SUSTAINABLE PLACES 2022

HYPERGRYD

HEATflex

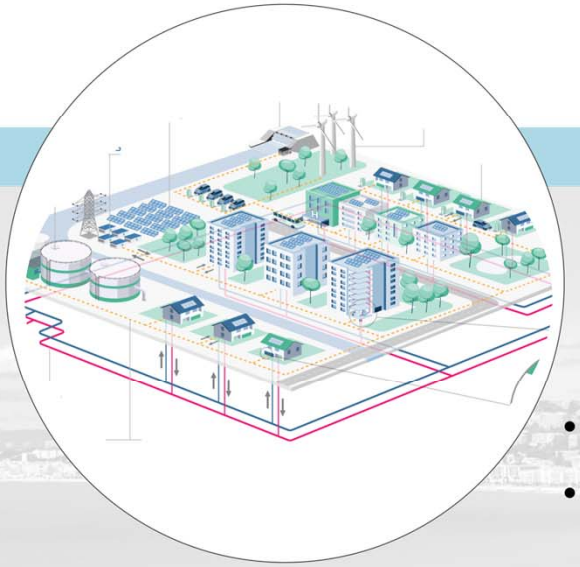
W.E. DISTRICT

SUPER P2G

MISSION INNOVATION ITALY

POA SMART GRID

PROGETTO MISSION - Microreti e sistemi smart, multivettore ed integrati per accelerare la transizione energetica



#SUSTAINABLEPLACES2022

SECTOR COUPLING

Tools and Technologies for Thermal and Electric Grids towards Sector Coupling

SEP. 6TH – SEP 9TH, 2022 NICE, FRANCE

SUSTAINABLEPLACES.EU

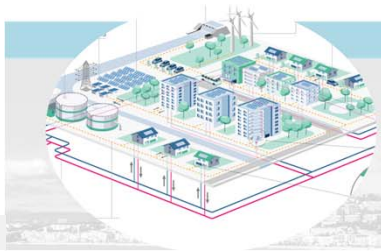
VILLE DE NICE

MÉTROPOLE NICE CÔTE D'AZUR

OVERVIEW

- HYPERGRYD
- WEDISTRICT
- SUPERP2G
- HEATFlex
- MISSION

SUSTAINABLE PLACES



SECTOR COUPLING

Tools and Technologies for Thermal and Electric Grids towards Sector Coupling

SEP. 6TH – SEP 9TH, 2022 NICE, FRANCE

About the project – Quick facts

HYPERGRYD

Hybrid Coupled Networks for Thermal-Electric Integrated Smart Energy Districts

Duration: October 2021 – March 2025 (42 months)

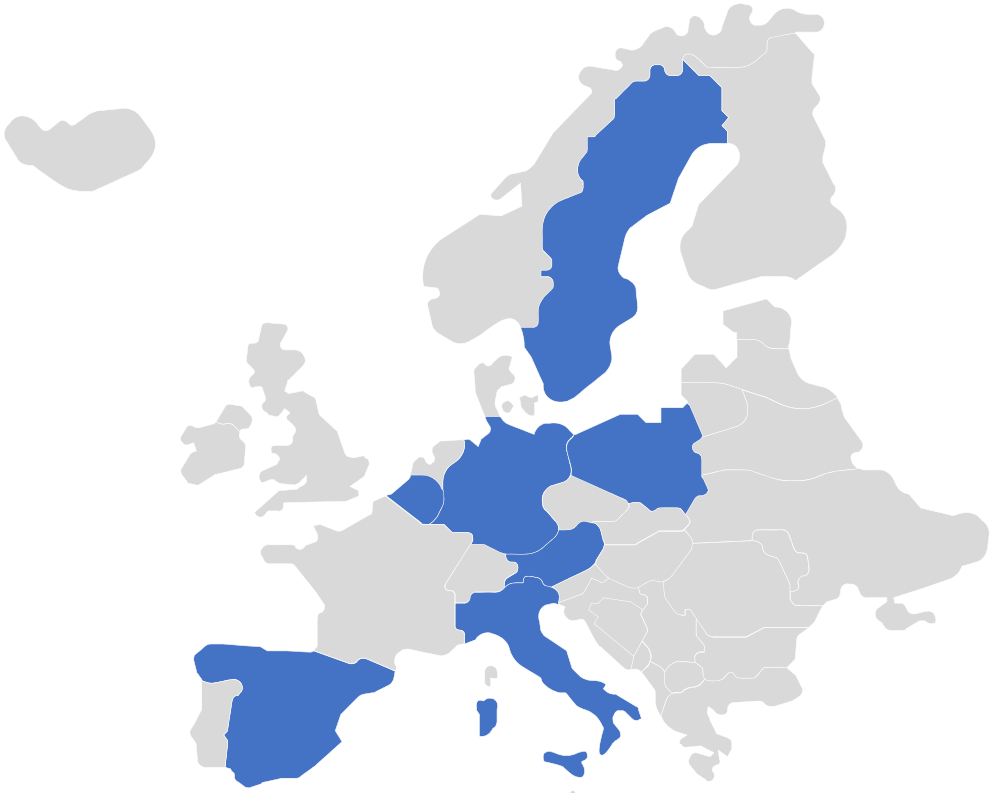
Call: H2020-LC-GD-2-1-2020 (Research and Innovation action)

Partners: 19 partners from 7 countries

TRL: 4-6

Coordinator: ARCbcn. Francesco Milani (f.milani@arcbcn.cat) & Àngel Font (a.font@arcbcn.cat)

Website: : https://hypergryd.eu/



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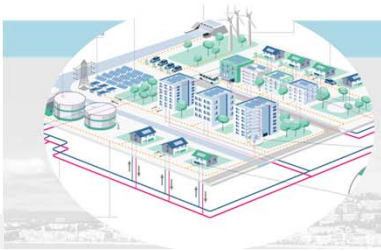

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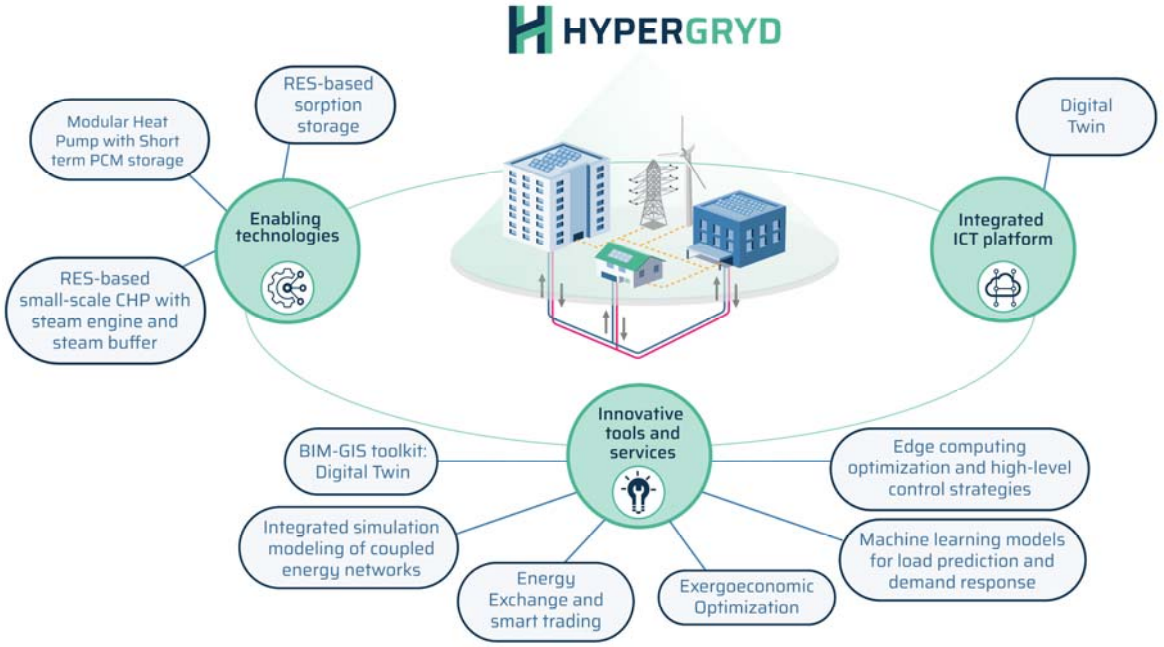
Project Objectives

HYPERGRYD

- Develop and integrate renewable-based solutions to empower the deployment of **smart hybrid energy networks**
- Optimize system design and operation
- Ensure flexibility and rapid deployment and guarantee robust and secure energy supply
- Enhance users' participation in the overall grid energy management
- Develop a single platform functioning as hub for hardware and tools testing



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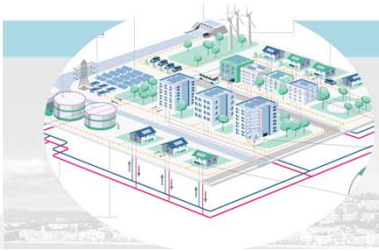

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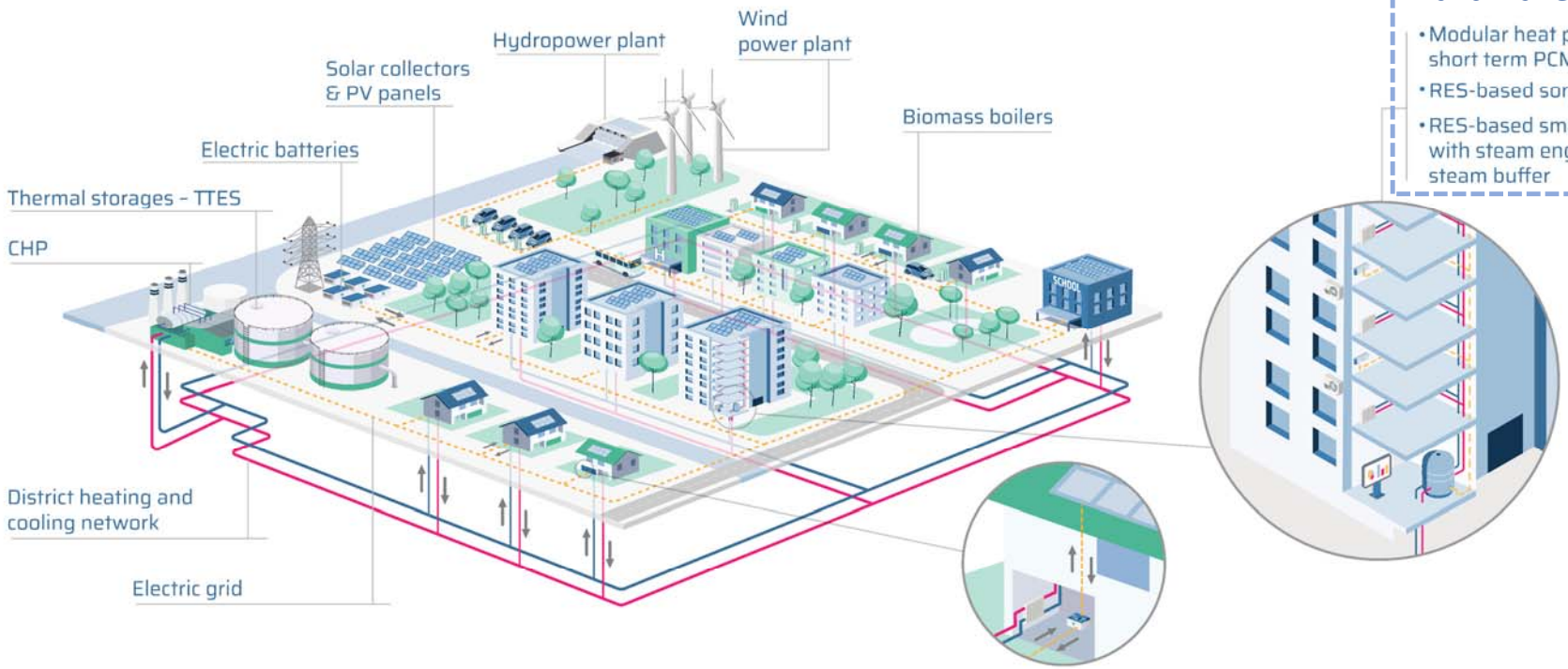
Overall concept and hardware

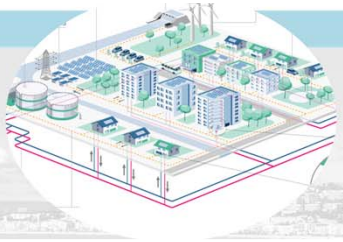
HYPERGRYD



Hardware

- Modular heat pump with short term PCM storage
- RES-based sorption storage
- RES-based small-scale CHP with steam engine and steam buffer

SUSTAINABLE PLACES



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Overall concept and hardware

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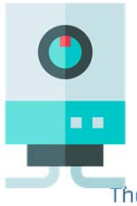


Modular Heat Pump with short term PCM storage

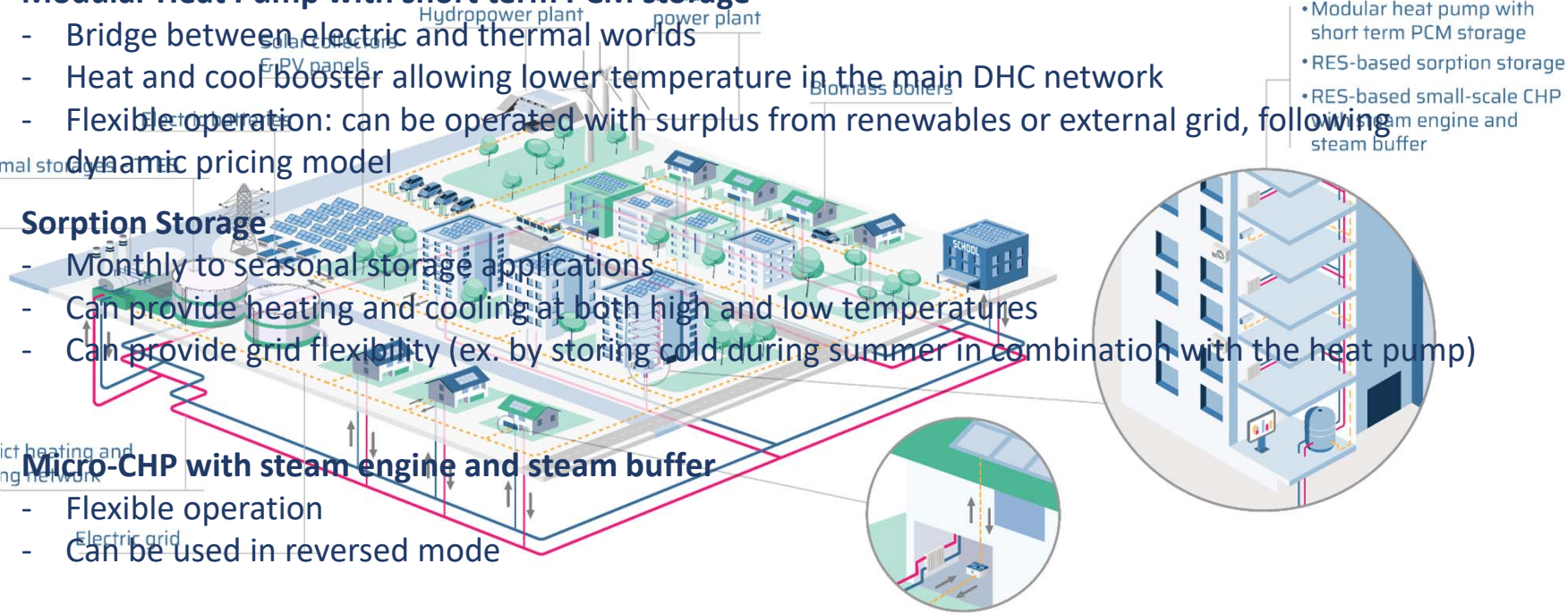
- Bridge between electric and thermal worlds
- Heat and cool booster allowing lower temperature in the main DHC network
- Flexible operation: can be operated with surplus from renewables or external grid, following dynamic pricing model

Sorption Storage

- Monthly to seasonal storage applications
- Can provide heating and cooling at both high and low temperatures
- Can provide grid flexibility (ex. by storing cold during summer in combination with the heat pump)

Micro-CHP with steam engine and steam buffer

- Flexible operation
- Can be used in reversed mode



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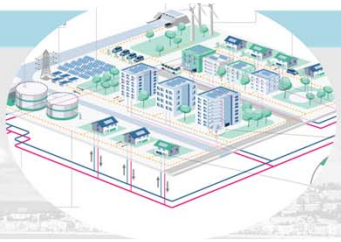

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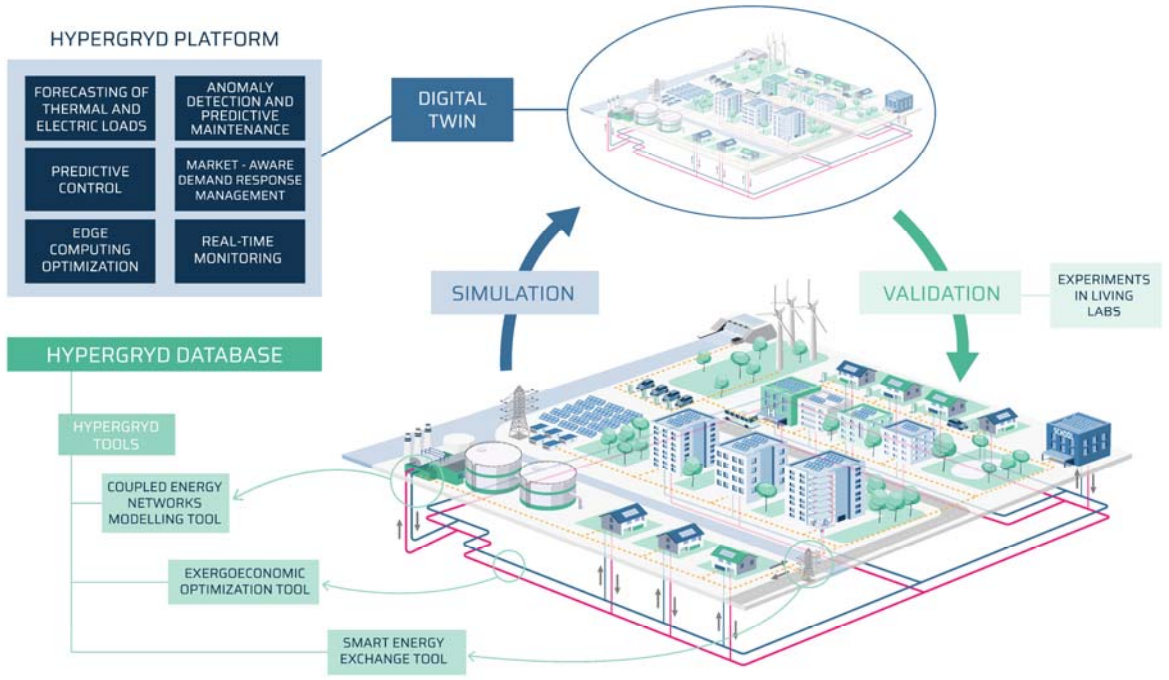
Tools and Services

HYPERGRYD

- Dynamic simulation for the modeling of multi-carrier energy networks
- BIM-GIS-based digital twin of a district
- Exergoeconomic optimization
- Creation of local energy markets
- Machine learning models for load prediction and demand response
- Edge computing optimization and high-level control strategies



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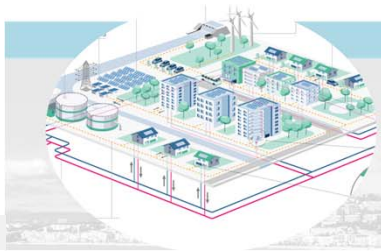

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Demonstration

HYPERGRYD

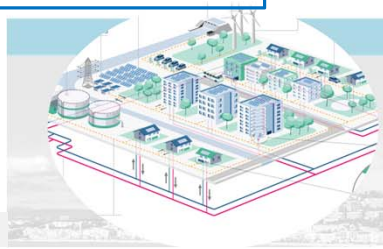
Turin (Italy) – ENVIPARK
LiL Type: Office District
Solution: ENCO dynamic simulation tool and Digital Twin

Großschönau (Austria) - SONNENPLATZ
LiL Type: Biomass-based District Heating System
Solution: GIS-BIM tool, exergoeconomic model, dynamic simulation tool and local energy marketplace

Jablonna (Poland) – KEZO Research Center
LiL Type: Laboratory and office buildings
Solution: HP with PCM storage, sorption storage, algorithms for heat pump and DHC management

Bozen (Italy) - EURAC
LiL Type: Research Lab
Solution: micro-CHP with steam engine and steam buffer

SUSTAINABLE PLACES



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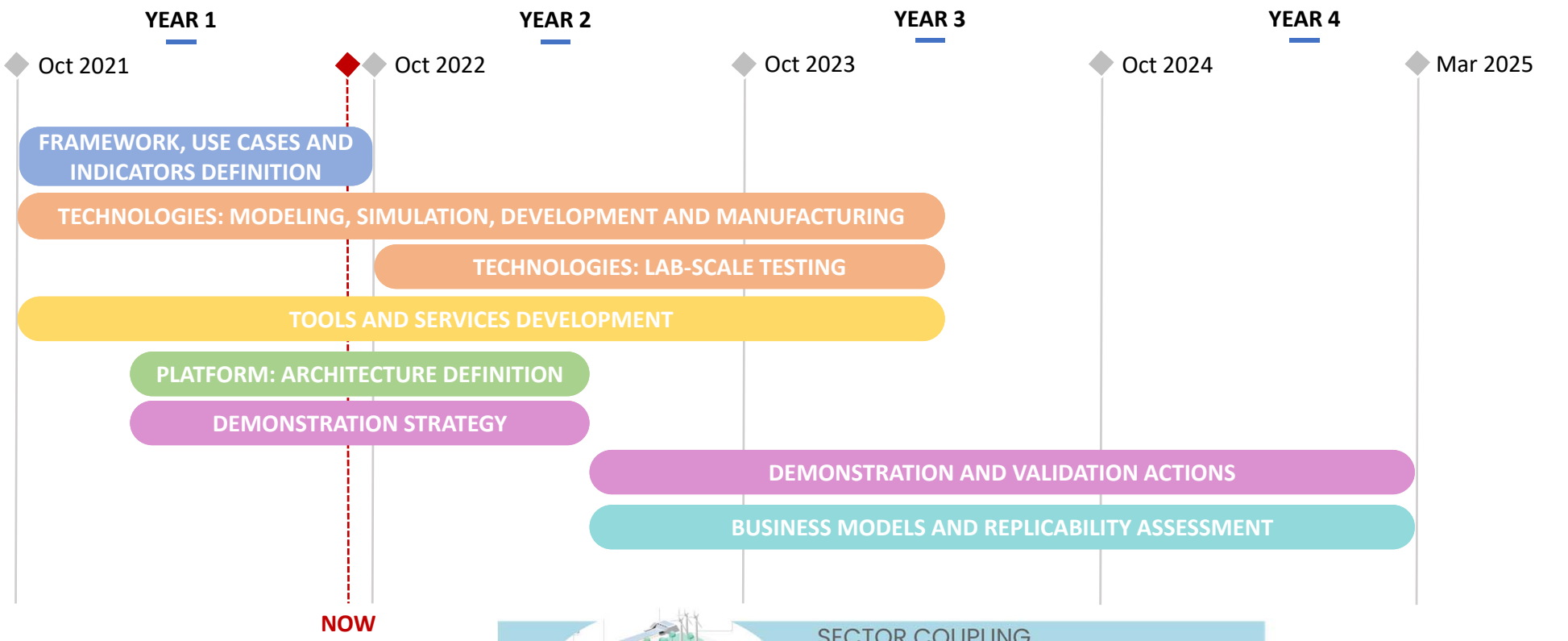
Project Status



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Main Challenges

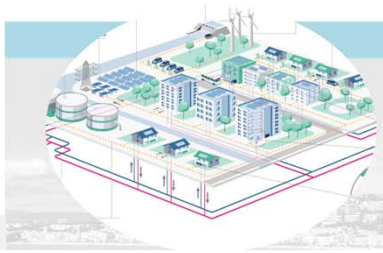
Data availability/accessibility (consumption profiles). Data protection and privacy issues

HYPERGRYD Platform: architecture and common database definition

Lack of standards in sector coupling: connection/coupling procedures to DHC and low voltage networks

Supply of IoT components: delivery time for hardware components

SUSTAINABLE PLACES



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Tools and Technologies for Thermal and Electric Grids towards Sector Coupling

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W.E. DISTRICT
Heating & cooling solutions

POLITEHNICA UNIVERSITATEA DIN BUCUREȘTI UPB 1818

Atos

Bucharest demo-site

Sustainable Places 2022, 8th September 2022

This project has received funding from the Eu

WEDISTRICT

Context

Heating and cooling of buildings in EU accounts for 50% of total energy consumption.

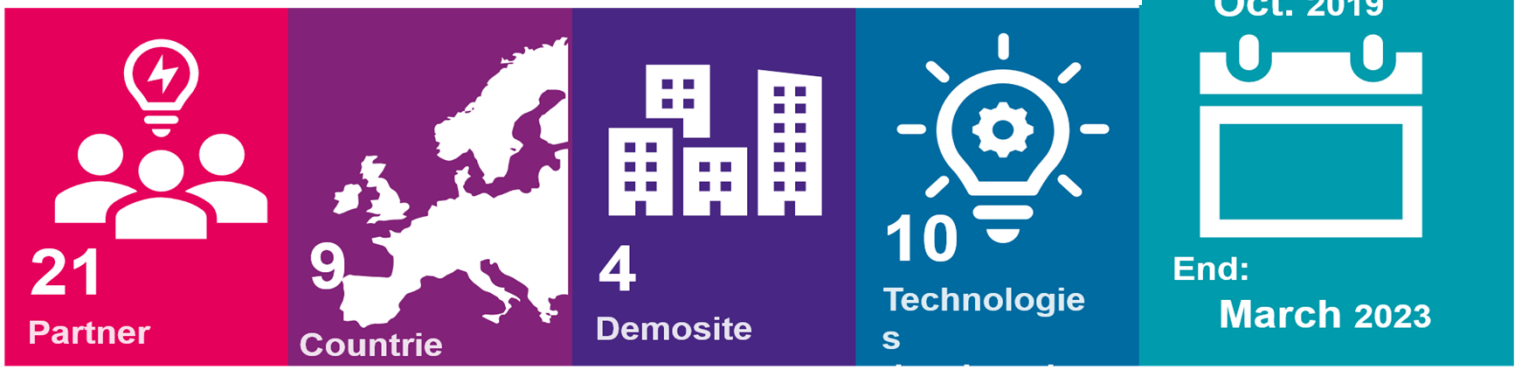
70% of this energy is generated from fossil fuels.

Objectives

The overall objective of the project is to demonstrate district heating and cooling (DHC) as integrated solutions that exploit the combination of

- renewable energy sources,
- thermal storage and
- waste heat recycling technologies

to satisfy 100% of the heating and cooling energy demand in new DHC and up to 60-100% in retrofitted DHC.



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°857801

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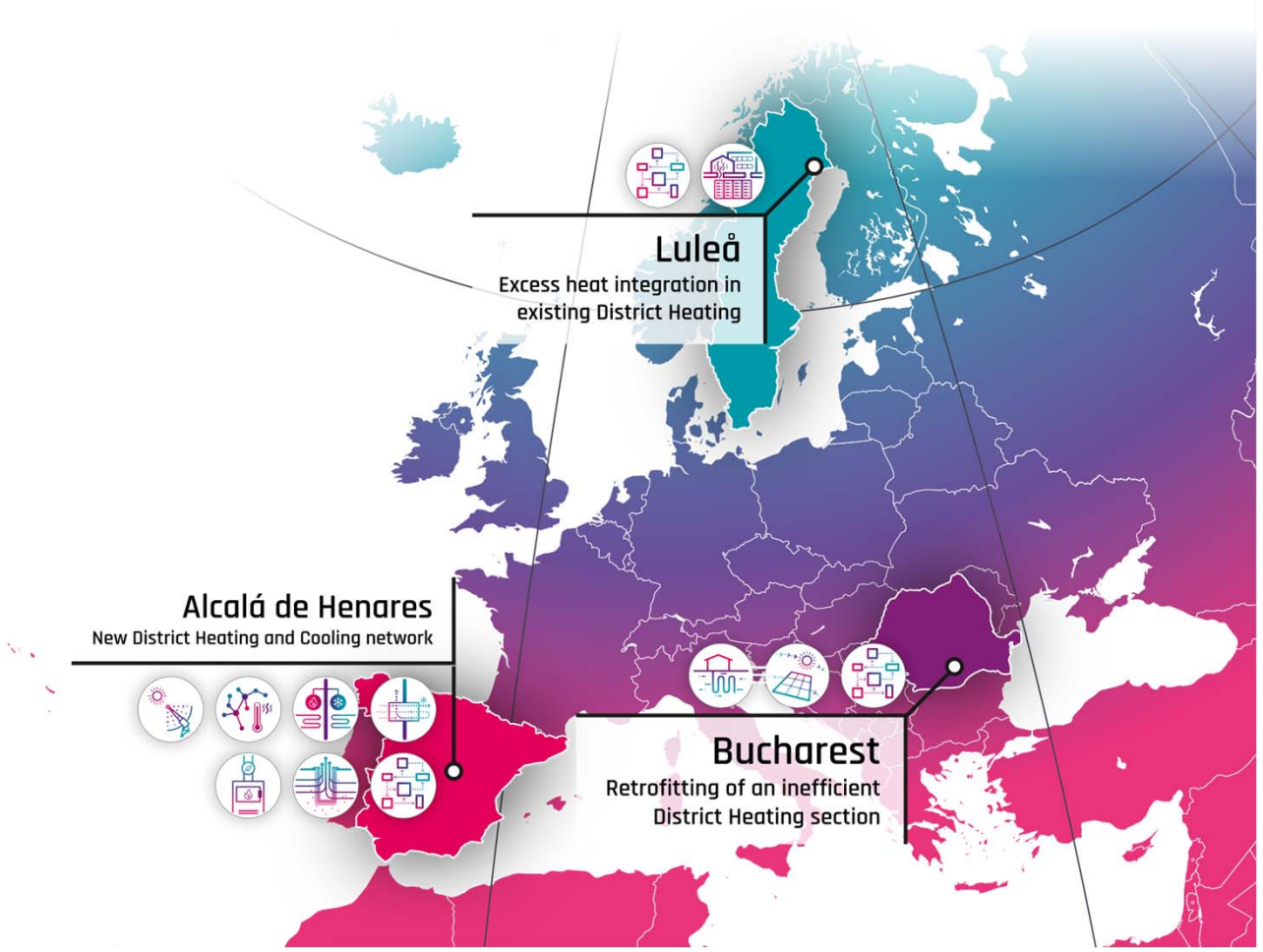

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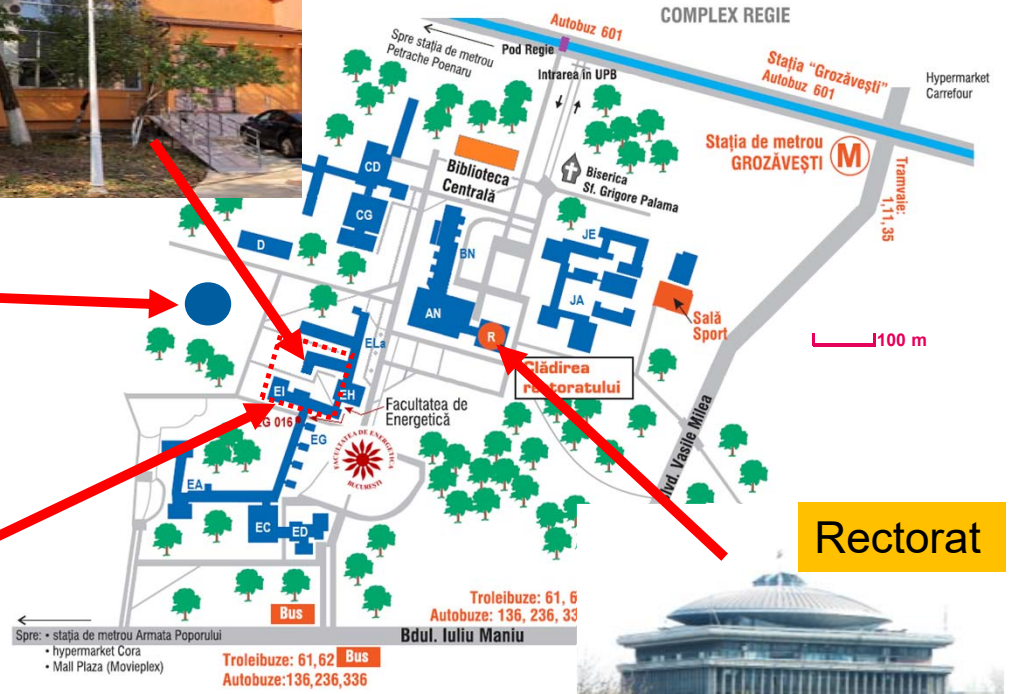
Location of Bucharest demo-site – UPB Campus

Target Building – RES Laboratory

CHP Plant

Bucharest demo-site



Rectorat

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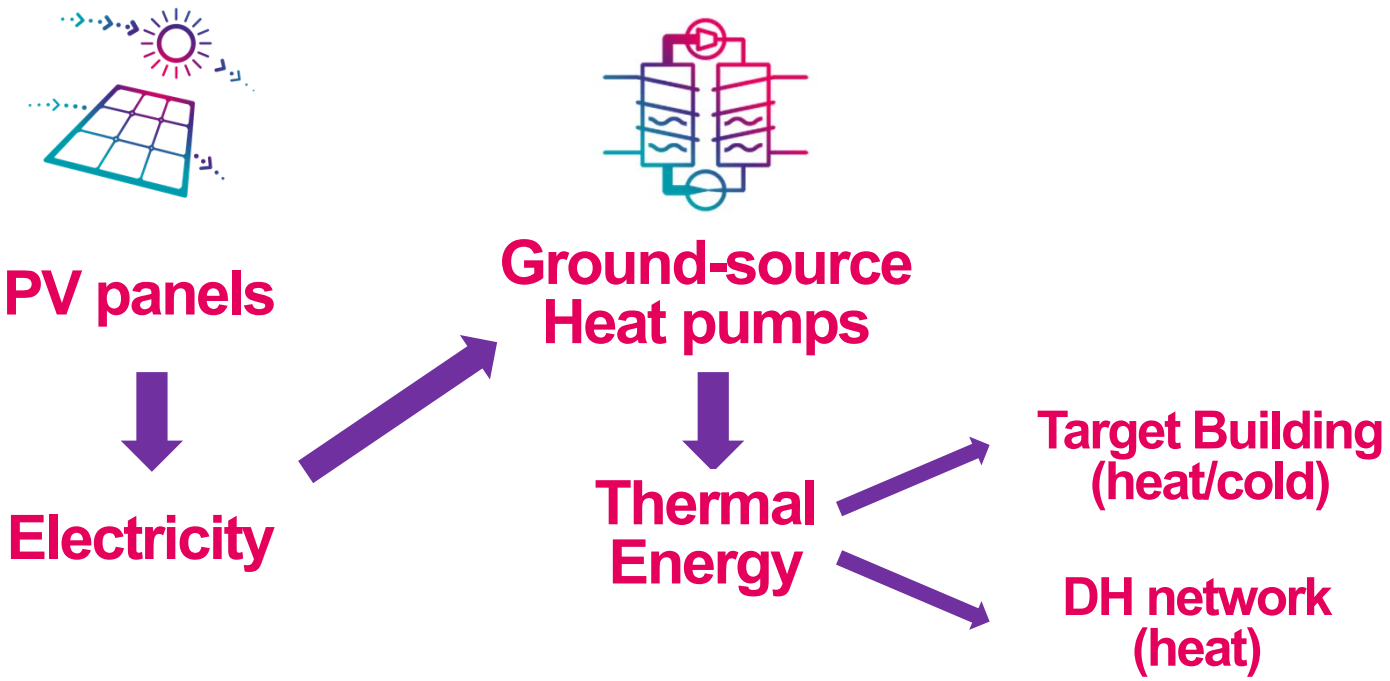
Objectives of UPB Demo

- **generate three forms of energy (electricity, heat and cold) based on a hybrid renewable energy source (geothermal and solar);**
- **the electricity produced to cover at least the consumption of the thermal energy generation unit (on a yearly basis);**
- **fully cover the heating and cooling demand for the Target Building using thermal energy produced from 100% renewable energy sources;**
- **reintegration of the Target Building into the UPB heat distribution network to inject the overproduction of heat;**
- **develop a modular concept that will ease the process of replication and scaling.**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°857801

Geothermal-PV hybridization concept



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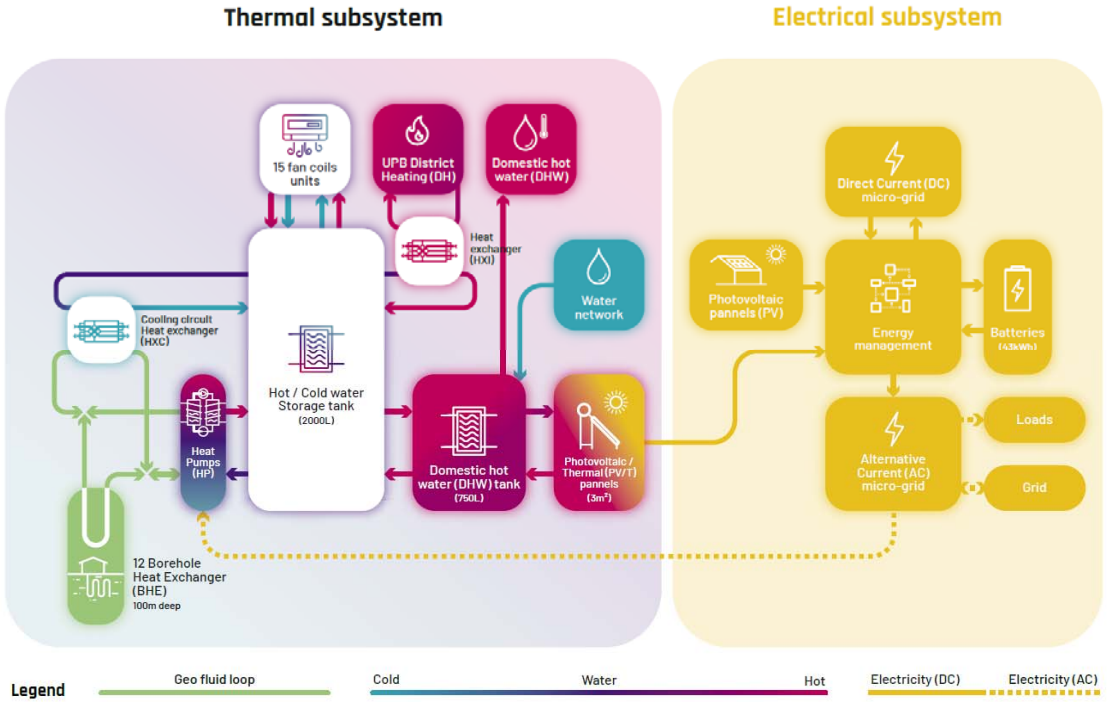
Description of Bucharest demosite



- **Hybridization: geothermal – PV**
- **2 interconected subsystems: thermal & electrical**
- **Electrical energy production to cover the consumption of the thermal subsystem, on a yearly basis**
- **Overproduction of heat produced from RES injected into DH**
- **Zero CO_2 emissions at demo-site level**

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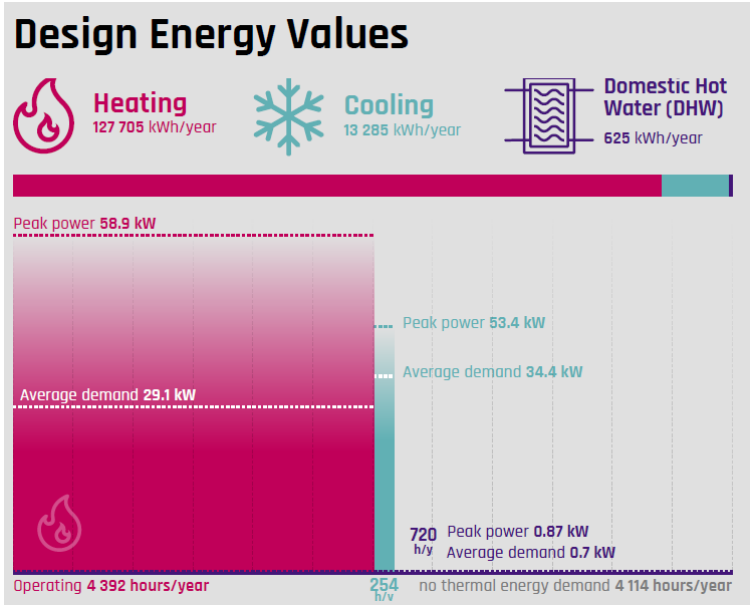

Thermal subsystem

Master ground-to-water heat pump with **42.3 kW heating** and **33.6 kW cooling**

Slave ground-to-water heat pump with **20.5 kW heating** and **16.2 kW cooling**

12 boreholes heat exchangers (BHE): 100m depth

Thermal Energy Storage (TES) tank (Hot Water / Cold Water) of **2000L**

Domestic **Hot Water tank of 750L**
with instant Domestic Hot Water (DHW) production capability

Photovoltaic/Thermal (PV/T) panels (3 m^2)

15 Fan coil units to deliver thermal energy in Target Building (TB)

Electrical subsystem

Total photovoltaic (PV) installed power: **66 kW**

Total electrical energy storage (batteries): **43kWh**

Two subnets

Technological variety

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Equipment deployment areas

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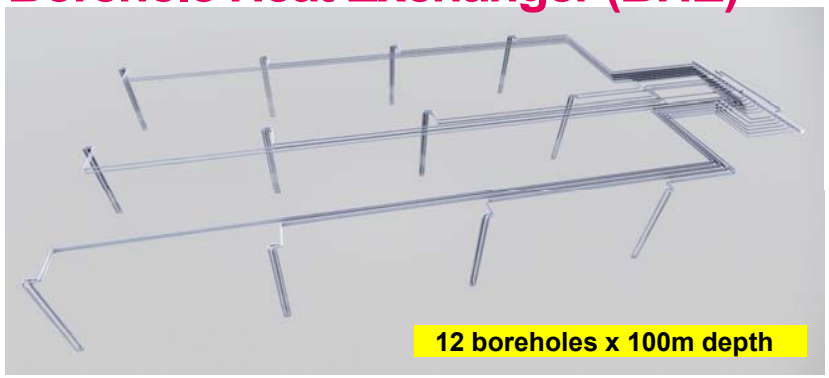
Thermal Subsystem installation

Borehole Heat Exchanger (BHE)



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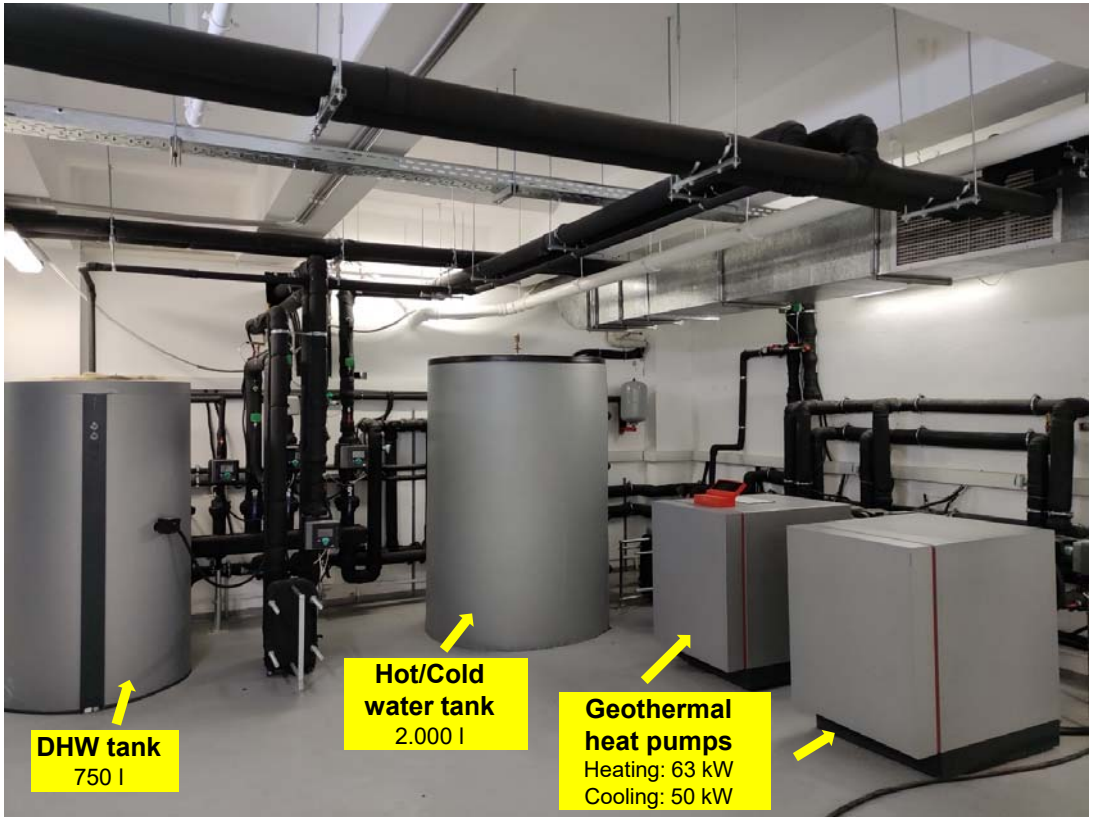
Thermal Subsystem installation

Heat Pump system



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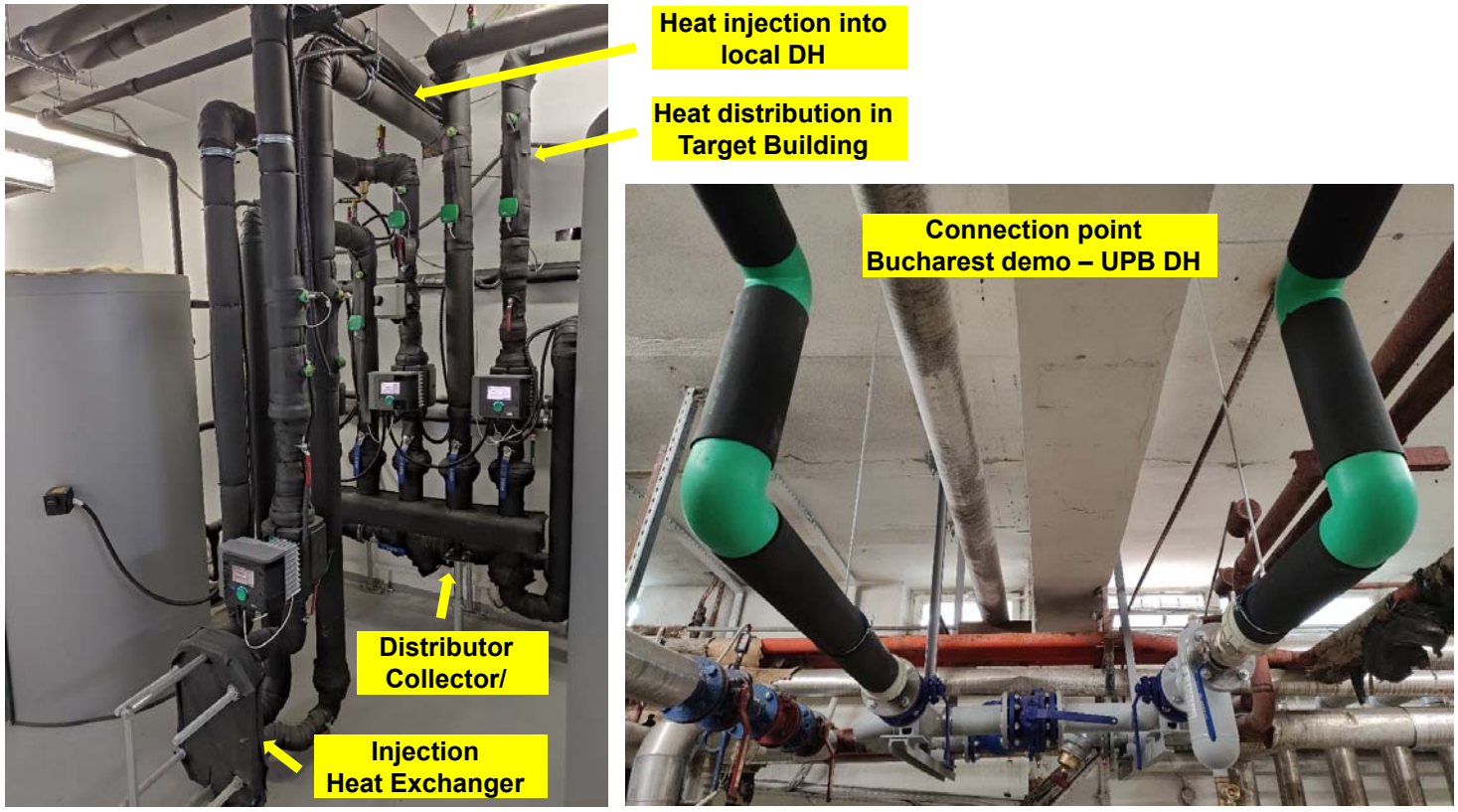
Thermal Subsystem installation

Heat Pump system



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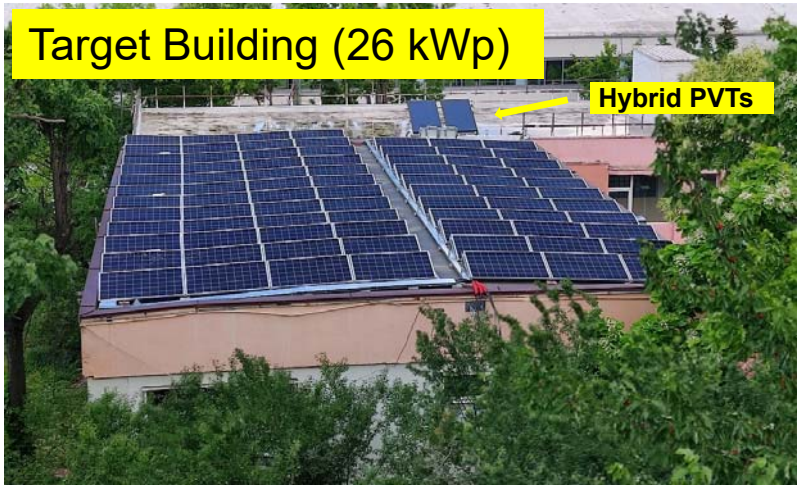
Electrical Subsystem

PV panels

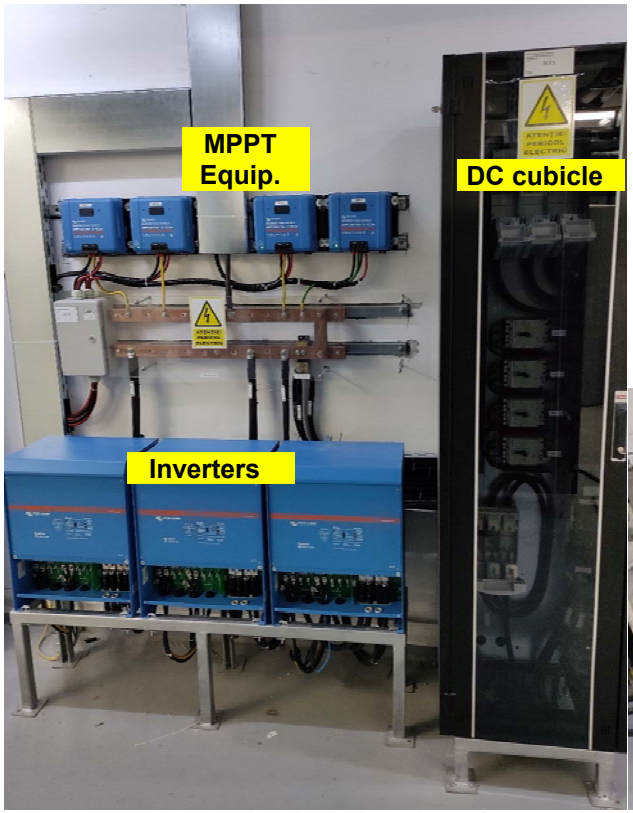
EI building (40 kWp)

Target Building (26 kWp)



Electrical Subsystem – technical room (Target Building)

Batteries, invertors, convertors and auxiliary equipment



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Electrical Subsystem – technical room (EI building)

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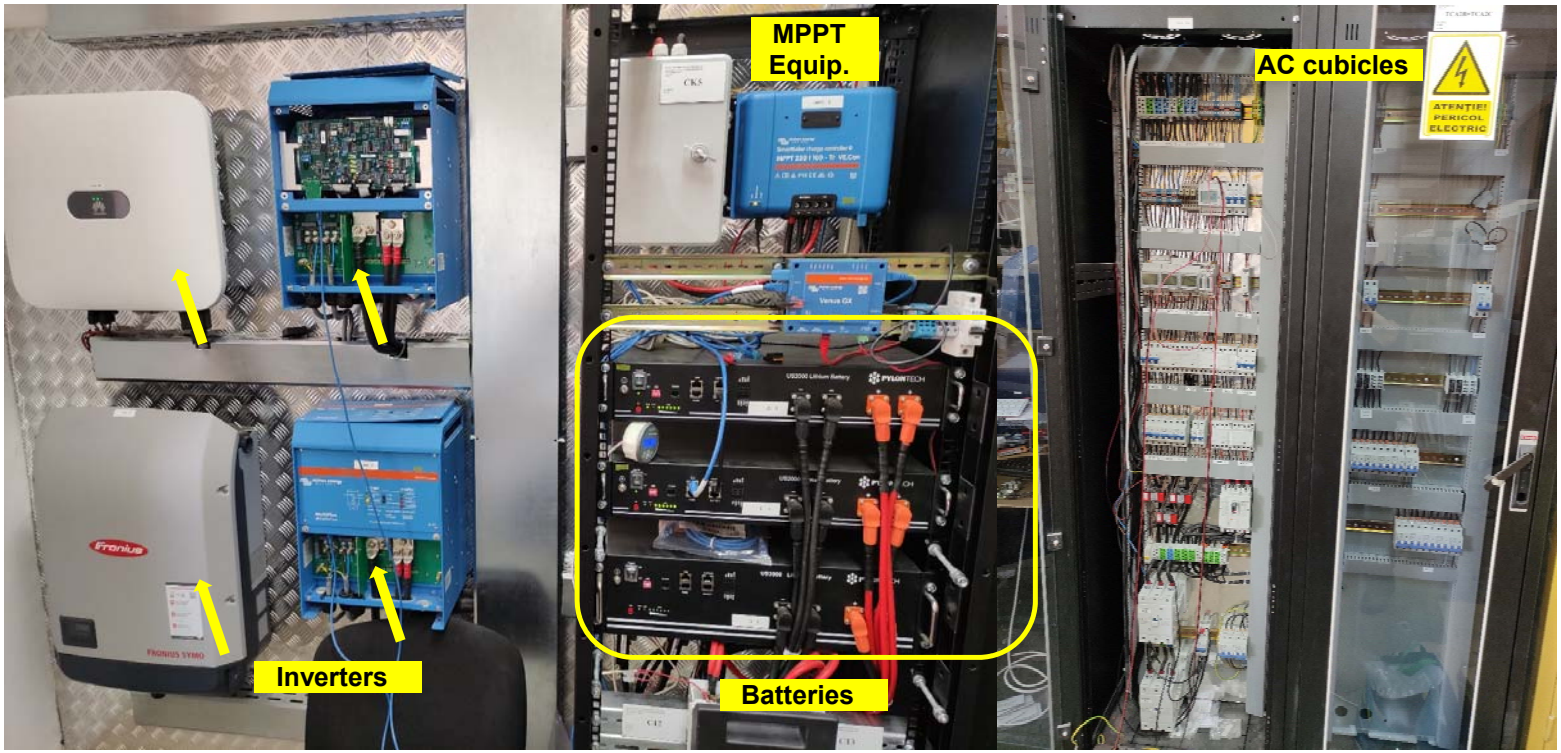

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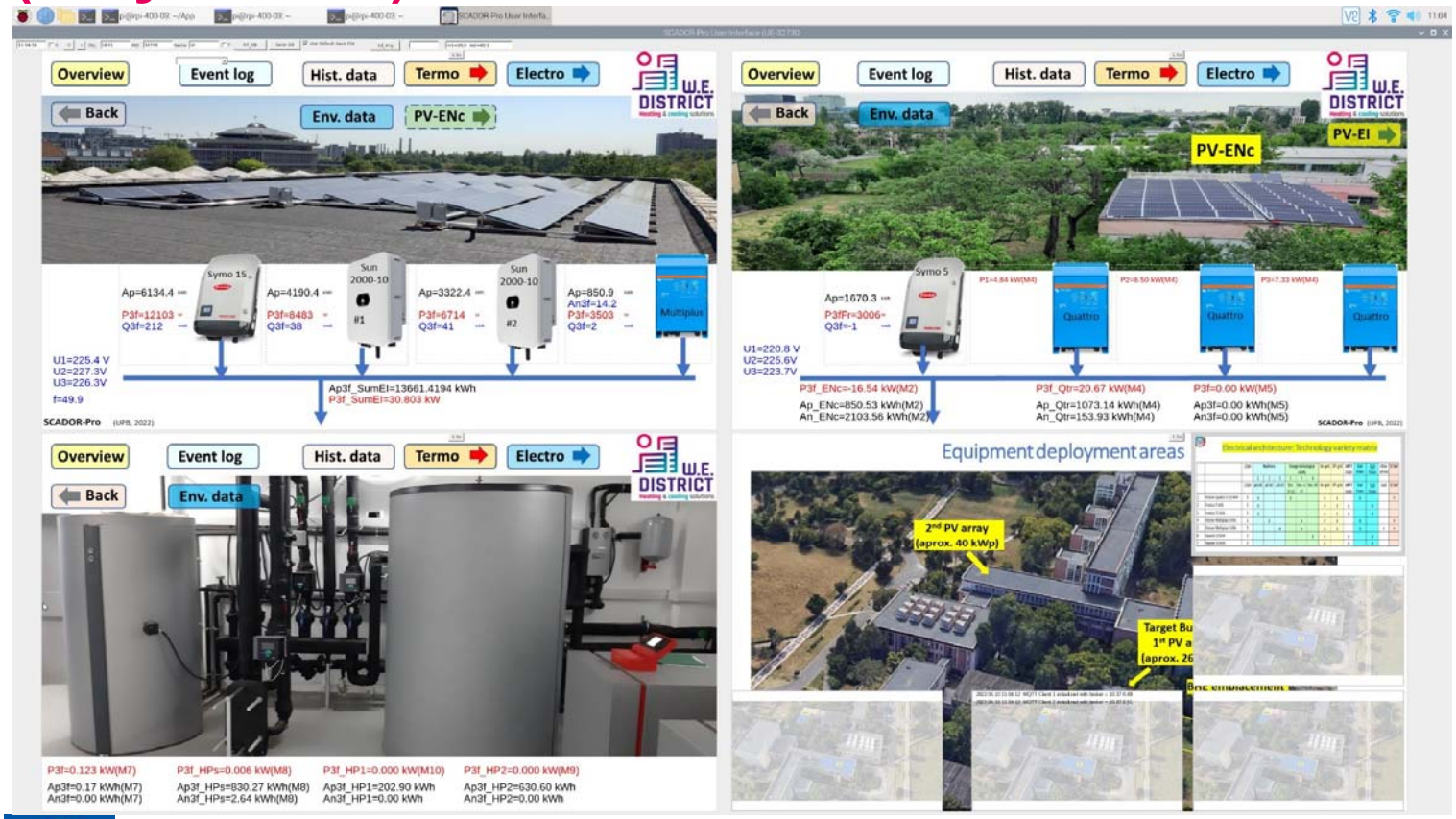
SCADA interface - PV production & HP consumption (early version)



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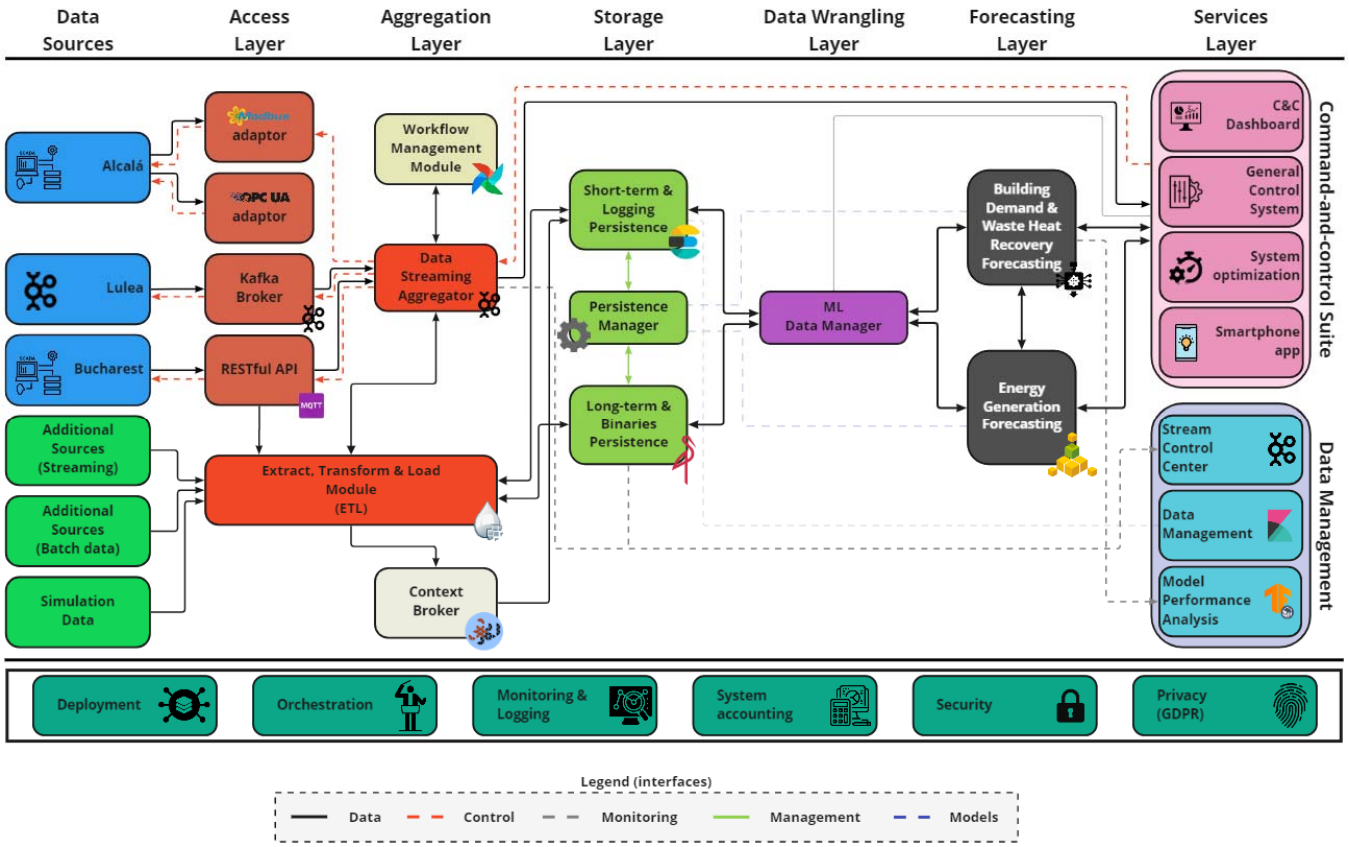
Advanced Digitalization Platform (v2)



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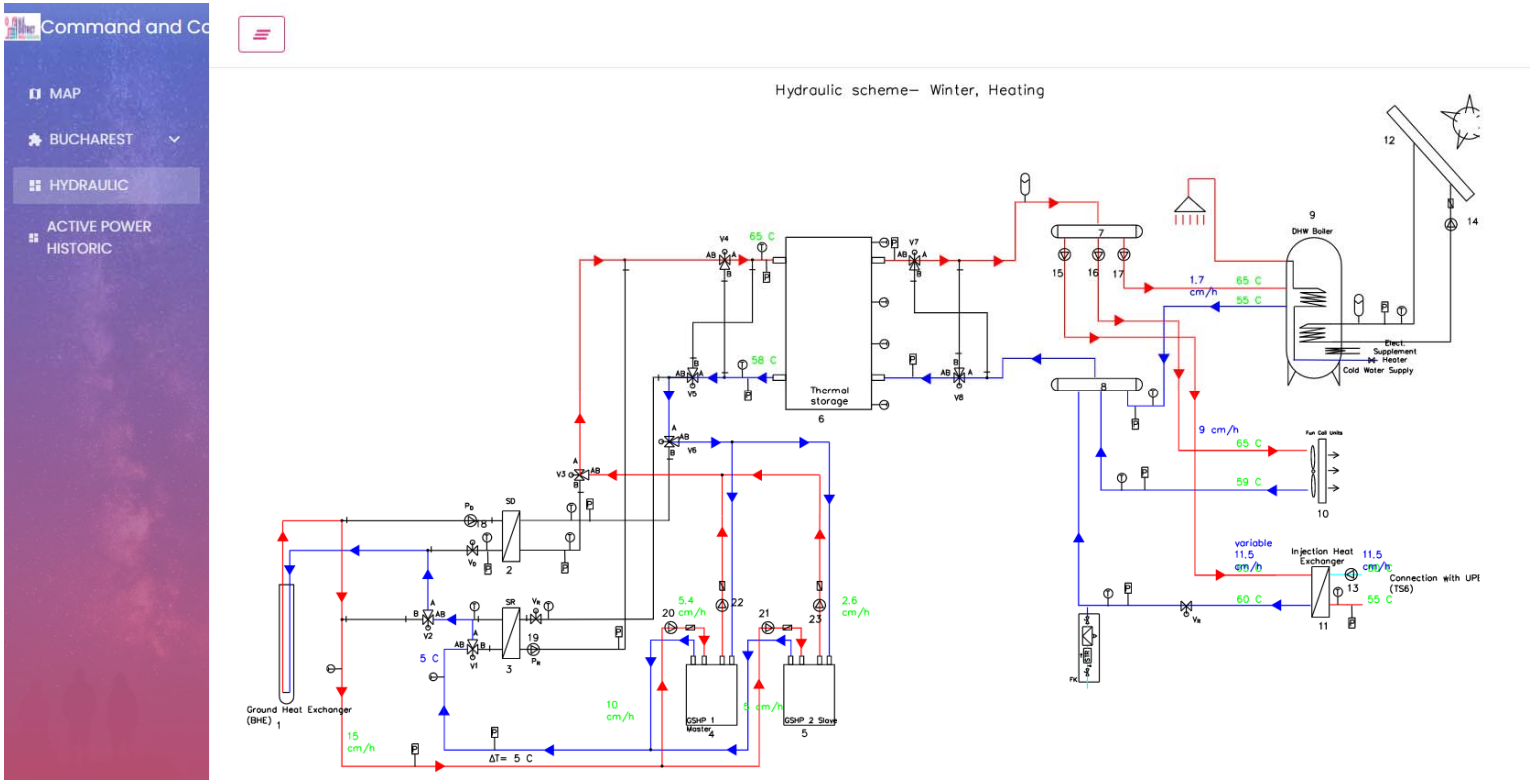
Command-and-Control Suite main features

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°857801

CC-Suite Hydraulic Real Time Diagram



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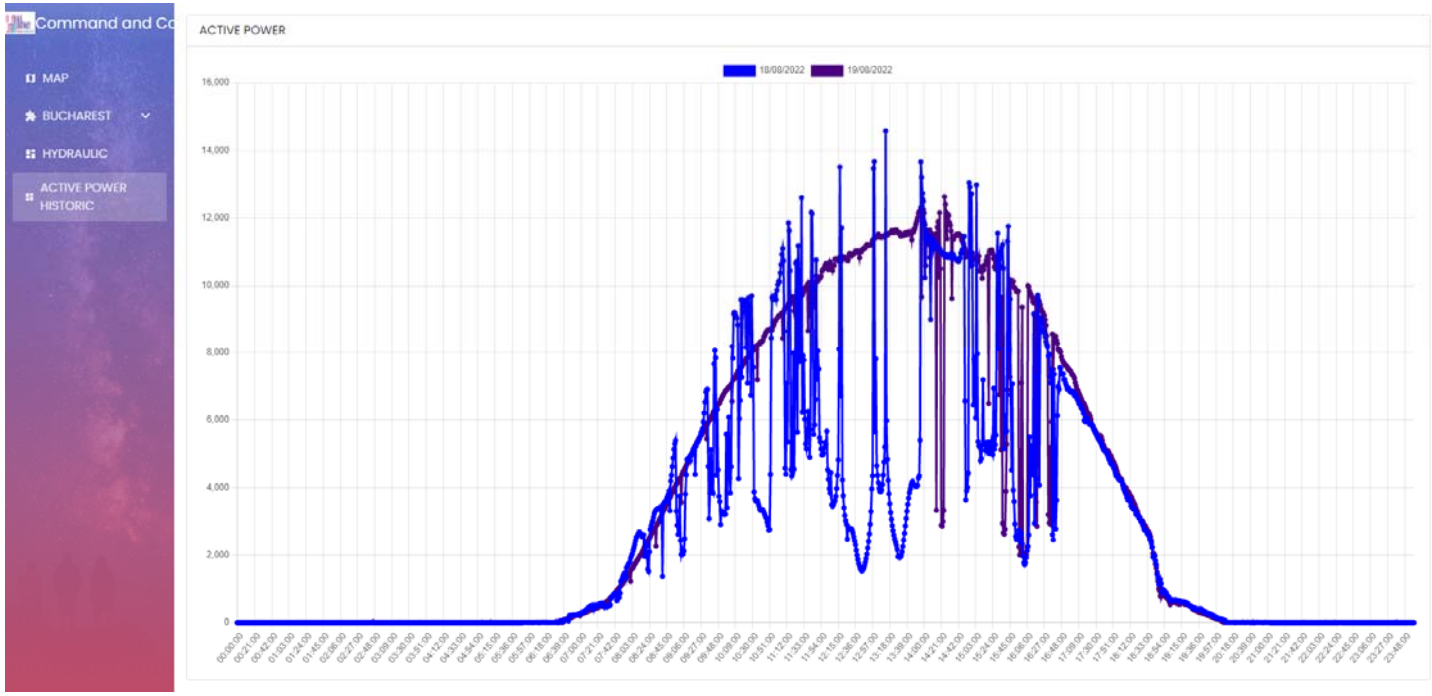
CC-Suite Active Power Historic



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WEDISTRICT Partners

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Thank you!

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SuperP2G - Synergies Utilising renewable Power REgionally by means of Power To Gas

Thursday, September 8th, 2022 | Sustainable Places |
Tools and Technologies for Hybrid Thermal and Electric Grids towards Sector Coupling

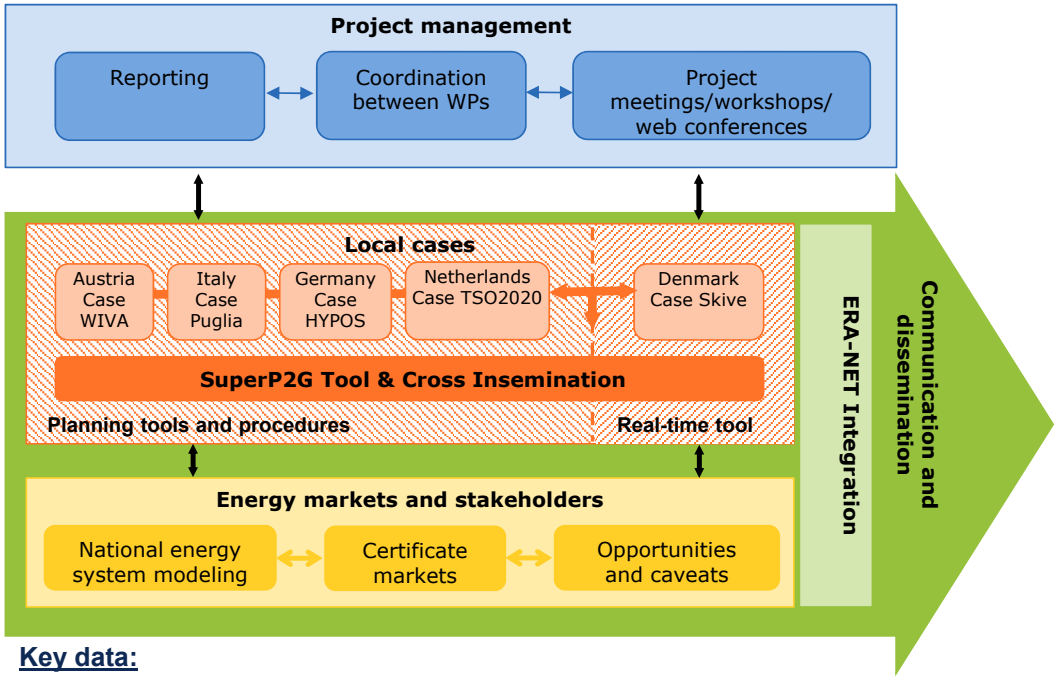
Hans Rasmusson
Sectetery General, ERIG

This project has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems' focus initiative integrated, Regional Energy Systems, with support from the European Union's Horizon 2020 research and innovation programme under grant agreement No 775970

SuperP2G - Synergies Utilising renewable Power REgionally by means of Power-To-Gas

The Project at a glance

- SuperP2G interconnects leading P2G initiatives in five countries, ensuring joint learning.
- Each national project focuses on different challenges, where researchers team up with local need-owners to co-create solutions.
- SuperP2G focuses on improving existing evaluation tools including open access, as well as develop a new open tool based on the “OptiFlow” and “H2IndexII” tools.
- This is supplemented with analysis of regulation and markets, as well as stakeholder involvement.



Key data:

- Duration: 36 Months
- Start: 01.11.2019

Research partners:

- **Denmark:** DTU ME, DTU Elektro, GreenLab Skive
- **Austria:** JKU Linz
- **Germany:** DBI-GTI, DVGW-EBI
- **Italy:** CNR, Uni Bologna
- **Netherlands:** RUG-FEB
- **Europe:** ERIG

The national Cases – Each case has different focus

Netherlands Case – TSO2020
contribute to the realisation of societal objectives in the field of climate policy by **exploring the economic conditions** and **potentials of hydrogen** supply chains **Production, Transport, Storage, Distribution, Trade, Consumption** thereby giving in-depth insight to stakeholders on the **costs and benefits** of several options **to design such a system**

Germany Case – HYPOS
improve existing tools **"H2Index II"** and **"EcoMeth"** for **H2-Prize analysis** and **optimal location of P2G value chains** suitable for the regional development **considering future H2-Demand** and **process engineering and design of P2G-plants**, tailored to fit the **specific application and circumstance**

Denmark Case – GreenLab Skive
make it possible for **local multi-energy carrier-based business park** to manage **multiple value streams** in **real time** as well as **optimise the infrastructure set-up** in a feasible way

Austria Case – WIVA P&G
promote regional integration of renewable energy across energy vectors by providing a **methodology for assessing future demand** for **renewable H2** and **SNG** for the **industry**, including aspects of **cost development** based on existing tools of **"MOVE", "Collect", "Prestige"**

Italy Case – Puglia
allow for national regional smart energy systems and sectoral integration evaluation including P2G by providing a **national database for dynamic power production** info and **hydrogen demand** based on **public available data** added with **own results** of analysis and **laboratory tests**

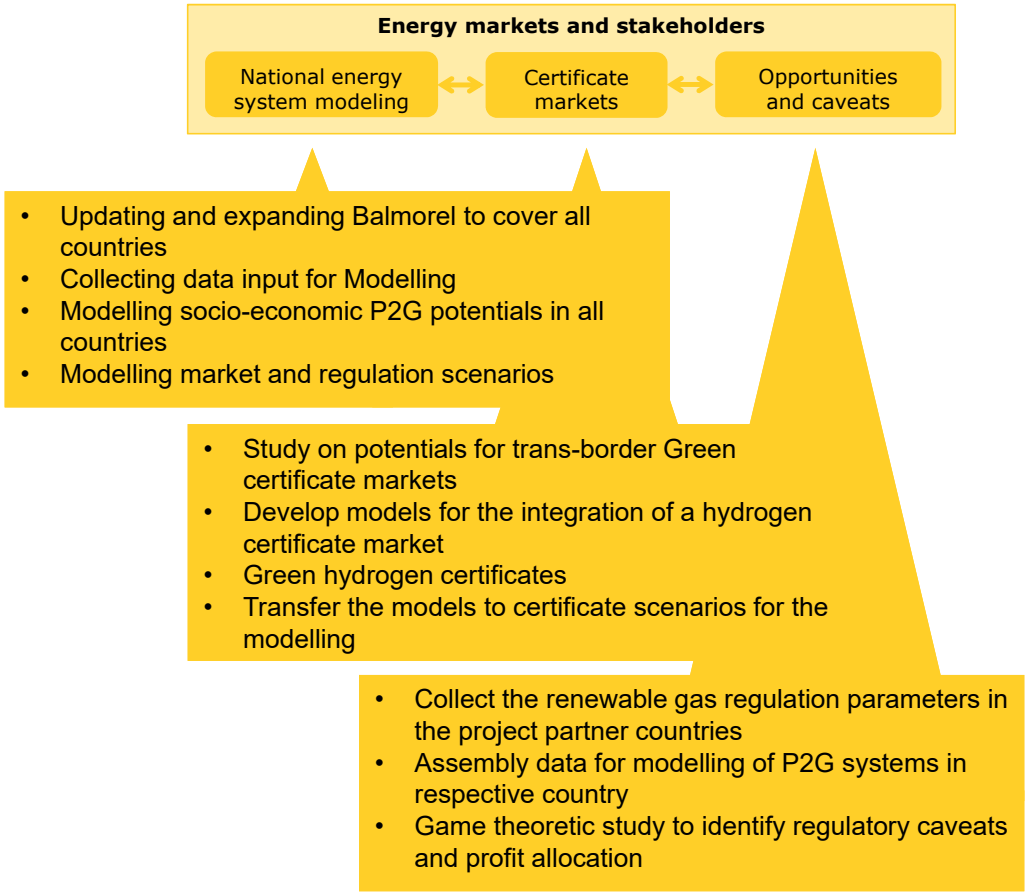
Overarching energy markets and stakeholders overview complement the national cases

has the objective to…

facilitate commercialization of P2G projects through improved markets, regulation and stakeholder involvement

The goal is to…

- gather best practice results from national projects with regard to technology, goods and services and stakeholder/adoption.
- These inputs, together with inputs from need-owners, such as the affiliated TSO's and DSO's, feed into the analysis of regulation and markets, including the green gas certificate market and the game theory analysis.
- It also feeds into the national energy system modelling, which is used for assessing the future potentials for P2G in the different countries.



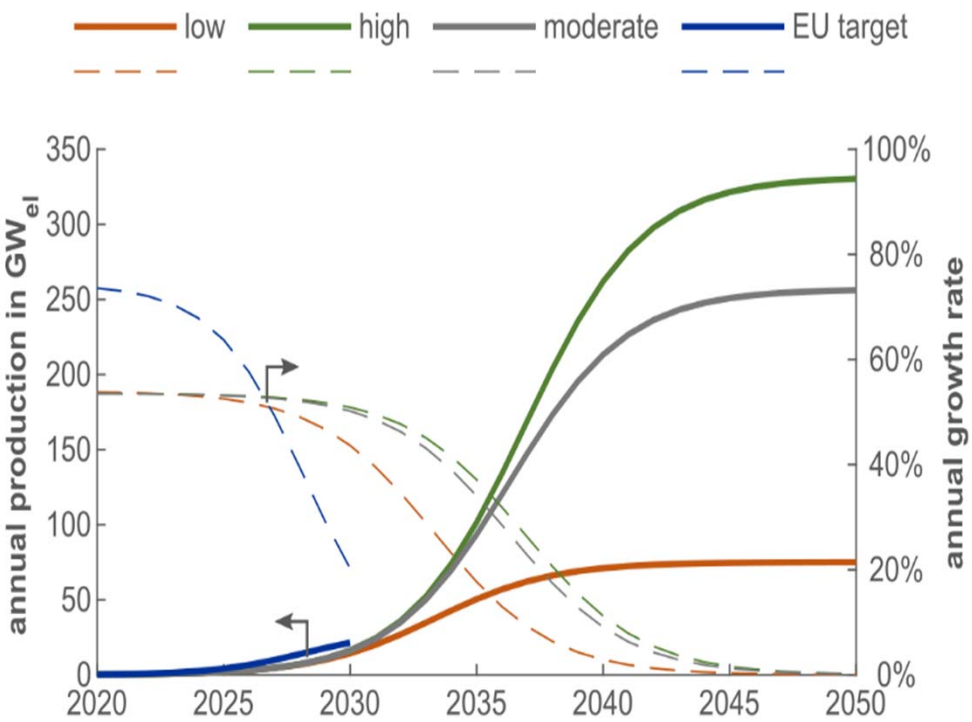
Intermediate results from JKU-Linz on future demand of installed PtGas capacity

Global need for PtG as H2 or CH4

- H2 demand for **chemical industry** (primary ammonia and methanol synthesis) approx. **3781 TWh/a**
- Demand for direct reduction in **steel production** around **1851-2639 TWh/a**
- Global potential for PtG **storage** capacities up to **2,360 GWel**

Scenario	Electrolysis capacity in GW_{el}	Methanation capacity in GW_{SNG}	Notes
Low	1,310	0	• PtH_2 for chemical industry (ammonia, refinery, methanol synthesis) only • No PtM
Moderate	3,670	280	• PtH_2 for chemical industry • PtM with intermediate H_2 storage
High	4,530	1,360	• PtH_2 for chemical & steel industry • PtM without intermediate H_2 storage

Annual Production and Growth Rates for Electrolysis



JKU-Linz projection of potential cost reduction of PtGas technology

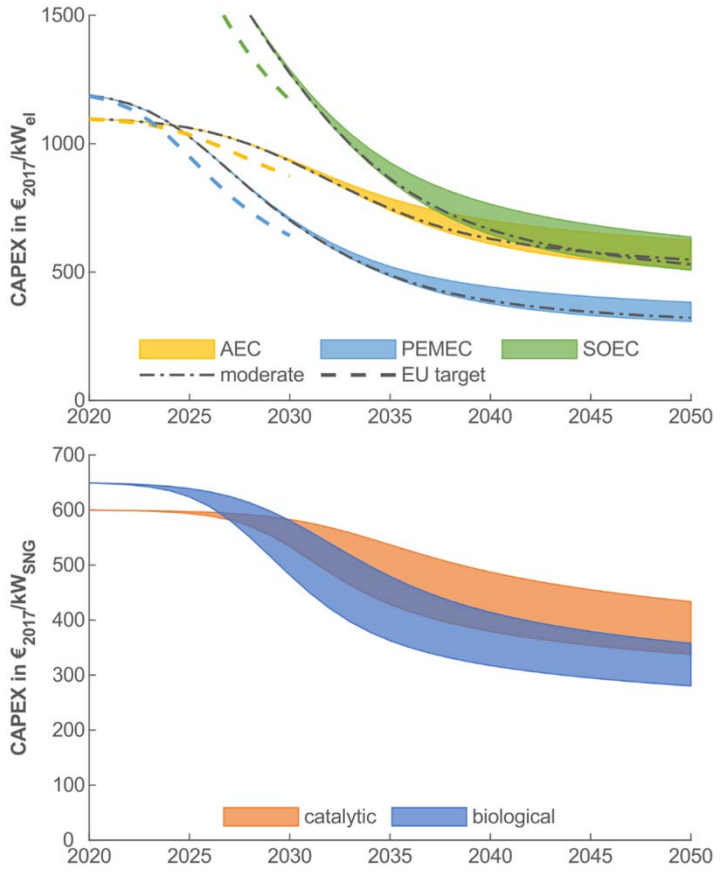
Results obtained with the tool „CoLLeCT“

Electrolysis:

- Only **minor short term cost reductions** expected for **alkaline electrolysis**
- **PEM** electrolysis can **undercut alkaline** technology costs permanently in the **short and medium term**
- **HT electrolysis** is (related to input capacity) only **competitive in long-term** considerations

Methanation:

- In the long term **higher reduction potentials** are expected for **biological methanation**
- Altogether, **both technologies** (catalytic & biological) are on a **similar cost level** over the whole observation period
- Aligned to cost data from recent implementation projects (Store&GO; 3 different plants)



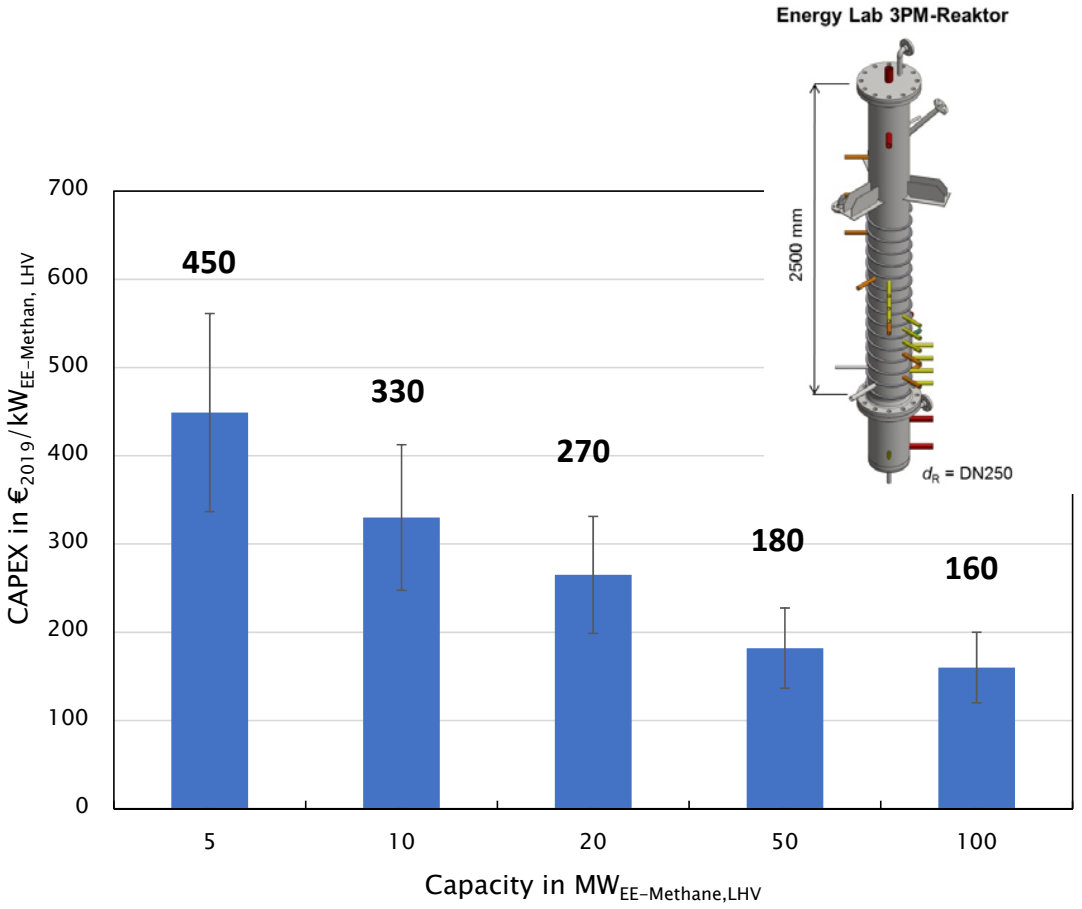
Results at DVGW-EBI indicates better performance at similar costs with emerging methanation technologies

Three Phase Methanation Technology

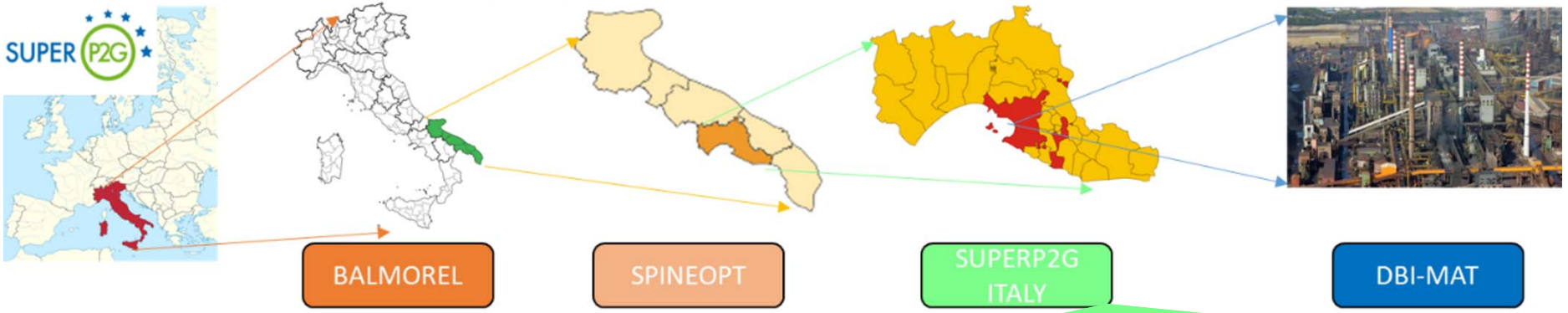
- **High dynamic operation** possible
- **High thermal conductivity** due to the liquid phase → Avoidance of hot spot formation → catalyst deactivation is avoided

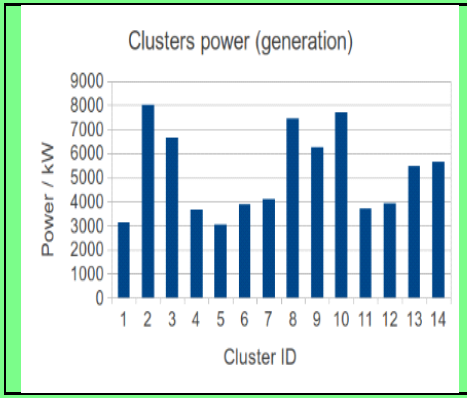
- **Technical and economic evaluation** of a three-phase-methanation (3PM) reactor on the basis of the demo plant at **KIT Energy Lab 2.0**
- Data included into the **EcoMeth Tool**

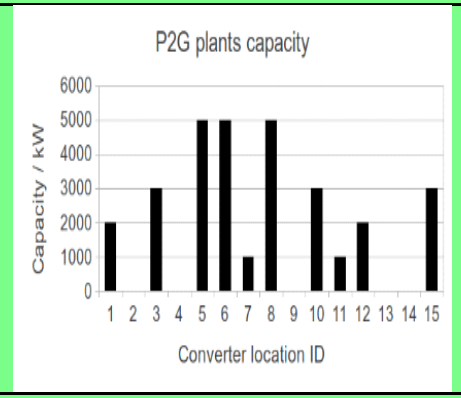
- **CAPEX** cost for a **5 MW** plant are **330 €/kWLHV** with regard to methane output
- **CAPEX** could be reduced to **160 €/kWLHV** for **large scale plants**

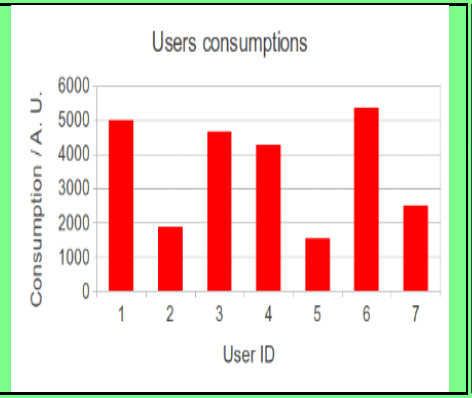


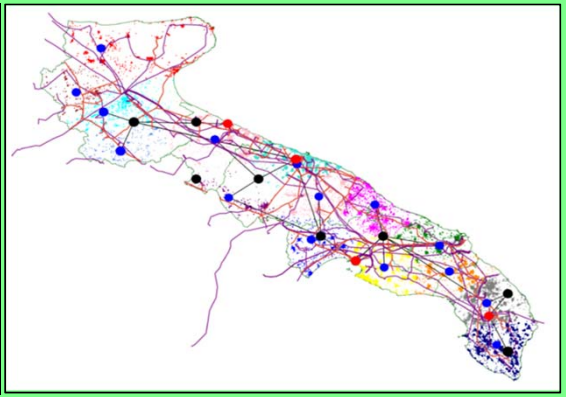
Many of the tools in SuperP2G has been applied in the Italian case in Puglia – an Italian SuperP2G-tool developed by CNR-ITAE





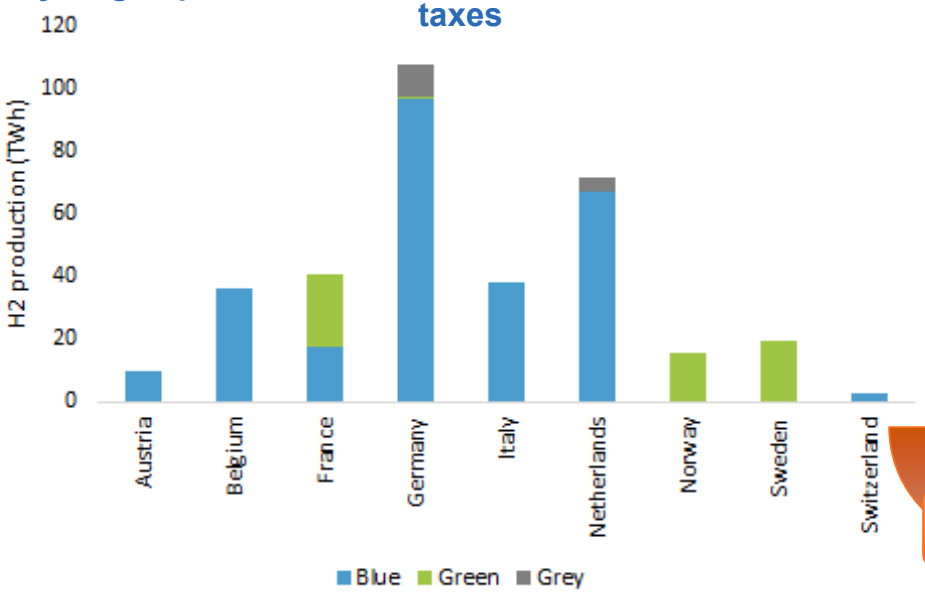






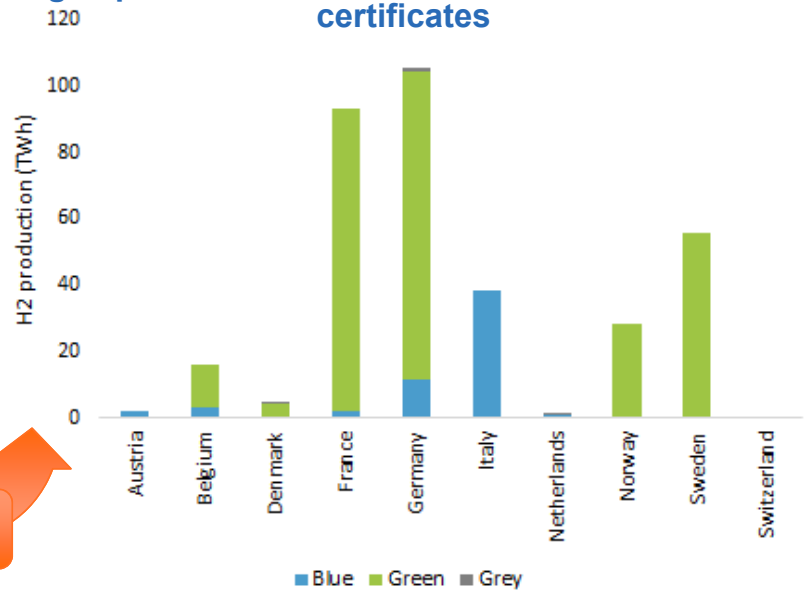
Results of the analysis on certificate prices for green H2 and its effect on the corresponding demand by DTU MAN

Hydrogen production mix in 2030 for reference case with taxes



2 €/MWh Certificate

Hydrogen production mix in 2030 scenario with taxes and certificates



- Germany has the highest production followed by the Netherlands.
- Imposing the environmental tax on grey H2 while exempting the blue hydrogen will make blue H2 competitive in 2030.
- Green H2 is produced in countries with relative lower electricity prices.

- Norway, Sweden and Denmark producing only green H2.
- Italy, Austria and the Netherlands maintain blue H2 dominance.
- Italy assumptions for electricity costs are forcing the blue H2 to be competitive vs the green H2

Main challenges encountered during SuperP2G

For the implementation of PtGas

Supply-side barriers:

- Still high LCOE and investments

Demand-side barriers:

- Renewable fuel consumers, missing promoting schemes

Regulatory barriers:

- Renewable fuel certification

Infrastructural barriers:

- Transport of hydrogen

Modelling and tool development

Poor availability of data:

- from the industry e.g. demand of resources
  - difficulties in estimating local hydrogen demand in automotive and industrial sectors
- from previous studies (results published, but not with datasets)

Availability of tools:

- too much choices with poor distinction

Remaining Timeline of the Project

Denmark: Finalize modelling of socio-economic potential of hydrogen production in EU
Netherlands: Publication of final results and scientific papers concerning P2G and flexibility

Germany: H2 Index III developed
Finalizing modelling of **markets and regulation**
SP2G Tool calculations and final testing

September | October | November | December | January | February | March

Austria: Future H2/SNG demand & cost development

National Workshops in the **Netherlands** and **Germany**

Denmark: Results from GLS application

Italy: Simplified tool for green hydrogen potential and P2G planning for local energy systems

Final Report

Final SP2G Event on European Level

www.SuperP2G.eu
LinkedIn: Showcase/superp2geu

Thank you!

Disclaimer
The content and views expressed in this material are those of the authors and do not necessarily reflect the views or opinion of the ERA-Net SES initiative. Any reference given does not necessarily imply the endorsement by ERA-Net SES.

About ERA-Net Smart Energy Systems | www.eranet-smartenergysystems.eu
The transnational joint programming platform (JPP) ERA-Net SES unites 30 funding partners from European and associated countries. It functions as a network of owners and managers of national and regional public funding programs in the field of research, technical development and demonstration. It provides a sustainable and service-oriented joint programming platform to finance transnational RDD projects, developing technologies and solutions in thematic areas like smart power grids, integrated regional and local energy systems, heating and cooling networks, digital energy and smart services, etc.

Hans Rasmusson
Sectetery General, ERIG

This project has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems' focus initiative integrated, Regional Energy Systems, with support from the European Union's Horizon 2020 research and innovation programme under grant agreement No 775970

HEATflex

- Duration: 05.2019 – 04.2022 (36 month)
- ERA-NET SES RegSys 1st Joint Call
- Lead: Plan Energi (DK)
- Projectpartners:
  - 4ward Energy Research GmbH (AT)
  - Reiterer & Scherling GmbH (AT)
  - Güssing Energy Technologies GmbH (AT)
  - Regelungs- und Verteilerbau GmbH (AT)
  - Energy Cluster Denmark (DK)
  - Viborg Fjernvarme (DK)

Smart Energy Systems ERA-Net

Co-funded by the Horizon 2020 programme of the European Union

powered by klima+ energie fonds

Innovation Fund Denmark

4ward Energy Research GmbH

Reiterer & Scherling Ingenieurbüro - Unternehmensberatung

GET www. .ac.at Güssing Energy Technologies

rvb

energy CLUSTER DENMARK

PlanEnergi

viborg varme

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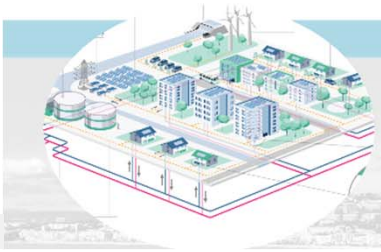


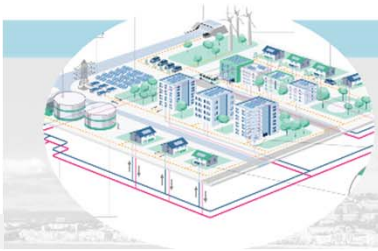
SECTOR COUPLING

Tools and Technologies for Thermal and Electric Grids towards Sector Coupling

SEP. 6TH – SEP 9TH, 2022 NICE, FRANCE

Main relevant output:

- **HEATflexcel Production Tool** – A tool for estimating the (positive) effects of integrating waste heat, sector coupling and renewable energy sources into heating networks
- **HEATflexcel Grid Tool** - A tool for calculating the effects that can be achieved by reducing network temperatures and other measures in heat networks
- **HEATflex Toolbox** – A toolbox developed in the project for technical/economical integration, business cases and roadmaps



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Tools and Technologies for Thermal and Electric Grids towards Sector Coupling

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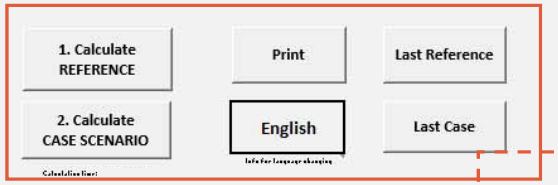
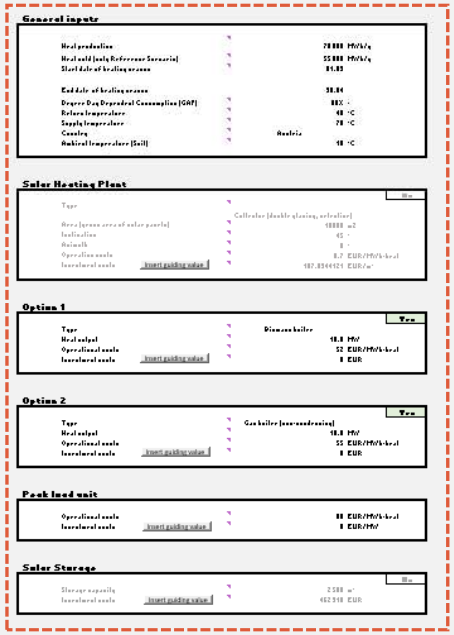
What is HEATflexcel Production?

Free to download and 'how to use' video:
https://www.heatflex.dk

Buttons to run the calculations

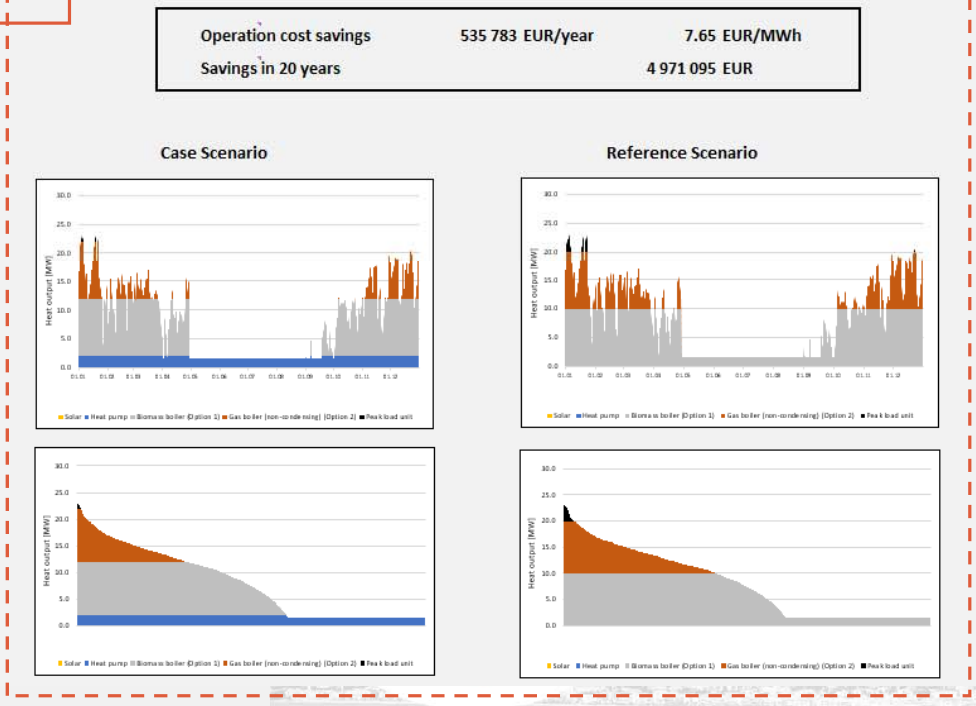


input area

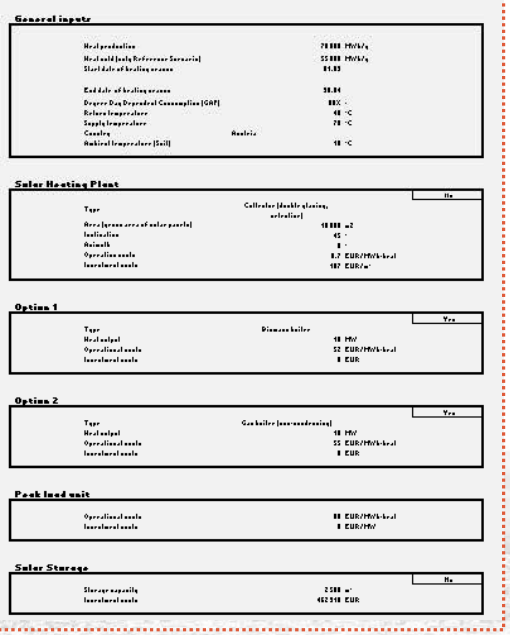


HEATflexcel Production

first output



Inputs of the last reference scenario



HEATflex

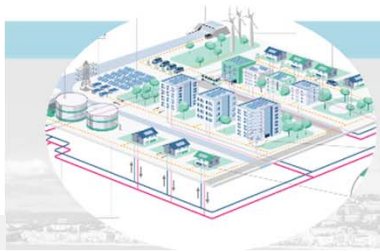
Baseline

Current situation, energy			*Temperatures in the grid and soil*			*Financial Accounting*		
Sales of heat per year	50 000	MWh/y	Supply temperature	90	°C	Fixed costs	1 000 000	EUR/y
Production of heat per year	62 000	MWh/y	Return temperature	60	°C	Fuel cost	35	EUR/MWh
Loss of heat per year	12 000	MWh/y	Soil temperature	10	°C	Service costs	25	EUR/MWh
Loss of heat in %	19%					Total costs	4 720 000	EUR/y
						Revenue	5 050 000	EUR/y
						Interest rate	3%	
Grid data			*Revenue data*			*Results*		
Length, servicelines (channel m)	25 000	m	Fixed cost tariff per customer	350	EUR/consumer/y			
Length, grid (channel m)	30 000	m	Fixed cost tariff per square meter	0	EUR/m2/y	**Profit**	**330 000**	**EUR/y**
Heatloss, service lines	14,0	W/m	Energy tariff	80	EUR/MWh			
Heatloss, service lines	3 066	MWh/y	Number of consumers	3 000	Pieces	**Profit (20 years)**	**5 239 567**	**EUR**
Heatloss, grid in streets	8 934	MWh/y	Heated floor area	390 000	m2			
Heatloss, grid in streets	34	W/m	Average cost	1 683	EUR/building			

HEATflexcel Grid Tool

- Excel based
- No detailed grid simulation
- Free and easy to use, e.g. for grid operators
- Make quick (economic) statements about improvements (decision support)
- Changes and additions possible

SUSTAINABLE PLACES



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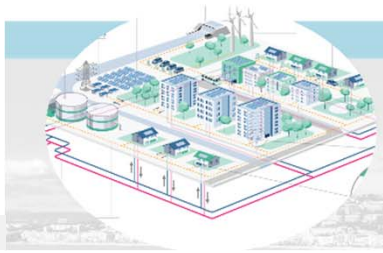
Scenario A; Effect of lower temperatures in grid

Reduction of supply temperature	0,5	°C per year	Minimum supply temperature	70	°C	**Results**	
Investments on cooling	50 000	EUR/y	Minimum return temperature	45	°C	**Profit (20 years)**	**5 557 737 EUR**
Decrease return temperatur	0,3	°C per year				**Improvement in relation to the baseline**	
More efficient production units	0,2%	per degrees lower flow temp.				**Savings (20 years)**	**318 170 EUR**
More efficient production units	0,2%	per degrees lower return temp.					

HEATflexcel Grid Tool

- Input for the baseline
- Effects of lowering grid temperatures
- Effects on refurbish of the grid
- Densification and network expansion
- Decentralized producers and prosumers

SUSTAINABLE PLACES



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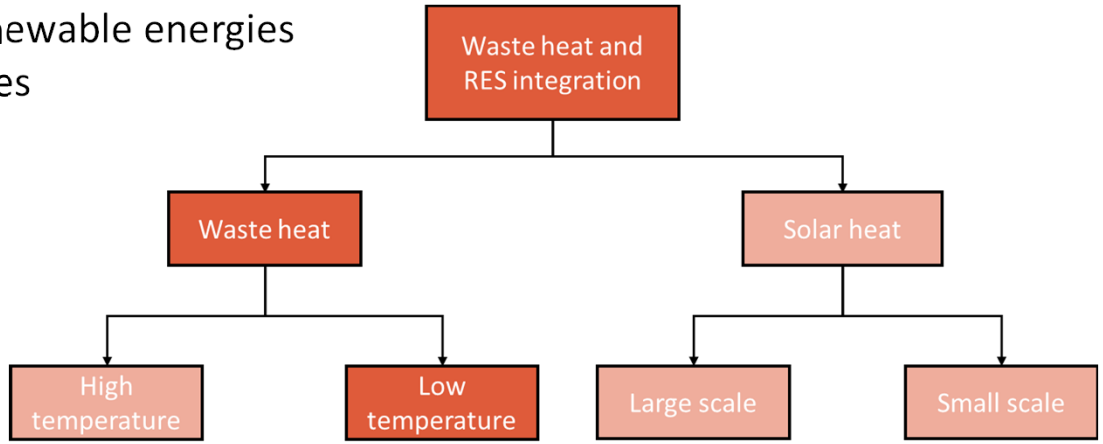
Roadmap

- Roadmap 1: Feed-in of waste heat and renewable energies
- Roadmap 2: Reduction of grid temperatures
- Roadmap 3: Flexibility measures



Link: https://heatflex.dk/toolbox/

HEATflex

- Roadmap
- Technical aspects
- Regulative/legal aspects (incl. safety aspects)
- Calculation models/tools
- Business cases

Link: https://heatflex.dk/toolbox/

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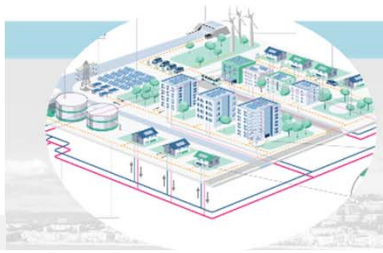

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HEATflex

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This project has been funded by partners of the ERA-Net SES 2018 joint call RegSys (www.eranetsmartenergysystems.eu) - a network of 30 national and regional RTD funding agencies of 23 European countries. As such, this project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 775970. On Danish side HEATflex is partly funded by the Innovation Fund Denmark (IFD) under file No 9045-00003B. On the Austrian side HEATflex is funded by the Austrian Climate and Energy Fund.

SUSTAINABLE PLACES

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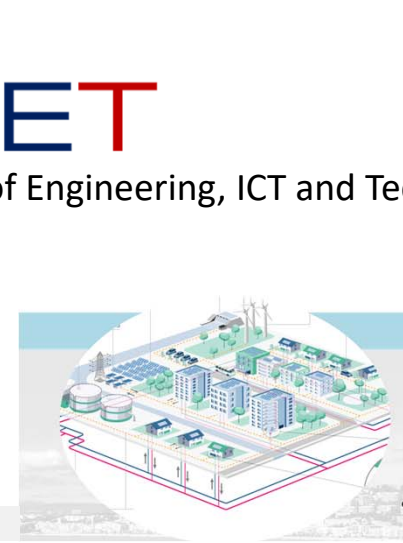
MISSION - Multivector Integrated Smart Systems and Intelligent microgrids for accelerating the energy transitiON

Francesco Sergi
Senior researcher
Institute of Advanced Energy Technologies «Nicola Giordano»
National Research Council of Italy

Department of Engineering, ICT and Technology for Energy and Transport (DIITET)



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MISSION INNOVATION
accelerating the clean energy revolution

Paris agreement at COP 21

- **Formed in 2015 to accelerate clean energy transition**
- **23 countries + EU**
- **Doubling R&I investment in clean energy by 2021**
- **Facilitating greater private sector engagement in clean energy**

SUSTAINABLE PLACES

MISSION INNOVATION ITALY

MINISTERO DELLA TRANSIZIONE ECOLOGICA

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

RSE
Ricerca Sistema Energetico

Consiglio Nazionale delle Ricerche

Mission Innovation ITALY

three years projects:

- ❑SMART GRIDS
- ❑HYDROGEN
- ❑ADVANCED MATERIALS

MISSION INNOVATION
accelerating the clean energy revolution

POA SMART GRID

PROGETTO MISSION - Microreti e sistemi smart, multivettore ed integrati per accelerare la transizione energetica

Mission Innovation SMART GRID

MISSION - Multivector Integrated Smart Systems and Intelligent microgrids for accelerating the energy transitiON

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MISSION INNOVATION ITALY

MINISTERO DELLA TRANSIZIONE ECOLOGICA

MISSION INNOVATION
accelerating the clean energy revolution
POA SMART GRID
PROGETTO MISSION - Microreti e sistemi smart, multivettore ed integrati per accelerare la transizione energetica

A lower level of attention was placed, in the last decade, on thermal networks and the area of integrated multi-vector (thermal-electrical-gas) energy networks was even less explored.

The final goal of this project is the study, **advanced design and implementation of technological solutions that enable the transition of networks towards integrated and smart multi-energy distribution systems.**

ENEA
Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile

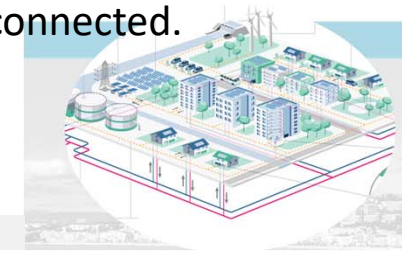
- To develop **two smart grid demonstrators** - microgrid size and full scale - located, respectively, at the CR ENEA in Portici (Smart Energy Microgrid ENEA) and the RSE offices in Milan and Piacenza (Extension multi-energy of the Distributed Energy Resources Test Facility RSE).

RSE
Ricerca Sistema Energetico

- With a view to scalability and replicability, the demonstrators will be designed and built up with a modular approach, i.e. they will consist of smart subnets - nano and / or micro-sized - operating independently or interconnected.

Consiglio Nazionale delle Ricerche

SUSTAINABLE PLACES



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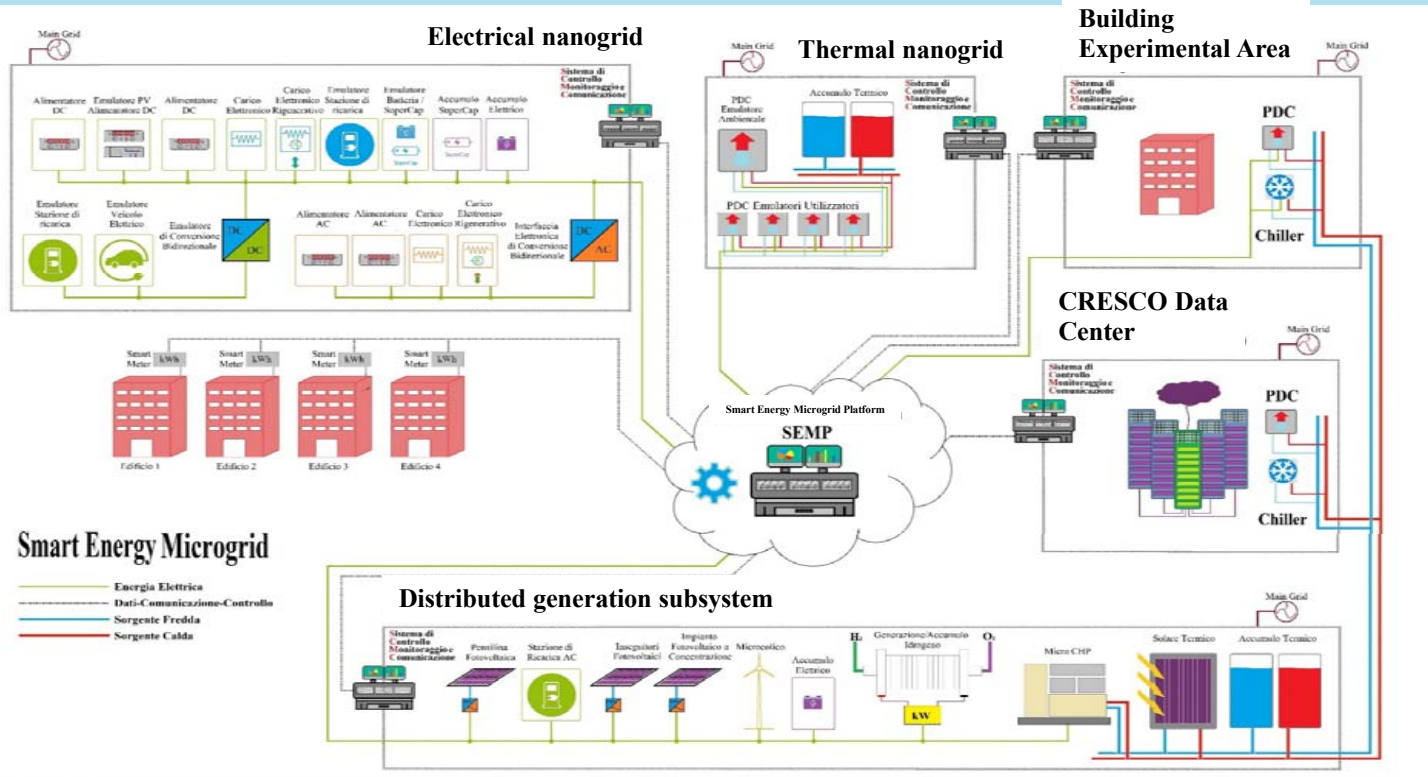
General goals

- Development of the control logic of the local subnets.
- Development of the SEMP control logic and management platform.



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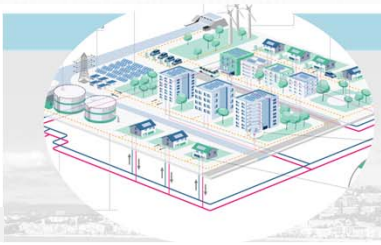

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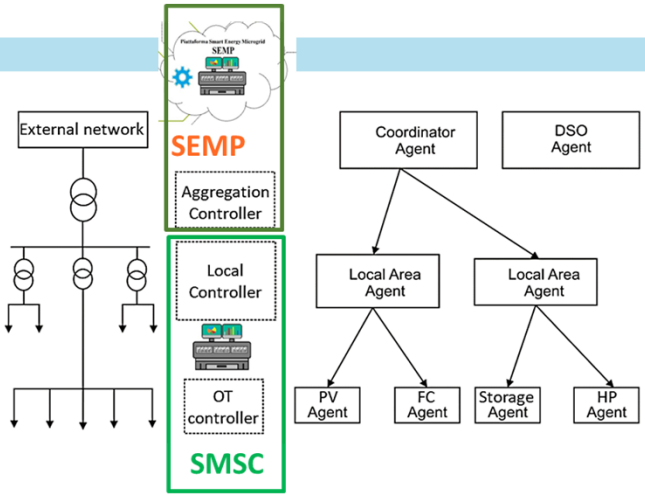


Specific goals

- Development of a flexible control architecture, capable of experimenting both cooperative and competitive logics
- Micro-grid approach of a single user vs micro-grid consisting of several users
- Management of internal resources for the provision of services to the electricity system and to pursue objectives on the prosumer side

Network layer (SEMP) - interface with external entity (DSO, TSO, other): implementation of protocols currently used

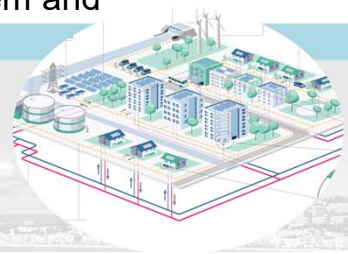
Infrastructure level (SEMP / SCMC) - coordination between the individual sub-networks:

- Definition of metrics for energy enhancement
- Identification of priority objectives

Plant level (SCMC / OT Controller) - distribution of flows within the sub-network:

- Definition of specific cost functions for the technologies present
- Measurement / monitoring of local energy quantities

SUSTAINABLE PLACES



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MINISTERO DELLA TRANSIZIONE ECOLOGICA

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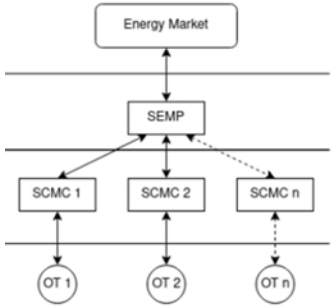
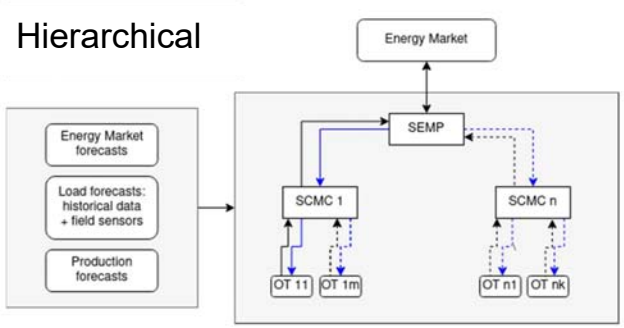
First achievement:

- Assessment of the different logic architectures to be considered during the experimentation
- Analyse of the state of the art of sub-components energy modelling

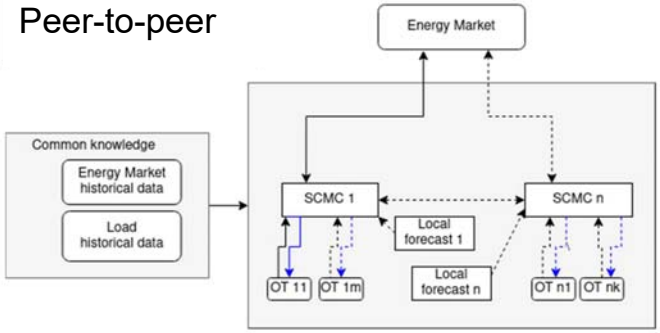


SUSTAINABLE PLACES

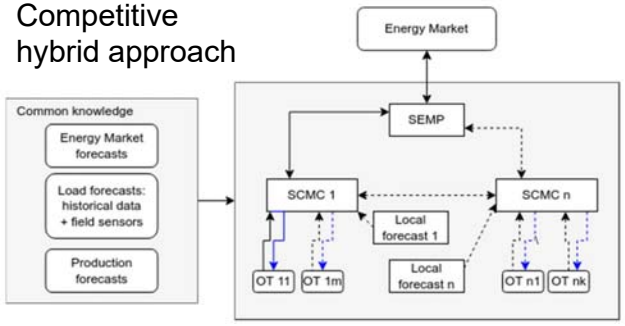
Hierarchical



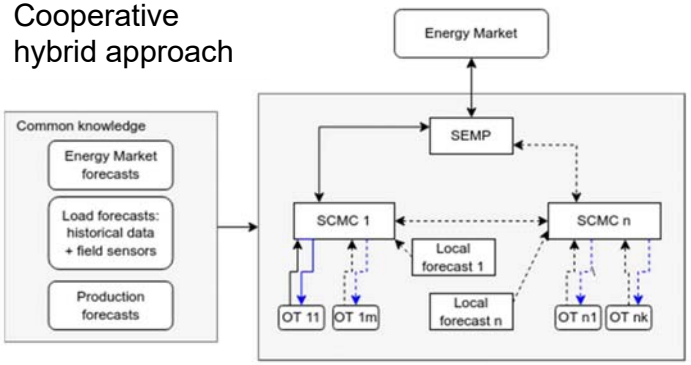
Peer-to-peer

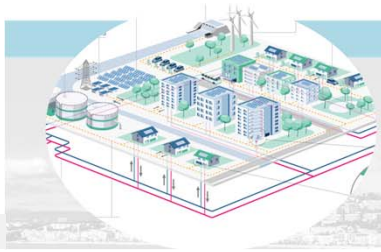


Competitive hybrid approach



Cooperative hybrid approach





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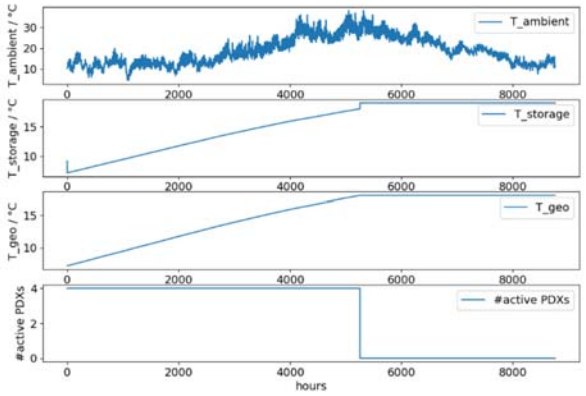
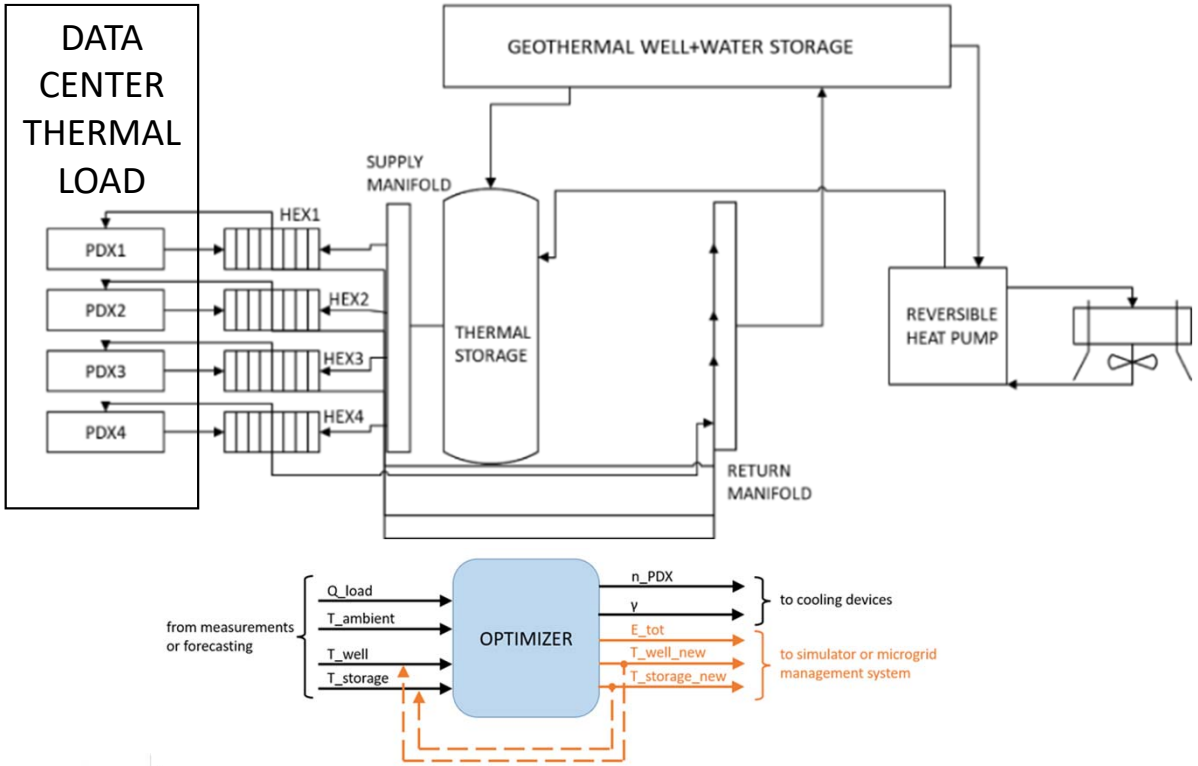
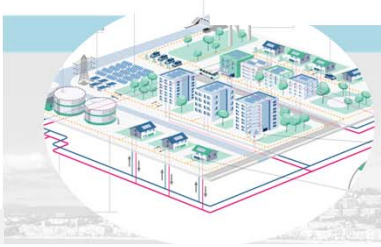
First achievement:

- Preliminary modelling of the thermal Management System of the CRESCO Data Center Cooling and optimization



SUSTAINABLE PLACES





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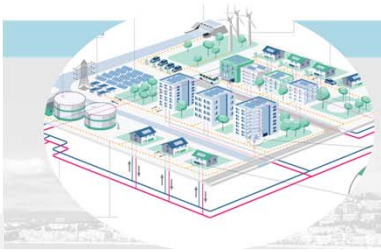
NEXT STEPS

- **To develop a complete modelling of the entire microgrid simulating market operation in the different logic architectures**
- **To design the whole control and communication system, enabling the operation of the different energy vectors and sub-nets**
- **To implement demand response services through the aggregation of distributed resources (two demos working in aggregated mode)**

SUSTAINABLE PLACES



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Many thanks for your attention!

Francesco Sergi
Senior researcher
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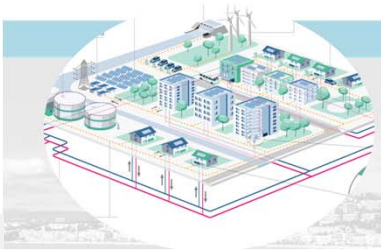
National Research Council of Italy

Consiglio Nazionale delle Ricerche

cnr DIITET

Department of Engineering, ICT and Technology for Energy and Transport (DIITET)

SUSTAINABLE PLACES



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