GIFT

Designing flexibilities serving a greener energy mix

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The GIFT Project

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Odit-e

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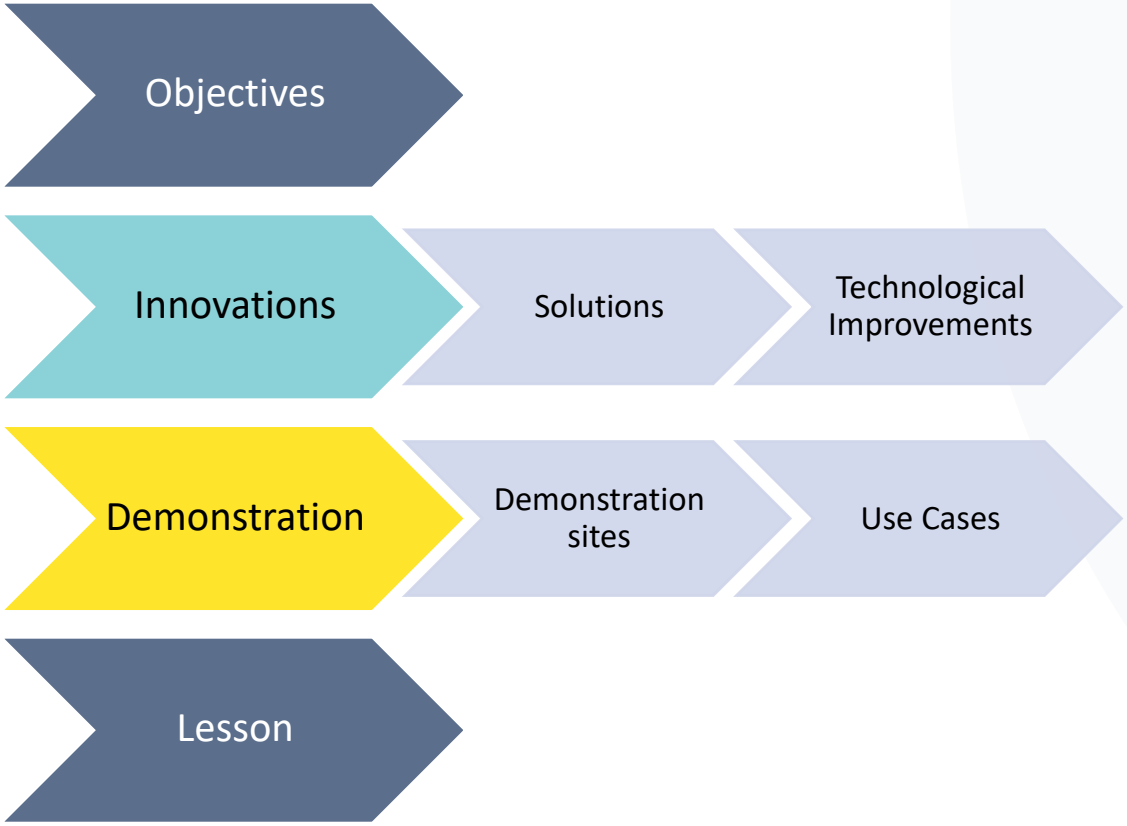
Project Presentation



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Objectives

Project Goals

The main objective of the GIFT (Geographical Islands FlexibiliTy) project is to decarbonise the energy mix of islands.

- *1: Allow a high level of local renewable energy sources penetration*

- *2: Provide observability of the energy grid to better manage its flexibility and plan its operation and evolution*

- *3: Develop synergies between the electricity, heating, cooling, water and transport networks*

- *4: Reduce the use of hydrocarbon-based energies*

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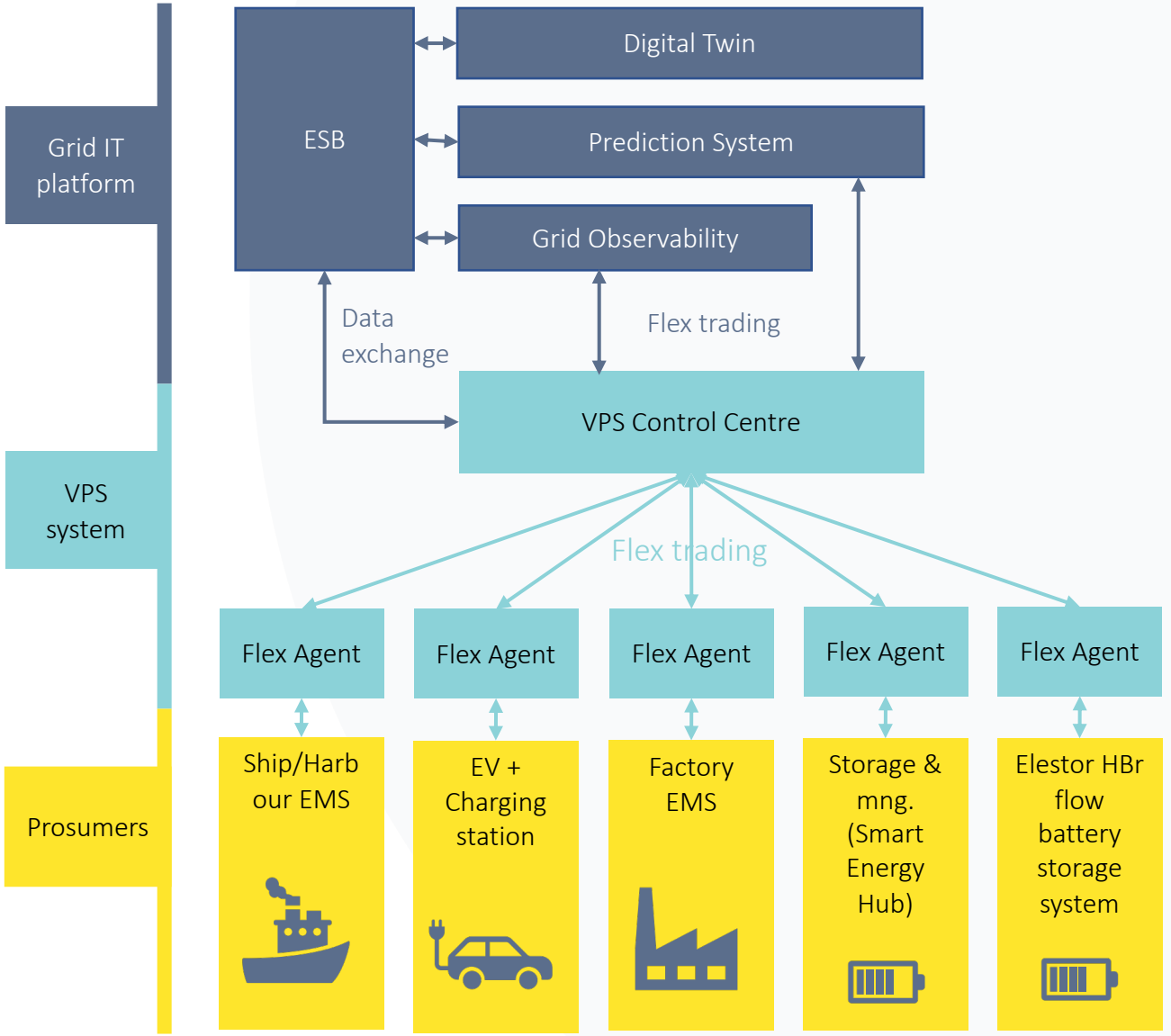
Innovations

Solutions

- *<u>Grid IT platform</u> for KPI visualisation, geographic visualisation, grid observability, prediction and detection of grid operation states that require DR, prospective modelling and long-term assessment.*
- *<u>VPS system</u>, a decentralised automatic demand response trading platform, connecting demand response (DR) providers, intermediaries and DR users.*
- *<u>Prosumers</u> or smart energy consumers that provide flexibility by modifying their energy demand pattern or selecting alternate sources for energy to reduce the load on the power grid.*



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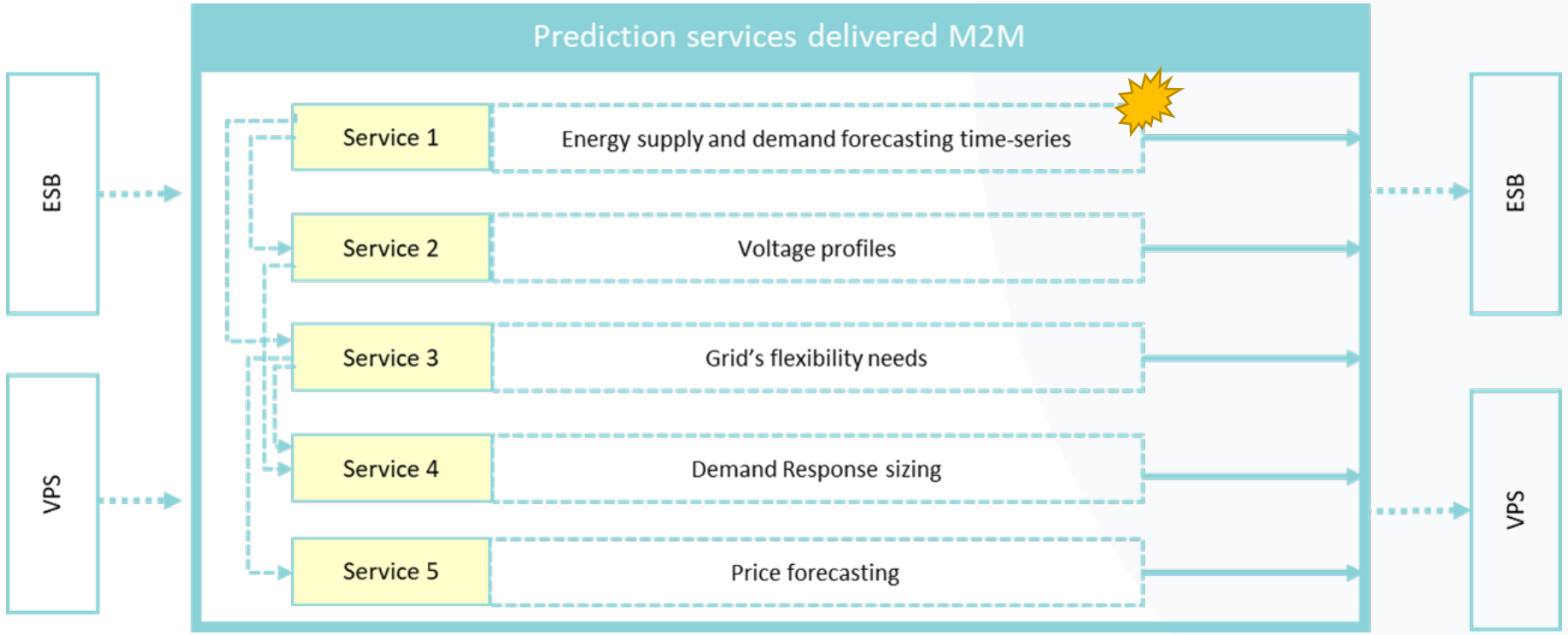
Innovations

R&D Nester Prediction System



3rd place at the IEEE PES AMPS/ISS ODS competition 2021

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Innovations

Odit-e Grid Observability System

A dedicated solution for the island's DSO to ensure that **appropriate operational conditions** of the grid are maintained **in high DER penetration scenario** and **without further investments**.

- **Automatic** computation of the model of the grid for voltages and load rates analysis
- Machine learning algorithms **only based on smart meters data** and a couple of real time measurement points
- Optimized asset management with **CAPEX deferral**, **avoided reinforcements** and **extended asset's lifetime**
- Dedicated **user interface** for monitoring and decision making
- Real time state estimation of the grid and forecasts for **automatic flexibility request placement** to solve issues

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Innovations

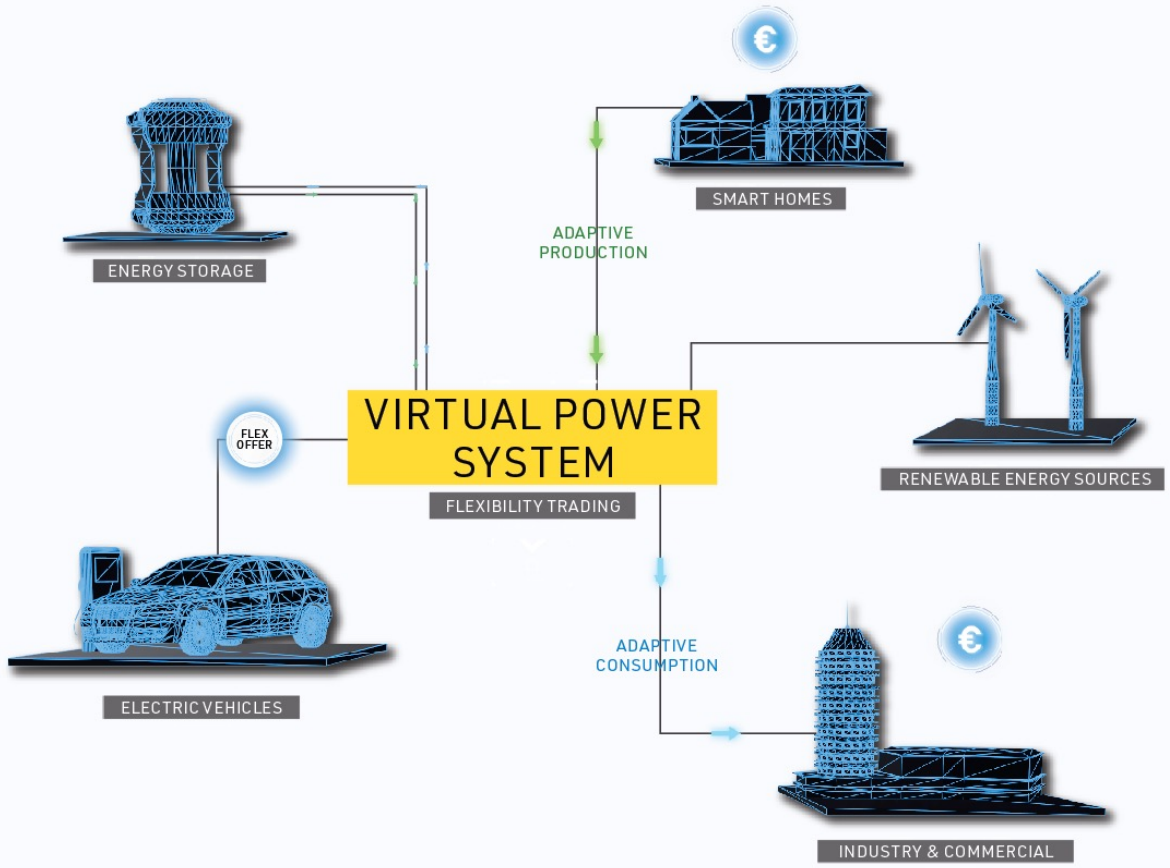
INEA: Virtual Power System for Flexibility Trading

- **Virtual power system – VPS**

Automated flexibility exchange platform connects all relevant prosumers and buyers of flexibility. It is market oriented, meaning it enables non-invasive operation instead of curtailment.

- **FlexOffer**

Universal trading mechanism to describe, buy and sell energy flexibilities. The concept works bottom-up, managing flexibilities provided by any source: generation plants, households, small and medium-sized industry, or electrical vehicle charging stations.



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INEA

Innovations

Flexibility potential

- Two schools (boilers)
  Flex potential 1080 + 1350 kWh/day
- Kindergarten (heating cables)
  Flex potential 210 kWh/day
- Hålogaland Kraft HQ (HVAC)
  Flex potential 480 kWh/day
- Wholesaler (two large freezers)
  Flex potential 930 kWh/day

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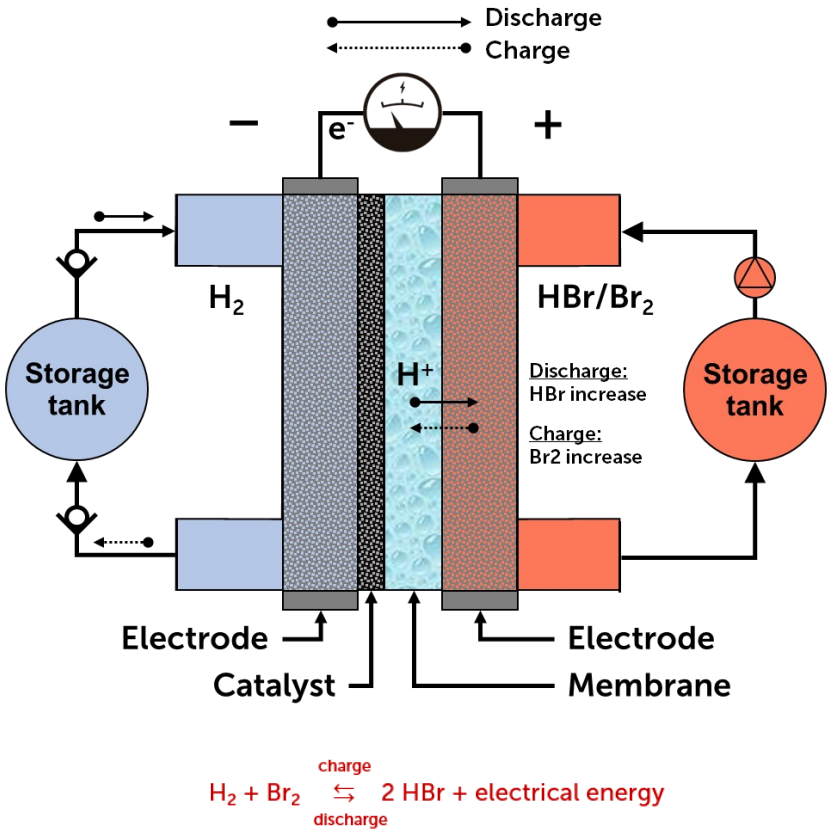
Innovations

Elestor HBr flow battery storage system



- Working with hydrogen-bromine
  (Abundant, cheap and fully recyclable)
- Chemicals are used, 100% reversible, not consumed
  (Nothing goes in or out, except electricity!)
- Reactants do not degrade
  (Neither with high 'Depth of Discharge')
- Negligible loss of capacity during lifetime
- Fast reactivity enables fast switching
  (Milliseconds possible)
- Power [kW] and capacity [kWh] independent scalable
- High power potential / High energy potential
  (Very well suitable for longer duration storage like 10 hours or more)
- Upgradable and serviceable system
- Potential to combine power and heat
- Low-cost at large systems (LCoS < € 0.05 / kWh)

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Innovations

Elestor HBr flow battery storage system

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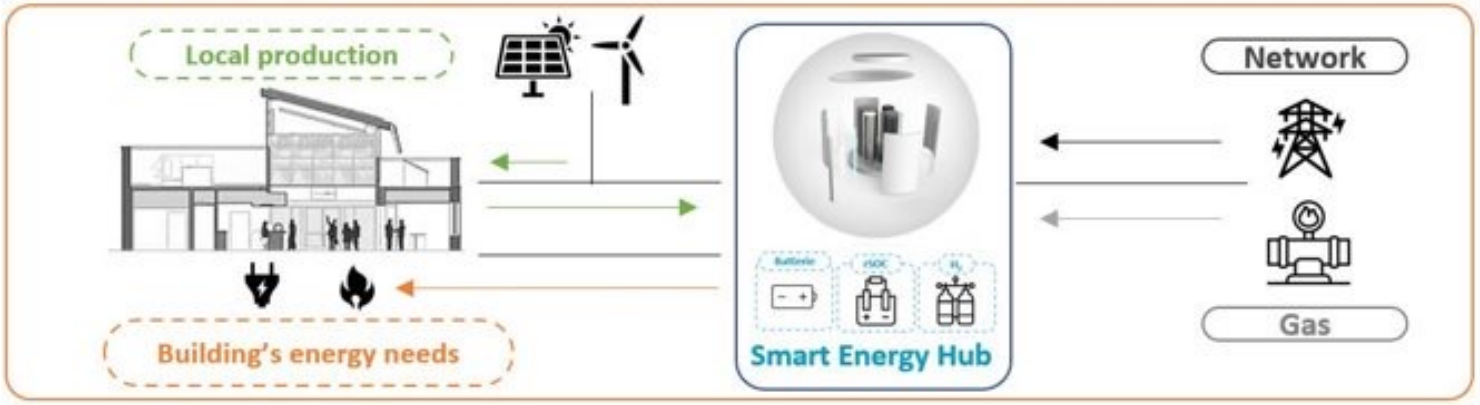
elestor electricity storage

Innovations

Sylfen - Smart Energy Hub - Storage system

An innovative solution which allows buildings or groups of buildings to store the surplus of **locally produced renewable energy** by transforming it into **hydrogen** (electrolysis function). When there is an electric need the Smart Energy Hub restores **electricity and heat** into the building, by consuming the hydrogen previously produced, or by **cogeneration** from biogas or natural gas (fuel cell function).



An **rSOC** energy processor (Reversible Oxide Fuel Cell) **Electrolyser** and Fuel cell

Li-ion batteries for a highly responsive energy storage

Hydrogen storage for MWh of energy

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Sylfen

Innovations

Sylfen - Smart Energy Hub - Storage system

Innovations

Etrel & Trialog – EV charging system

Flexibility trading platform - VPS

EV charging EMS (Etrel)

EV charging EMS (Trialog)

A complete EV charging system comprising EV charging stations and back-end for management of charging processes, control of charging load and interaction with VPS. Two charging scenarios are supported:

- Case 1: Home charging (Etrel): one charging station at prosumer
- Case 2: Public charging (Trialog): several charging stations at prosumer; advanced algorithms are implememented in EMS for distribution (disaggregation) of load required by VPS to individual charging sessions

Benefits for system users:

- Increased security of public grid operation by exploitation of EV charging load flexibility
- Financial benefits for EV users and charging station operators
- Consideration of EV user‘s needs (time available for charging, required energy) in charging load management
- Increased security of private network by limitation of EV charging load to characteristics of internal (building‘s) network

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ETREL Trialog

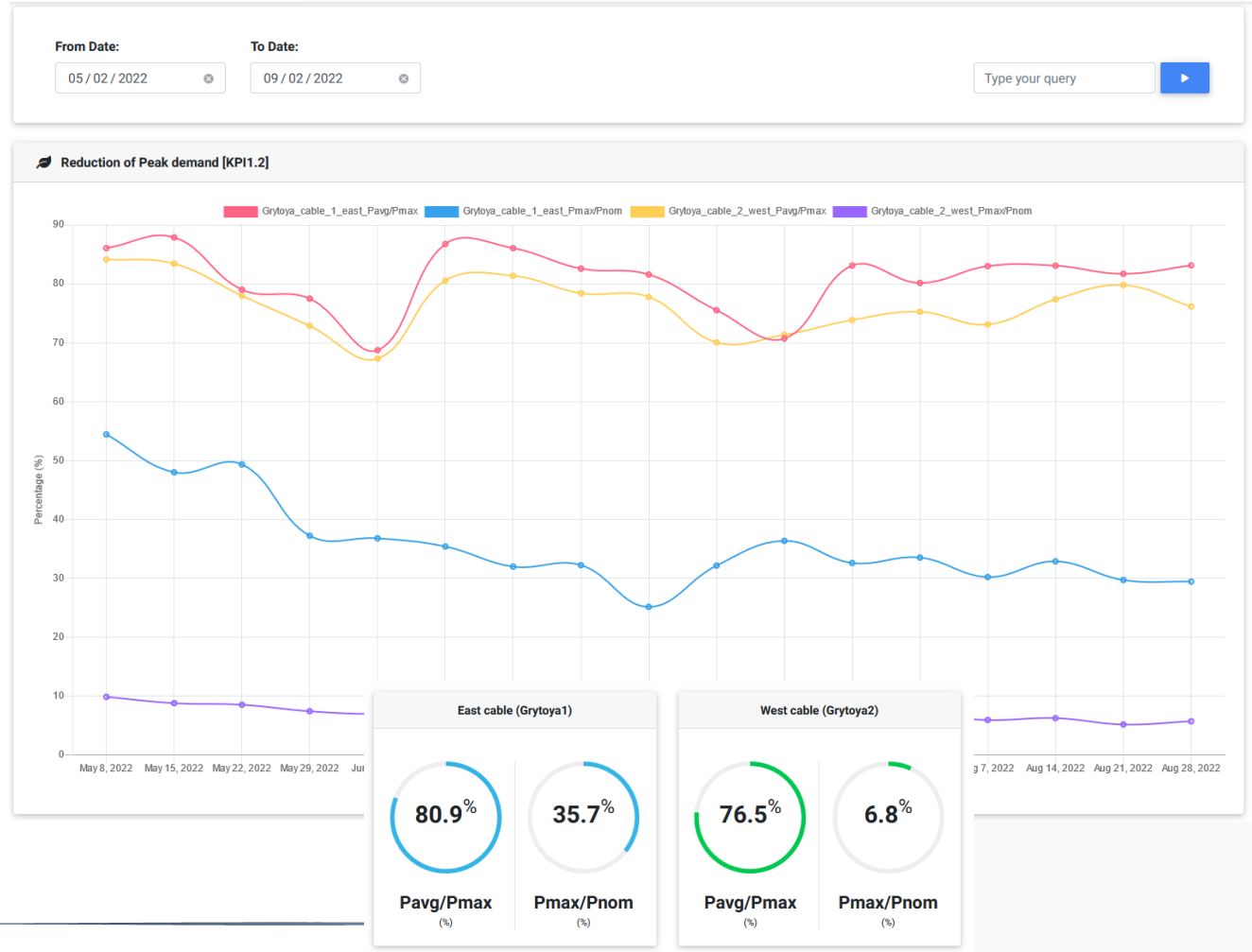
Innovations

Enterprise Service Bus: Analytics Dashboard

Intuitive GUI application for custom visualizations of the project's KPIs. Provides a flexible environment for

Communicating the overall impact of GIFT project

Performance of individual technological solutions



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Demonstration

Demonstration sites

These solutions will be implemented and piloted on:

- *Procida Island (IT)*
  - *Small island with grid congestions*
  - *High seasonality of demand (tourism)*
- *Hinnøya Island Cluster (NO)*
  - *Cluster of large and small islands*
  - *Fish farms using diesel generators*

EV + Charging station

Factory EMS

Storage & mng. (Smart Energy Hub)

Ship/Harbour EMS

EV + Charging station

Factory EMS

Elestor HBr flow battery storage system)

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Demonstration

Use Cases

From the **Harmonized electricity market role model:**

- Congestion management
  - ✓ Norwegian pilot
- Smart Harstad LEC
  - ✓ Norwegian pilot
- Fish Farms LEC
  - ✓ Norwegian pilot
- Procida LEC
  - ✓ Italian pilot

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Lesson

Lesson Learnt, Results and Future activities

Lesson Learnt

- Challenge to obtain appropriate grid network data
- Motivate potential prosumers to be included into flexibility trading system

Results

- Interoperability and integration lab test done successfully
- Grid state observability near-real time and forecast tests done

Future activities

- Deployment of solutions and validation on two demonstration islands
- Business cases in follower islands

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Thank you !

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More about GIFT:

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