



BIM4Ren

TRAINING

Spanish case study

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This project has received funding from the H2020 programme under Grant Agreement No. 820773

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Context and overall presentation of the Spanish pilots



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STARTING POINT:

- Management of many documents and resources
- We are often not involved in the design phase of a project
- Lack of definition of existing buildings
- Interaction with many actors



H2020 G.A. 820773

What do we expect from BIM4Ren tools?



GRUPO
KURSAAL

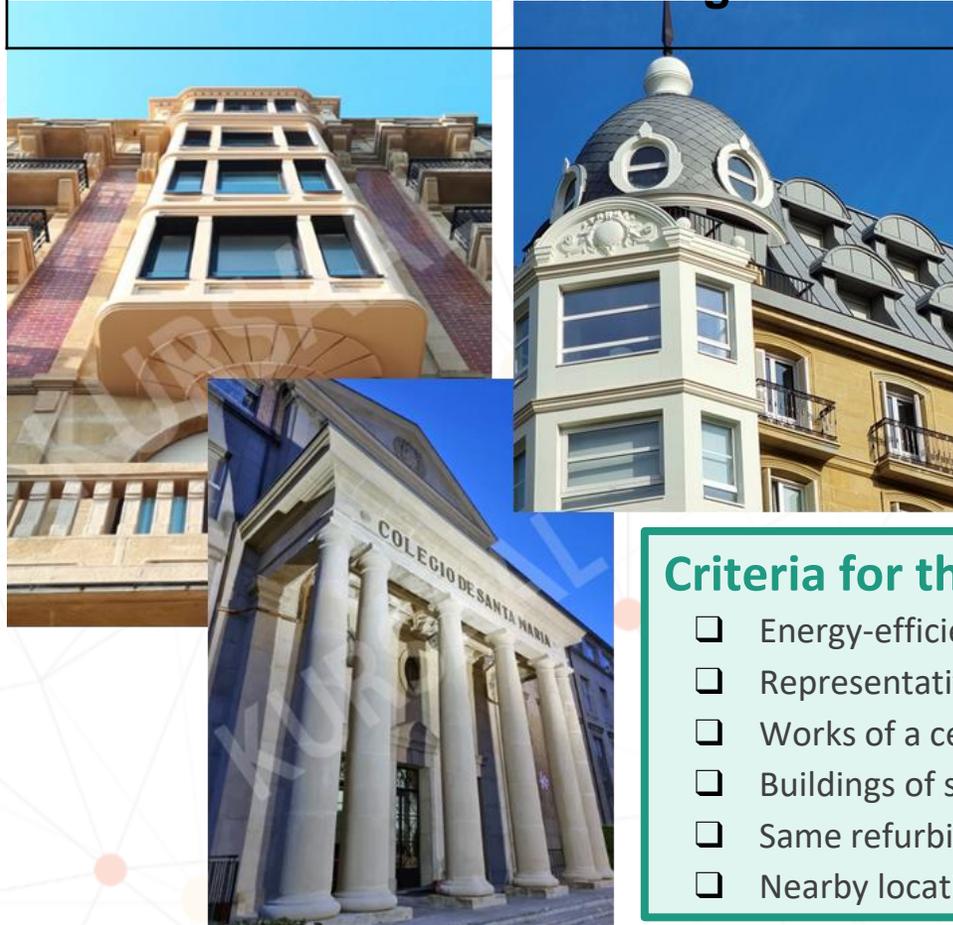


OUR GOALS...

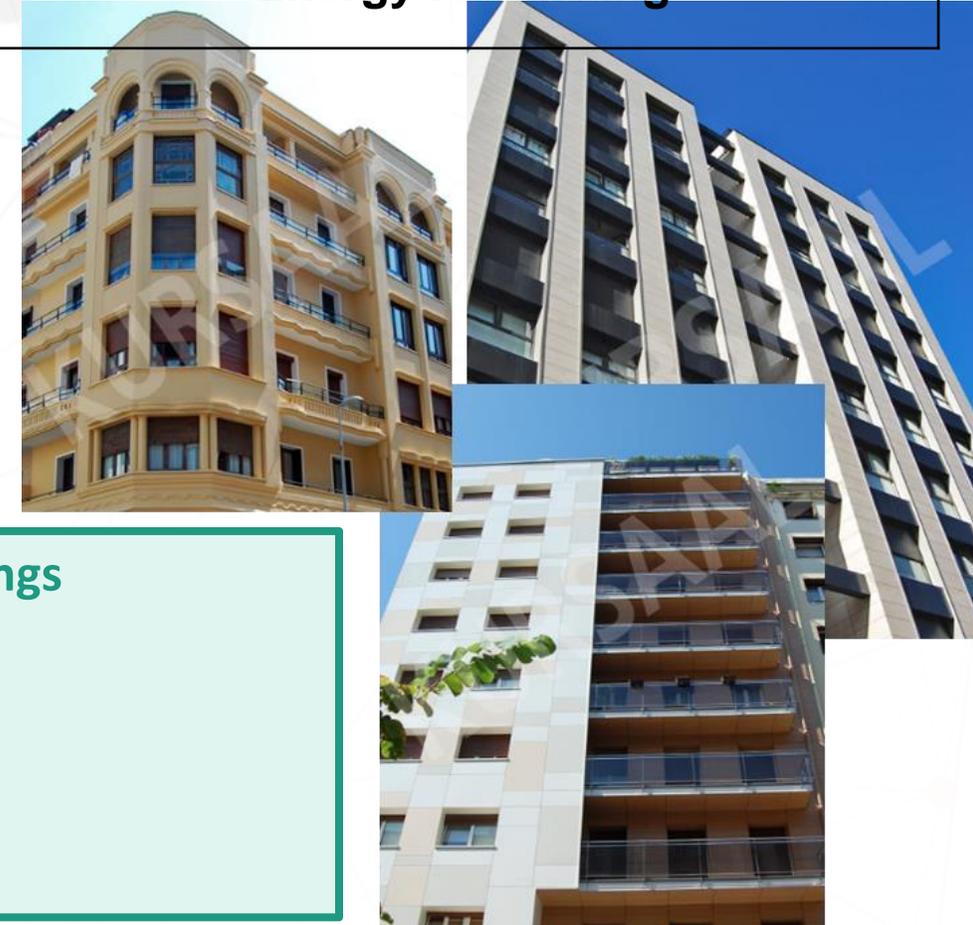
- Help with document and resource management
- Support to the project designers we work with
- Better definition of the existing building
- Stimulate communication
- Easy-use tools

Kursaal's project portfolio

Traditional retrofitting



Energy retrofitting



30% vs 70%

Criteria for the selection of pilot buildings

- Energy-efficient refurbishments
- Representative works of Grupo Kursaal
- Works of a certain size
- Buildings of similar typology
- Same refurbishment system
- Nearby location

CASE 1 BIM VS NON-BIM PROJECT

CASE 2 ANALYSIS OF THE IMPACT OF BIM ON ENERGY EFFICIENCY

BASELINE
**BERTSOLARI TXIRRITA 38,
DONOSTIA**



PILOT
SERAPIO MUJIKA 18, DONOSTIA



PILOT
GAZTAINONDO 1-3-5, IRÚN



BASELINE
BERTSOLARI TXIRRITA 38,
DONOSTIA



ENERGY RETROFITTING: CERAMIC VENTILATED FAÇADE AND ETICS ON BALCONIES

- Project designer: Mikel Diaz de Ilarraza, BIKA arkitektura
- Construction year - 1973
- 15 floors / 6 dwellings per floor
- Start of renovation works: june 2020
- End of work: 2021
- KPI measurements



PILOT SERAPIO MUJIKA 18, DONOSTIA



ENERGY RETROFITTING: CERAMIC VENTILATED FAÇADE AND ETICS ON BALCONIES AND ROOF

- Project designer: Álvaro Encío
- Construction year: 1967
- 15 floors / 4 dwellings per floor
- Start of renovation works: october 2020
- End of work: 2022

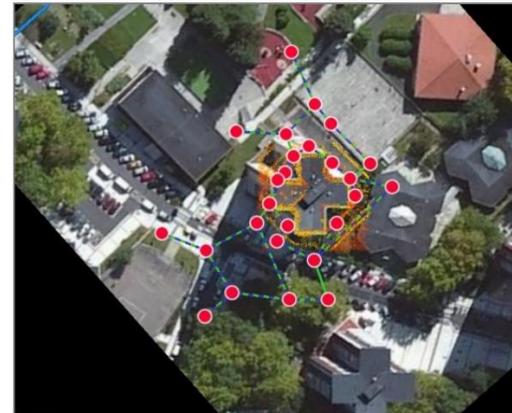


PILOT SERAPIO MUJIKA 18, DONOSTIA

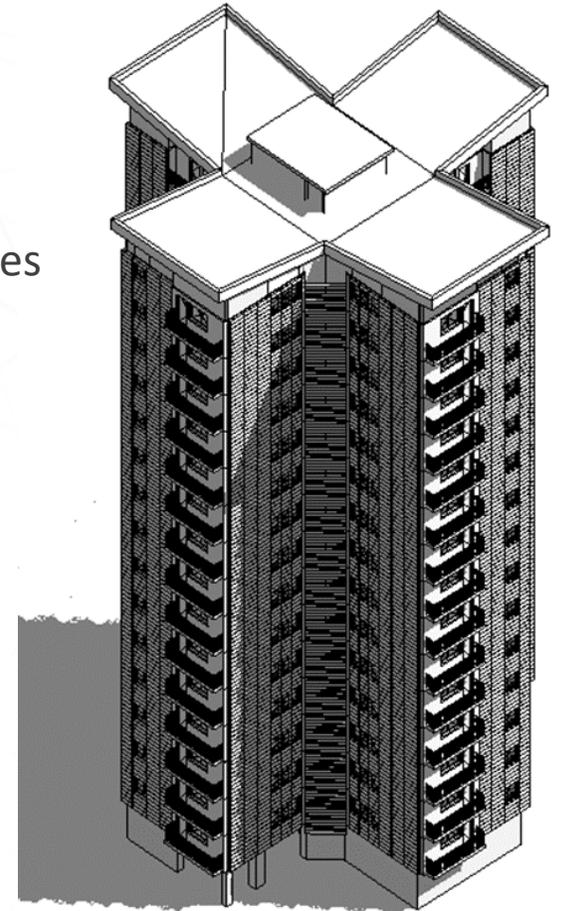


ENERGY RETROFITTING: CERAMIC VENTILATED FAÇADE AND ETICS ON BALCONIES AND ROOF

- 3D scanning - point cloud of façades
- BIM model
- Digital tools: design and construction phases



SiteMap 1



PILOT GAZTAINONDO 1-3-5, IRÚN



ENERGY RETROFITTING WITH ETICS

- Project designer: Fernando Ruiz Lacasa
- Construction year: 1975
- 3 portals/ 8 floors / 4 dwellings per floor
- Start of renovation works: 2021
- Monitoring during 24 months
 - 6 complete dwellings
 - 5 sensors per dwelling
 - Temperature
 - Relative humidity
 - CO2
 - Electricity consumption
 - Heating and DHW consumption



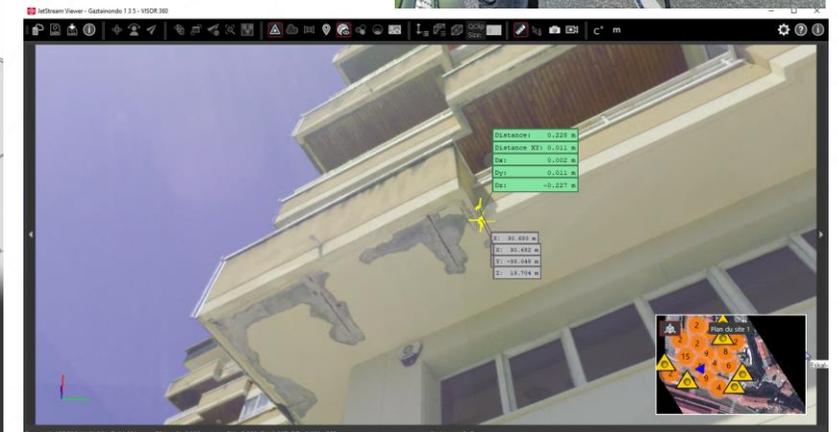
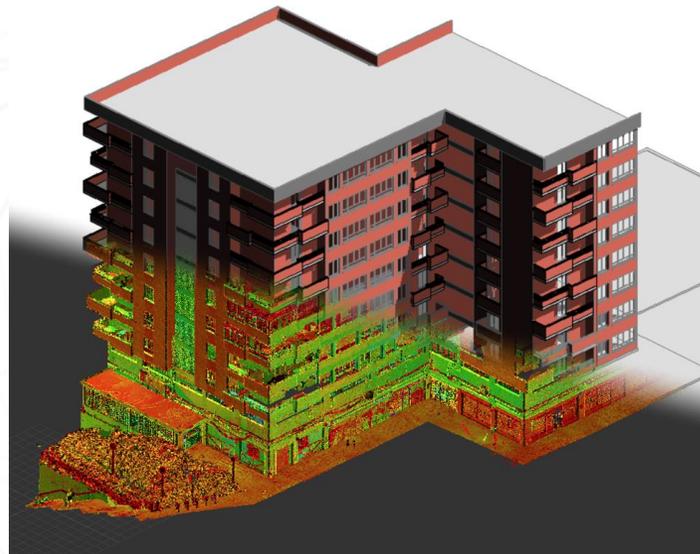
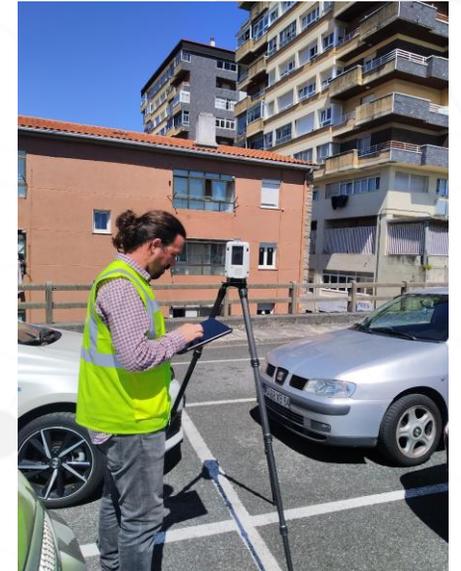
Spanish pilots

PILOT GAZTAINONDO 1-3-5, IRÚN



ENERGY RETROFITTING WITH ETICS

- Outdoor 3D scanner
- 3D scanner of courtyard and typical dwelling
- BIM model
- Digital tools: design and construction phases





Business-as usual renovation projects by Kursaal

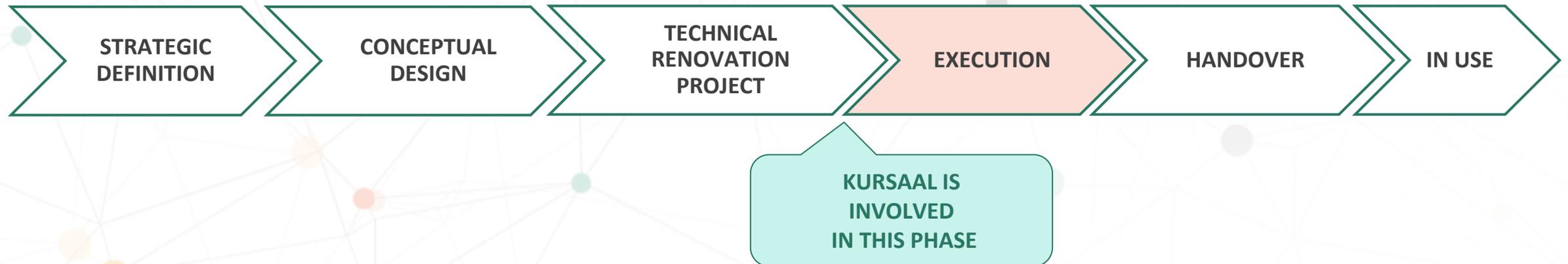


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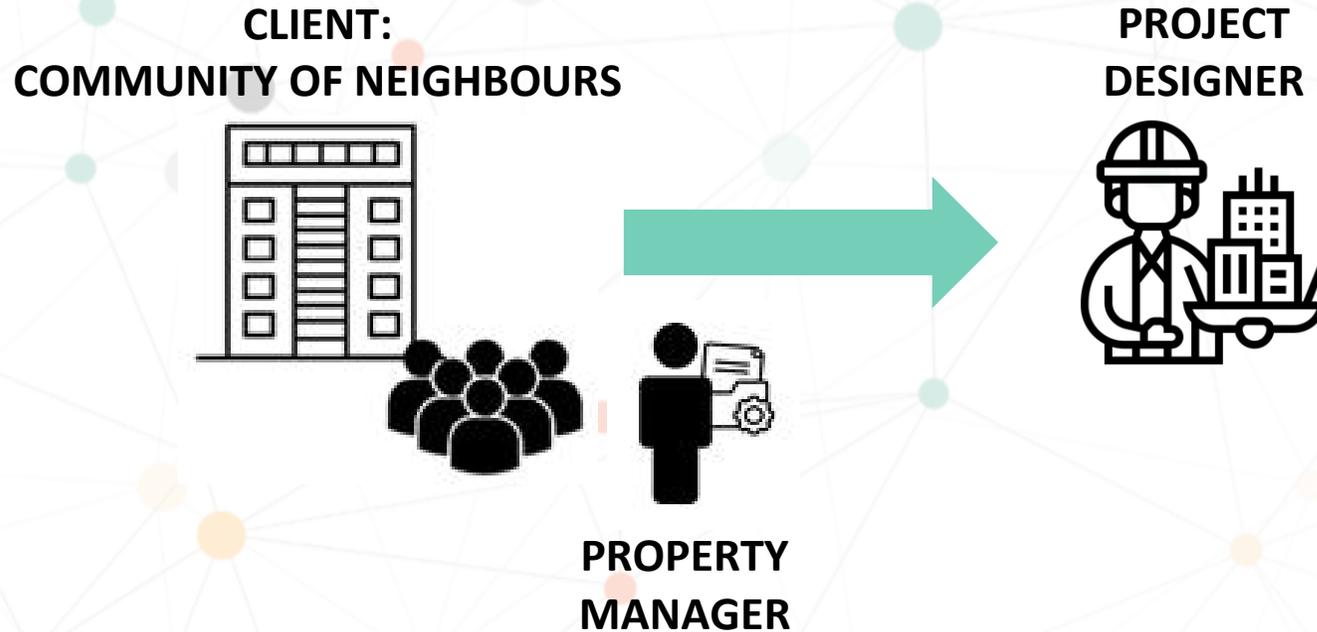
Workflow



Typical workflow in building renovation processes:

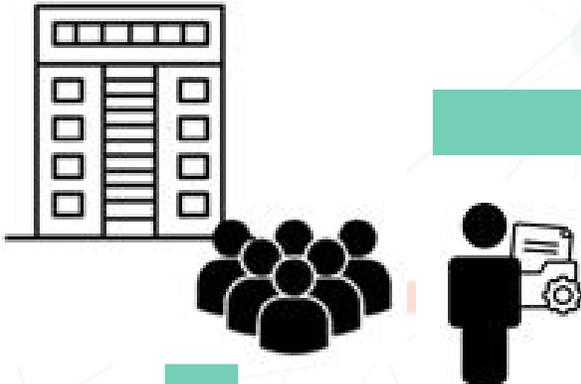


What is the usual process of a renovation company?



What is the usual process of a renovation company?

**CLIENT:
COMMUNITY OF NEIGHBOURS**



**PROPERTY
MANAGER**

**PROJECT
DESIGNER**



RENOVATION COMPANY

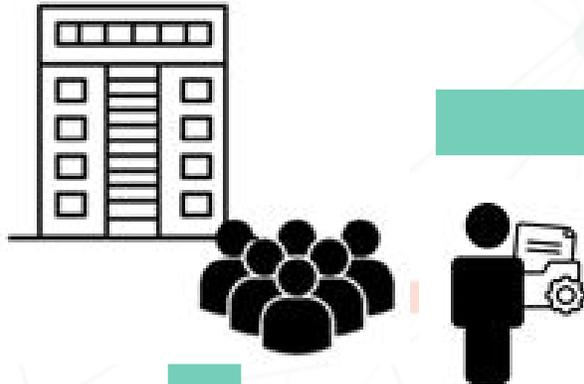


Budget

- Initial project study and budgeting

What is the usual process of a renovation company?

**CLIENT:
COMMUNITY OF NEIGHBOURS**



**PROPERTY
MANAGER**

**PROJECT
DESIGNER**



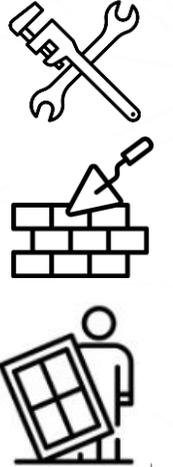
RENOVATION COMPANY



Work phase

- After signing the contract with the client, the work is meticulously studied: guilds contract, material buying...

GUILDS



Main challenges identified



Common working tools:

- Software: Autocad, Sketch Up, Presto...
- Prevention management software
- Economic and administrative management software
- Communication: email, mobile phone...

Organisational challenges:

- Document management
- Task and communication management
- Digitization of processes

On-site challenges:

- Accurate measurements
- Unforeseen events on site
- Material waste



Potential of BIM to optimize the construction phase: Kursaal use case



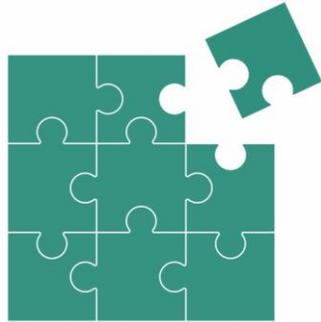
This project has received funding from the H2020 programme under Grant Agreement No. 820773

Potential of BIM to optimize the construction phase



BIM4Ren tools:

- A extensive training in specific BIM software is not required.
- They can be easily included into the normal workflow.
- They allow to quickly obtain simple models, which are useful for some applications.
- Helpful with document and task management.
- Affordable cost.
- They are still under development to improve their performance.



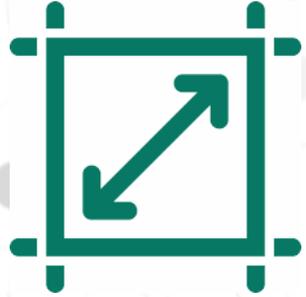
ANTICIPATE CONFLICT POINTS

Conflicting points between different systems can be anticipated with a 3D model. Developing a 3D model to this level of detail requires a large initial investment.



BETTER COORDINATION

Improve communication and coordination between different agents involved in a renovation process.



ACCURATE MEASUREMENTS

Facilitate accurate measurements for material purchasing phase, certifications, etc. That way there are not repetitive tasks.



WASTE OF MATERIALS

Minimise the excess of material on site by adjusting purchases thanks to accurate measurements.

Potential of BIM to optimize the construction phase



BIM is a very broad methodology. It is fully demonstrated that can help in very large projects and especially new construction projects.

What happens in renovation projects?

In small projects, the effort of training and implementation of BIM is not cost-effective. We take it as something unattainable and we do not know how to approach it.





But digitalization is also possible for SMEs and small renovation projects.

We need to lower the threshold of BIM and adapt it to the specific needs of each company.

DIGITISING AND STANDARDISING PROCESSES

BIM REPRESENTS A GREAT **OPPORTUNITY!**

Quality improvement

Standardises processes

Improved efficiency

Cost savings

Time savings



BIM driven workflow of the pilots based on the BIM4Ren tools



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BIM based renovation workflows

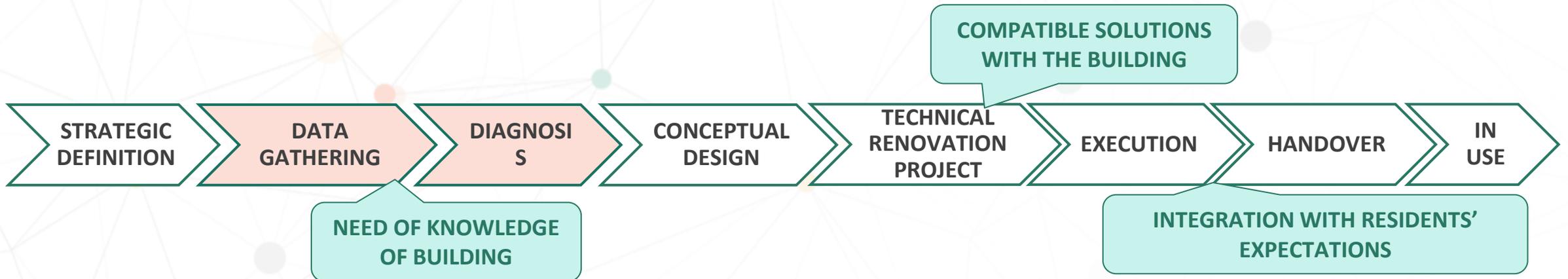


NEW CONSTRUCTION WORKFLOW VS RENOVATION WORKFLOW: New challenges in renovation

General workflow of the construction process



General workflow of the renovation process: new challenges



New challenges arise in the retrofitting process that BIM can address through **higher data accuracy**, **collaborative working** and the ability to implement **more technically demanding solutions**.

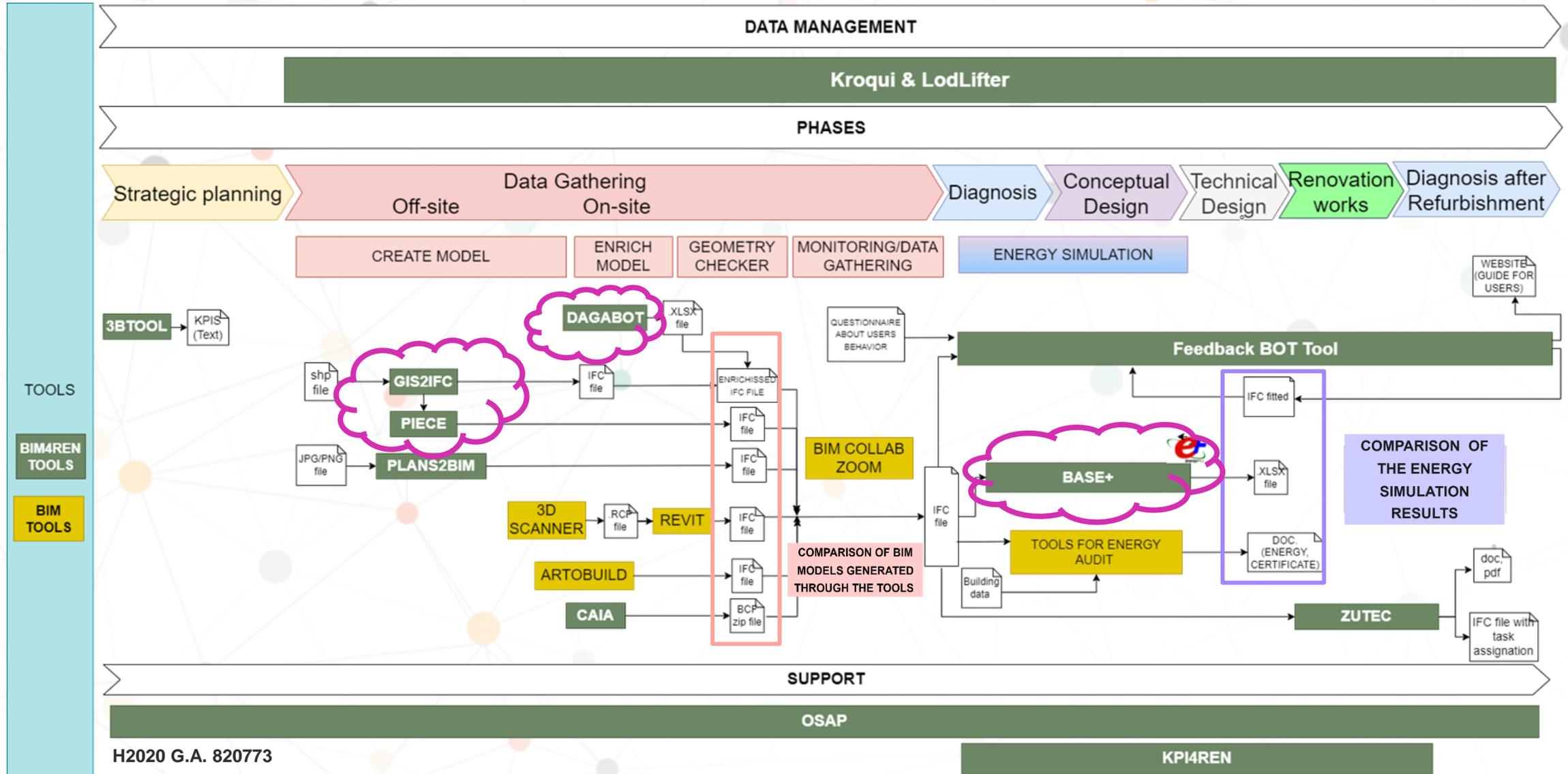
BIM4Ren tools testing in Spanish Pilot



NAME OF THE TOOL	PHASE	PROVIDER	COMMENTS
3Btool	Strategic Planning	TEC	Tested on Gaztainondo
GIS-2IFC	Data Acquisition	TEC	Tested on Gaztainondo and Serapio Mujika
Plans2BIM	Data Acquisition	WBIM	Tested on Gaztainondo
PIECE	Data Acquisition	TEC	Tested on Gaztainondo and Serapio Mujika
DAGABOT	Data Acquisition	TEC	Tested on Gaztainondo
CAIA	Data Acquisition	RWTH	Tested on Gaztainondo. Bugs detected and improvements suggested
BASE+	Data Driven Design	TEC	Tested on Gaztainondo
Validation and Feedback Tool	Data Management	TNO	Temperatures and energy usages collected in 5 apts, and user behaviour via questionnaire (2021)
Kroqi & LodLifter:	Data Management	CSTB	Tested on Gaztainondo
VRMP	Support	VRM	Preliminarily tested but afterwards rejected (project withdrawal) and replaced by ZUTECA+CAIA
OSAP -	Support	EKO	Starting with the tools integration in OSAP
KPI4REN: (Process & performance measurements through KPIs)	Support	TEC	Measurements on going in the Baseline (Bertsolari Txirrita) and Serapio Mujika
ZUTECA	Data Management	R2M	Customization for the pilot needs in progress
Others: ArTOBuilt	Data Acquisition	NOT BIM4REN	Not taking part of the project but interesting to compare results
Others: Escaner 3d.	Data Acquisition	NOT BIM4REN	Not taking part of the project but interesting to compare results



BIM4Ren tools testing in Spanish Pilot





TRAINING

BIM4Ren tools demonstration on the Spanish pilot



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BIM4Ren tools testing in Spanish pilot



Feedback about tools

PERFORMANCES ASSESSMENT	CAIA	AR2BUILT	PLANS2BIM	PIECE	GIS-TO-IFC	DAGABOT
ACCESSIBILITY TO THE TOOL FOR INITIATING THE PROCESS	Mediocre connection during opening, sometimes fails		Need to fill too much information			An app must be previously installed
EASE TO MANAGE IT ON SITE	Hard to handle the plan during the positioning		X	X	X	
SPEED OF DATA ACQUISITION	Positioning the plan is time consuming	Yes			The import from GIS is not straightforward	
AUTOMATIC RECOGNITION PERFORMANCE	X	Yes, if the data acquisition is done carefully	Yes, but it fails with some details as pilasters or closets	X	X	X
USABILITY OF THE EDITOR/DASHBOARD	X	Not editable				
PROCESSING SPEED	Not processing		Medium speed		Medium speed if a vast range of buildings are taken	
VISUALISATION OF THE OUTPUTS	Poor visualisation			Need to have an IFC viewer installed	Need to have an IFC viewer installed	The results from the excel file can be visualised in a simple model
ACCURACY OF THE MODEL CREATED	X	Not accurate enough. Maybe suitable for early phases.	Depending on the accuracy of 2D drawings	Not accurate for the geometric model	Dependant on the reliability of GIS model	Not accurate in terms of geometry but suitable for survey purposes
INTEROPERABILITY WITH OTHER TOOLS	Yes, if a BCF file was exportable	IFC, csv, PDF	IFC format tools	IFC format tools	IFC format tools	Csv format
BUGS OR MISFUNCTIONS	A few.	Very few.	Apparently not.	Apparently not.	Apparently not.	Very few
SUGGESTED IMPROVEMENTS AND/OR WISHES FOR FUTURE	<ul style="list-style-type: none"> -Fix connection bugs -Enable uploading plans in PDF format -Improve the handling of the plan -Instead of moving the plan, would be better to position the main camera -Improve visualisation of already made pictures -Enable downloading a BCF file or final PDF report 	<ul style="list-style-type: none"> -Enable to save and download pointclouds in a lighter format (.e57, .las...). -Enable the possibility to add pilasters standing out the walls -Fix the scaling of plans during the PDF export. -Fix the bugs while joining 3 or more walls 	<ul style="list-style-type: none"> -Improve the automatic recognition while working with façade plans -Enable the text recognition from the 2D plans for adding a text parameter to each space (e.g. kitchen, room...) -Add some kind of manual tool for helping before the recognition (e.g. pointing at railings) -Improve window recognition 	<ul style="list-style-type: none"> -Possibility of entering individual data, i. e. number of windows, installations instead of entering as a whole -Estimation of the U-value by selection of the façade typology 	<ul style="list-style-type: none"> -Improvement of the GIS files of cities from municipalities is desirable. -Precise instructions for import of not complete GIS file would be useful 	<ul style="list-style-type: none"> -Positioning of the facades in the model prior to inspection would help to the inspection.
HELPFUL FOR YOUR COMMON WORK?	Could be on rare occasions	Could be for making the plan of a dwelling or building, in early phases of a retrofitting project	Could be, for getting a quick BIM model of a building, or for digitizing a plan of a façade, but this module doesn't seem to work properly.	Only helpful combined with the Energy simulation tools, BASE+	Only helpful combined with the Energy simulation tools, BASE+	Helpful for easy and quick inspections
OVERALL COMPARISON BETWEEN TOOLS	Not helpful at this stage	Helpful if the access to the dwellings is available	Helpful if there are 2D drawings of the building	Not useful standalone, only together with GIS-TO-IFC or as input for BASE+	Helpful if the shp files are complete in combination with PIECE	Only tool which helps to the facade's inspection



Tools Testing on-site: DAGABOT



DAGABOT : Assessment of pathologies in building renovation



7:45 85%

Facility
Gaztainondo 1

Orientation
Gaztainondo 1_FAC_E

Storey
4

Damage
DAMAGE TO REINFORCEMENT IN CONCRETE

Gravity*
Mild Medium **Grave**

Extension*
0-25% **25-50%** 50-75%

Cancel Save

7:44 85%

Name
DAGABOT

Project
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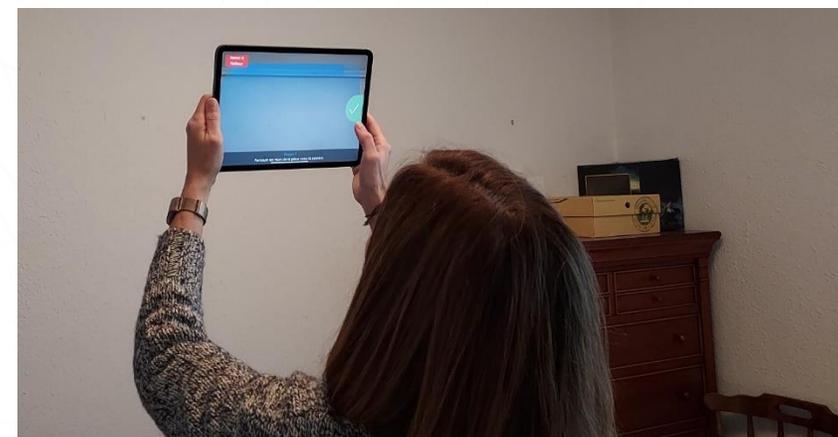
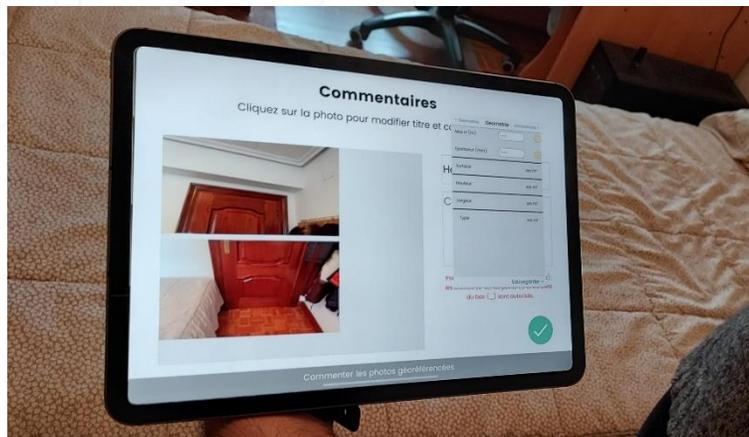
Information
This application is developed in the BIM4REN Project



Tools Testing on-site: CAIA/ARTOBUILT



CAIA : Context –aware Image acquisition: Generation of images through an AR app and synchronisation with BCF server
BIM model generation through Scan to BIM



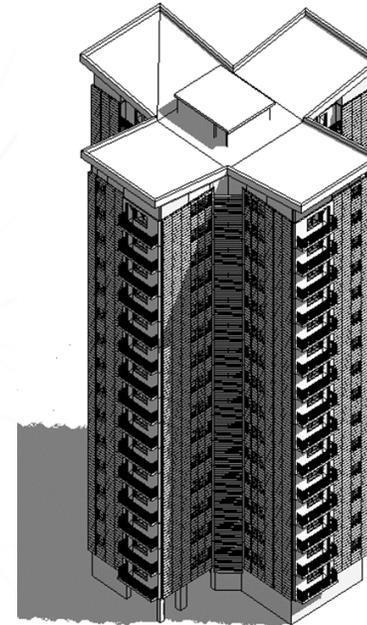
Tools Testing on-site: 3D SCANNING

3D SCANNING: BIM model generation through Scan to BIM

3D Model of the building pilot in
Gaztainondo (Pil.2)



3D Model of the Building Pilot
in pilot Serapio Mujika (Pil.1)

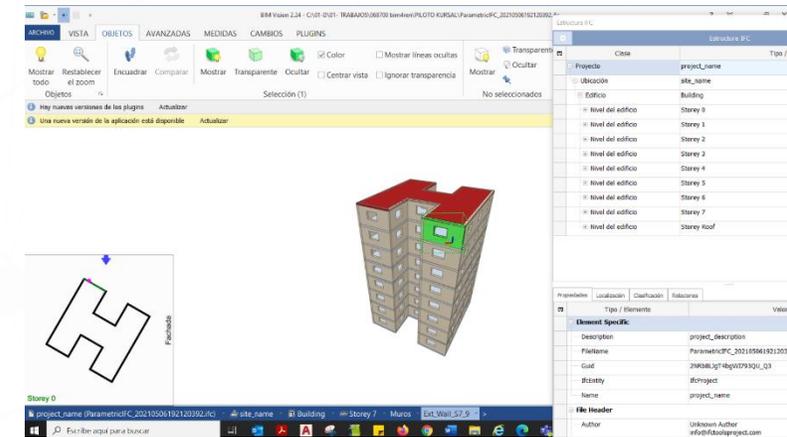
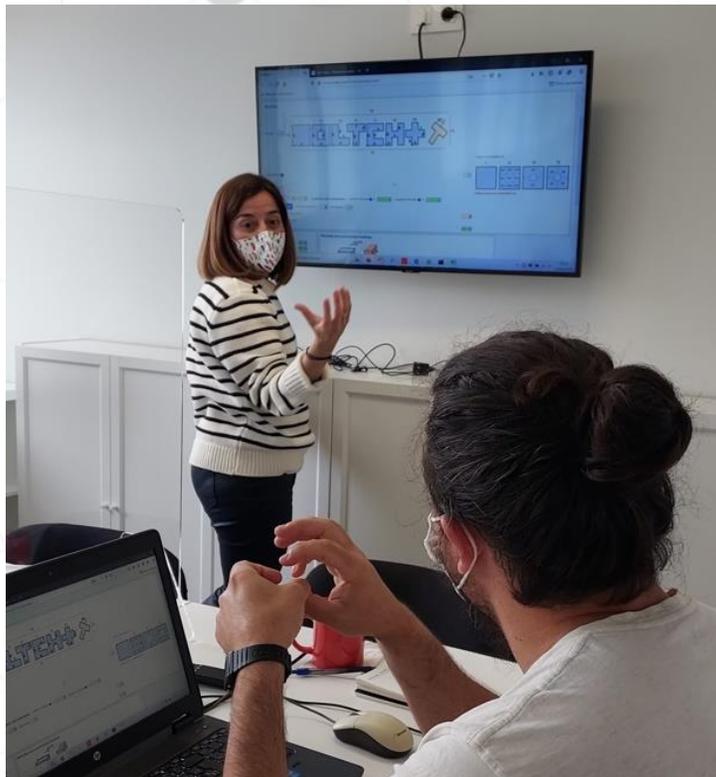


Tools Testing off-site: 3BTool/PIECE/GISTOIFC/BASE+

3BTOOL: Quick and easy energy assesment of buildings, benchmarking and renovation packages

PIECE+GISTOIFG: Automated creation of IFC file from a GIS file and parametric generator

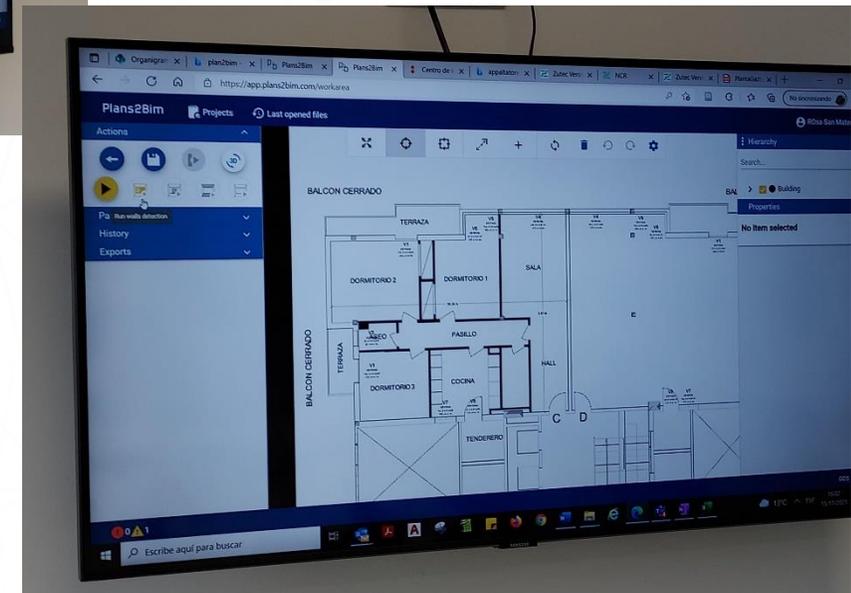
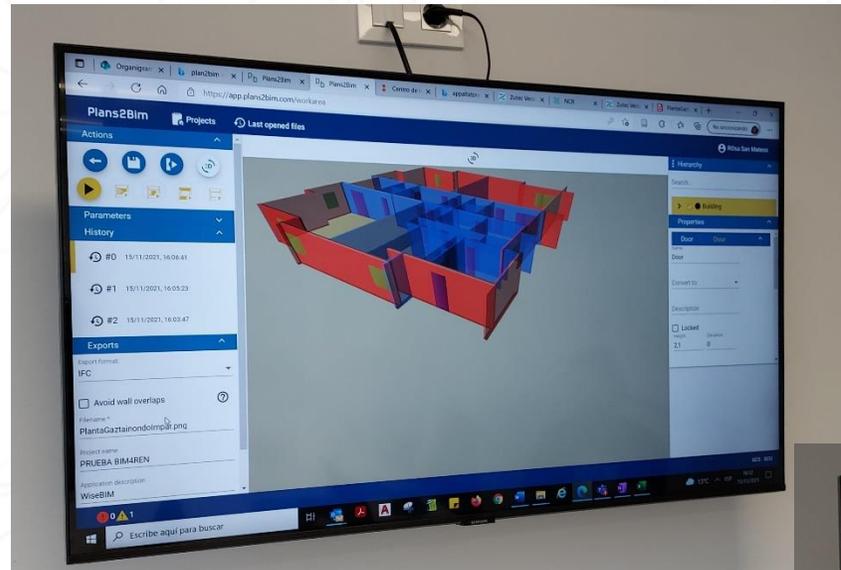
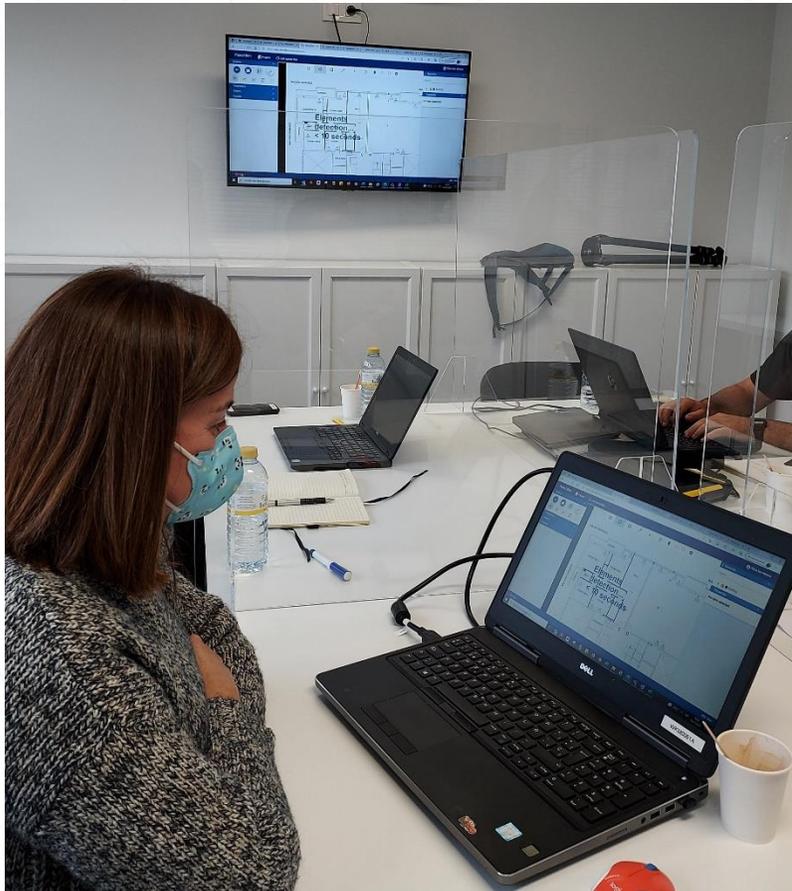
BASE+: Building Energy Assessment from an IFC file and DST for selecting the best renovation scenarios



Tools Testing off-site: Plans2BIM



PLANS2BIM : BIM Model Creation from 2D Drawings



Tools Testing off-site: ZUTEC



ZUTEC : Building lifecycle management: inspections and task assignment



17:42 45%

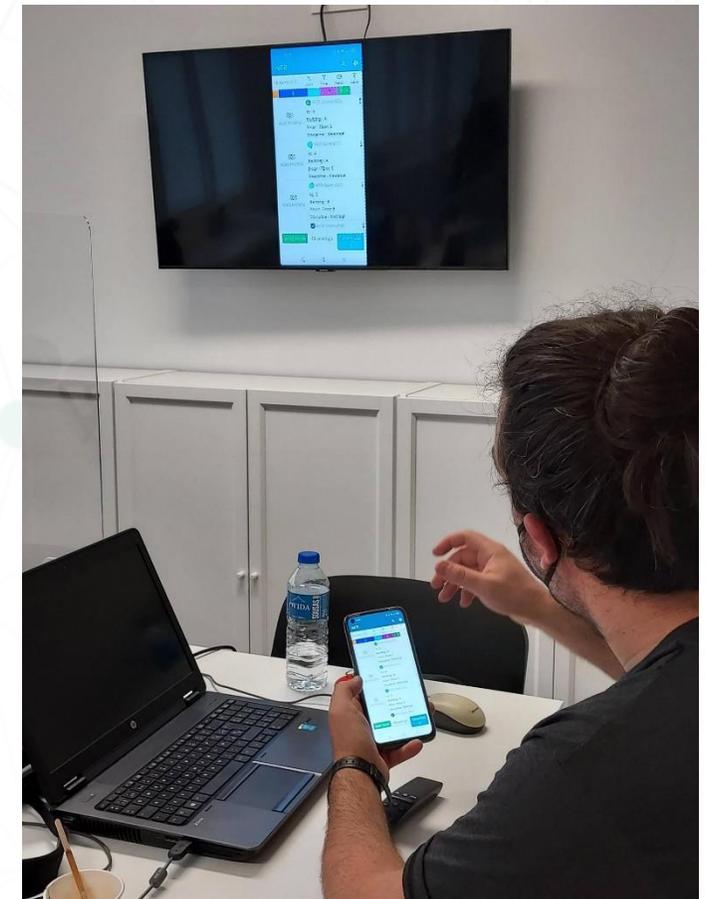
NCR

22 items (22) Sort Filter Reset Sync

1 5 2 3 2 1 2 6

-  NCR Open (GC) :
Id : 4
Building : A
Floor : Floor 1
Discipline : Electrical
-  NCR Open (GC) :
Id : 5
Building : B
Floor : Floor 2
Discipline : Eletrical
- ADD PHOTO NCR Open (PM) :
Id : 8
Building : B
Floor : Floor 2
Discipline : Eletrical
- ADD PHOTO NCR Open (PM) :
Id : 9
Building : A
Floor : Floor 1

Add Item Drawings Download



Tools Testing off-site: Feedback Bot tool

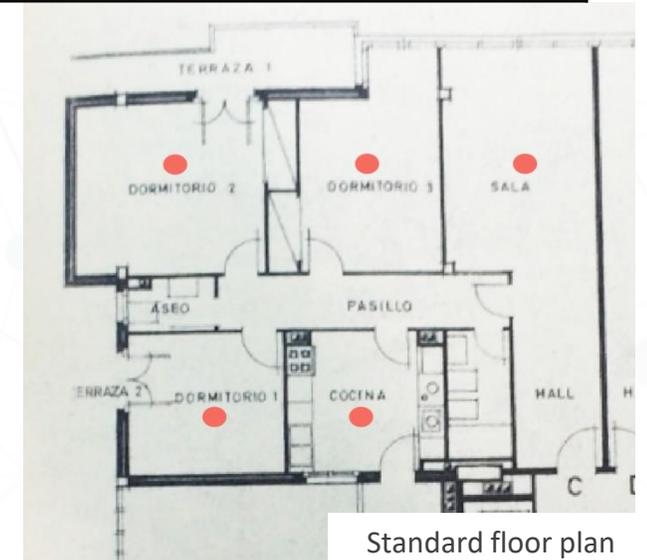


FEEDBACK BOT TOOL: Calibration of the energy model according to real monitoring after renovation and interactive guide for residents to check their energy consumption



Monitoring starting date: **April 2021**
Duration: **1 year**
Number of dwellings monitored: **5**
5 sensor/dwelling:

- Kitchen,
- Living room
- 3 bedrooms



Standard floor plan

BIM4Ren Feedback Tool For Users

EN NL SPA

Use the tabs below to view and alter the reference schedules.
When you are done with changing the schedules, press "Simulate New Scenario" to calculate the energy demand and indoor temperature statistics for the new schedules.
Press "Return to Reference Scenario" to reset all the changes to the schedules and show the energy demand and indoor temperature statistics for the reference schedules.

Select the energy unit: Simulation period:

Delivered Energy

Heating: **325.7 kWh**
Cooling: **0.0 kWh**

Change in heating demand compared to the reference: **10.3 kWh**
Change in Cooling demand compared to the reference: **0.0 kWh**

Temperature Statistics

average indoor temperature: **18.8 °C**

overall indoor temperature [°C]

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
06:00-09:00	21.0 °C	21.0 °C	21.0 °C	21.0 °C	21.0 °C	21.0 °C	21.0 °C
09:00-13:00	21.0 °C	21.0 °C	21.0 °C	21.0 °C	21.0 °C	21.0 °C	21.0 °C
13:00-18:00	19.0 °C	19.0 °C	19.0 °C	19.0 °C	19.0 °C	17.0 °C	17.0 °C
18:00-23:00	19.0 °C	19.0 °C	19.0 °C	19.0 °C	19.0 °C	17.0 °C	17.0 °C
23:00-06:00	17.0 °C	17.0 °C	17.0 °C	17.0 °C	17.0 °C	17.0 °C	17.0 °C

Buttons: Return to Reference Scenario, Simulate New Scenario, Reset Thermostat Schedule

Time step: every 10 minutes

Indoor Temperature,
Relative humidity
CO2



Gas consumption



Electricity consumption



Tools Testing off-site: GIS-2-IFC, Parametric IFC & BASE+



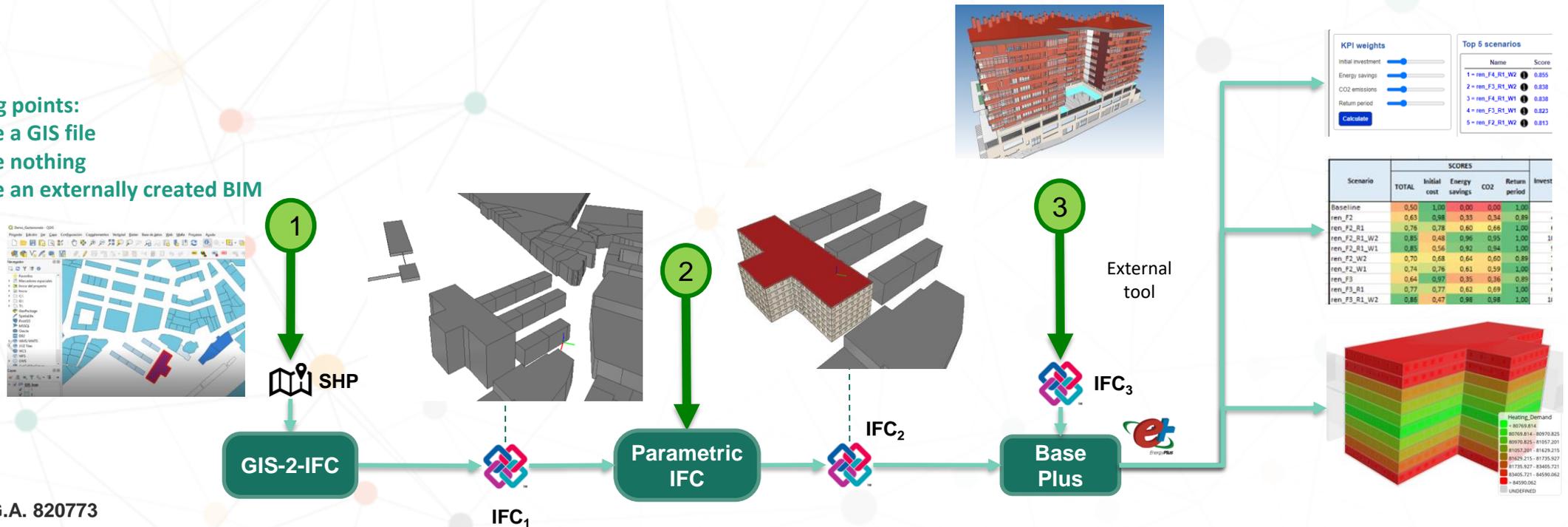
GIS-2-IFC, Parametric IFC & BASE+

A toolkit composed by three modules that can work independently or in a sequence and is flexibly adapted to different starting situations

- **GIS-2-IFC:** creation of a low-resolution district scale BIM/IFC model from GIS
- **Parametric IFC:** creation of a ready-to-simulate IFC file following quick parametric rules.
- **Base+:** decision support tool for energy renovation alternatives using an IFC as input and parametric run of Energy Plus simulations in the cloud

Different starting points:

- 1) We have a GIS file
- 2) We have nothing
- 3) We have an externally created BIM



Tools Testing off-site: GIS-2-IFC



Data gathering: **GIS-2-IFC**: An easy-to-use tool for the data acquisition phase, using off-site methods

- Description:**
 - Automatic district-scale IFC creator (low resolution)
 - Converts an ESRI shapefile to an IFC with multiple buildings (only envelope)
- Target end users:** Any user with minimum GIS background
- Required time:** Few seconds for medium size areas (e.g. 100x100m)
- Requirements:** GIS with height information
- Next improvements:** to automatically connect to cadaster or open data sources

SHP to IFC converter
Step 1: upload shapefile (zip)

Select file:



SHP to IFC converter
Step 2: select and map attributes

Object type:

Identifier of the reference object:

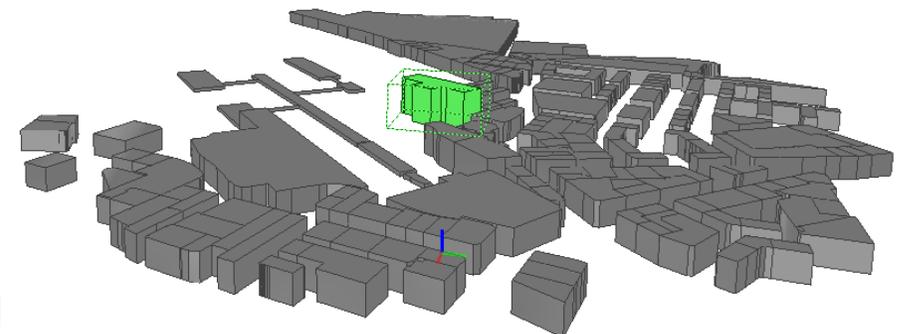
Radius around the reference object (50m < r < 300m):

GIS attribute name	Predefined IFC property name	Custom IFC property name
<input type="checkbox"/> HERRIA	<input type="text" value="Custom (provide the name in the next column)"/>	<input type="text" value=""/>
<input type="checkbox"/> ZCAT	<input type="text" value="Custom (provide the name in the next column)"/>	<input type="text" value=""/>
<input type="checkbox"/> PLANTAS	<input type="text" value="Custom (provide the name in the next column)"/>	<input type="text" value=""/>
<input type="checkbox"/> REFCAT	<input type="text" value="Custom (provide the name in the next column)"/>	<input type="text" value=""/>

Version:



Version:

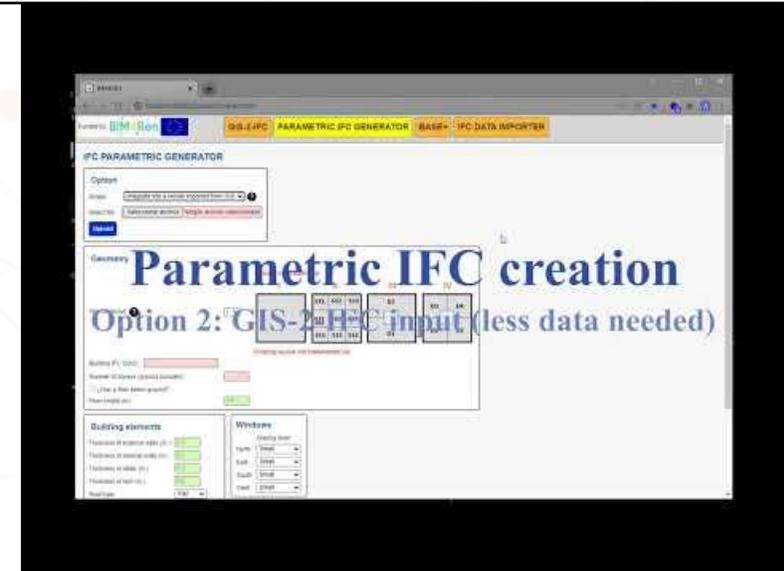


Tools Testing off-site: Parametric IFC



Parametric IFC Creator: An easy-to-use tool for the data acquisition phase, using off-site methods

- ❑ **Description:**
 - ❑ Generate a ready-to-simulate IFC, based on different shapes & internal layouts following parametric rules
 - ❑ We can start from scratch or from a previously created district model with GIS-2-IFC
- ❑ **Target end users:**
 - ❑ No need of technical skill in BIM/Energy
- ❑ **Required time:** Few seconds for medium size areas (e.g. 100x100m)
- ❑ **Requirements:**
 - ❑ “Free edition” ? no requirements. GIS import ? IFC model coming from GIS-2-IFC
- ❑ **Next improvements:** allow more flexible configuration options for windows, roofs, layouts, etc.



Combined video GIS2IFC + Parametric IFC

Layout & orientation

Internal distribution

Dimensions, storeys...

Free edition

External obstacles

Thickness of external walls (m): 0.3
 Thickness of internal walls (m): 0.1
 Thickness of slabs (m): 0.3
 Thickness of roof (m): 0.2
 Roof type: Flat

Building use
 Main use: Residential
 Ground floor use: Residential

Windows and surrounding buildings

	Glazing level	Distance to surrounding building (m) (0.0 if adjoining)	Height of surrounding building (m) (0.0 if there are no buildings)	Length of surrounding building (m)	Offset to the building start (m) (can be <0.0)
F1 (Small)	0.3	0.0	0.0	0.0	0.0
F2 (Small)	0.3	0.0	0.0	0.0	0.0
F3 (Small)	0.3	0.0	0.0	0.0	0.0
F4 (Small)	0.3	0.0	0.0	0.0	0.0

GIS import

Geometry

Internal layout: 1

Building IFC GUID: [input field]

Number of storeys (ground included): [input field]

Has a floor below ground?

Floor height (m): 0.0

Building elements

Thickness of external walls (m): 0.3
 Thickness of internal walls (m): 0.1
 Thickness of slabs (m): 0.3
 Thickness of roof (m): 0.2
 Roof type: Flat

Windows

Glazing level: [input field]
 North: Small
 East: Small
 South: Small
 West: Small

Building use

Main use: Residential
 Ground floor use: Residential

Layout & orientation
Automatically taken from GIS

External obstacles
Automatically taken from GIS



H2020 G.A. 820773

Tools Testing off-site: Diagnosis: BASE+



BASE+ : Decision support tool for the Diagnosis and Data driven design phase

Description:

- Preliminary energy renovation potential assessment using a conceptual IFC
- Automatic generation of Energy Plus input files by processing spaces and quantities from IFC
- Generation of renovation scenarios based on built-in logic and user defined criteria
- Launch parallel E+ simulations in the cloud Output: KPI rankings & detailed Excel file

Target end users:

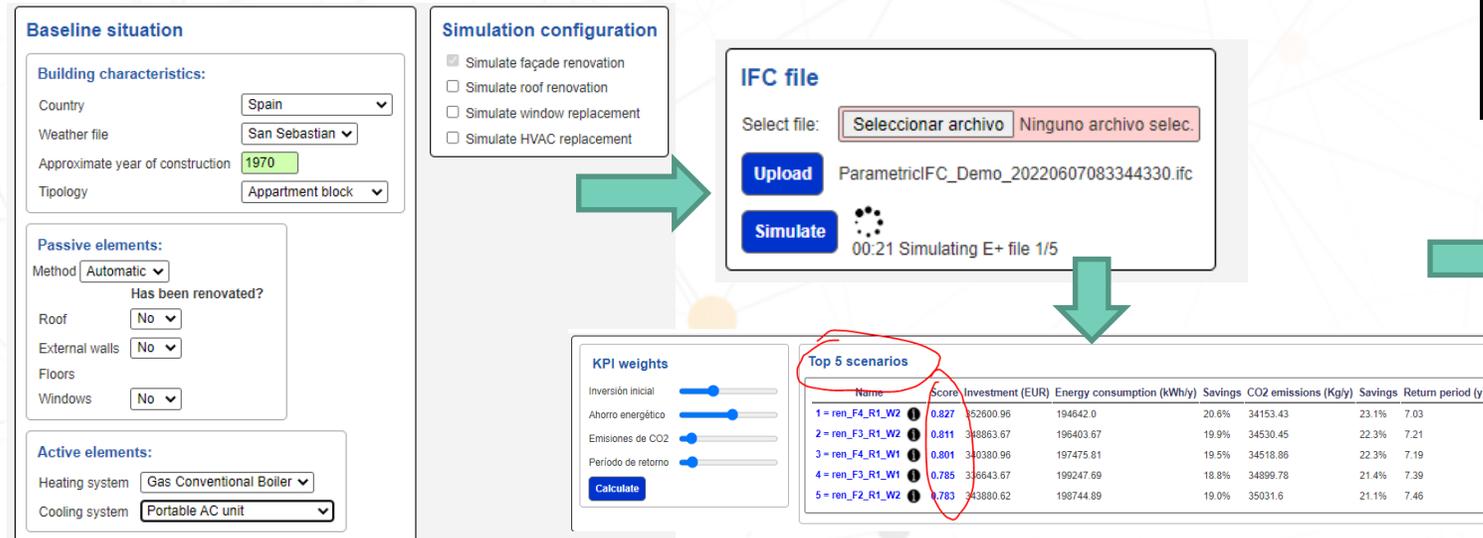
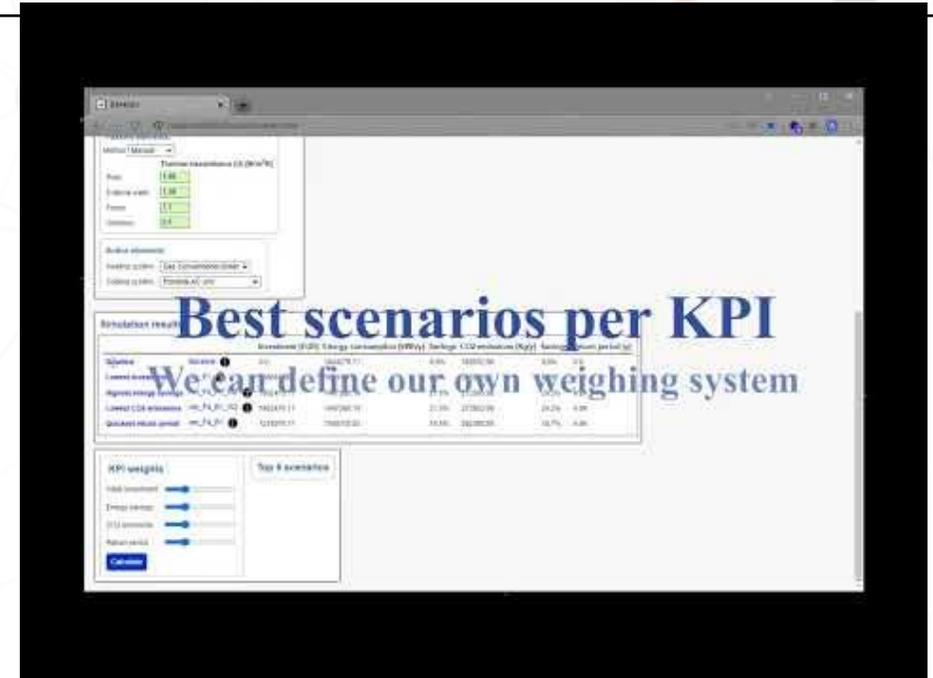
- Users with medium technical skills, not experts in energy or BIM

Required time: Few minutes for medium size buildings (up to 10 thermal zones)

Requirements:

- IFC model coming from previous step
- Support to externally created IFC files is still in progress

Next improvements: support any kind of IFC & increase the simulation speed



BASE+ video

WEIGH: ABS 5, REL 25%, Energy savings 5, CO2 saving 5, Return of inv 5

Interest rate: 1.00%

Detailed Excel for download

Scenario	SCORES					Energy consumption cost (EUR/y)			Inflation		CO2 emissions (Kg/y)		Return period (y)	Return period (y)							
	TOTAL	Initial cost	Energy savings	CO2	Return period	Total	Savings	Savings %	Total	Savings	Savings %	0		1	2	3	4	5	6		
Baseline	0.50	1.00	0.00	0.00	1.00	0	44.563	0	0.0%	0.00%	8.335	0	0.0%								
ren_F2	0.63	0.98	0.33	0.34	0.89	41.920	37.031	7.532	16.9%	2.00%	6.672	1.662	19.9%	6	-41.920	-34.807	-27.473	-19.911	-12.118	-4.086	4.189
ren_F2_R1	0.76	0.78	0.60	0.66	1.00	66.094	30.725	13.838	31.1%	2.00%	5.047	3.288	39.4%	5	-66.094	-52.916	-39.310	-25.326	-10.894	-3.976	19.294
ren_F2_R1_W2	0.86	0.68	0.96	0.95	1.00	102.494	22.541	22.022	49.4%	2.00%	5.616	4.719	56.6%	5	-102.494	-81.497	-69.649	-37.596	-14.941	-9.151	35.586
ren_F2_R1_W1	0.85	0.56	0.92	0.94	1.00	93.994	23.311	21.252	47.7%	2.00%	3.705	4.630	55.5%	5	-93.994	-73.076	-62.130	-30.540	-8.293	14.628	38.238
ren_F2_W2	0.70	0.68	0.64	0.60	0.89	78.320	29.788	14.775	33.2%	2.00%	5.367	2.968	35.6%	6	-78.320	-64.328	-49.901	-35.029	-19.700	-9.904	12.369
ren_F2_W1	0.74	0.76	0.61	0.59	1.00	69.220	30.401	14.162	31.8%	2.00%	5.441	2.894	34.7%	5	-69.220	-55.750	-41.861	-27.545	-12.791	-2.411	18.071
ren_F3	0.64	0.97	0.35	0.36	0.89	45.378	36.531	8.052	18.0%	2.00%	6.562	1.772	21.9%	6	-45.378	-35.760	-27.945	-19.669	-11.544	-2.965	5.873
ren_F3_R1	0.77	0.77	0.62	0.69	1.00	67.552	30.182	14.981	32.3%	2.00%	4.927	3.408	40.9%	5	-67.552	-53.846	-39.116	-25.150	-10.140	-5.215	21.256
ren_F3_R1_W2	0.86	0.47	0.98	0.98	1.00	103.952	21.952	22.611	50.7%	2.00%	3.487	4.847	58.2%	5	-103.952	-82.380	-60.140	-37.117	-13.594	10.745	35.817



Methodology for assessment the process improvement through KPIS



This project has received funding from the H2020
programme under Grant Agreement No. 820773

Methodology for assessment the process improvement through KPIS



DEFINITION OF KPI

A Key Performance Indicator (KPI) is a **quantifiable measurement of the performance** of either the **process** during renovation or the **building** under renovation.

KPIs may relate to the building or to one or more of its parts, systems, components or individual elements

HOW TO MEASURE THEM

- Defining the measurement units
- Defining the measurement and validation (M&V) protocol (who, how, where, when to measure)
- Comparing the achieved values with the threshold values of the KPIs



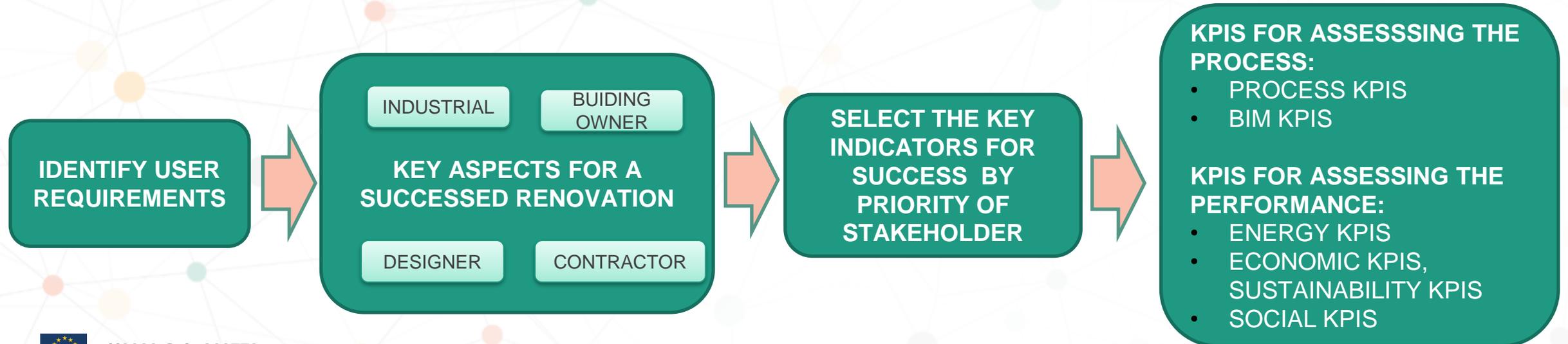
Methodology for assessment the process improvement through KPIS



STARTING FROM THE **USER REQUIREMENTS** => DEFINITION OF **INDICATORS** FOR RENOVATION PROCESS

The **indicators** allow to **measure the success of the renovation process** according to different criteria and relevance by stakeholder

PROCESS FOLLOWED IN BIM4REN FOR DEFINING THE KPIS



Methodology for assessment the process improvement through KPIS



KPIs defined in BIM4ren for assessing the renovation **PROCESS**:

Process KPIS:

- Time Savings
- Processes repeated
- Cost Savings
- Waste Generated
- Disturbances
- Level of Digitalization of the process
- Resources Consumed

BIM KPIS:

- Interoperability between tools
- Integration of stakeholders requirements
- Investment / training required for BIM
- BIM trained workers
- Level of Involvement of stakeholders in phases
- Communication between stakeholders

KPIs for assessing the **PERFORMANCE** of the renovated building

Energy KPIs

- Final energy demand
- Heating & cooling demand
- DHW demand
- Final energy Consumption
- Energy Savings
- RES production

Economic KPIS:

- Investment
- Payback period
- Accessibility to financing

Sustainability KPIS:

- Recycled material content
- Carbon Footprint
- Water Consumption
- Waste generated
- CO2 emmissions
- Sustainability Labelling

Social KPIS:

- Thermal comfort
- Average Temperature
- Average Humidity
- Air Quality
- Fresh air
- Daylighting

Methodology for assessment the process improvement through KPIS



Example KPI: PROJECT COST PREDICTABILITY

	CODE	PR1.4	UNIT	%
GOAL	Improve project cost predictability.			
DESCRIPTION	It allows monitoring the project cost predictability in order to lower risks. This KPI compares the tendered cost of the process to the actual cost, measuring the accuracy of the prediction.			
UNIT	%.			
MEASUREMENT & VALIDATION				
COMMENTS	When the cost predictability is high ,the risk of tendering cost is low. One of the biggest issues of the building industry is the lack of accuracy when predicting cost, which generates budget overruns and economic losses. Literature asserts that BIM methodology benefits project cost tendering. The model's accuracy is higher and predictability should get benefit from it.			



Methodology for assessment the process improvement through KPIS



KPIS methodology applied to SPANISH USE CASES

BASELINE: Bertsolari
Txirrita 38. Donosti



PILOT: Serapio Mujika 18.
Donosti



VS

SELECTED KPIS IN SPANISH PILOT FOR MEASUREMENT THE SUCCESS OF RENOVATION :

- KPI PR1.4. BUDGET PREDICTABILITY DE PRESUPUESTO
- KPI PR1.2. SCHEDULE PREDICTABILITY
- PREVISIBILIDAD DE PLAZOS
- KPI PR1.1. HUMAN RESOURCES PRODUCTIVITY
- KPI PE3.4 RENOVATION WASTES

WITHOUT ANY BIM TOOL

USING BIM TOOLS

- Data acquisition : 3D scanner
- Construction monitoring and task management : ZUTEC





Conclusions about the digitalisation of the process in the Spanish use case



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Conclusions about the digitalisation of the process in the Spanish use case



- **BIM in renovation** is not only a set of tools for data gathering but also for supporting in the whole renovation process **boosting collaboration, accurate diagnosis, managing data, monitoring the results...**
- **Digitalisation is also feasible for SME and small renovation projects** representing a huge opportunity for improving the quality, efficiency, cost predictability and saving time. The threshold of BIM must be lowered and adapted to the specific needs of each company.
- A **wide range of BIM-based tools** according to the type of renovation, phase addressed and users need is available=> The **best selection** for each company and project must be done accordingly **no matter the project or company**
- It is necessary to **adapt the use of BIM** to suit each type of company, **size of the project and stage of the process**
- Digitisation of processes represents a **great opportunity for SMEs**



BIM4Ren

TRAINING

Thank you for
your attention



This project has received funding from the H2020 programme under Grant Agreement No. 820773

<http://bim4ren.eu/>



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