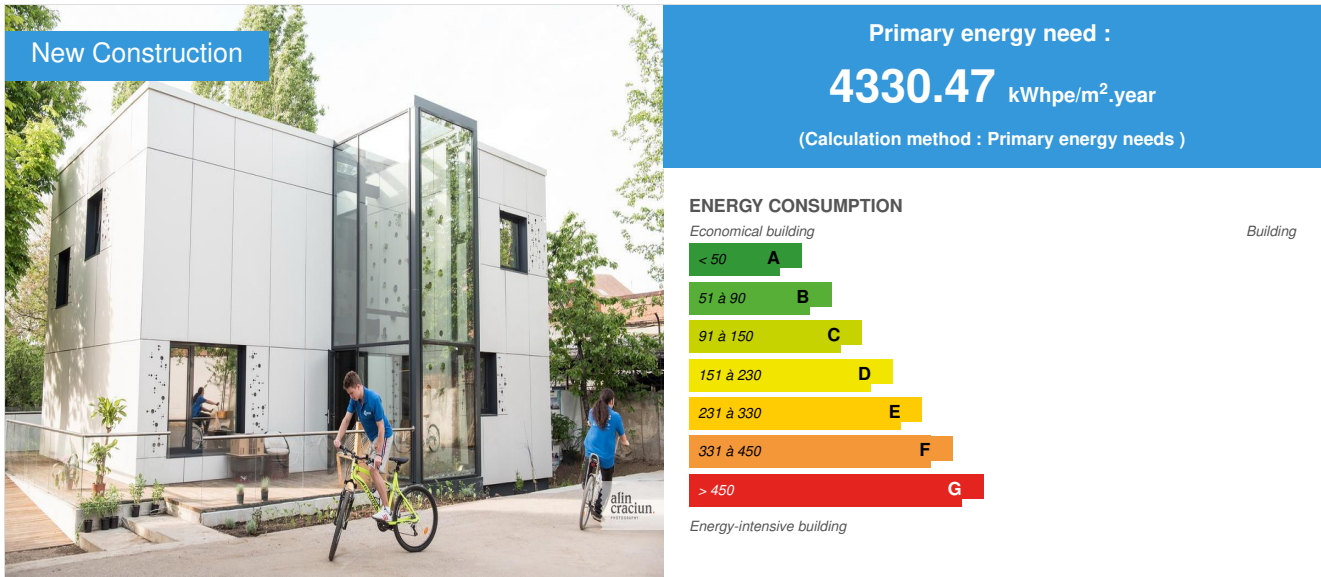


## EFdeN 4C

by [Alexandra Tatar](#) / 2016-06-25 20:38:32 / International / 10146 / EN



**Building Type** : Isolated or semi-detached house  
**Construction Year** : 2015  
**Delivery year** : 2015  
**Address 1 - street** : 66 Pache Protopopescu Boulevard 021414 BUCHAREST, Romania  
**Climate zone** : [Dfb] Humid Continental Mild Summer, Wet All Year

**Net Floor Area** : 130 m<sup>2</sup> Useful area (ro)  
**Construction/refurbishment cost** : 174 483 €  
**Cost/m2** : 1342.18 €/m<sup>2</sup>

Proposed by :



### General information

We are over 30 young and passionate students, from fields ranging from architecture, engineering, communication or management, and together we form the EFdeN team.

In 2014 we represented Romania in the final for Solar Decathlon Europe in France, alongside 19 teams from 16 countries and 4 continents. We attended 10 interdisciplinary events, from architecture to engineering, innovation and communication.

We designed and built an extraordinary safe and comfortable solar house, energetically efficient. The house is automatized, being 100% electrical, without monthly bills and environment-friendly. After many hours of work and dedication, the house became Romania's First Center of Research for Comfort Conditions - EFdeN 4C.

[See more details about this project](#)

<http://efden.org/>

### Stakeholders

Function : Investor

Romstal

+40 21 332 09 01, +40 21 332 09 02

<http://www.romstal.ro/>

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Function : Investor

Saint Gobain

+40 21 207 57 00

<http://www.saint-gobain.ro/>

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Function : Investor

Transelectrica

+40 21 303 56 11

<http://www.transelectrica.ro/>

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Function : Investor

UXF

+40 31 432 87 36

<http://umbrellafx.com/>

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Function : Investor

Transgaz

+40 26 980 33 33

<http://www.new.transgaz.ro/>

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Function : Investor

Engie

+40 21 9281

<http://www.gdfsuez.ro>

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### Contracting method

Public Private Partnership

### If you had to do it again?

We participated with this house in the Solar Decathlon competition, in the 2014 edition. Because we had to transport the house to France and back, to Versailles, it had to respect a modular model. Based on this modular design, our permeability simulations didn't match with the real tests. That's why, next time, we hope to manage a more compact model, with as few joints as possible.

Also, the facade is made from 3mm ceramic plaques. During the construction stage, we discovered it is very breakable and thin, some of them being ruined either by transportation, either by bad handling.

### Building users opinion

Our prototype is open for the public every Thursday and Sunday, and during special occasions, such as "Museum Nights" or during important visits. People were overjoyed by the concept of "The Futuristic House" and some even traveled from other countries to visit and see the new technologies and innovations. Also, some of our colleagues did an experiment, sleeping in the house for three days. The feedback was positive, the ability to control the lights and the heat coming in handy, as well as the modular design, describing the house "comfortable" and "feeling like a true residence".

## Energy consumption

Primary energy need : 4 330,47 kWhpe/m<sup>2</sup>.year

Primary energy need for standard building : 268,00 kWhpe/m<sup>2</sup>.year

Calculation method : Primary energy needs

CEEB : -0.0233

Breakdown for energy consumption : Heating - 10% / 3.37 kWh FE/m<sup>2</sup>/year

Cooling - 11% / 3.58 kWh FE/m<sup>2</sup>/year

Ventilation - 13% / 4.30 kWh FE/m<sup>2</sup>/year

Domestic hot water - 19% / 6.16 kWh FE/m<sup>2</sup>/year

Lighting - 16% / 5.18 kWh FE/m<sup>2</sup>/year

Appliances & devices - 31% / 10.12 kWh FE/m<sup>2</sup>/year

## Envelope performance

Envelope U-Value : 0,30 W.m<sup>-2</sup>.K<sup>-1</sup>

More information :

Walls area (m<sup>2</sup>) (W/m<sup>2</sup>K) 246 / 0.129

Floor area (m<sup>2</sup>) (W/m<sup>2</sup>K) 132.5 / 0.124

Roof area (m<sup>2</sup>) (W/m<sup>2</sup>K) 90.77 / 0.121

Glazing area (m<sup>2</sup>) Triple glazed:45.18 / 0.8

Double glazed:42.4 / 1

Indicator : EN 13829 - n50 » (en 1/h-1)

Air Tightness Value : 0,87

## More information

A one-year monitoring interval will start soon, with our Living Building Challenge application. At this time no corrective actions have been done.

## Real final energy consumption

Final Energy : 32,68 kWhfe/m<sup>2</sup>.year

Real final energy consumption/m<sup>2</sup> : 4 331,75 kWhfe/m<sup>2</sup>.year

Real final energy consumption/functional unit : 4 331,75 kWhfe/m<sup>2</sup>.year

Year of the real energy consumption : 2 015

## Renewables & systems

### Systems

Heating system :

- Boiler fuel
- Heat pump
- Combined Heat and Power
- Others
- Electric heater
- Radiant ceiling
- VAV System
- Others
- Solar thermal

Hot water system :

- Individual electric boiler
- Boiler fuel
- Heat pump
- Solar Thermal
- Other hot water system

Cooling system :

- Radiant ceiling
- Chilled Beam

Ventilation system :

- Natural ventilation
- Double flow heat exchanger

#### Renewable systems :

- Solar photovoltaic
- Solar Thermal
- Energy recovery from waste
- Heat pump

Renewable energy production : 43,00 %

#### Other information on HVAC :

The majority of the materials and equipments used in the HVAC system can be reused or recycled in high percent. Most of them contain materials like copper, steel, aluminum and brass known for their recyclable and reusable properties.

Overall, the percentage of reuse and recycle of the HVAC system is 95%. The toxic substance that is found in the HVAC system is the refrigerant used by the heat pump, specifically the R407C. The refrigerant is contained in a closed circuit, in the outside of the heat pump, so the eventual risk probability is very low.

We also have photovoltaic panels, solar panels and heat pumps.

#### Solutions enhancing nature free gains :

We use buffer zones, thermic table, shadowing system, ceramic facade, PCMs (Phase Changing Material) and the photovoltaic panels, that cover the terasse and hide it from sunlight.

## Smart Building

#### BMS :

We use the BMS system in order to keep parameters of thermal comfort and indoor air quality values within the maximum admissible limits. In order to obtain the desired effect we monitor the exterior parameters of temperature, solar radiation humidity and

## Environment

### Urban environment

At the moment, the EFdeN prototype is situated in the yard of the Faculty of Installations in Bucharest, in a central, easily accessible area. Being a research center, the location is perfect for the pertaining students, who can come and study the equipment and the houses' effect on the environment.

Still, the house was designed as part of a residential complex, its purpose being to revitalize the old industrial neighborhoods, the disaffected spaces, known as "brown-fields", of Bucharest.

Land plot area : 181,55 m<sup>2</sup>

Built-up area : 50,56 %

Green space : 415,00

## Products

### Product

Blu Mohito

Arta Gradinilor

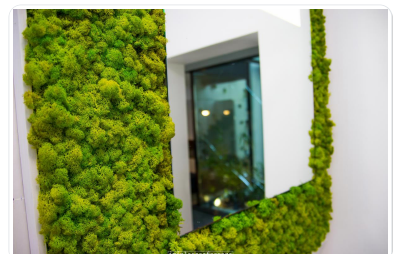
+40 721 202 053; +40 743 605 158

<https://www.artagradinilor.ro/>

Product category : Finishing work / paints, mural, wallcoverings

It is a natural moss that is called Blue Mohito. It has not only aesthetic but also functional properties, absorbing moisture and gradually releasing it.

The moss was chosen for its functional purposes. Also, it helped our goal of increasing the green space per capita, integrating nature in the EFdeN house.



Aspera Fenix Nanotechnology

Atipic

+40 21 253 15 79

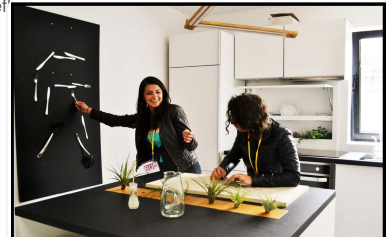
<http://www.atipic.ro>

Product category :

The external surface of Aspera Fenix Nanotechnology involves the use of nanotechnology and it is characterized by next generation acrylic resins, hardened and

fixed with Electron Beam Curing process, opening up new avenues in the field of interior design. With low light reflection, fingerprint and features a very pleasant soft touch. Thanks to the use of nanotechnologies, Aspera Fenix Nanotechnology thermally heals any superficial micro-scratches, as its name indicates.

This material, with its power to regenerate, was greatly accepted and embraced by our members and our stakeholders. Being easily cleanable and its scratches self-healing, it respects our goal of reducing unnecessary household items in the EFdeN house.



## Costs

### Construction and exploitation costs

Global cost : 200 329,12 €

Reference global cost : 174 482,98 €

Renewable energy systems cost : 11 360,70 €

Global cost/Dwelling : 200329.12

Reference global cost/Dwelling : 174482.98

Total cost of the building : 174 483 €

## Health and comfort

### Water management

Consumption from water network : -117,17 m<sup>3</sup>

Consumption of harvested rainwater : 41 760,00 m<sup>3</sup>

Water Self Sufficiency Index : 1

Water Consumption/m<sup>2</sup> : -0.9

Water Consumption/Dwelling : -117.17

For Bucharest, the local rainfall collected from our house in one year is calculated as follows:

Q- quantity of rainwater, 580 [L/sqm/year]

S - collecting surface, 80 [sqm]

cf- material coefficient, 0.9

VrB = Q x S x cf [L/year]

VrB= 41760 L/year

### Comfort

Calculated indoor CO<sub>2</sub> concentration :

<720ppm

Measured indoor CO<sub>2</sub> concentration :

0.04%

Calculated thermal comfort : Summer - 12.01% Winter - 13.17%

Measured thermal comfort : 26 degrees Celcius in the Summer, 20 - 22 degrees Celcius in the Winter

Acoustic comfort :

## Carbon

### GHG emissions

GHG in use : -5 781,60 KgCO<sub>2</sub>/m<sup>2</sup>/year

Methodology used :

Romanian methodology

GHG before use : 41 850,00 KgCO<sub>2</sub> /m<sup>2</sup>

Building lifetime : 50,00 year(s)

, ie xx in use years : -7.24

## Contest

## Reasons for participating in the competition(s)

We wish to participate in the "Energy and temperate climates" category, because our house, EFdeN 4C is placed in Romania, a country located in a temperate climate, where a winter heating is required.

The "Low Carbon" category is also appropriate for our prototype. We integrated vegetation and biodiversity, such as open spaces, roofs & green walls, urban agriculture, etc.

We can apply to the "Smart building" category as well, because EFdeN 4C has intelligent systems that are used efficiently.

Our house combines all the elements that create the perfect intelligent, sustainable house, so we checked the "Sustainable Construction Grand Prize" category as well.

## Building candidate in the category



Energy & Temperate Climates



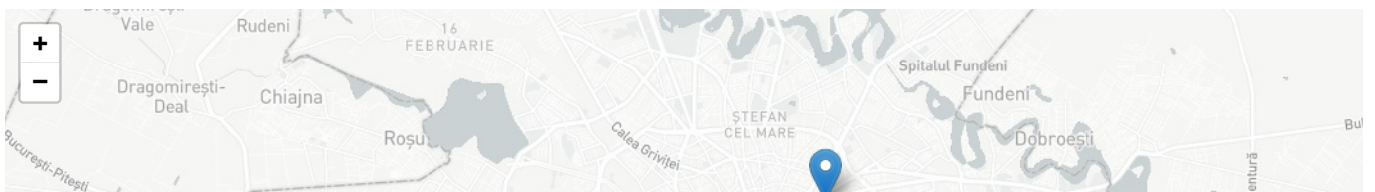
Low Carbon

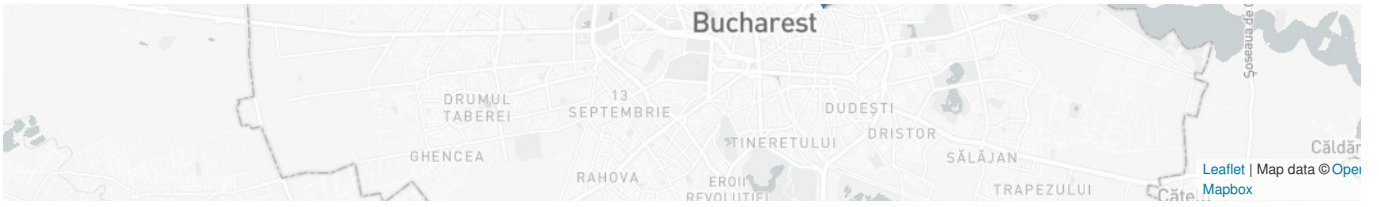


Smart building



Users' Choice Award





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