EPC RECAST

ENERGY PERFORMANCE CERTIFICATE RECAST

Next Gen. EPC Conference – May 23rd 2024 – Olivier GRESLOU (CSTB)

EPC RECAST : Innovative workflow and digital toolbox to support the implementation of new generation of EPCs for residential buildings

The overall EPC RECAST process

EPC RECAST

EPC RECAST in a nutshell

Innovative process and digital toolbox to develop and validate a new generation of EPCs for residential buildings

✓ To facilitate and improve working practices of **EPC assessors** → **quality** and **reliability** of EPCs

✓ To tailor renovation recommendations, highlight benefits for **building owners** → **user-centric** approach

Data collection

Quality checks

Renovation roadmaps

Non-energy benefits

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OUR TEAM

CSTB
le futur en construction

tecnalia
Inspiring Business

Fraunhofer
IBP

LUXEMBOURG INSTITUTE OF SCIENCE AND TECHNOLOGY
LIST

POLITECNICO
MILANO 1863

eDF

ENGIE

bimeo

ENBEE
Environment & Building Energy Efficiency

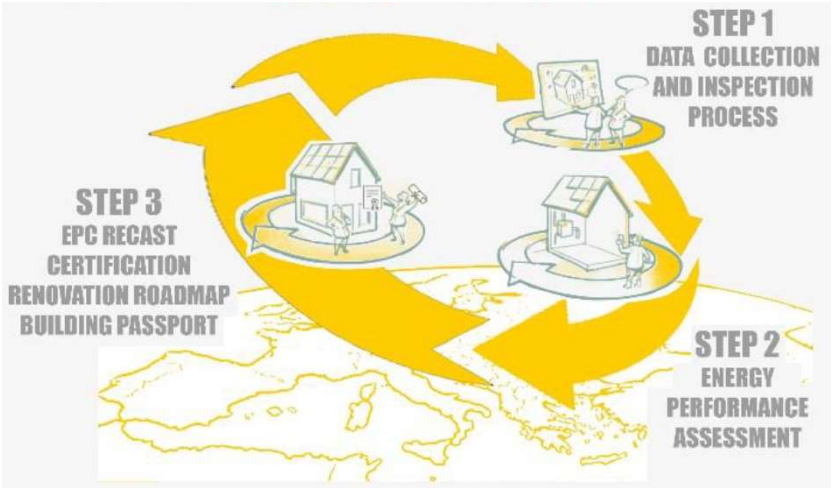
R2M
RESEARCH TO MARKET
SOLUTION

REHVA
Federation of European Heating, Ventilation and Air Conditioning Associations

EPC RECAST

Project objectives

- Supporting the **work of EPC assessors** to **improve reliability of EPCs** **:** data collection, quality checks, model calibration
- Developing a prototype of **cloud system toolbox** for EPC assessors and a new generation of EPCs
- Co-designing the EPC assessment process with owners and assessors : interactive **user-centered design approach**
- Improving **renovation recommendations** in EPCs with renovation roadmaps and additional indicators
- Collecting recommendations from public authorities and industrial stakeholders : **advisory board** and **mirror group**



Workload for EPC assessor:
≤ half a day of on-site work,
off-site work ≤ on-site work

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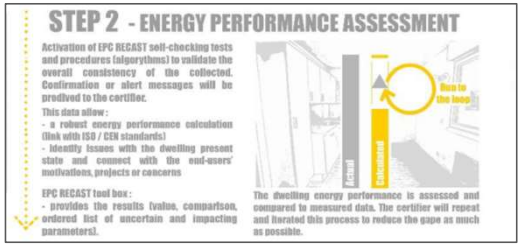
The EPC RECAST Steps

STEP 1 – Data Collection and Inspection Process

TARGET : Duration ≤ 0.5 day, on-site

STEP 2 – Energy Performance Assessment

TARGET : Step 2 + Step 3 ≤ 0.5 day, back at the office



STEP 3 – Certification & Renovation Roadmap

TARGET : Step 2 + Step 3 ≤ 0.5 day, back at the office

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The standard EPC evaluation process : data and layers

Climate and building use	Input layer	Evaluation layer	Output layer
Standard conditions (climate and use)	Standard data collection	Standard national software	Standard EPC
Real conditions (climate and use)	EPC RECAST data collection	EPC RECAST energy performance assessment	EPC RECAST EPC
			Measured energy consumption

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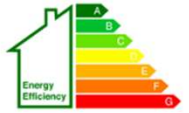
The EPC RECAST evaluation process : step 1

Climate and building use	Input layer	Evaluation layer	Output layer
 Standard conditions (climate and use)	 Standard data collection	 Standard national software	 Standard EPC
 Real conditions (climate and use)	bimeo EPC RECAST data collection	Cstb Energy Plus EPC RECAST energy performance assessment	 EPC RECAST EPC
			 Measured energy consumption

Calibration of dynamic energy simulation model

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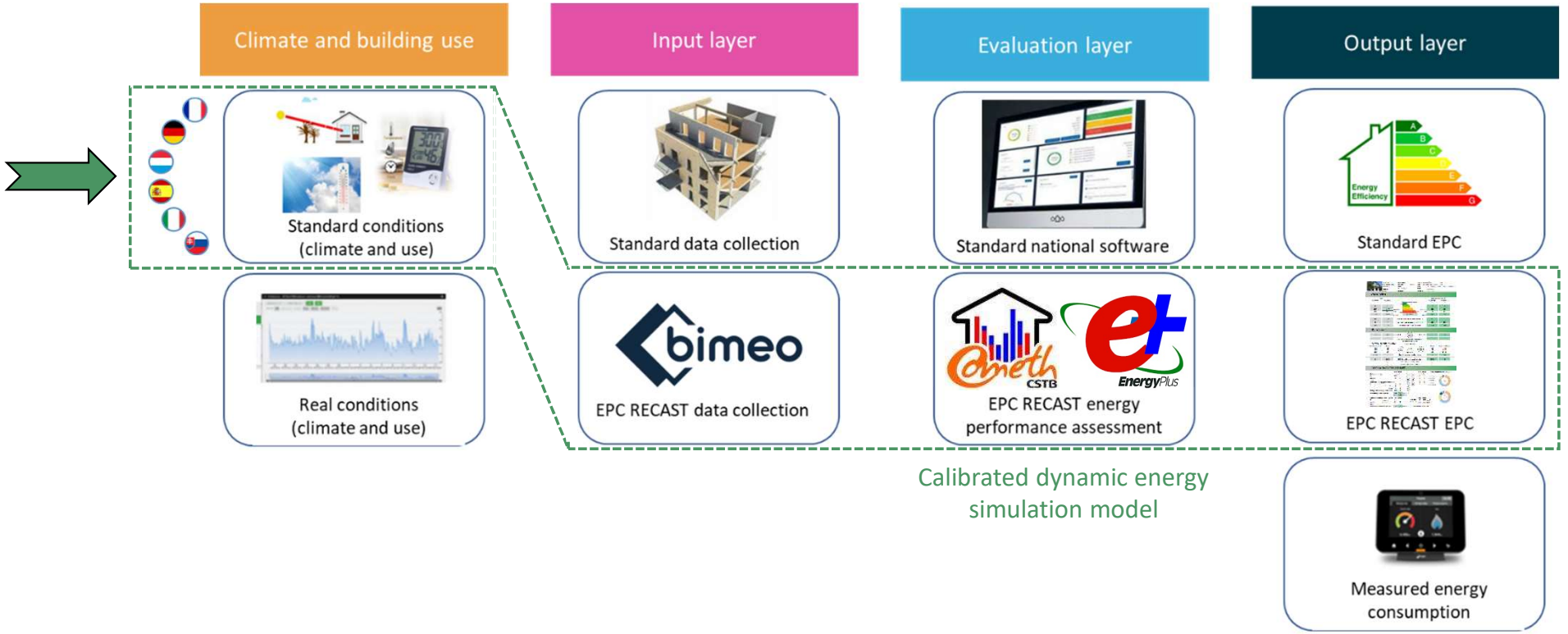
The EPC RECAST evaluation process : step 2



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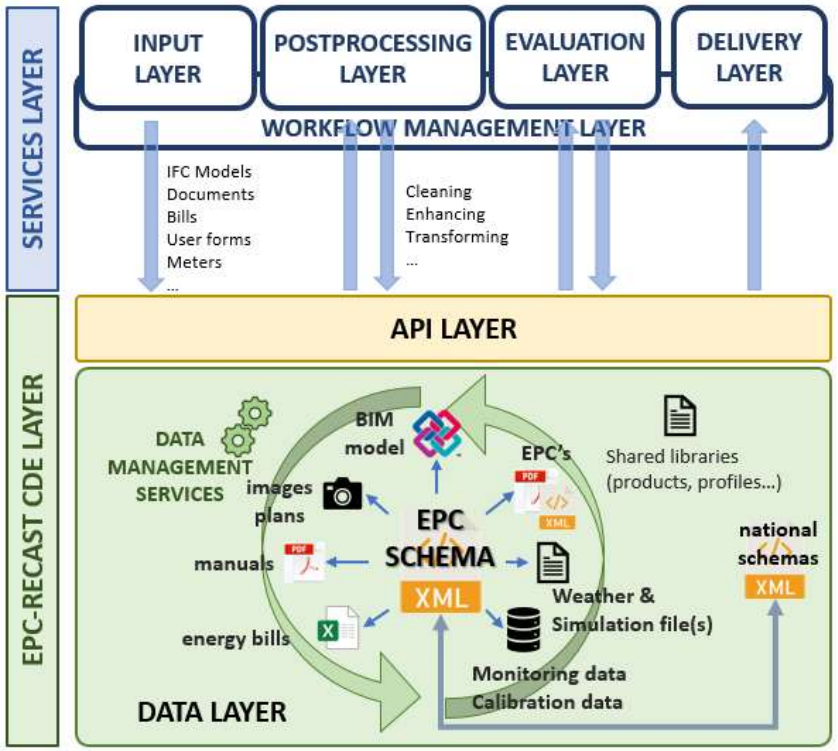
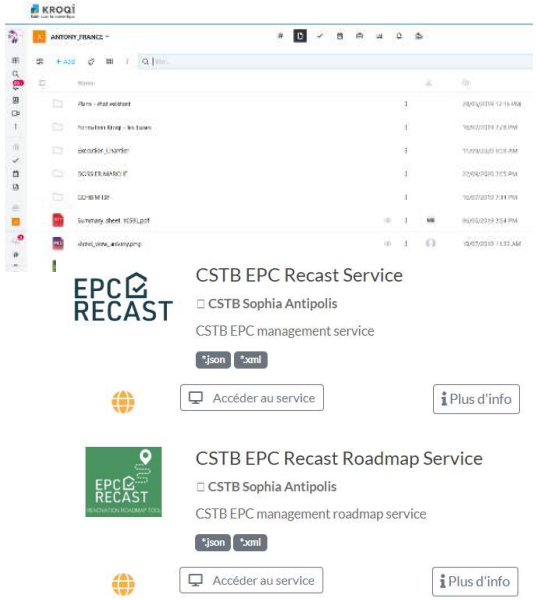
Integrated data and services : Common Data Environment



KROQI
Bâtir avec le numérique

Cloud-based platform : files management and web services



XML

Central data model and complementary data files

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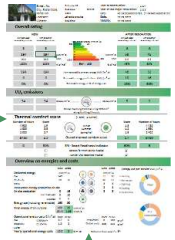
Common Data Environment

Data model and files

EPC RECAST core process

Data model and files



Next Gen. EPC

On-Site Diagnosis

On-Site Measurements

Consumption data

Dynamic energy simulation

Automated Model calibration (Real conditions) → EPC calibrated Simulation (Standard conditions)

Renovation roadmap

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EPC RECAST supporting the EPBD RECAST

✓ **Article 4.** Methodology for calculating the EP

→ **Computing cores for dynamic EP calculation**

→ **Model calibration and operational rating**

✓ **Article 9.** Trajectories for progressive renovation

✓ **Article 12.** Renovation passport

→ **Quick renovation roadmap tool**

✓ **Article 16.** Data exchange

→ **Common data environment**

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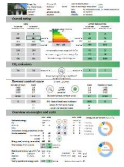
✓ **Article 17.** Financial incentives

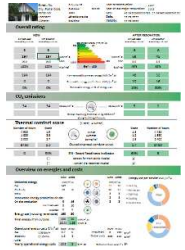
→ **KPIs before and after renovation on the EPC**



✓ **Article 19.** EPCs

→ **EPBD RECAST compliant template**

→ **Digital tool for on-site visits**



✓ **Article 20.** Issue of EPCs

→ **Simulation data model and report**

✓ **Article 22.** Databases for the EP

→ **Common data model of the building**

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STEP 1 – On-Site data collection

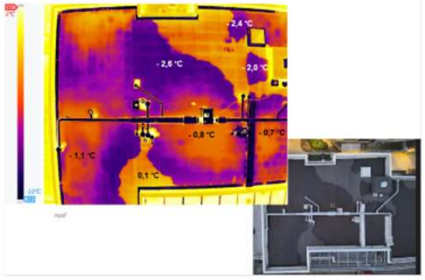
Technologies for data collection

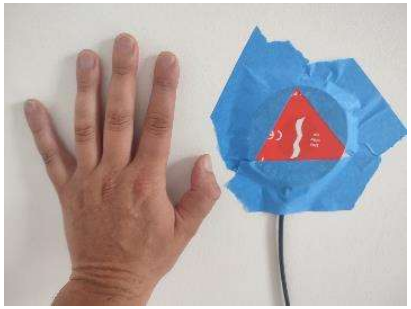
Main difficulties for real data collection about the dwelling:

- Often inaccurate evaluation of the building dimensions
- High variability of data collection practices and results
- High uncertainties in the assessment of the envelope thermal characteristics & energy systems

What are EPC RECAST's major contributions?

New tools and technologies to facilitate and enrich the on-site data collection





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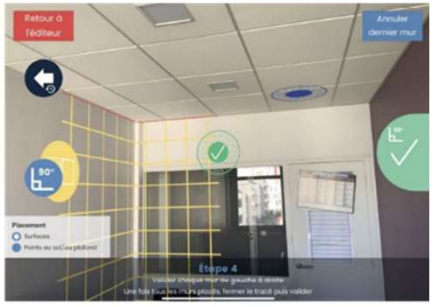
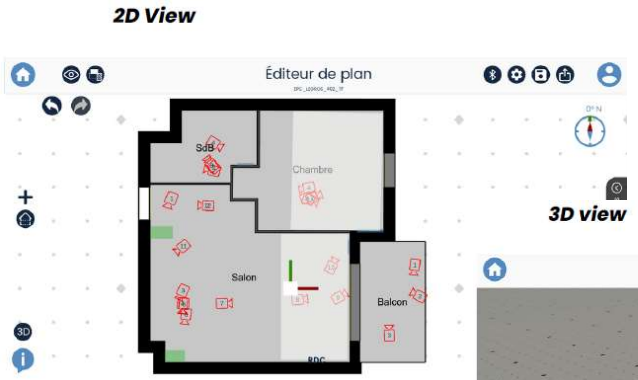
On-site inspection of the building

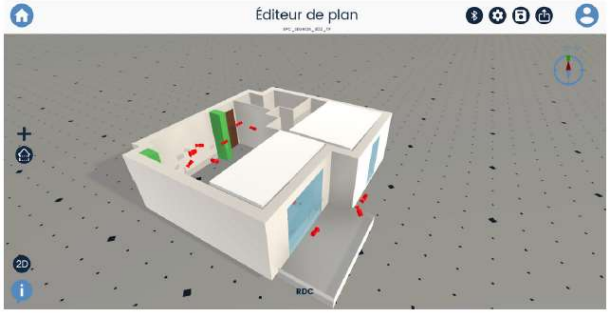
The BIMEO technology for the digitization of the dwelling

- Augmented-reality technology based on Ipad + Lidar sensor
- Fast geometrical scan to generate a reliable BIM-model of the dwelling with precise dimensions
- Integrated questionnaires to facilitate observations of the envelope and energy systems and centralize information

✓ Fast data collection
✓ Automated connection with energy simulation software







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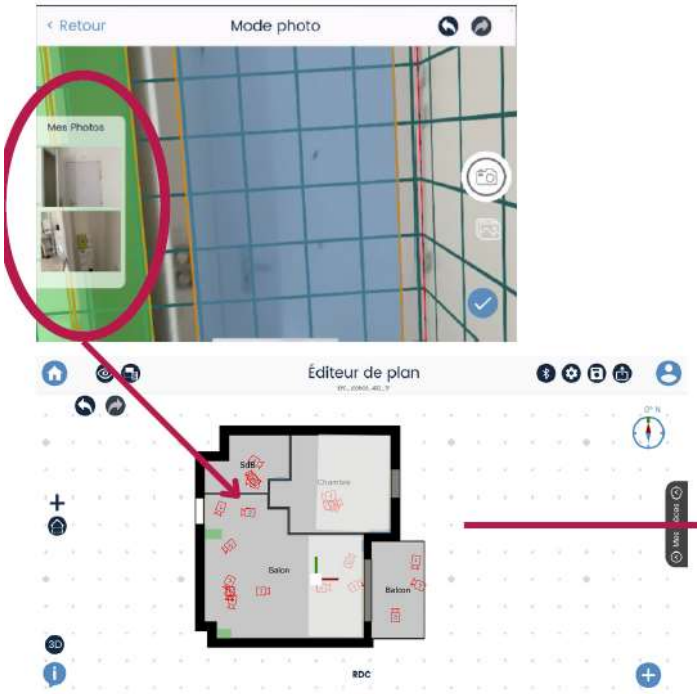
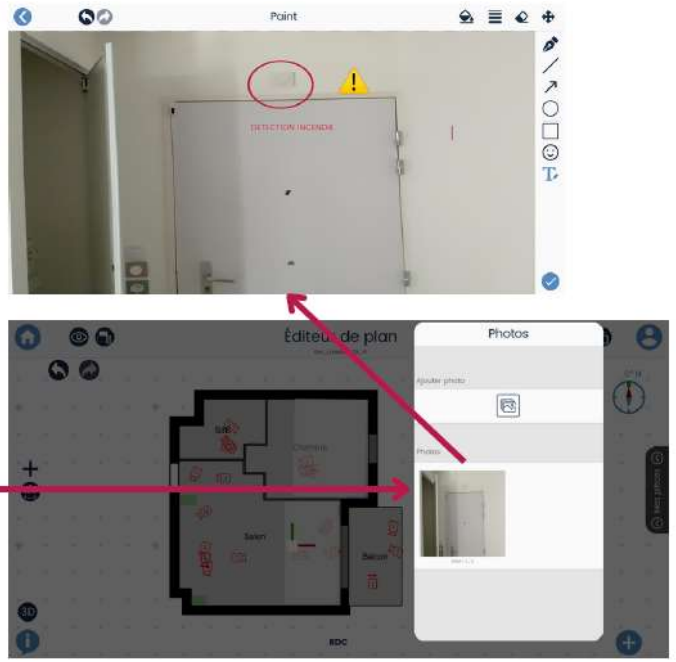
On-site inspection of the building

The BIMEO technology for the digitization of the dwelling

Adding georeferenced photos to the building plan



Annotation of photos



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Specific measurements : thermal characteristics of the envelope

Difficult assessments for EPC assessors :

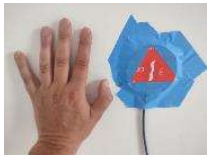
- Lack of technical documentation dating back to construction or previous renovations
- Visual observations : insufficient to characterize wall materials and thermal bridges
- EPC assessors cannot take samples of wall materials

→ Default values in national EPC methods strongly decrease the simulated energy performance

→ Reference values based on typical walls and materials

Measuring the performance of the building envelope

→ Additional measurements could be used to evaluate infiltration rates and heat losses through walls to get heat transfer coefficients (« U values »)



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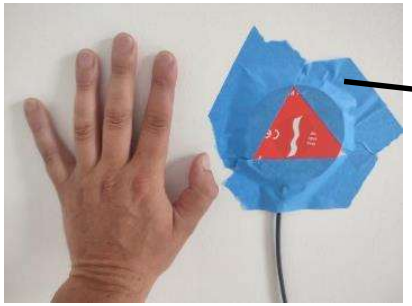
Thermal characteristics of the envelope : using heat-flux meters



Sampled dwellings in multifamily building

- Heat-flux meters + sensors to measure indoor and outdoor temperatures
- Analysis based on **ISO 9869**
- Duration of measurements : 7 days with low impact on households
- Temperature difference between outside and inside > 10°C
- Use of a thermal camera to position heat-flux meters at the right place

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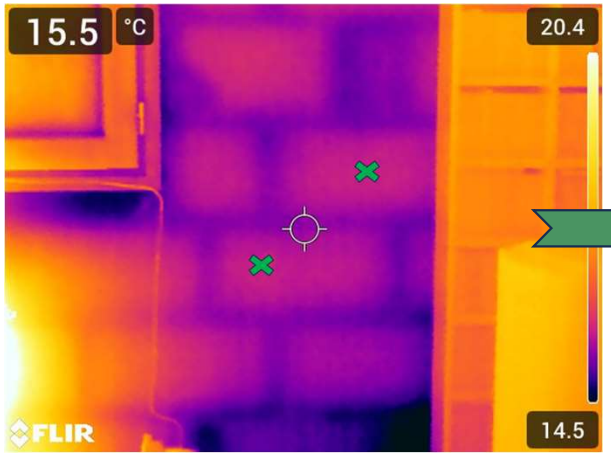
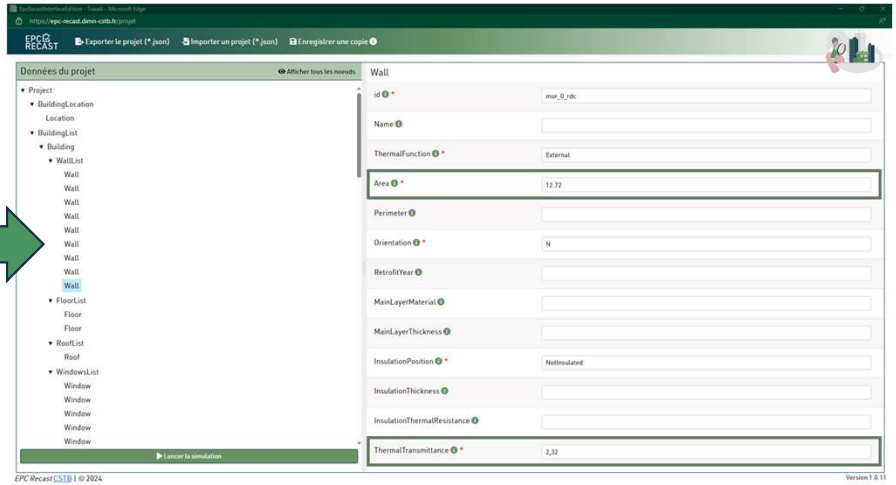
Getting the U-Value of the wall : Example on a pilot house



Thermal Camera Scan

Installed Heat-Flux Meters and remote measurements toolkit



Thermal Transmittance (U-value) in EPC RECAST simulation tool

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STEP 2 – Energy performance assessment

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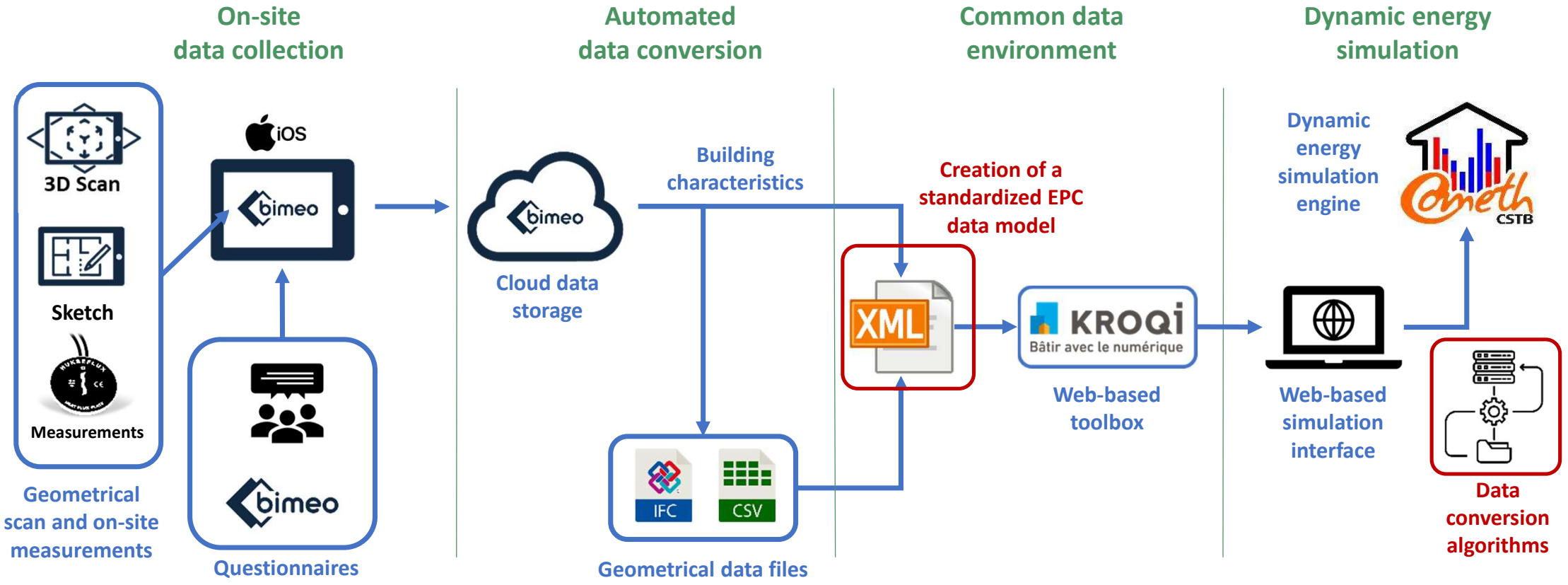
From data collection to dynamic energy simulation



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EPC RECAST tool for dynamic energy simulation

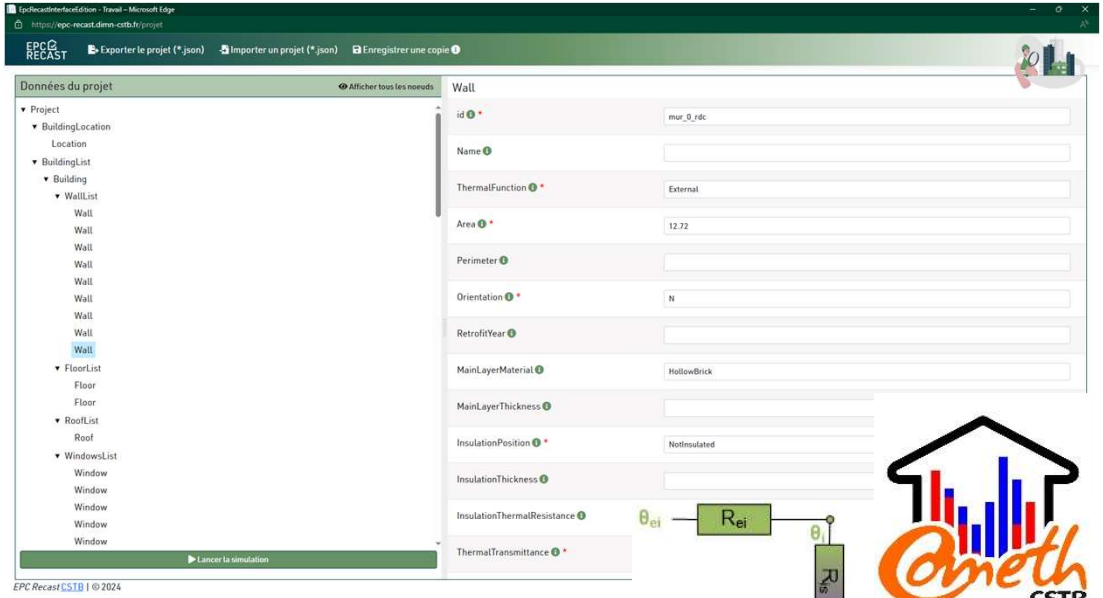
- Online interface with simple set of input data

→ *equivalent to datasets in national EPC software (simplified simulations, monthly or annual time steps)*

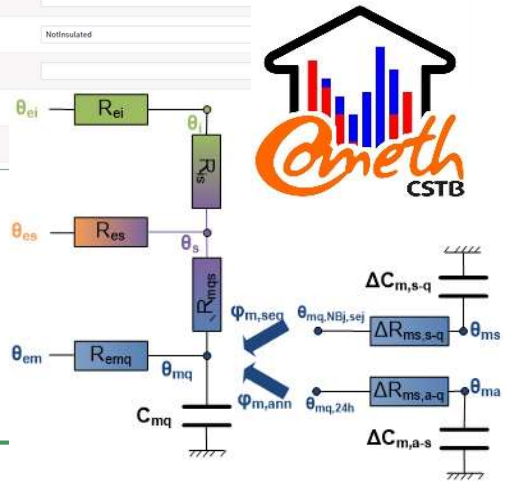
- Automated connexion with detailed computing core for dynamic EP assessment, hourly time step

- Reads and updates the EPC RECAST XML data model

✓ Easy-to-use, quick setup
✓ Takes into account thermal inertia of the envelope
✓ Allows detailed simulations of HVAC systems from very little information (eg : heat pumps)



Web-based simulation interface



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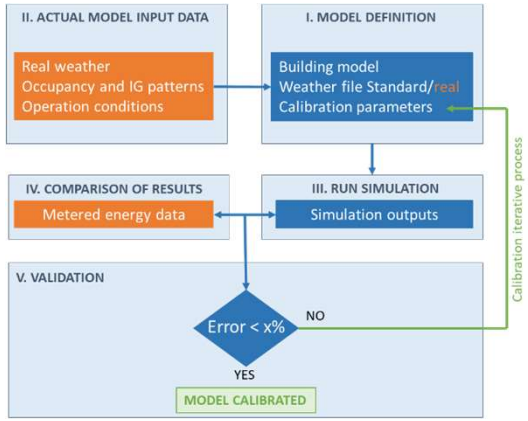
Mitigating the gap between calculated and measured energy

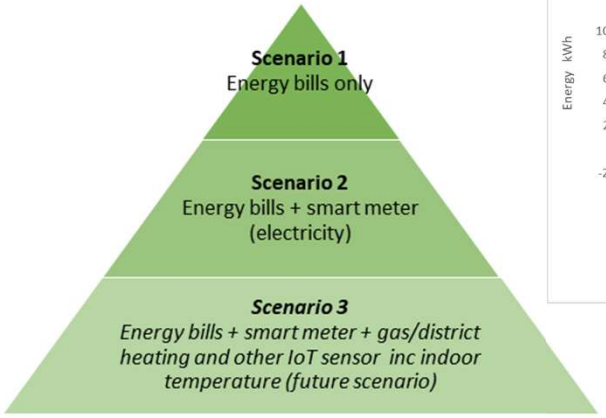
Two approaches have been developed and tested**:**

1. Calibration procedure

Iterative process for asset rating – actual input data - model definition – run simulation – comparison of results with metered data



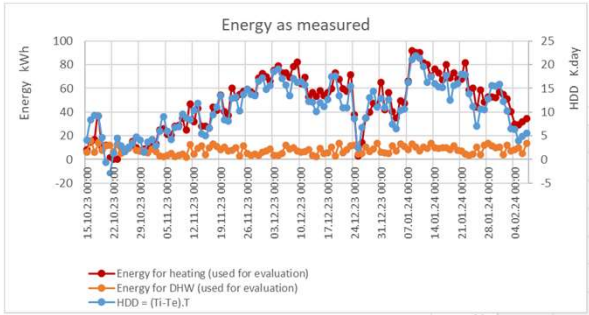
Steps of proposed calibration procedure

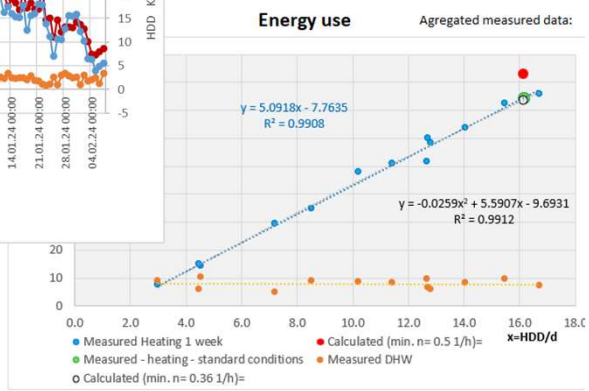


The measured data availability.

2. Operational rating for heating and DHW

Normalisation of measured energy to standard conditions
Test on measured data in WP3 (SK pilot buildings),
Link to EN 15378-3:2017





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Guided automated calibration of parameters

Performance gap between calculated and measured data

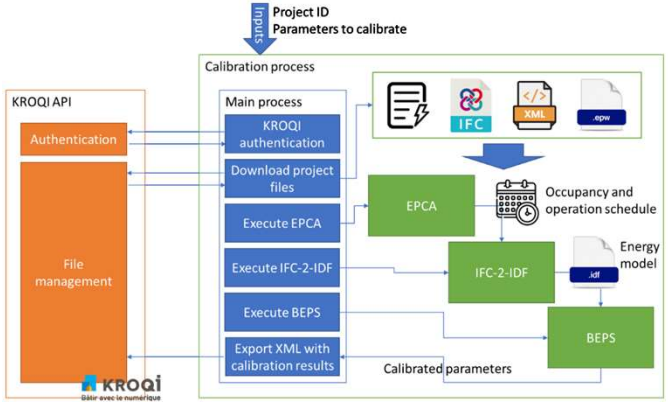
- EPC energy models are not reliable enough

→ conclusions are not valid

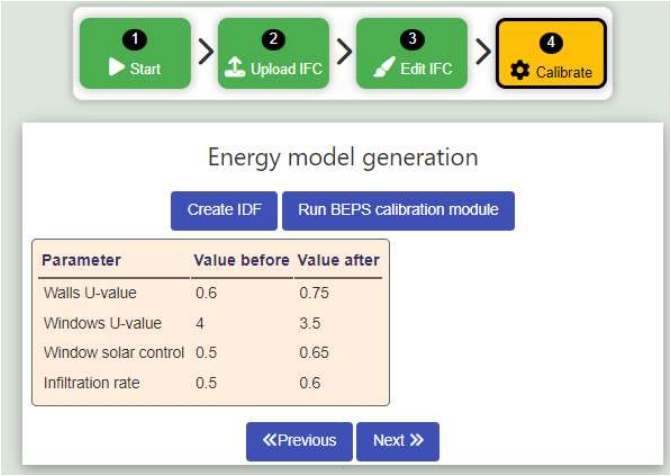
- Reliable predictions through simulations to evaluate improvement measures and define **best-value renovation roadmap**

Necessary to reduce the performance gap to ensure reliable results

Online toolbox with step-by-step process



Calibration of main uncertain parameters



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STEP 3 – Certification and Roadmap

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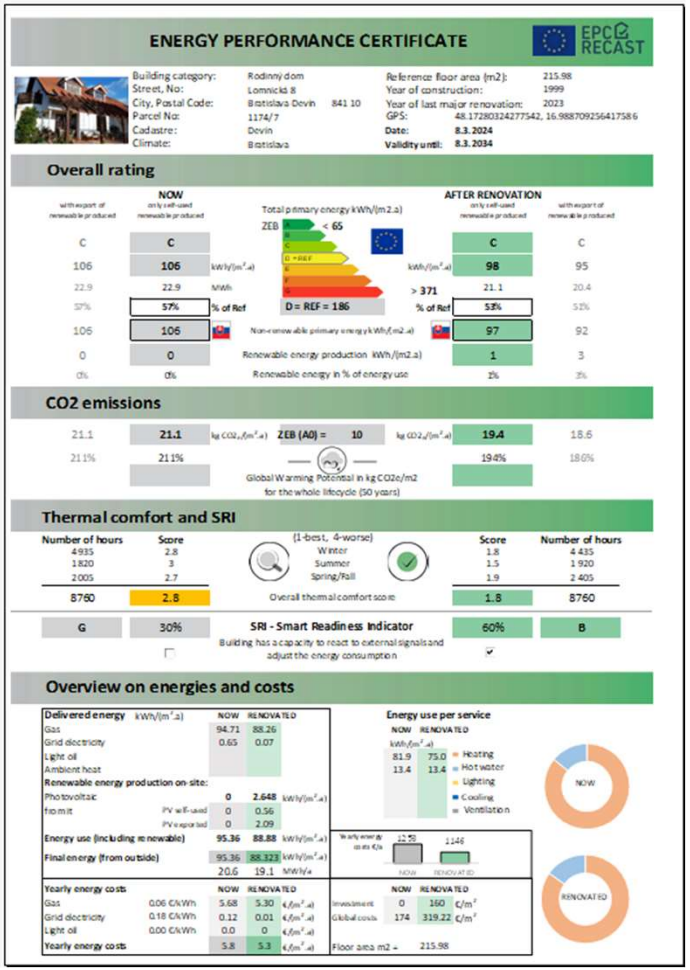
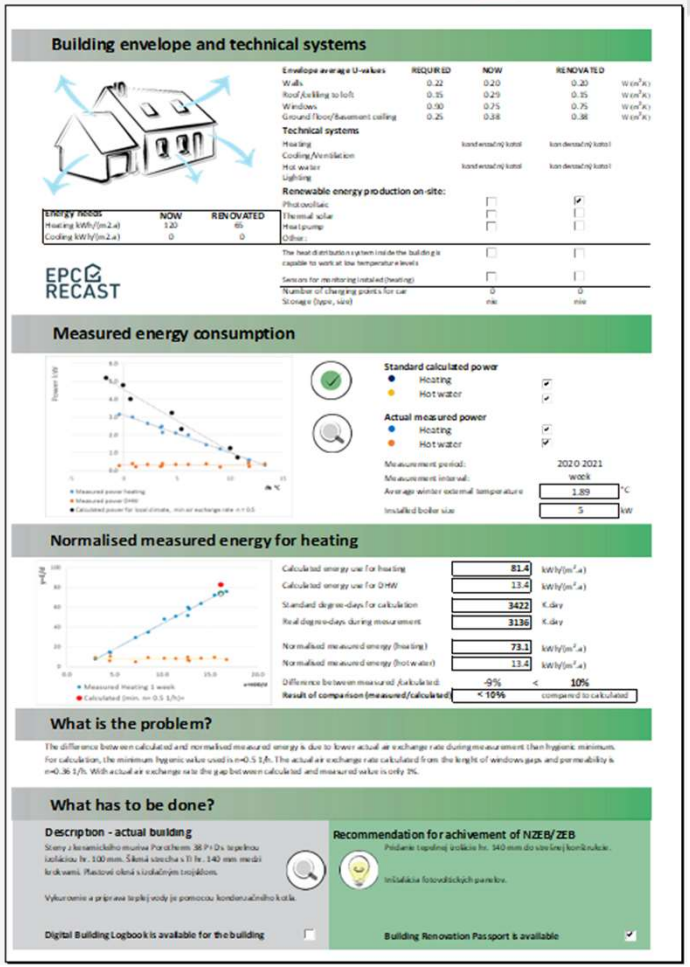
Next Gen EPC Template

The 2024 EPBD recast:
IAQ, new performance indicators

New performance indicators :

- **Thermal comfort** score
- **Smart readiness indicator** (SRI)
- **Metered energy**, energy signature, operational rating
- Costs reporting taking into account the **owner-tenant dilemma**.





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Renovation Roadmap : fast evaluation based on the EPC data

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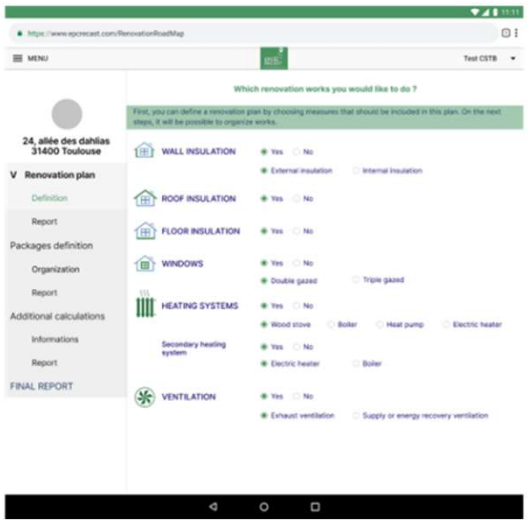
RENOVATION ROADMAP TOOL

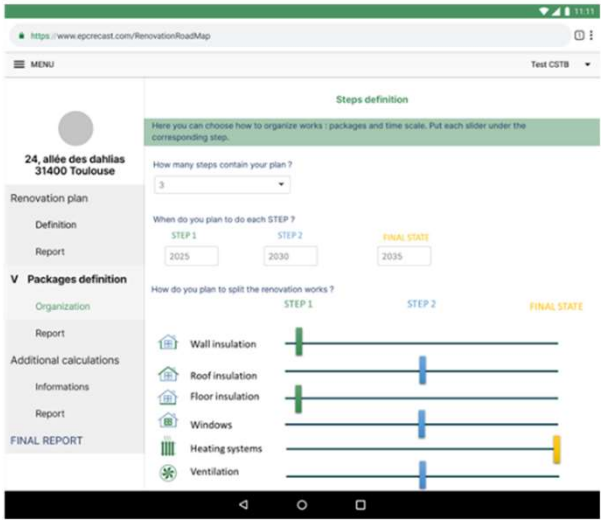
1. Import data from the EPC data model

2. Select your renovation works



… get feedbacks and warnings

3. Split your works into steps



… and simulation results

4. Get your final Renovation Roadmap

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Applying EPC RECAST on pilot buildings

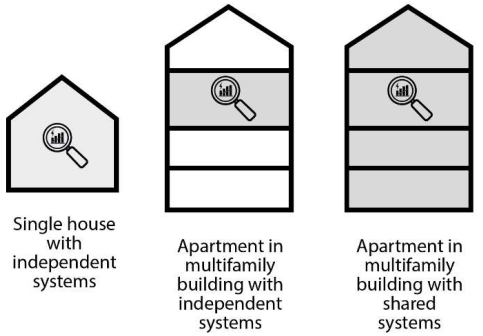
EPC RECAST

Pilot activities

- The EPC RECAST toolbox and process has been tested on more than **55 pilot sites : 3 multi-family buildings, 40 apartments and 12 single-family houses** spread over the 6 participating countries

- By **sucontracted EPC assessors and project partners** (2022-2024)

- **Next-generation EPCs** are delivered at dwelling or building scale



- **Long-term monitoring** has been implemented in 50% of the pilot dwellings (2021-2023)

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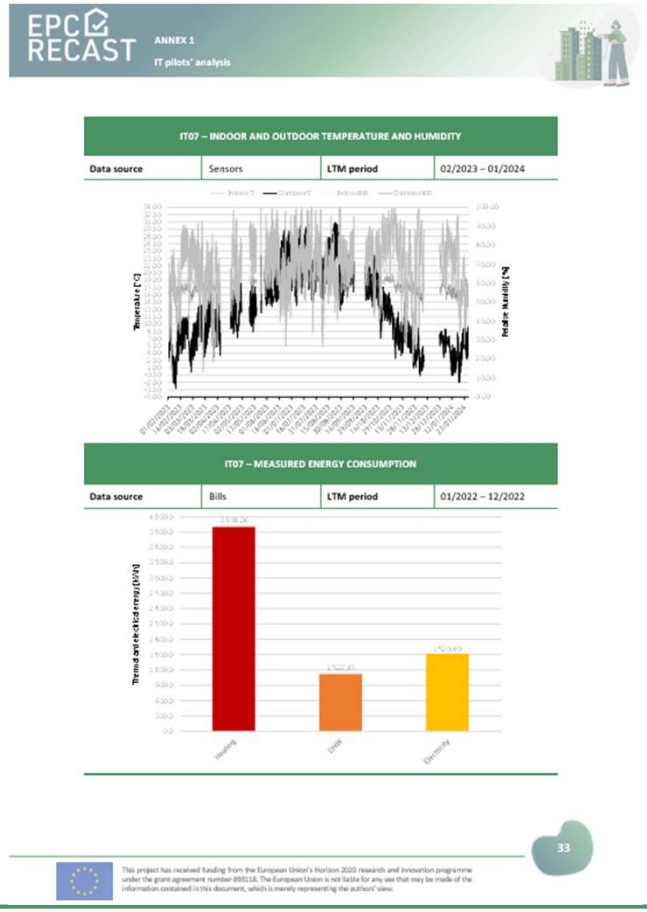
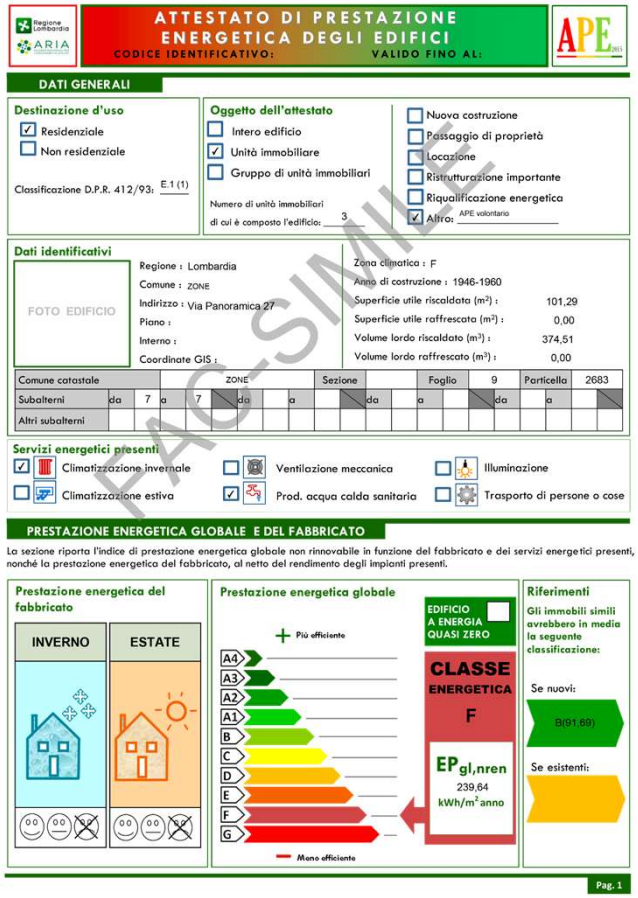
EPC RECAST

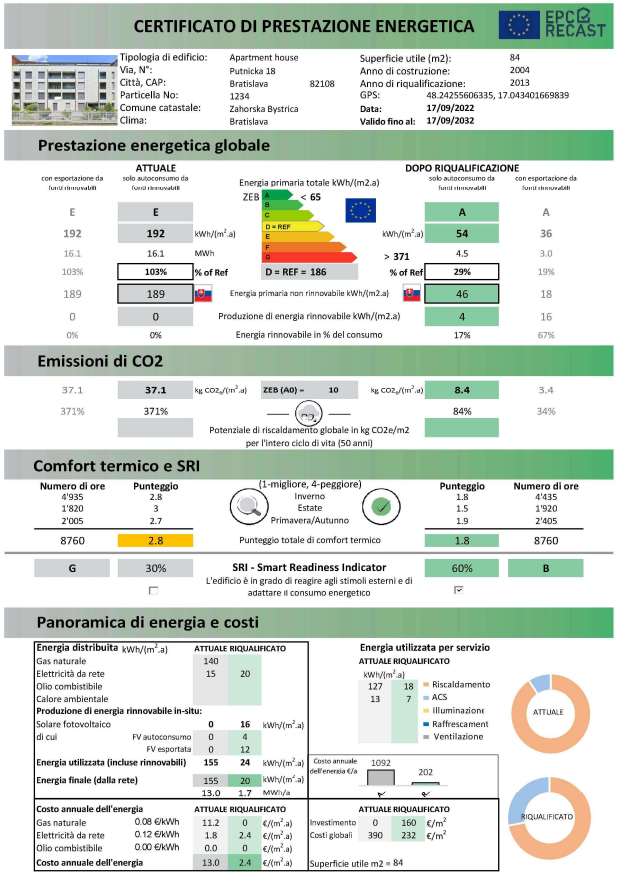
Long Term Monitoring



Standard EPC



EPC Recast EPC



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Examples of pilot results (Italy)

Energy use	Long-Term Monitoring primary energy [kWh/m²y]	KROQI simulation primary energy [kWh/m²y]	Standard EPC primary energy [kWh/m²y]	Variation between KROQI simulation and Standard EPC (Standard EPC as baseline)
Total	427.06	396.17	344.64	+ 15%
Heating	393.15	310.28	316.86	- 2%
Cooling	-	55.38	1.16	-
DHW	33.91	27.20	26.62	+ 2%

Energy use	Long-Term Monitoring primary energy [kWh/m²y]	KROQI simulation primary energy [kWh/m²y]	Standard EPC primary energy [kWh/m²y]	Variation between KROQI simulation and Standard EPC (Standard EPC as baseline)
Total	142.61	252.26	315.75	- 20%
Heating	124.17	229.01	298.00	- 23%
Cooling	-	-	-	-
DHW	18.44	19.74	17.75	+ 11%

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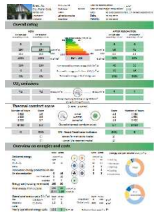
Key Conclusions

EPC RECAST

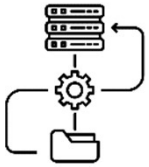
EPC RECAST proves that:

- ✓ **Integrated workflows to improve the daily work of EPC assessors** are already feasible:
  - ✓ **a common data model** of the building
  - ✓ a set of digital services and measurement protocols

- ✓ **Reporting tools** from the EPBD can be made **interoperable** and delivered jointly:
  - ✓ improved EPCs, simplified Renovation Roadmaps, automated simulation reports
  - ✓ based on **a common data model** of the building



- ✓ Detailed hourly simulations can be made accessible to assessors :
  - ✓ **without** requesting the evaluation of **more parameters**
  - ✓ through **data conversion algorithms**



- ✓ Innovative digital tools can already **facilitate on-site visits and data collection**

- ✓ Implementation on national markets : **IT development strategies** and **data standardization** are now needed

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THANK YOU FOR YOUR ATTENTION!

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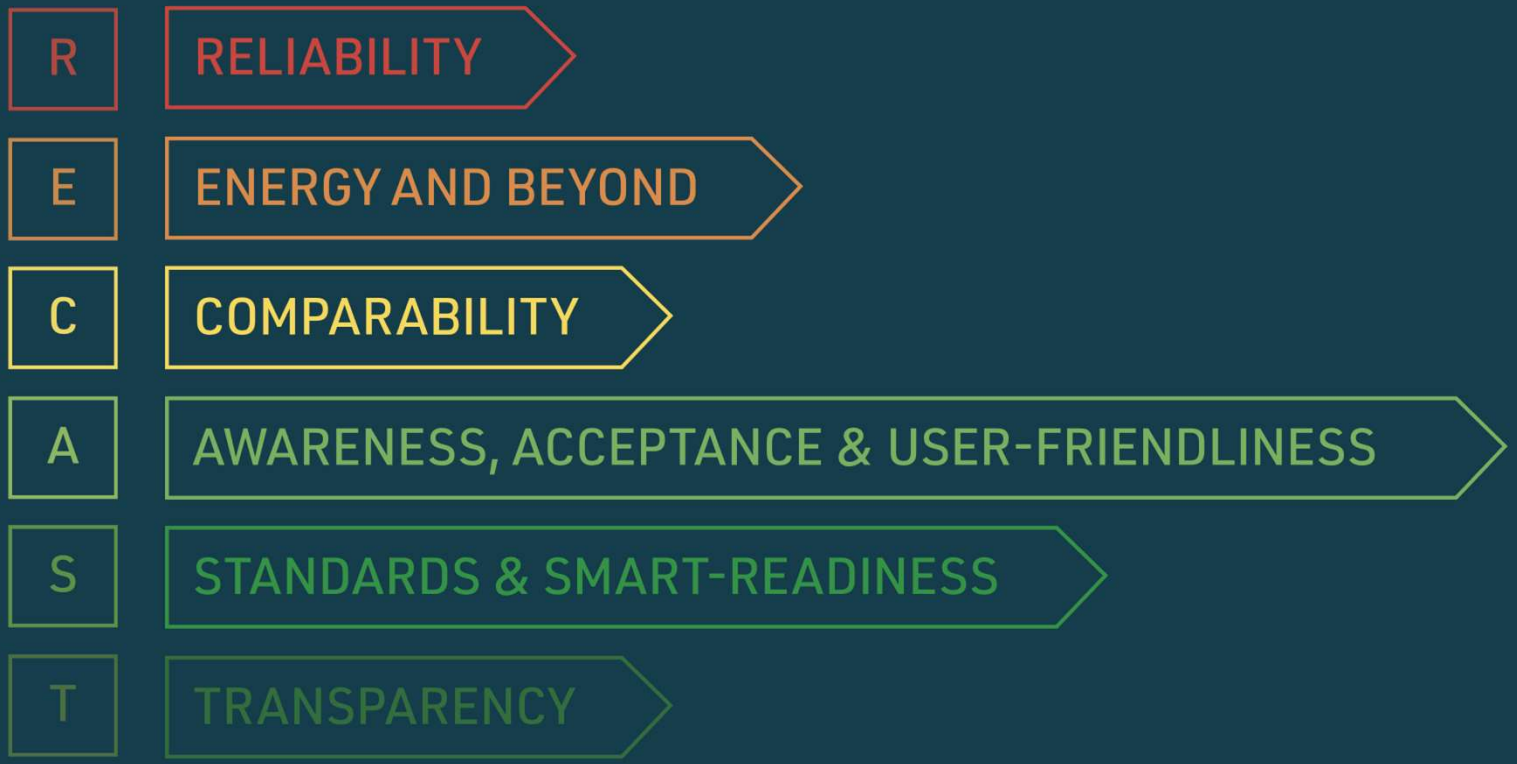

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ENERGY PERFORMANCE CERTIFICATE RECAST