

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





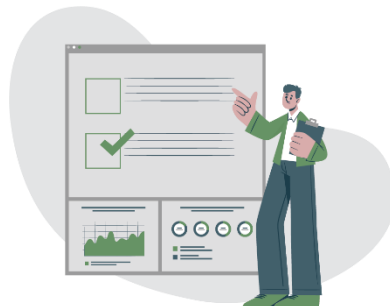
EPC RECAST in a nutshell

*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



OUR TEAM



LUXEMBOURG
INSTITUTE OF SCIENCE
AND TECHNOLOGY

LIST



POLITECNICO
MILANO 1863





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:
 \leq **half a day** of on-site work,
 off-site work \leq on-site work





The EPC RECAST Steps

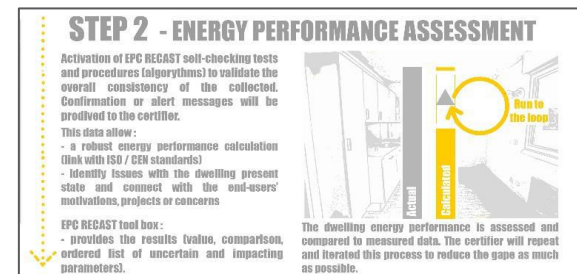
STEP 1 – Data Collection and Inspection Process

TARGET : Duration ≤ 0.5 day, on-site



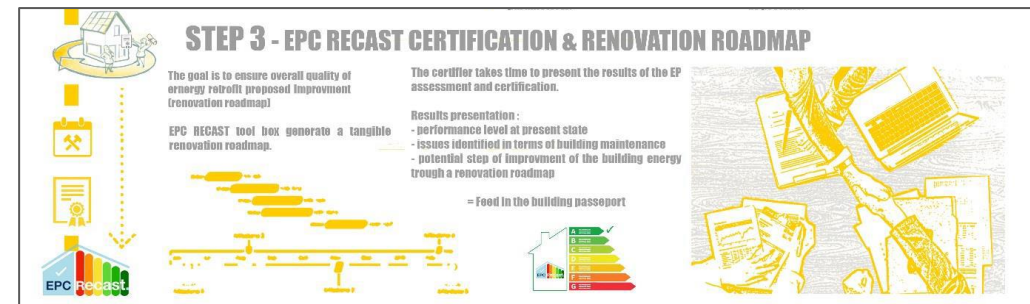
STEP 2 – Energy Performance Assessment

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



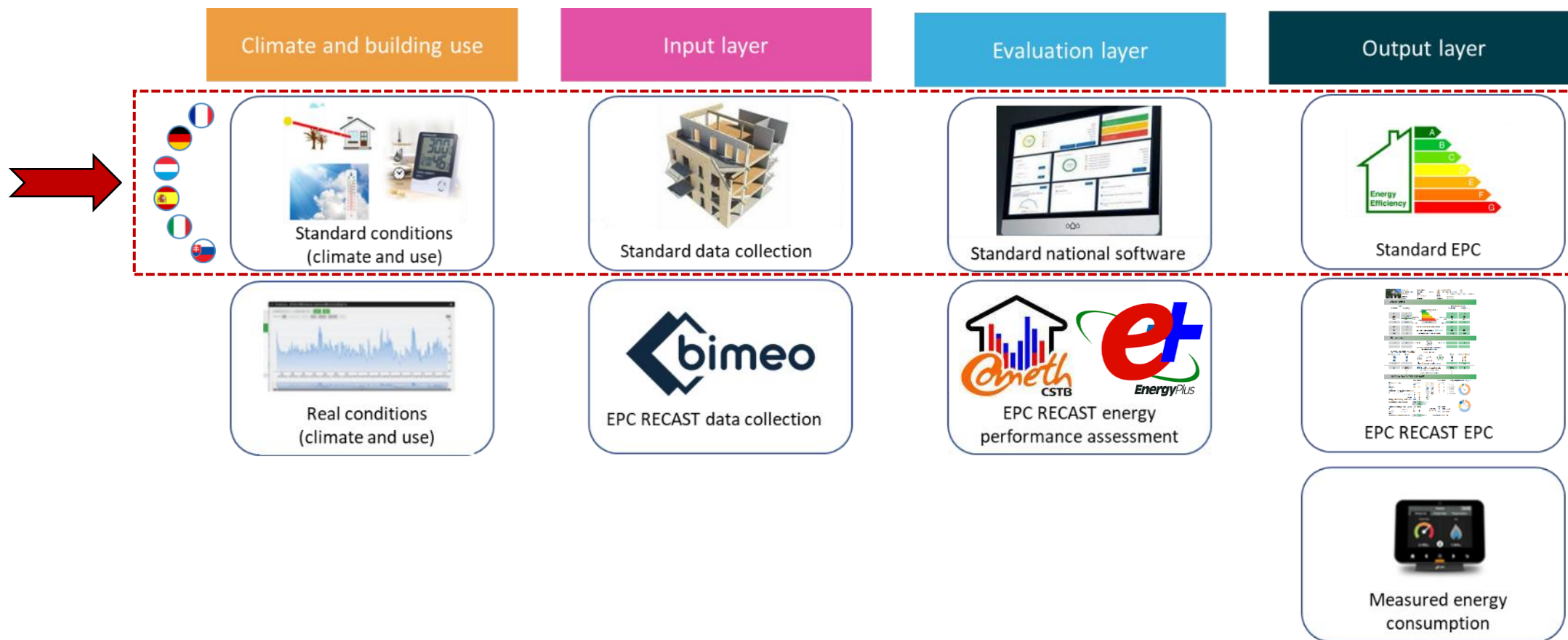
STEP 3 – Certification & Renovation Roadmap

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



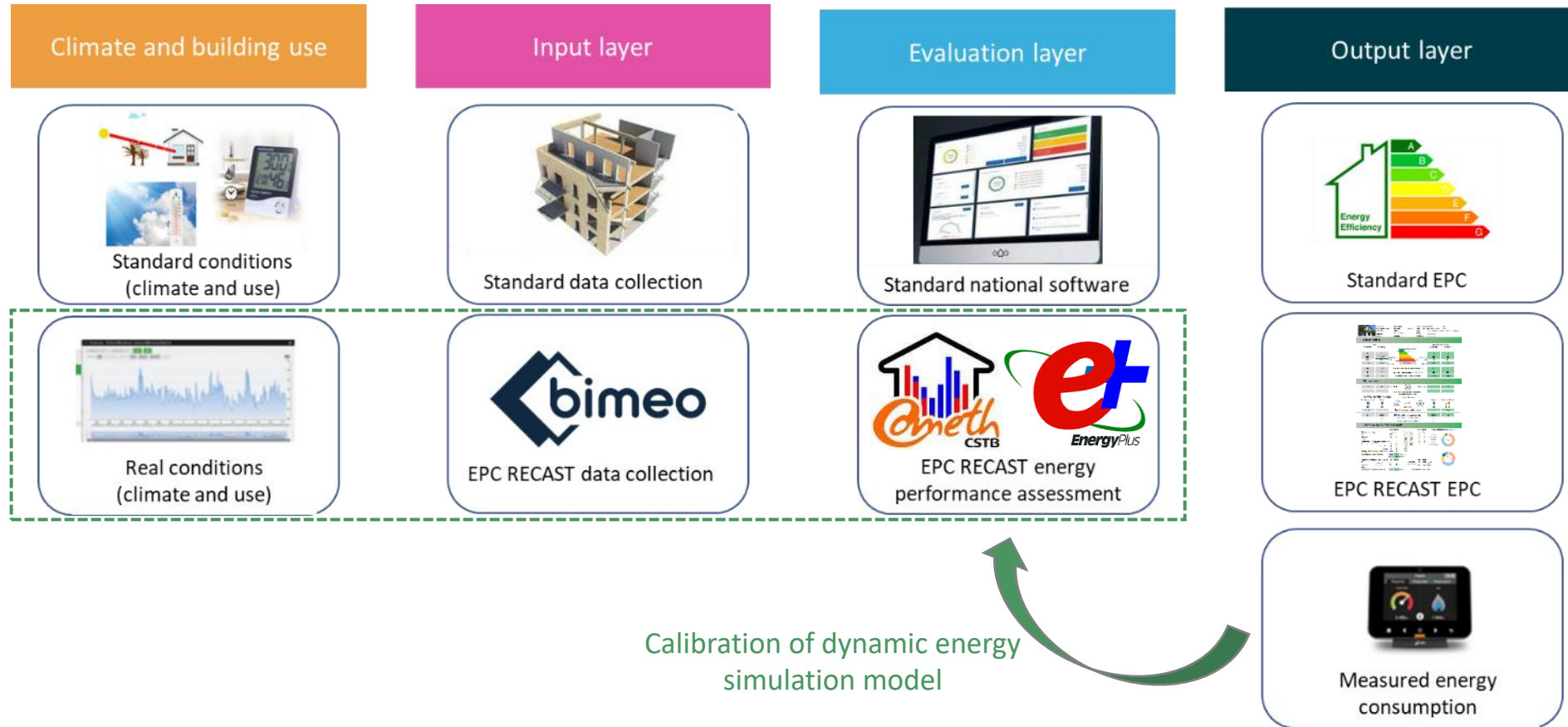


The standard EPC evaluation process : data and layers



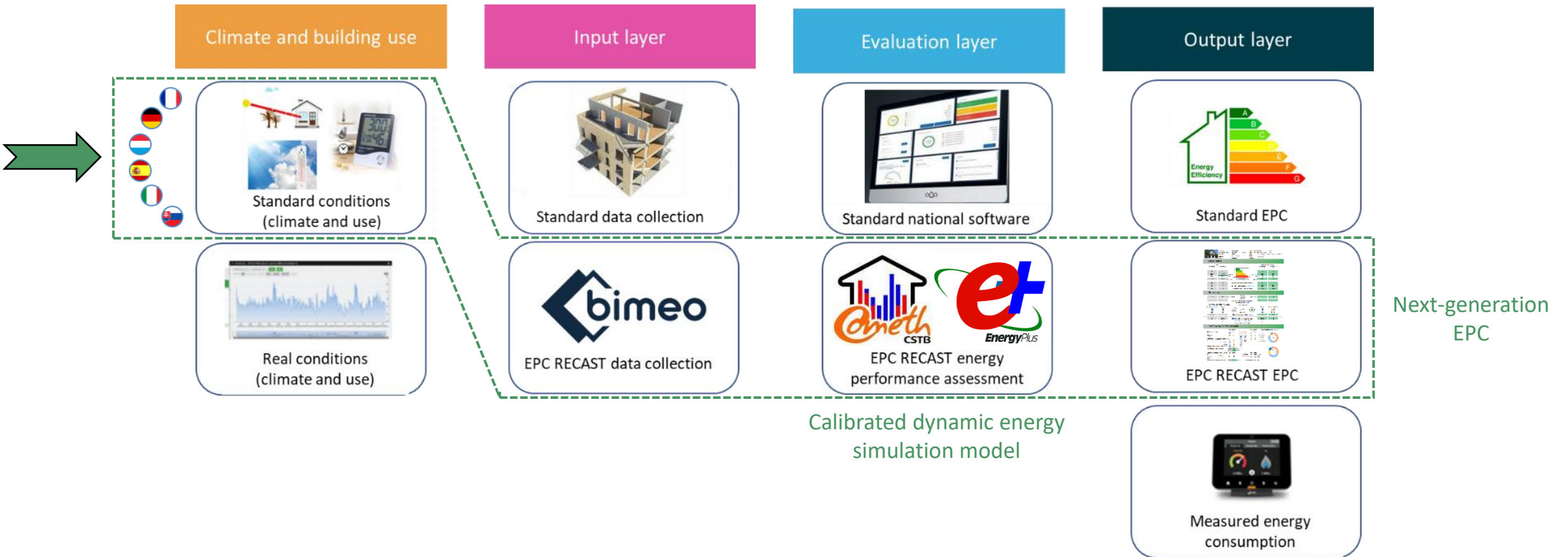


The EPC RECAST evaluation process : step 1



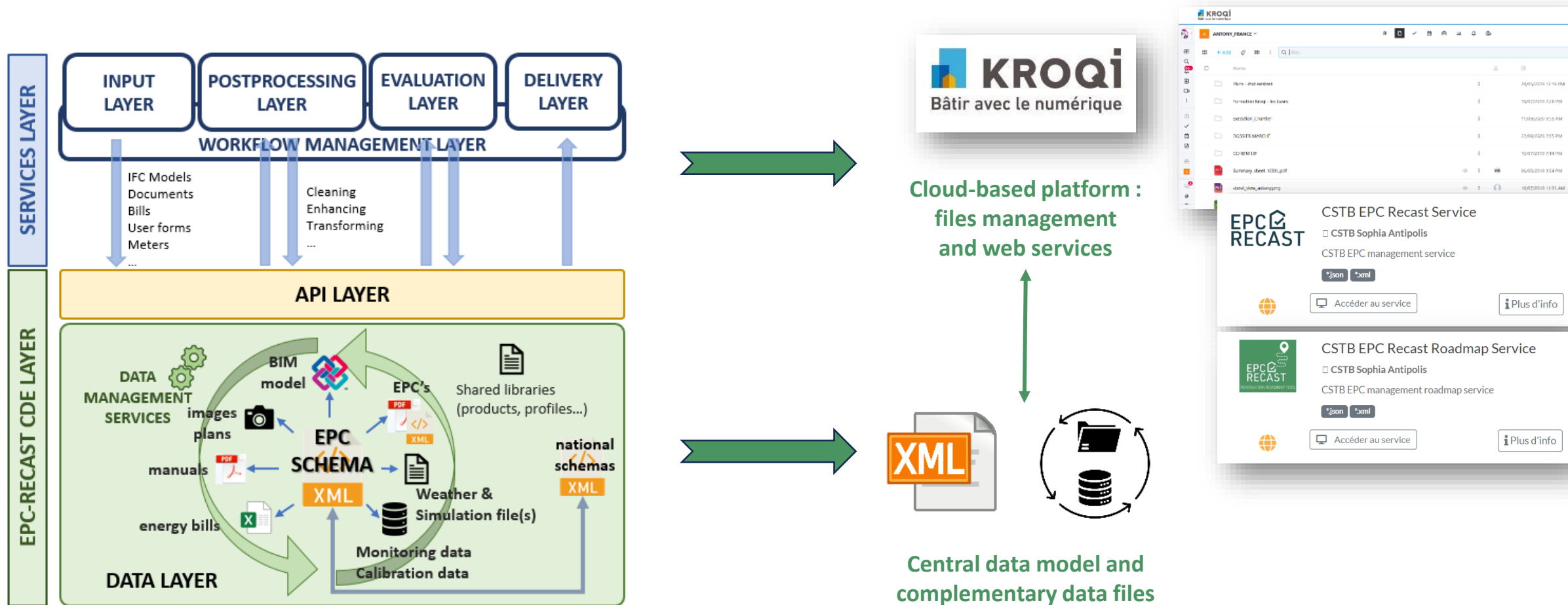


The EPC RECAST evaluation process : step 2





Integrated data and services : Common Data Environment



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



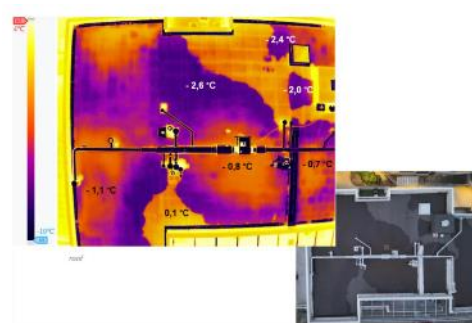
Questionnaire for the EPC ASSESSOR during the on-site visit

Connexion requise à l'accès pour enregistrer votre progression, les notes et plus

* indique une q. estion obligatoire

Adresse e-mail *

Votre adresse e-mail

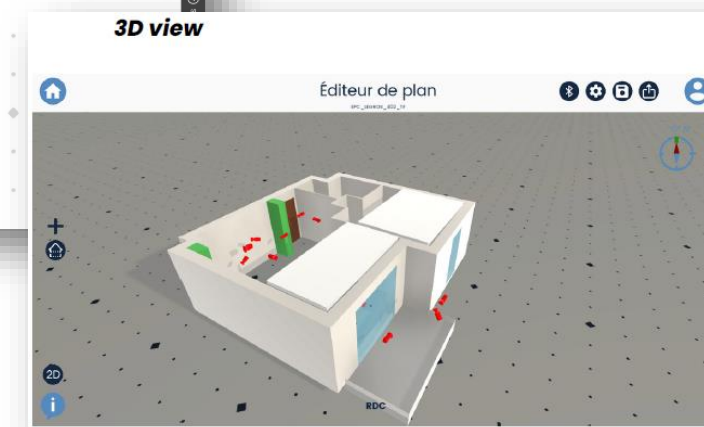
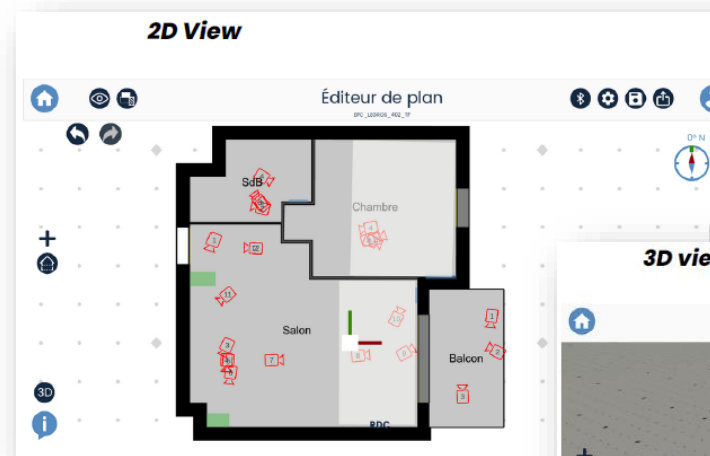
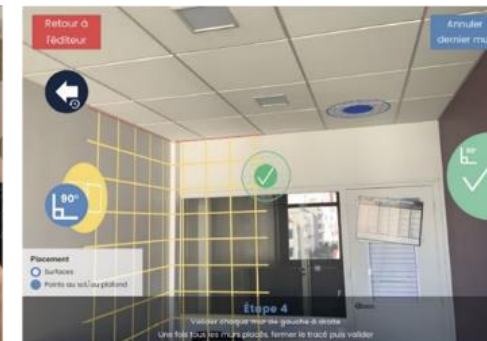




On-site inspection of the building

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

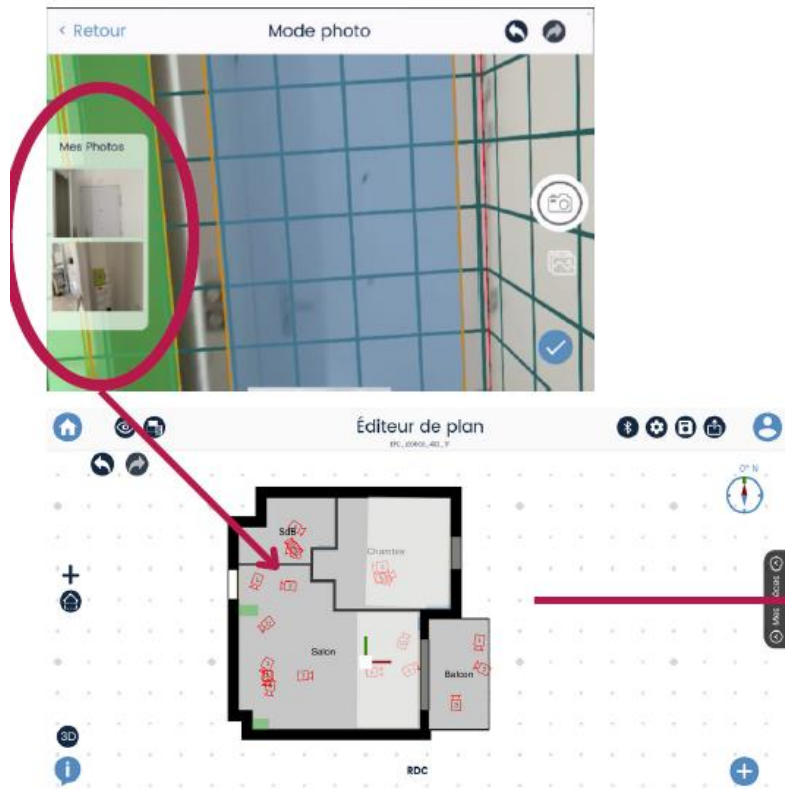




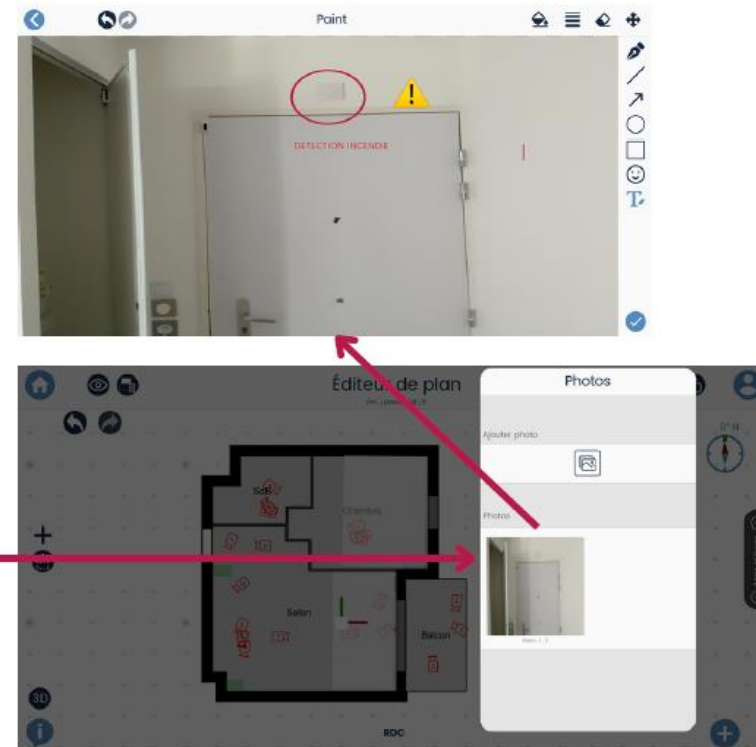
On-site inspection of the building

The BIMEO technology for the digitization of the dwelling

Adding georeferenced photos to the building plan



Annotation of photos





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

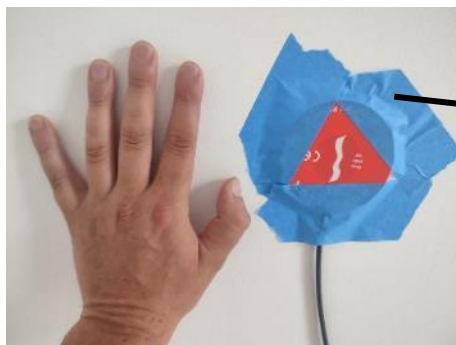


Additional measurements could be used to evaluate infiltration rates and heat losses through walls to get heat transfer coefficients (« U values »)





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 $> 10^{\circ}\text{C}$
- Use of a thermal camera to position heat-flux meters at the right place



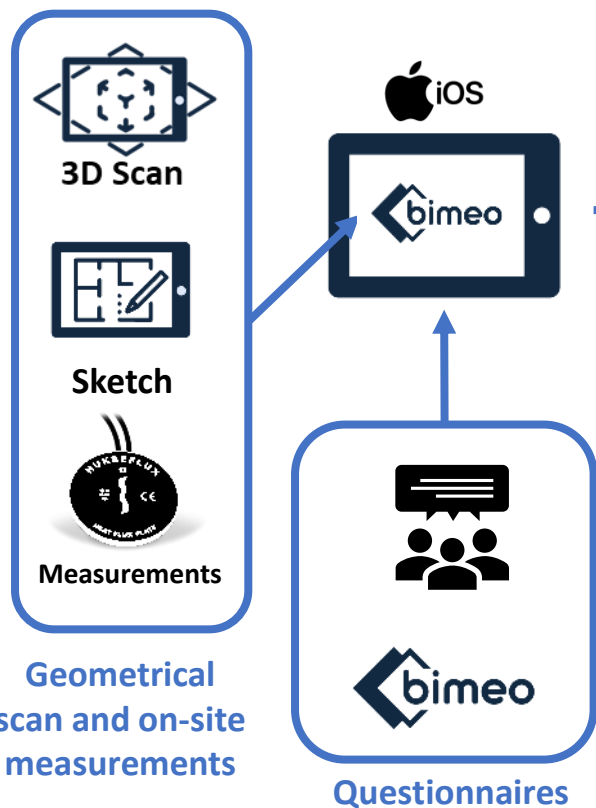
STEP 2 – Energy performance assessment



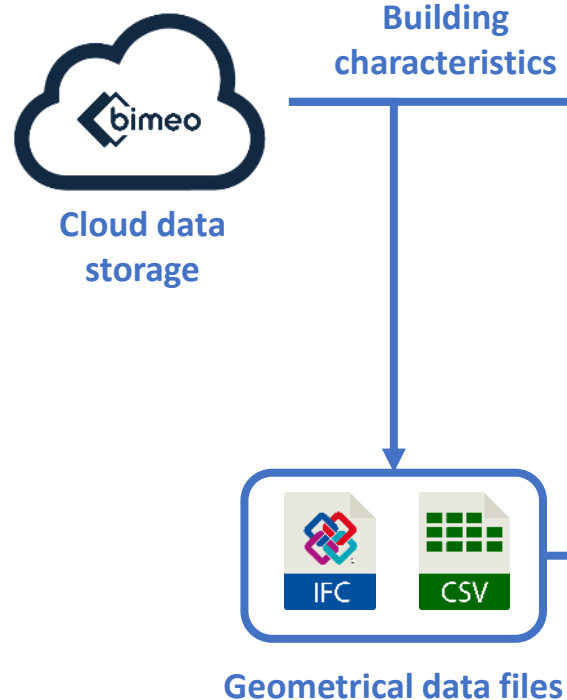


From data collection to dynamic energy simulation

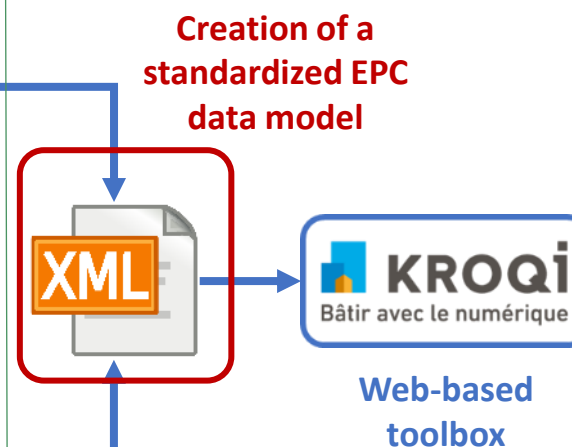
On-site data collection



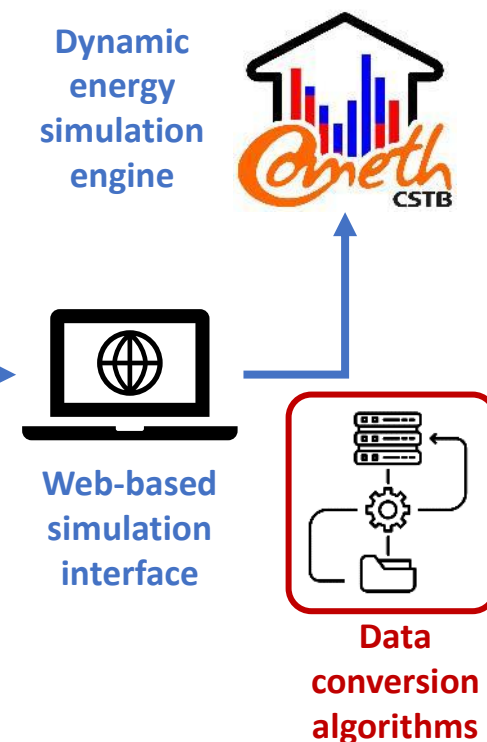
Automated data conversion



Common data environment



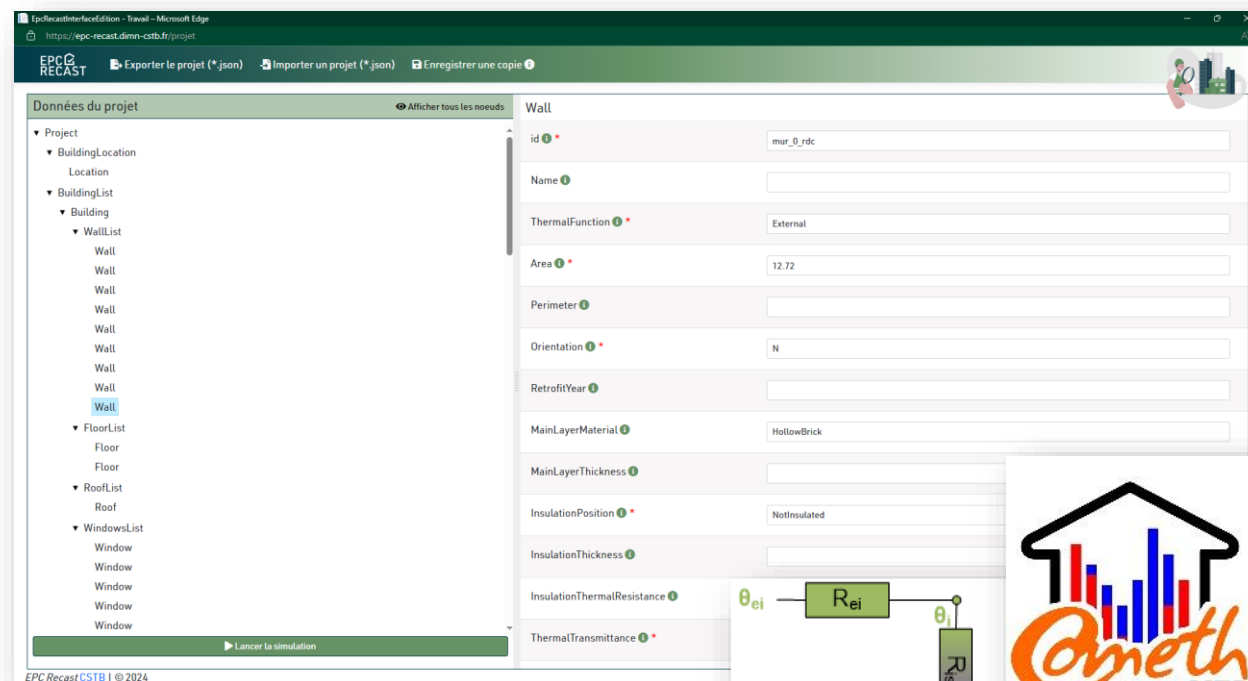
Dynamic energy simulation



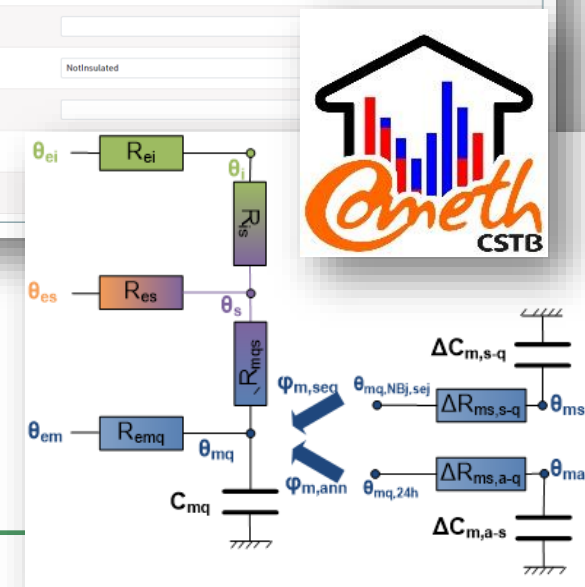


EPC RECAST tool for dynamic energy simulation

- 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



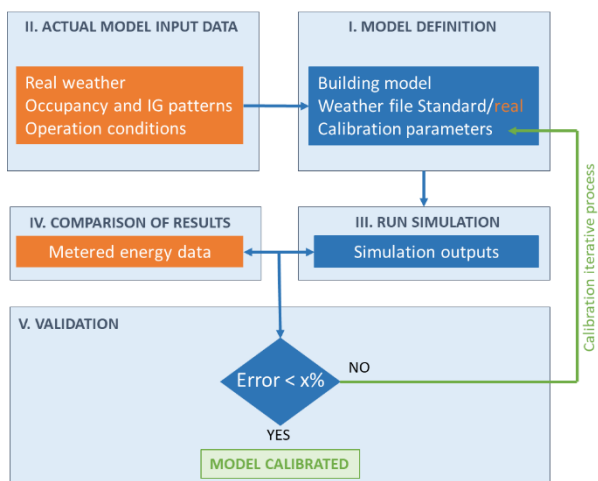


Mitigating the gap between calculated and measured energy

Two approaches have been developed and tested:

1. Calibration procedure

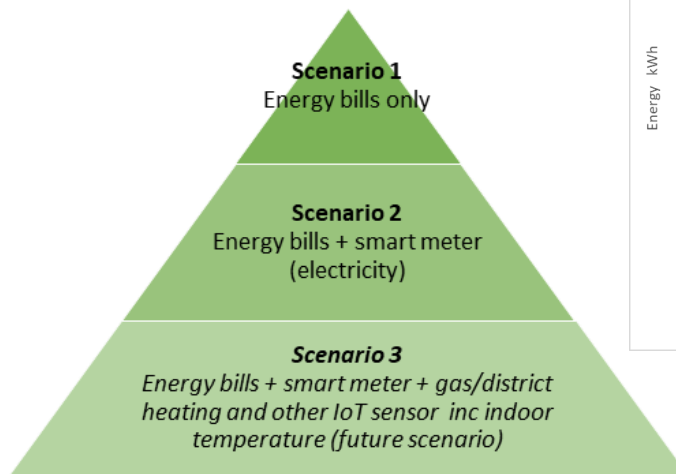
Iterative process for asset rating – actual input data - model definition – run simulation – comparison of results with metered data



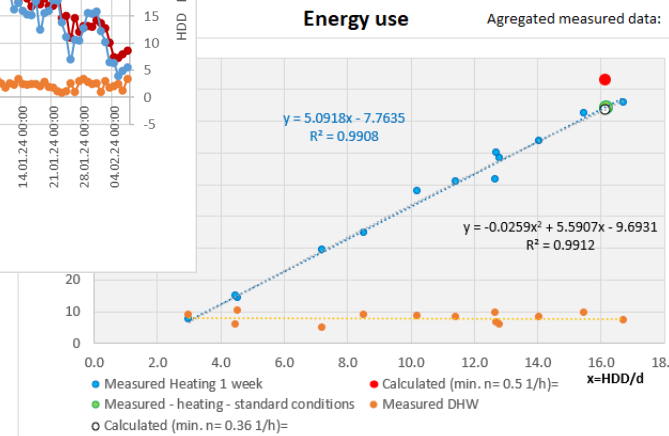
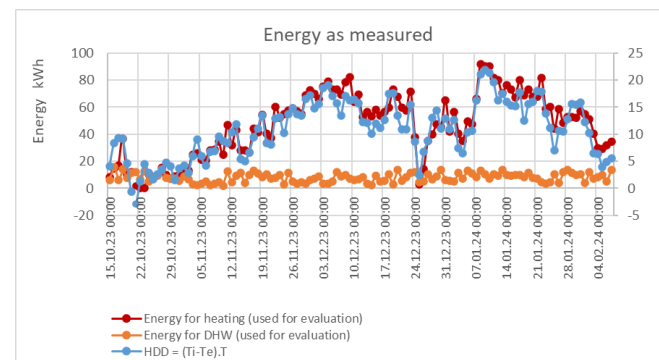
Steps of proposed calibration procedure

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



The measured data availability.





Guided automated calibration of parameters

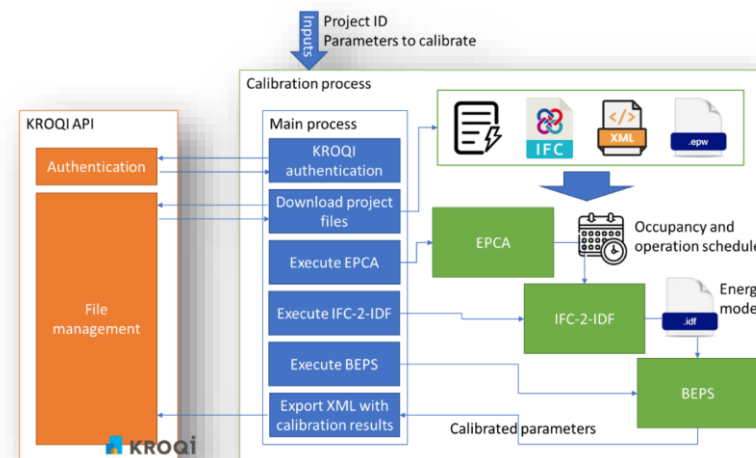
Performance gap between calculated and measured data

- 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



1 Start

2 Upload IFC

3 Edit IFC

4 Calibrate

Energy model generation

Create IDF

Run BEPS calibration module

Parameter	Value before	Value after
Walls U-value	0.6	0.75
Windows U-value	4	3.5
Window solar control	0.5	0.65
Infiltration rate	0.5	0.6

<<Previous

Next >>



STEP 3 – Certification and Roadmap





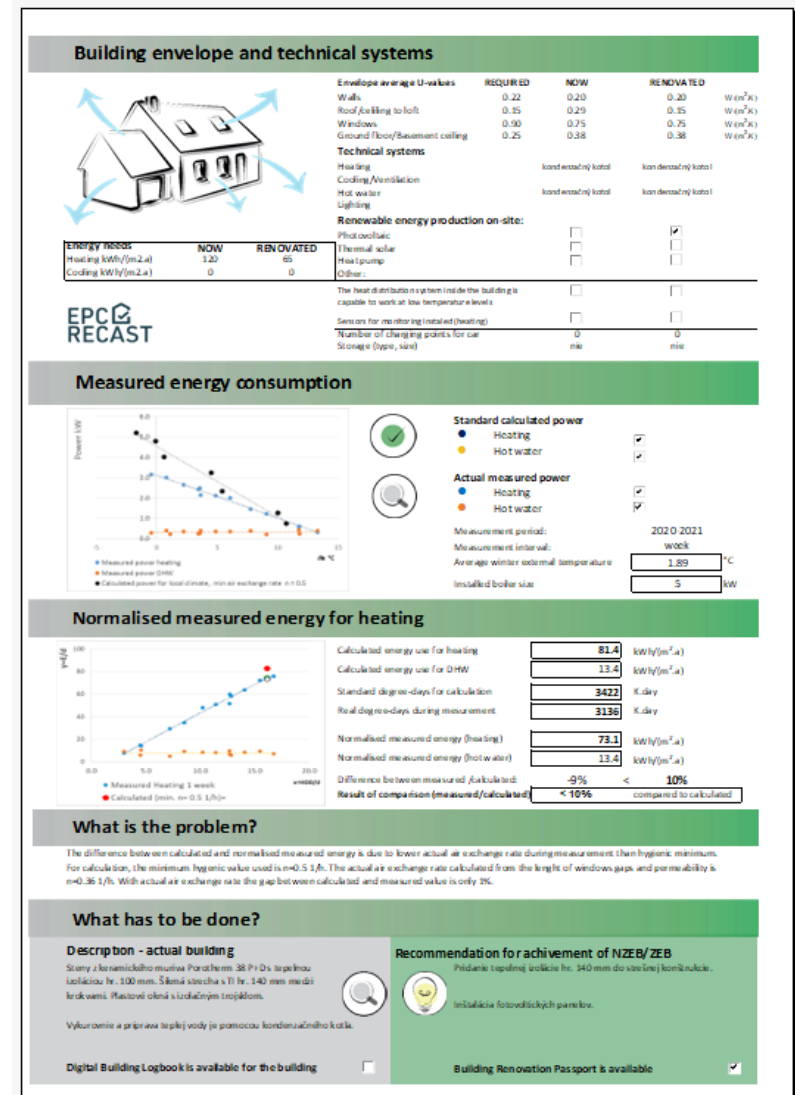
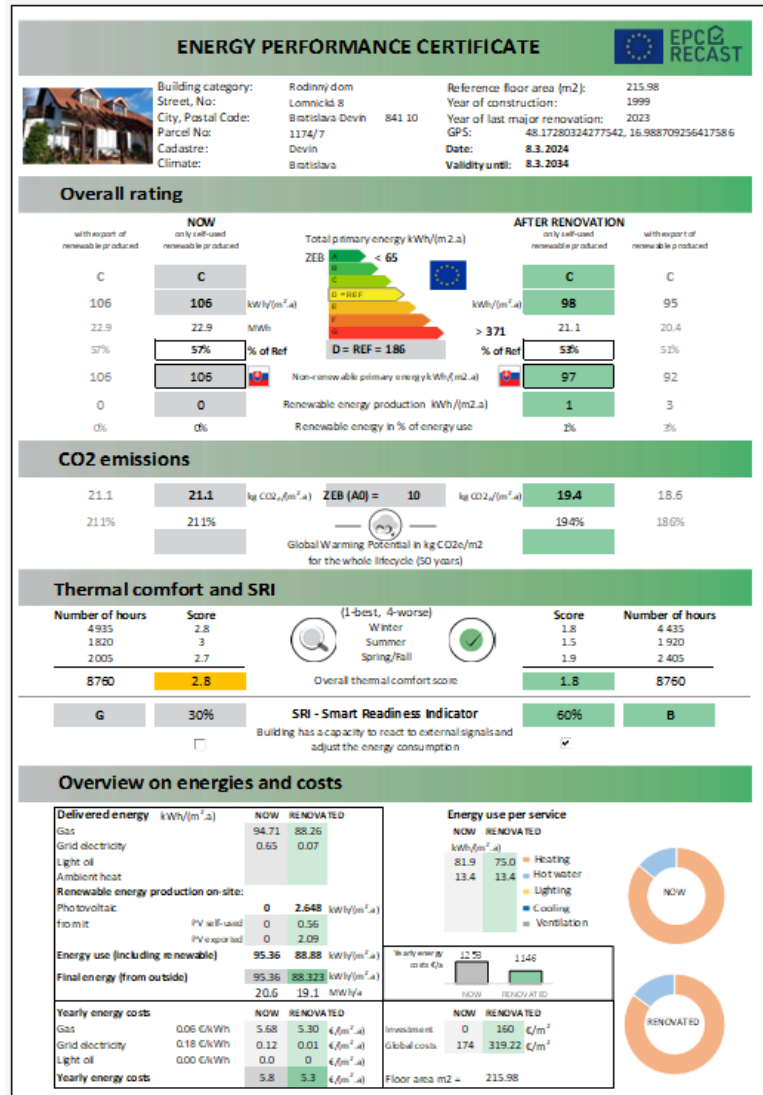
Next gen. EPC Template

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**.





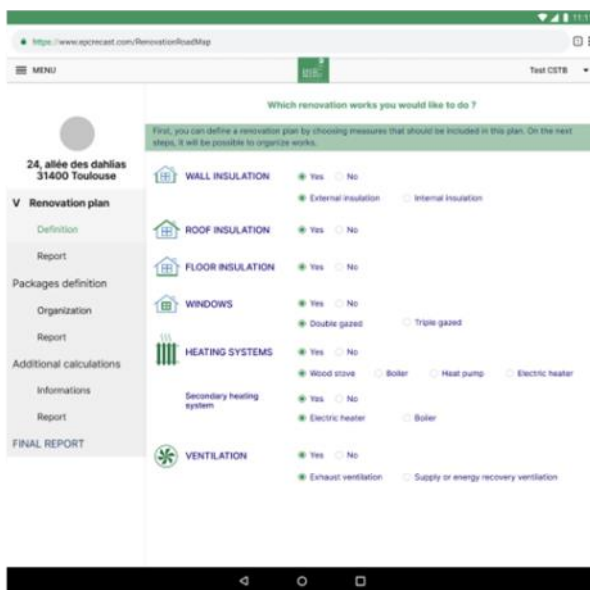
Renovation Roadmap : fast evaluation based on the EPC data



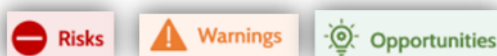
1. Import data from the EPC data model



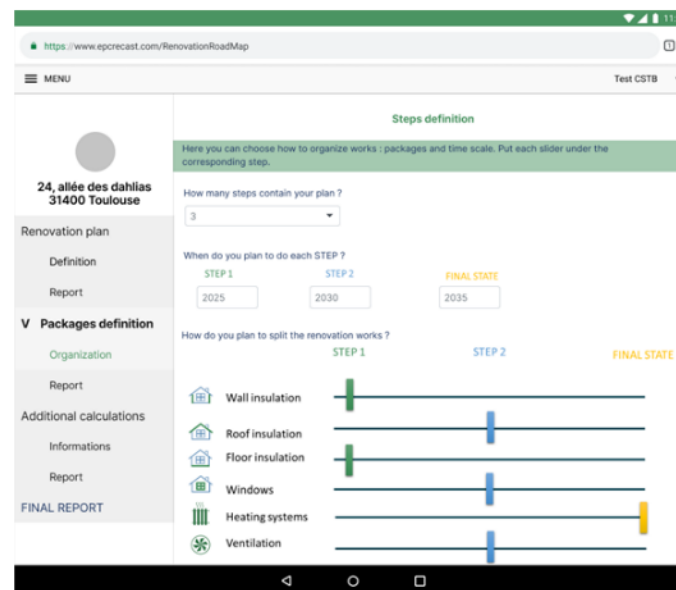
2. Select your renovation works



... get feedbacks and warnings



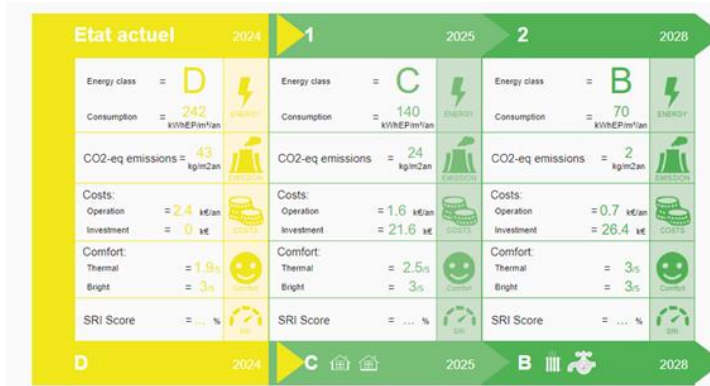
3. Split your works into steps



... and simulation results



4. Get your final Renovation Roadmap



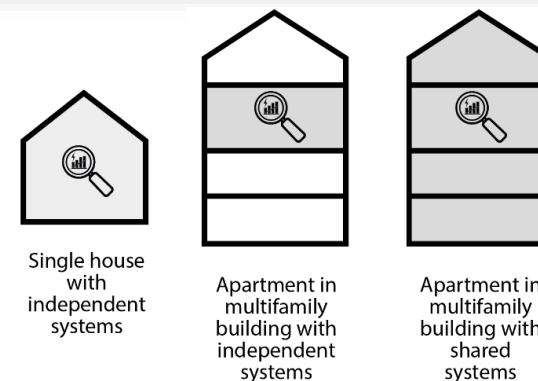
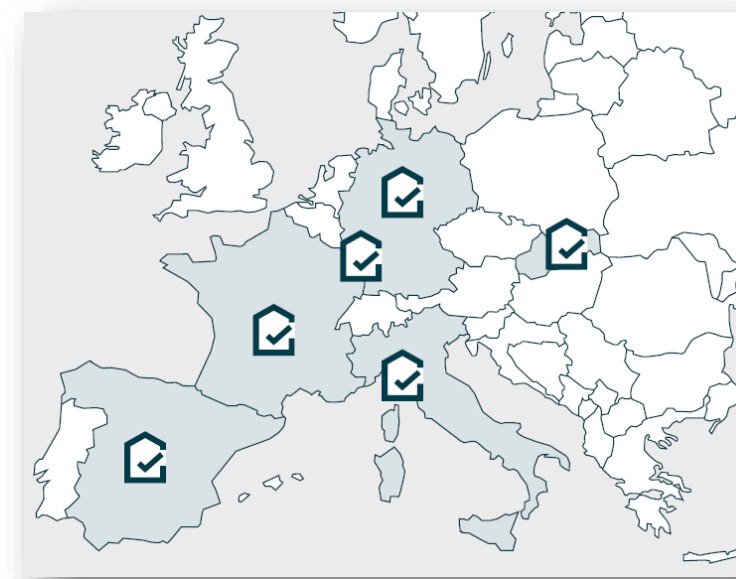
Applying EPC RECAST on pilot buildings





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)

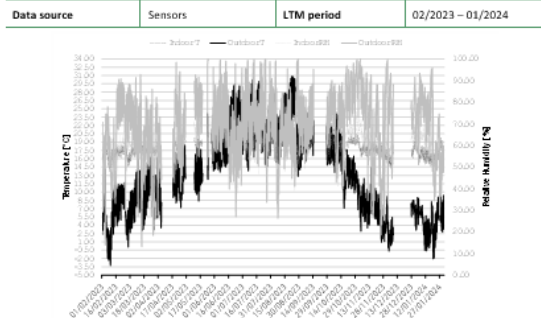




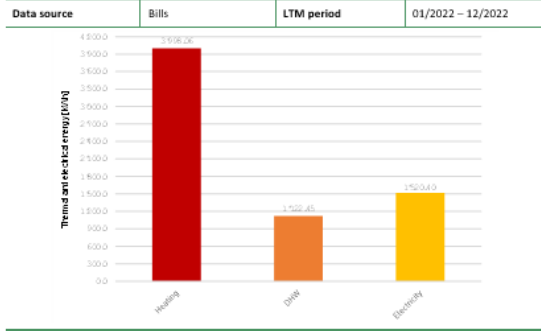
Long Term Monitoring



IT07 – INDOOR AND OUTDOOR TEMPERATURE AND HUMIDITY



IT07 – MEASURED ENERGY CONSUMPTION



Standard EPC



DATI GENERALI

Destinazione d'uso

- Residenziale
- Non residenziale

Oggetto dell'attestato

- Intero edificio
- Unità immobiliare
- Gruppo di unità immobiliari

Classificazione D.P.R. 412/93: E.1 (1)

Numero di unità immobiliari di cui è composto l'edificio: 3

Altre informazioni:

- Nuova costruzione
- Passaggio di proprietà
- Locazione
- Ristrutturazione importante
- Riqualificazione energetica
- Altro: APE volontario

Dati identificativi

Regione: Lombardia
Comune: ZONE
Indirizzo: Via Panoramica 27
Interno:
Coordinate GIS:

Zona climatica: F
Anno di costruzione: 1946-1960
Superficie utile riscaldata (m²): 101,29
Superficie utile raffrescata (m²): 0,00
Volume lordo riscaldato (m³): 374,51
Volume lordo raffrescato (m³): 0,00

Comune catastale	ZONE	Sezione	Foglio	9	Particella	2683
Subaltermi da	7 a	7 da	a	da	a	da
Altri subaltermi						

Servizi energetici presenti

- Climatizzazione invernale
- Ventilazione meccanica
- Illuminazione
- Climatizzazione estiva
- Prod. acqua calda sanitaria
- Trasporto di persone o cose

PRESTAZIONE ENERGETICA GLOBALE E DEL FABBRICATO

La sezione riporta l'indice di prestazione energetica globale non rinnovabile in funzione del fabbricato e dei servizi energetici presenti, nonché la prestazione energetica del fabbricato, al netto del rendimento degli impianti presenti.

Prestazione energetica del fabbricato

INVERNO	ESTATE

Prestazione energetica globale

CLASSE ENERGETICA F

EP_{gl,nren} 239,64 kWh/m² anno

Riferimenti

Gli immobili simili avrebbero in media la seguente classificazione:

Se nuovi: **B(91,60)**

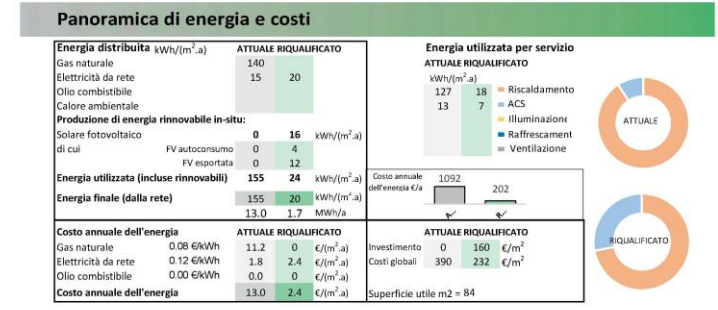
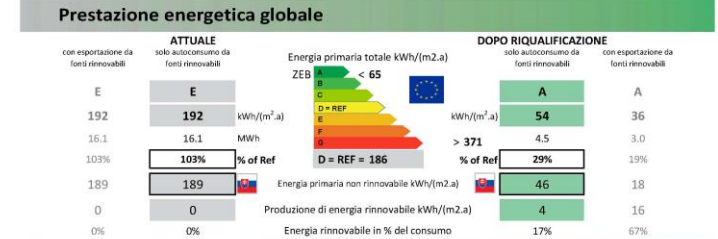
Se esistenti: **B**

EPC Recast EPC



Tipologia di edificio: Apartment house
Via, N°: Putnicka 18
Città, CAP: Bratislava 82108
Particella No: 1234
Comune catastale: Zahorska Bystrica
Clima: Bratislava

Superficie utile (m²): 84
Anno di costruzione: 2004
Anno di riqualificazione: 2013
GPS: 48.24255606335, 17.043401669839
Data: 17/09/2022
Valido fino al: 17/09/2032



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Examples of pilot results (Italy)



Energy use	Long-Term Monitoring primary energy [kWh/m ² y]	KROQI simulation primary energy [kWh/m ² y]	Standard EPC primary energy [kWh/m ² y]	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/m ² y]	KROQI simulation primary energy [kWh/m ² y]	Standard EPC primary energy [kWh/m ² y]	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%



Key Conclusions





EPC RECAST proves that:

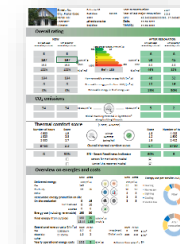
✓ **Integrated workflows to improve the daily work of EPC assessors** are already feasible:

- ✓ a **common data model** of the building
- ✓ a set of digital services and measurement protocols



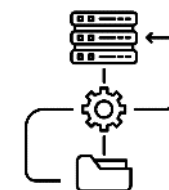
✓ **Reporting tools** from the EPBD can be made **interoperable** and delivered jointly:

- ✓ improved EPCs, simplified Renovation Roadmaps, automated simulation reports
- ✓ based on a **common data model** of the building

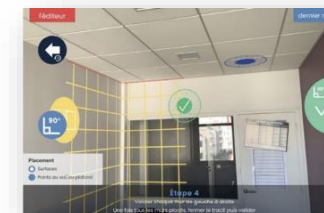


✓ Detailed hourly simulations can be made accessible to assessors :

- ✓ **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



THANK YOU FOR YOUR ATTENTION!



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R

RELIABILITY

E

ENERGY AND BEYOND

C

COMPARABILITY

A

AWARENESS, ACCEPTANCE & USER-FRIENDLINESS

S

STANDARDS & SMART-READINESS

T

TRANSPARENCY

EPC
RECAST
ENERGY PERFORMANCE
CERTIFICATE RECAST