

MILANO SMART CITY CONFERENCE

23-24 novembre 2021
Fiera Milano, Rho

In concomitanza con
SMART BUILDING EXPO SICUREZZA
MADE expo








Edificio come attore del bilanciamento delle reti elettriche

Enrico Pochettino

Direttore Innovazione IREN

IREN Group

IREN is one of the largest and most dynamic multiutility company on the Italian scene and operates in the following sectors:

-  Electric/thermal energy production
-  Electric energy distribution
-  Waste management
-  Integrated water service
-  Gas distribution
-  District Heating
-  Technological services



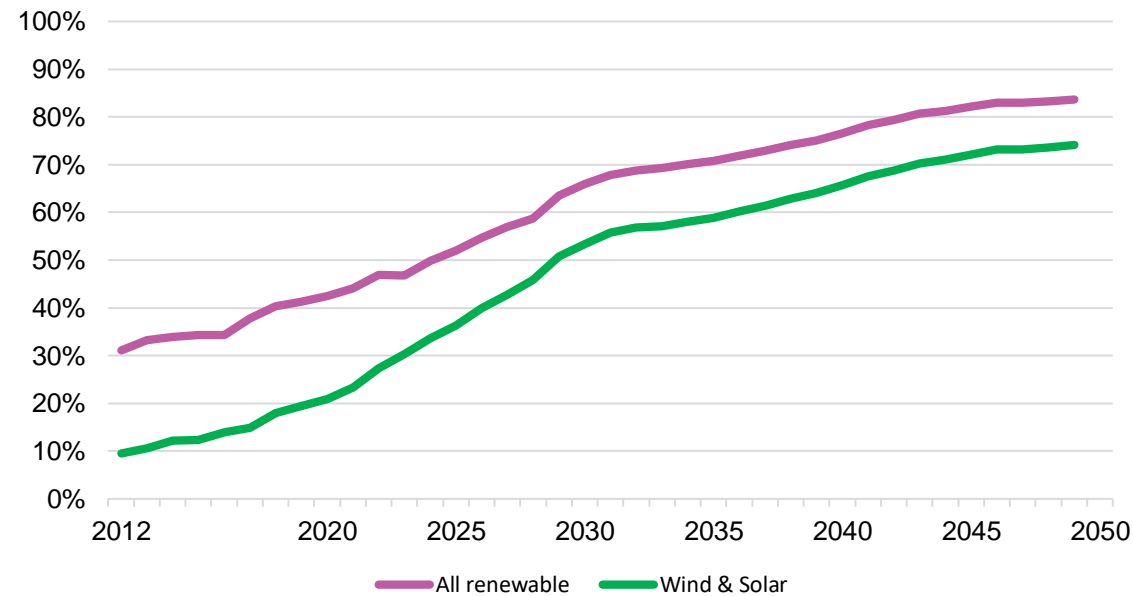
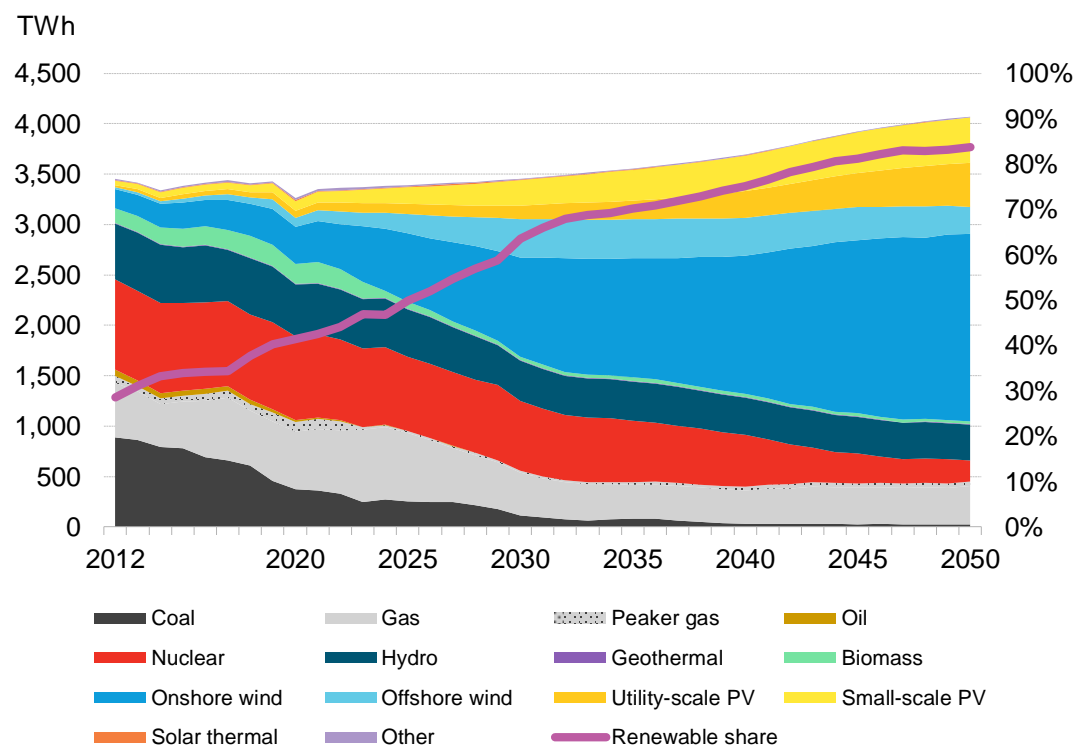
1,9
million customers
ENERGY SECTOR

> 3
Million inhab.
WASTE MANAGEMENT

2,8
million inhab.
I WATER CYCLE

3,7
Billion €
REVENUES

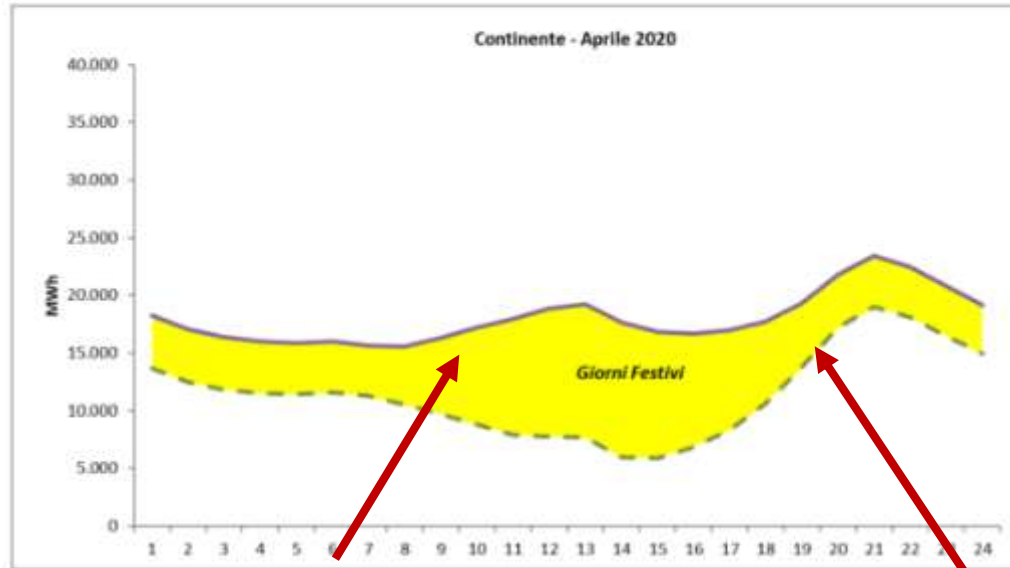
Electricity Generation In Europe: Scenarios At 2050



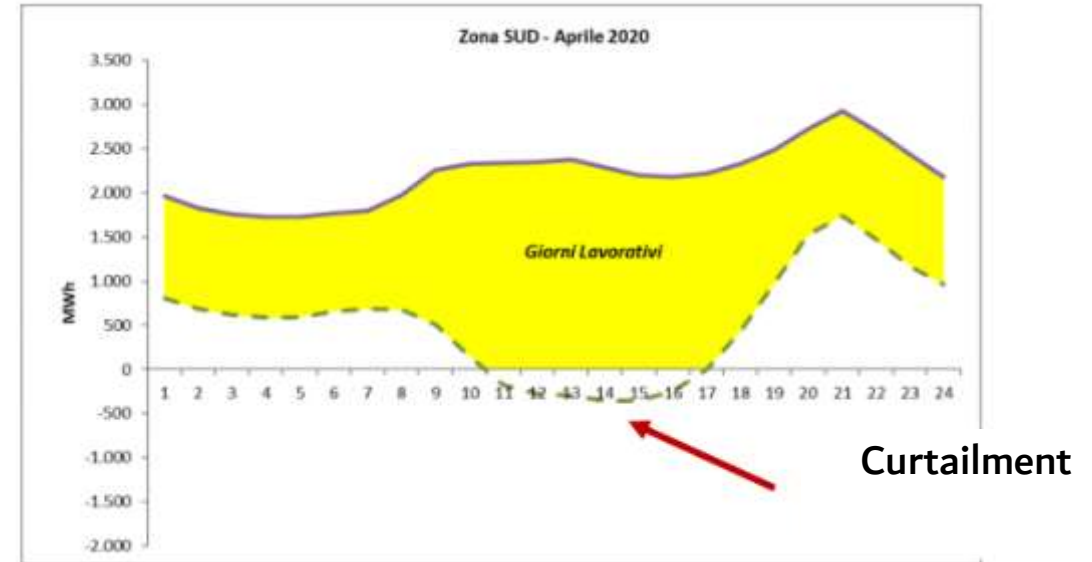
Renewables penetration, % of generation

Generation in EU, TWh

The Integration Of Renewable Energy Sources



Electricity demand covered by RES (mainly wind and PV) Ramps

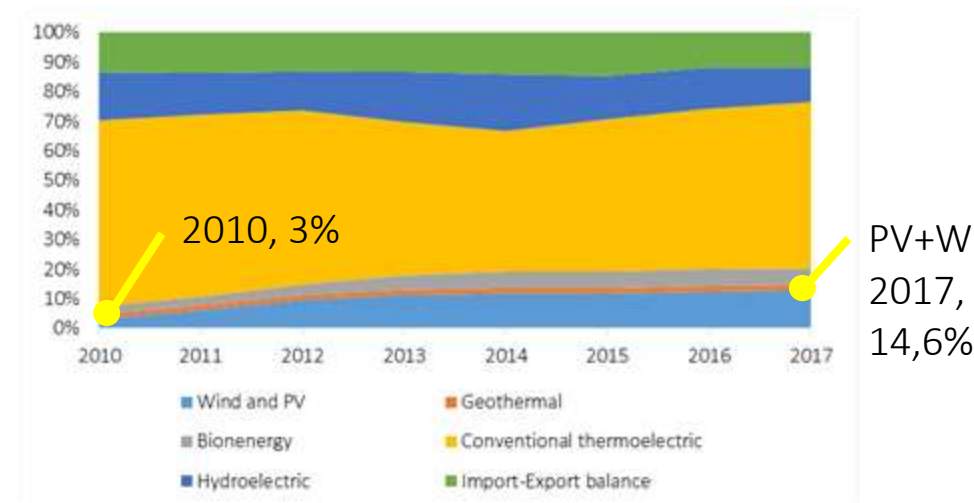
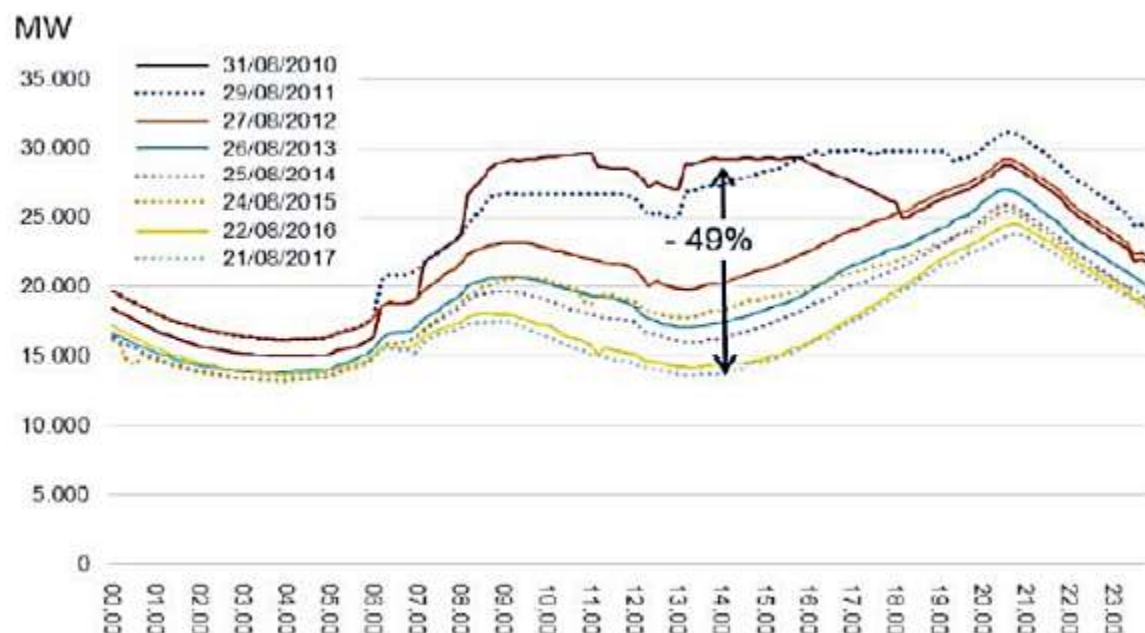


Curtailment

The integration of a high rate of variable renewable energy sources such as wind and solar, means a **deep change in the management** of conventional power plants, which must be more flexible and follow the ramp-up and ramp-down, in order to cover the morning and the evening peaks in particular.

In the South Area of Italy (Zona Sud), the production of electricity from wind and solar in some hours of the day is higher than the energy demand: if such surplus cannot be transported to other areas or if conventional power plants cannot reduce their load (when there is no surplus), there is a **risk for curtailment**.

The Integration Of Renewable Energy Sources

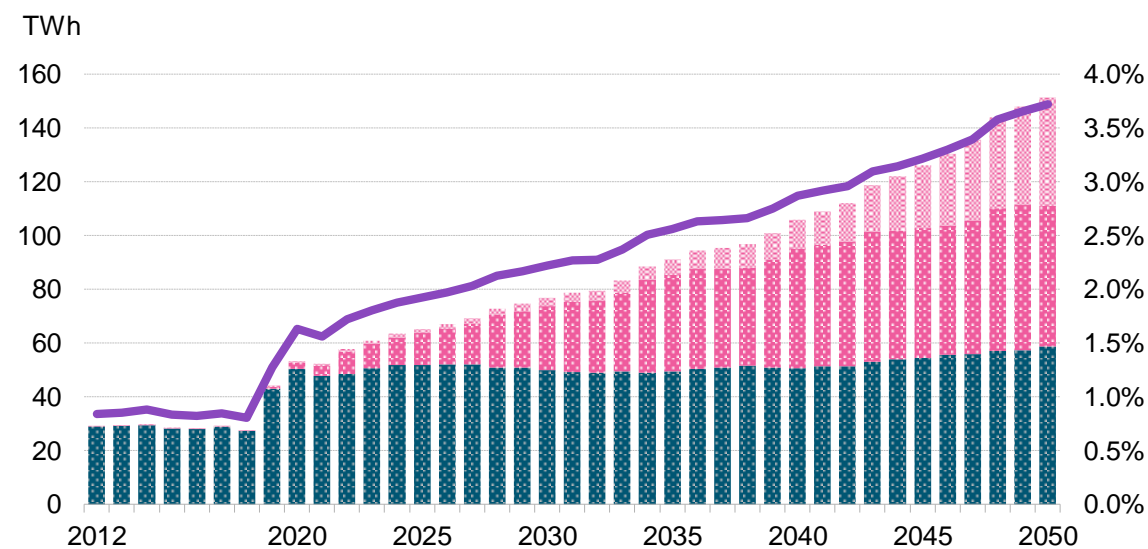
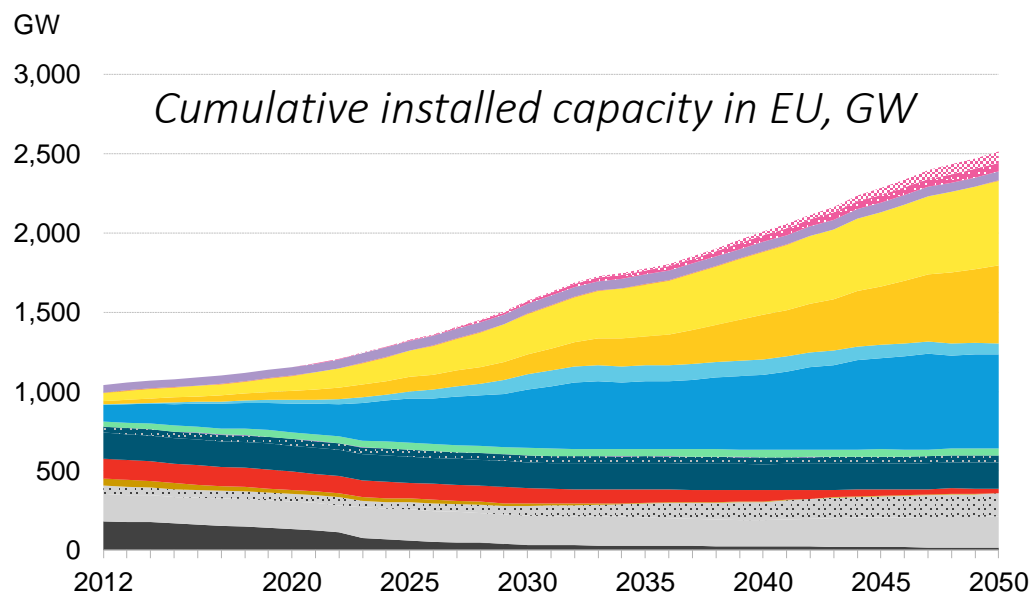


Electricity generation by source, Italy

The electricity taken from the national transmission network by the distribution network has clearly diminished in the period 2010-2017. This phenomenon is stronger in the central hours of the day, where about 49% of the peak reduction was achieved due to the increasing diffusion of the distributed generation.

From 2010 to 2017, the installed wind and solar capacity has increased from 9,41 GW (9% of the total capacity) to 29,45 GW (25% of the total capacity).

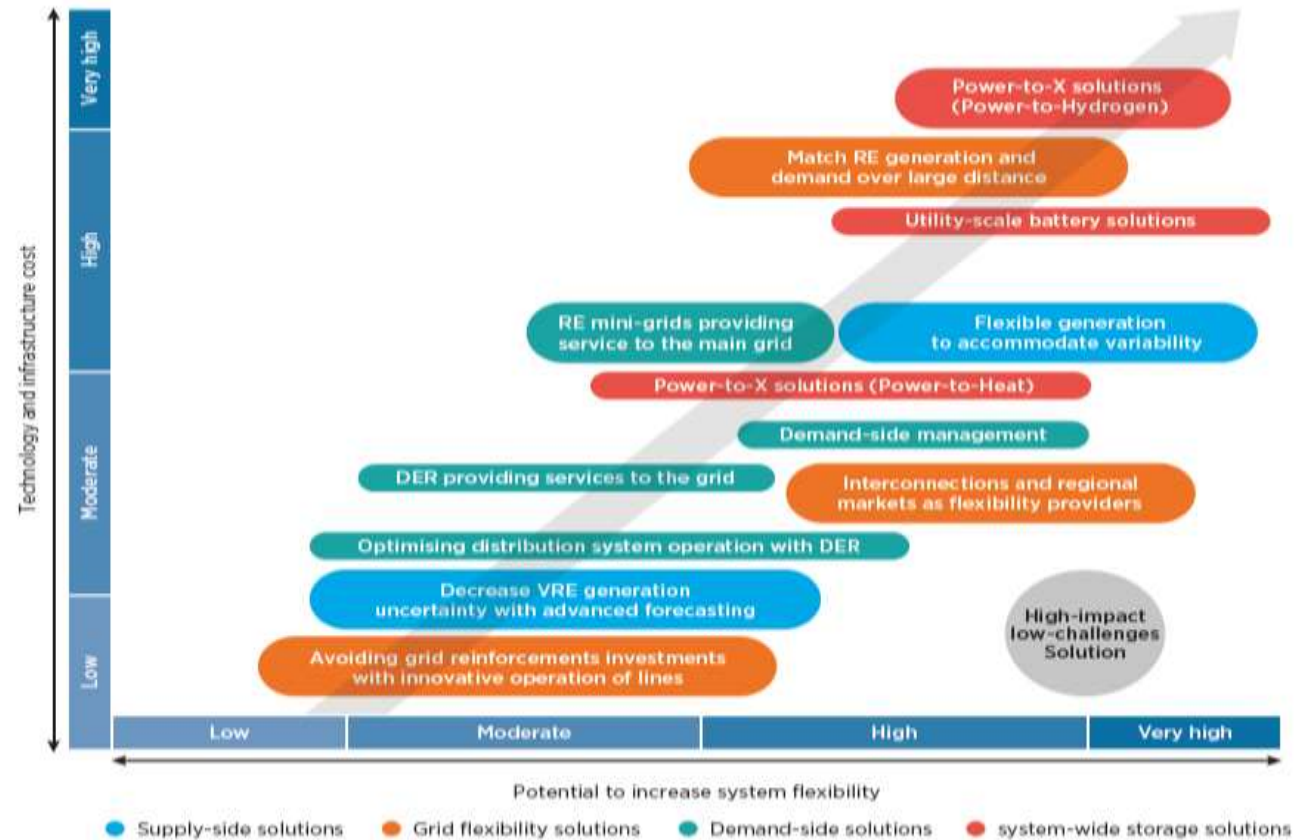
Electricity Generation In Europe In 2050: New Energy 'Sources'



- Coal
- Oil
- Pumped hydro
- Onshore wind
- Small-scale PV
- Utility-scale batteries
- Combined-cycle gas
- Nuclear
- Geothermal
- Offshore wind
- Solar thermal
- Peaker gas
- Hydro
- Biomass
- Utility-scale PV
- Other

■ Utility-scale batteries ■ Small-scale batteries

Flexible Solutions To Support RES: The Power-to-X



Demande Response





Prosumers



Smart metering

Innovation In The Energy And Power Markets

- From a centralized production to **distributed small-scale Renewable Energy Sources** with consumers that are becoming producers at the same time (**prosumers**)
- **Data are becoming pervasive** in the energy and power sector. This trend improves the **awareness** of citizens regarding their consumptions and opens at opportunities for utilities of applying **Demand Response** strategies
- **Community Energy models** are used to aggregate end-users and small-scale producers, boosting the central role of **Distribution System Operators** for the grid



Community Energy and aggregation

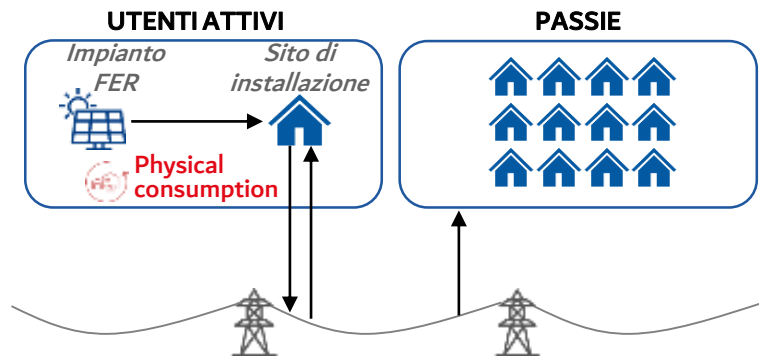
Buildings Must Be Not Only Energy Efficient But Also Energy Flexible



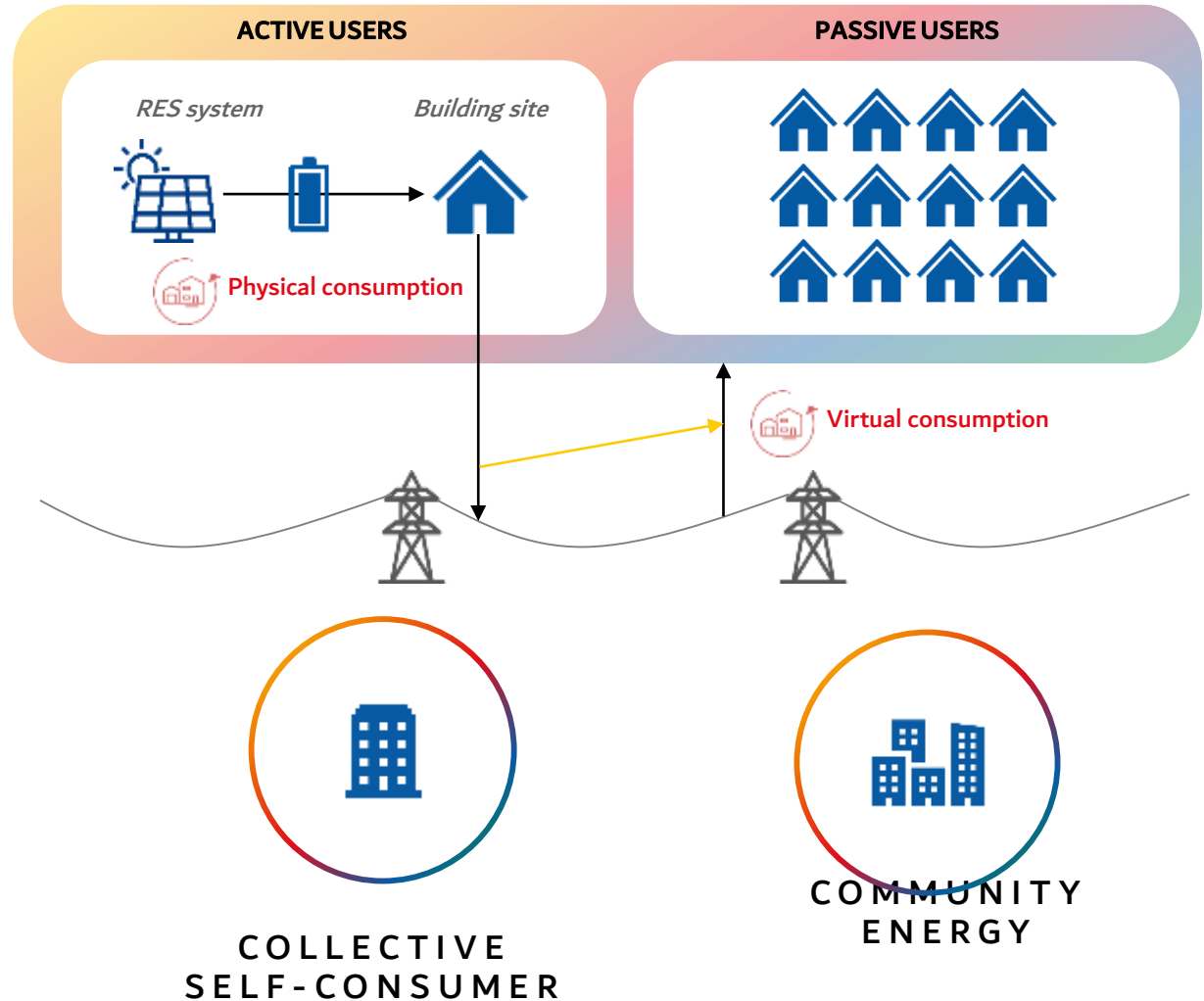
	Production	Consumption	Storage	Flexibility
PV panels	✓			
Micro-CHP	✓			✓
Heat Pump and thermal storage		✓	✓	✓
Air conditioning		✓		✓
Batteries			✓	✓
Electric Vehicles		✓	✓	✓
Appliances (washer, dryers)		✓		✓

The Renewable Energy Communities

MODELLO TRADIZIONALE CON IMPIANTO FV



COMMUNITY ENERGY




Demand Response In Italy (UVAM)



How Building Of The Future Shall Be

Energy efficient buildings have more intelligent and controllable systems (e.g. heat pumps, building automation systems) installed leading to energy flexibility




Energy Efficient

Buildings must consume LESS energy thanks to the installation of performing insulation, HVAC systems, on-site Renewable Energy Sources

Energy Flexible

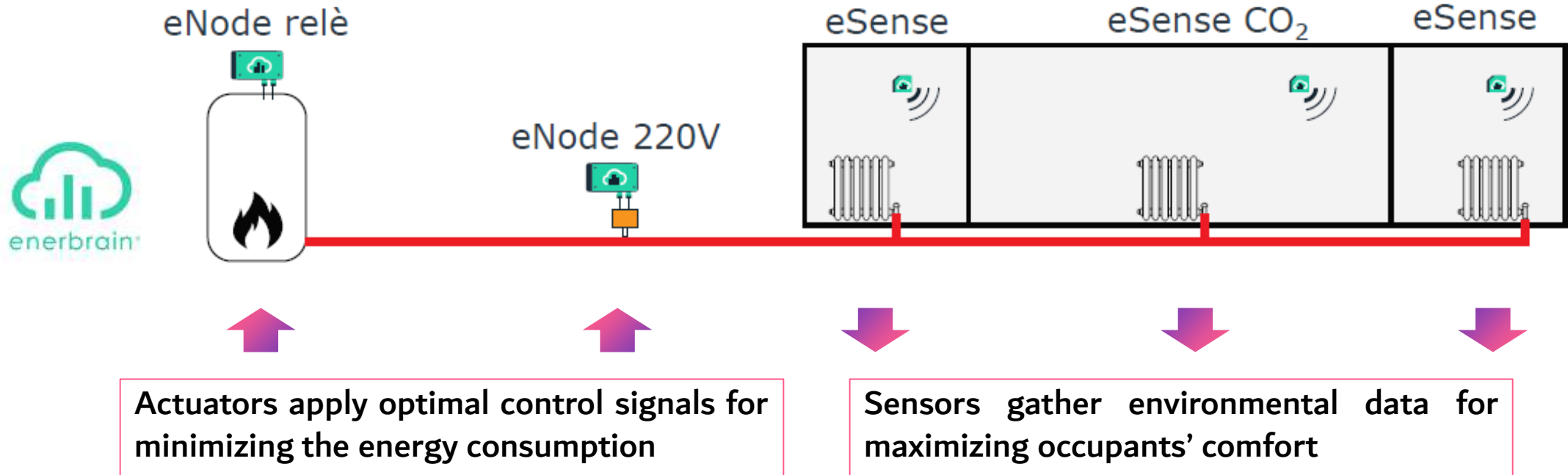
For the volatility of Renewable Energy production buildings must consume energy WHEN available for stabilizing the grid or maximizing the self-consumption of on-site Renewable Energy Sources



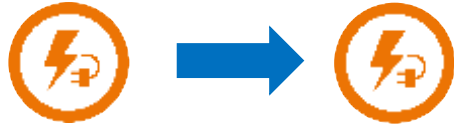
Energy flexible buildings maximize the share of Renewable Energy consumed increasing affordability and sustainability

Digitalization is the key-enabler

Smart Buildings: efficiency + comfort + flexibility

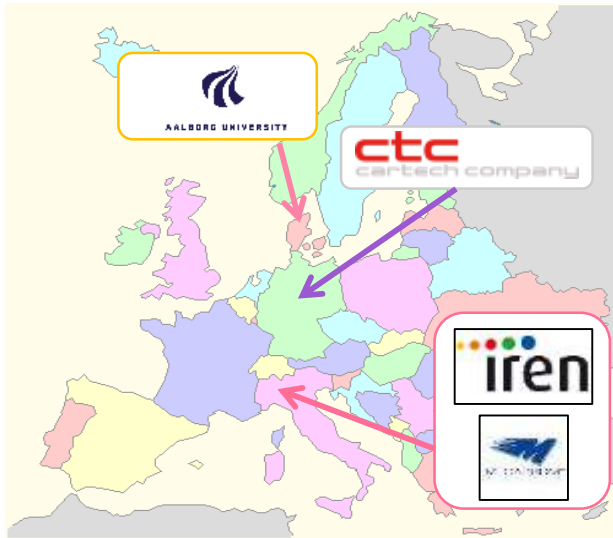


- Artificial Intelligence for optimizing trade-offs among conflicting needs (e.g. comfort vs. energy demand)
 - Cloud access to data visualization and facility management tools



Vehicle-to-Grid

E-vehicles As A Support For The Power Grid: The eVolution2G Project



The Project aims to study and test, under operative conditions, **Vehicle-to-Grid (V2G)** devices as a solution for the electric grid balancing.

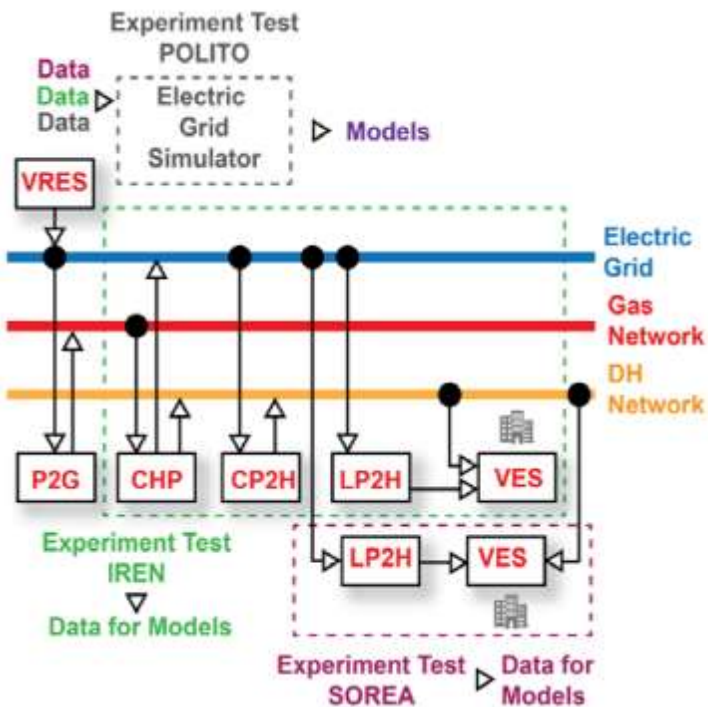
The main goals of the project are:

- to develop a light vehicle with an innovative system for the management of the battery and the bidirectional charge;
- to develop an Energy Management and Control System for the management of the data exchange between all the players involved (customers, DSO, CPO, etc.);
- to test prototypes of HW and SW.



Integration of Networks

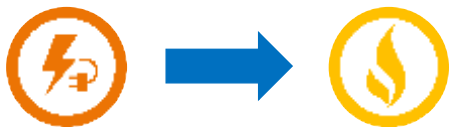
The Planet Project



In the PLANET project, a **decisional support system** for policy makers and players (such as DSM aggregators) will be developed. The aim is to facilitate the **integration of RES** through a synergic coordination between multiple grids and networks.

IREN realised a pilot test case in a residential building, with the aim to integrate its operative networks with the use of Power-to-x solutions.

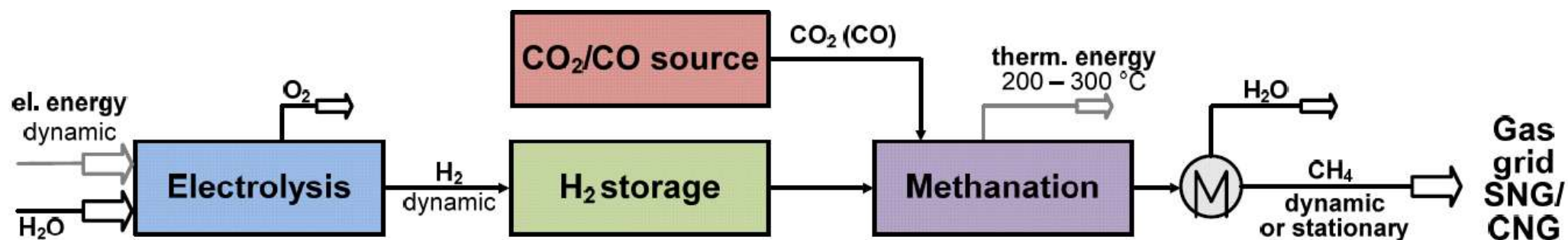
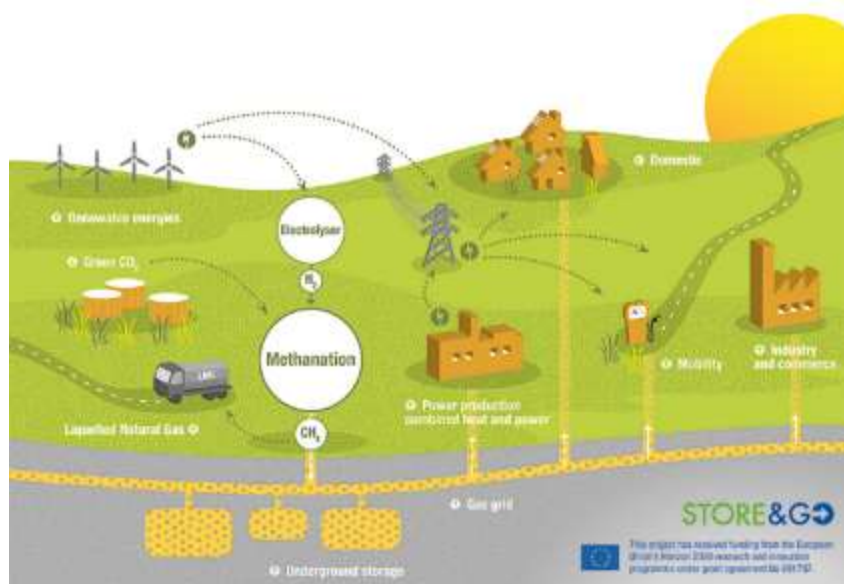
The goal is to enable services of *Demand Response* and *Demand Side Management* on the electrical and the thermal systems.

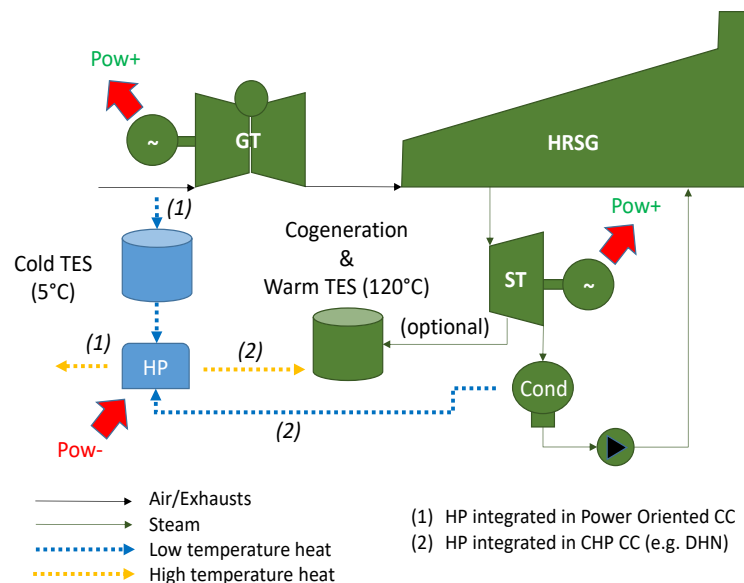
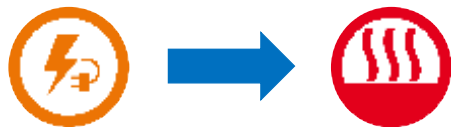


Power-to-Gas

From Green Electrons To Molecules: The STORE&GO Project

The STORE&GO Project demonstrated 3 innovative **Power to Gas (PtG)** systems located in Germany, Switzerland and Italy. The project aims to validate the **technical and economical feasibility** of integrating the PtG technology with innovative systems of energy generation and distribution.





Power-to-Heat

Heat Pumps For The Flexibility Of Power Plants: The Pump-heat Project

The Project aims to **increase the flexibility of traditional fossil fuel power plants**, especially combined cycles, in order to satisfy the electric grid's needs to compensate the increasing fluctuations in the RES energy supply.

The Project will focus primarily on the integration of heat pumps with conventional and cogeneration combined cycle plants:

- feasibility study of heat pumps integration with combined cycle systems and analysis of the operational modes
- innovative heat pump development at high temperatures
- development of heat storage systems with phase-changing materials
- 3 testing sites, one of which in IREN's Moncalieri (TO) cogeneration power plant



Power-to-Heat-to-Power

CHESTER: A Thermal Solution To Store Green Electrons

The Project aims to develop and implement an innovative solution of **Power-to-Heat-to-Power**, named CHEST, which allows the maximum exploitation of electric and thermal vRES already integrated with district heating systems.

The CHEST system under study will integrate:

- **heat pumps**
- **latent heat storage systems**
- **Organic Rankine Cycles (ORC)**

in order to develop:

- a high-efficiency system for RES exploitation
- a complete integration of all technical components
- a smart energy management system
- a lab-scale pilot for testing

