Thermal Storage & Smart Building Integration

Wednesday November 19 | 15:30 – 17:00

AGENDA

1. OPENING
2. PROJECTS
3. ROUNDTABLE DISCUSSION
4. CONCLUSION

BEST-Storage

ThumbsUp

BuildON

oPEN Lab
TARTU PAMPLONA GENK
LEADING THE TRANSITION TO POSITIVE ENERGY NEIGHBOURHOODS

ECHO
EFFICIENT COMPACT MODULAR THERMAL ENERGY STORAGE SYSTEM

HYSTORE
Hybrid Services from Advanced Thermal Energy Storage Systems

MODERATOR

Emilia Pisani

RISE

SPEAKERS

Laura Vallese

Padova University
ITC - CNR

ECHO
EFFICIENT COMPACT MODULAR THERMAL ENERGY STORAGE SYSTEM

Hugo Grasset

Solintel

BEST-Storage

Guillermo Andrés Nieto

Veolia

ThumbsUp

Marco Rocchetti

R2M Solutions

HYSTORE
Hybrid Services from Advanced Thermal Energy Storage Systems

Sofía Mulero Palencia

Cartif

BuildON

Alicia Kalms

CENER

oPEN Lab
TARTU PAMPLONA GENK
LEADING THE TRANSITION TO POSITIVE ENERGY NEIGHBOURHOODS

ECHO

EFFICIENT COMPACT MODULAR THERMAL ENERGY STORAGE SYSTEM

Speaker: Laura Vallese,
University of Padova and ITC-CNR

Project details

Project number: 101096368
Project title: Efficient Compact Modular Thermal Energy Storage System
Project Acronym: ECHO
Topic: HORIZON-CL5-2022-D3-01-14
Type of action: HORIZON-IA
Granting authority: CINEA
Duration: 01 January 2023 – 31 December 2026
EU Contribution: 6.169.498,00 €
Total cost: 8.169.948,00 €

Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

Why Thermal Energy Storage (TES)?

Energy **supply-demand** balance

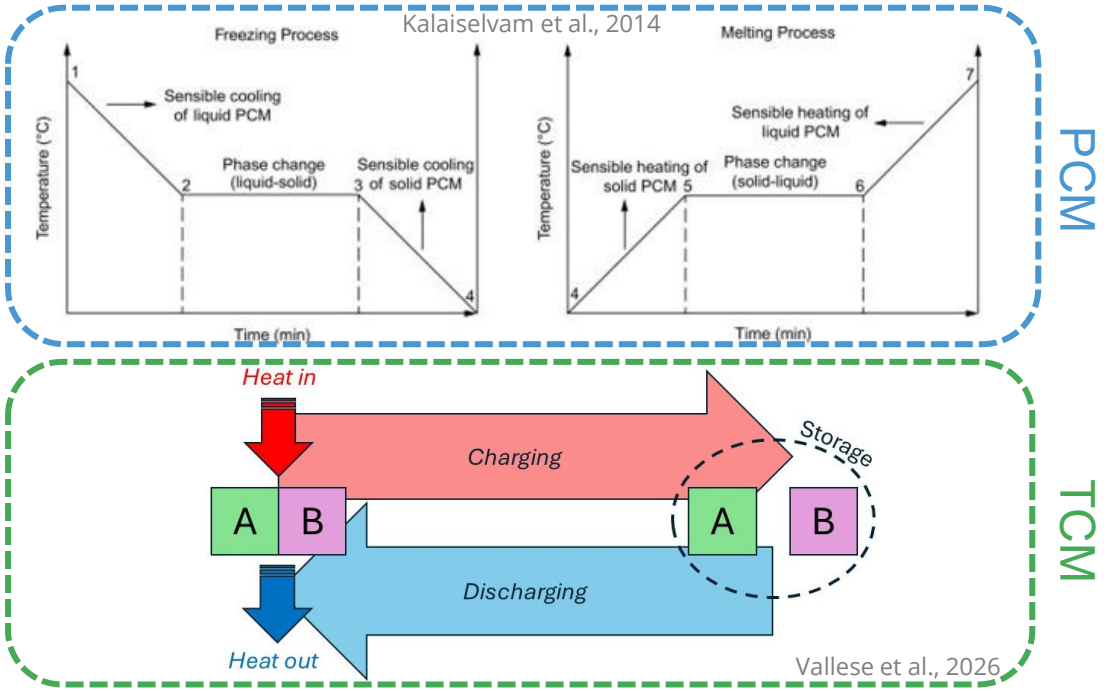
Renewable energy sources (RES) integration

Simpler and cheaper alternative to electric **batteries**

How to store thermal energy?

While sensible TES is the most mature technology, **latent** and **thermochemical** TES offer higher energy densities

smaller volumes required



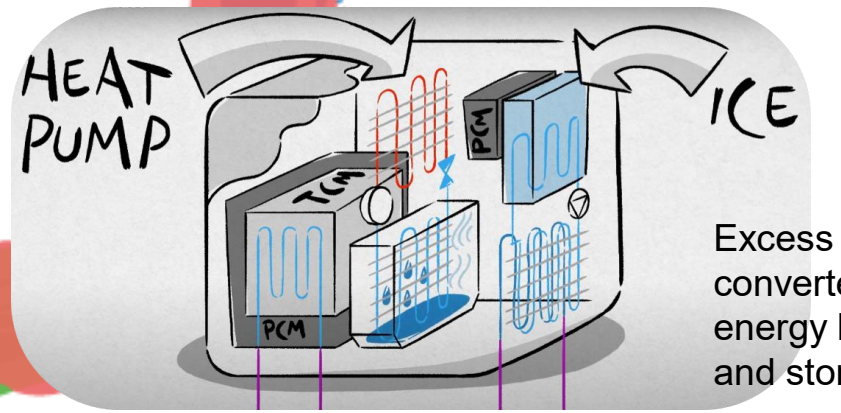
Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

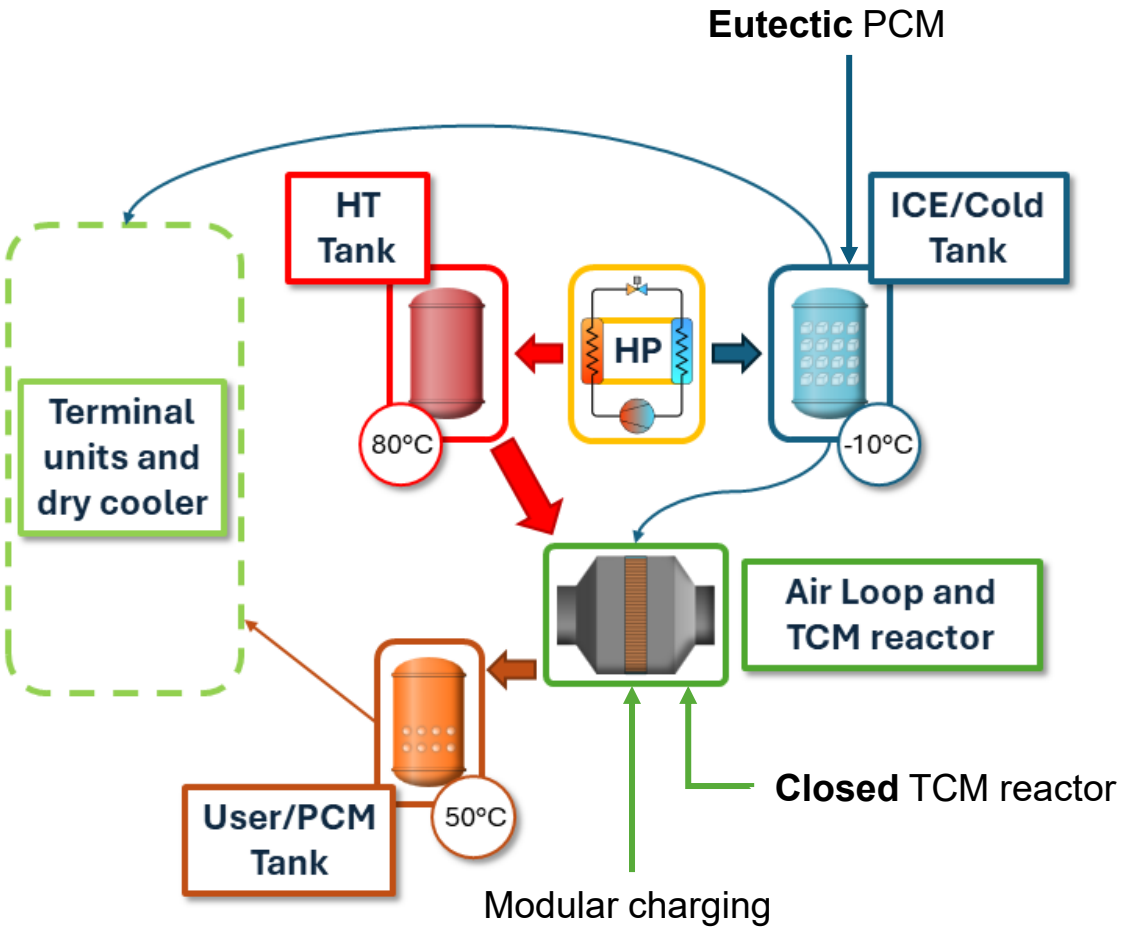
Project objectives and innovation

Development and demonstration of an innovative TES for **residential** applications

- High efficiency and **flexibility**
- **Modularity** and compactness
- Thermochemical materials (**TCM**) and phase change materials (**PCM**)
- **Peak shaving** and **load shifting**



Excess electric energy is converted to thermal energy by the heat pump and stored in the system



Funded by the European Union

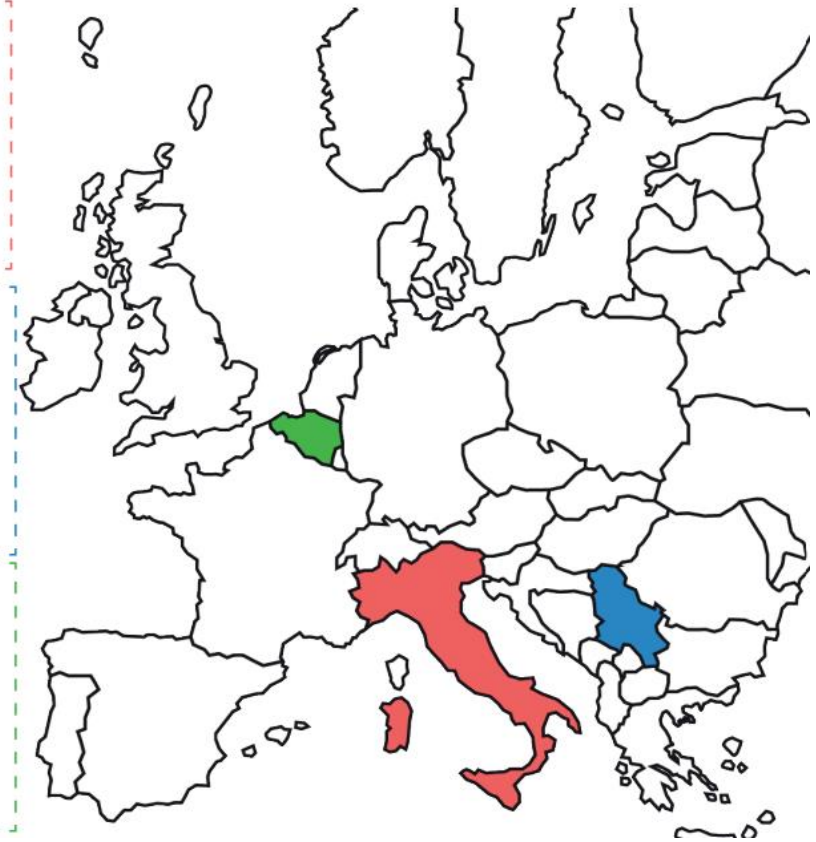
"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

Demonstration sites

DEMO SITE 1
Padova (Italy)
Consiglio Nazionale delle Ricerche

DEMO SITE 2
Belgrade (Serbia)
institute MIHAILO PUPIN

DEMO SITE 3
Putte (Belgium)
GREENCO
green energy solution consultant



- Demonstrating the **feasibility** of installation and operation of ECHO TES
- Testing storage capability **up to 4 weeks**
- Optimizing the **control strategy** to integrate RES
- **Monitoring** heating/cooling efficiency and thermal comfort inside the building

Partners

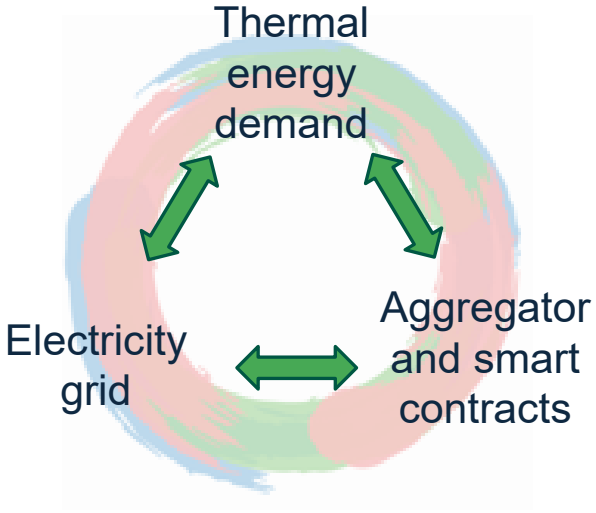
Affiliated entities

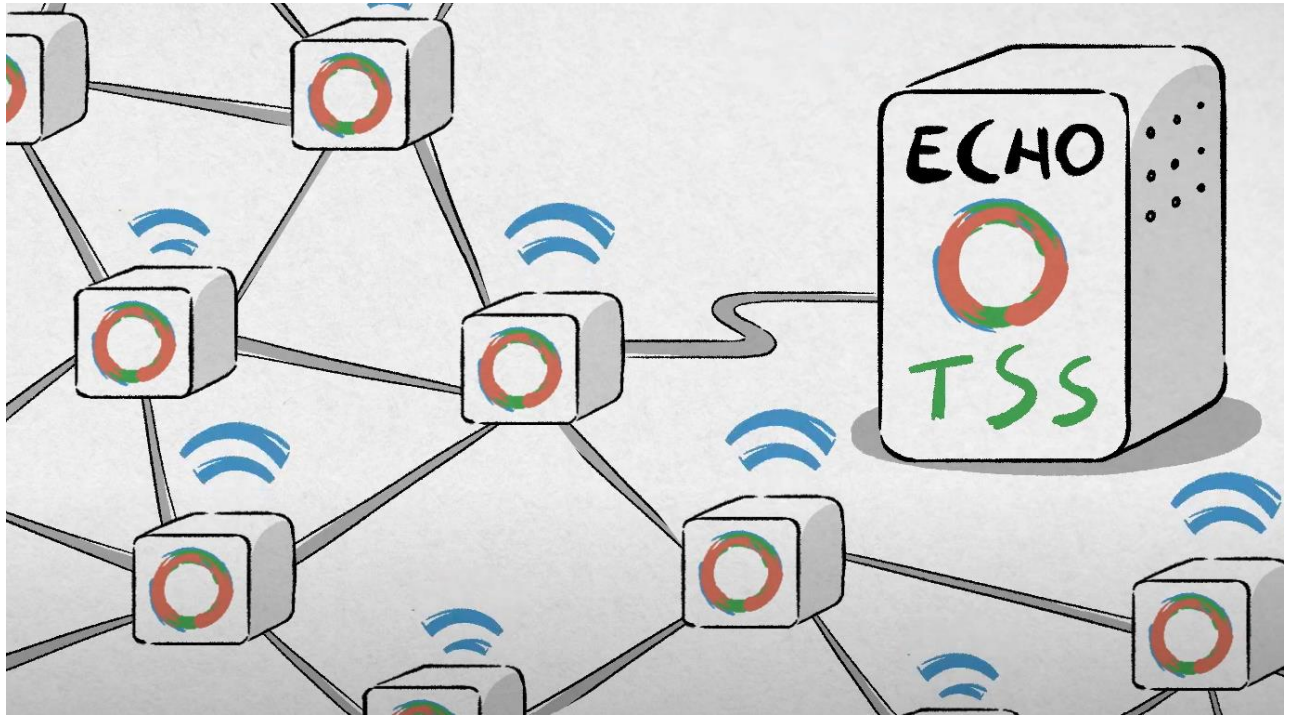
Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

ECHO TSS – Transaction Simulation System

Connecting different buildings equipped with ECHO TES through protocols of **virtual automated transactions**





Evaluate the effect on the demand side, quantify **load shifting** and electricity market aspects

Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

How can ECHO TES empower end-users, provide flexibility and support a sustainable energy transition?

- Adaptable to different energy sources, **building scales** and **end-user needs** for heating, cooling, and hot water.
- Integration with **existing** building heating/cooling systems.
- More **end-user autonomy**: local RES and self-consumption → less dependence on the grid.
- Support creation and operation of **energy communities** → citizens participate in energy management and benefit economically from demand flexibility.
- AI-based control → TES **optimization** and usage based on user preferences, weather forecasts, and energy market.
- Energy **load shifting** addressing RES intermittency → less peak electricity demand and costs for end-users → **resilience** and **grid stability**.
- RES integration → less greenhouse gas **emissions**: renewable heating and cooling technologies.
- **Awareness** campaigns → social acceptance.

Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

Contacts

Laura Fedele
ITC-CNR
Project coordinator
laura.fedele@itc.cnr.it

Isella Vicini
beWarrant - Tinexta Innovation Hub
Dissemination manager
isella.vicini@tinextainnovationhub.com

Laura Vallese
University of Padova and ITC-CNR
PhD student in Industrial Engineering
laura.vallese@phd.unipd.it

Andrea Spotti
beWarrant - Tinexta Innovation Hub
Dissemination specialist
andrea.spotti@tinextainnovationhub.com

Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

ECHO

EFFICIENT COMPACT MODULAR
THERMAL ENERGY STORAGE SYSTEM

Thanks for your attention

echo-euproject.eu

Funded by the European Union

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Climate Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them."

Balancing the grid one building at a time:

The power of decentralized TES

Guillermo Andrés Nieto, Veolia

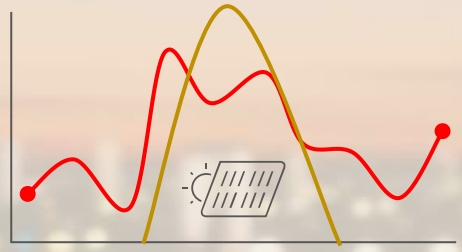
Wednesday, November 19th 2025, Enlit Europe, Bilbao, Spain

THUMBS UP
project GA101096921
funded by the European Union

ThumbsUp

VEOLIA

Houston, we have a problem!



Sun shines when we may not need its energy, wind blows while you sleep

Massive electrification is here

The European electrical grid was designed for the 20th century

ThumbsUp

VEOLIA

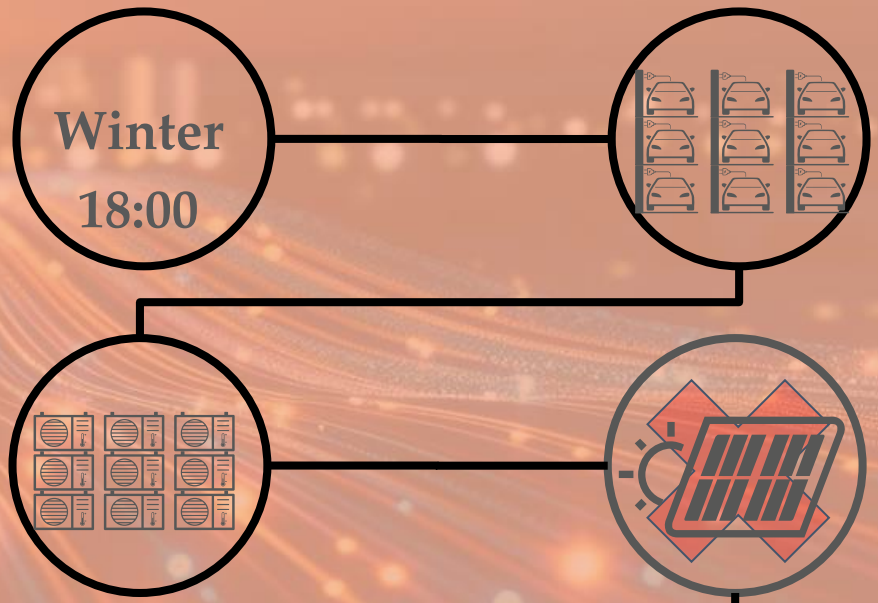
What happens when we all plug in at once?

🤔

Let's imagine…

❓❓

"The perfect storm"



Result?

Should we double the infrastructure…or be smarter?

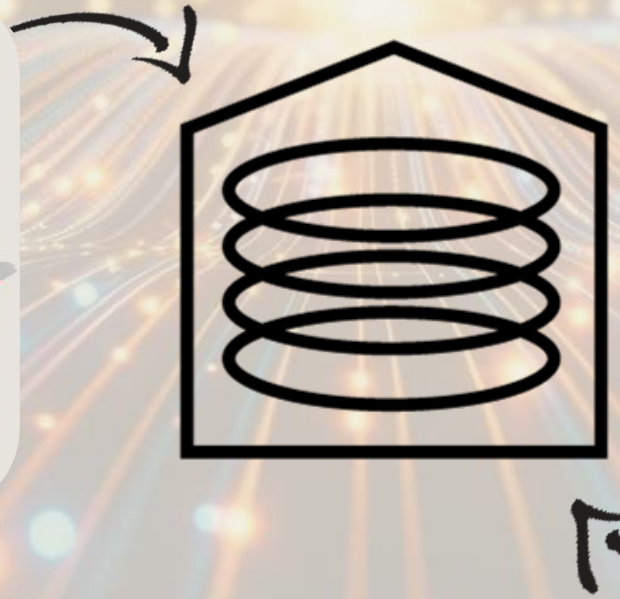
ThumbsUp

VEOLIA

What if every building were a thermal battery?

Decentralization:

In every building, in every home



Store energy when there's surplus, use it when there's shortage

ThumbsUp

VEOLIA

Thermal energy storage solUtions to optimally Manage BuildingS and Unlock their grid balancing and flexibility Potential

PHASE I:
Key enabling technologies development

PHASE II:
Validation & Demonstration campaigns

PHASE III:
Replication campaign

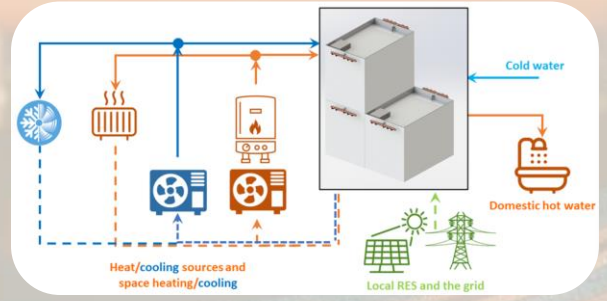
Balancing the grid one building at a time

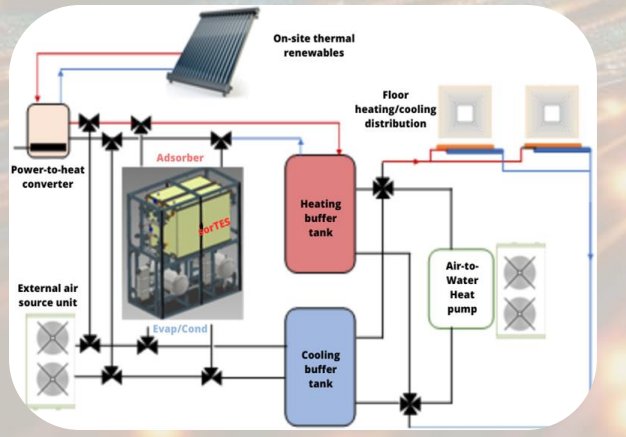
ThumbsUp

VEOLIA

PHASE I → PHASE II → PHASE III

FractLES/SorTES development for intraday/up to 4 weeks use

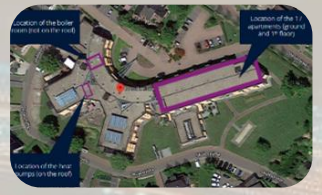




Validation/Demonstration campaigns to reach a TRL6/TRL7

Applications to H&C and DHW at different levels and with the most suitable module combination

Replication campaign to study further impact of the solutions in up to 5 replication sites



Dedicated studies of the **impact at DHN and electric grid level**

ThumbsUp

VEOLIA

From problem to solution in 3 steps:

Modular TES

Low temperature distributions H&C

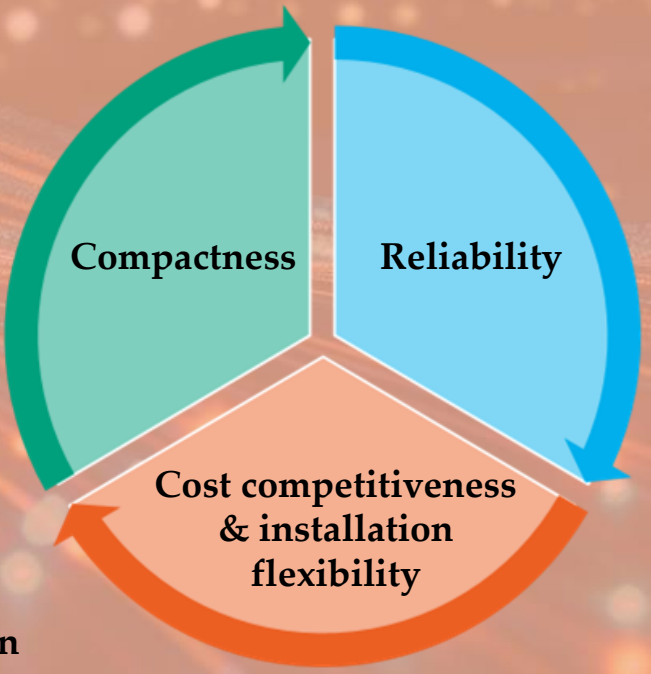
Different scales

Easily coupable to HP

1 CHARGE

2 STORE

3 RELEASE



Empowering citizens

From passive consumers to active prosumers

- Lower bills
- Energy independence
- Resilience against blackouts
- Active contribution to green energy transition

The numbers that matter:

High energy densities up to **65kWh/m3** and **120kWh/m3** for FractLES and sorTES

CAPEX of **140€/kWh** and **200€/kWh** for FractLES and SorTES

Peak shifting of RES, potential heat exchange with DHN and other buildings

Replication by 2030

In at least **1,000 building** across Europe

Triggering an investment of at least **200M€**

Thank you!

Guillermo Andrés Nieto, Veolia

guillermo.andres-nieto@veolia.com

Join the decentralized thermal revolution

Learn more at
thumbsupstorage.eu

@ThumbsUpTES

THUMBS UP
project GA101096921
funded by the European Union

Thermal Energy Flexibility in buildings and districts

ENLIT - 19 November 2025
Bilbao, Spain

Marco Rocchetti

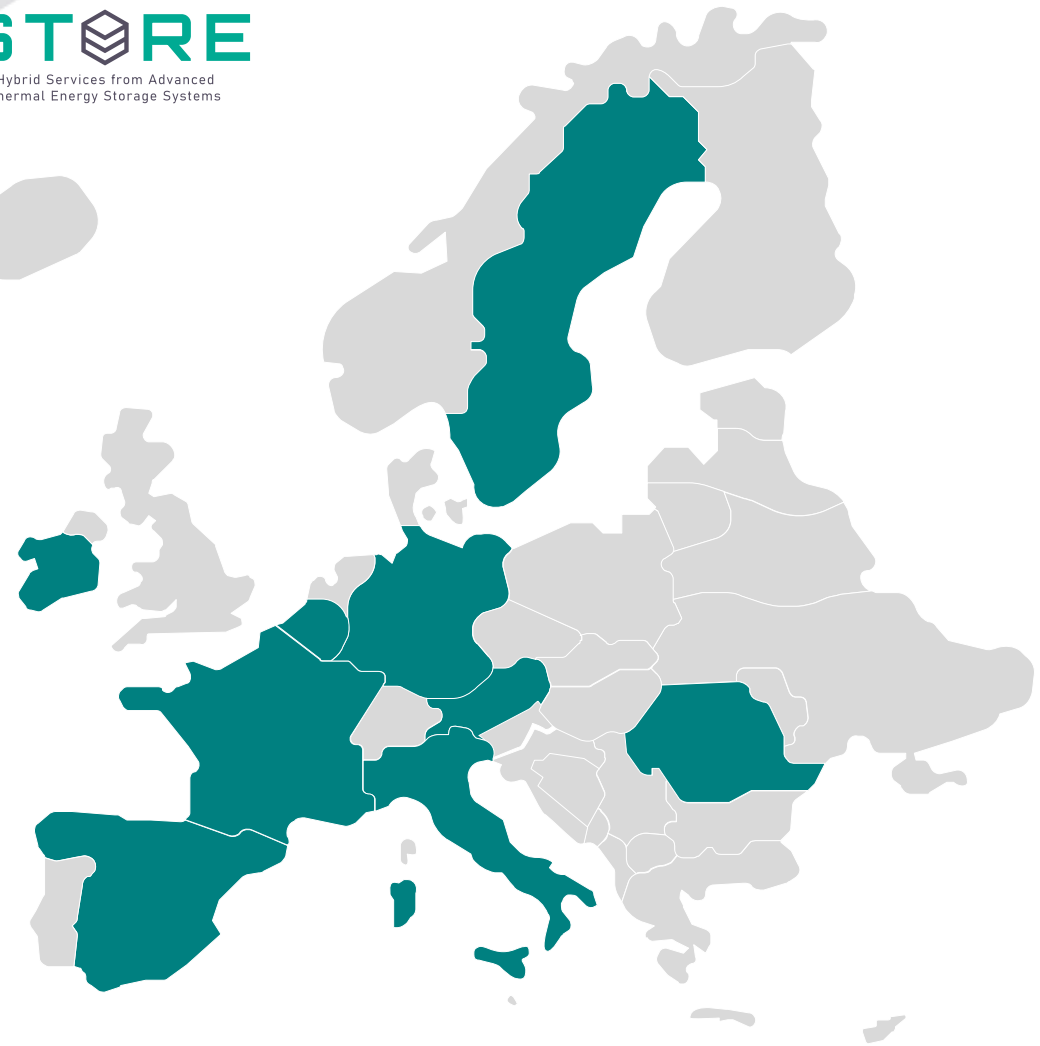
HYSTORE
Hybrid Services from Advanced Thermal Energy Storage Systems

Call: HORIZON-CL5-2022-D3-01
HYSTORE: Grant Agreement n. 101096789
Duration: January 20203 – December 2026

HYSTORE
Hybrid Services from Advanced Thermal Energy Storage Systems

18 partners from 8 countries

1. ARC (ESP) – Coordinator
2. CNR (ITA)
3. KTH (SWE)
4. Rubitherm (GER)
5. AIT (AUT)
6. Ochsner (AUT)
7. Pink (AUT)
8. InovaLab (ITA)
9. STAM (ITA)
10. Sorption Technologies (GER)
11. Maston (SWE)
12. DCU (IRE)
13. EURAC (ITA)
14. R2M (ITA)
15. UCD (IRE)
16. Monserrat (ESP)
17. RAAL (ROU)
18. EIM (BEL)



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

HYSTORE Mission

Develop and validate four innovative sets of **Thermal Energy Storage** concepts, based on **PCM** and **TCM** solutions.

The four novel concepts attain different applications:

- ✓ Heating and cooling
- ✓ DHW
- ✓ Provision of hybrid services (related to heat and power) thanks to a **smart aggregator** and an **open-source multi-service platform**.

HYSTORE Objectives & impacts

Allow **TES to be coupled and integrated** with **grid-level aggregators** that can be federated in the context of both single buildings and local energy communities.

+120%
Energy Density

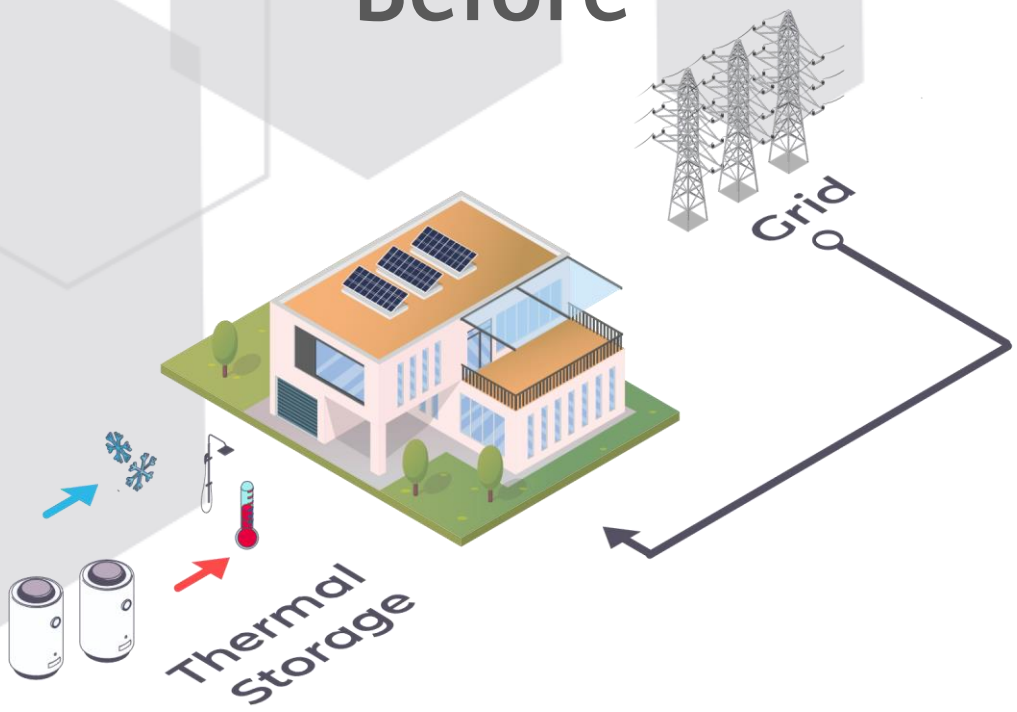
-50% CAPEX

Enhanced
Installation Efforts

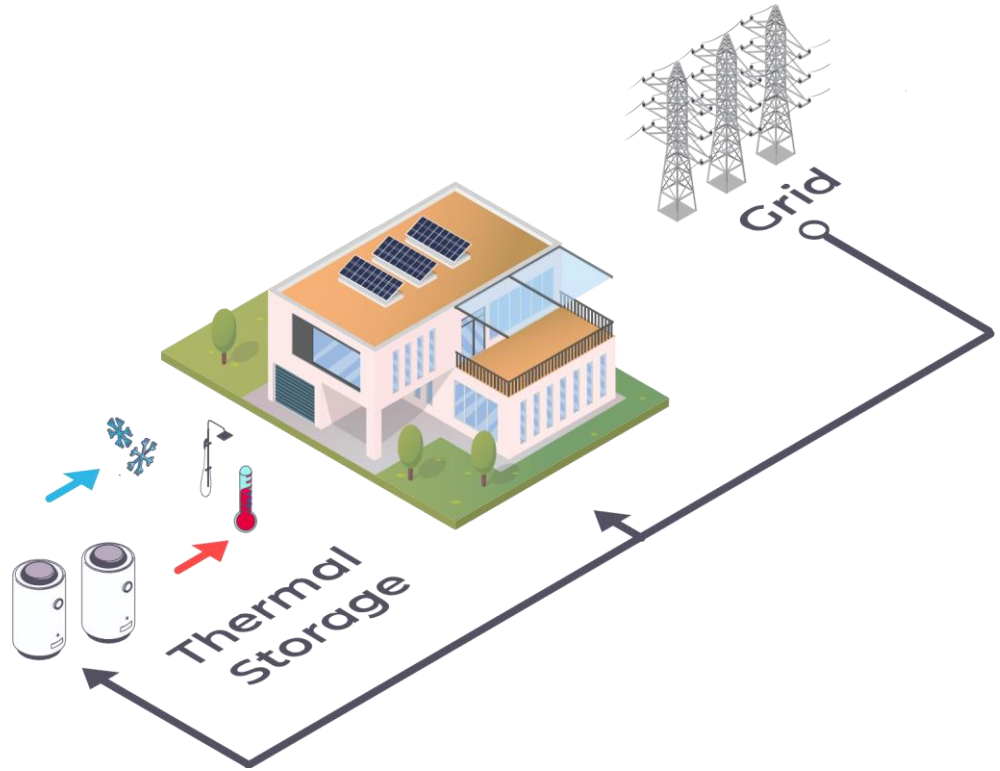
Competitive with
Batteries

HYSTORE Context

Before

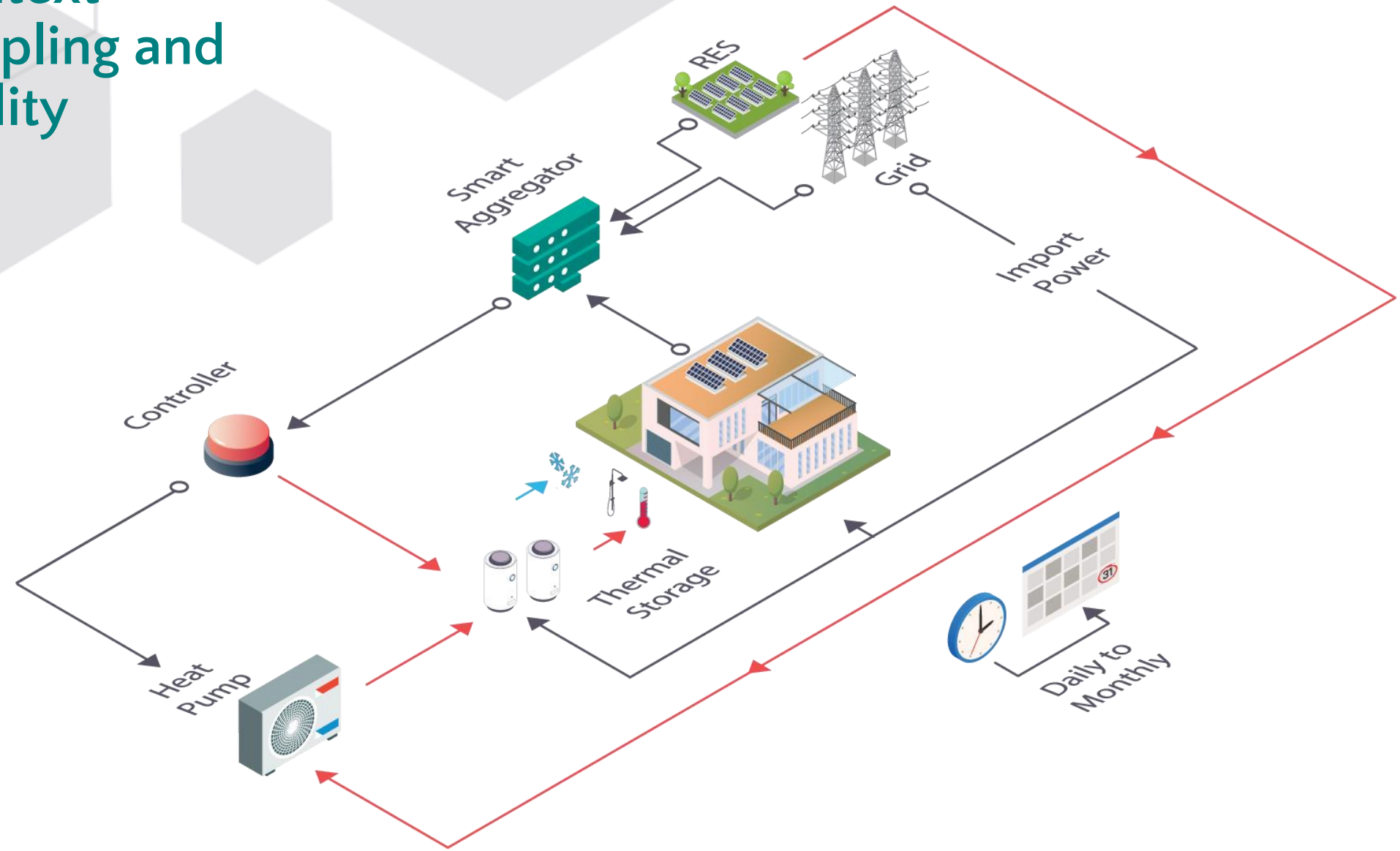


After



Connection to the grid that can unlock new demand, lower the cost and increase the performance of TES

HYSTORE context for sector coupling and energy flexibility



The HYSTORE demonstration sites

Use Case 4: DUBLIN

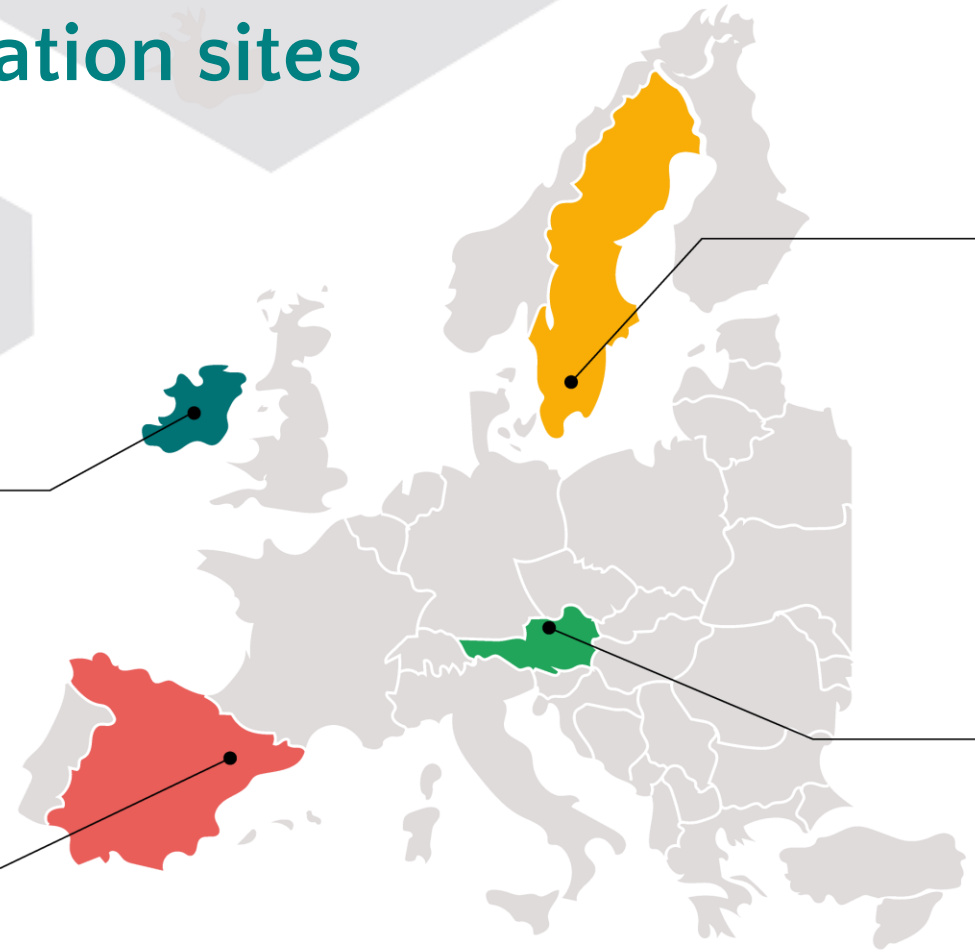
What: TCM H&C + smart platform
Use case: heterogeneous complex (university campus) with high RES share
Building services: heating
Grid services: higher RES usage, peak shaving, balance management

Replication scope: overall campus (30,000 people) and other Northern countries multi-functional buildings

Use Case 3: MONTSERRAT

What: TCM H&C + + low T H&C PCM + smart platform
Use case: heterogeneous complex with high RES share
Building services: heating and cooling
Grid services: peak load shifting, frequency and voltage regulation

Replication scope: overall complex (10 buildings) and mid-scale DHC (2.5 MWth)



Use Case 2: STOCKHOLM

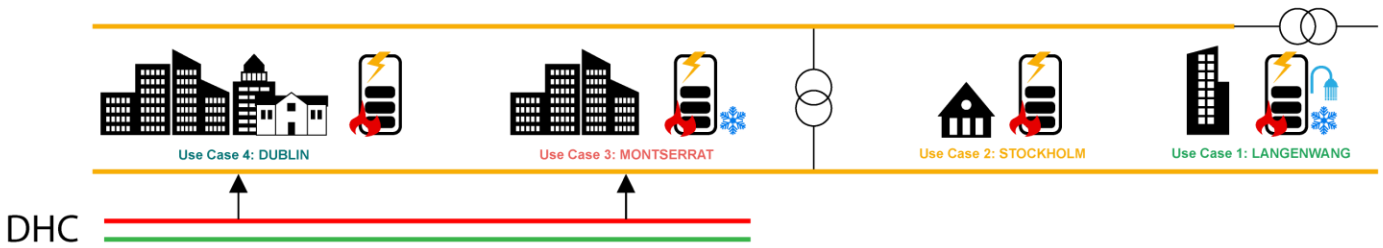
What: PCM HEATING + smart platform
Use case: residential building
Building services: heating
Grid services: peak shaving and shifting, demand-side management

Replication scope: overall campus and other close residential districts

Use Case 1: LANGENWANG

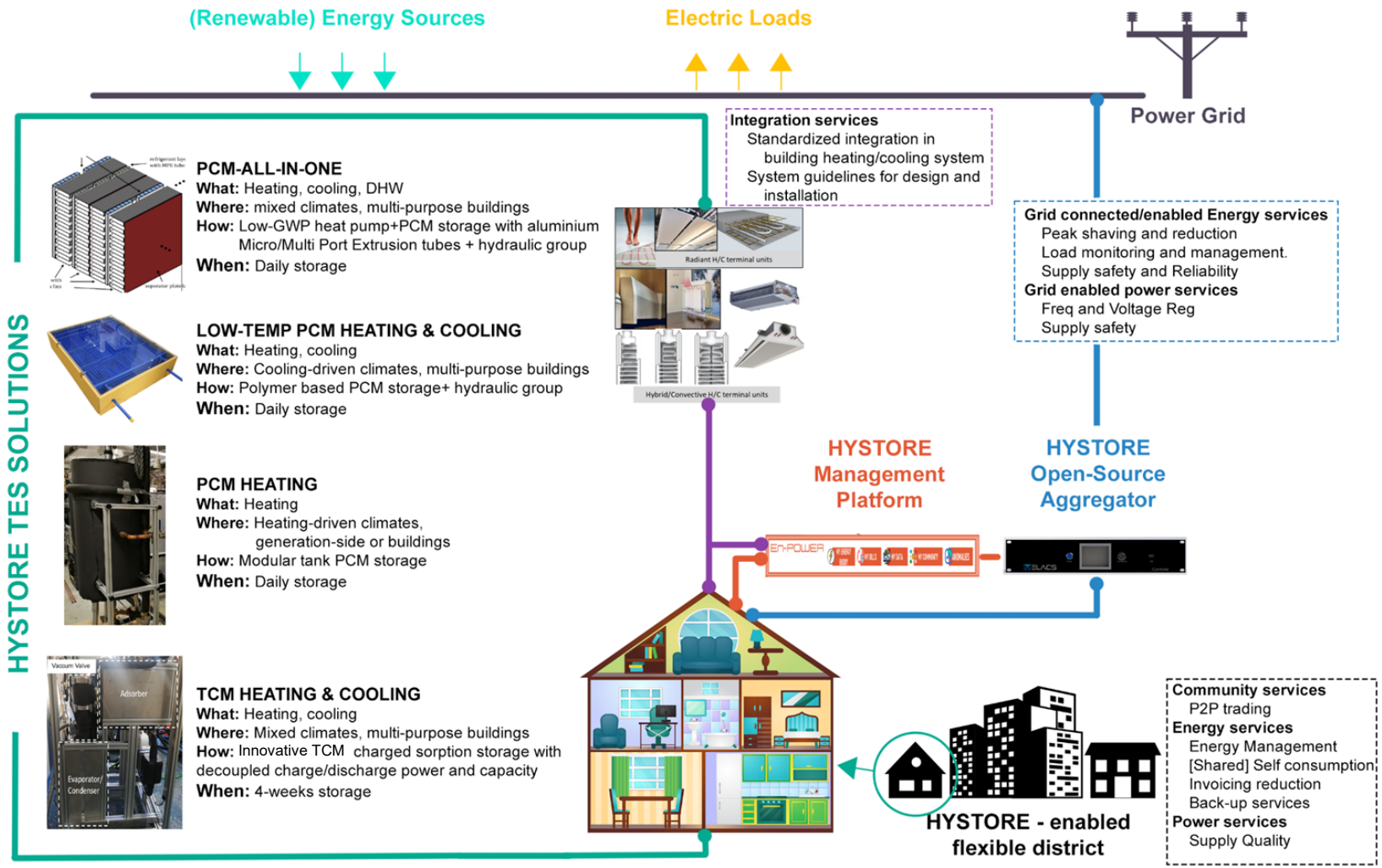
What: PCM-ALL-IN-ONE
Use case: multi-purpose building
Building services: heating,cooling, DHW
Grid services: peak shaving and shifting, demand-side management

Replication scope: other close mixed residential/industrial districts



HYSTORE Outcomes

1. PCM development for commercially ready storage
2. PCM All-in-One unit
3. PCM Low Temperature heating & cooling solution
4. PCM heating solution
5. TCM unit
6. Plug-and-play aggregators



Innovation and advancement beyound the state of the art

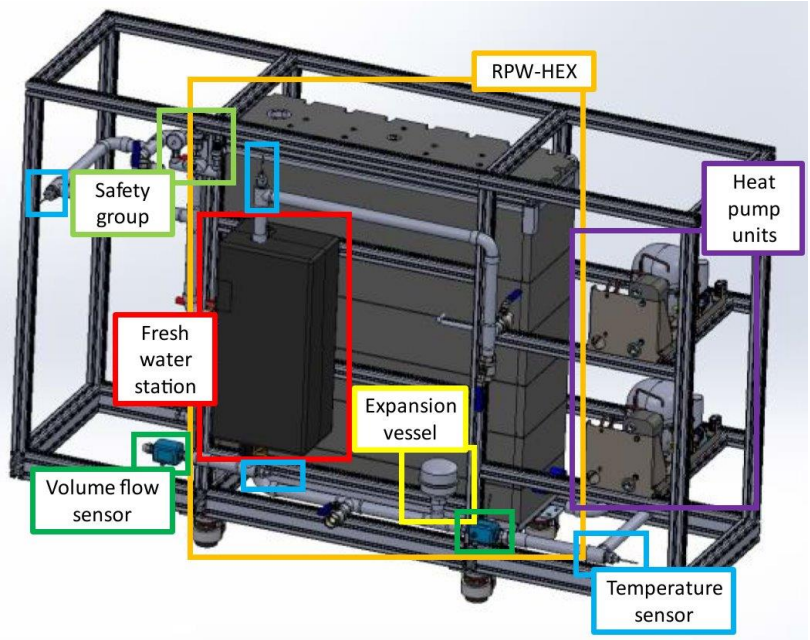
1. PCM development for commercially ready storage

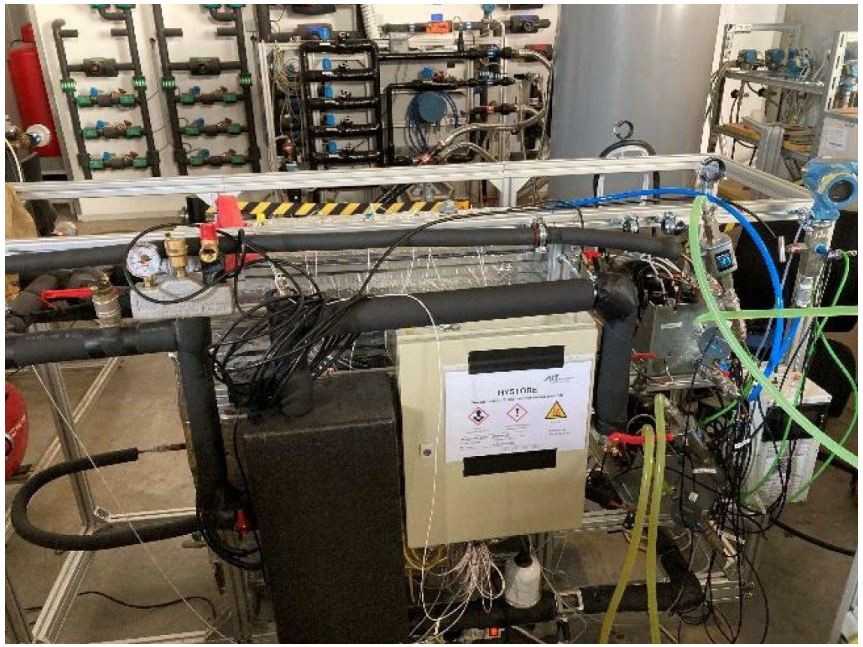
Measure experimental data on chosen PCMs for ageing, hysteresis, and supercooling using a bench-scale latent heat TES unit. Verify storage robustness and longevity.

Innovation and advancement beyound the state of the art

2. PCM All-in-one solution for heating, cooling and DHW

Develop an all-in-one unit with adapted HEX design and integrated heat pump for multipurpose operation (heating, cooling, DHW) using PCM storage.





Innovation and advancement beyound the state of the art

3. PCM Low Temperature heating & cooling solution

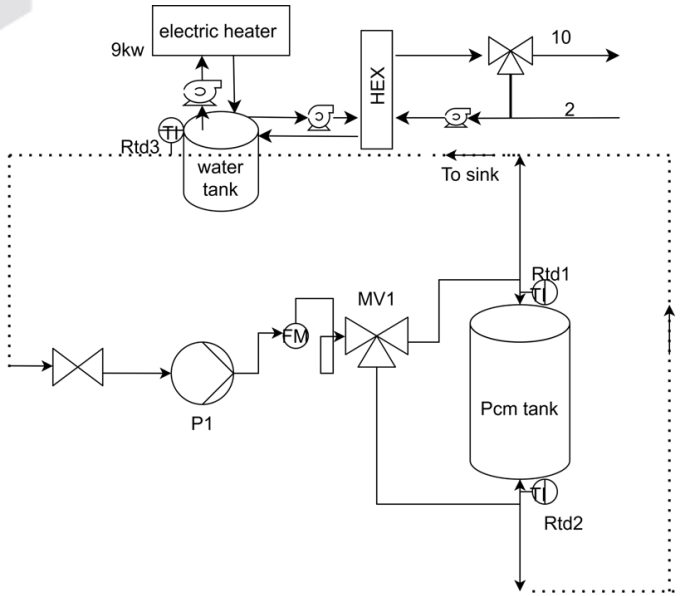
Develop a stable storage system using non-critical materials and capillary matrix-based design for PCM modules. Introduce a polymer heat exchanger and housing for easy plug and play installation of multiple modules.

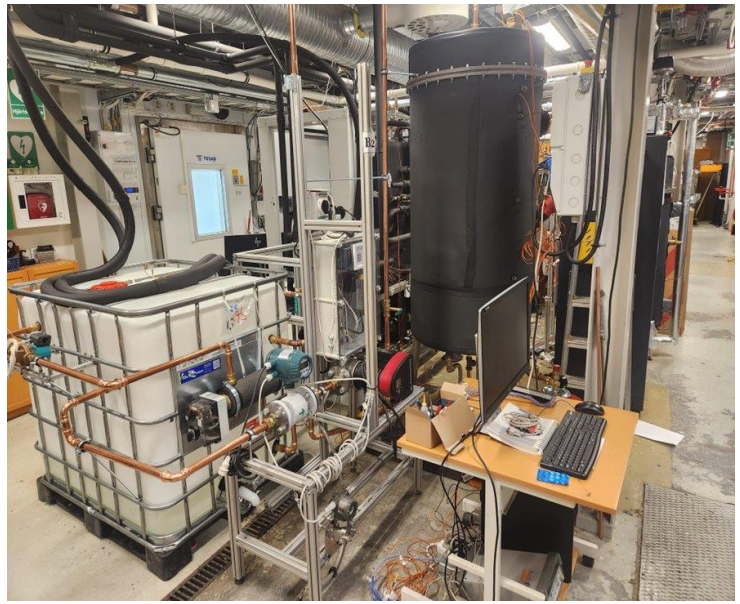
200 L storage filled with SP31 - Rubitherm

Innovation and advancement beyound the state of the art

4. PCM heating solution

Integrate LHTES with heat pumps in real-life buildings using multiple PCM types and enhanced heat exchangers. Optimize system layout for efficient utilization of temperature differences, even at low state of charge.

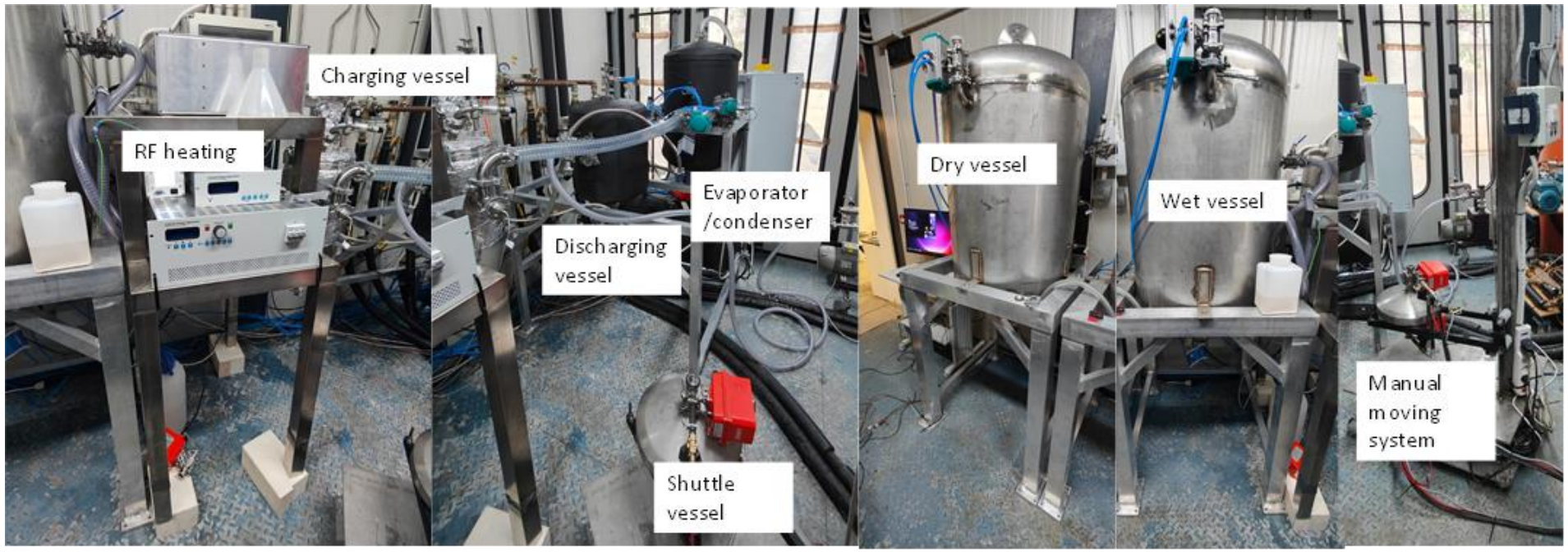




Innovation and advancement beyound the state of the art

5. TCM heating & Cooling solution

Implement innovative charged TCM storage using zeolites for homogeneous, extended heating without a heat exchanger.



Innovation and advancement beyound the state of the art

6. Plug-and-play aggregators with IoT interoperability and edge computing capabilities

A modular hardware aggregator for integrating TES with grid services will be developed. The SEAS solution will support federated learning capabilities.

Thank you

marco.rocchetti@r2msolution.com

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

LinkedIn: hystore-project

Co-funded by
the European Union

Smart building digitalization and automation

Flexible solutions empowering citizens

Thermal Storage and Smart Building Integration session

Sofía Mulero Palencia, CARTIF

ENLIT 25
18-20 NOVEMBER, BILBAO (SPAIN)

CARTIF

Enlit Europe

BuildON

Agenda

1. Why digitalisation matters
2. Smart Building technologies
3. BuildON in a Nutshell
4. The BuildON Smart Transformer Toolbox
5. Empowering citizens
6. Evidence from BuildON pilots accross Europe
7. Towards a Smarter, More Flexible Europe

1. Why digitalisation matters

Building stock status

40% energy consumption

75% non-compliant buildings

36% emissions

be standing in 2050

(EC, 2020)

▲ in electricity demand from 23% to 30-31%1 by 2030 (ENTSO-E, 2020)

-0.5%/year for space heating consumption

+1.3%/year for electrical appliances consumption (households)

Opportunity

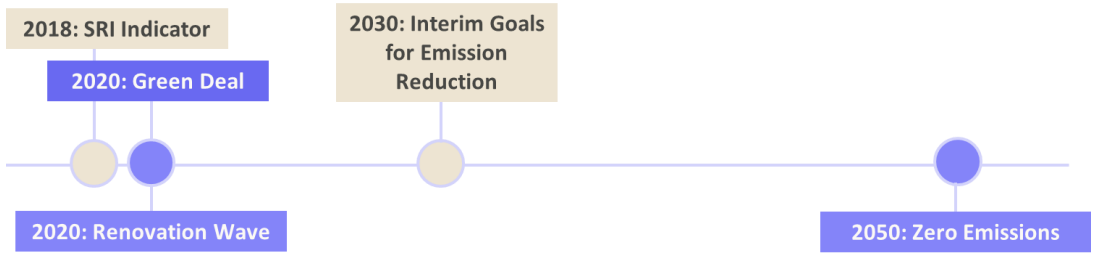
Significant potential for energy efficiency improvements

Challenge

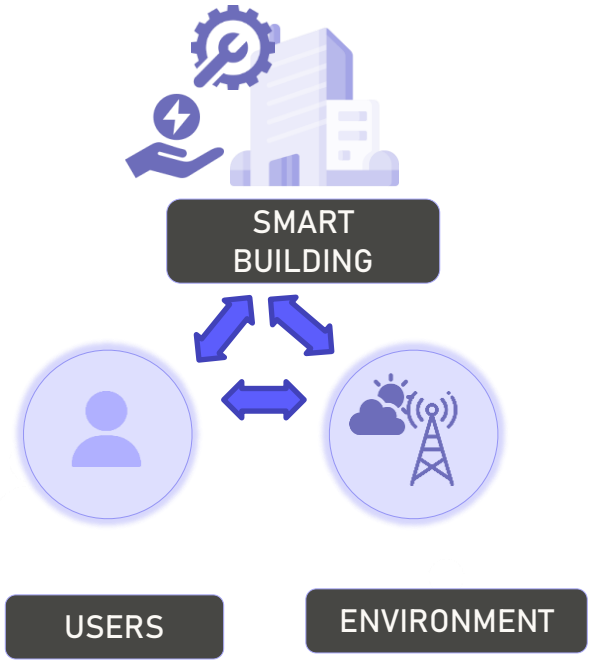
Renovations often not feasible due to legal and financial barriers

DIGITALISATION

European Initiatives roadmap



2. Smart Building Technologies



BARRIERS

SOCIAL ASPECTS

- Lack of **user-friendly** solutions
- Technological **knowledge gap**

HARMONISATION

- Need for seamless integration of SW and HW
- Relevance of interoperability and standardisation

INTEGRATION NEW TECHNOLOGIES

- AI/ML for energy management and optimisation
- Digital Twins for real-time monitoring and control

3. BuildON in a Nutshell

BuildON

Affordable and digital solutions to Build the next generatiON of smart EU buildings

GA ID:
101104141

Start date
1 May 2023

End date
31 October 2026

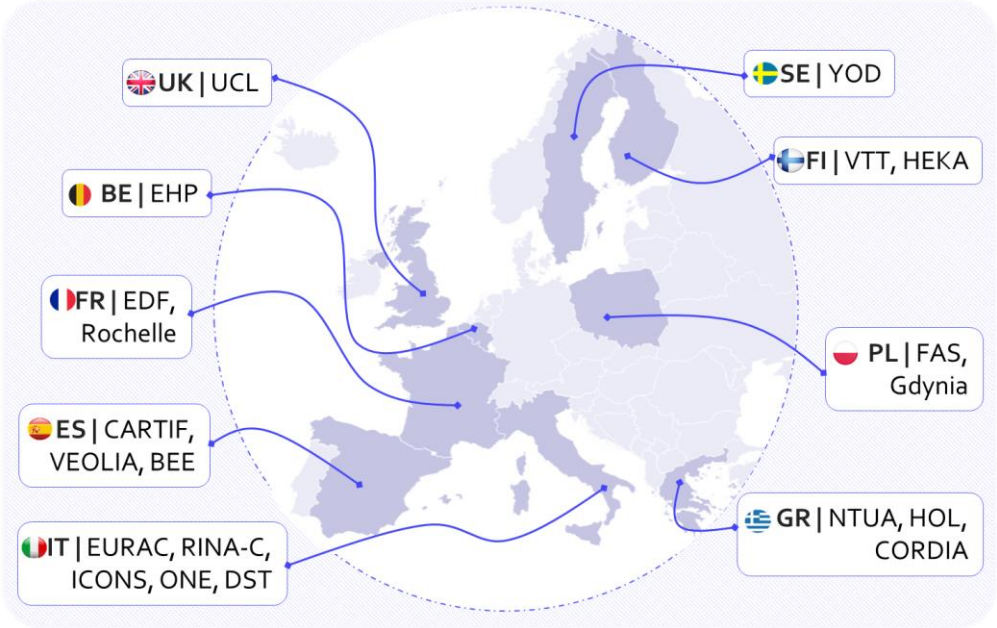
Granting authority:
European Climate, Infrastructure and Environment Executive Agency (CINEA)

EU contribution:
5,598,718.01 €

Co-funded by the European Union

Innovate UK

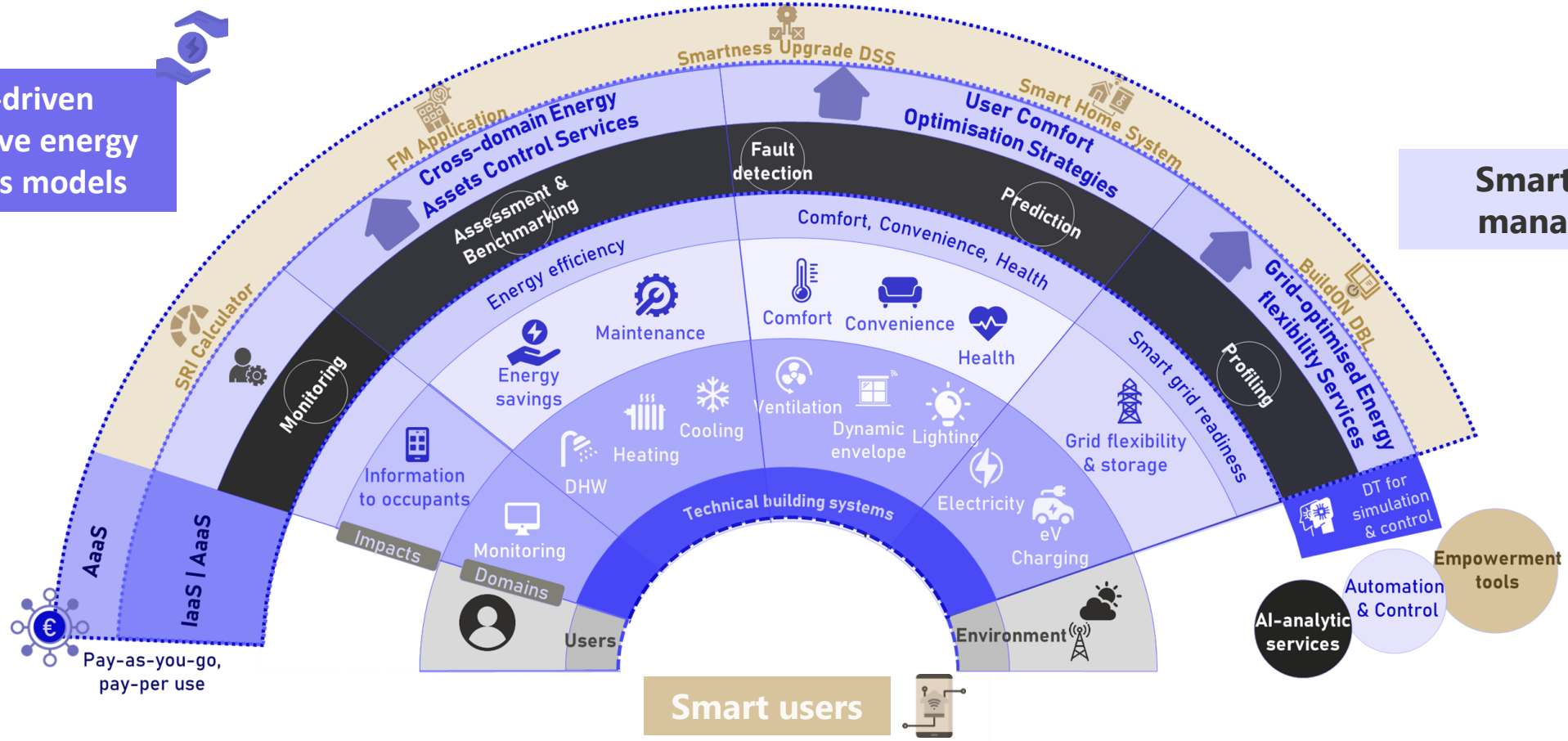
CARTIF



CARTIF · EPU NTUA · eurac research · VTT · RINA · ICONS · HOLISTIC · FASADA · EDF · La Rochelle Université · Heka · VEOLIA · CORDIA · GDYNIA · one team · Euroheat & Power · yadiwo · BeePlanet factory · UCL · dst.

4. The Smart Transformer Toolbox

Data-driven innovative energy business models



Smart energy management

4. The Smart Transformer Toolbox

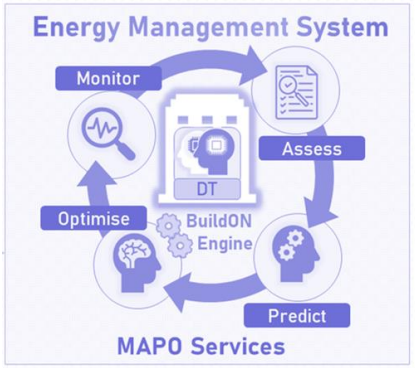
BARRIERS

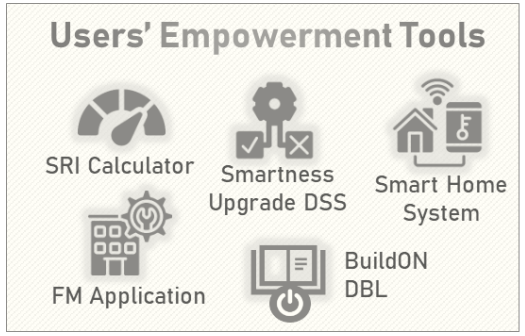
- SOCIAL ASPECTS
- HARMONISATION
- INTEGRATION NEW TECHNOLOGIES

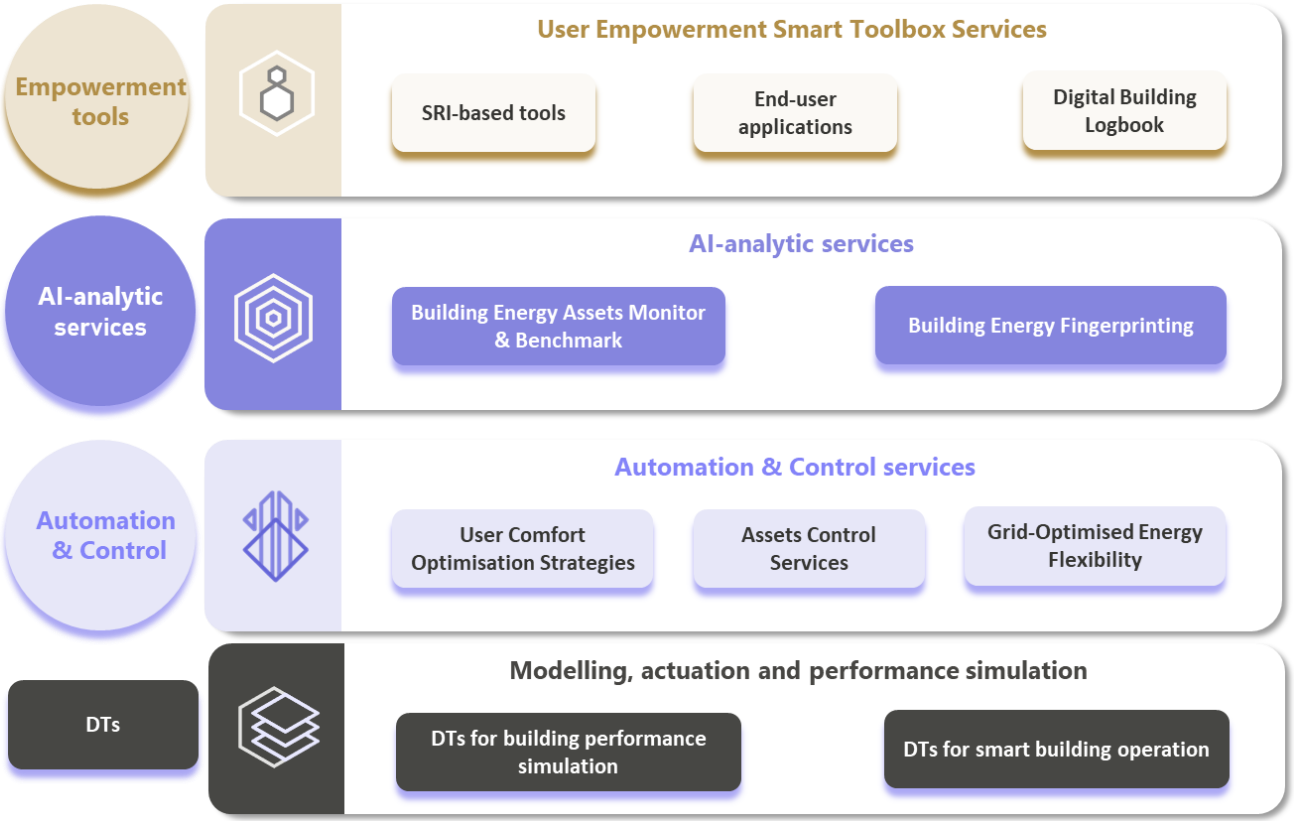
- Data-driven innovative energy business models — BUSINESS
- User-friendly tools to empower users towards more efficient energy use — SOCIAL
- IoT Edge-Cloud interoperable framework for building data exchange and operation — TECHNICAL
- Smart energy management system: MAPO analytics and optimisation services — TECHNICAL
- Digital Twins for building performance simulation and smart building operation — TECHNICAL

5. Empowering citizens

- SRI-aligned tools
- Digital Building Logbook
- Smart Home Management System (residential)
- Facility Management application (tertiary buildings)
- Digital Twins







6. Evidence from BuildON pilots accross Europe

PILOTS	WHY?	HOW?

P1 VEOLIA — Residential

P2 HEKA — Residential

P4 EDF — Offices

P5 CORDIA — Commercial

P3 FAS/GDYNIA — Educacional




Energy efficiency measures when **renovations unfeasible**.

Reducing costs when **investment is limited**.

Improve IEQ **levels**

Achieve **users well-being**

To provide **advanced monitoring** and **control** capabilities

Keep **energy consumption** on **low** levels

Optimize energy consumption using **real-time** data

To **reduce consumption** of **fossil fuels** in favour of greener energy from RES

- Building **Automation and Control Network enhancement**.
- **Enhancement** of building **energy management**.
- AI-based services **to improve** cross-domain control**, optimise flexibility, visual comfort and IEQ**
- DTs for **energy performance simulation and operation**

Co-funded by the European Union

Sofía-Mulero Palencia, CARTIF

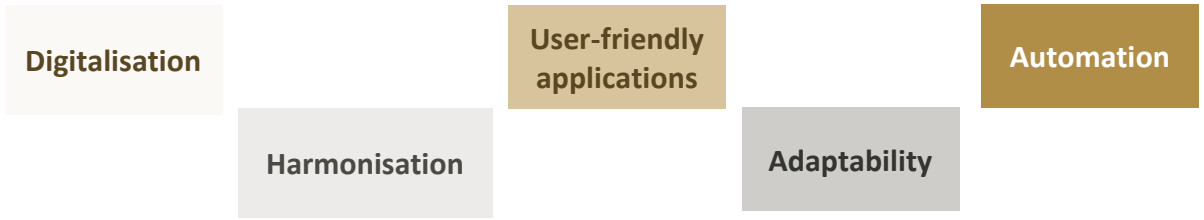
7. Towards a Smarter, More Flexible Europe

Digitalisation is one of the fastest and most cost-effective paths to decarbonisation

The STT will reach TRL 8 by 2026 (ready for adoption)

Interoperability + AI + Digital Twins + Social aspects transform building operations

Every building can become an active energy participant



Thank you for your attention!

Co-funded by the European Union

CARTIF

Enlit Europe

buildon-project.eu

@BuildON_EU

buildonproject

info@buildon-project.eu

SMART BUILDING DIGITALIZATION AND AUTOMATION
FLEXIBLE SOLUTIONS EMPOWERING CITIZENS
SOFÍA MULERO PALENCIA, CARTIF

ENLIT 25
18-20 NOVEMBER, BILBAO (SPAIN)

BuildON

This Project is funded by the European Union under the EU Programme Horizon-CL5-2022-D4-01-03 under Grant Agreement Number: 101104141. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

TARTU
PAMPLONA
GENK

oPEN Lab – Scaling Energy Solution Management from Building to District

ENLIT Bilbao 19 November 2025

Speaker: Alicia Kalms (CENER)

This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 101037080.

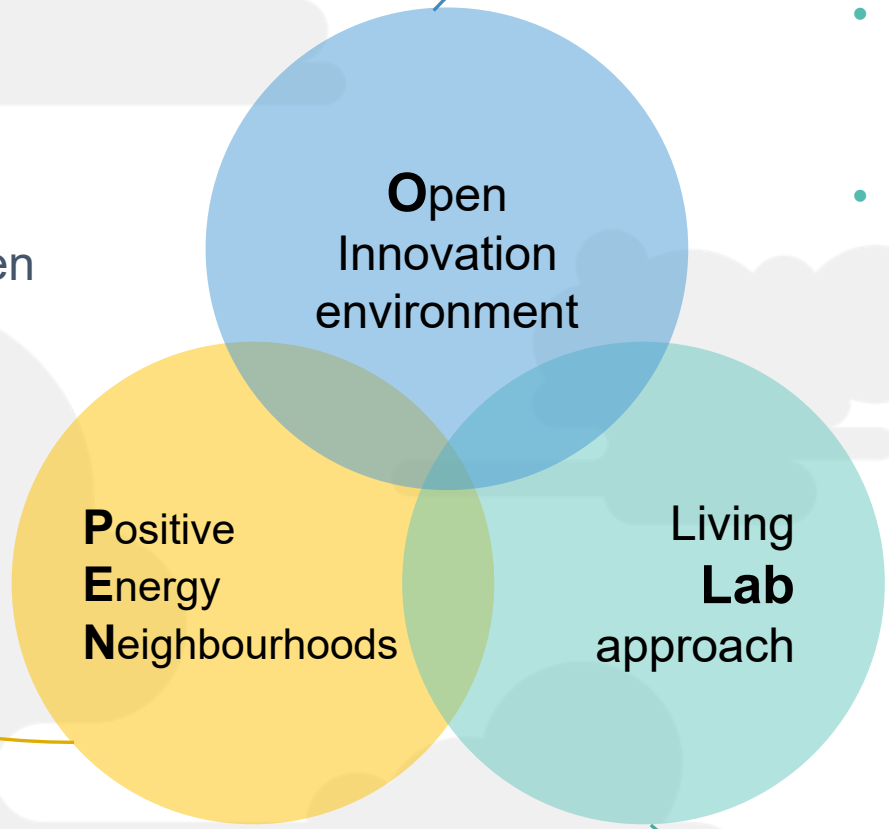
oPEN Lab

TARTU
PAMPLONA
GENK

LEADING THE TRANSITION TO POSITIVE ENERGY NEIGHBOURHOODS

What does oPEN Lab stand for?

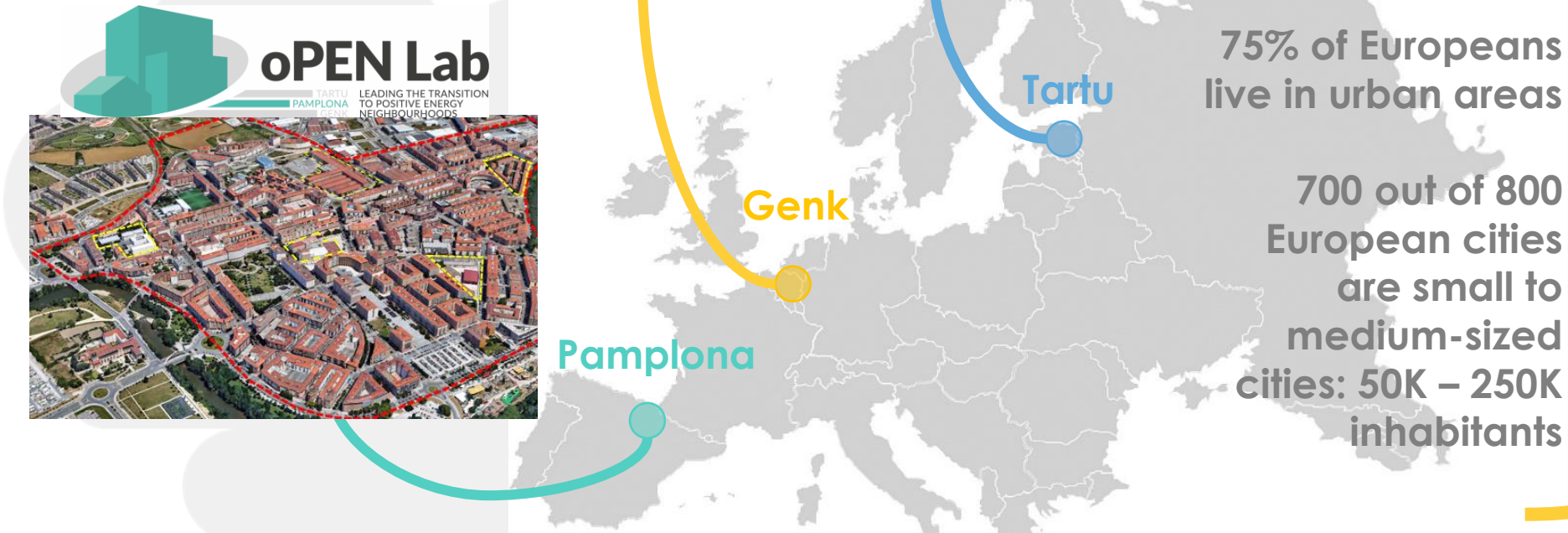
- Integrated energy solutions
- Aggregated renovations on neighbourhood level (community approach)
- Optimal pathways for chosen low carbon technologies
- Increase RES



- Co-creation among companies, citizens, research organisations & governments (4-helix model)
- Structural changes beyond what any organisation could do alone

- User oriented innovation models
- Innovation processes in real-life communities (social identity and cohesion)

Open innovation living labs for smart building solutions for energy efficiency



75% of Europeans live in urban areas

700 out of 800 European cities are small to medium-sized cities: 50K – 250K inhabitants

Revitalisation of urban areas across Europe

3 open innovation living labs

- Identify and demonstrate replicable, commercially viable solution packages
- Achieving PEN within existing urban contexts
- Cross-sectorial integration, accelerating service innovation

Smart building solutions for energy efficiency

oPEN Lab
TARTU PAMPLONA GENK
LEADING THE TRANSITION TO POSITIVE ENERGY NEIGHBOURHOODS

1 POSITIVE ENERGY NEIGHBOURHOOD

25 SOCIAL HOUSING

8 privately owned GARDEN CITY HOMES

33 HOUSEHOLDS

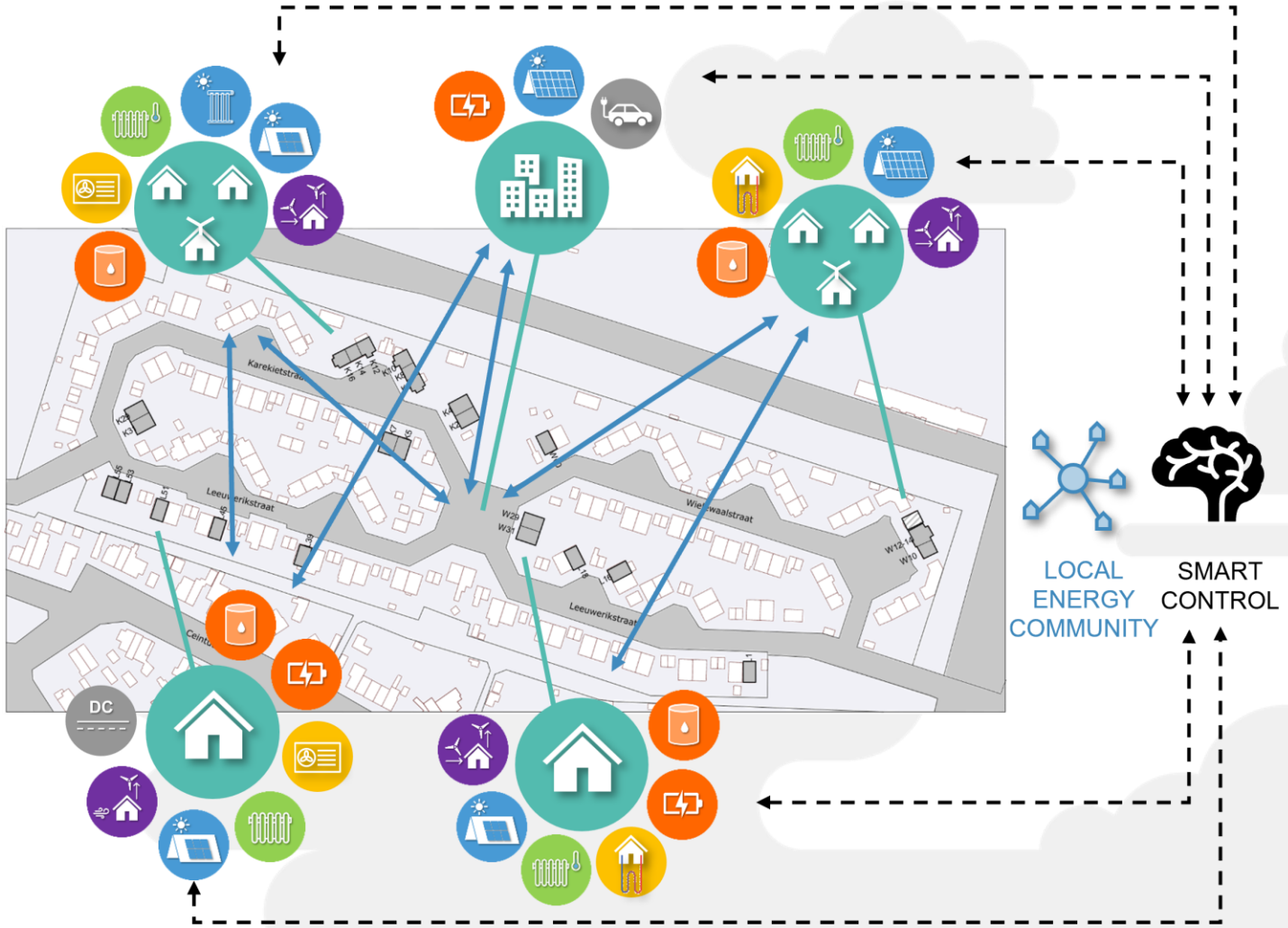
16+ INNOVATIVE TECHNOLOGIES

Single family housing neighbourhood linked to a sandbox area

Smart building solutions for energy efficiency
Building + Neighbourhood

oPEN Lab
TARTU PAMPLONA GENK LEADING THE TRANSITION TO POSITIVE ENERGY NEIGHBOURHOODS

Real life Technical playground…



LOCAL ENERGY COMMUNITY

SMART CONTROL

TECHNOLOGY BOXES
- INDIVIDUAL
- MICROGRID

HEAT PUMPS
- AIR-WATER
- GEOTHERMAL

RENEWABLE ENERGY
- PV
- BIPV
- SOLAR THERMAL
- HYBRID (PVT)

STORAGE
- THERMAL
- ELECTRIC

EMISSION SYSTEM
- EXISTING RADIATORS
- LOW-TEMP RADIATORS
- SURFACE HEATING

VENTILATION
- EXTRACT with DEMAND CONTROL
- BALANCED with HEAT RECOVERY

OTHER
- DC GRID
- EV CHARGING

Scaling Energy solution Management to District

oPEN Lab
TARTU PAMPLONA GENK
LEADING THE TRANSITION TO POSITIVE ENERGY NEIGHBOURHOODS

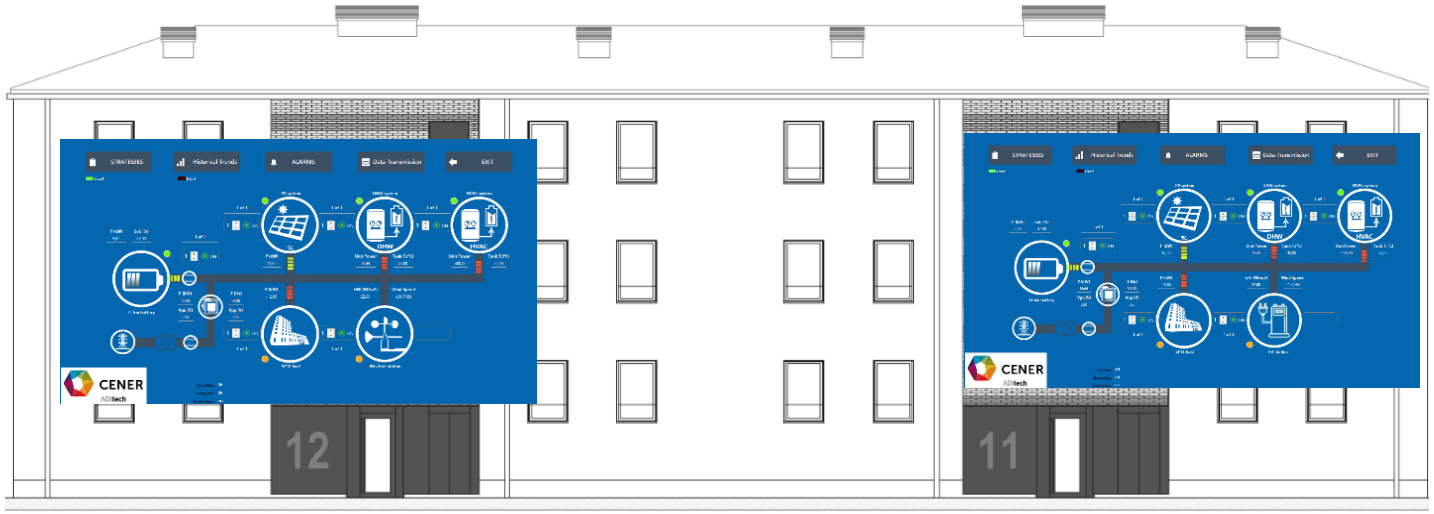
1 POSITIVE ENERGY NEIGHBOURHOOD

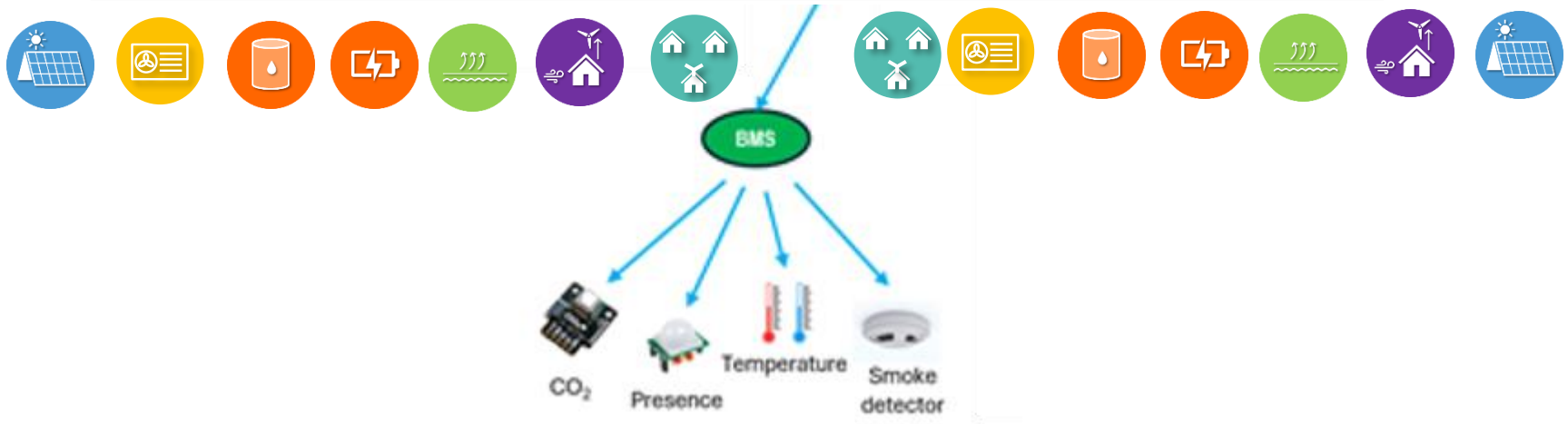
12 SOCIAL HOUSING

8 000 m^2 renovated

12+ INNOVATIVE TECHNOLOGIES

EMS @building+@neighbourhoud





Functionalities

- Monitoring
- Control
- Local optimisation
- Integration of external services
- I/O Digital Twin

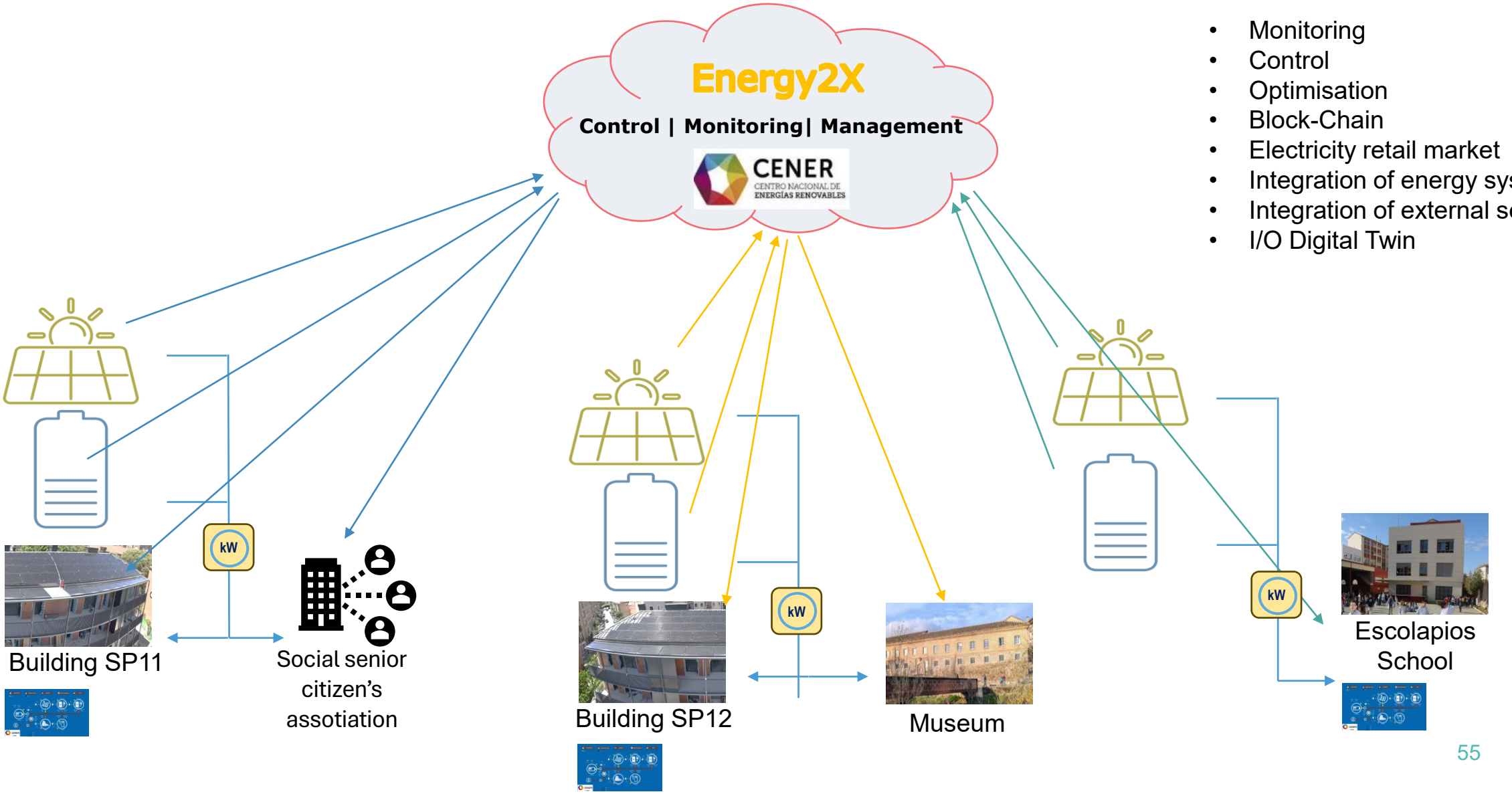
Functionalities

- Monitoring
- Control
- Home Automation interface
- User's feedback
- I/O Digital Twin

EMS @building+@neighbourhoud

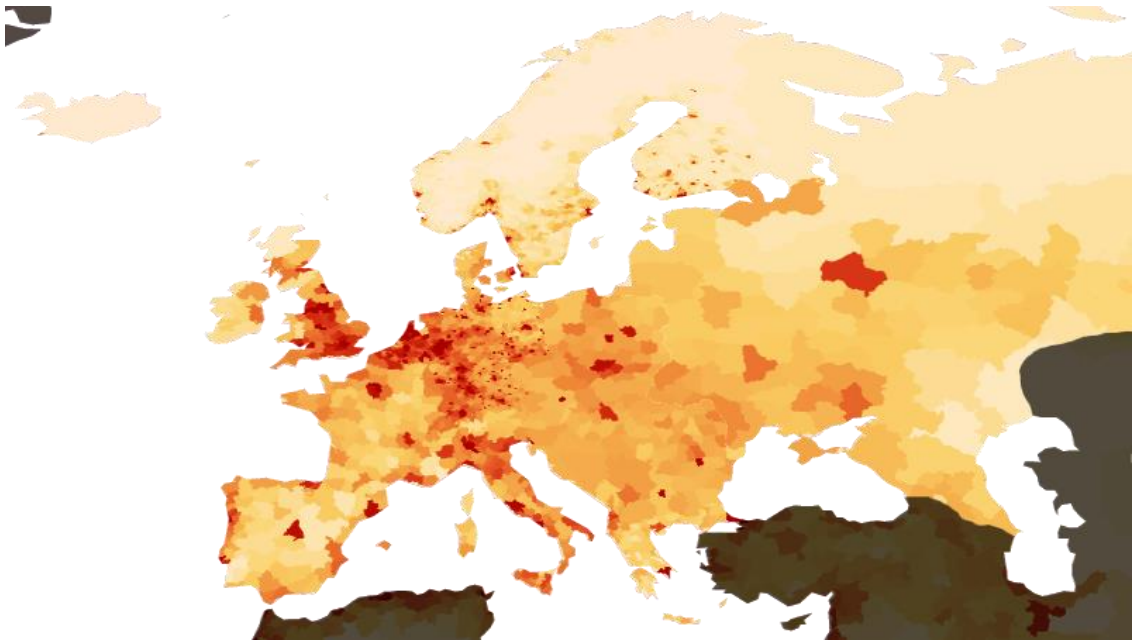
Functionalities

- Monitoring
- Control
- Optimisation
- Block-Chain
- Electricity retail market
- Integration of energy systems
- Integration of external services
- I/O Digital Twin



Replicability and outlook

An open, modular, and replicable approach



- Feedback from all stakeholders
- Ready for replication in real life
- EMS design philosophy is open, modular, and adaptable to different building and technological typologies
- Not just a tool for Rotxapea neighbourhood, but an instrument for smart energy management across the PEN ecosystem? Yes!
  - A neighbourhood approach empower local communities to take an active role in their energy use, while accelerating the market uptake of novel technologies and business services at scale.
  - PEDs accelerate the market uptake of combined novel technologies and business services.
  - oPEN Lab model transforming neighbourhoods where collaboration is key.

THANK YOU FOR YOUR ATTENTION!

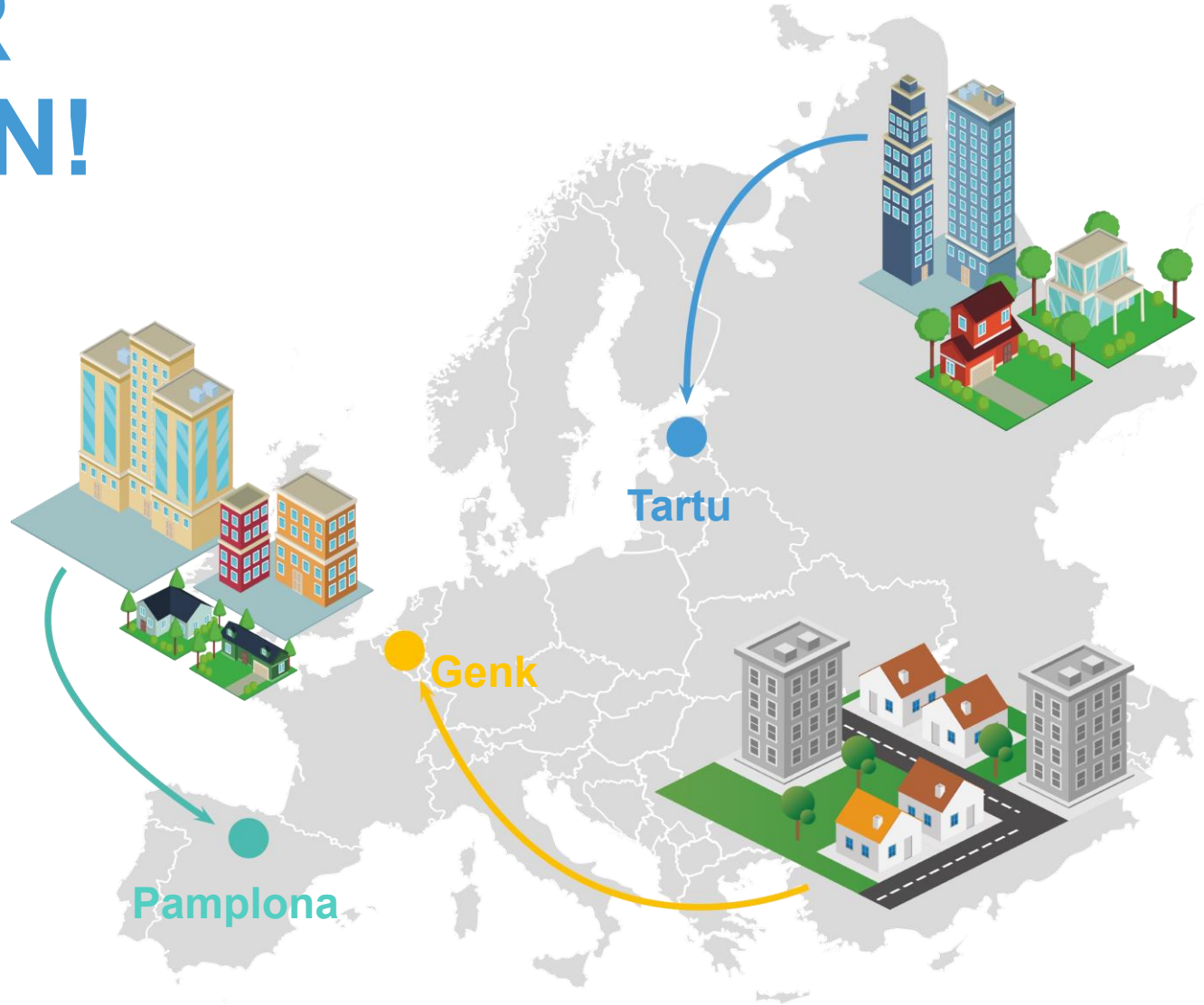
CONTACT

info@openlab-project.eu

@oPENLab_project

oPEN Lab

oPEN Lab Project



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 101037080.

Question round table: how can these technology solution packages including EMS can provide seamless support to the power grid?

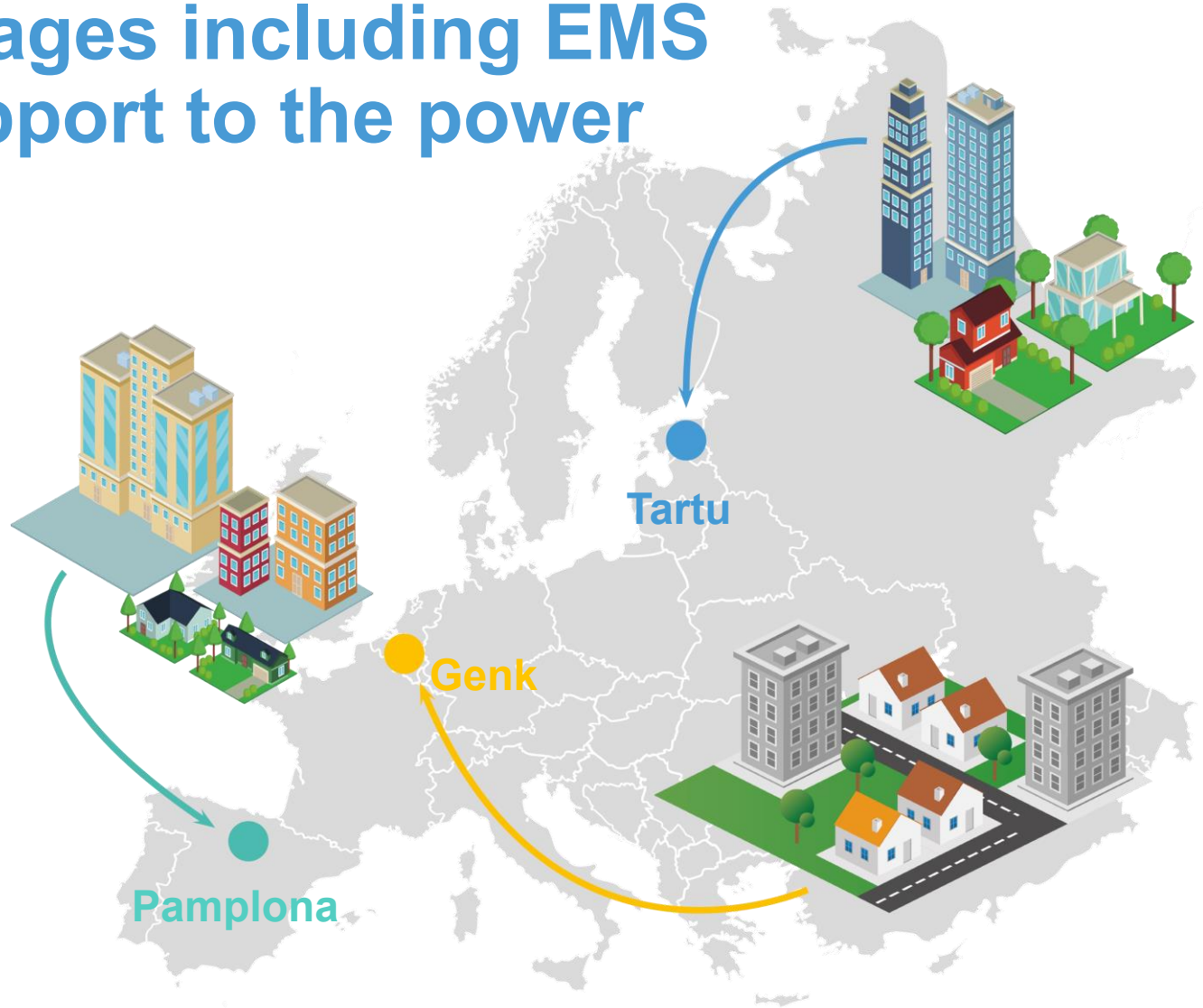
CONTACT

info@openlab-project.eu

@oPENLab_project

oPEN Lab

oPEN Lab Project



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement No 101037080.

Follow us!

ECHO
EFFICIENT COMPACT MODULAR THERMAL ENERGY STORAGE SYSTEM

BEST-Storage

ThumbsUp

HYSTORE
Hybrid Services from Advanced Thermal Energy Storage Systems

BuildON

oPEN Lab