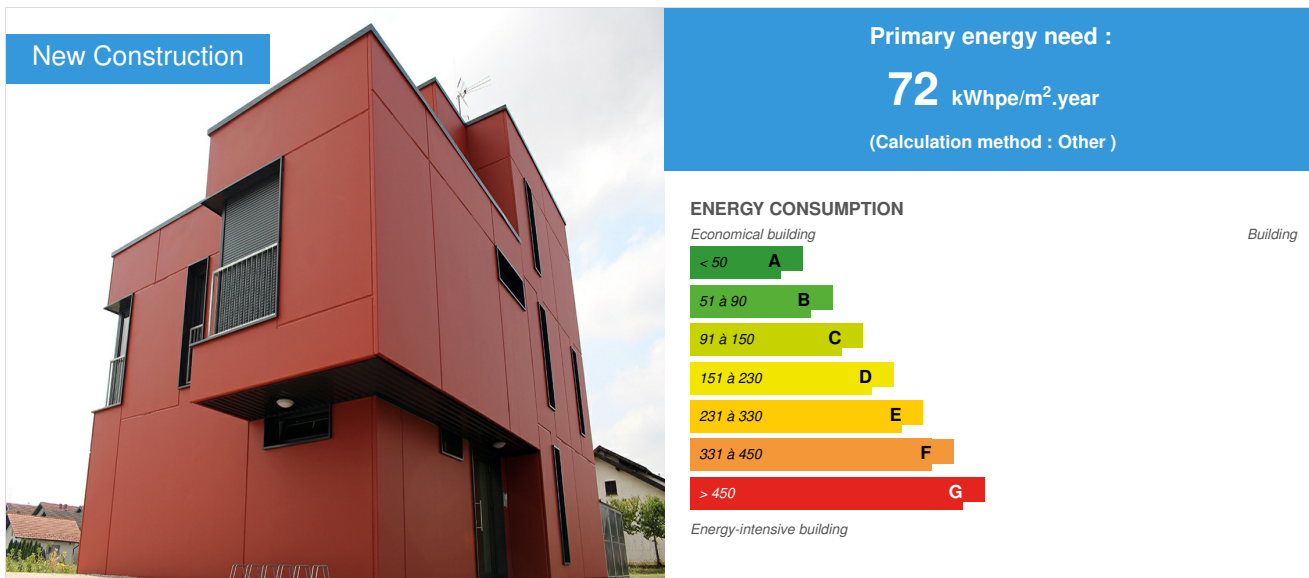


## The First ECO-SANDWICH House

by Mark Miscevic / 2017-06-10 17:18:36 / International / 11091 / EN



**Building Type** : Collective housing < 50m  
**Construction Year** : 2016  
**Delivery year** : 2016  
**Address 1 - street** : 48000 KOPRIVNICA, Croatia  
**Climate zone** : [Csa] Interior Mediterranean - Mild with dry, hot summer.

**Net Floor Area** : 393 m<sup>2</sup>  
**Construction/refurbishment cost** : 313 661 €  
**Cost/m<sup>2</sup>** : 798.12 €/m<sup>2</sup>

### General information

The First ECO-SANDWICH® House is a unique example of a holistic and innovative approach to sustainable architecture. The house is the first of twelve planned passive house energy standard multi-family houses in the green area of City of Koprivnica in Croatia, within the program of social housing. The First ECO-SANDWICH® House is also the World's first application of ECO-SANDWICH® wall system.

ECO-SANDWICH® wall system was developed as a result of cooperation between Croatian scientific institutions (Faculty of Civil Engineering and Faculty of Architecture, University of Zagreb) and industry. It is a ventilated prefabricated wall panel that utilizes recycled construction and demolition waste (CDW) and mineral wool produced using innovative and sustainable Ecosse® technology.

ECO-SANDWICH® tackles four major environmental problems. It reduces greenhouse gas emission by energy efficiency of buildings, it reduces energy consumption in building sector, it increases resource efficiency through the use of construction and demolition waste (50% of total aggregates is obtained from recycled aggregate) and it minimizes the use of regulated chemicals like phenol and formaldehyde from the insulation material production process.

The research in the field of concrete technology shows that recycled aggregate can be used as a satisfactory substitute for aggregate from natural resources. Thermal transmittance of the concrete with recycled aggregate is 36% lower than the thermal transmittance of the concrete with natural aggregate. Additionally, thermal transmittance of the concrete with recycled bricks is 45% lower than the thermal transmittance of the concrete with natural aggregate. This adds a great value to material that is currently used for backfilling operation or is rejected at the landfills.

A newly developed mineral wool made using Ecosse® Technology is manufactured from abundant recycled and naturally occurring materials. The technology is free of formaldehyde, phenols, pentanes, butanes and acrylics.

The first application of ECO-SANDWICH® system was realized as a donation of the European Union project to the investor, the City of Koprivnica Social Housing

Agency, which supported the ECO-SANDWICH<sup>®</sup> project from the very beginning. The project was realized thanks to the first implementation of sustainable, innovative, green public procurement as a model of financing in Croatia.

The first ECO-SANDWICH<sup>®</sup>House is a brand new residential type within the Social housing program in Croatia. It is a multi-family house with three different apartments, each having its own garden equipped with electrical and water supply. The house is designed as a passive solar house which is closed on the North to limit energy loss and open on the South to utilize solar radiation. All apartments are equipped with heat recovery ventilation systems.

The project itself and realization of the house explored the possibilities of applying the ECO-SANDWICH<sup>®</sup> system. Therefore, the building has a complex shape, with cantilevers, corner windows, loggia, balconies, etc., to solve as much details as possible and to create a catalog of solutions for future applications. It has been proven that the concept of a passive house, even with the application of a prefabricated façade system, does not necessary have to generate simple and boring architecture.

## Stakeholders

### Stakeholders

**Function :** Investor

City of Koprivnica Social Housing Agency

<https://apos-koprivnica.hr/>

**Function :** Designer

Ljubomir Mišćević, University of Zagreb, Faculty of Architecture, Institute for Architecture

miscevic@arhitekt.hr, mmiscevic@arhitekt.hr

Architect

**Function :** Others

Tea Beličev, Mark Mišćević

Lead Architect

**Function :** Structures calculist

Mladen Meštrović

Structural Engineering

**Function :** Company

Ivan Cetinić

Mechanical installations, plumbing and drainage

**Function :** Other consultancy agency

Stipe Mihotić

Electrical Engineering

**Function :** Others

Beton Lučko d.o.o., Leo Gavrić

Facade design

**Function :** Contractor

Teh-Gradnja d.o.o.

Main Contractor

## Energy

### Energy consumption

Primary energy need : 72,00 kWhpe/m<sup>2</sup>.year

Primary energy need for standard building : 120,00 kWhpe/m<sup>2</sup>.year

Calculation method : Other

CEEB : 0.0002

## Envelope performance

Envelope U-Value : 0,16 W.m<sup>-2</sup>.K<sup>-1</sup>

### More information :

Compared to the solutions prevalent on the market, the ECO-SANDWICH® wall system has favourable market characteristics both in terms of life-cycle cost and performance, retaining at the same time a substantially lower environmental impact than the competing products with the same insulation thickness.

The embodied energy of the ECO-SANDWICH® is 33.8% lower than that of lightweight composite insulation panels such as those made of aluminium or galvanized sheets and polyurethane insulation.

Moreover, the ECO-SANDWICH® wall system has greater thermal mass. This optimizes the benefits of solar gain, reducing the need for heating energy by 2-15% and also smoothes out fluctuations in internal temperature thus reducing daytime air-conditioning requirements by up to 50%.

The ECO-SANDWICH is both reusable and fully recyclable.

By using recycled CDW in combination with mineral wool ECO-SANDWICH® constitutes an innovative product whose embodied energy payback time is 22 months due to savings during exploitation.

The ECO-SANDWICH® prefabricated wall panels have a high durability, low operating costs, and provide a number of advantages over competitive products. Panels are economical and enable rapid construction with high aesthetic values. The ECO-SANDWICH® wall panels are both reuseable and fully recyclable.

The ECO-SANDWICH® has a vast potential to substantially improve energy performance of the deteriorating building stock thus facilitating a move towards reaching the EU's 20-20-20 goals by 2020, creating new business opportunities and fostering a more innovative and competitive economy.

The present condition of the existing building stock in Croatia and replication market is deeply unsatisfactory. Most buildings are 'sub-standard' in terms of energy efficiency, comfort and health. The largest share of energy consumption in buildings is used for space heating and more than 83 % of buildings consume from 150 to 200 kWh/m<sup>2</sup>/a of energy for heating. In EU 27 buildings consume around 40 % of energy needs and account for 36 % of EU's CO<sub>2</sub> emissions. Therefore, these countries present an ideal market for the application of a durable, energy efficient and sustainable ECO-SANDWICH® wall system.

Thermal transmittance of the concrete with recycled aggregate is 36% lower than the thermal transmittance of the concrete with natural aggregate. Also thermal transmittance of the concrete with recycled bricks is 45% lower than than the thermal transmittance of the concrete with natural aggregate.

A newly developed mineral wool manufactured using Ecosse® Technology is used as a thermal insulation material. The ECOSE® based mineral wool provides significant environmental advantages. It is manufactured from abundant recycled (glass bottles, plate glass, internal waste; up to 85% of total content of resources) and naturally (silica) occurring materials. According to BRE Green Guide-a (BREEAM system), the technology is free from formaldehyde, phenols, pentanes, butanes and acrylics. It has lower embodied energy than traditional oil based binders (reduced up to 70%) and it improves the overall sustainability of buildings and it has no artificial colours or dyes.

Building Compactness Coefficient : 0,77

Indicator : n50

Air Tightness Value : 0,50

## Renewables & systems

### Systems

#### Heating system :

- Condensing gas boiler
- Others

#### Hot water system :

- Condensing gas boiler

#### Cooling system :

- No cooling system

#### Ventilation system :

- Double flow

#### Renewable systems :

- No renewable energy systems

## Environment

## Urban environment

Placed in a Green Quartier of City of Koprivnica. City of Koprivnica has won the European energy week award – ManagEnergy Local Energy ActionAward for project "Novo lice Koprivnice" and has also been placed in the top five in one more category. This is an ambitious project of local authority whose goal is to create sustainable, energy efficient and economically oriented City through cooperation of all city's public institutions and companies.

In Green Quartier there are 3 multi-family passive houses with 28 apartments within social housing program in Croatia.

This multi-family apartment buildings were planned and constructed to meet the requirements for a Class A energy performance with less than 15 kWh/m<sup>2</sup>/year for heating. They are comprised of 28 apartments distributed between three floors. The walls have been insulated with 20 cm thick stone wool, the roof with 30 cm extruded polystyrene (XPS). The windows are triple-glazed. Heating and cooling are provided by an underfloor system connected to a reversible heat pump and a gas boiler. A ventilation system with a high recuperation factor ensures good indoor air quality. The domestic hot water (DHW) is generated by solar thermal collectors used in combination with the gas boiler. The total final energy includes heating, hot water, cooling, ventilation and lighting and amounts to 66 kWh/m<sup>2</sup>.year, which is 78% lower than the national building energy performance requirements. Twenty two percent (22%) of the final energy is provided by the solar thermal collectors. The most impressive result of the project is that the building was constructed without having any superior cost difference when compared to that of a regular building which fulfills national requirements. The total costs amounted to 912 €/m<sup>2</sup>.

4 more big multi-family houses (around 28 apartments), and 11 more small multi-family houses (3 apartments, house type as The First ECO-SANDWICH house) are planned to be build in Green Quartier.

## Products

### Product

ECO-SANDWICH

Beton Lučko

info@betonlucko.hr

<http://www.eco-sandwich.hr>

**Product category :** Gros œuvre / Structure, maçonnerie, façade

ECO-SANDWICH® wall system was developed as a result of cooperation between Croatian scientific institutions (Faculty of Civil Engineering and Faculty of Architecture, University of Zagreb) and industry. It is a ventilated prefabricated wall panel that utilizes recycled construction and demolition waste (CDW) and mineral wool produced using innovative and sustainable Ecosse® technology.

ECO-SANDWICH® tackles four major environmental problems. It reduces greenhouse gas emission by energy efficiency of buildings, it reduces energy consumption in building sector, it increases resource efficiency through the use of construction and demolition waste (50% of total aggregates is obtained from recycled aggregate) and it minimizes the use of regulated chemicals like phenol and formaldehyde from the insulation material production process. The research in the field of concrete technology shows that recycled aggregate can be used as a satisfactory substitute for aggregate from natural resources. Thermal transmittance of the concrete with recycled aggregate is 36% lower than the thermal transmittance of the concrete with natural aggregate. Additionally, thermal transmittance of the concrete with recycled bricks is 45% lower than the thermal transmittance of the concrete with natural aggregate. This adds a great value to material that is currently used for backfilling operation or is rejected at the landfills.

A newly developed mineral wool made using Ecosse® Technology is manufactured from abundant recycled and naturally occurring materials. The technology is free of formaldehyde, phenols, pentanes, butanes and acrylics.

ECO-SANDWICH® won 4 prizes: Gold Medal at INOVA 2013, INOVA Best Ecological Invention and "Green Mark – sign of excellence" - Best Croatian Green Economy Team and gold medal at IINOVA 2014 in Brussels. Additionally, ECO-SANDWICH® was nominated for BAU-trend AIT + Xia award for new generation of innovative products during BAU Messe 2015, and it was chosen among more than 2000 producers and their products to be in between 10 competing for the prize. ECO-SANDWICH® was also presented during 18th European Forum on Eco-innovation (Barcelona, Spain, May 2015).



## Costs

## Health and comfort

### Indoor Air quality

A newly developed mineral wool made using Ecosse® Technology is manufactured from abundant recycled and naturally occurring materials. The technology is free of formaldehyde, phenols, pentanes, butanes and acrylics.

All the apartments are equipped with mechanical ventilation system, as well as with significant number of windows (every room has its own window) that are enabling natural ventilation (windows on south, north, west and east side of the building).

### Building candidate in the category



Energy & Temperate Climates



Users' Choice

