Tools for Data Driven Renovation Design

the BIM4Ren solutions

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Easy-to-use BIM tools and workflows for collaborative and energy-efficient renovation of residential buildings

Coordinator: Nobatek/INEF4

Consortium: 23 partners from 10 European countries

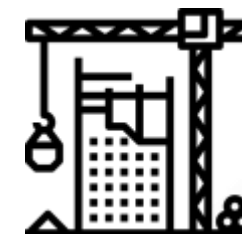**Duration:** 48 months

Start: 1st Oct 2018

Budget: 7M€

CONSTRUCTION SECTOR LANDSCAPE

Existing buildings are responsible for 40% of the total energy consumption and 38% of GHG emissions

The construction sector:

We need to increase the renovation level of the existing building stock from 1% to 3% !

- **Has a very low productivity**
- **Has a very low use of digital tools**

99.9% of the sector is made up of SMEs with less than 10 employees

60% of the sector production is done by SME (less than 50 employees) while employing 70% of the sector working population (Eurostat 2011)

Digital Transformation is not easily accessible to SMEs and handcrafters.

We need to put adapted tools in the hands of every kind of construction actor.
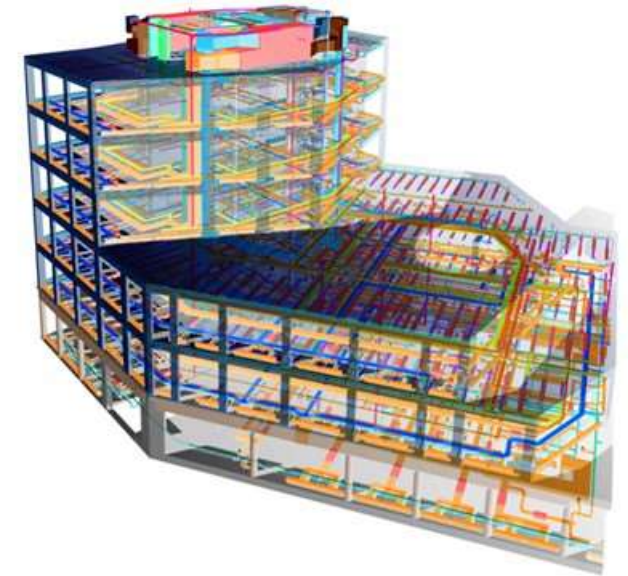
BIM AS A TRIGGER FOR THE DIGITAL REVOLUTION

BIM is both:

- A collaborative process involving the generation and management of a digital representation of a building

- A semantically enriched model to describe a building, covering its lifecycle.

It allows for a more efficient, collective and integrated design among all stakeholders.

The BIM revolution needs to be available for all the construction value-chain.

BIM has strong potential to improve information management during a renovation and help overcome process fragmentation and communication problems between stakeholders.

BIM4Ren 4 INNOVATION PILARS

BIM4Ren

01 Digital Driven Workflows

Development of BIM based workflows dedicated to the renovation of residential buildings adapted to the complexity of targets of construction sector and put into a systematic and integrated workflows.

One Stop Access Platform 03

All the services are integrated altogether, accessible from a single entry point granting access to all end users offering the most adequate solutions to its needs and objectives.

02 BIM4Ren Tools & Digital Environment

Workflows are backboned by a novel, state of the art, open and decentralized environment, and BIM solutions on data collection, data management and data driven design are integrated into it.

Pilots as Living Labs 04

Project pilots are used as a user-centered, open-innovation ecosystem with co-creation, exploration, experimentation and evaluation of the deployed tools.

BIM4Ren CONCEPT

Data Management

Data collection
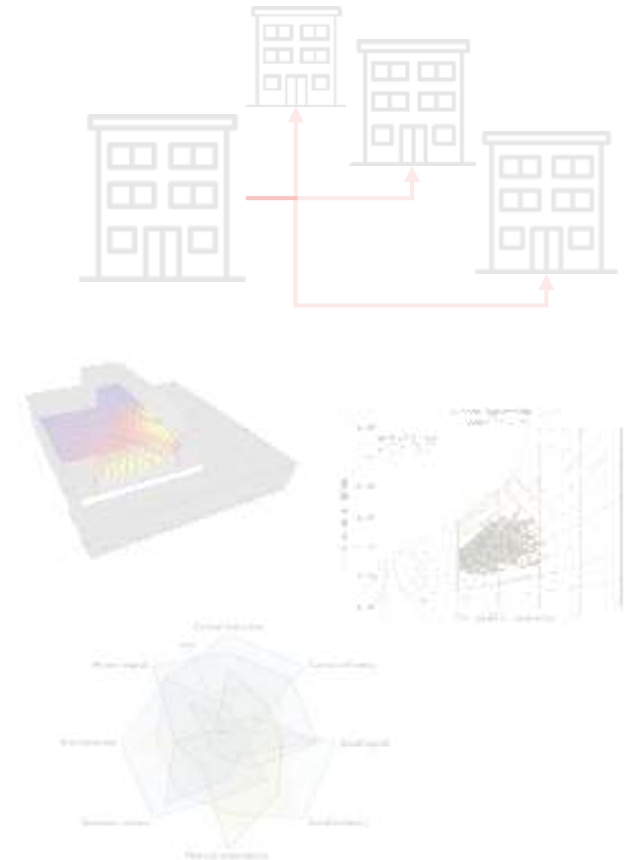
Data- driven design

WHAT IS THE EXISTING DATA ?

Year?

Local regulation?

Cost € ?

Energy performance?

Geometry?

Stakeholders expectations?

Type of occupants ?

Renovation potential ?

State of the existing infrastructure ?

Stakeholders involved in the renovation

BIM4Ren CONCEPT

Digital inputs → **Data Management**

Data collection

Data- driven design

WHAT IS THE
EXISTING DATA ?

1. To create the BIM model
2. To organize, consolidate, secure
3. To exploit the BIM model

Stakeholders involved in the renovation

BIM4Ren CONCEPT

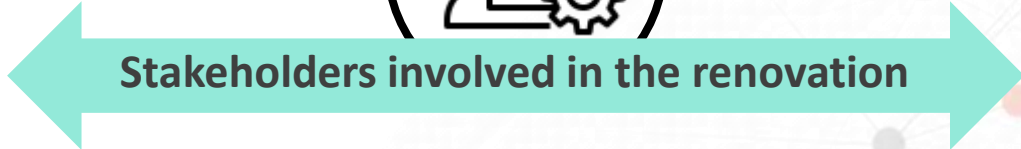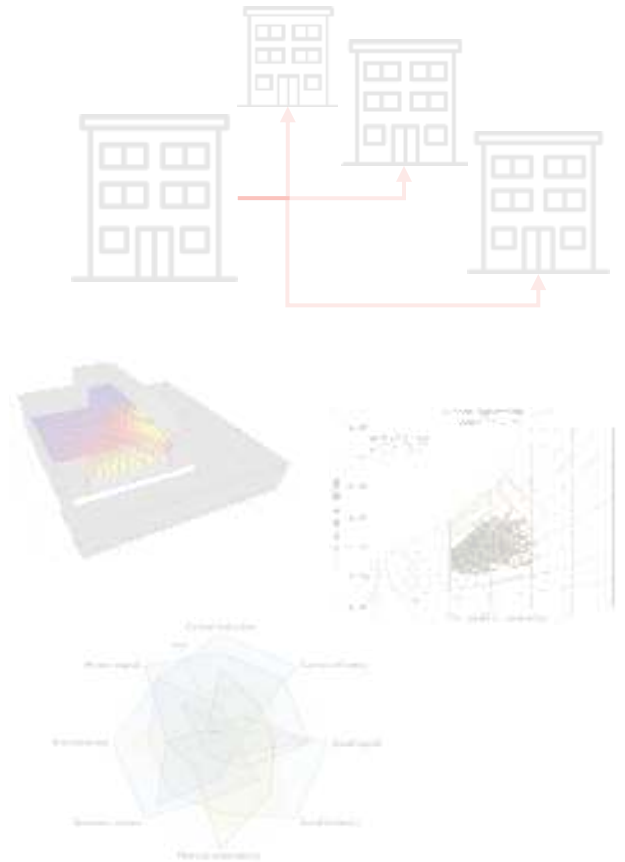**Digital inputs** → **Data Management** → Exploit BIM → **Data- driven design**

Data collection

WHAT IS THE EXISTING DATA ?

1. To create the BIM model
2. To organize, consolidate, secure
3. To exploit the BIM model

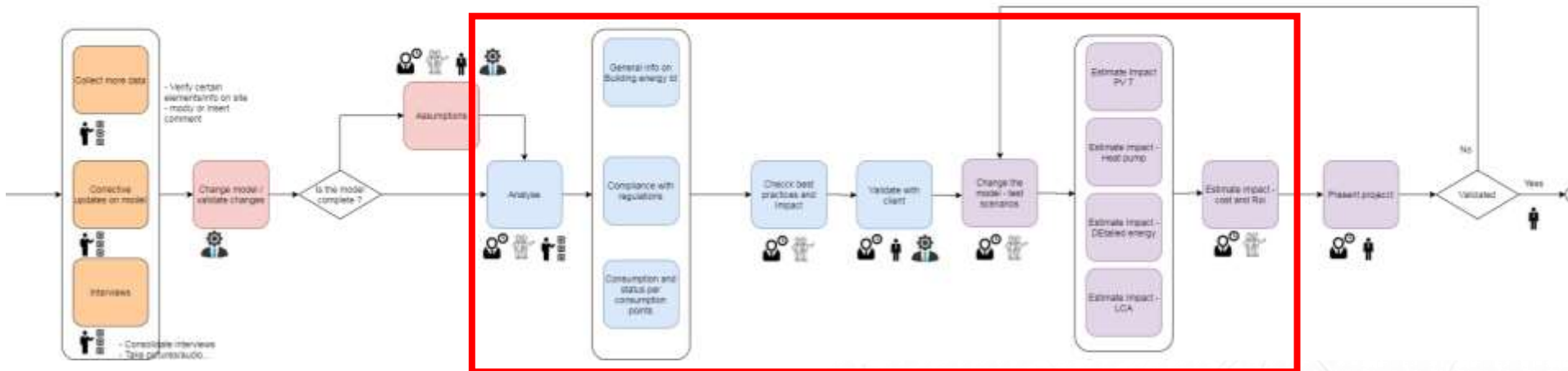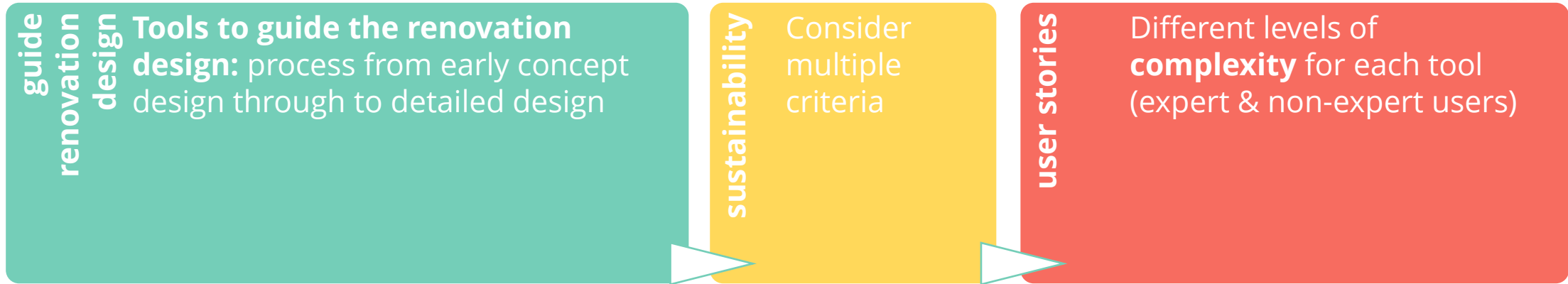**Stakeholders involved in the renovation**

Tools for Data Driven Renovation Design

BIM4Ren

| guide renovation design | **Tools to guide the renovation design:** process from early concept design through to detailed design | sustainability | Consider multiple criteria | user stories | Different levels of **complexity** for each tool (expert & non-expert users) |
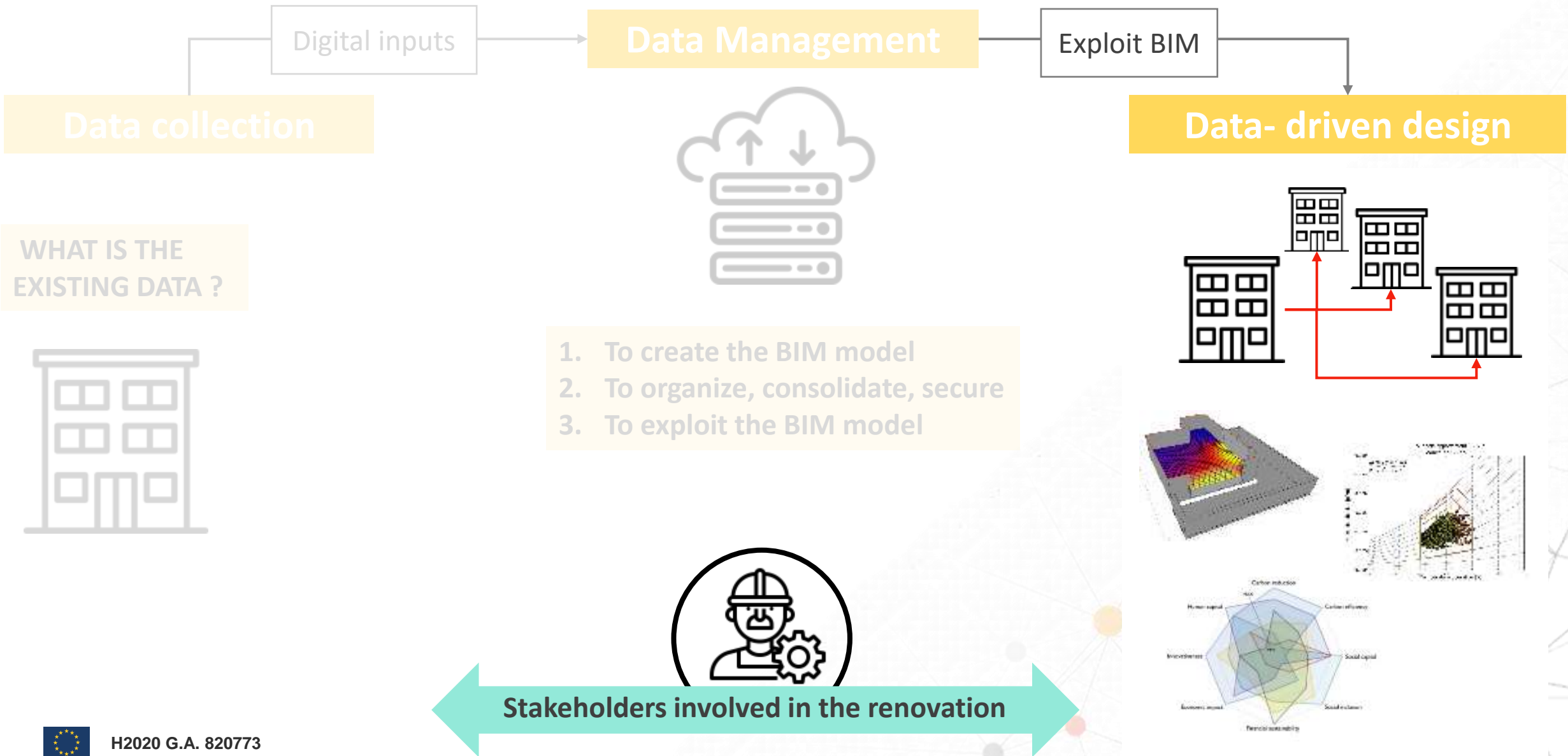
A slice of the BIM4REN stack

Scenario evaluation

- 3BTool - TECNALIA
- Renovation manager - NBK/INEF4
- Scenario Comparison - IES

Focussed Analysis

- BIMSolar - ENERBIM

Occupant Feedback

- Feedback Tool - TNO
- REACT - VGTU
- SMACH - EDF

3BTool

BIM4Ren

3BTool: Building Benchmark and Best practices tool

What does it do?

Support tool that shows an indicative **primary energy use** of a target building based on pre-simulated reference models. It also classifies the **energy performance** as good, moderate or low by considering the energy rating boundaries for each country. Finally, **renovation packages** are suggested depending on the level of energy performance to be achieved.

Who is it for? When?

General Public. It can be used by end-users non familiar with energy or construction matters at early stage of the project

Why should it be used?

- It is an intuitive web-based tool including current data from EU Building Stock observatory
- Good range of reference values for energy performance ratings coming from National Certificates of each country
- Engagement of end users to enhance their building energy performance

Renovation Manager
A parametric renovation webassistant

BIM4Ren

- **Who is it for?**
  - Residential building managers who want to digitize the history of the renovations done and plan new ones
  - Engineers who can evaluate and propose different renovation scenarios

- **What does it do**
  - Store information related to buildings and the renovation projects
  - Assist users in work planning
  - Design renovation scenarios through by accessing BIM objects catalogue or creating your own objects
  - Evaluate energy consumption, comfort and cost of up to 10.000 renovation scenarios
  - Let the user explore the results dynamically to identify best solutions

1. Define the renovation projects

2. Define the potential renovation scenarios as simple modifications of envelope and HVAC systems

3. Explore the results

Scenario Comparison Tool

What does it do?

Starting from an existing model of their area, users can choose from a predefined set of renovation interventions to test on a building, **run fast energy simulations**, and visualise and compare "before and after" results.

The tool is part of IES iCIM online platform, a community resource monitoring and management platform. iCIM can be deployed in communities of any scale, to display and interact with 3D models of the buildings in the community.

Who is it for?

Portfolio managers or homeowners who wish to **explore the potential of specific renovation solutions** in their building(s).

Why and when should it be used?

The Scenario Comparison tool can be used at the beginning of the renovation process, before the start of the design, to **choose between promising renovation strategies**.

It allows owners and managers to quickly make **informed decarbonisation decisions before investing** in their building and community.

BIMsolar® - BIPV & PV+T software

To urban planners, architects and energy consultants, who need to get crucial KPIs to support their decision to GO SOLAR, as energy prices are dramatically increasing, the BIMsolar platform offers a unique BIM based service solving PV thermal feasibility studies and generating the next generation of ready for service BIM objects.

REACT

REACT: The neuro-questionnaire and system on renovation acceptation

What does it do?

Tool analyze, customize and manage the quality control pertinent to the smart spaces of buildings according to user AFFECT (emotional, affective and physiological states, valence, arousal, as well as happiness and interest) states in an integrated manner, as a singular entity. The customized management of quality control covers the lighting intensity and colors, scents, media, information, knowledge, data, activities, learning materials, games, music, videos, temperature, humidity, air pollution, vibrations and the like pertinent to the smart spaces.

Who is it for? When?

General Public and Facilities Managers. It can be used by end-users non-familiar with buildings at the maintenance stage of the project.

Why should it be used?

- Establishing and maintaining optimal parameters for the quality of a building's customized smart spaces
- Upholding required levels of users positive and negative emotions, affective states, happiness and interest by changing the quality parameters pertinent to the smart spaces

SMACH
Occupant behaviour simulation with BIM compatibility

Appliances models

Human behavior model

Building energy model

- Who is it for?
  - This tool is aimed at energy experts involved in the renovation process, as a mean to **engage occupants in the renovation process in order to promote energy-efficient post-renovation behaviours**

- What does it do?
  - It simulates the behaviour of occupants in their building, and allows to **assess the specific impact of behaviour on the efficiency of the renovation project**

- Why should you use this?
  - **Behaviour strongly impacts** the short-term and long-term success of the renovation.

- When?
  - Occupant behaviour simulations can be used **before the renovation project** (in order to anticipate the role of occupant behaviour on energy consumptions) and **after the renovation** (in order to advise occupants on the best behaviour to foster and maintain energy efficient behaviours and benefit the most from the renovation).
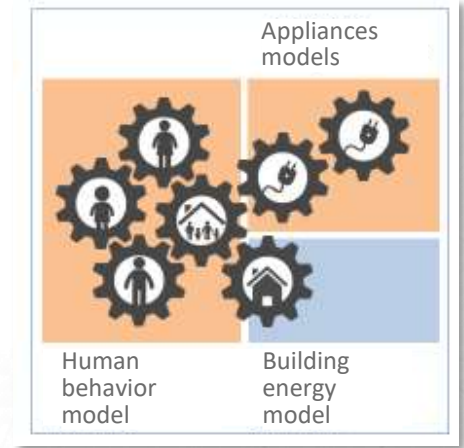
Feedback to occupants

- **Who is it for**
  - The feedback tool is developed for occupants of recently retrofitted houses

- **What does it do**
  - The tool gives insight to the occupants on the **effect of their behaviour on their energy use**. The tool displays the energy use for heating and cooling of their house fitted to their current thermostat settings and their current use of windows and solar shading. By playing with their behaviour settings in the tool, the tool will show the energy use of the house with the adapted behaviour.

- **Why should you use this and when**
  - Your behaviour in your house has a large influence on your energy use. The tool gives you insight in the effect of your actions and makes it possible to make informed choices on your behaviour
  - This information is valuable for all occupants, but becomes especially valuable when your house is renovated with energy saving measures. You might have received a energy certificate, but these give information without taking into account your actual behaviour.

Tool demos online

THANK YOU

http://bim4ren.eu/

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