conducted and evaluation of natural light have driven the design of the building shape and glazing to ensure at every point of the house, all year long, the best lighting conditions in relation to the activities required.
For artificial lighting high efficiency appliances equipped with LED have been provided. The environmental benefits of using LEDs as light source are well known: very low thermal emission; excellent value of luminous efficiency that translates into a saving of energy; extremely long operating life; absence of toxic substances like lead and mercury.
Lighting appliances for the interiors are characterized by the blending between aluminum and ceramic.
Lighting appliances for the outdoors are self sufficient thanks to a small PV panel and a wind turbine.



Isometric views, 21st June, Sunrise to sunset



Night lighting plan



Outdoor self sufficient lamp

Conclusions

We believe that an eco-conscious approach is the only way to face the global warming problems. We point first to the reuse of the component, aiming at designing when possible modular components, easy disassemble, without the glue employ. This approach is in our meaning much important than the recyclable possibility, that anyway needs some energy to be done.
But we believe also that the importance of a so overall experience like the Solar Decathlon where multidisciplinary students are involved belongs not only to the building sector. We try then to introduce a complete overview of the problem in our philosophy, not only including a responsible building approach but also involving many others common lifestyle. Our uniforms employ natural textiles. The furniture designed by the team derive from a nesting process in order to reduce material waste. Our menu try to reduce at maximum exotic products and meat consumption, that can have an important impact on the environment, for the gas emission in atmosphere.

Industrialization and Market Viability Brief Report

MED in Italy

Industrialization and Market Viability Brief Report

The entire world has yet recognized that the earth's ecosystems are currently at a critical stage. They are already severely damaged and human activity currently leads to irreversible losses of fundamental ecosystem functions. The construction sector has the largest single share in global resource use and pollution emission.

Far from being just an economic phenomenon, the construction business reflects and is influenced by variables and trends taking place at multiple levels (demographic, legal, social, cultural, technological, etc.). From a supply side point of view, construction is a business and the main target pursued by operators is to carry on activities in the most effective (meeting pre-fixed targets) and efficient (maximizing profits) way. From a demand side point of view, however, constructions are perceived as something more than the object of a transaction. They are often endowed with meanings and values that go far behind their functional features, being associated by people to a shelter, security, comfort, a place to rest, family.

The Italian construction sector is highly fragmented and mainly constituted by small and micro enterprises. These firms suffer from the common weaknesses that characterize small dimension business: lack of managerial competencies, reluctance to change and innovation, low capitalization and cash flow issues, scarce marketing orientation, low technology adoption. All these features hinder a fast development of a sustainable construction sector, strongly pushed at the institutional level.

At the consumer level, due to the very recent changes provided by the austerity policy implemented by the Government headed by Mario Monti, Italians are modifying their behaviors turning from traditionally "not green" to more conscious behaviors. Pension and labor reforms, increased fiscal pressure – higher VAT, higher excises on gasoline and energy sources, increased land-taxations following the revision of the national cadastral system, etc. have worsened the economic condition of Italian families, spurring them to revise their living habits and expenses. The indirect effect of such changes consists in the spreading of more social and green behaviors aimed at saving money, and consequently preserving the environment.

In such a context, projects aimed at finding housing solutions that are sustainable represent important factors for both improving the environment condition and the standards of living of the population.

Through the competence and creativity of its staff, Med in Italy aims to provide a new concept of sustainable house. A house that is environmentally, economically, and socially sustainable. A house that through technological innovation is able to cope with warm climates, finally meeting the needs of consumers who are sensitive to environmental issues and live in the Southern regions of Europe. Med in Italy does not provide only an ecological house, it proposes a renewed living philosophy inspired by the values of Italianity.
The identification of the key success factors at the basis of our value proposition arises from the consideration of two main issues:

1. The greatest part of sustainable houses is projected and built to maximize comfort and savings of households, as well as minimize environmental impacts of constructions in cold climates. This means that the major part of companies operating in the green building sectors aim to meet the needs of people living in the Central and Northern regions of Europe.

2. The Italian green building sector is dominated by large foreign groups (mainly of a German origin) that established a business unit in our country following an internationalization strategy. These companies, evidently, operate according to their own business philosophy and culture, strong of a long lasting construction tradition in the sustainable building sector developed in their country. At the same time, the Italian companies in the national competitive scenario do not seem to emphasize and sufficiently exploit their location as a strategic lever, rather they use the expertise of the entrepreneur or of the owner family as a differentiation tool.

This given, we identified two key success factors that could boost the competitiveness of the Med in Italy house, working out a positioning that combines both functional and emotional competitive strategies. Such a decision has been made also taking into account that several surveys have pointed out the limited influence that cognitive factors have relative to affective factors on consumer purchasing behavior of green products.

We believe that these two factors could represent powerful differentiating characteristics and would make the Med in Italy value offering unique in the Italian as well as in the international competitive arena.

1. *Fit for warm climates*: The first one relates to a functional characteristic of the house. Thanks to an innovative construction solution, the house can meet the needs of people living in the warmer regions of Europe, characterized by warm winters and hot summers. The innovation consists in the addition to the wall layers, aside from insulation panels, of a void to be filled with local heavy infill materials once the house is assembled. This solution gives a mass value that is triple the value of a normal framed wall, and therefore very close to a traditional masonry wall. At the same time, this also increases the acoustic performance, by solving a problem that is typical of lightweight constructions.

2. *Italianity*: The second refers to the emotional attributes that our house is endowed with. We strongly believe that the "country of origin" of our offering and its embodied values cannot be ignored since they represent a hard to imitate and powerful source of competitive advantage. Italianity refers both to production and to the way the Med in Italy house is conceived. At a production level, it includes creativity of professionals and recovery of ancient materials and building techniques that are deeply rooted to the Italian territory. At the level of house conception, it embodies the characteristics, personality, culture and values typically associated to Italians. They are known for being warm, welcoming people who love to relax, celebrate and socialize with family and friends. Celebration and relaxation usually take place around the table at home, where people enjoy the traditions of the local cuisine. Our house is therefore thought to be a shelter, a place to rest, but also a place to welcome relatives and friends. It is conceived not only as a place where to live, but also a way of living.

These two differentiating traits place the Med in Italy house in a position that has not yet been covered by other competitors, characterized by high levels of considered functional (fit for warm climates) and emotional (italianity) features. In addition to being appealing for end users, such a positioning could be strategically exploited to appeal constructors willing to widen their product lines, entering a new market.

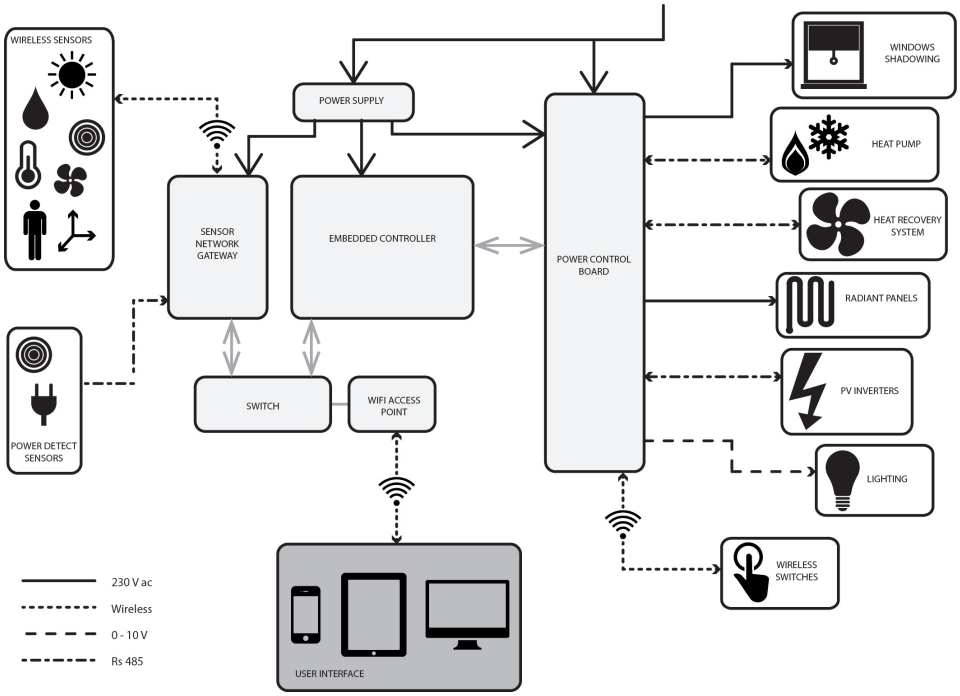
Wall prefabrication at Rubner Haus, Bozen

The role of industrialization in such context is to allow the housing prototypes to be at the same time efficient and highly customizable to the needs and desires of possible households.

In that sense, the house becomes a complex system, able to embody all the values above described. The majority of its structure is prefabricated, and its consistency is tested in the factory before delivery on site. In fact, in this scenario driven by digital models there are no standard components, in terms of final product: every house is different and based on different macro-components. A series of standard material sources is given and then all the rest of the process is customization of those base components through CNC (Computer Numerically Controlled) machining.

Rendering

This builds up a totally new model for prefabrication, commonly defined “mass customization”, that does not require standardization of building components, and therefore and aesthetic of repetition. We studied the fabrication and assembly process of our main sponsor and partner, Rubner Haus AG, and found out how all the houses that they normally produce are entirely modeled digitally before construction, since construction itself happens through files.
And they are all different from each other: walls and slabs can be laid out in infinite configurations and they receive in the digital model all the necessary information for cuts, milling, connections and joints. The digital model is directly the source for fabrication: data are transferred from the offices to the machines of the shop floor, and components are then ready to be assembled into macro-components. Mass Customization, usually referred to industrial design and small products, here gets empowered at the architectural scale. Crucial to this process is therefore an integrated design system, able to link dynamically the generation of construction and performance information with the development of a possible layout for the houses.
We designed a digital structure for the generation of design, engineering and construction information, where different specialists and sources could converge in a centralized “intelligent” 3D model of the house. This allowed us to manage a network of contributions, since know-hows and products coming from our many partners needed translation and combination to be constantly managed in their implications on a house that works as an integrated system, no matter how simple or complex.
A system that keeps on existing even after construction and installation of the house. We designed a network of sensors and a behavior monitoring platform aimed at raise awareness of the households, not just to allow technical management. The house gets integrated to its systems, all digitally managed, and can offer scalable services accordingly.
So innovation on product at this level happens only with an innovation on process: we had to develop a new structure for our design team, in order to manage a new kind of outcome.
The result is the possibility to offer to the market “dwelling products” where all the quality and the emotional impact of a Mediterranean and Italian architecture is fed by its technological generation.



Home automation system

Communication and Social Awareness Brief Report

MED in Italy

Communication and Social Awareness Brief Report

The main purpose of our communication activity has been to give social awareness at different target groups (general public, professionals, young, children, women) around two subjects, inter-related:

1. the Solar Decathlon Competition issues;
2. the highly efficient Mediterranean architecture, starting from our Med in Italy prototype solutions.

The actions aimed at satisfy the first subject started since the early beginning of the project. Giving a social awareness on the Competition in itself in Italy is more important than in other countries because we are the first Italian Team who competes in it and so far in Italy none knew the competition. Now we reached, thanks to the press (20 TV shows, 10 Radio programs, 12 national newspapers, 24 magazines, 150 webpress, and many social networks and websites), a knowledge around these issues.

The most innovating action dealing with this has been the 10 episodes (of 1 hour each) television program, named "La casa che verrà" ("The home that will come"), showing on Leonardo TV channel the design and construction of the 19 self-sufficient buildings presented at the Solar Decathlon 2011. Leonardo is the unique Italian chain on "housing". The show target is professionals, but could touch also a large public because the episodes analyze the technologies and solutions adopted for using natural energy to lower the environmental impacts in an easy and funny way.

"La casa che verrà" TV show

The show has been on air from November to January and from March to May and will be again on air from June to September. The last episode dealt on our Med in Italy prototype, opening the expectation on the next edition of Solar Decathlon in Madrid.

Concerning the second subject, the MED in Italy communication plan was designed on a double track: the vision of the future and the taste of innovation with a smell of Italian history and cultural heritage. The main tool we could manage to promote this double image is the channel offered by mass media, firstly within the most really popular sites of newspapers and magazines. From this perspective, we empowered the press office, the media relations and the media partnership actions, expecting from this choice a relevant coverage of 30 million of potential readers/viewers and 30 million of potential web audience. Just the media partnership activity with Rai Radio2 Caterpillar, Rainews, L'Espresso, Vanity Fair, Focus, Focus Junior, Casaviva and Il Giornale dell'Architettura assured a major visibility, as well as a large interactive participation of the general and the targeted public. To communicate our idea of highly efficient Mediterranean architecture we employ 5 points: 1. **passive**, 2. **active**, 3. **fast**, 4. **eco-conscious**, 5. **dense**.

We involve on that different targets in different ways, often very innovative.

'Green' Public/General Public

- Strong media partnerships chosen within the different segments (Tv, radio, internet, magazines) have enhanced the MED in Italy message through periodical articles, interviews, stories, contests and blogs.

Our media partners, mentioned above, were directly involved and regularly provided with updated and exclusive information in order to outreach the widest audience all over the Country. Inside news and updates are carried out by the National television channel Rainews and the nationwide appreciated green radio program Caterpillar. Il Giornale dell'Architettura, a national magazine specializing in architecture has also featured five articles on MED in Italy until November 2012.

• To promote MED in Italy and support the initiative, the project was published on Eppela, a crowdfunding website to get the necessary funding to launch ideas (www.eppela.com), both a way to find support and a source of visibility through the media and social networks.

Aperitif at Massimo Catalani atelier

• Large public, and women in particular, are involved in voting traditional recipes and natural Mediterranean ingredients proposed by the renewed TV chef Alessandro Borghese, through the website of our media partner Espresso Food & Wine, one of the most popular Italian information weekly magazine. In that way we spread out the Mediterranean way of life, that the house represents: an ending healthy style, the family, the regular three courses meals around the table, taken in long timing. 34.000 on line votes from the large public selected the Mediterranean recipes. The most voted menu enters in the official dinner party menu offered by our team during the Solar Decathlon Europe contest. On July 11th 2012, at the artist Massimo Catalani's atelier in Rome, chef Borghese prepared it for journalists and stakeholders. The menu poll was also hosted on the main Italian information website La Repubblica (over 2million single daily viewers).

• We took part to the section "Smart Cities" of the "Repubblica delle idee", a TED-Style Conference held in Bologna the June 17th 2012 in order to meet the best opinion leaders, institutions, professionals and media to promote our project at the highest level of the society and to sensitize them about sustainable architecture and green innovations. A TED Conference is a live streaming talk to present ideas in the most innovative and engaging way (ideas worth spreading). The speakers are given a maximum of 10' to address an increasingly wide range of topics within the research and practice of science and culture. This is the widest way to touch different targets from young to elderly people dealing with all the 5 points above mentioned.

Professionals

• The focus was addressed on those professionals who are involved in green-building-industry and green energy. Online communication, print brochures, events, trade fairs (3) and scientific conferences (15) and the partnership with the dedicated magazine Il Giornale dell'Architettura were considered.

Educational target

• The Young public was mainly reached by social networks and media coverage. Through magazines, social networks and websites, readers were informed step by step on architectural and living solutions for the MED in Italy's. An important role in visibility was played by the Med in Italy upgraded website, that devoted a large section to the younger public.

• Teenagers (12-19 years), Young People and Creatives (19-25 years) have been reached by a contest organized in collaboration with Casaviva magazine's website. Readers were invited to suggest solutions on specific topics involving architectural and living problems of MED in Italy house. In that way we disseminated the passive and eco-conscious concepts, as saving energy, safety in use of devices, low embodied energy of materials, and so on.

• A contest addressed to children (age 5-11) was organized in collaboration with Focus Junior, the Italian most read monthly Magazine for children. Kids were invited to draw a Mascot for MED in Italy's. Out of 173 drawings the selected winner by the jury was a G-ECKO-LOGICAL, a gecko that becomes the actual mascot leading kids in a fantastic journey into the MED in Italy solar house, edited on the children section of the website and during the kid's tour in the Villa Solar. The drawings could give the basis for defining a tale concerning the environment preservation and the environmental issues, disseminating in a plane way the passive, active and dense concepts.

• To design team uniforms, MED in Italy has involved the Italian Fashion Academy located in Rome. A special class will be promoted for students who willed to create different outfit to be worn in the evening dinner party, the assembly and disassembly phases, the public tour. A jury of stylists voted the most suitable Mediterranean clothing styles for the Solar Decathlon competition in Madrid. In that way students involved in fashion experimented the eco-conscious point, dealing with environmental and technological concepts like the importance of saving fabrics, reducing waste, employing natural textiles, and the active one by looking for high-tech materials that could give extraordinary performances to clothes.

on the left: The contest and the official mascotte
on the right: Woman daily uniform

Media

- Mass media and social media partnership and cooperation were included to spread the Italian innovative approach of MED in Italy. A Media Relations and Partnership Strategy have provided the journalist and people involvement through classic and innovative tools.

• Press office actions:

- *Strong media relations* within the different segments (Tv, radio, internet, magazines) enhanced the message through periodical articles, interviews, stories, contests and blogs: over 50 main media have been involved so far with about 220 publications, including National RAI television (TG1, TG3, TG5, Rainews, Geo & Geo, Ambiente Italia), and RAI radio program Caterpillar, Radio 24, Ecoradio, Radio CittàFutura and UniromaTv have also broadcasted the initiative. Italian newspapers and magazines have covered the event (La Repubblica, Corriere della Sera, Il Sole 24 Ore, La Stampa, Terra, L'Espresso, Wired, Panorama, Modus), as well as the Spanish information media La Razon. All the most visited websites have talked and published images and videos about MED in Italy (Ilsole24ore.it; casa24.it; repubblica.it, lastampa.it; ilgiornale.it; vanityfair.it; famigliacristiana.it; iltempo.it; leiweb.it; ansa.it; dire.it; adnkronos.it; agi.it; terranews.it; architetti.com; blogsfere.it; greenbiz.it; archiportale.com; ecoblog.it; ecoseven.net; architetturaecosostenibile.it). The estimated outreach is 30 million people in Italy.
- A *press conference* was held on April the 11th 2011 to present the MED in Italy project to the media in the Foreign Press Hall, located in Rome. All the main national media attended the event with an outcome of over a hundred articles published throughout newspapers, magazines, websites, radio and TV programs.
- A *media event* was organized on July 11th 2012 with the collaboration of Massimo Catalani, the artist who realized the 10 meter long house fresco. The chef Alessandro Borghese cooked and tested part of the menu chosen on L'Espresso website and website readers. Journalists, sponsor, stakeholders and general public attended the event to taste the Mediterranean menu.

• Online Communication:

- *Med in Italy Site*: The Med in Italy website have provided a friendly interface for the general public and for the main communication target. The site represents the main tool to increase the public participation on the house's building process. A section hosting information about the development of the prototype and the overall project provided fresh news for media and professionals. Children guided by G-ECKO-LOCICAL Mascot learn about the project in a friendly and educational way.
- *Vanity Fair blog*: a regular blog is hosted by the webpages of Vanity Fair, written directly by members of the MED in Italy team. It maintained an open channel with one of the main target of the communication, women aged 25-50, highly educated and interested on environmental issues.
- *Social media (Facebook, Twitter, Google+)*: several moderators suggested issues of general interest on energy saving at home, ecological choice in everyday life such as 'green' kitchen and recipes. The focus was on lifestyle and original environmental solutions that can interest young people. The aims was to involve the internet community in building up new awareness on sustainability.

For the social awareness we combined technology and nature by using vegetal indicators to reach the goals of:

- highlight the presence of pollutants in the air of our cities;
- evaluate the impact these have on living organisms,
- raise awareness among visitors on the need to adopt and promote environmentally sustainable construction principles.

In the communication activity a very important idea is also to give a future to the project. A road show of the house is planned for the end of 2012 and the 2013 in order not only to disseminate the concepts of Med in Italy, but also to give the possibility of feeling it.