BaityKool

by Emma Penot / 2021-03-19 15:20:50 / International / 4325 / EN

Primary energy need :

49 kWhpe/m².year

(Calculation method : RT 2012)

ENERGY CONSUMPTION

Economical building *Building*

< 50	A
51 à 90	B
91 à 150	C
151 à 230	D
231 à 330	E
331 à 450	F
> 450	G

Energy-intensive building

Building Type : Isolated or semi-detached house
Construction Year : 2018
Delivery year : 2018
Address 1 - street : Mohammed bin Rashid Al Maktoum Solar Park Seih Al D DUBAï, United Arab Emirates
Climate zone : [BWk] Mid-latitude Dry Arid (Desert)

Net Floor Area : 78 m²
Construction/refurbishment cost : 600 000 €
Cost/m2 : 7692.31 €/m²

Proposed by :

General informations

BaityKool is a prototype of dwelling which competed for the Solar Decathlon Middle East 2018, in Dubai.This competition gathers many teams composed of students from various universities all over the world. The project aims to design, implement and test a prototype of 80m2 adapted to the Middle-East climate. Our dwelling is designed in "U" shape, with a mineral aspect outside and a vegetal aspect inside.

Solar canopy - Day and night strategy to save energie.
Solar canopy fulfills many proper functions of BaityKool's bioclimatic strategy. Like treetops housing the home, our solar canopy protects our vegetal heart from Dubai's intense direct sunlight. Shade is provided by bi-glasses solar panels, which guarantee enough light to provide a great luminous comfort while reducing heat sensation in the patio. This solar canopy produces our whole electricity thanks to innovative cells whose patterns are optimized to capture and route solar energy as efficiently as possible. These cells are "biomimetic" because they take inspiration from the phenomenon of photosynthesis during which leaves collect energy.

Greywater treatment - wastewater recycling systems.
The water treatment devices developed by our team can be considered as innovative combinations of two patented technologies: Lumbrifiltration and Bio Solar Purification. These systems have never been coupled before.

Green Roof

The filtered water gets to be reused for vegetables and local plants, which are situated on the pergola, on the side walls of the patio and on the roof. Different aspects have been taken into account to choose the right plants. First, we selected local plants as they are the most suitable ones for the climate. Secondly, we chose plants that do not have important water needs as well as succulents for the roof, given their exposure to harsh conditions, while we chose climbing plants that need water for the walls and the pergola. This way they release water in the air and refresh it thus creating a microclimate.

Aquaponic system
In our prototype, filtered water also gets to be reused thanks to the aquaponic module.

Radiative sky Cooling
To provide comfort in our prototype, while acting efficiently and ecologically, we developed the Radiative Sky Cooling system (RSC), our main thermal innovation. By disposing RSC panels on the rooftop, we exploit the celestial vault's cool radiations to refresh the interior part of the building. Indeed, this system is made up of heat exchangers that, exposed to the sky at night, can refresh the circulating water bringing it at a lower temperature that the ambient one. The front surface of these panels, thanks to its great emissivity in long wavelengths, allow us to produce cold water at night in Dubai. Afterwards, the cold captured by our Radiative Sky Cooling panels is diffused inside the dwelling via silent aesthetic radiative panels. The RSC system ensures 25% of the cooling needs of BaityKool.

Hight performance wall
Ultra-high performance fiber concrete is, as its name suggests, an innovative concrete with better efficiency than conventional concrete. Despite a lower thickness, its properties are multiplied, which allows infinite aesthetic options. The peculiarity of these facades is the ease and speed of implementation.

Innovative construction mode
The project was thought to anticipate all phases of its realization. Materials, assembly techniques and the total weight of our shipments meet various requirements such as logistics, energy performances and architecture of our project. Everything is connected.

Versatile unit for urban development
One of the best advantages of our prototype is its ability to adapt to as many functions as we need to create an almost self-sufficient centrality. By creating multi-storey options, while keeping a globally low-rise built environment, we allow more density that not only gives opportunity to more people to live within this community, but it also provides qualitative shaded streets where the inhabitants, as well as the communities' neighbours, can walk, meet and interact. In fact, considering the strong structure of our prototype, we can easily stack it on several levels without the need of renewing structural calculations.

See more details about this project

https://baitykool.com/

Photo credit

baitykool team

Stakeholders

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Aquaponic System

Function : Other consultancy agency

Contracting method

Other methods

Energy

Energy consumption

Primary energy need : 49,00 kWhpe/m^2.year

Primary energy need for standard building : 298,00 kWhpe/m^2.year

Calculation method : RT 2012

CEEB : 0.0004

Breakdown for energy consumption : BaityKool is Net-Zero-Energy NZED-House. In One year we produce 14023 kWh, which is produced at 79% by the solar coverage rate. Energy needs : Heating: 0KWh, Cooling: 14071KWh, Lighting: 572KWh, Ventilation: 610 KWh, Hot water: 366KWh

Envelope performance

Envelope U-Value : 0,32 $W.m^{-2}.K^{-1}$

More information :
The total annual production of the PV system including the PV field on the pergola (mobile roof), the Est façade, the West façade, and the South Façade is 14MWh.
We use UHPC (Ultra Hight Performance fiber Concrete) at the outside surface to protect our prototype while allowing some light to pass through holes to ensure visual comfort during the day, and reduce the use of lightning.
Moreover, a ventilated cavity behind the UHPC panel is planned to cool down the structural wall. On the other hand, raw earth is used from inside to regulate the hygrometry. Insulation are placed in the middle of these two components (UHPC and Raw earth) in order to increase as much as possible the thermal resistance of the structural walls. In addition, all the windows are double glazed to limit the heat gain from the outside during periods of high temperatures.

Real final energy consumption

Final Energy : 49,00 kWhfe/m^2.year

Renewables & systems

Systems

Heating system :

- Heat pump
- Radiant ceiling
- Solar thermal

Hot water system :

- Heat pump
- Solar Thermal

Cooling system :

- Roof-top
- Solar cooling
- Radiant ceiling

Ventilation system :

- Natural ventilation
- Nocturnal Over ventilation
- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic
- Heat pump

Renewable energy production : 100,00 %

Environment

Urban environment

For two years, until 2020, this prototype was kept at the Solar Decathlon. Today we are working on this prototype in order to transfer it to the sustainable city in Dubaï. It will be transferred on june 2020. The goal of this transfert is to make this competition prototype a real habitable laboratory. This living laboratory will receive public and researcher during tree years in order to study the differents concepts of BaityKool and different way of living in hot climat.

Land plot area : 100,00 m^2

Built-up area : 80,00 %

Green space : 20,00

Products

Product

Aquaponic system

Arkituria

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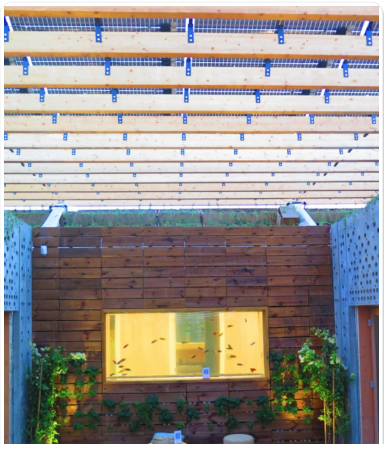
https://www.facebook.com/arkiturria

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '8'

The aquaponic system is conceived in order to be as autonomous as possible. To do so, we designed a module that can be integrated in any building. In our case, the system is composed of a 830L fish tank and an additional tank. Those tanks are separated by 18 ZipGrow towers, an innovative vertical system to grow plants and vegetables. These vertical farms can produce around 300 kg of edible plants per year, thus representing the average green consumption of four people. The whole system, made of the fish tank and the ZipGrow towers, is embedded into the separating wall between the patio area and the corridor.



Costs

Construction and exploitation costs

Global cost : 600 000,00 €

Renewable energy systems cost : 231 000,00 €

Global cost/Dwelling : 60000

Cost of studies : 32 000 €

Total cost of the building : 600 000 €

Subsidies : 510 000 €

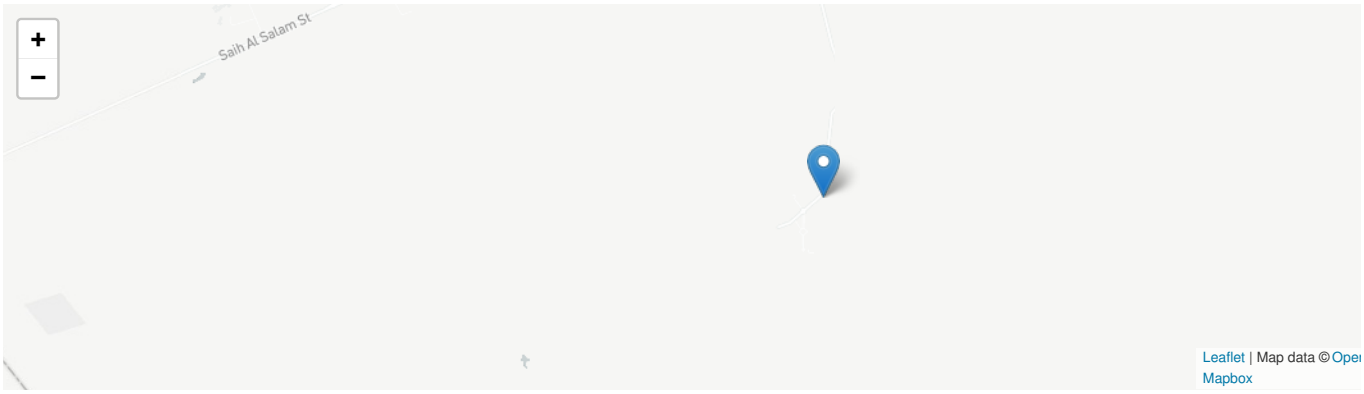
Additional information on costs :
Total First Design Studies (Communication, Travel, Structure) 32000€
Total Major Work: 103600€
Total Inside Arrangement: 31000€
Total Outside Arrangement (Pergola, Terrace, Claustra) 18000€
Total systems: 127400€
Total Communication + Marketing: 10000€

Total Student Team Manpower: 130000€
Total Management: 46000€
Total Project Cost: 600000€

CONTEST

Building candidate in the category

Energy & Hot Climates



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