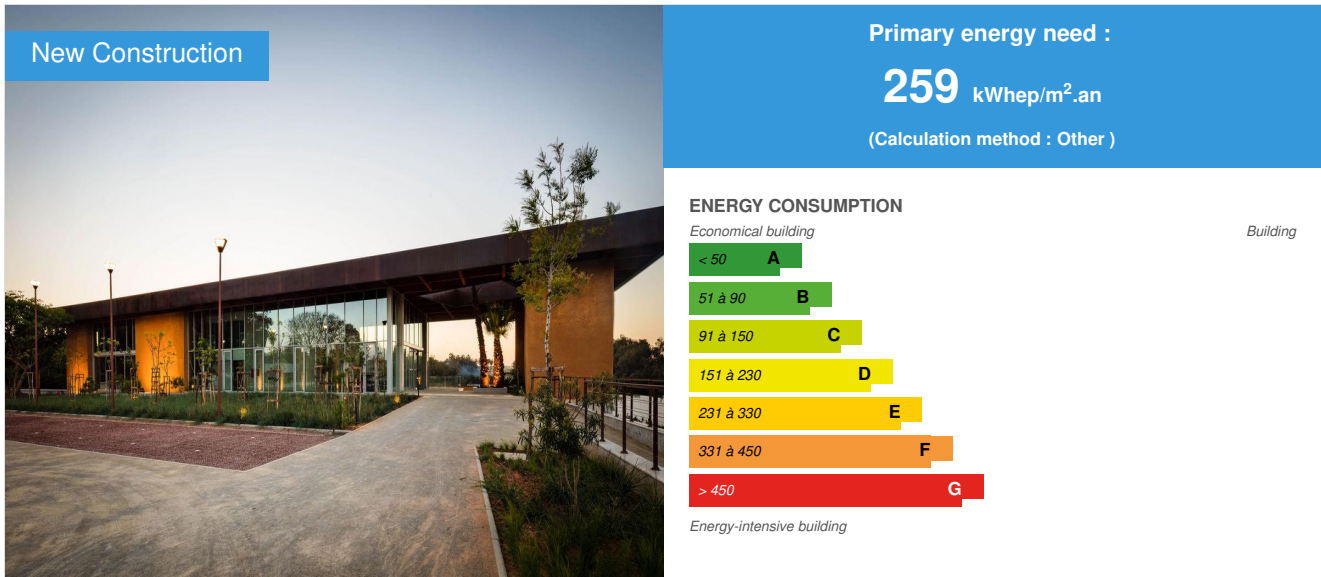


## Environmental Education Center

by Saif Eddine Majdaoui / 2019-06-20 18:03:51 / Maroc / 9180 / FR



**Building Type** : Other building

**Construction Year** : 2016

**Delivery year** : 2018

**Address 1 - street** : km 31 près des jardins exotiques 11000 SALé, Maroc

**Climate zone** : [Csa] Interior Mediterranean - Mild with dry, hot summer.

**Net Floor Area** : 6 000 m<sup>2</sup> Autre type de surface nette

**Construction/refurbishment cost** : 8 000 000 €

**Number of none** : 15 none

**Cost/m2** : 1333.33 €/m<sup>2</sup>

### General information

The Center for Environmental Education, adjoining the exotic gardens of Bouknadel, ... This is an operation initiated by the Mohammed VI Foundation for the Protection of the Environment, designed by Layla SKALI, accompanied on the environmental and development side by Bureau Veritas Morocco Group.

The CEE is an elegant building, contemporary very bright high-end; built in earth, bioclimatic design, made of raw materials assumed, it is at the forefront of technology serving ecology, well-being, comfort of use and health.

Another peculiarity for this project, which shows the evolution of organizational methods, especially thanks to digital. Technologies equip the building: Home automation, display screens of environmental indicators ...

A strong commitment to the environment

Another marker of this project, CEE is the first building testing the feasibility of setting up a Moroccan label for projects located in Morocco. Its architecture illustrates the commitment of the Mohammed VI Foundation for the protection of the environment and its partners in a process of sustainable construction and environmental labeling. The large glazed areas allow to work in natural light the maximum of time. High performance double glazing is equipped with blinds ..... Inside, the structure of the walls built in earth allows the storage of the heat and its slow restitution. The strength of this building is to achieve the objectives of Moroccan environmental labeling with a mostly isolated and efficient envelope, thanks to this combination of the inertia of the earth, the performance of glazing and home automation equipment. At the level of the outdoor gardens, 274 m<sup>2</sup> of photovoltaic panels of 168 modules provide the necessary energy for building operation and all its annexes with a coverage percentage of needs exceeding 90% (low demand) and more than 30 % (high demand). Finally, unlike Moroccan operations, a Wastewater Treatment Plant is installed to completely cover the watering needs of all the gardens and green spaces surrounding the Center.

## Data reliability

Self-declared

## Stakeholders

### Contractor

**Name :** Fondation Mohammed VI pour la protection de l'environnement

**Contact :** KM,3,2 Route de Zaiers, avenue mohammed VI, rue EL MADANI IBN Houssaini RABAT

<https://www.fm6e.org/>

### Construction Manager

**Name :** LAYLA SKALI ARCHITECTE

**Contact :** LAYLA SKALI architecte Rabat, Rabat-Salé-Zemmour-Zaër, Morocco

### Stakeholders

**Function :** Other consultancy agency

BET ETAM-ETUDES

Abdelaziz Lazhari

DESIGN STUDIES

**Function :** Company

OCBM Ouminium de construction de batiment MAGHREB

Route Des Zenatas - R.S. 111 (Cotiere), Casablanca 20100, Maroc

<http://www.ocbm.ma/>

Company in charge of the lot 1 big work waterproofing charm in wood and rammed earth

**Function :** Company

EQUELEC

QUARTIER INDUSTRIEL DOUAR DOUM-LOT18C RABAT-TAKADDOUM

<http://equelec.ma/home/>

strong and weak current, lift, air conditioning, ventilation Plumbing and sanitary -PCI

**Function :** Company

ALIFBEL

LOT JOINERY ALLUMINIULM, WOOD JOINERY, REMOVABLE PANELS

**Function :** Company

GTPM

PLASTER LOT AND PAINT

**Function :** Company

REVPLOMB

LOT COVER FLOOR AND WALL

**Function :** Company

ATELIER VERT

Atelier Vert 3, Rue Rouget de l'Isle Casablanca

<http://www.ateliervert.com/>

LOT PLANTATION AND WATERING

**Function :** Company

GHANI CONSTRUCTION

LOT MENUISERIE METTALIQUES

**Function :** Assistance to the Contracting Authority

Bureau Veritas Maroc

Imm Sigma 4ème étage La Colline 20520, Casablanca

Environmental assistance to the project management

## Owner approach of sustainability

Mohammed VI foundation label for the protection of the environment based on international labels: LEED, HQE, BREEAM

## Architectural description

A zero-loss passive architectural design meeting the targets below:

Eco - Construction: Integrated Choice of Processes and Construction Products / Clean Construction Site

Eco - Management: Energy / Water management, waste activities

Comfort: Hygro-thermal, acoustic, visual and olfactory

Health: Sanitary quality of spaces, air, water.

Expected results:

- Realization of an ecological construction project inspired by Moroccan ancestral know-how in an environmental approach aiming at performance, energy efficiency and sustainability
- Realization of an ecological construction project proposing a strong, functional and evolutionary integrated architecture.
- Realization of an ecological construction project exploiting all renewable energy sources effective for the good operation of the center.
- Obtaining an exemplary and demonstrative architecture, in terms of sustainable development, illustrating itself the ecological purpose. Rational exploitation of natural resources (land, water, air, wind), use of geothermal energy through a Canadian well, optimized water management, natural ventilation, use of wind power for point electricity generation (wind turbines), use of solar energy, solar street lights.

## Energy

### Energy consumption

**Primary energy need :** 259,00 kWh/m<sup>2</sup>.an

**Primary energy need for standard building :** 449,83 kWh/m<sup>2</sup>.an

**Calculation method :** Other

**Final Energy :** 81,99 kWh/m<sup>2</sup>.an

**Breakdown for energy consumption :**

Heating 2042.29 Kwh / year

Cooling 41049 Kwh / year

Interior lighting 38140,84 Kwh / year

ventilation 139 712.05

These data are based on a Dynamic Thermal Simulation study phase design (improved inputs and ambitious assumptions)

**More information :**

the actual consumption differs from the theoretical consumption, we did not perform any dynamic thermal simulation in the execution phase, however we have energy meters communicated to a centralized technical management (see photos), they indicate a consumption (17 MWh) the building is not yet busy regularly, we can share the annual consumption at the end of 2019,

The actual energy production by the installed PV system measured on June 13, 2019 is: 45 MWh in 2421 hours since system startup. (to see the photo)

### Envelope performance

**More information :**

Garden floor retaining wall: A 13 mm Placoplatre, 5 cm high density rock wool accompanied by a 1 cm layer of thermal insulation of mineral wool, 20 cm reinforced concrete covered with an extruded polystyrene insulation of 4 cm => U = 0.571 W / m<sup>2</sup>-K.

Exterior Garden floor: A 13 mm Placoplatre, 5 cm high density rockwool with a 1 cm air gap, covered with 20 cm reinforced concrete => U = 0.616 W / m<sup>2</sup>-K

Wall outside floor: Wall rammed from 80 to 100 cm, the option 80 cm was selected responding to the safeguards of the RTCM => U = 0.665 W / m<sup>2</sup>-K

- Low floor on solid ground: Concrete slab of 15 cm with // Extruded polystyrene thermal insulation of 4 cm U = 0.658 W / m<sup>2</sup>-K

- Intermediate floor: 10 cm polished concrete slab on a DAS 250 // a 60 cm plenum, and a 13 mm acoustic plasterboard U = 0.451 W / m<sup>2</sup>-K

- Roofing: bituminous waterproofing layer // 7 cm high density rock wool insulation // one layer of R12 insulating foam and 3 cm fir decking U = 0.338 W / m<sup>2</sup>-K U < 0.65 W / m<sup>2</sup>-K ✓

- Structural partition: 16 cm reinforced concrete  $U = 2,490 \text{ W / m}^2\text{-K}$
- Non-structural partition Garden level (classroom separation): Two layers of 26 mm plasterboard separated by rockwool insulation in 5 cm rigid panel  $U = 0.653 \text{ W / m}^2\text{-K}$
- Current non-structural partition: Two plaster plaster of 15 mm on a brick terracotta 6 holes of 7 cm.  $U = 1.630 \text{ W / m}^2\text{-K}$
- Glass partition: Simple glazing Stadio extra clear with aluminum joinery without thermal break.  $U = 5.788 \text{ W / m}^2\text{-K}$
- Curtain wall double glazing argon filling with aluminum joinery with thermal break:  $U = 1,4 * 0,95 + 4,719 * 0,05$ ,  $U_w = 1,396 \text{ W / m}^2\text{-K}$ ,  $U < 3,30 \text{ W / m}^2\text{-K}$  ✓ and  $FS = 0.34$

## Real final energy consumption

Real final energy consumption/m<sup>2</sup> : 20,00 kWh/m<sup>2</sup>.an

Year of the real energy consumption : 2 019

## Renewables & systems

### Systems

Heating system :

- Heat pump

Hot water system :

- No domestic hot water system

Cooling system :

- Reversible heat pump
- Roof-top

Ventilation system :

- Nocturnal ventilation

Renewable systems :

- Solar photovoltaic

Renewable energy production : 50,00 %

Other information on HVAC :

- TRAN chilled water pump with a net COP of 2.22 and an EER of 3.31 (cold power of 70.4 Kw and hot of 52.5 Kw)

- TROX brand air handling unit certified EUROVENT

Monocrystalline panels (LG MONO X 300)

Capacity of the PV station 50 Kwhp

GHG or CO<sub>2</sub> avoided is 205 Kg / day

Average production of 274 Kwh / Day

Solutions enhancing nature free gains :

A large photovoltaic field

### Smart Building

BMS :

Centralized Technical Management, a monitoring system

## Environment

### GHG emissions

GHG before use : 178,71 KgCO<sub>2</sub>/m<sup>2</sup>

Dynamic Thermal Simulation that gives the Ef consumption in Kwh / m<sup>2</sup> and a conversion to KgCO<sub>2</sub> using the "CO<sub>2</sub> equivalent" gas emission factors of the electricity consumption in each country proposed in the table below are

### Comfort

Health & comfort :

ODAMAT paint (ODASSIA): Ecolabel certified Interior and exterior paints and varnishes Indoor and outdoor paints and varnishes

Ecolabels certificates are available

**Calculated thermal comfort :** Nous avons calculer les températures de l'air, Température radiante et opérative, ainsi que les heures d'inconfort et le d'humidité relative pour chaque type d'espaces, les calculs ont générés par pas d'une heure (sur une année = 8762 HEURES) : Pour les

**Acoustic comfort :**

Double acoustic partitions PREGYPLAC DECO BA13 (type D72, thickness 48 mm) with insulation with a sound reduction index of 43 dB.

compact panels of Natural Mineral Wool Ultracoustic P, KNAUF

LAFARGE ACOUSTIK Continuous Ceilings (BD): high density fibreboard

with perforations. An absorbent veil that improves acoustic absorption and also serves to filter the particles is laminated plates.

## Products

### Product

5000W air handling unit

TROX / TKM50HE

**Product category :** Génie climatique, électricité / Ventilation, rafraîchissement

This recognized brand product has been accepted due to its performance, in addition to night ventilation to minimize the operation of the latter.

LG MONOX 300

LG

**Product category :**

Among the best photovoltaic systems

This product has been recommended by the MOE, validated by the AMO environment and Appreciated by the whole team after installation is put into use.

## Costs

### Urban environment

The project site is on the national road km 31 near exotic gardens.

## Building Environmental Quality

### Building Environmental Quality

- Building flexibility
- works (including waste management)
- acoustics
- comfort (visual, olfactive, thermal)
- waste management (related to activity)
- energy efficiency
- renewable energies
- products and materials

## Contest

### Reasons for participating in the competition(s)

Mastery and optimization of solar gains







Over-night ventilation to avoid air conditioning  
Organic gardens and vegetable garden

Phyto-purification of water / Filtering and treatment with plants,

Rainwater harvesting for watering

permeabilization of soils  
A large photovoltaic field with real output that exceeds 30% of energy needs.

### Building candidate in the category

  
  
**Energie & Climats Chauds**  
  
**Santé & Confort**  
  
**Prix du public**