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#SUSTAINABLEPLACES2022

NextGenEPCs cluster

EPCs: Measuring building performance and adding operational rating

SEP. 7TH, 14:45-18:00 CET, HYBRID

SUSTAINABLEPLACES.EU

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Find me on

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REHVA

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Next Generation Energy Performance Certificates H2020 cluster

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The new EPC for Europe

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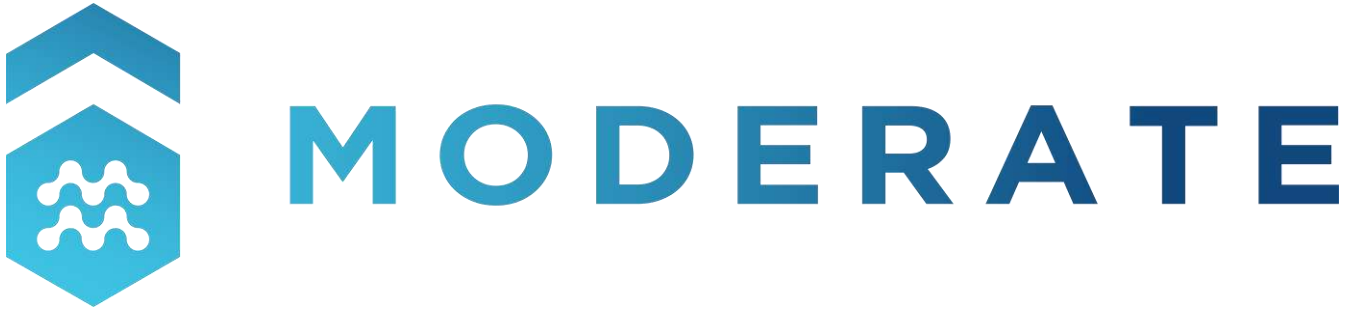
HE-projects Call 2021

SmartLivingEPC: SmartLivingEPC project aims to integrate the main parameters that constitute Industry 4.0 into a Smart Energy Performance Certificate, and deliver a certificate which will be issued with the use of digitized tools and retrieve the necessary assessment information for the building shell and building systems from BIM literacy, including enriched energy and sustainability related information for the as designed and the actual performance of the building.

CHRONICLE: CHRONICLE aims to deliver a dynamic and holistic nD BIM-based building performance framework comprising multiple performance dimensions. Within this framework economic and sustainability performance factors as well as human centric and social performance factors (comfort, well-being and social aspects) will be addressed by well-defined KPIs (macro and micro, short and long term), outcome-based calculation methods and data analytic services.

Going farther, together!



SUSTAINABLE PLACES 2022

Sep. 6 - Sep. 9, 2022 | Nice, France

REHVA Federation of European Heating, Ventilation and Air Conditioning Associations

R2M RESEARCH TO MARKET SOLUTION

SEP. 6 – Sep. 9, 2022 | Nice, France

Hybrid workshop

Energy Performance Certificates (**EPCs**): **Measuring** building **performance** and adding **operational** rating

7 September 2022, 14h45 – 18h00 CEST

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SUSTAINABLE PLACES 2022

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Hybrid workshop

EPCs: Measuring building performance and adding operational rating

7 September 2022, 14h45 – 18h00 CEST

Energy performance certificates (EPCs) are becoming the **centre piece** of the **EPBD** being linked to all the other policy instruments (e.g. **SRI**, **Digital Building Logbooks**, **Renovation Roadmaps** & **Passports**, **Level(s)**…) and soon to be used as reference for **financing building performance activities**. Thus, they withhold the **highest potential to ensure an EPB coherence framework** for all instruments to flawlessly work together.

Considering that it's now our **last chance to really make a difference in the buildings sector** we need to increasingly **consider measuring building performance and adding operational rating to guarantee building actually perform as intended in operation**. There isn't yet a single acknowledged way in doing this and if we're to be effective in achieving the EU's climate and energy goals and fully leverage the digitalization of the built environment in the process there should be at least an overall framework to be followed as guideline.

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Transition

Build forward together

"Go far, go together"

Business as usual

Build back better

"Go fast, go alone"

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REHVA Federation of European Heating, Ventilation and Air Conditioning Associations

Joint Research Centre JRC

← Welcome, Andrei Vladimir Lițiu

Keynote Level(s), Shane Donatello →

TNO innovation for life

ARCHITECTS' COUNCIL OF EUROPE
CONSEIL DES ARCHITECTES D'EUROPE

← Keynote, Marleen Spiekman

Keynote, Judit Kimpian →

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Panellists associated sister projects

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Juan Antonio Aranda

Tasos Tsitsanis

Lukas Kranzl

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SUSTAINABLE PLACES 2022

Sep. 6 - Sep. 9, 2022 | Nice, France

Moderated panel discussion + Q&A from the audience

Shane Donatello

Juan Antonio Aranda

Marleen Spiekman

Tasos Tsitsanis

Judit Kimpian

Lukas Kranzl

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Relationships between EPCs, NZEBs and key EU policies

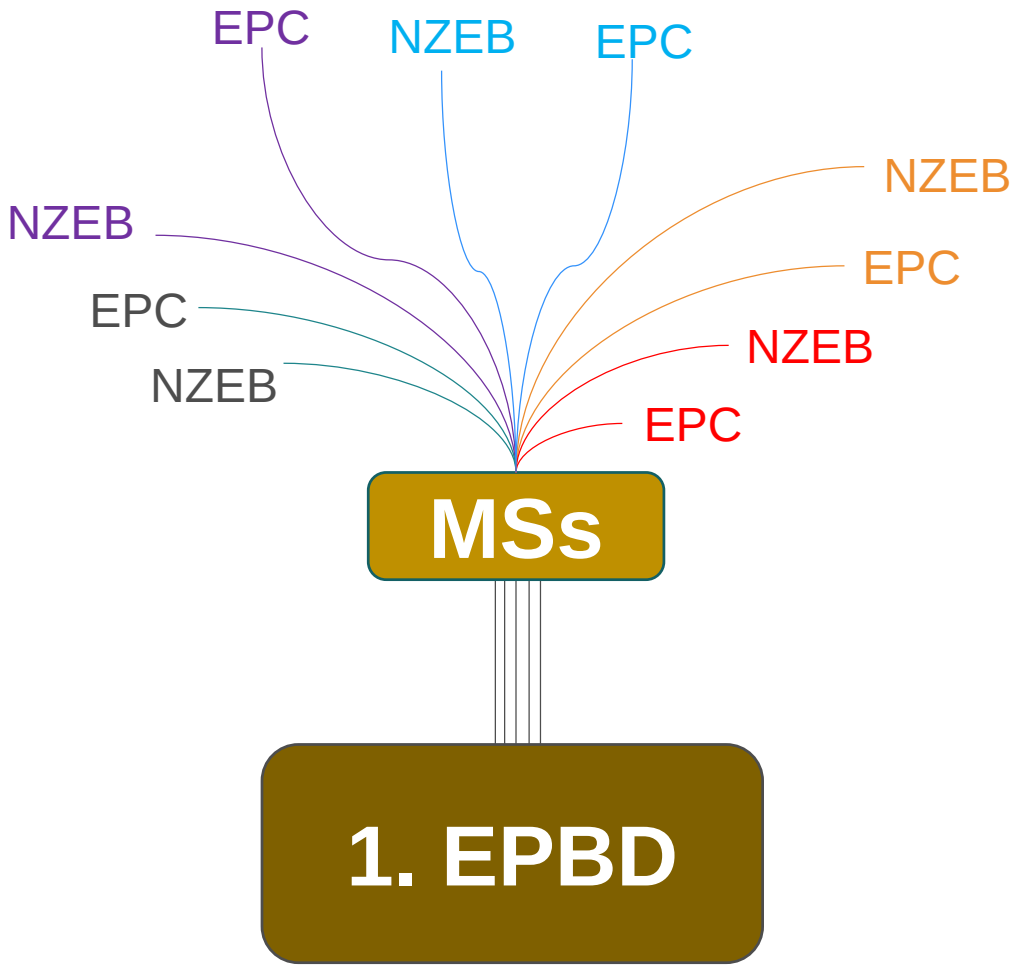
Presentation at the NextGenEPCs cluster of the “Sustainable Places” workshop held in Nice, France, Sept. 7th 2022.

Shane Donatello, JRC

Contents

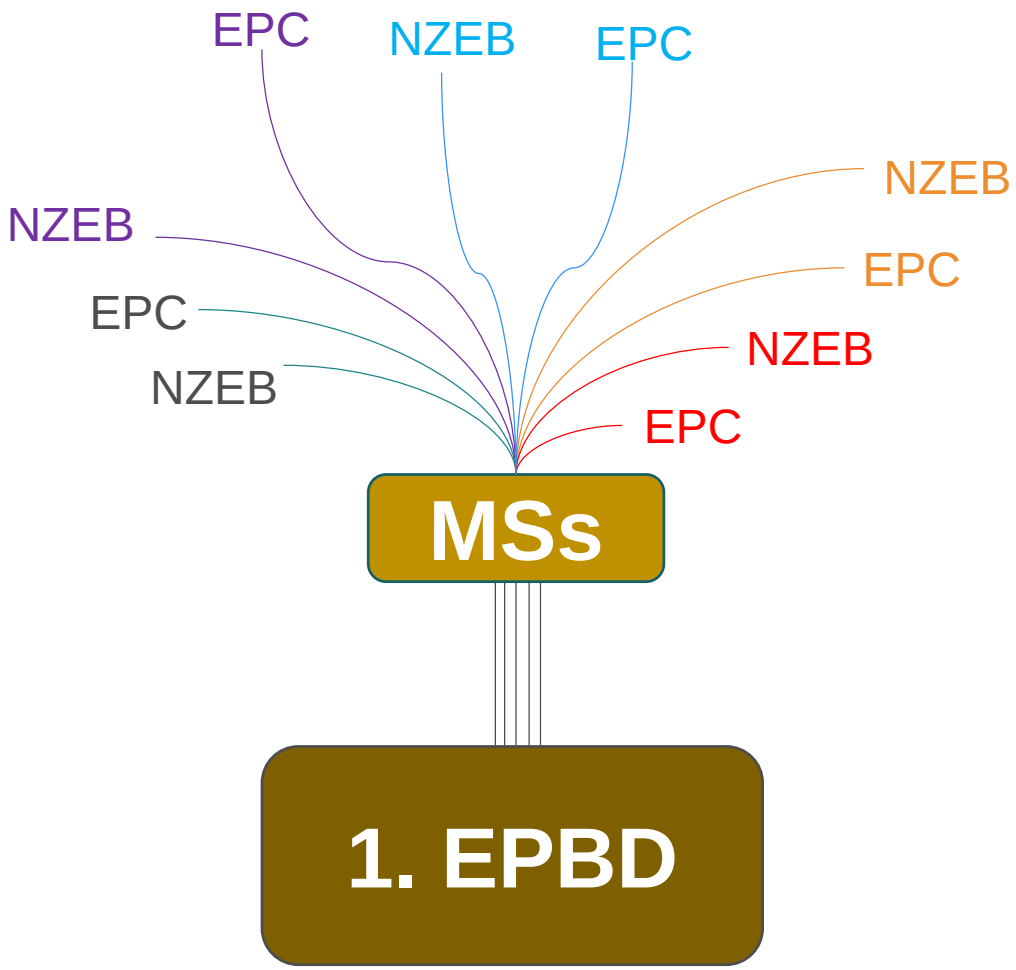
1. Recap on key EU policies for EPCs and NZEBs.
2. Brief explanation of Level(s).
3. Issues with the energy performance gap.
4. The Level(s) road to life cycle carbon (and NZEB).
5. Issues with the life cycle carbon performance gap.

1. Recap on key EU policies for EPCs & NZEBs



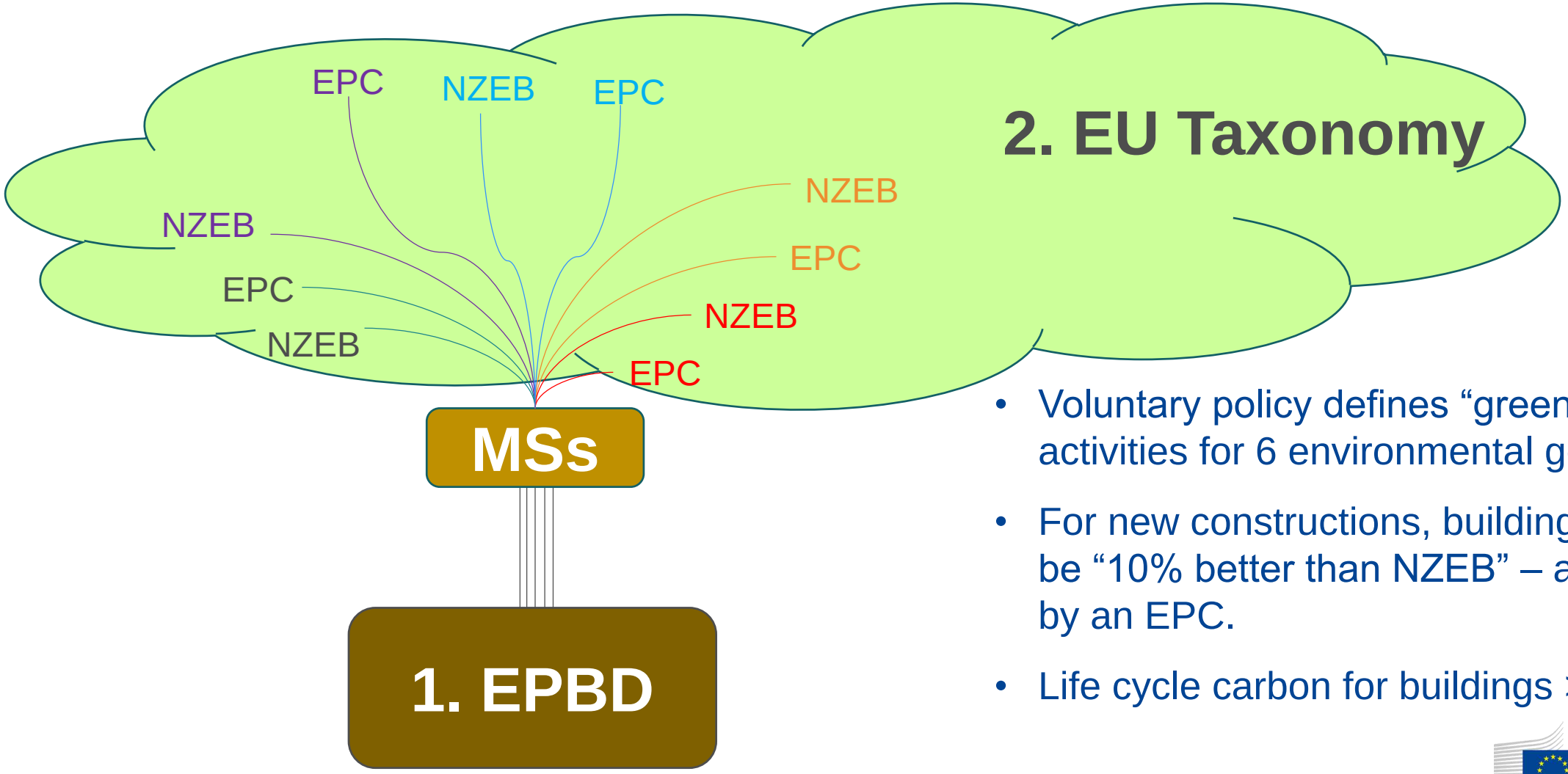
- Core EU policy is the Energy Performance of Building Directive.
- From this Directive and associated EN standards, Member State (MS) methodologies form.
- Differences in MS methodologies lead to lots of different outputs and ambition levels for Energy Performance Certificates (EPCs) and Nearly Zero Energy Buildings (NZEBs).
- Now a move to Nearly Zero **Emission** Buildings for NZ**E**Bs.

1. Recap on key EU policies for EPCs & NZEBs



- GBRSs are an important market development, not an EU policy.
- International GBRSs do not tend to set criteria directly related to EPCs or NZEB definitions.

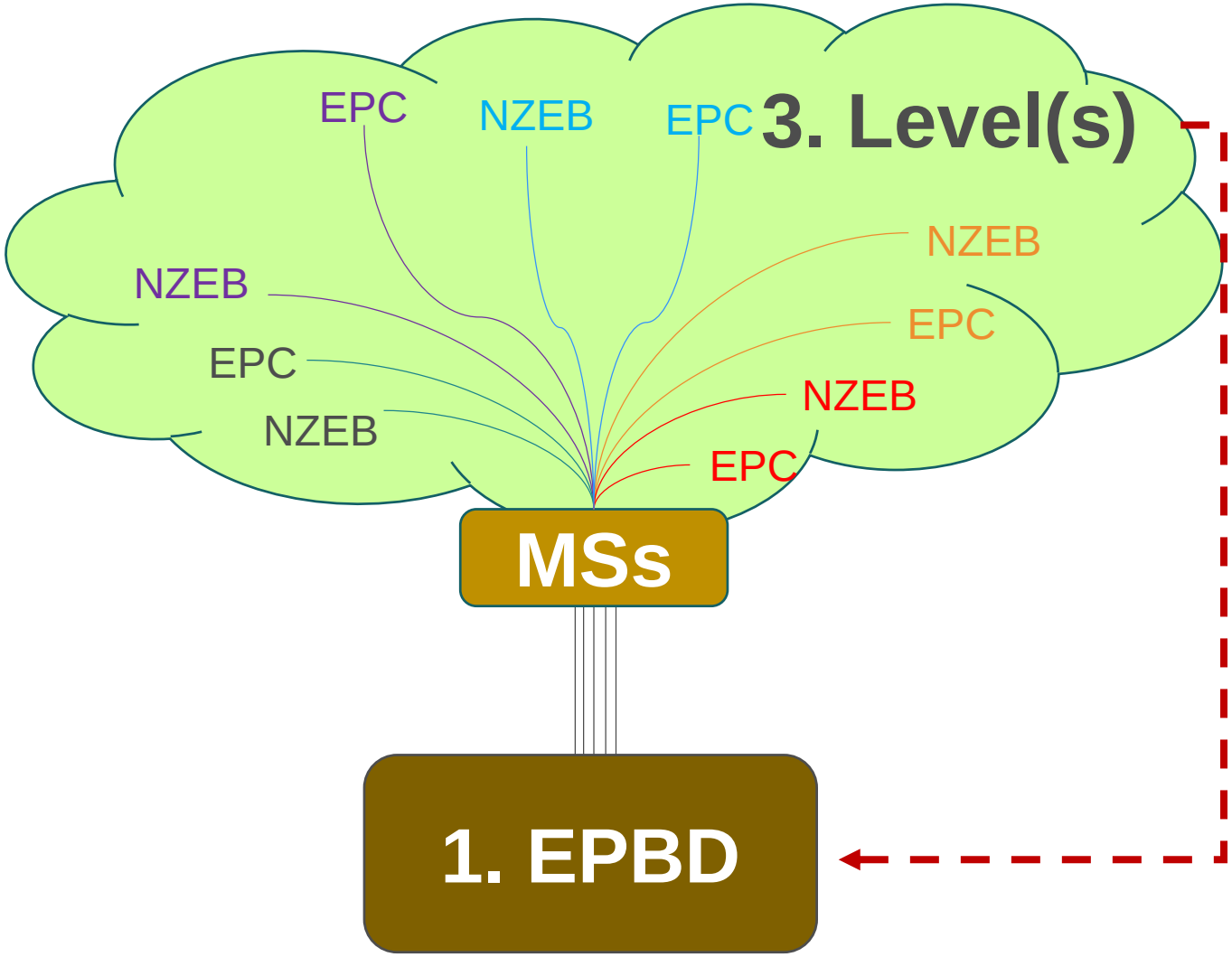
1. Recap on key EU policies for EPCs & NZEBs



- Voluntary policy defines “green” economic activities for 6 environmental goals.
- For new constructions, buildings should be “10% better than NZEB” – as proven by an EPC.
- Life cycle carbon for buildings >5000m2

*See Delegated Regulation (EU) 2021/2139 at: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R2139

1. Recap on key EU policies for EPCs & NZEBs



- Voluntary policy has indicators on use stage energy consumption (1.1) and life cycle carbon (1.2).
- No benchmarks, but sets a mandatory reporting format.
- Reference point for life cycle carbon method in Taxonomy.
- Proposed to be reference point for life cycle carbon in new EPBD.

European Commission

2. Brief explanation of Level(s)

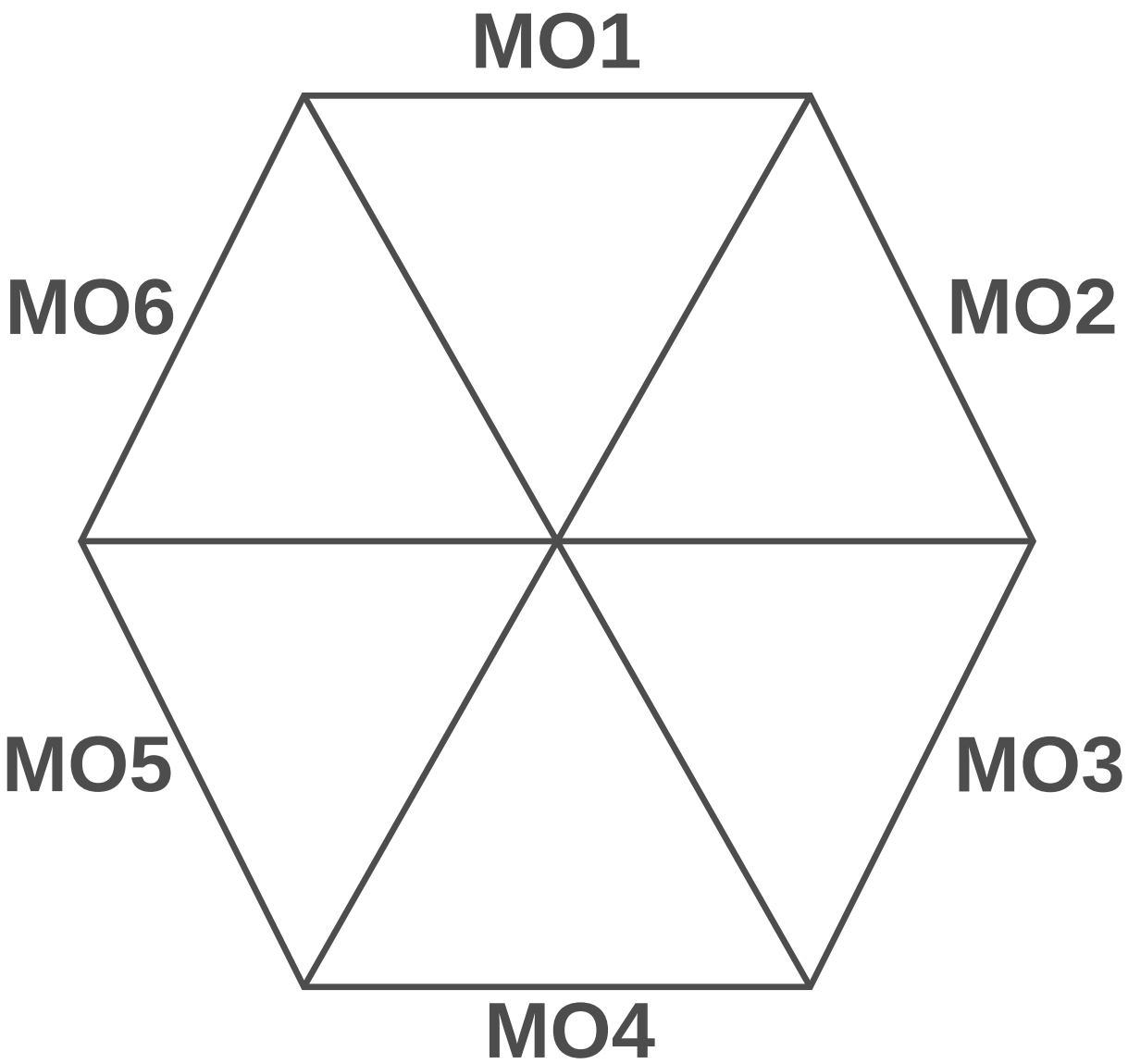
Level(s) is:

- …a common language (for creating a shared understanding of sustainability performance in buildings).
- …an assessment and reporting tool (for sustainability performance of buildings).
- …based on six macro-objectives (see next slide).

Level(s) is not:

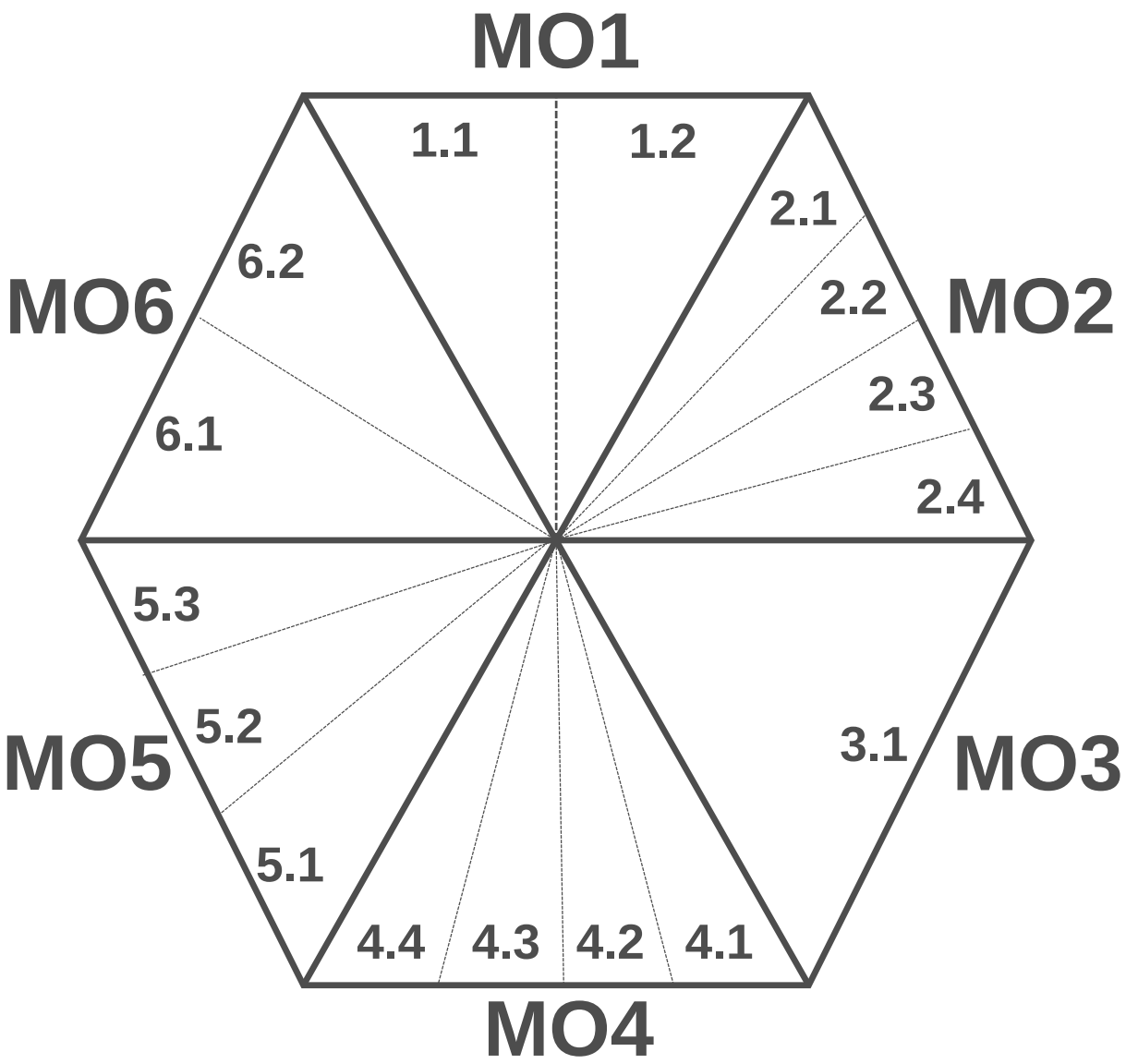
- …a green building rating scheme like BREEAM, LEED etc.
- …setting mandatory benchmarks

2. Brief explanation of Level(s): MOs



- 6 macro-objectives.
- MO1, MO2 and MO3 deal with **environmental** considerations.
- MO4 and MO5 deal with **social** considerations.
- MO6 deals with **economic** considerations.

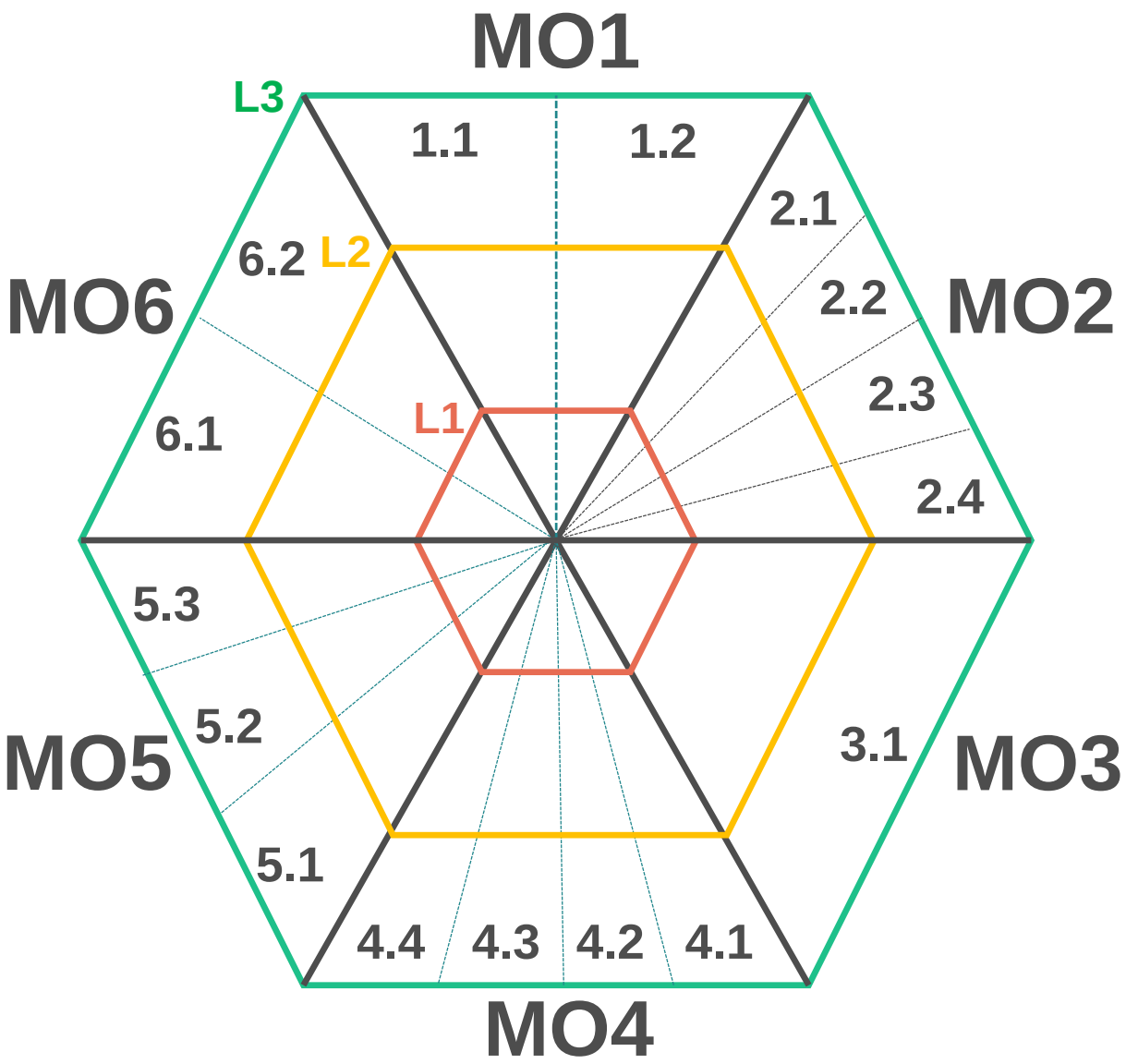
2. Brief explanation of Level(s): indicators



- 16 indicators.
- 1-4 indicators per macro-objective.

European Commission

2. Brief explanation of Level(s): levels 1-3

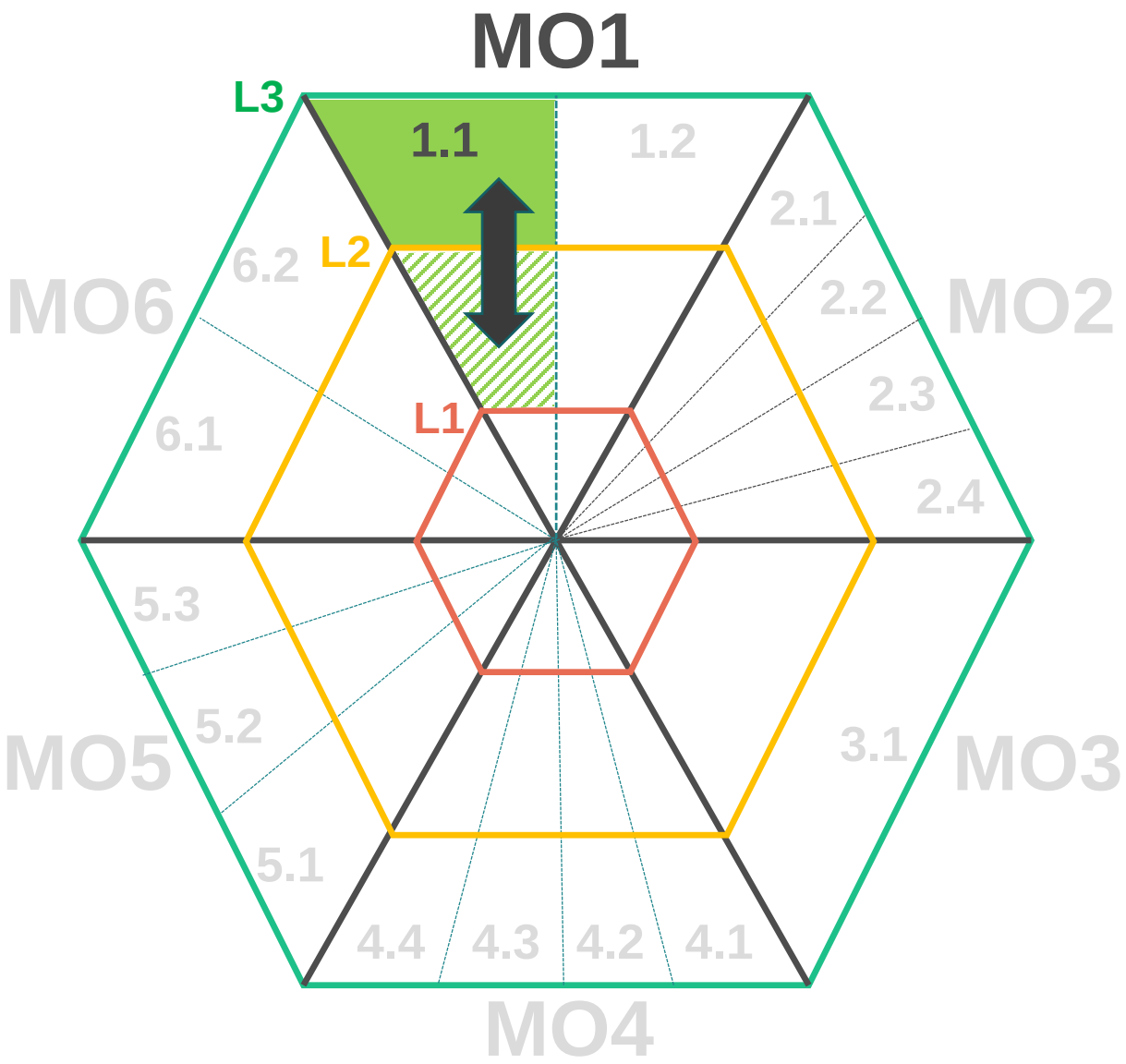


Each indicator has 3 levels

- Level 1 is the “entry level”, for design concepts.
- Level 2 requires detailed calculations/estimations based on designs.
- Level 3 requires real life measurement.

European Commission

3. Issues with the energy performance gap



Difference in results for indicator 1.1 at level 2 and level 3 → performance gap.

- Level 2 is design estimate of energy performance (kWh/m2/yr).
- Level 3 is real life energy performance (kWh/m2/yr).

European Commission

3. Issues with the energy performance gap

	kWh/m²/yr
L2.1 EPBD services [1] non-renewable primary energy self-used [2] (mandatory)	
L2.2 EPBD services [1] renewable primary energy self-used [2] (optional)	
L2.3 EPBD services [1] total primary energy self-used [2] (optional)	*L2.1 + L2.2*
L2.4 Exported renewable primary energy (mandatory)	
L2.5 EPBD services [1] non-renewable primary energy balance [3] (mandatory)	*L2.1 – L2.4*
L2.6 Non-EPBD services non-renewable primary energy self-used [2] (optional)	
L2.7 Non-EPBD services renewable primary energy self-used [2] (optional)	
L2.8 Non-EPBD services [1] total primary energy self-used [2] (optional)	*L2.6 + L2.7*
L2.9 Total primary energy self-used [2] (optional)	L2.3 + L2.8
L2.10 Total primary energy balance [2] (optional)	*L2.9 – L2.4*

1. For the purposes of comparability, EPBD services in Level(s) reporting should be considered as: heating, cooling, ventilation (including any humidification and dehumidification), hot water and lighting.

2. Self-used means energy delivered to the building as part of the building operation. This includes all energy delivered from all sources, including onsite sources for EPBD services, such as PV panels and solar thermal installations and ignores any excess of renewable energy from onsite sources that is exported.

3. Primary energy "balance" means the subtracting any exported renewable primary energy from the total "self-used" energy.

- Level(s) 1.1 reporting format as per July 2021 (v1.2).
- Choice of mandatory indicators tries to be adaptable to all different MS methods.
- But real meters don't read like this.
- Best choice to minimise performance gap might be 2.10 (net total primary energy).

European Commission

3. Issues with the energy performance gap

Building service	*Energy need*	*System efficiency* [1]	*Energy carrier* [2]	*Delivered energy per energy carrier*	*Non renewable primary energy factor* [3]		*Renewable primary energy factor* [3]		*Total primary energy factor* [3]	
	kWh/yr	Decimal	Free text	kWh/yr	Decimal factor	kWh/yr	Decimal factor	kWh/yr	Decimal factor	**kWh/yr**
Heating	*1200*	*0.80*	*Biogas*	*1500*	*0.30*	*450*	*1.00*	*1500*	*1.30*	***1950***
Cooling										
Ventilation										
Hot water										
Lighting										
Other (please specify) [4]										
Exported renew. energy [5]	*n/a*	*n/a*								
Total										

1. The efficiency with which delivered energy is converted into needed energy. For example, if a boiler converts 85% of the calorific value of a fuel into heat in water coming out of the tap or shower, the system efficiency would be 0.85. Dividing the energy need by the system efficiency will produce the delivered energy result (delivered energy can never be lower than the energy needed).

2. For example, energy carriers from distant sources: solid, liquid or gaseous fossil fuels; solid, liquid or gaseous biofuels or grid electricity. From nearby sources: district heating or district cooling. From onsite sources: electricity from PV panels, electricity from wind turbines, heat from solar thermal, geothermal or aerothermal. In cases where more than one energy carrier is used for the same building system (e.g. hot water from a gas boiler and from onsite solar thermal) two rows should be made for hot water, one for each energy carrier.

3. Any given energy carrier may have a non-renewable factor and a renewable factor, or just one of the two. These factors may be greater or less than 1, although the combined total of non-renewable and renewable primary energy factors for a given energy carrier cannot be less than 1.

4. If the methodology requires other energy needs to be accounted for, or the user simply wants to do this, then one row should be used for each "other" energy service.

5. When making the entry for delivered energy for any exported renewable energy from the building, a negative number should be used.

- Extra detail behind reporting at level 2 for indicator 1.1.
- Estimates per energy system.
- "Other" data generally refers to plug loads and could be major contributor to the energy gap (see next slide).

European Commission

3. Issues with the energy performance gap

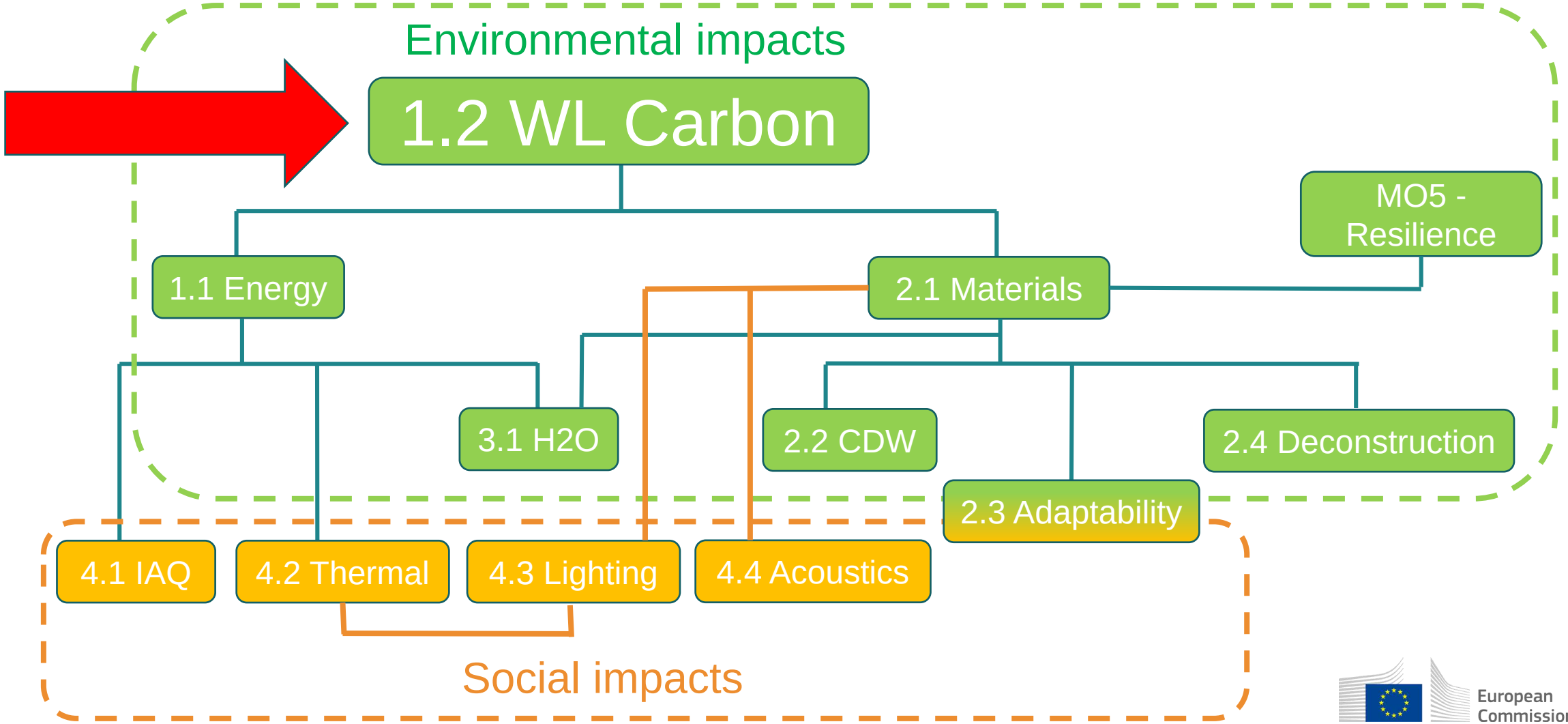
Even if there is a building energy management system installed, matching design performance to real performance becomes difficult when:

- Combining ventilation and air conditioning systems.
- Combining space heating and domestic hot water systems.
- Plugging in portable heaters.
- Plugging in potable ventilators.
- Plugging in electric vehicles to charge.
- Plugging in lamps and ambient lighting

Links to images from internet searches: portable heater; portable fan; e-car, e-scooter; lamps

European Commission

4. The Level(s) road to NZE$_{mission}$B



European Commission

4. The Level(s) road to NZE$_{mission}$B

Indicator	Unit	Product (A1-3)	Construction process (A4-5)	Use stage (B1-7)	End of life (C1-4)	Benefits and loads beyond the system boundary (D)
(1) GWP - fossil	kg CO_2 eq					
(2) GWP - biogenic	kg CO_2 eq					
GWP – GHGs (1+2)	kg CO_2 eq					
(3) GWP – land use and land use change	kg CO_2 eq					
GWP – overall (1+2+3)	kg CO_2 eq					
Notes:						

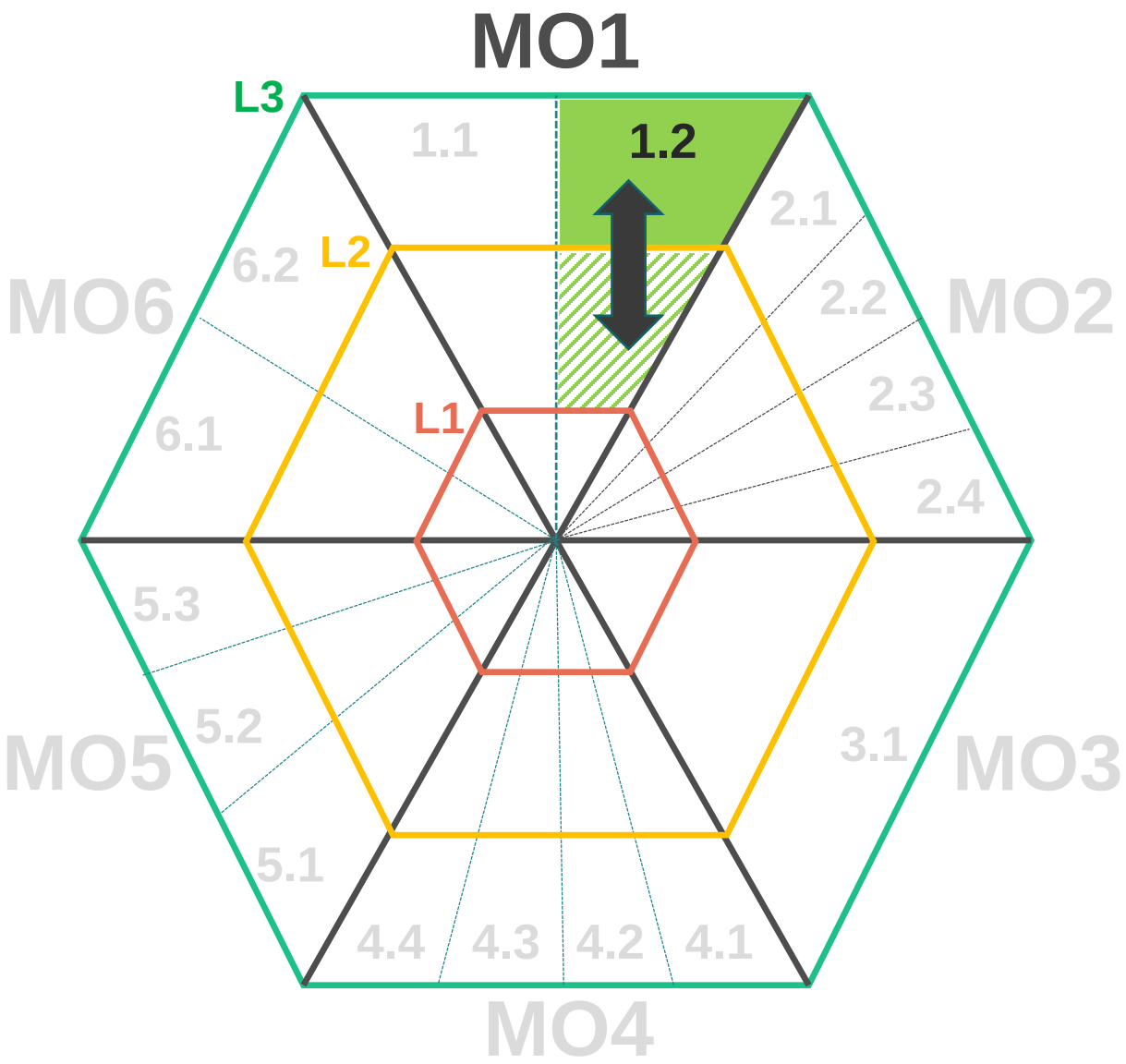
Macro-objective 1: Greenhouse gas and air pollutant emissions along a buildings life cycle

Use stage energy performance user manual: introductory briefing, instructions and guidance (version 1.1) **Level(s) User Manual 3: Indicator 1.1** (2021-07-15)	Download
Level(s) User Manual 3: Indicator 1.1 - Available translations. **Level(s) User Manual 3 - Indicator 1.1 - available translations** (2022-05-16)	Download
Life cycle Global Warming Potential (GWP) user manual: introductory briefing, instructions and guidance (version 1.1) **Level(s) User Manual 3: Indicator 1.2** (2021-01-29)	Download
Level(s) User Manual 3: Indicator 1.2 - available translations. **Level(s) User Manual 3: Indicator 1.2 - available translations** (2021-11-30)	Download
Indicative list of LCA software and databases for use with indicator .2 **Level(s). Indicator 1.2 (pdf)** (2021-07-08)	Download

- Level(s) indicator 1.2 is based on EN 15978.
- JRC user manual:
  - Defines a minimum scope for embodied carbon.
  - Provides default service lives for building systems and elements.
  - Provides an indicative list of suitable LCA software and databases.

European Commission

5. Issues with the energy performance gap

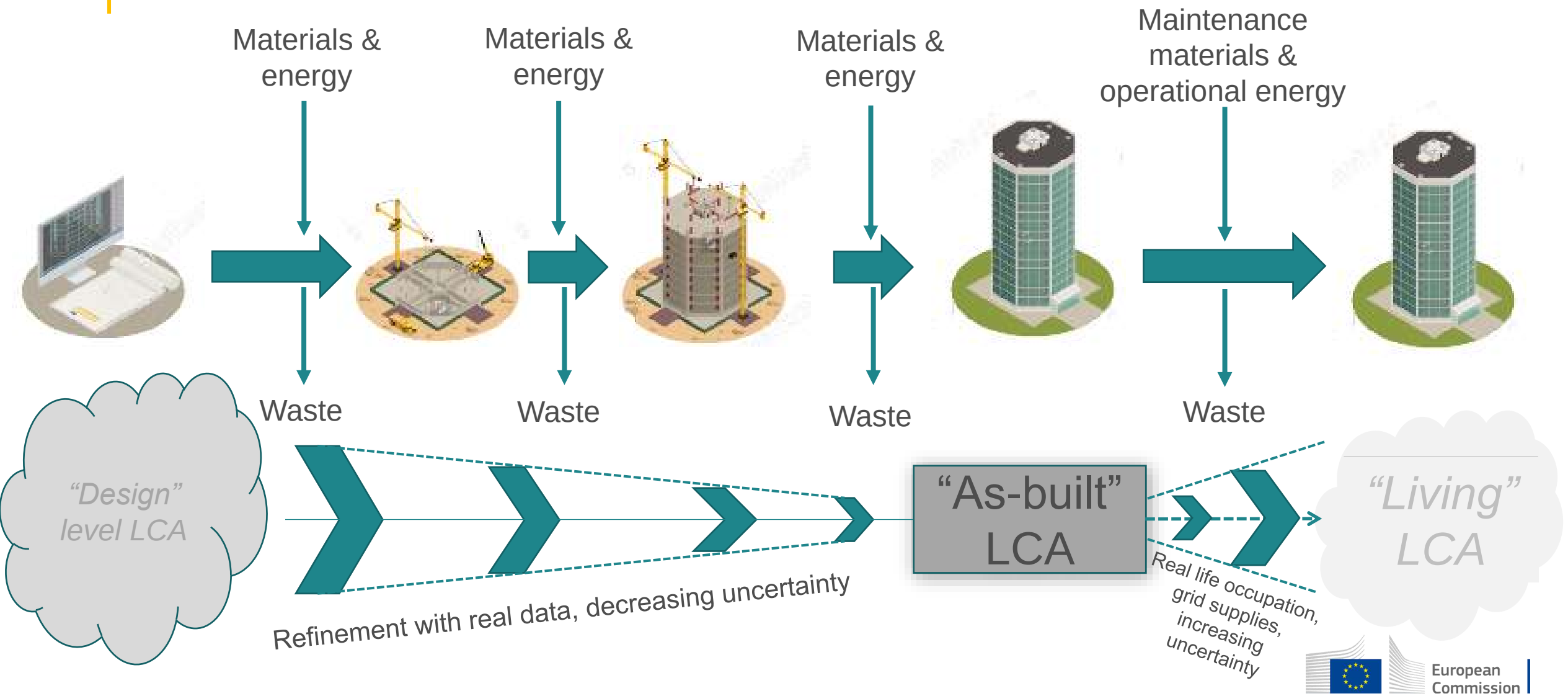


Difference in results for indicator 1.2 at level 2 and level 3 → performance gap. The main issues are:

- Energy performance gap….
- Grid carbon factors (for 50+ yrs).
- Scope for embodied carbon needs to be the same (esp. onsite ren.).
- Realistic assumed service lives.
- Generic vs. specific embodied carbon

European Commission

5. Issues with life cycle carbon performance gap



Concluding points

- Level(s) is a voluntary policy, aiming to be a common denominator.
- Level(s) reporting on energy consumption is quite comprehensive.
- Should be able to handle all the different MS methods (and EPCs).
- Level 2 and level 3 reporting on same building → performance gap.
- Level(s) reporting on life cycle carbon is influencing EU Taxonomy and EPBD.
- Fixes some variables left open by EN 15978.2011 (new EN 15978 due soon though).

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Thank you

Contact us at:
JRC-B5-LEVELS@ec.europa.eu ; Shane.DONATELLO@ec.europa.eu

European Commission

TNO innovation for life

OPERATIONAL RATING

FROM THEORY TO PRACTICE | MARLEEN SPIEKMAN

INTRODUCTION
MARLEEN SPIEKMAN

- Researcher at TNO, the Netherlands
- Building physicist
- Social scientist

- Author of the Dutch National Energy Performance Standard
- Author of several CEN/ISO EPBD Standard

} Theoretical performances

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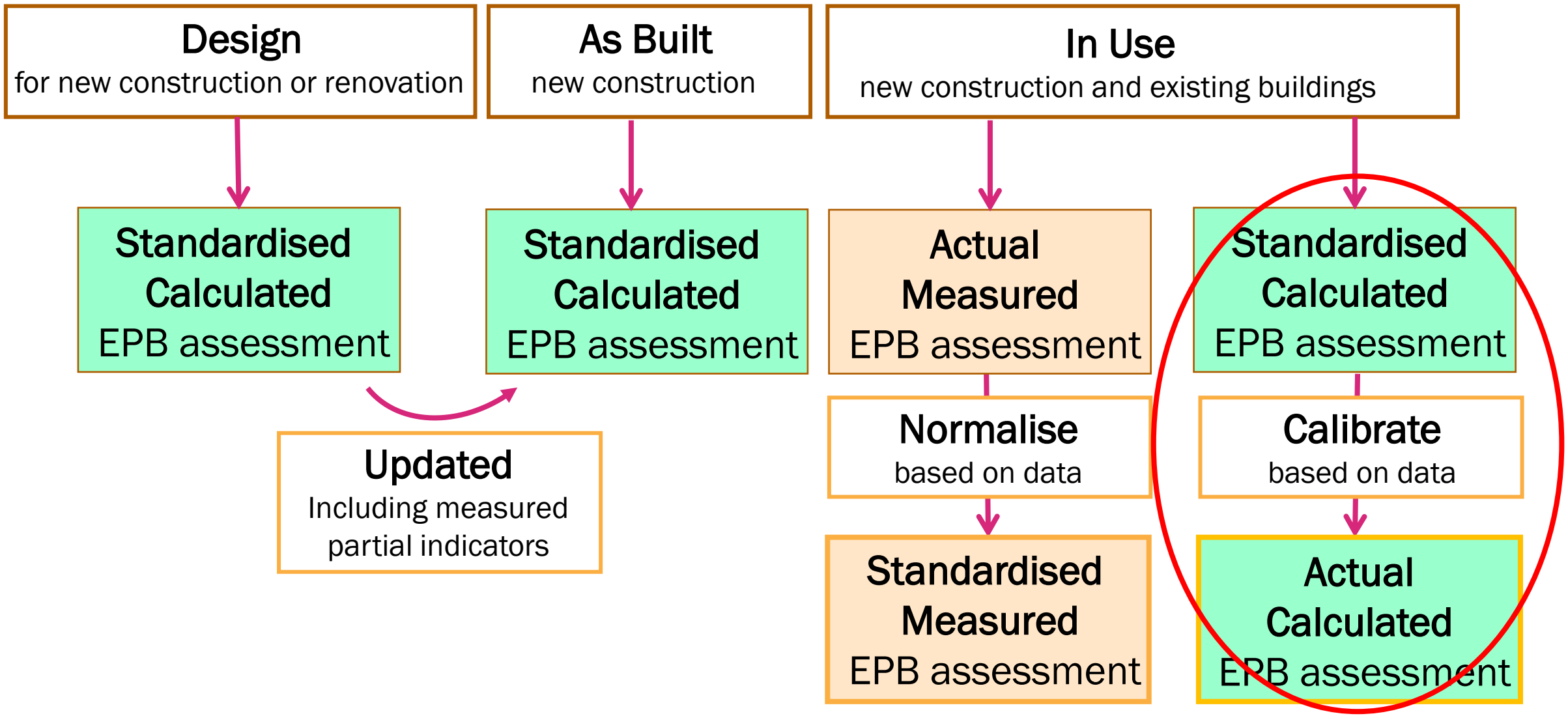
EPB ASSESSMENT TYPES DURING BUILDING LIFECYCLE



OPERATIONAL PERFORMANCE

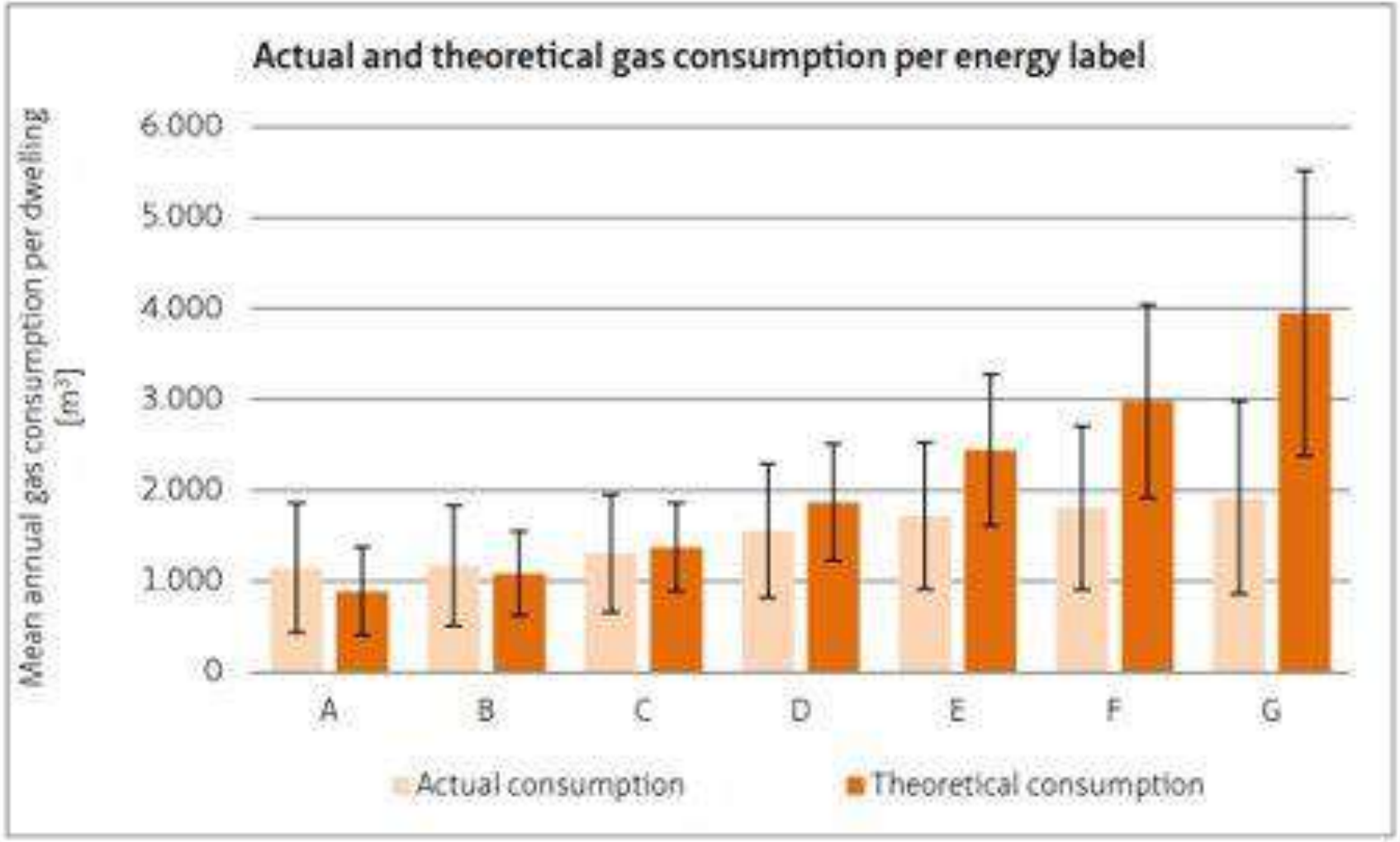
AIMS – TIME FRAMES

- Short term predictions (hours/days): model based controls / flexibility: peek shaving and effective use of renewables
- Mid term predictions (weeks): fault detection / fault diagnoses
- Long term predictions (months): predictive maintenance
- Very long term predictions (years): effect of renovation measures

LARGE DIFFERENCES OF ENERGY USE BETWEEN NEIGHBOURS

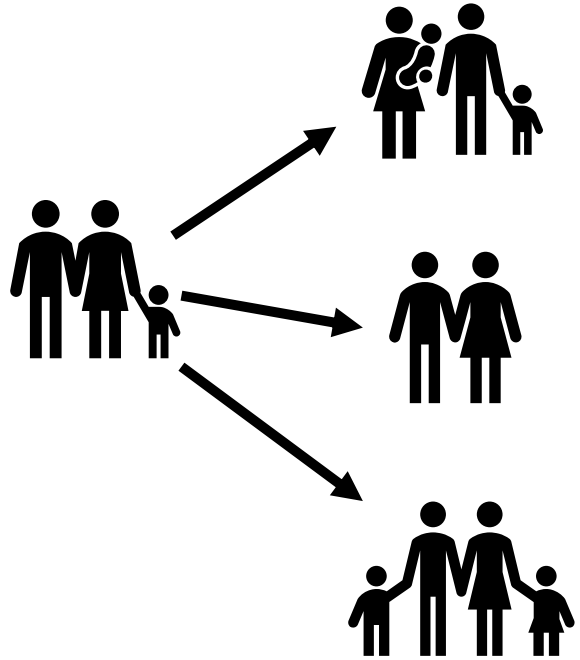
Calculated energy use: using ‘ standard user’	1156 m^3	1156 m^3	1156 m^3	1156 m^3	1156 m^3
Actual energy use: with actual user	816 m^3	1247 m^3	2363 m^3	1325 m^3	426 m^3

GAP BETWEEN ACTUAL AND THEORETICAL ENERGY USE



MAKE THEORETICAL CALCULATIONS MORE REALISTIC
USING DATA

- Replace standard user by actual use
- Based on available data
- Using questionnaires
- And/or sensor data

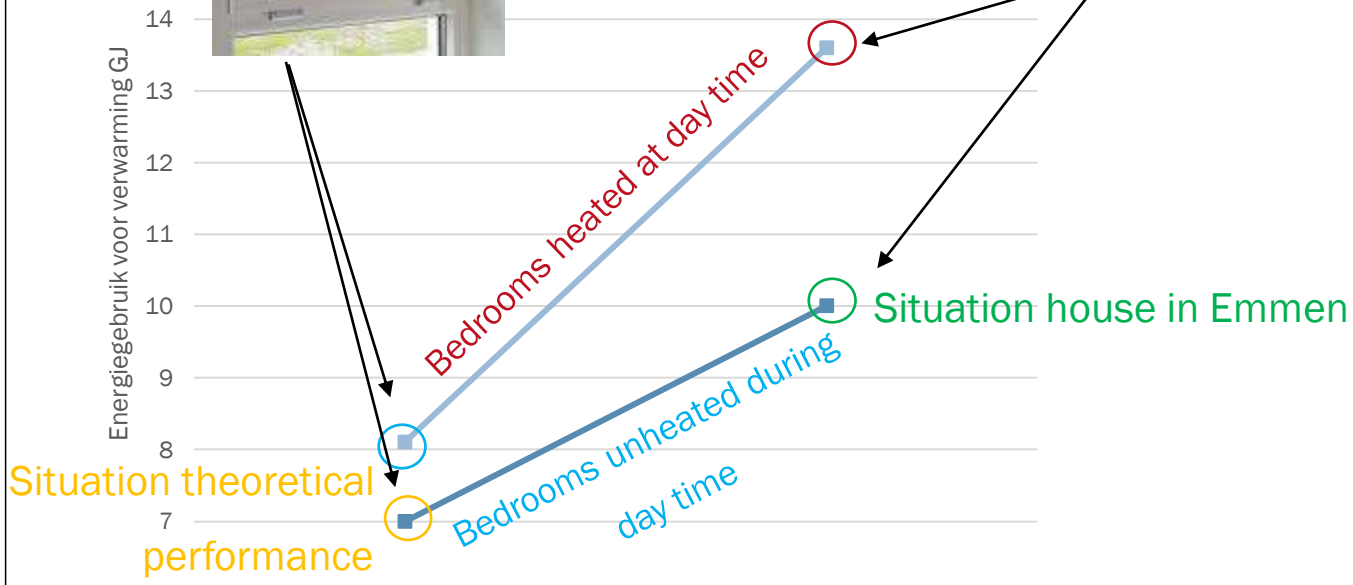


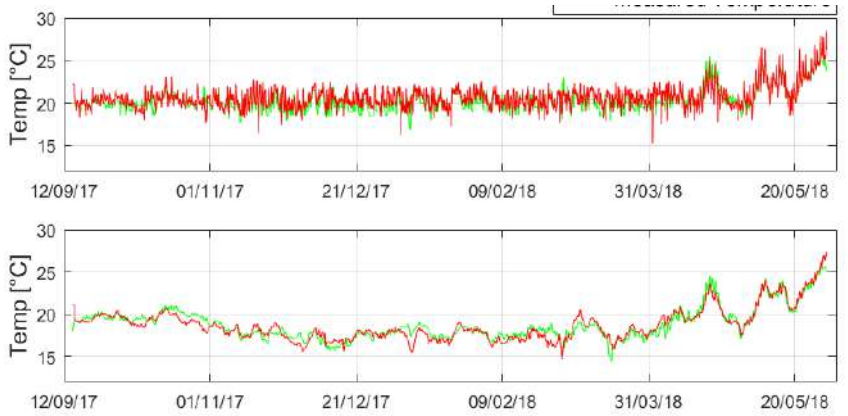
FIRST PREDICTIVE TWIN: SOCIAL HOUSING EMMEN (NL)

USING DETAILED SENSOR DATA

Bedroom windows closed

Bedroom windows open

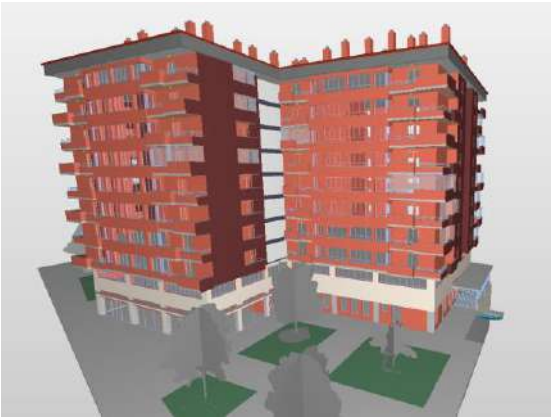




TNO innovation for life

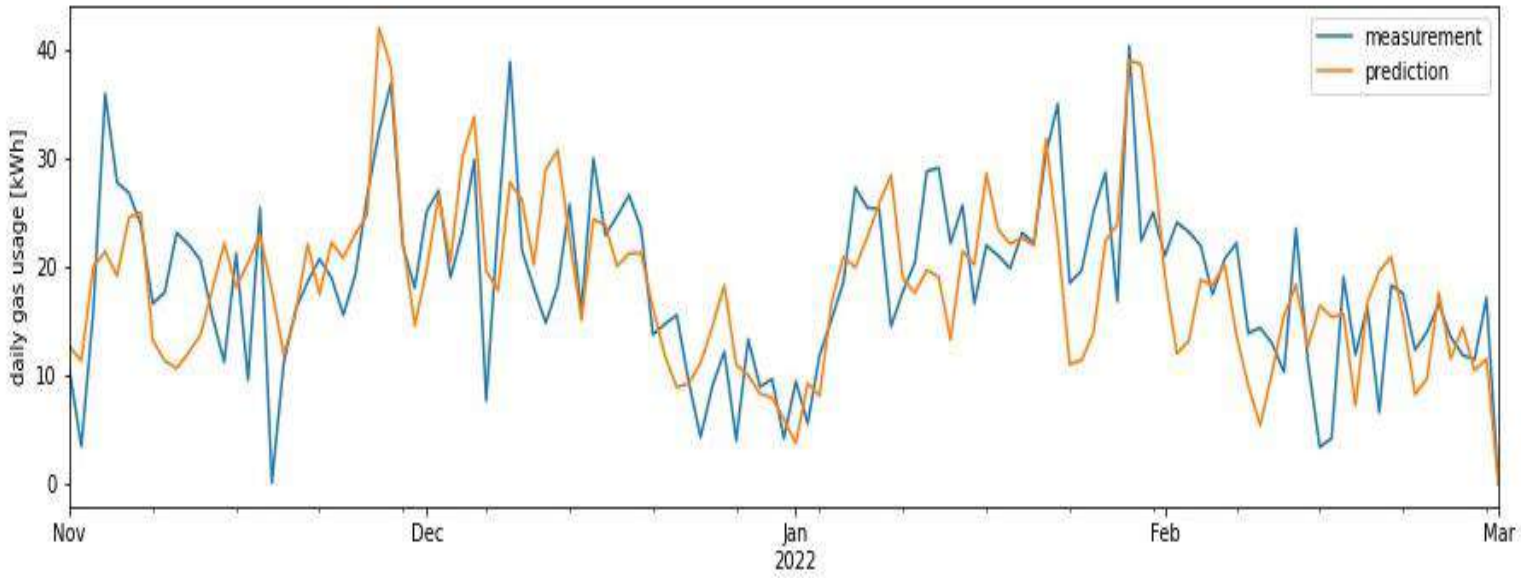
EXAMPLE: APARTMENT SAN SEBASTIAN (BIM4REN PROJECT)
USING U-CERT SIMPLE OPERATIONAL RATING PROTOCOL

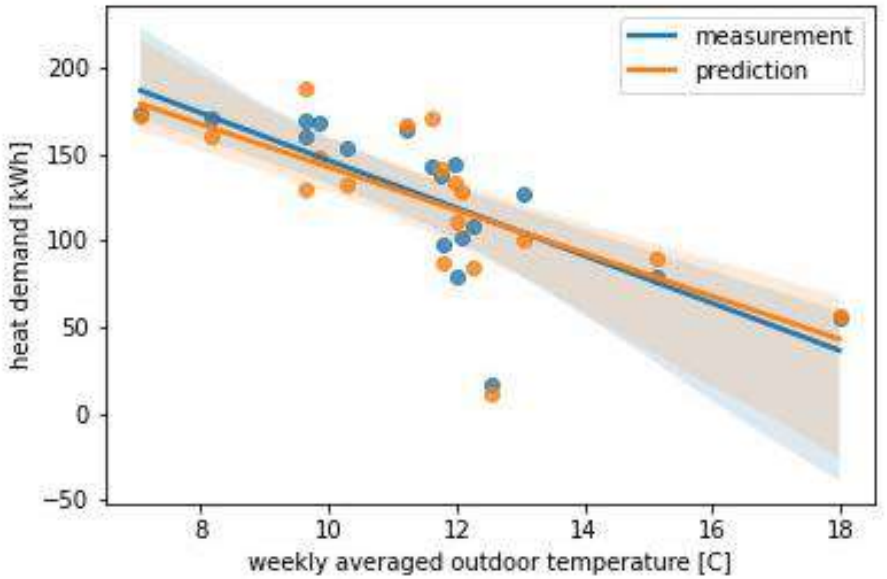
- Monitoring data
  - Energy use
  - (Indoor temperatures)
- Questionnaire
  - Setpoint for heating
  - Interaction with windows
  - Use of the solar shading
- One-zone hourly model (CEN/ISO EPBD Standard)
- Nov 2021 – March 2022



DAILY GAS USAGE FOR HEATING & ENERGY SIGNATURE

MEASUREMENT VERSUS MODEL





SUMMARY & LESSONS LEARNED

- User behaviour has a big influence on energy saving/comfort/indoor air quality
- Gap between theory and practice causes over-estimation of the effect of energy saving measures
- Operational rating gives a better prediction of effect of renovation measures
- Getting a model to fit is easy. Getting a realistic fit is not!
- It still takes a large amount of expertise to make an operational model
- When designing an operational model: always start with the aim (and don’t make a Christmas tree)

OPERATIONAL RATING: IMPORTANT FOR WHOM?

Very long term predictions (years): effect of renovation measures:

- Home owner who wants to choose optimal energy saving measures
- Government who wants effective use of resources (costs/subsidies, man power & materials)
- Providers of performance guarantees/services → important tools for acceleration and up-scaling

- Housing corporations? Good average fit needed, no individual fit


THANK YOU
FOR YOUR ATTENTION
TNO innovation for life

SUSTAINABLE PLACES 2022

Sep. 6 - Sep. 9, 2022 | Nice, France

Hybrid workshop

EPCs: Measuring building performance and adding operational rating

7 September 2022, 14h45 – 18h00 CEST

Panellists associated sister projects

frESCo BEYOND MODERATE

Juan Antonio Aranda

Tasos Tsitsanis

Lukas Kranzl

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frESCO Innovative Energy Services and Business Models for the Residential Sector

SENSEI and frESCO projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847066 and 893857.

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frESCO

https://www.fresco-project.eu/

- Overview of current EPC status
- New frESCO P4P Energy Services
- The role of PMV in a P4P approach

frESCO project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 893857.

Barriers to Current EPC in Residential

- Low penetration of the ESCO EPC model in the residential sector.
  - Low absolute saving potential per user.
  - High transaction costs.
  - Owner – tenant dilema.
  - Low generation and storage levels in the residential sector at present.
  - Low smart readiness level in the residential sector at present.
- Limited scope of the EPC services in the residential sector.
- No active participation of the residential consumers in the energy markets beyond the retail company and tariff choice.
- No or limited use of the demand response source for grid management and balancing.

frESCO Solution

NOVEL HYBRID SCHEMES that reduce payback thanks to simultaneous cost savings (from energy efficiency) and revenues creation (through demand response)

NEXT GENERATION of EPC

Building retrofitting (installation of smart equipment for metering, sensing, actuating)

Installation of distributed generation and storage (PV&batteries/EVs)

Flexibility services

Energy efficiency measures, spanning behavioral transformation

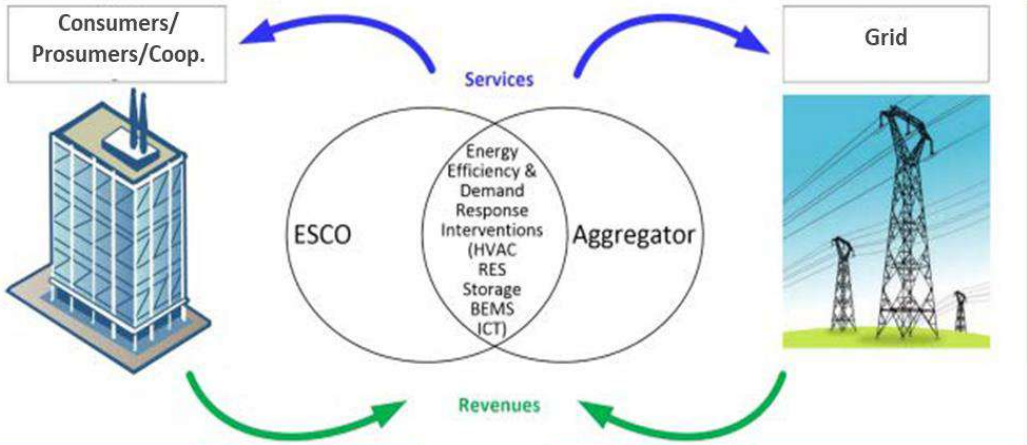
Self-consumption optimization (smart automation at both building and energy community level)

non-energy services (Comfort preservation, IAQ, Security, Well-being, etc.)

frESCO Innovative Service Concept

Consumers/Prosumers/Coop.

- Cost reduction thanks to Demand adaptation to tariff
- Improvement of comfort conditions
- Favorable offers for installation of smart meters
- Empowerment through active participation in Energy market and energy autonomy



Grid

- Operation stability, Resilience and Security of supply
- Cost reduction avoiding network reinforcement
- Congestion reduction and network losses minimization
- Planned maintenance facilitation

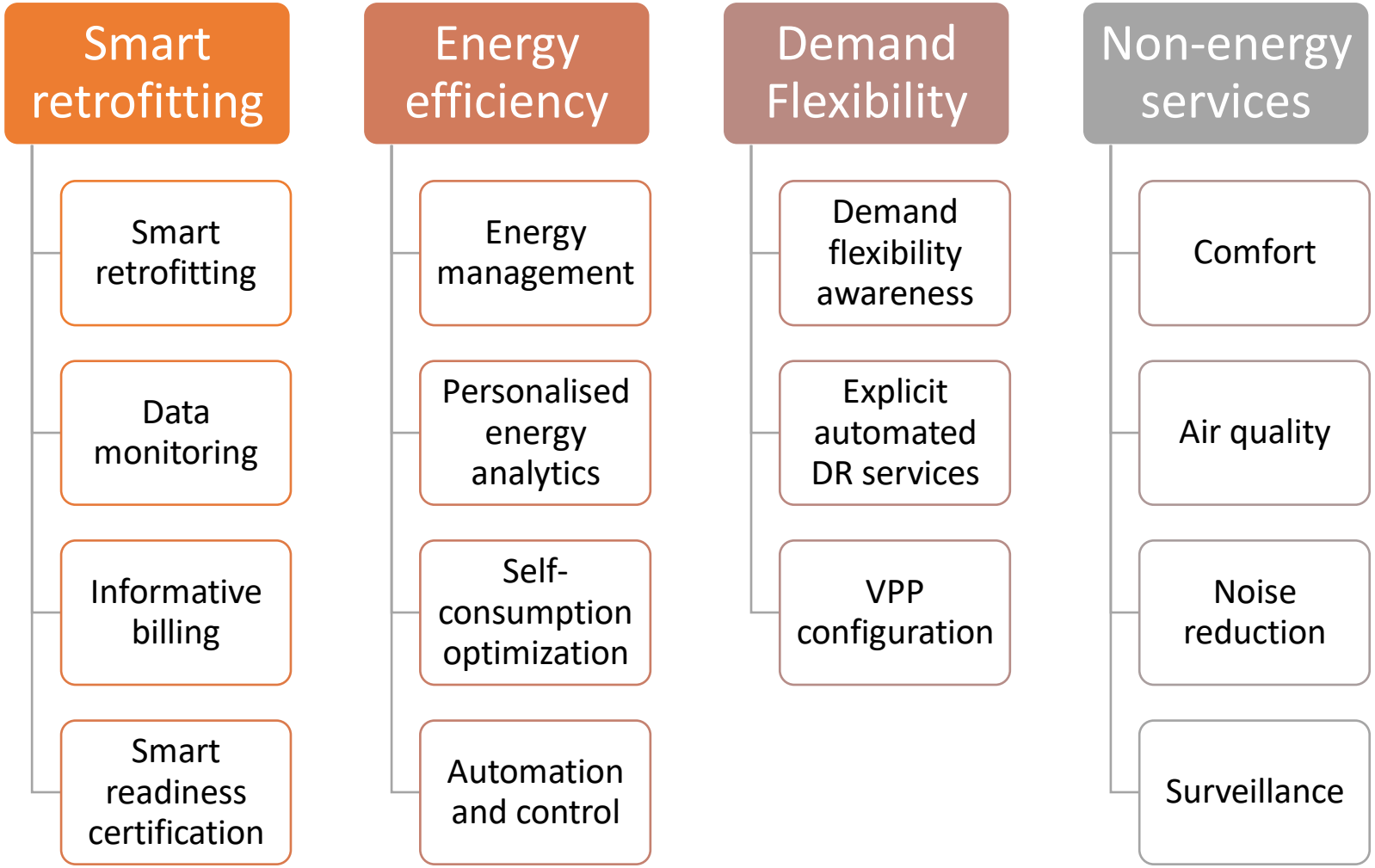
ESCOs

- New Savings from user behaviors improvement
- New Savings from Self-consumption optimization
- New Revenues from flexibility analysis → selecting best energy deal → bid excess flexibility in energy market
- Higher savings thanks to enlarged portfolio and enter in a new market

Aggregators

- New Revenue by utilizing stand-by flexibility to provide EE services that improve performance
- New Revenue by monetizing non-energy services (e.g. human comfort, health and security aspects)
- Higher revenues thanks to an enlarged portfolio (and market sector) for flexibility provision

frESCO Energy Services Proposal

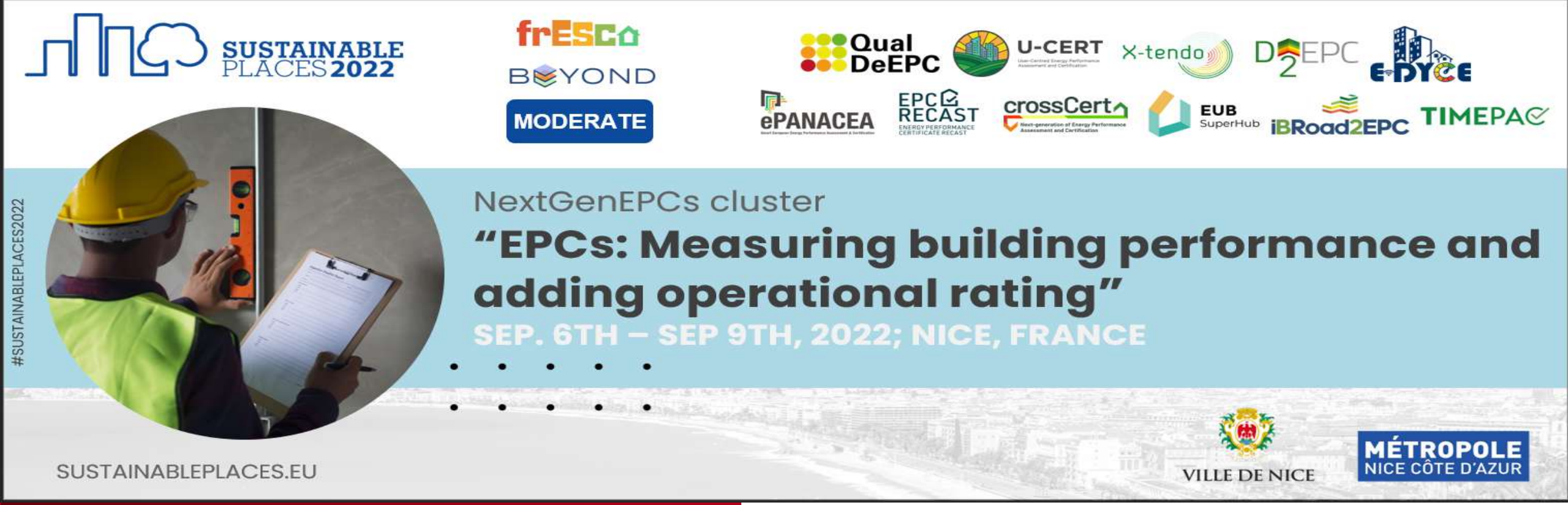


P4P Approach

- Specific PMV methodology for energy efficiency and flexibility
- Data driven baselining and forecasts
  - Efficiency PMV: Holistic dwelling assessment with seasonal baseline and possible regular adjustments. Payments derived from verified energy and economic savings.
  - Flexibility PMV: Load-based assessment with short term baseline and no adjustments. Payments derived from market revenues from the trading of verified demand flexibility

frESCO Proposed Business Models

- Thassos island (Greece): green hotel bungalows with PV generation and storage
- Krk Island (Croatia): single-family residential buildings
- Rennes (France): housing single family residential buildings
- Madrid (Spain): Block of apartments residential building with collective PV



frESCO

https://www.fresco-project.eu/

frESCO Project Contact

juan.aranda@fcirce.es

frESCO project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 893857.

BEYOND

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NextGenEPCs cluster

EPCs: Measuring building performance and adding operational rating

SEP. 7TH, 14:45–18:00 CET, HYBRID

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VILLE DE NICE

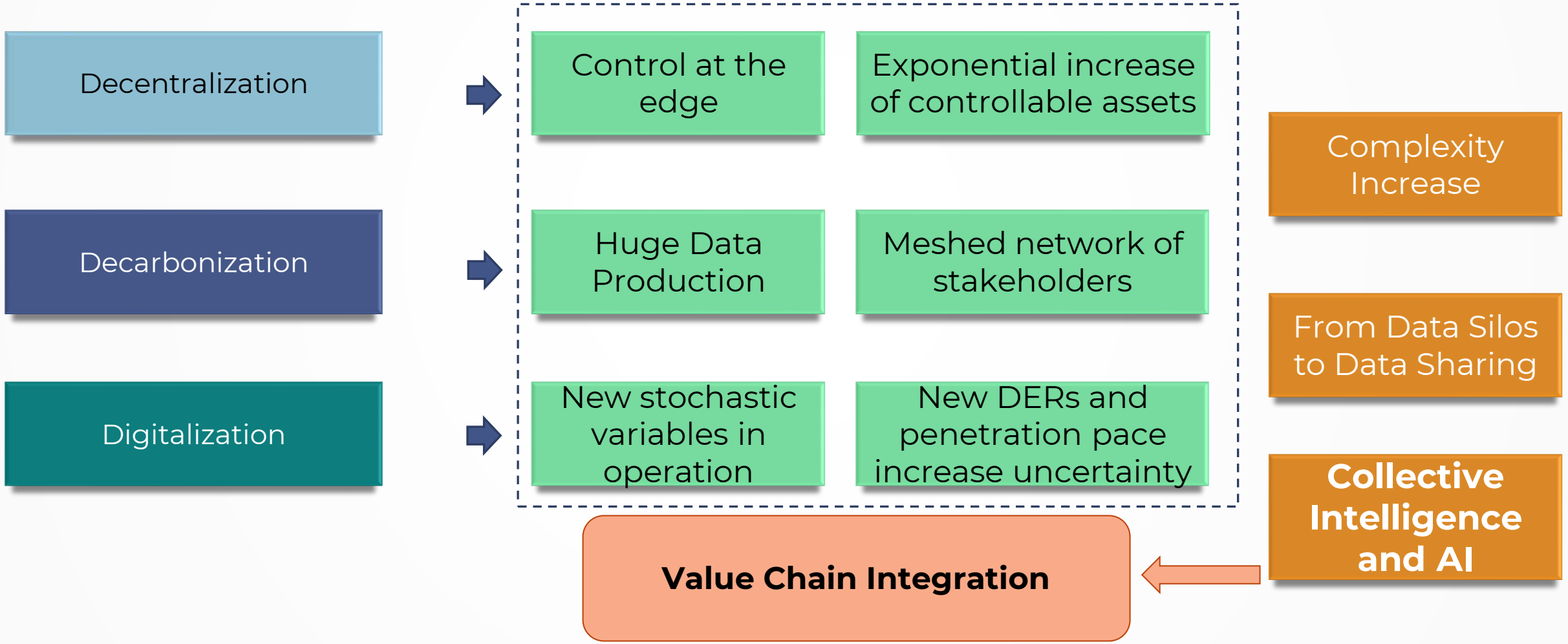
MÉTROPOLE NICE CÔTE D'AZUR

BEYOND has received funding from the European Union's Horizon 2020 Research and Innovation programme under the Grant Agreement No 957020.

Project Overview

BEYOND has received funding from the European Union's Horizon 2020 Research and Innovation programme under the Grant Agreement No 957020.

Why (Big Data for) Buildings?



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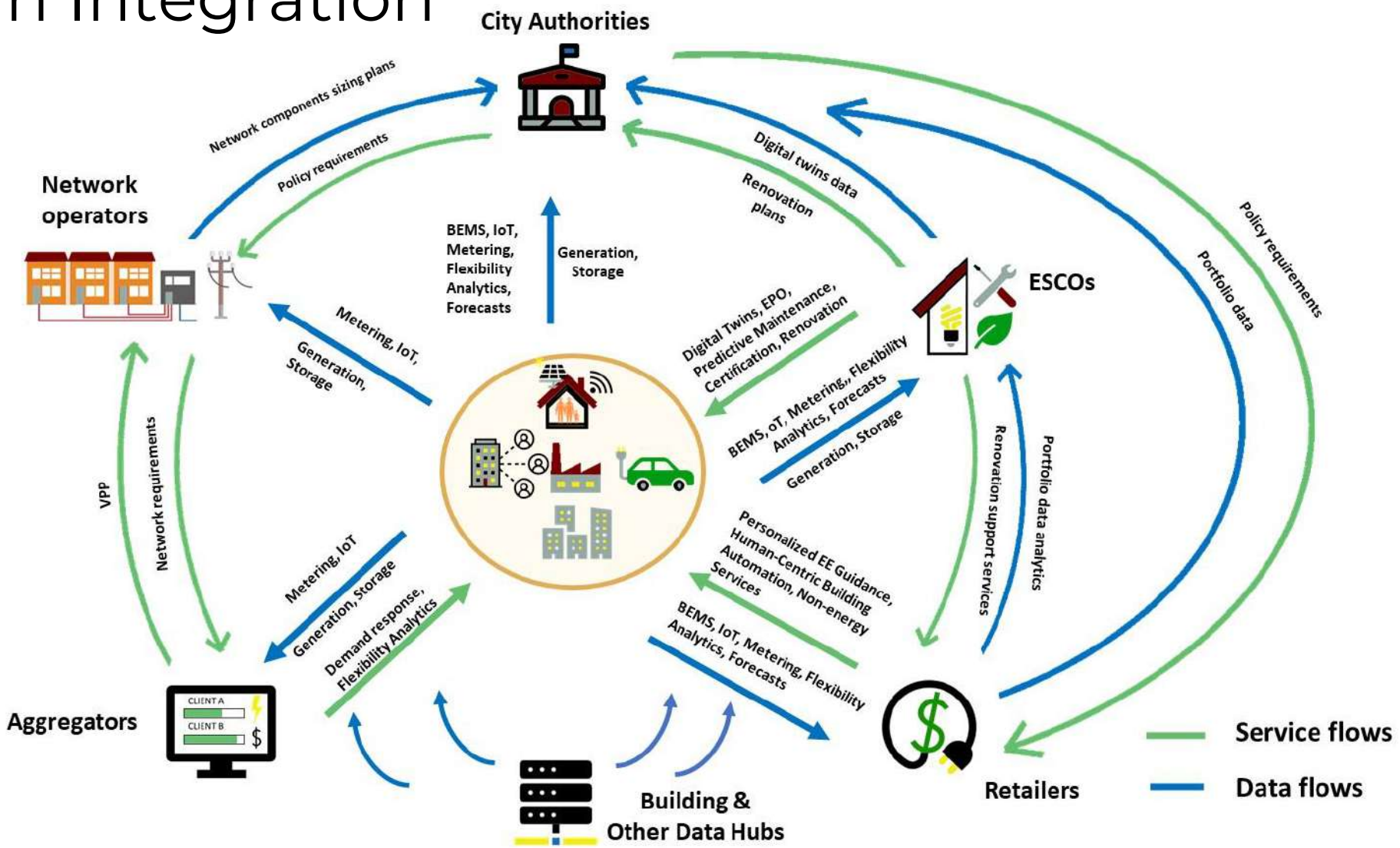
Collective Intelligence through Building-Data Value Chain Integration



BEYOND in a nutshell – Technical Novelties (1/2)

Effortless data management

Easing tasks for the curation, mapping and linking of private data assets with external data based on a Common Information Model

Intuitive data exploration

Support in searching, locating/"matchmaking", understanding, exploring and "preparing" energy-related data for analytics

Analytics as a Service

Enabling novel applications for the whole value chain

- Personal Analytics
- Industrial Analytics
- Edge baseline analytics

By-design Interoperability

Provision of standardized interfaces to collect and export intelligence

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BEYOND in a nutshell – Technical Novelties (2/2)

End-to-end data security

Encrypt and check-in data through an on-premise environment with multiple modalities

Real data privacy

Data remains private and on -premise while allowing for joint actions with other “trusted” stakeholders

Secure experimentation playground

Designing and executing analytics and “applications” in private sandbox environments, spawn on demand

Trusted data sharing

fCreating, signing and validating smart multi-party data contracts in an immutable manner, while remunerating the involved stakeholders

Advanced access control

Regulate access to the private data assets through declarative authorization policies

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Operational Rating in BEYOND

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The BEYOND Added-Value Apps

I. Impact Assessment Module for Holistic Energy Optimization and Policy Making at urban level → City Authorities

II. Informed Decision-Making Module for Energy Infrastructure Sizing and Planning → Network Operators (District Heating/ Electricity)

III. Advanced renovation support module → ESCOs, Construction Companies

IV. Building Digital Twin module for Self-consumption maximization and predictive maintenance → ESCOs, Facility Managers

V. Building Portfolio Analytics and Management module → Retailers

VI. Personalized energy analytics and human-centric automation module → Prosumers

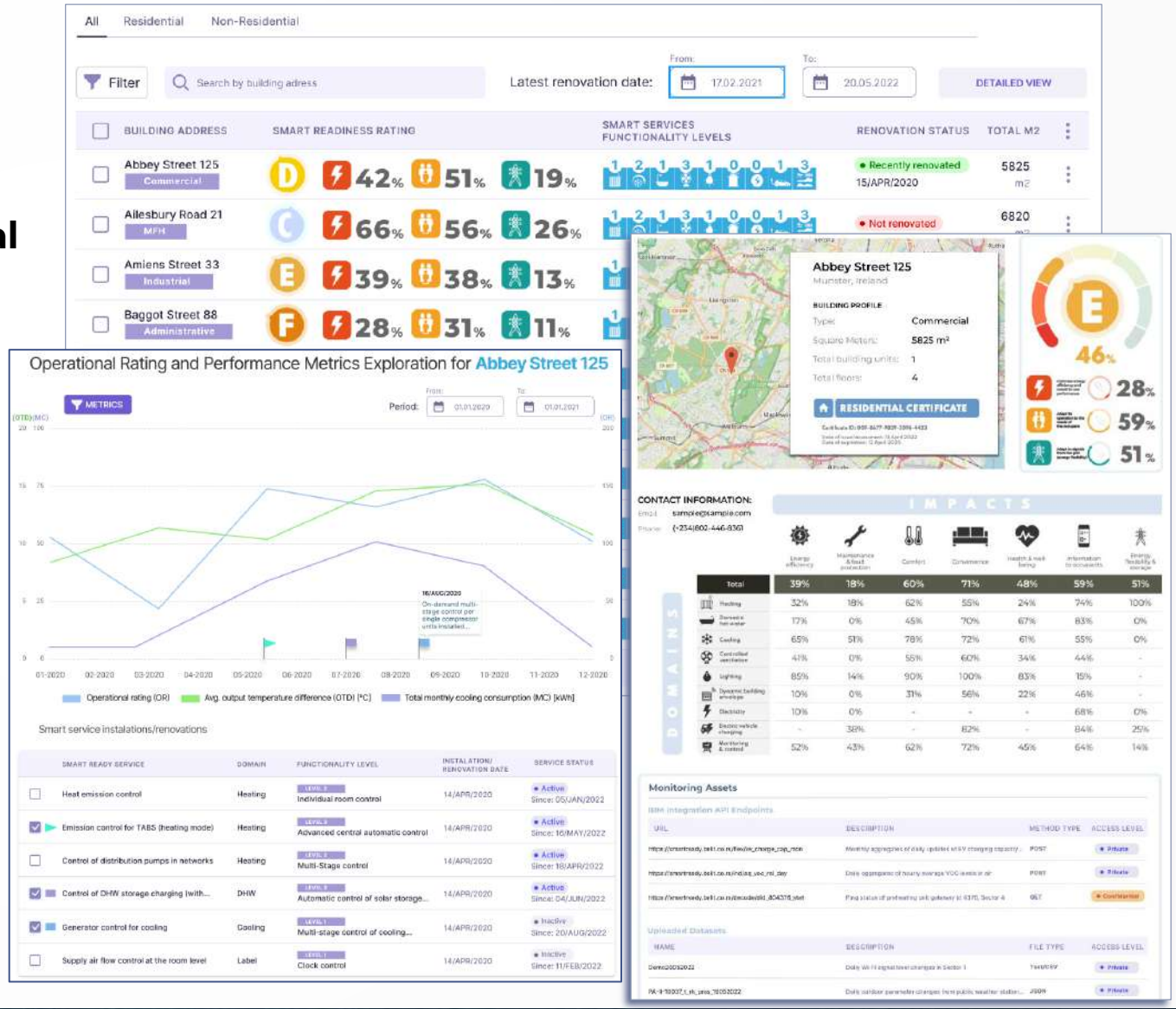
VII. Building Energy Performance and Smart Readiness Certification → ESCOs

VIII. Optimal VPP Configuration and Consumer-centric Demand Response module → Aggregators

BEYOND has received funding from the European Union's Horizon 2020 Research and Innovation programme under the Grant Agreement No 957020.

Building Energy Performance and Smart Readiness Certification App

- Granular and AI-enabled “dynamic” energy **performance assessment and rating**
- Elaboration of the concept of **eDECs for operational rating** of demonstration buildings
- Normalization based on **occupancy and weather data**
- Building energy performance analytics, enabling further **spatio-temporal drilling into performance details/ outliers**
- Additional **Smart Readiness Assessment and Classification** as part of the respective application.



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Thank You!

BEYOND

A reference big data platform implementation and AI analytics toolkit toward innovative data sharing-driven energy service ecosystems for the building sector and beyond

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SUSTAINABLE PLACES 2022

Sep. 6 - Sep. 9, 2022 | Nice, France

Moderated panel discussion + Q&A from the audience

Shane Donatello

Juan Antonio Aranda

Marleen Spiekman

Tasos Tsitsanis

Judit Kimpian

Lukas Kranzl

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Panellists Next Gen EPC cluster

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Sep. 6 - Sep. 9, 2022 | Nice, France

Maike Venjakob

Marleen Spiekman

Lukas Kranzl

Paris Fokaides

Michal Zbigniew Pomianowski

María Fernández Boneta

Jana Bendžalová

David Jenkins

Peter Gyuris

Alexander Deliyannis

Giovanna De Luca

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Find me on

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REHVA

Federation of European Heating, Ventilation and Air Conditioning Associations

Find me on

Going farther, together!

Next Generation Energy Performance Certificates H2020 cluster

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User-Centred Energy Performance Assessment and Certification

X-tendo

D2EPC

E-DYCE

ePANACEA
Smart European Energy Performance Assessment & Certification

EPC RECAST
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EUB SuperHub

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The new EPC for Europe

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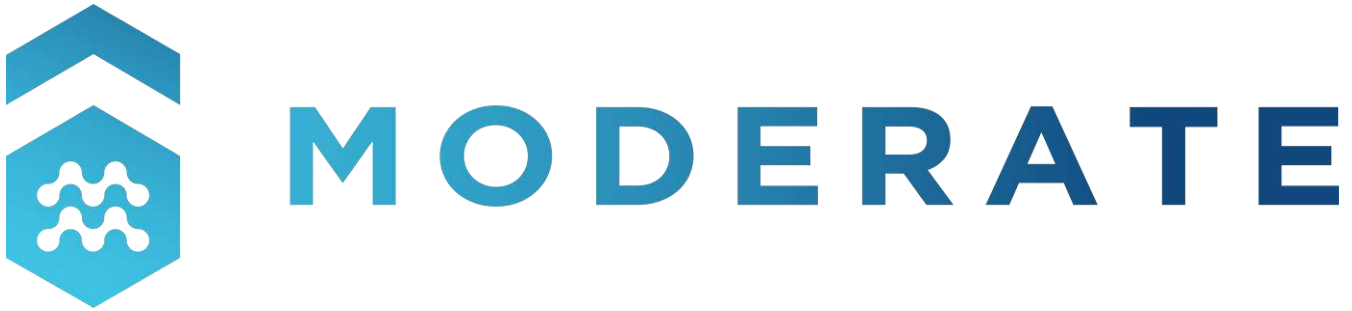
HE-projects Call 2021

SmartLivingEPC: SmartLivingEPC project aims to integrate the main parameters that constitute Industry 4.0 into a Smart Energy Performance Certificate, and deliver a certificate which will be issued with the use of digitized tools and retrieve the necessary assessment information for the building shell and building systems from BIM literacy, including enriched energy and sustainability related information for the as designed and the actual performance of the building.

CHRONICLE: CHRONICLE aims to deliver a dynamic and holistic nD BIM-based building performance framework comprising multiple performance dimensions. Within this framework economic and sustainability performance factors as well as human centric and social performance factors (comfort, well-being and social aspects) will be addressed by well-defined KPIs (macro and micro, short and long term), outcome-based calculation methods and data analytic services.

Going farther, together!



SUSTAINABLE PLACES 2022

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REHVA Federation of European Heating, Ventilation and Air Conditioning Associations

R2M RESEARCH TO MARKET SOLUTION

SEP. 6 – Sep. 9, 2022 | Nice, France

Hybrid workshop

Energy Performance Certificates (**EPCs**): **Measuring** building **performance** and adding **operational** rating

7 September 2022, 14h45 – 18h00 CEST

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Energy performance certificates (EPCs) are becoming the **centre piece** of the **EPBD** being linked to all the other policy instruments (e.g. **SRI**, **Digital Building Logbooks**, **Renovation Roadmaps** & **Passports**, **Level(s)**…) and soon to be used as reference for **financing building performance activities**. Thus, they withhold the **highest potential to ensure an EPB coherence framework** for all instruments to flawlessly work together.

Considering that it's now our **last chance to really make a difference in the buildings sector** we need to increasingly **consider measuring building performance and adding operational rating to guarantee building actually perform as intended in operation**. There isn't yet a single acknowledged way in doing this and if we're to be effective in achieving the EU's climate and energy goals and fully leverage the digitalization of the built environment in the process there should be at least an overall framework to be followed as guideline.

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Transition

Build forward together

"Go far, go together"

Business as usual

Build back better

"Go fast, go alone"

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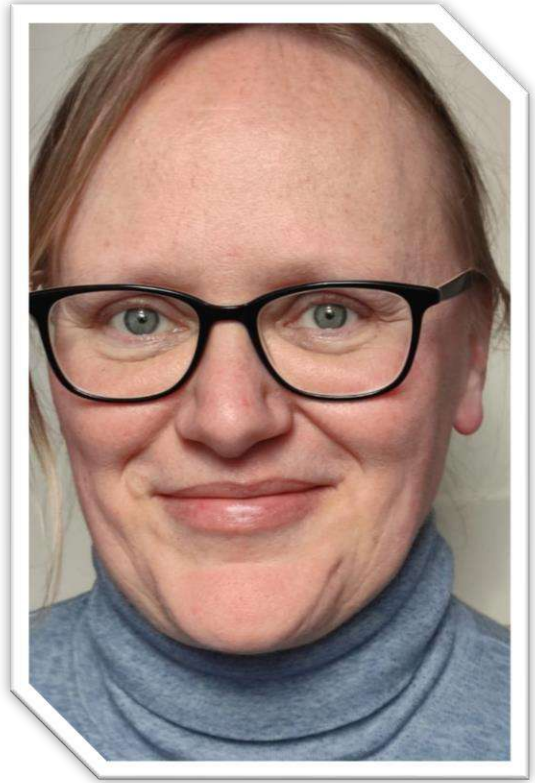
Qual DeEPC



Maike Venjakob

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QualDeEPC – High-Quality Energy Performance Assessment and Certification in Europe Accelerating Deep Energy Renovation

- **Objectives:** 1) Enhance the quality and cross-EU convergence of EPCs, and 2) enhance the link between EPCs and deep renovation
- **Implementation:** 1) Intensive dialogue between stakeholders at all levels, 2) 7 development priorities, 3) testing enhanced EPC form in 98 buildings
- **Results so far:** e.g. 1) Development Strategy Plan, 2) White Paper on Good Practice in EPCs, 3) Guidebook for improved EPCs, 4) Deep Renovation Network Platform www.qualrenovate.eu, 5) policy recommendations

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U-CERT

User-Centred Energy Performance Assessment and Certification

Marleen Spiekman

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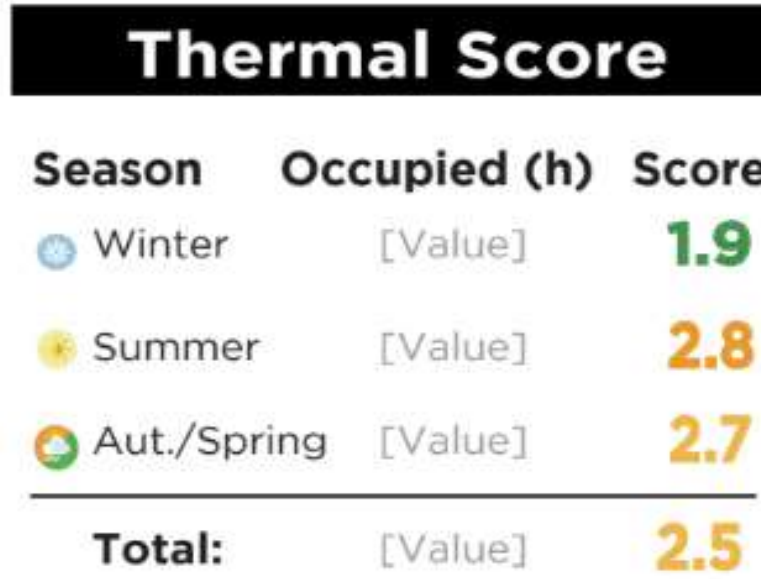
U-CERT

User-Centred Energy Performance Assessment and Certification

U-CERT focusses on making Energy Performance Assessment and Certificates more User Centric

- Ethnographic research: Needs and expectations of expert and non-expert users
- Ucert EPC structure: repository of indicators and data. → Some or all information is given (non-expert user versus expert user)
- Value added to the certificate via 4 dimensions of indicators: Energy Performance, Indoor Environmental Quality, Smart Readiness and Costs
- Protocol developed that makes assessment **more realistic**



U-CERT
User-Centred Energy Performance Assessment and Certification

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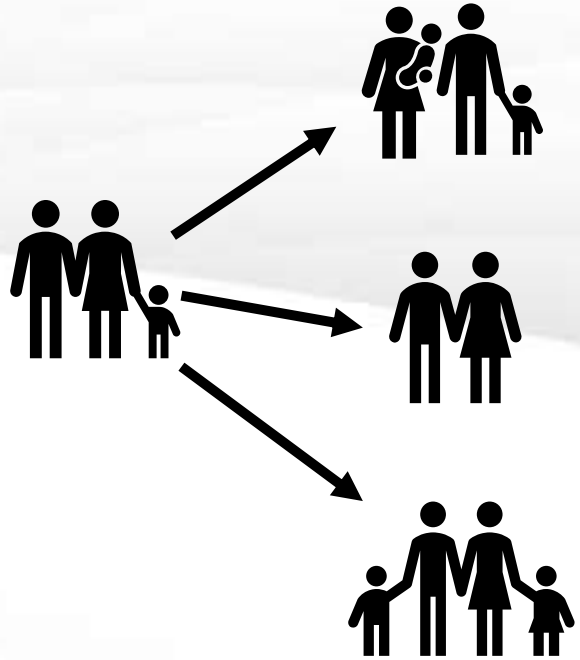
U-CERT's Protocol

to make **energy performance calculations more realistic**:

- Replace standard user by actual use
- Choose among different levels of detail
- From simple to extensive questionnaire
- Possibly adding sensor data



→ Better prediction of effect of renovations

- On energy saving
- On indoor comfort and indoor air quality

U-CERT
User-Centred Energy Performance Assessment and Certification

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X-tendo

Lukas Kranzl

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eXtending the energy performance assessment and certification schemes via a mOdular approach

Lukas Kranzl – TU Wien

07.09.2022

Sustainable Places

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 847056.

Features

- Demonstrate and encourage the roll out of 10 innovative EPC features
- Improve reliability, usability and convergence of practices and tools related to next generation EPCs
- 09/2019 – 08/2022

X-tendo

Investigations and outcomes

- Methodologies and concepts for 10 features
- End-users needs and perspectives
- Cross-cutting criteria for development
- Test project results from 9 countries
- Experience sharing, workshops and webinars
- Estimation of quantitative impact

X-tendo

Market, business models and training needs

Encourage an integrated approach to renovation using the new features and promoting wider benefits such as health and environmental benefits.

Foster collaboration between private and public actors with features such as digital building logbooks and one-stop-shops.

Promote more collaborative and open-source knowledge systems for EPCs.

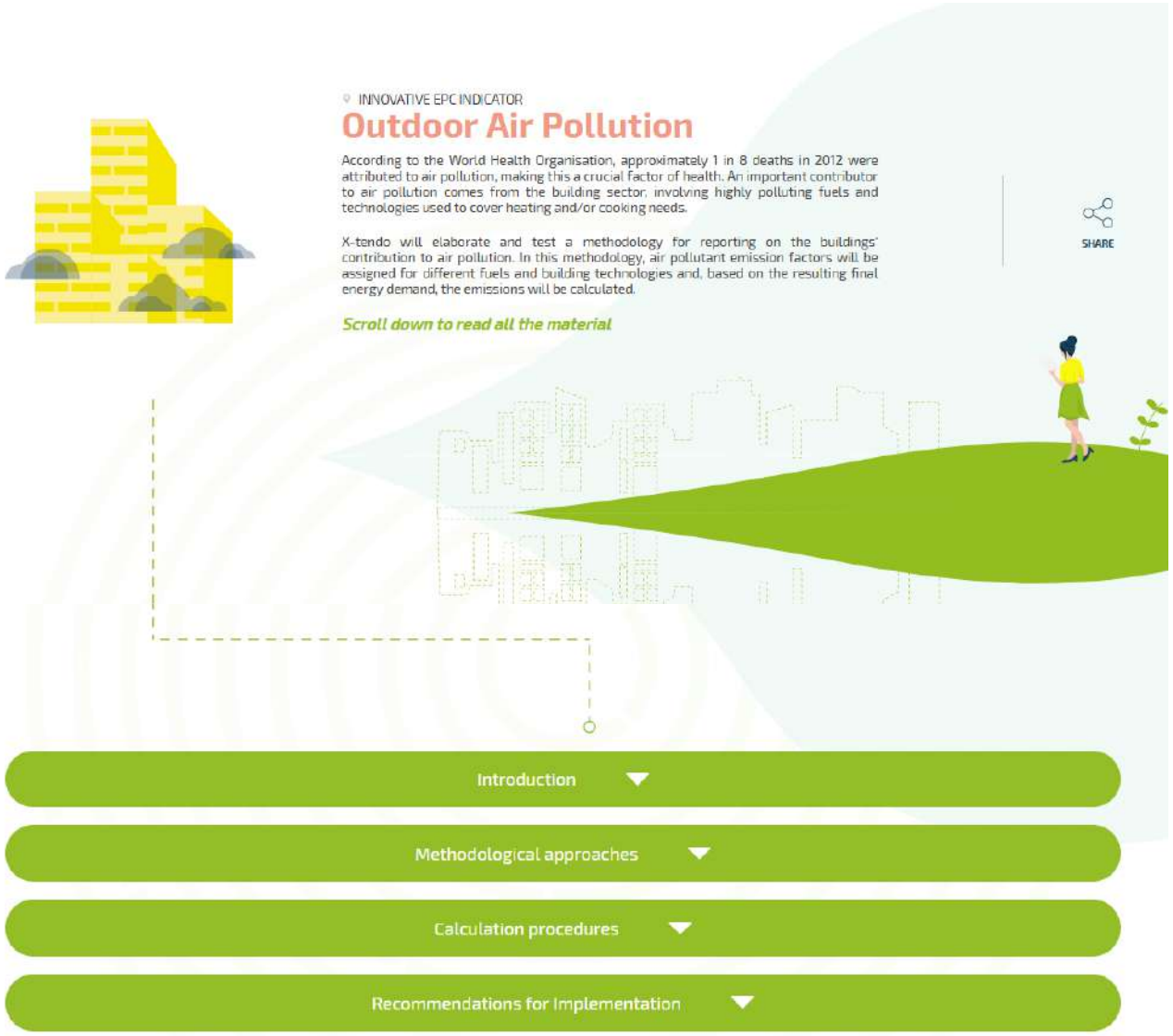
Support the implementation of additional features by training and upskilling of EPC assessors.

X-tendo

The Toolbox

Sections per feature

- Short feature description
- Download material
  - Methodological approaches
  - Calculation spread sheets
  - Recommendations
- https://x-tendo.eu/toolbox/



Other materials

https://x-tendo.eu/toolbox/background-material/

X-tendo

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AAECR Asociația Auditorilor Energetici pentru Clădiri din România

adene

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КАПЕ CRES

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ENEA

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www.x-tendo.eu

#xtendoproject

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SUSTAINABLE PLACES 2022

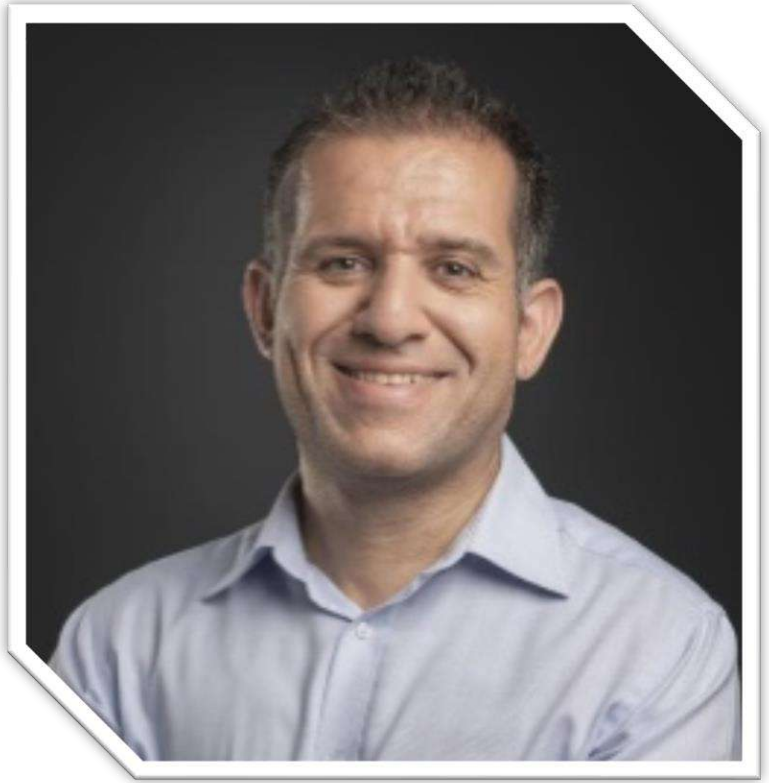
Sep. 6 - Sep. 9, 2022 | Nice, France

Hybrid workshop

EPCs: Measuring building performance and adding operational rating

7 September 2022, 14h45 – 18h00 CEST

D2EPC



Paris Fokaides

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SUSTAINABLE PLACES 2022

D2EPC

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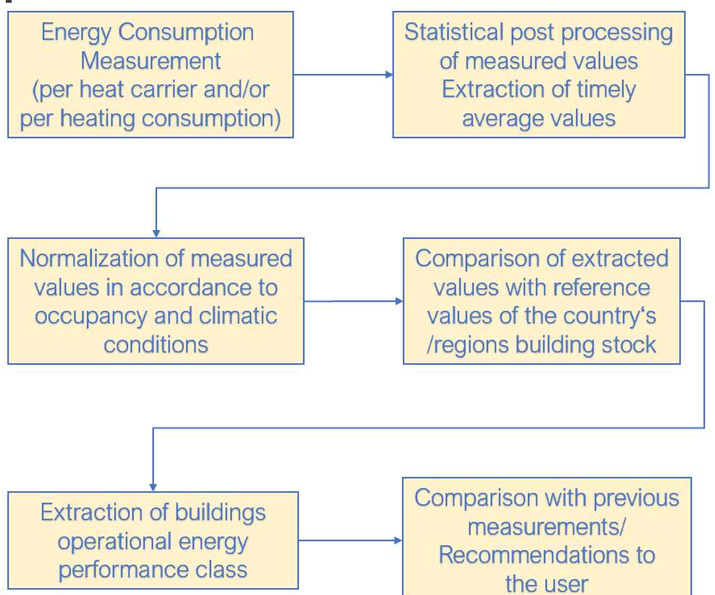
Definition of D2EPC operational indicators

Energy Indicators	Total Energy/Occupancy	kWh/occupants
	Total Energy/Occupancy Hours	kWh/h*occupants
	Total Energy/Area	kWh/m^2
	Total Energy/Volume	kWh/m^3
	Heating Consumption per Energy Carrier/Occupancy	kWh/occupants
	Heating Consump per Energy Carrier/Occupancy-hours	kWh/h*occupants
	Heating Consumption per Energy Carrier/Area	kWh/m^2
	Heating Consumption per Energy Carrier/Volume	kWh/m^3
	Cooling Consumption per Energy Carrier/Occupancy	kWh/occupants
	Cooling Consump per Energy Carrier/Occupancy-hours	kWh/h*occupants
	Cooling Consumption per Energy Carrier/Area	kWh/m^2
	Cooling Consumption per Energy Carrier/Volume	kWh/m^3
	Weather-Normalized Heating & Cooling Energy Cons.	---
	Lightning Energy Consumption/Occupancy	kWh/occupants
	Lightning Energy Consumption/Occupancy-Hours	kWh/h*occupants
	Lightning Energy Consumption/Area	kWh/m2
	Lightning Energy Consumption/Volume	kWh/m^3
	Electrical Appliances Energy Consumption/Occupancy	kWh/occupants
	Electrical Appliances Energy Cons./Occupancy-hours	kWh/h*occupants
	Electrical Appliances Energy Consumption/Area	kWh/m^2
	Electrical Appliances Energy Consumption/Volume	kWh/m^3
	DHW Consumption per Energy Carrier/Occupancy	kWh/occupants
	DHW Consump. per Energy Carrier/Occupancy-Hours	kWh/h*occupants
	DHW Consumption per Energy Carrier/Area	kWh/m^2
	DHW Consumption per Energy Carrier/Volume	kWh/m^3

Procedures for delivering D2EPC operational KPIs



Establishment of CEN WG on Operational Rating

CEN/TC 371 **N 771**

CEN/TC 371 "Energy Performance of Buildings"
Secretariat: **NEN**
Secretary: **van der Horn-de Vries Annet Mrs.**

Result of voting Creation of new Working Group on Operational rating of energy performance of buildings

Document type	Related content	Document date	Expected action
Ballot / Result of voting	Ballot: CEN/TC 371 Creation of NWI Operational rating of EPB (restricted access)	2022-08-10	

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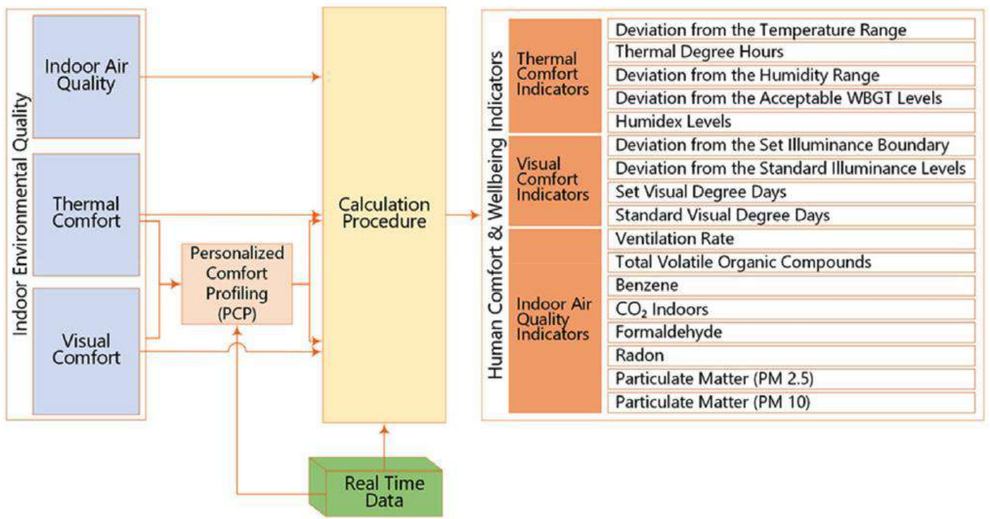
MÉTROPOLE NICE CÔTE D'AZUR

SUSTAINABLE PLACES 2022

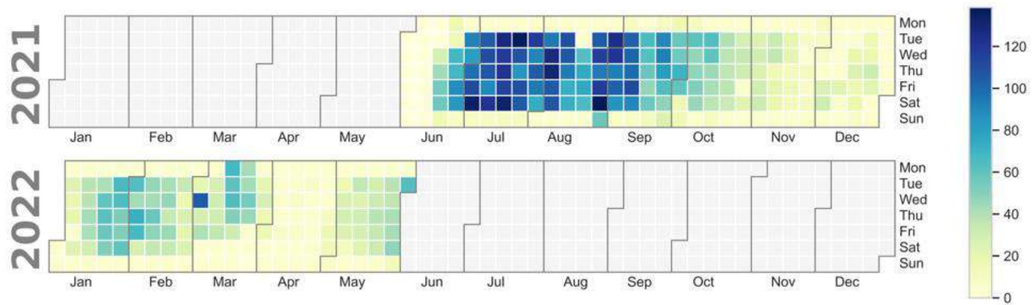
D2EPC

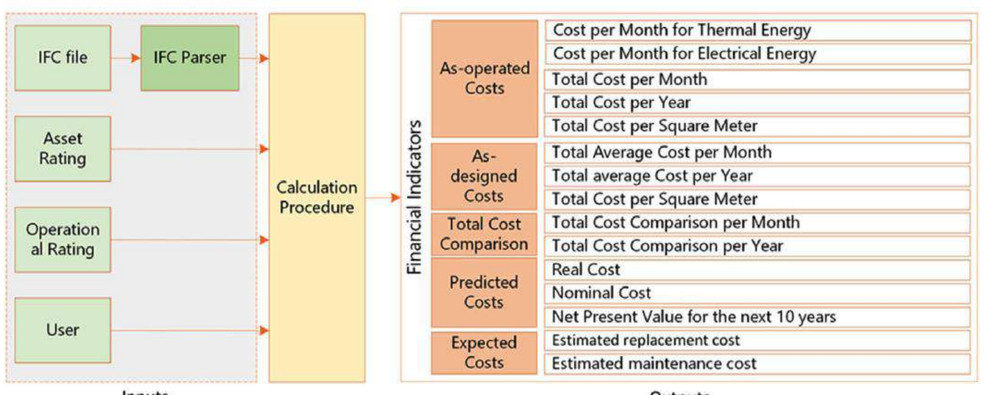
#SUSTAINABLEPLACES2022

Definition of D2EPC LCC and human comfort indicators



Establishment of Reward and Penalty Scheme based on Operational Rating





VILLE DE NICE

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SUSTAINABLE PLACES 2022

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Hybrid workshop

EPCs: Measuring building performance and adding operational rating

7 September 2022, 14h45 – 18h00 CEST

Michal Zbigniew Pomianowski

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EDYCE -Energy flexible DYnamic building Certification

Prepared by:

Michal Pomianowski – Aalborg University

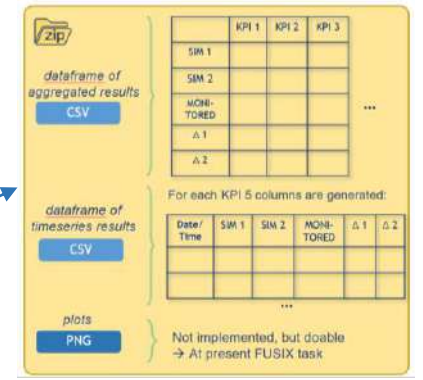
EDCYCE coordinator

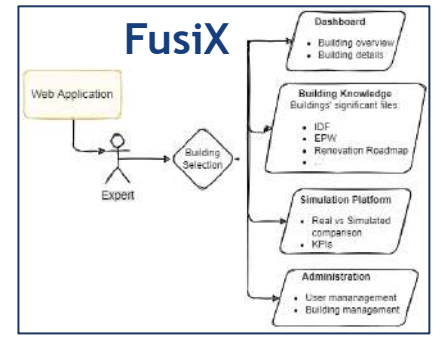
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 893945.

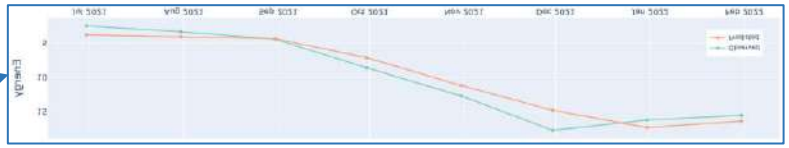
Operational rating activities

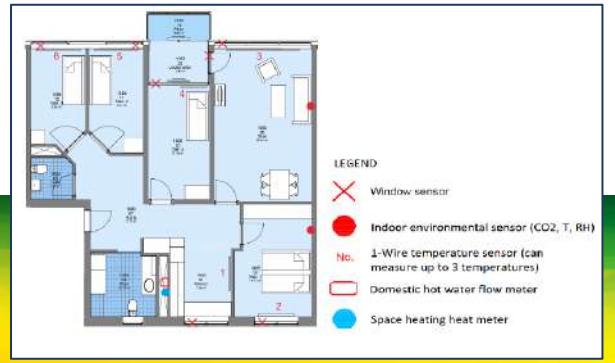
- Inclusion of operational assessment in D-EPC protocol
- Disaggregated KPIs grouped into families:
  energy, energy-signature, comfort&quality, free-running operation
- Scripted performance gap in PRE-DYCE tool (dynamic simulation)
  actual weather, adapted condition of use, supported by inspection protocol
- Middleware FusiX that collects monitored parameters from buildings and pair them with simulation results (harmonization of naming required),
  web and mobile UI.
- Prediction capability – short (day), mid (week), long term (month)
- Additional building's monitoring to enrich DEPC outcome

KPI	Symbol	Assessment schema				Evaluation period	
		EPC	DEPC-AS	DEPC-AA	DEPC-O	Min	Max
Global energy performance index	Q_gl			✗	✗	month	year
Final energy need for heating	f_Q_h			✓	✓	week	year
Final energy need for cooling	f_Q_c			✓	✓	week	year
Final energy need for DHW	f_Q_dh			✗	✓	week	year









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ePANACEA

Smart European Energy Performance Assessment & Certification

María Fernández Boneta

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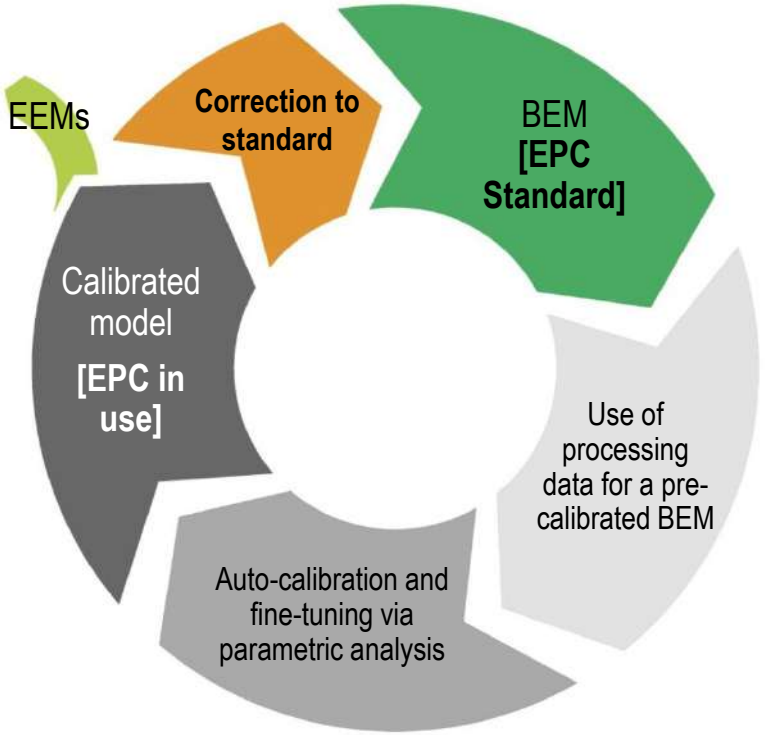
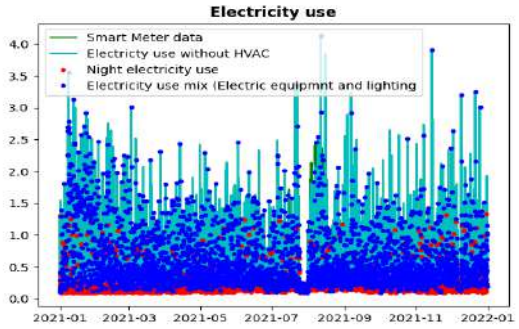
The EPC cycle





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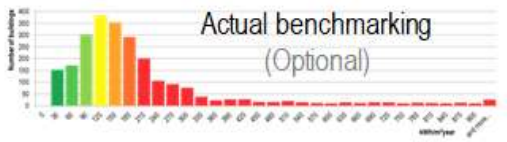
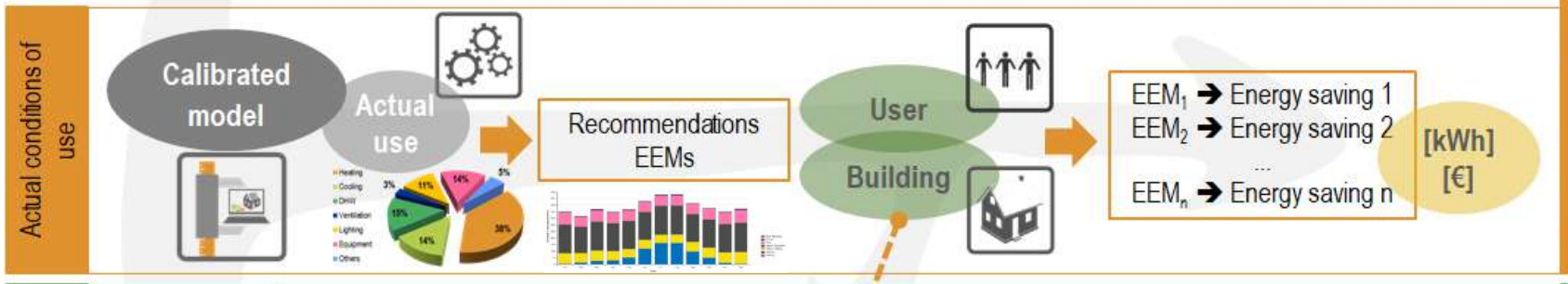
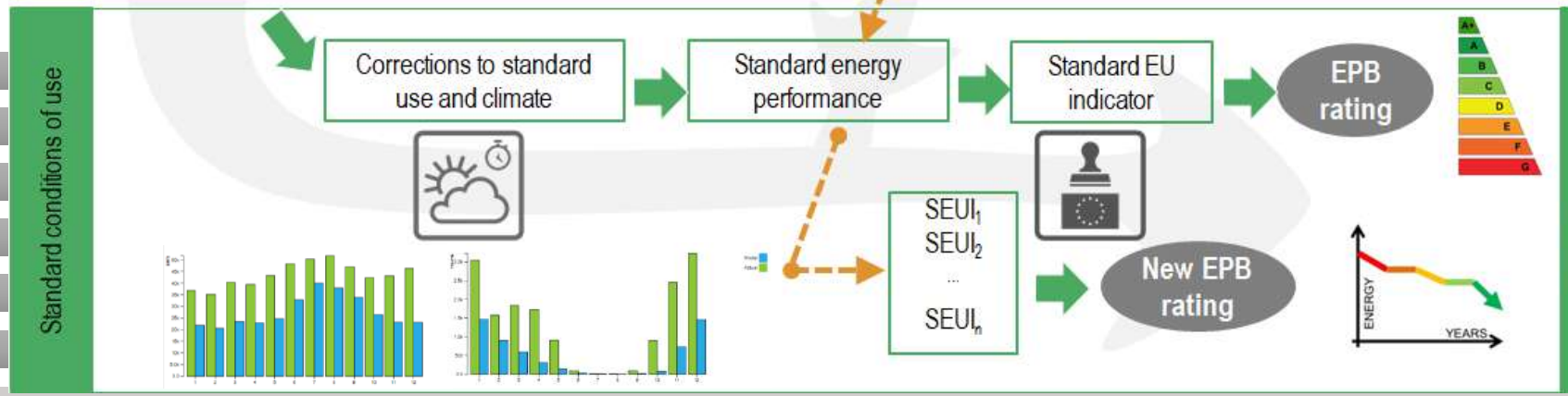
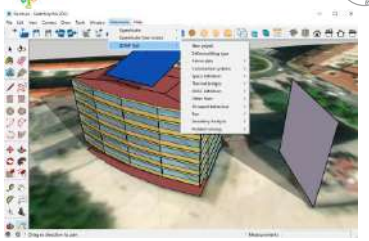
ePANACEA







SEPAP Tool



python Ruby

- EnergyPlus simulation engine
- Open Studio SDK
- OS SketchUp Plugin
- OpenStudio Application
- PAT-Parametric Analisys Tool
- OpenStudio Server

This project has received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement No 892421

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EPC RECAST

ENERGY PERFORMANCE CERTIFICATE RECAST

Jana Bendžalová

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EPC RECAST

ENERGY PERFORMANCE
CERTIFICATE RECAST

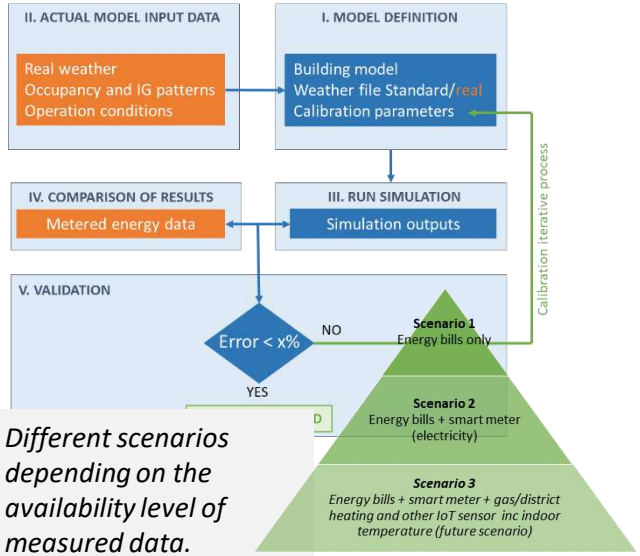
Task 1.4 – Supporting the EPC assessors in mitigating the gap in between predicted and measured EP

The performance gap is pointed out as the main reason behind unreliable EPCs.

1. Calculation: improve calculation model, reliability of input data (calibration), the particularities of the EPC scheme in each country
2. Using actual energy data that is corrected to standard conditions - the need of improved methodology to process actual energy data

1. Calibration procedure

Iterative process for asset rating – actual input data - model definition – run simulation – comparison of results with metered data – **VALIDATION** if certain level of error is achieved - **MODEL CALIBRATED**



Different scenarios depending on the availability level of measured data.

2. Measured energy performance (operational rating) for heating and DHW

EN 15378-3:2017 – Normalisation of measured energy to standard conditions - yearly data (min. 3 years).

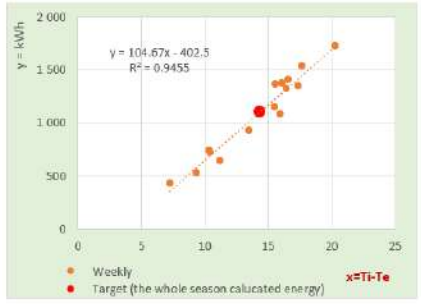
EPC RECAST – procedures:

- **Shorter intervals** (hours, weeks, months)
- **Aggregation** of data to suitable intervals
- **Normalization** for climate, indoor conditions
- Limit the uncertainty (converting the extrapolation to the **interpolation)**
- **Tested** on theoretical data from simulation
- **ENERGY SIGNATURE** (EN 15378-3) calculated / real operation
- **Data quality**, BACS, metering, link to **SRI**

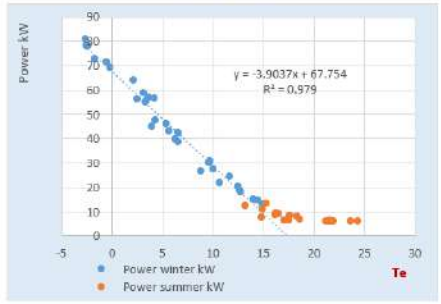
Plan: test on real measured data in WP3, amendment to EN 15378-3:2017

Regression — Measurement: 15 weeks of full heating season (28 weeks)

Interval	a	b	Standard HDD K.day	E=y kWh/(m2.y)	σ	n	R^2
Weekly	104.67	-402.5	3018	72.1	0.03	212.0	0.946
Calculated energy perfromance				73.1	kWh/(m2.y)	-1%	calcultation gap



Energy signature



Potential use of normalised metered energy consumption under typical operating conditions:

- Reported in EPC (together with asset rating)
- to verify the **correctness** of the calculated energy use, enable comparison between calculated and actual performance (EPBD revision, Dec. 2021)

→ **confirmation of predicted energy savings after renovation, financial and subsidies schemes**

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OUR TEAM

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ENBEE
Environment & Building Energy Efficiency

R2M
RESEARCH TO MARKET
SOLUTION

REHVA
Federation of European Heating, Ventilation and Air Conditioning Associations

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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

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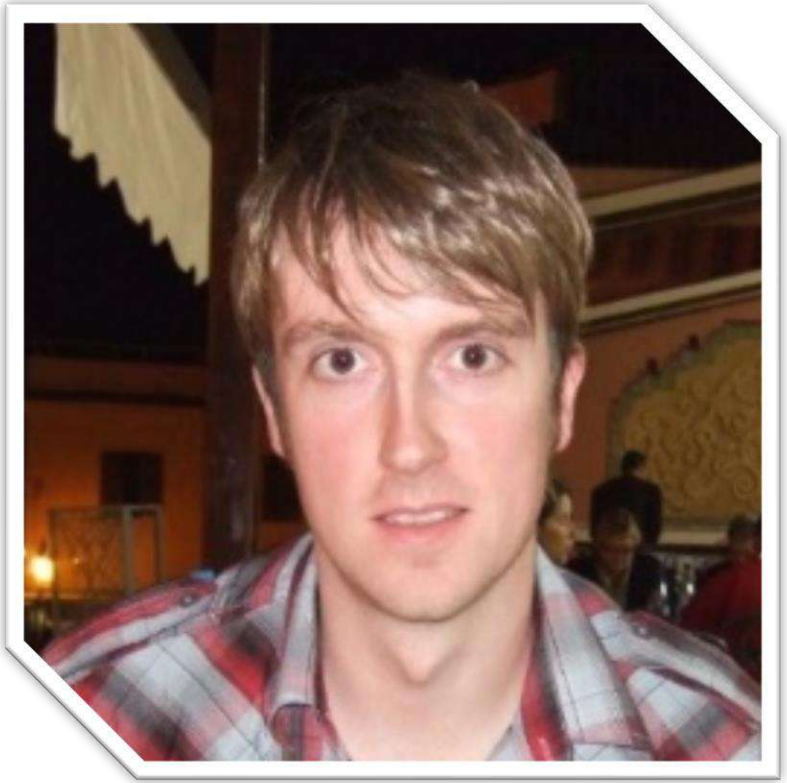
crossCert

Next-generation of Energy Performance Assessment and Certification



David Jenkins

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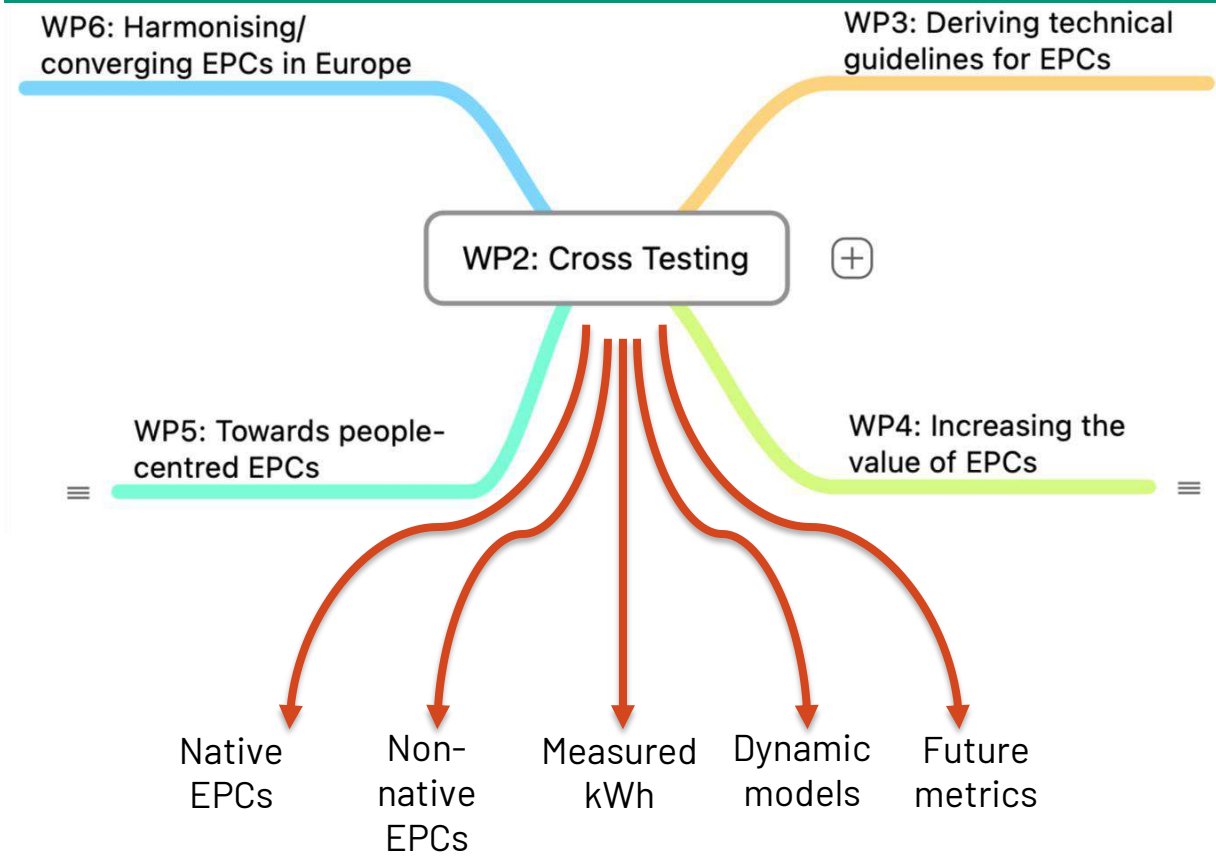
The crossCert project – cross-testing EPCs



What is this actually telling the user about the building?

www.crosscert.eu

crossCert in figures:

- 12 partners | 11 countries
- 140+ buildings
- 3 years (Sep 2021 - Aug 2024)
- 3 M€ budget

ES	Universidad de Zaragoza (UZ)
UK	Heriot Watt University (HWU)
SI	Institute for Innovation and Development of University of Ljubljana (IRI UL)
EL	Centre for Renewable Energy Sources and Saving (CRES)
HR	North West Croatia Regional Energy Agency (REGEA)
PL	Polish National Energy Conservation Agency (KAPE)
BG	Center for Energy Efficiency - EnEffect Foundation (ENEFFECT)
MT	Malta Intelligent Energy Management Agency (MIEMA)
ES	Ente Regional de la Energía de Castilla y León (EREN)
DK	Energy Consulting Network AS (ECNET)
AT	Austrian Energy Agency (AEA)
DE	Climate Alliance (CA)

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EUB SuperHub

Peter Gyuris

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iBRoad2EPC

Alexander Deliyannis

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TIMEPAC

Giovanna De Luca

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NextGenEPCs cluster

EPCs: Measuring building performance and adding operational rating

SEP. 7TH, 14:45-18:00 CET, HYBRID

SUSTAINABLE PLACES 2022

TIMEPAC The new EPC for Europe

Transversal Deployment Scenarios Enhancing EPC schemas through operational data integration

Giovanna De Luca

Politecnico di Torino, Department of Energy “Galileo Ferraris”

TIMEPAC WP2 – TDS2

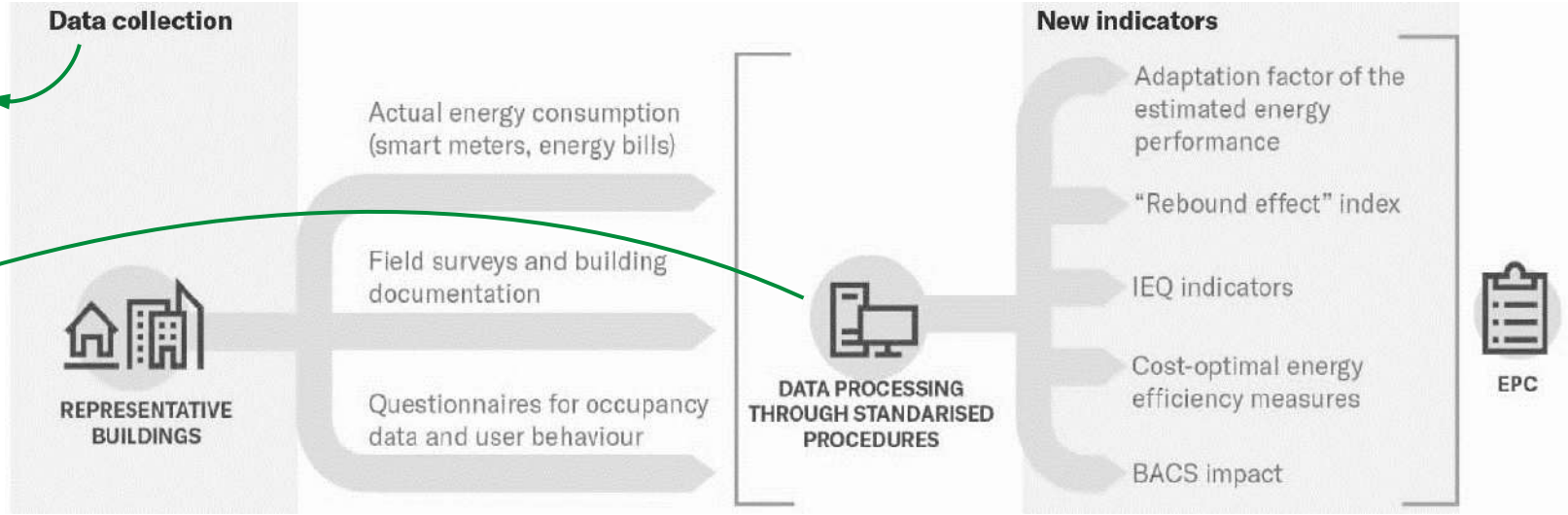
The goal of the **TIMEPAC WP2** is to develop an enhanced EPC scheme

TIMEPAC
enhanced EPC requirements

- Improved data quality
- Dynamic and flexible document
- Extended parameters and information, also including ***operational data*** (TDS2)

Methodologies for data collection and elaboration/derivation

Methodologies building energy model calibration and for **operational** and **tailored** building energy performance assessment



To improve the accuracy and the reproducibility of the whole energy performance procedure, and to add (realistic) information related to the current building and suggest renovation actions

TIMEPAC The new EPC for Europe

If you would like more information, please visit www.timepac.eu or contact us at

giovanna.deluca@polito.it

Thanks for your attention!

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Moderated panel discussion + Q&A from the audience

SUSTAINABLE PLACES 2022
Sep. 6 - Sep. 9, 2022 | Nice, France

Maike Venjakob

Marleen Spiekman

Lukas Kranzl

Paris Fokaides

Michal Zbigniew Pomianowski

María Fernández Boneta

Jana Bendžalová

David Jenkins

Peter Gyuris

Alexander Deliyannis

Giovanna De Luca

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Transition

Build forward together

"Go far, go together"

Business as usual

Build back better

"Go fast, go alone"

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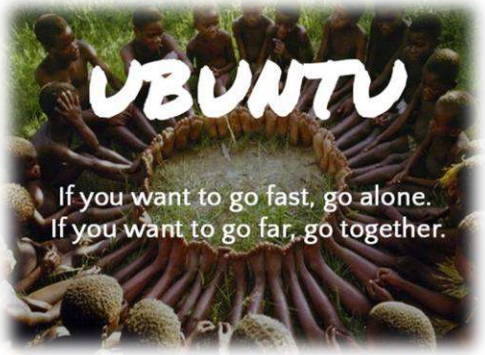

Closing remarks and next steps

Andrei Vladimir Lițiu & Jasper Vermaut
REHVA

Blagodarjá!	Aitäh!	Go raibh maith agat!	Obrigado!
Hvala!	Kiitos!	Grazie!	Mulțumesc!
Děkuji!	Merci!	Paldies!	Ďakujem!
Tak!	Danke!	Ačiū!	Hvala!
Dank je!	Efcharisto!	Grazzi!	Gracias!
Thank you!	Köszönöm!	Dziękuję!	Tack!