

# PLANET Network Orchestration tool to simulate the future energy flows



Planning and operational tools for optimising  
energy flows & synergies between energy networks

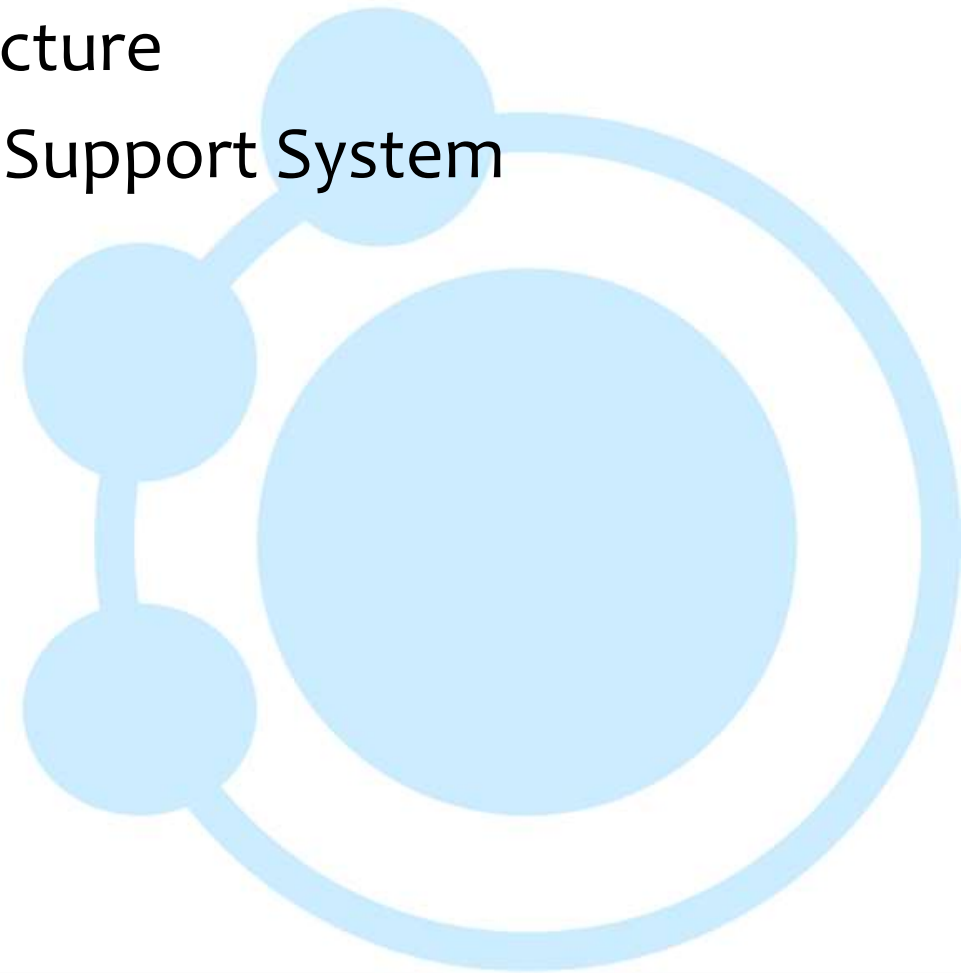
Dr. Antonis Papanikolaou, Hypertech SA  
Energy Modelling Platform for Europe (EMP-E) 2019  
“Modelling the Implementation of a Clean Planet for All Strategy”  
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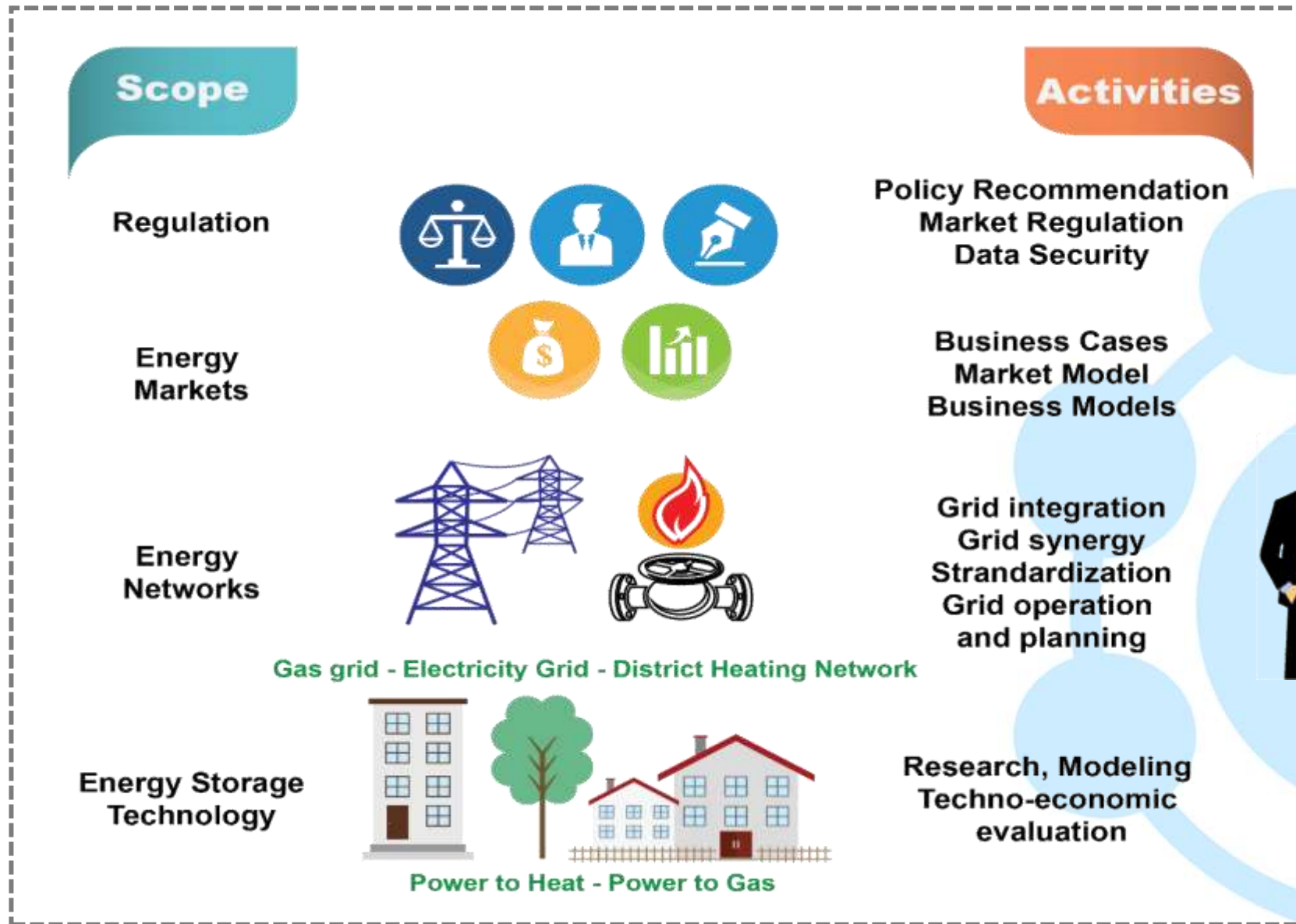
This project has received funding from the European Union's  
Horizon 2020 research and innovation programme under  
grant agreement no 773839

# Contents

1. **PLANET H2020: The framework explained - concept, objectives, stakeholders and technologies involved**
2. PLANET Use Cases and System Architecture
3. PLANET Orchestration tool & Decision Support System



# PLANET Concept



enabled by the  
**PLANET Decision Support System**

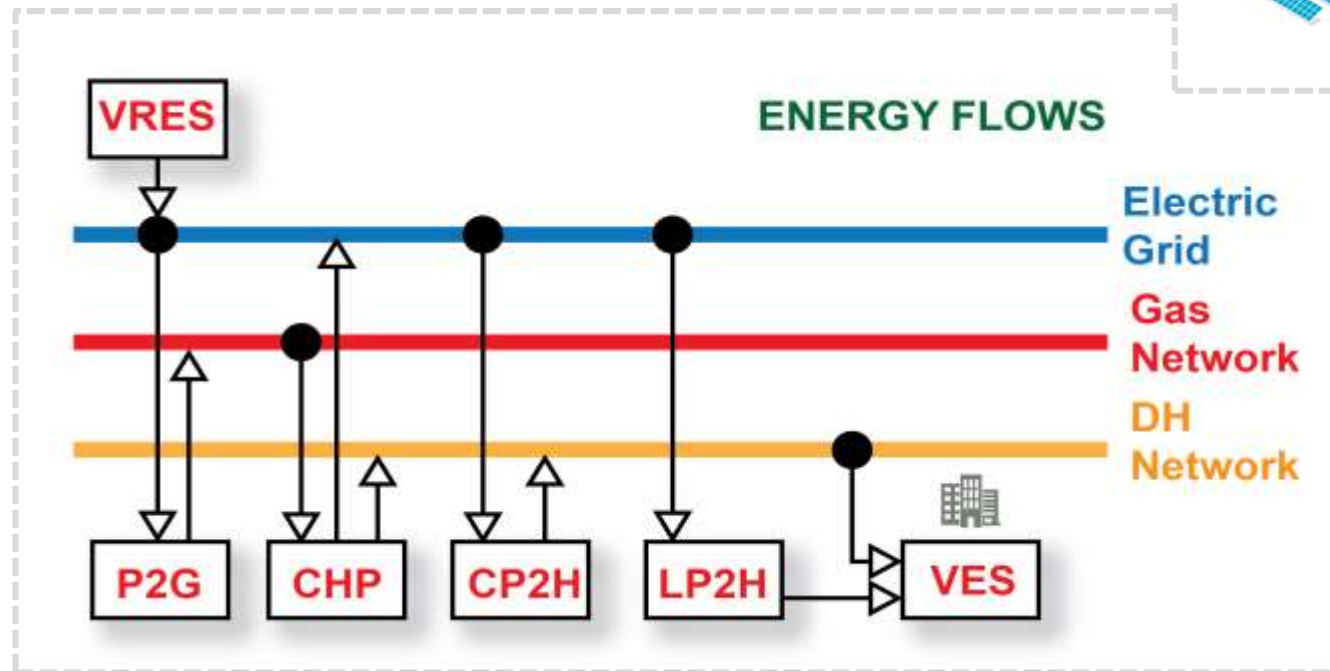
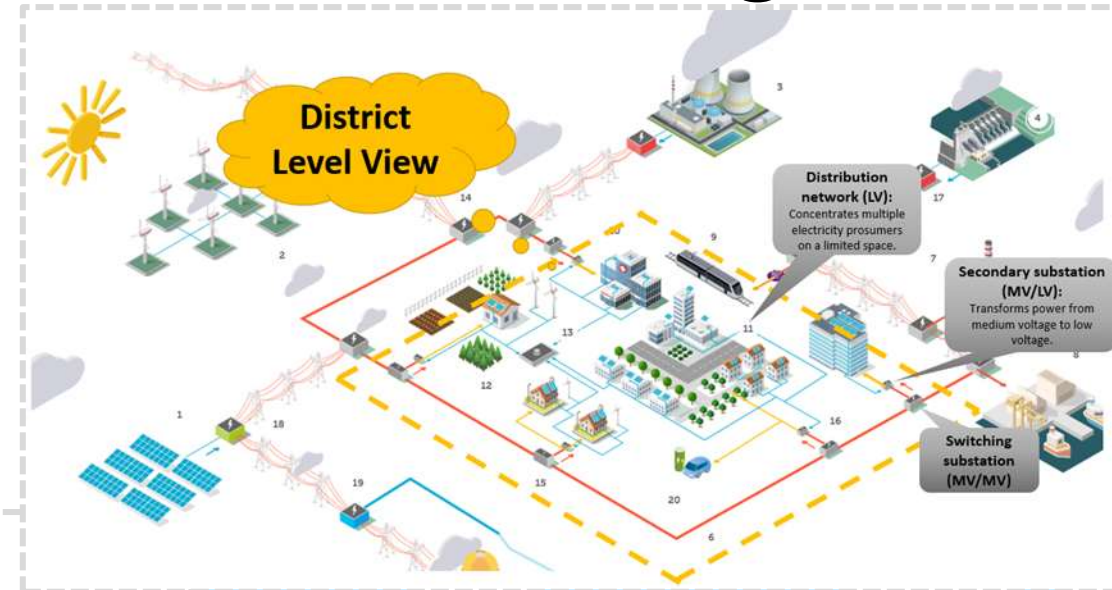
# PLANET Objectives

- I. **Energy system decarbonization** through maximum **penetration of VRES** in the electrical distribution grid enabled by **short/mid/long-term storage** solutions, e.g. innovative conversion/ storage technologies (P2X)
- II. **Minimization of expensive interactions with the electrical transmission grid** via energy flow channeling into DH and NG networks
- III. **Identify feasible pathways for sector coupling** to alleviate network expansion needs through simulation & constraints verification, e.g. overloading and voltage limit violations, in the e-grid

# PLANET Energy Networks & DER technologies

## Scope:

- Three major energy carriers: **Electricity, Heat and Natural Gas**
- **District-level** granularity
- **Medium Voltage** portion of Electricity Distribution Grid



Technologies:  
Bridging different carrier networks through **storage/ conversion technologies** (e.g. P2G, P2H, VES, etc.) enabling **sector coupling**.

# PLANET Main Stakeholders

- ***Distribution System Operators***

- Assessment of the added value of sector coupling in grid balancing with high presence of VRES-e

- ***Policy makers***

- Impact assessment of different “decarbonization” policies/ pathways to identify optimal primary energy mix and conversion asset deployment scenarios

- ***Storage/Conversion asset owners***

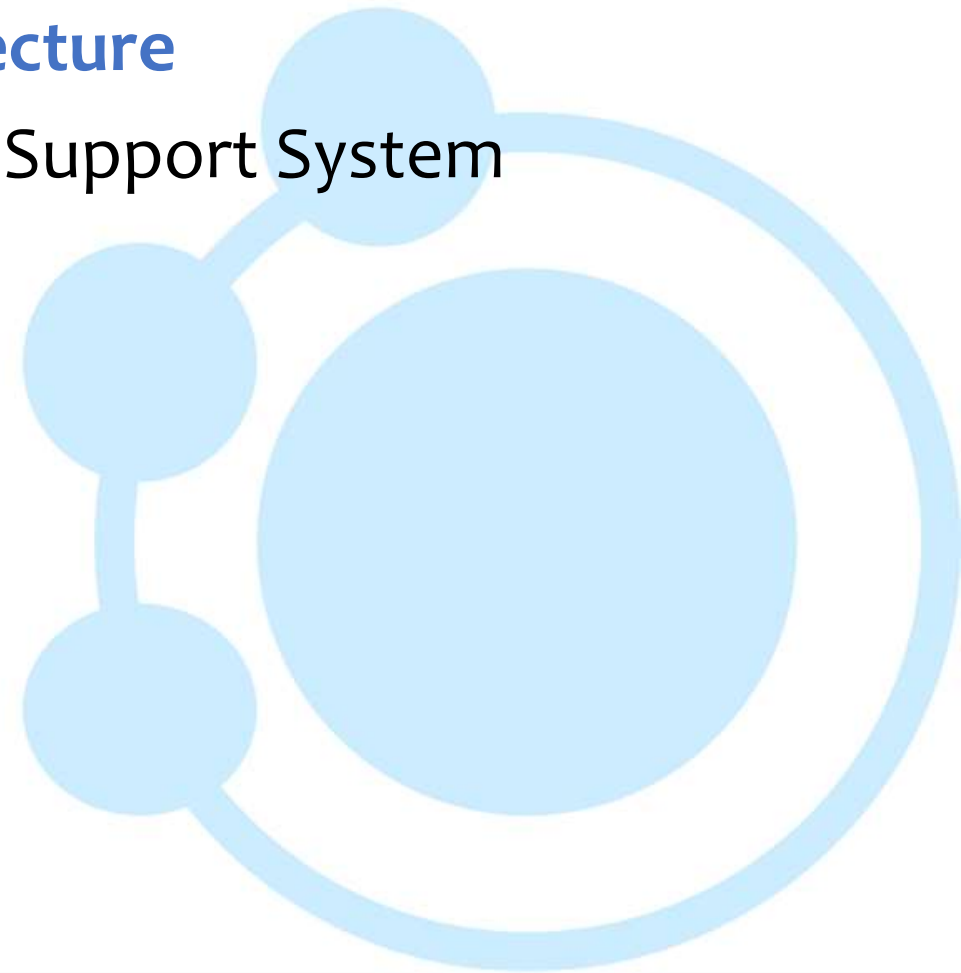
- Assessment of business viability of asset deployment in the energy system in terms of added value to the energy grid

- ***Aggregators***

- Evaluation of portfolio composition for energy/service market participation

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# PLANET Major Use Cases (1)

**18 sector coupling scenarios** have been investigated within PLANET project out of which the below **major Use Cases** have been identified including:

## A. **P2G deployment for system control**

- Deployment of P2G units in MV electrical grid nodes with excessive VRES generation for alleviation of reverse power flow and/or operational limit violations.
  - ↳ *Seasonal Energy Storage, Elimination of VRES curtailment w/o infrastructure upgrade*

## B. **VES for congestion management via electricity demand shifting**

- Utilisation of context-aware demand flexibility of VES-capable buildings for electrical grid balancing using local P2H technologies.
  - ↳ *Peak-load management, Demand modulation, Congestion management*

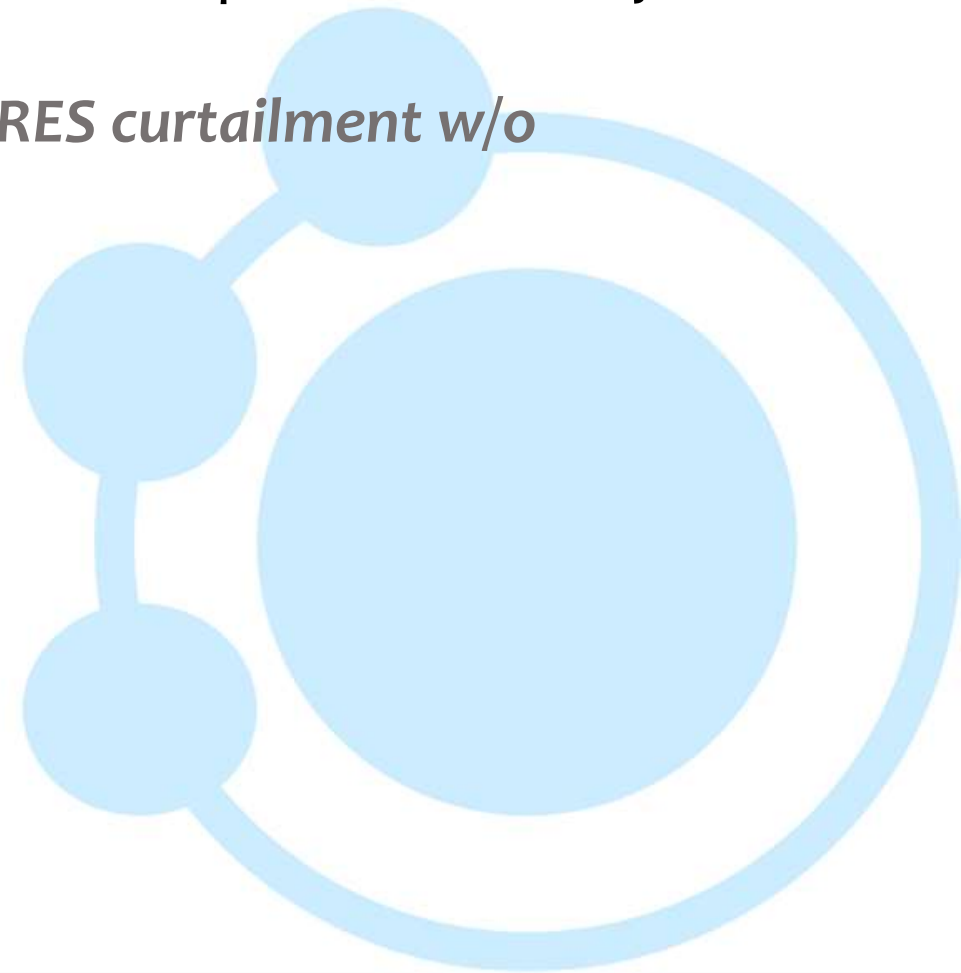


# PLANET Major Use Cases (2)

## C. *Centralised heat-pumps for hot water storage in DH plant facilities*

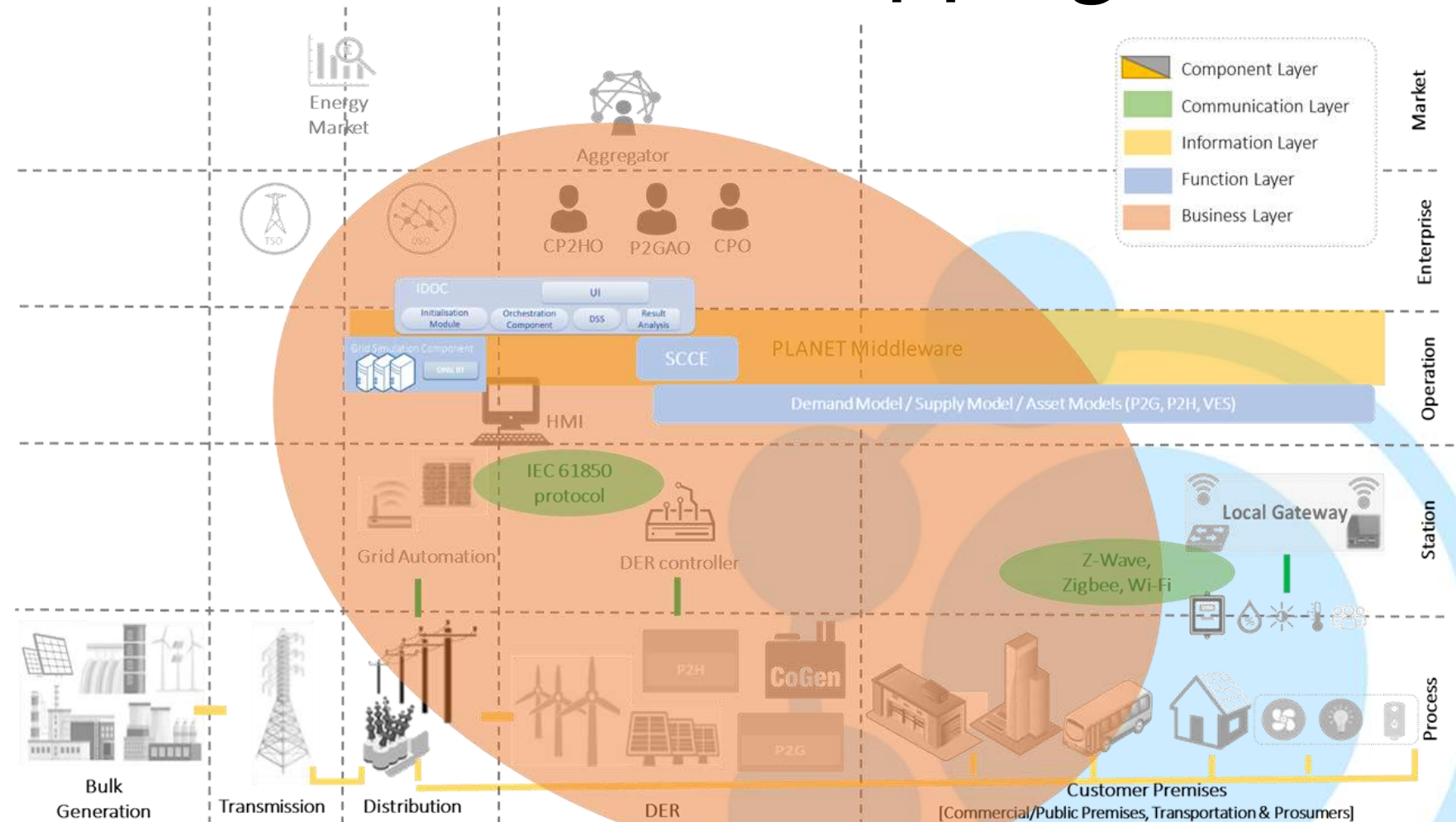
- Exploitation of the centralized P2H technologies to leverage the thermal storage capacity connected to the DH network and provide ancillary services to the electricity grid.

↳ *Peak-load management, Elimination of VRES curtailment w/o infrastructure upgrade, grid balancing.*



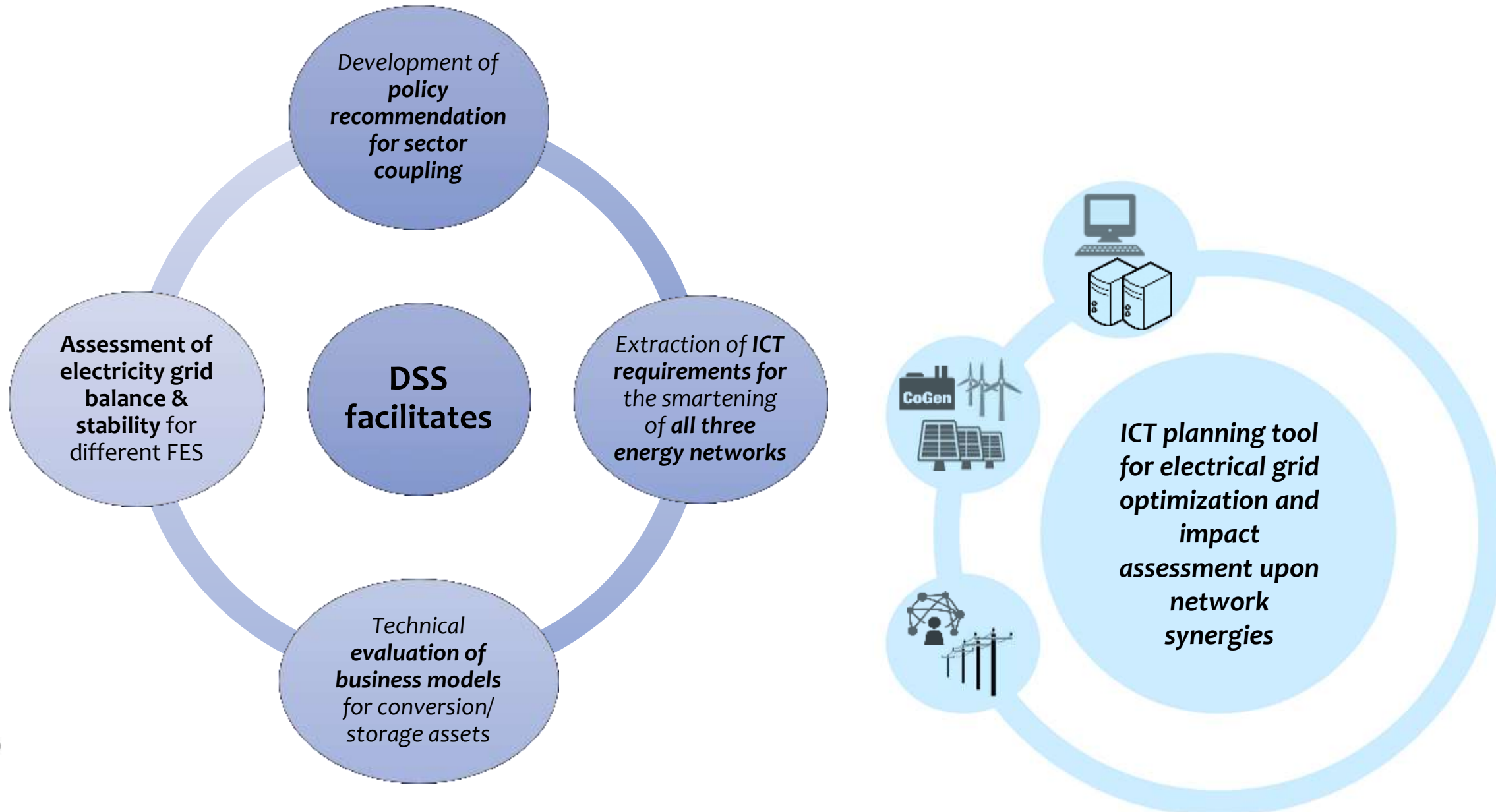
# PLANET Architecture: SGAM Mapping

PLANET DSS components mapped in the reference architecture of M/490 - Smart Grid Architecture Mode



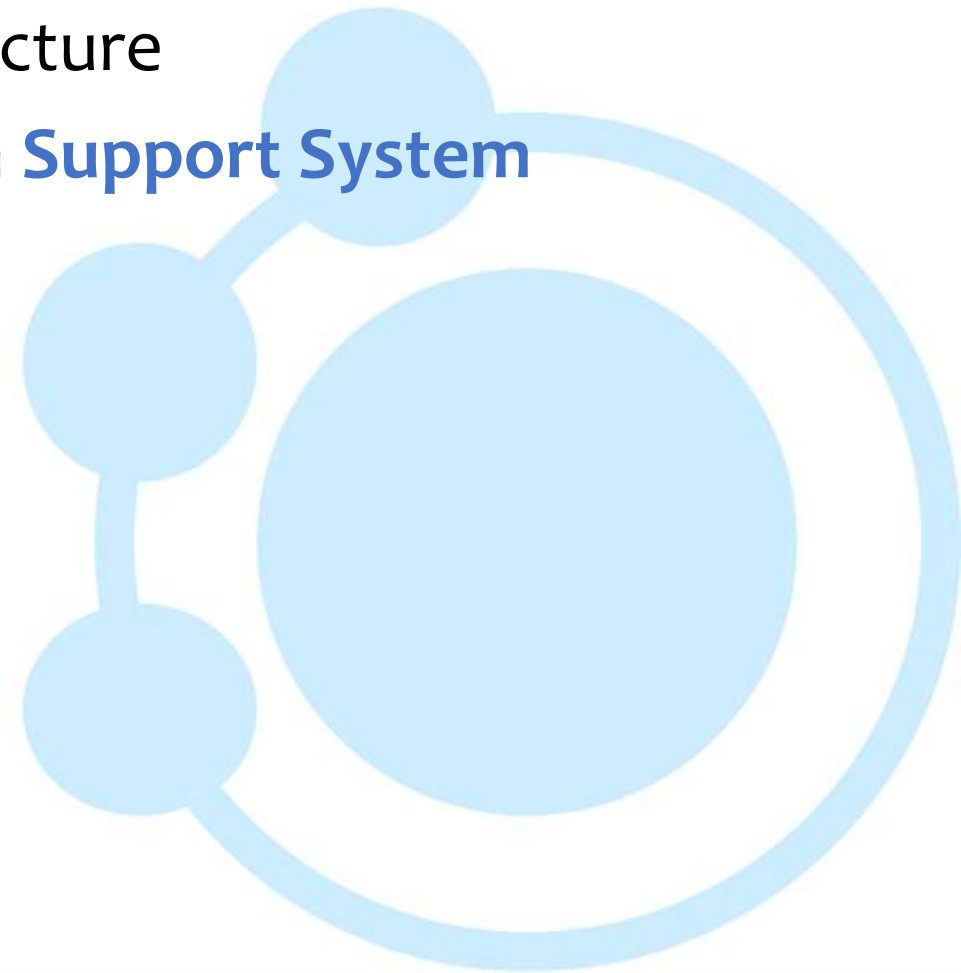
Partial view is by default provided given that the Smart Grid Plane consists of Zones and Domains of the Electricity System, excluding views of other carriers, e.g. DH, NG, etc.

# PLANET Decision Support System



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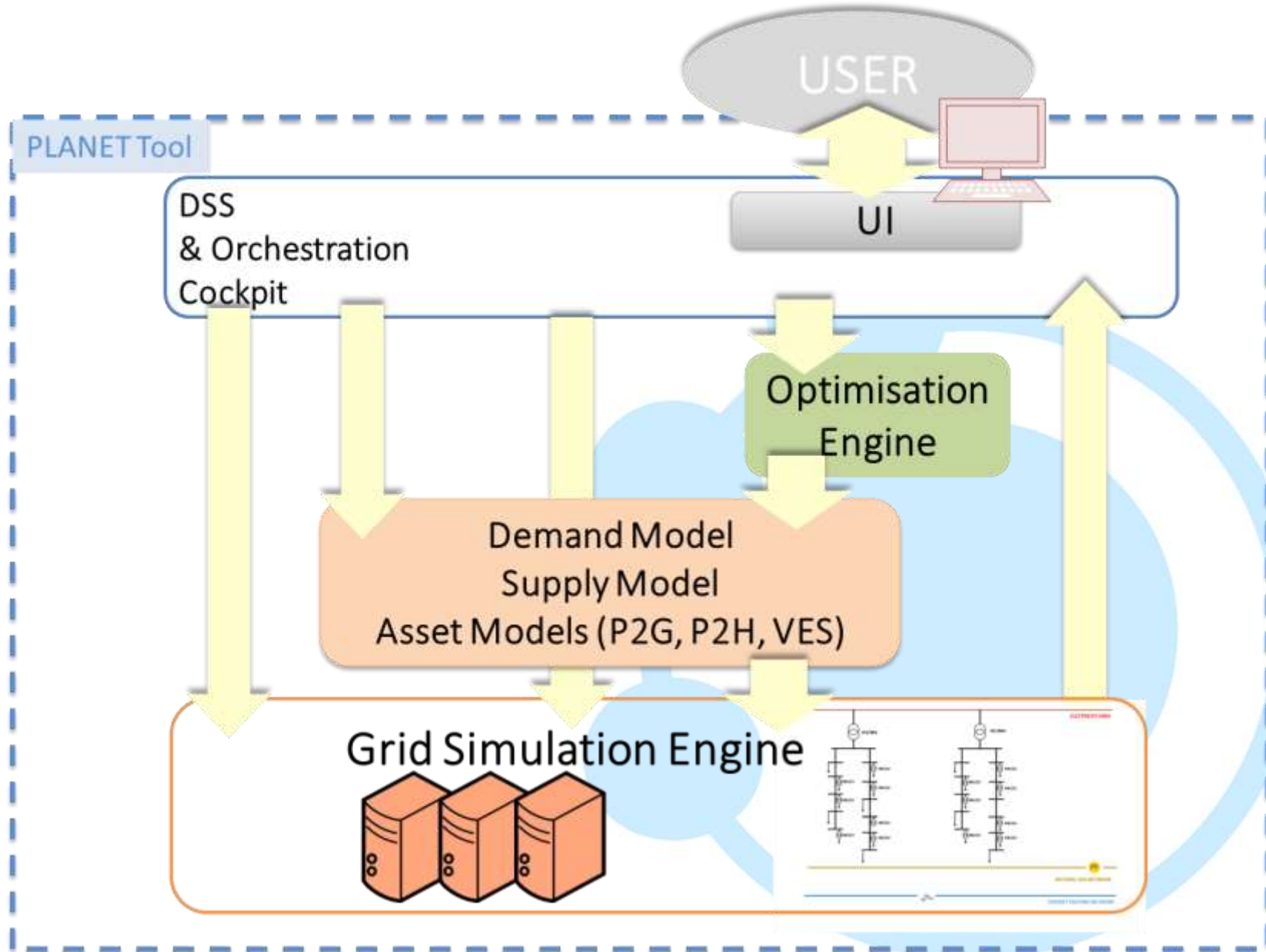
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# PLANET ICT tool: Architectural Overview

## DSS includes:

- Simulation engine
- Optimization engine
- Asset models (conversion/ storage units, distributed generation and district-level demand models )
- Orchestration Cockpit incl. User Interface



# PLANET ICT tool: Usage configuration (1)

The screenshot displays the PLANET ICT tool's configuration interface. The main window is titled "Simulation Parameters" and shows a scenario named "Torino 6 nodes - Excess PV and P2G unit in Node". A map of Europe is visible, with a red dot indicating the location of the nodes in the Torino region. The interface is divided into several sections:

- System Parameters:** Includes a "Select grid" dropdown menu.
- Energy Network:** Features tabs for "ELECTRIC GRID", "DISTRICT HEATING", and "GAS NETWORK". Under "ELECTRIC GRID", there are radio buttons for "1 Node" and "6 Node", with "6 Node" selected.
- Time Step (Seconds):** Includes checkboxes for "15" and "60", with "60" selected.
- Simulation Horizon:** Shows a date range from "June 2, 2016" to "June 3, 2016".
- Node Configuration:** A vertical list of nodes (Node 1 to Node 6) is shown, with a schematic diagram of the network connections to the right.

## Simulation scenario configuration, incl.:

- Selection of different energy vectors
- Configuration of each energy network
- Configuration of time parameters of simulation
- Configuration of connected DERs to each vector per node

This section provides a detailed view of the configuration for individual units within the simulation scenario.

**PV Configuration (Node 1):**

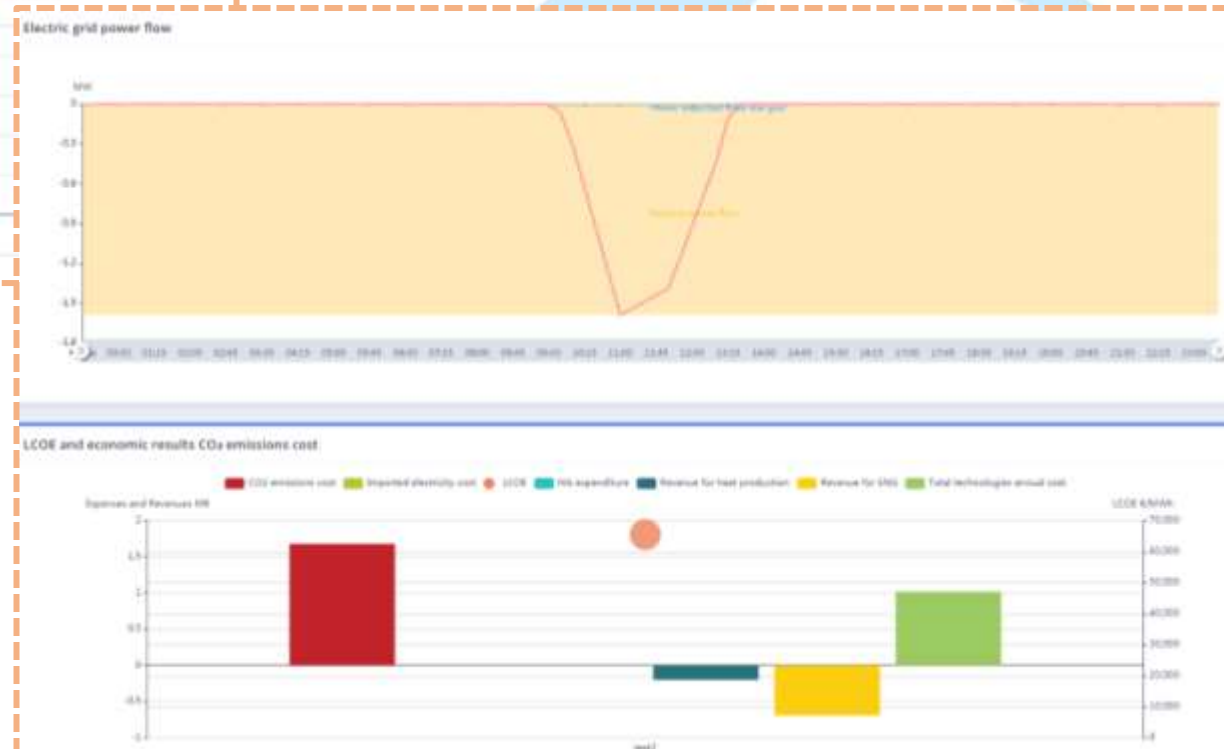
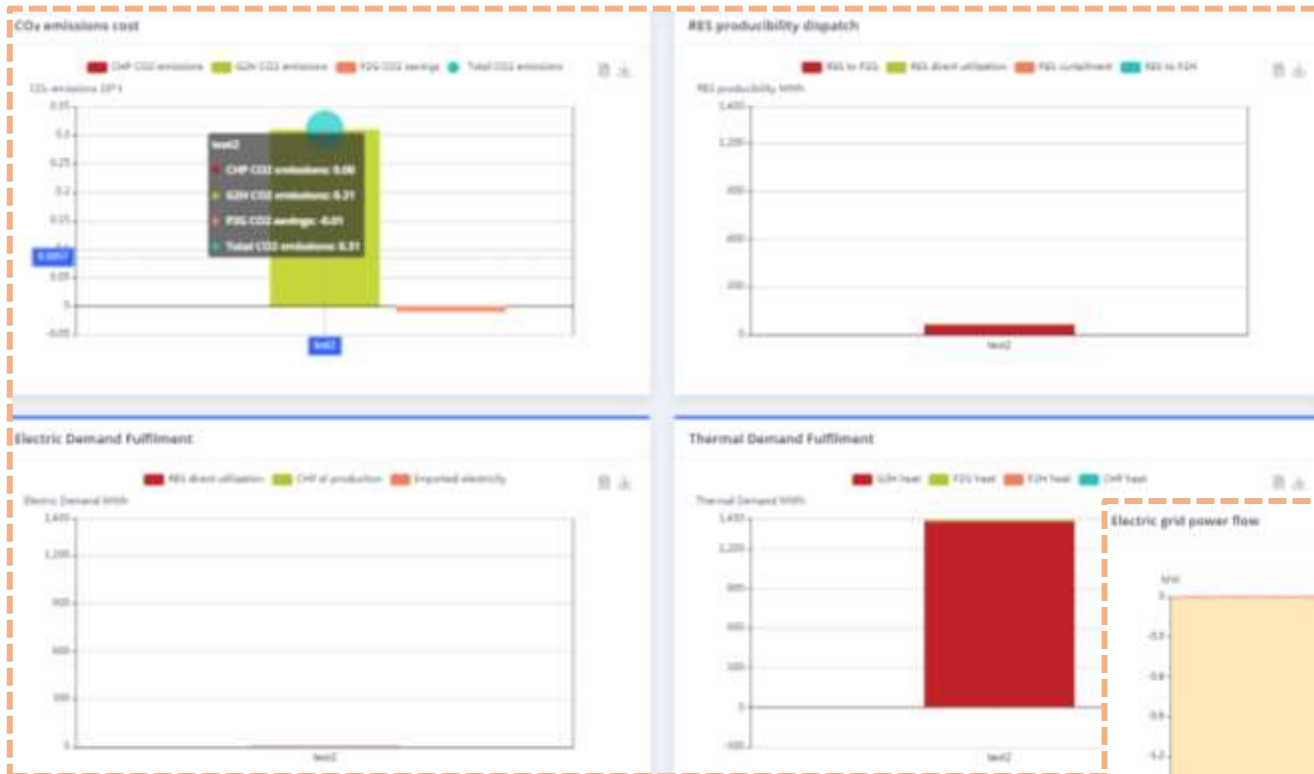
- System Loss:** 0.1 %
- Tracking:** 1-axis (azimuth)
- Tilt:** 35 °
- Azimuth:** 0 °
- Nominal Power:** 99.98 MW

**P2G Configuration (Node 6):**

- P2G1:** P2G1
- Eff<sub>elect</sub>:** 74 %
- Eff<sub>meth</sub>:** 80 %
- Eff<sub>th</sub>:** 24 %
- Electric Load:** Enabled

# PLANET ICT tool: Simulation results

Simulation of baseline scenario & FES with P2X deployment, calculation of optimal operating setpoints & scenario comparison



Result analysis and KPI assessment. Indicative indexes produced include LCOE, demand fulfilment, RES curtailment, reverse power flow, etc.

# Thank you!

[www.h2020-planet.eu](http://www.h2020-planet.eu)

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