

# Green building with BIM



*ArchiCAD helps achieve the accuracy needed to build sustainable modular homes*

Architects: [NOEM](#)  
Project name: The Eco-house 3.0  
Type of project: Residential  
Location: Serra Espadà  
(Castellón – Spain)  
Size: 96 square meters /  
1,033 square feet  
Software used: ArchiCAD

For years, the owners of this house dreamed of a small shelter in the area of Serra Espadà (Castellón – Spain). One day they decided to build their dream house using a prefab wood modular system to make the process quick and clean, and to maximize energy efficiency and comfort. One of the owners, a technology lover, was passionate about the idea of building a passive house through a 100% digital process to ensure a flexible construction that could be transformed over time if necessary. Today, he is the owner of the house that he dreamed of, his “refuge.”



Photo © Meritxell Arjalaguer

The Eco-house 3.0 is a bio-climatic and technological house, built in record time using a 100% digital process. It features a modern and cozy design with advanced technology that allows full automation from a smartphone and achieves maximum energy efficiency. The owners of this unique home wanted a digital building that would be respectful to the landscape they had fallen in love with. Using ArchiCAD, NOEM designed and built this modern passive house in ten weeks, ready to move into.

"We've been using ArchiCAD since 2013," Aitor Iturralde Martin of NOEM said. "Actually, it's an interesting story: In 2012, we had just won an award for our work and, as a result, we were visited at our office in Barcelona by Gábor Bojár, Founder and Chairman of GRAPHISOFT. We had a very nice chat with him and he encouraged us to start using ArchiCAD instead of Revit. We took his advice," Martin added.



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***“We can control the entire model in 3D, check all the interactions and size all the components that we will prefabricate with the confidence that everything will work,”***

- Aitor Iturralde Martin, architect

## Design

“The refuge” consists of two prefab wood modules manufactured in NOEM's warehouse and assembled on site, with a total floor area of 96 m<sup>2</sup>. A broad and generous porch with a large automated awning faces south and overlooks the Serra. The larger module (9 × 4.5 m) contains a living room/kitchen light that attaches to the porch with a retractable, 3 meter wide accordion window, combining the two spaces into one.

A second, 9x3 m module contains a double bedroom, a bathroom, and a flexible study that is transformable into a double room. The modules are built with solid structural panels of 81 mm laminated wood. Thick, 16 cm wood fiber panels thermally insulate the entire shell. Larch wood pieces are mounted on a ventilated facade, and high performing windows conform to the outer skin. The interior combines wooden beams, parquet floors, and white walls.

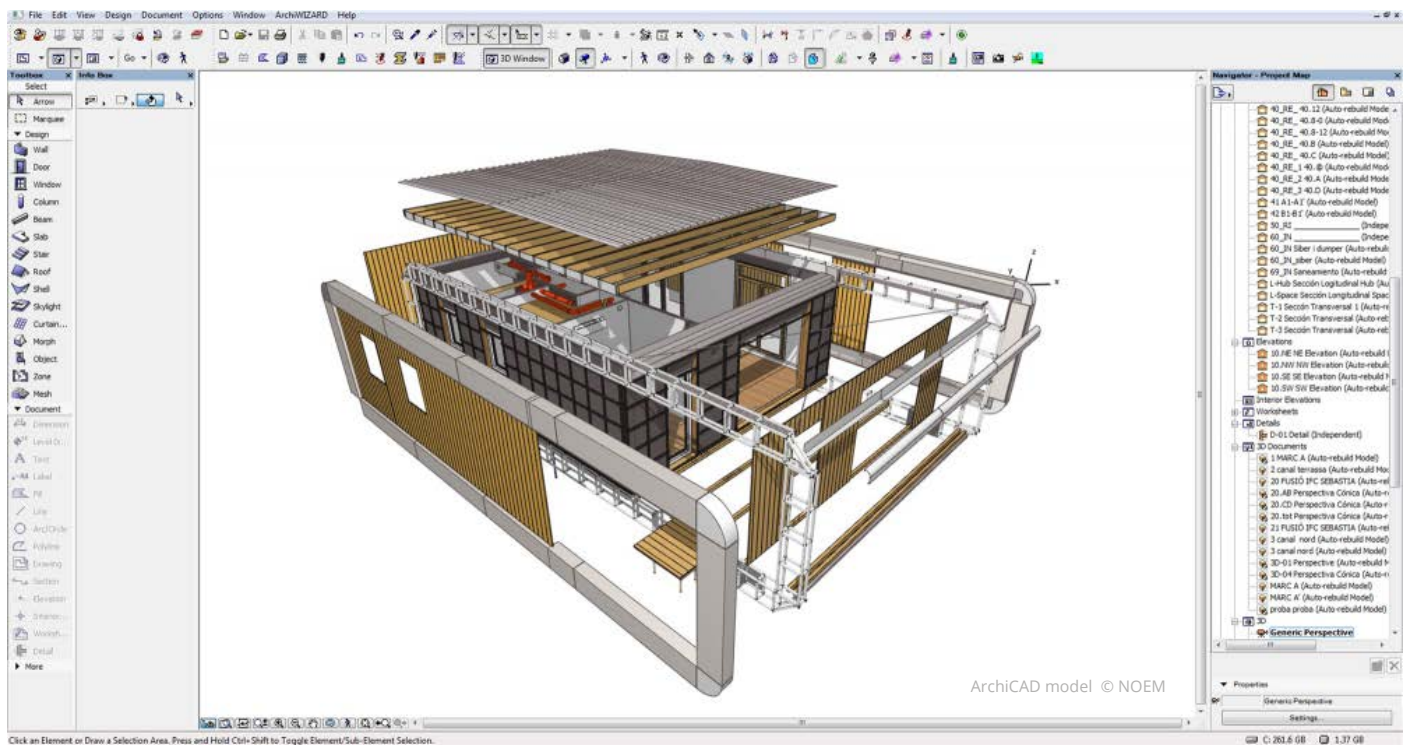
Digitization allowed the firm to share the design process entirely in real time with the client. Using GRAPHISOFT's BIMx, the same 3D model used for the design and manufacturing process was also used to take virtual tours inside the house so the owners could experience the house from their iPad as if it was a video game. They could imagine “living” in their new home virtually before building it, and could monitor the progress of the project despite being 300 kilometers away from the NOEM offices.



***“Thanks to GRAPHISOFT’s MEP Modeler, we can also design all the building’s holes to be cut by the CNC machine,”***

- Aitor Iturralde Martin, architect

To design this prefabricated house, NOEM generated a 3D BIM model of the architectural proposal. Every material and every little detail of the house was designed down to the last millimeter, and a sequence was simulated as if the house was on an assembly line. The finished BIM model was then tested and verified by the team, approved by the customer, and the parts and materials were ordered.



Video

[El Refugi - Time Lapse - NOEM Go](#)

## Challenges

Designing prefabricated, sustainable homes is demanding in that the construction happens very fast and mistakes are not allowed. NOEM prefabricates all the components in parallel, so they start to build the foundations on site, the structure in the factory, the windows... all at the same time. To avoid mistakes, every detail, every joint, every component in the model is under tight control. “ArchiCAD and BIM are the perfect tools to achieve this purpose. We can control the entire model in 3D, check all the interactions and size all the components that we will prefabricate with the confidence that everything will work,” Aitor said.

NOEM builds a home in 10 weeks: 4 design weeks, 5 manufacturing weeks in the factory and 1 assembly week on site. “We need

ArchiCAD to be as fast and precise as we are. We always say that we build the homes twice -- the first one in ArchiCAD and the second one on site. We're now starting to use EcoDesigner STAR. Our homes are designed following passive house standards and are energy self-sufficient, so energy simulation software is an important tool for us. We expect that EcoDesigner will allow us to develop these simulations inside ArchiCAD," Aitor said.

In addition to using ArchiCAD as their BIM tool, IFC interoperability with other software is key to NOEM's success. The firm exports an IFC model of a home to the wood factory where the model is imported in Cadwork, ready to be sent to the CNC wood cutting machine which uses laser cutting technology to secure pinpoint accuracy. "Thanks to GRAPHISOFT's MEP Modeler, we can also design all the building's holes to be cut by the CNC machine," Aitor explained.

#### **About NOEM (No-Emission House)**

Based in Barcelona, NOEM designs and builds award-winning custom homes, using wood as the basis of their projects and prefab technology as a manufacturing process. Their modular homes achieve maximum energy efficiency through passive house standards and the latest technology.

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