LAN3

Building Energy Renovation through Timber Prefabricated Modules BERTIM Project

Asier Mediavilla

tecnalia

BERTIM

Building Energy Renovation through Timber Prefabricated Modules

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 636984.

Main objectives

Improve building energy renovation process with timber prefabricated modules into an automated process

- Enhance the competitiveness of timber manufacturing companies and speed-up their processes through digital tools. Provide a BIM-based collaboration web tool (RenoBIM) for the data sharing and decision-making
- Develop prefabricated timber modules for building energy efficient renovation

Slide 1

LAN3 Igual puedes poner en el recuadro marron el nombre de la conferencia y las fechas
Lasarte Arlanzon, Natalia, 21/06/2018

Building Energy Renovation through Timber Prefabricated Modules

Enhance the competitiveness of timber manufacturing companies

Current situation: Complex process with many stages:

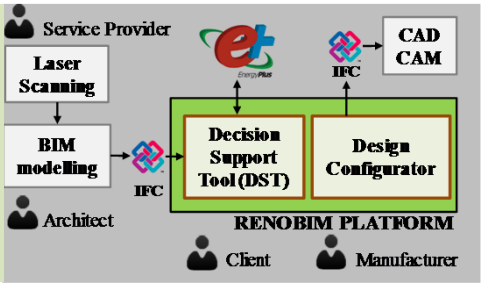
data collection → Desing & modelling → Cost-benefit/ energy assessment → Manufacturing → Installation

Different actors and skills, several software tools

BERTIM proposal:

A digital workflow to smoothly reuse the data and support collaboration

Data exchanges using Open BIM formats (IFC 2x3 / IFC 4)



Building Energy Renovation through Timber Prefabricated Modules

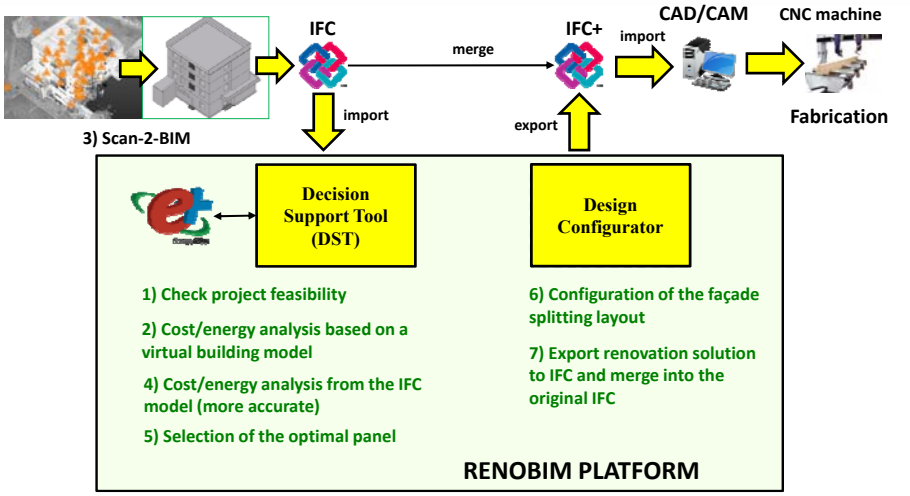
Develop prefabricated timber modules for building energy efficient renovation

- **Prefabricated 2D façade panels**
  - For envelop insulation
  - For HVAC system retrofitting through the façade
- **Prefabricated 3D rooftop residential modules with integrated RES**

The desing of the 2D panels fulfills:

- Reduction of 50% the energy consumption of the building
- Mass manufacturing process for prefabricated modules
- Transport of the modules in regular trucks
- Non-intrusive installation procedure
- Innovative connection system for quick modules' installation in building façade

Typical RenoBIM use case



Building Energy Renovation through Timber Prefabricated Modules

RenoBIM principles

- Not to develop from scratch → **integration** of existing tools **through Open BIM (IFC) formats**
  - Energy simulation, Web 2D/3D editing, CAD/CAM for fabrication
- **BIM** model requirements **tailored to the process**
- **Intuitive** web **interfaces for non-experts**, but relying in professional engines like Energy Plus
- Goal: **speed-up the early decision-making**

Targeted users

- Primary: **technical** and **sales/marketing staff** in the **manufacturing company**
- Secondary: **architects/designers**

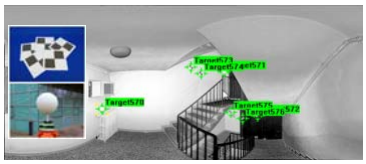
Building surveying practice

3D Scanner
FARO Focus 3D

+

Geolocation
LEICA gs08

- Placement of targets for future data capture with a total station
- Assembly of point clouds is prepared with targets to be registered and processed by Trimble Realworks software
- 69 outside and inside scan positions are realised in one day with a laser scanner
- Geo-location of this point cloud is completed with a GPS Leica
- 360° panoramic photos are delivered through Trimble Scan Explorer



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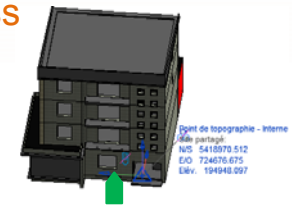
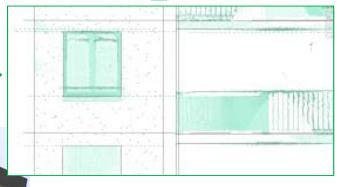
3D modelling process

3D Model
Autodesk Revit

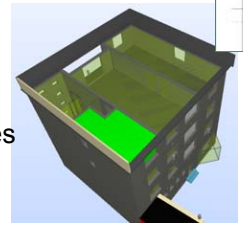


- The point cloud imported into Revit
- Storeys are defined and lines are created to define **the best average direction of facades**
- Modelling based on typical families (walls, windows, doors, floors, columns…)



- Conceptual space zoning

for energy simulation purposes



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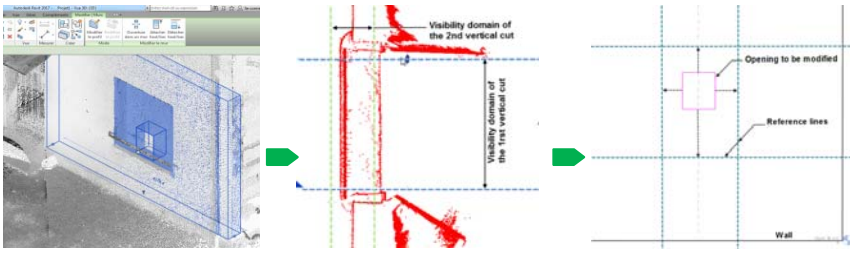
3D modelling specific methods

3D Model
Autodesk Revit

Very specific methods have been defined through “support measures” to obtain the specific accuracy required : e.g. here for an opening, to define the largest dimensions to be included in the masonry



First step in 3D view | Second step in horizontal cut | Third step in facade view

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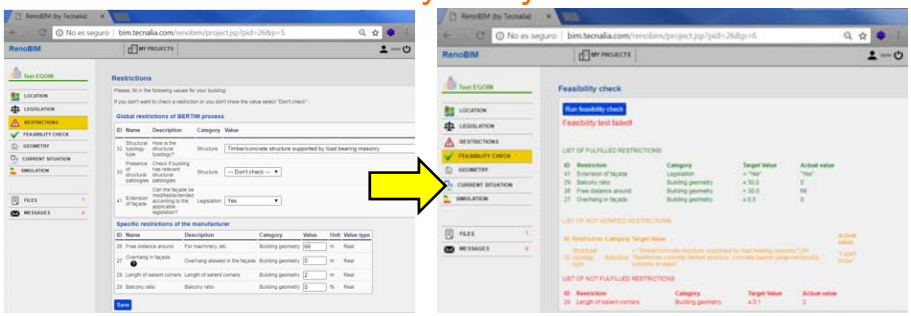
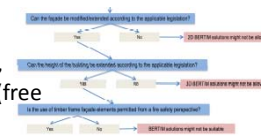
Feasibility analysis



End users enter data related to the building

- Generic aspects of BERTIM methodology (e.g legislation, structure, building condition…)
- Specific restrictions of manufacturers, linked to their products or processes (free distances, building geometry…)



An automatic report is generated with fulfilled/not fulfilled restrictions (or not checked)

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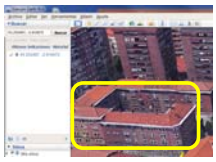
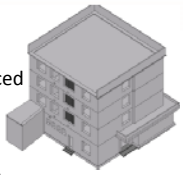
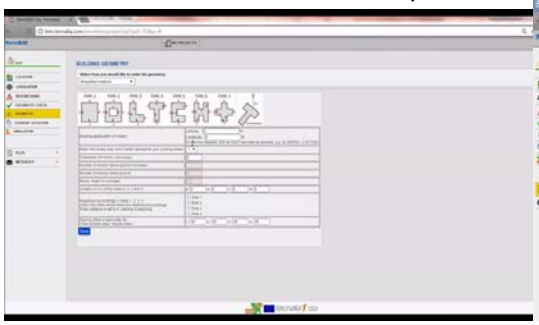
Virtual geometry vs BIM/IFC

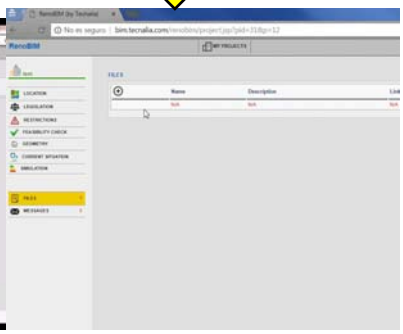


Define a virtual building manually:
- Lat/Lon, Orientation, Nº storeys
- Shape type & basic dimensions
- Neighbouring building heights & distances

Upload a georrefenced IFC file







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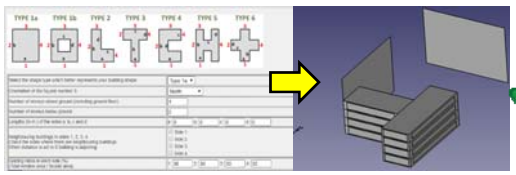
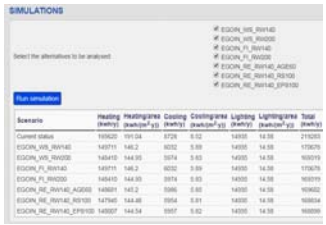
Cloud energy simulations

- Automatic generation of Energy Plus geometries
- Automatic detection of surface conditions (ground, external, partition, adiabatic…)
- Mapping to preset usage templates

Simplified approach





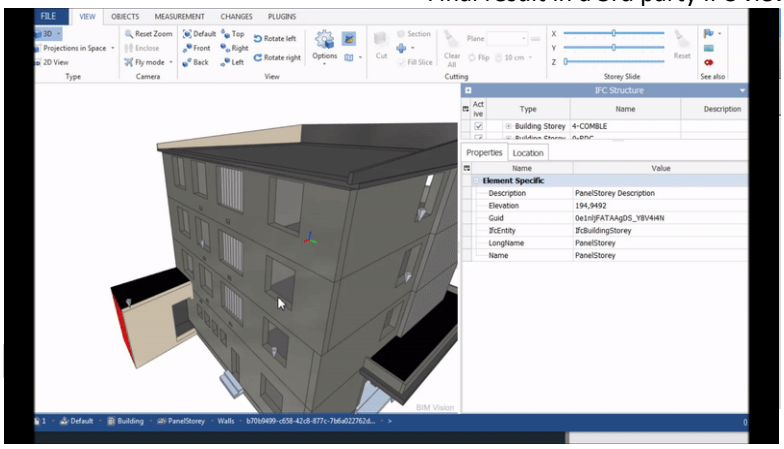
BIM/IFC approach

- Launch parallel cloud simulation with different alternatives (e.g. different insulation materials or thickness)
- Compare to current situation

Design configurator

Once a panel type has been selected, design the façade splitting layout
→ preliminary and quick dimensioning

Final result in a 3rd party IFC viewer



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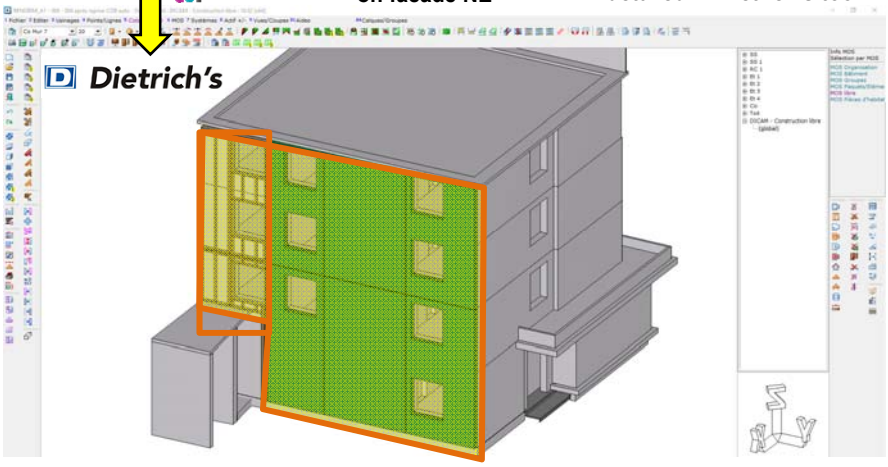
Import in CAD/CAM (Dietrich's): further detailing for fabrication

RenoBIM

IFC

8 modules added on facade NE

2 of the modules further detailed in Dietrich's tool



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Conclusions

- BIM → the power is in the information → more accurate data = better decisions
- Key: purpose of the BIM model
  - What we need to model and how → direct influence in modelling time and costs
- Key: Collaboration
  - Integration of actors of the supply chain
  - Optimization of time and reuse of data
  - Data reuse → data exchanges → need of standards → Open BIM
- BIM not only for "big ones" → it can be tailored to SMEs' needs

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Thank you for your attention!

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