16th ETIP SNET Regional Workshop

Western Region

Tuesday 28th February 2022

OPENING REMARKS

Estibaliz Goñi Gaztelu
Director of Processes & Technology (i-DE)

AGENDA

TIME	TOPIC
09.00	Opening Remarks
09.10	Keynote Speeches
09.40	Introduction to ETIP SNET & BRIDGE
09.50	Introduction to ETIP SNET Roadmap 2022-2031 and HLUCs
10.00	Panel Session: National/regional representatives
11.00	COFFEE BREAK
11.30	Projects Panel Session 1: Integrated Energy Networks *(based on ETIP SNET IP **HLUC 1,3,8**)*
12.15	Projects Panel Session 2: Renewable Energy Systems *(based on ETIP SNET IP **HLUC 2,4,6**)*
13.00	Projects Panel Session 3: Digitalization & Citizen's Involvement *(based on ETIP SNET IP **HLUC 5,7,9**)*
13.45	Wrap Up
14.00	Closing Remarks
14.15	End of the Meeting and transfer to lunch

European Commission

KEYNOTE SPEECHES

European Commission

EVE | Ente Vasco de la Energía

Javier Marqués

Technical director, B*asque Government –Ente Vasco de la Energía (EVE)*

European Commission

GOBIERNO DE ESPAÑA
MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO

Miriam Bueno

Spanish Ministry of Ecological Transition and Demographic Challenge

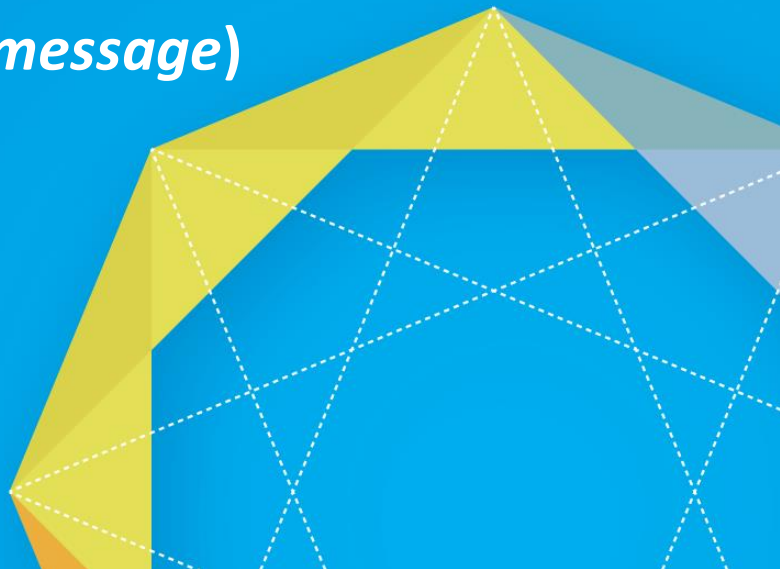
European Commission

European Commission

Paloma Aba-Garrote

CINEA – Director

(*recorded video message*)



George Paunescu

European Commission

(DG ENER B5)

ETIP SNET and BRIDGE

Two key EC supporting initiatives toward the energy transition

28 February 2023
16th ETIP SNET Regional Workshop
Bilbao

Luis Cunha – ETIP SNET Vice Chair

ETIP **Smart Networks for Energy Transition (SNET)**

The ETIP Smart Networks for Energy Transition (SNET) role is to **guide Research, Development & Innovation (RD&I) to support Europe's energy transition**

Drafting Strategic R&I Roadmap and Implementation Plans, and key policy papers and recommendations to the EC.

Address business and technology trends contributing to the overall energy system optimisation at affordable investment and operation costs

Investigate new transmission and distribution technologies, interfacing with storage, demand

response, flexible generation and RES following the full digitalization

ETIP SNET Organisation

Governing Board

Composed by European Associations in the following energy field sectors

Transmission System Operators (TSOs)	Distribution System Operators (DSOs)	National Representatives	Research & Academia
Storage (technology and services providers)	Consumers (aggregated and not aggregated)	Thermal Generation (flexible)	Renewable Energy Sources Generation
ICT, Network and Software providers	Equipment manufacturers and suppliers (non-ICT)	Interface to Other Energy Carriers (Heat, Transport, Gas, ...)	Regulators

Working Group 1

Reliable, economic and efficient energy system

Working Group 2

Storage technologies and system flexibilities

Working Group 3

Flexible generation

Working Group 4

Digitalisation of the electricity system and customer participation

Working Group 5

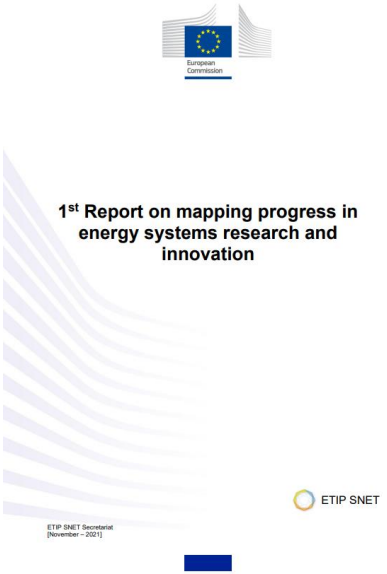
Innovation implementation in the business environment

NSCG

National Stakeholders Coordination Group

European Commission

Main achievements and publications



- **Vision 2050**
- **R&I Implementation Plan 2022-2025**
- **Report on mapping Progress in energy systems research and innovation**

European Commission

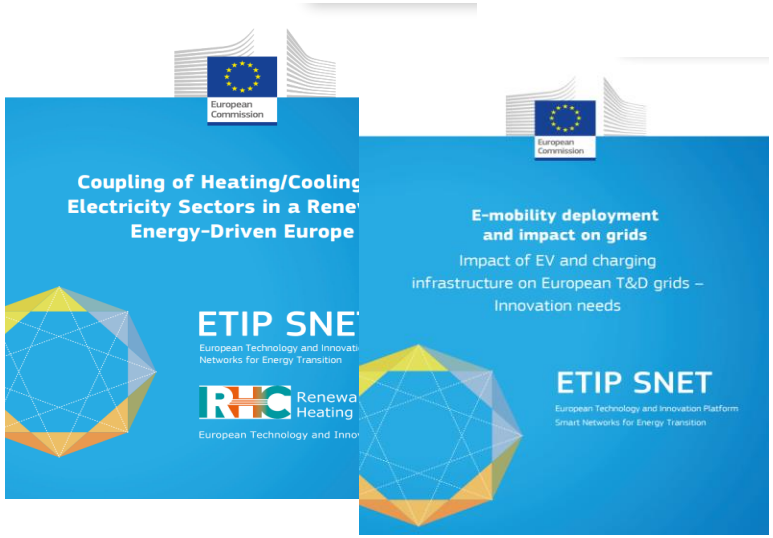
Main achievements and publications

The ETIP SNET Roadmap 2022 – 2031

that will be officially published this week!

European Commission

Main achievements and publications



White Papers from Working Groups

- Coupling of Heating/Cooling and Electricity Sectors in a Renewable Energy-Driven Europe
- Impact of EV and charging infrastructure on European T&D grids – Innovation needs
- E-mobility deployment and impact on grids
- Flexibility for resilience

European Commission

ETIP SNET what next? - Actions Plan 2023

- **By June 2023:**
  - **Implementation Plan** to feed the EC Work Programme 2025

- **By August 2023:**
  - **2 Policy Papers** on:
    - Energy Data Space
    - Energy regulatory Sandboxes

- **By the end of 2023:**
  - Several ***White Papers from the Working Groups*** will be developed on:
    - Energy Communities embedment to increase the grid flexibility and to flourish the electricity markets
    - H2 impact on Grids
    - Hydrogen based on power generation
    - Renewable generation and its effects on system level
    - Digitalisation, scalability and replicability

European Commission

ETIP SNET always looks for new experts!

✓ The energy transition is a goal that will be reached all together!

✓ The ETIP SNET always looks for new experts.

✓If you want to join our Working Groups please check out ETIP SNET website and filling in this form.

European Commission

BRIDGE INITIATIVE

- In strong collaboration with ETIP SNET, BRIDGE is a European Commission initiative aim at putting together EU Projects to create a ***structured view of cross-cutting issues*** which are encountered in the demonstration projects and may constitute an obstacle to innovation, fostering continuous knowledge sharing amongst projects.

Projects Topics

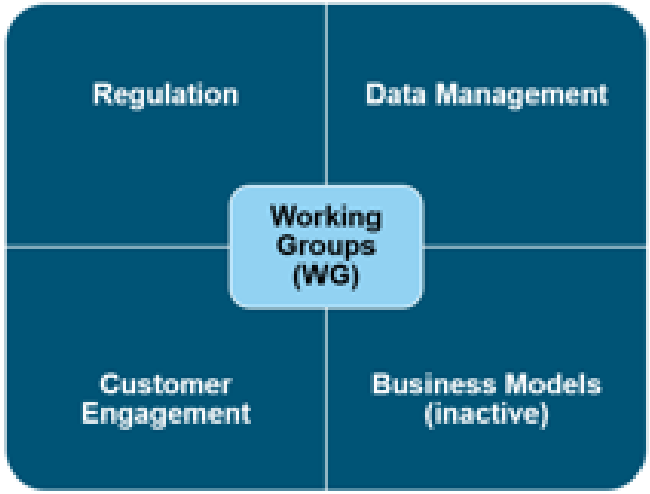
Smart Grids

Energy Storage

Islands

Digitalisation

Current Structure



Thank for your Participation

INTRODUCTION TO ETIP SNET ROADMAP 2022-2031

Nikos Hatziargyriou

ETIP SNET Technical Support Team

ETIP SNET Vision 2050

CONCENTRATED AND DISTRIBUTED vRES

FLEXIBILITY PORTFOLIO

STORAGE SOLUTIONS

INTEGRATED ENERGY NETWORKS

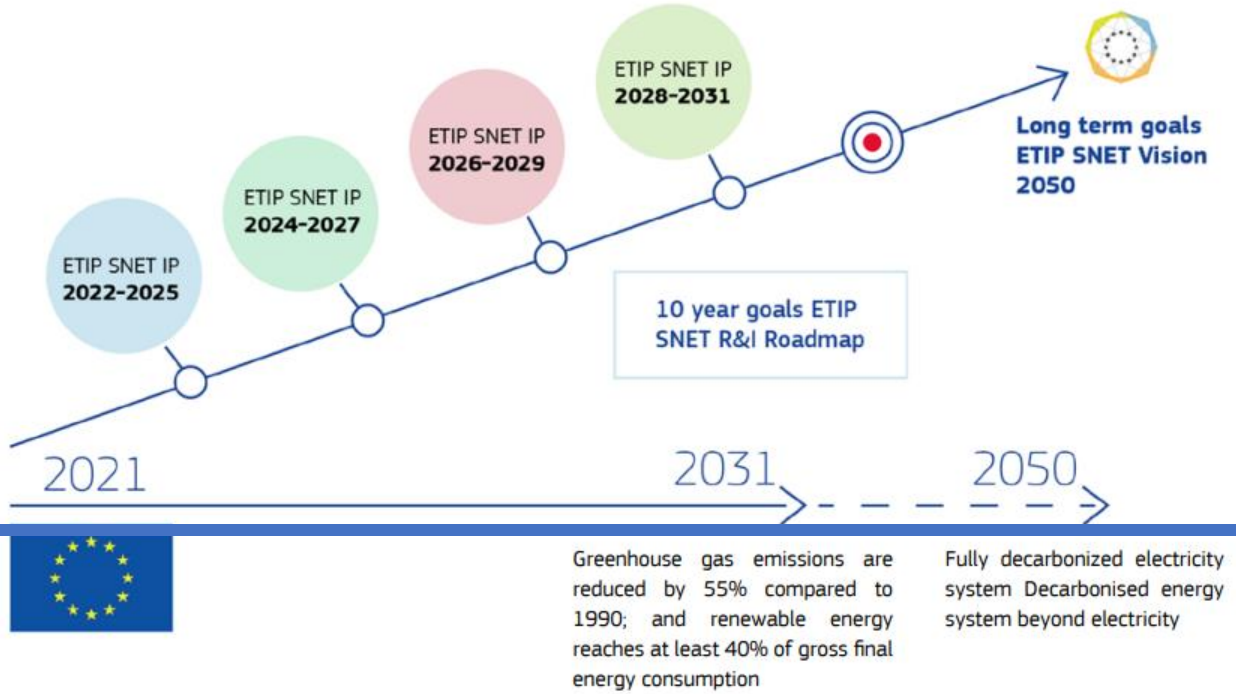
SECTOR COUPLING

DIGITALISATION

European Commission

Roadmap & Implementation Plan (IP)

The ETIP SNET R&I Roadmap 2020-2030 describes the 10-year path towards this future. The Roadmap will be updated by the end of 2022.



The ETIP SNET Implementation Plan 2022-2025 outlines in detail the priority R&I needs for the next four years 2022-2025.

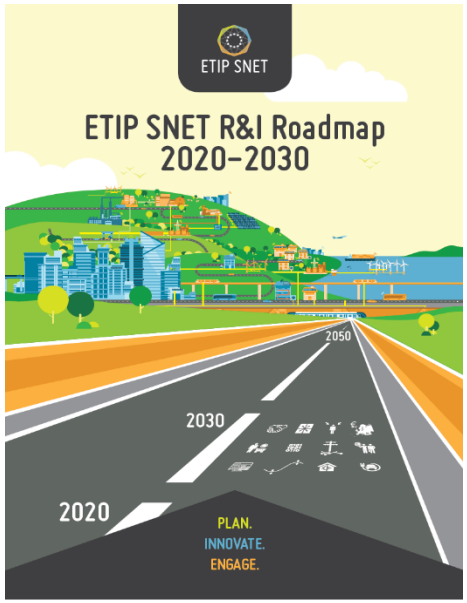
European Commission

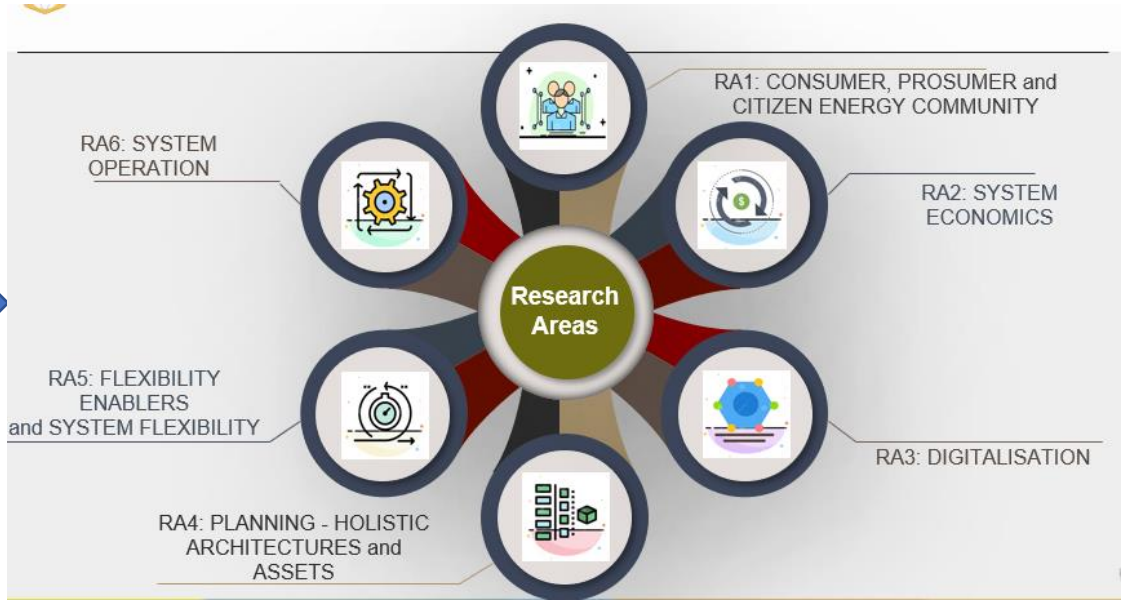
Main Drivers of the Roadmap and the IP

- **Decarbonisation of** energy systems, transport, industry, and building **stock**
- **Involvement of consumers and citizen communities in energy systems**

- **Digitalisation as key enabler of the environmental transition and participative energy markets**
- **Reliability, adaptability and resilience of the integrated energy systems**

European Commission

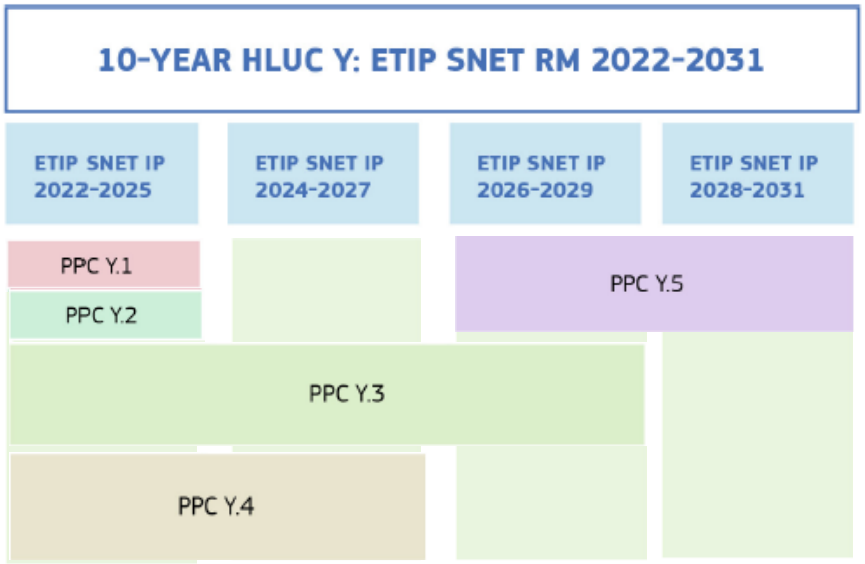


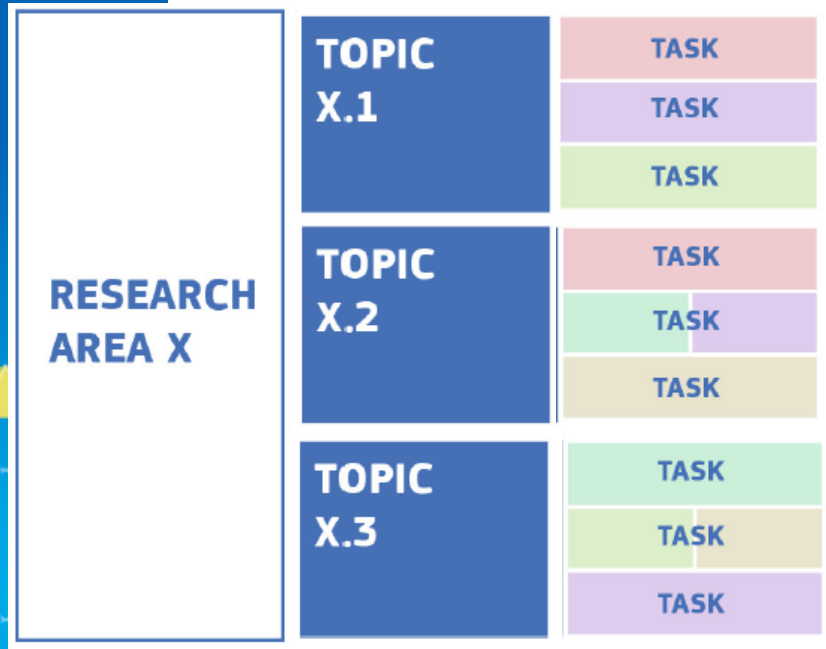


European Commission

Main Concepts

- HLUC: High-level Use Case
- PPC: Priority Project Concept

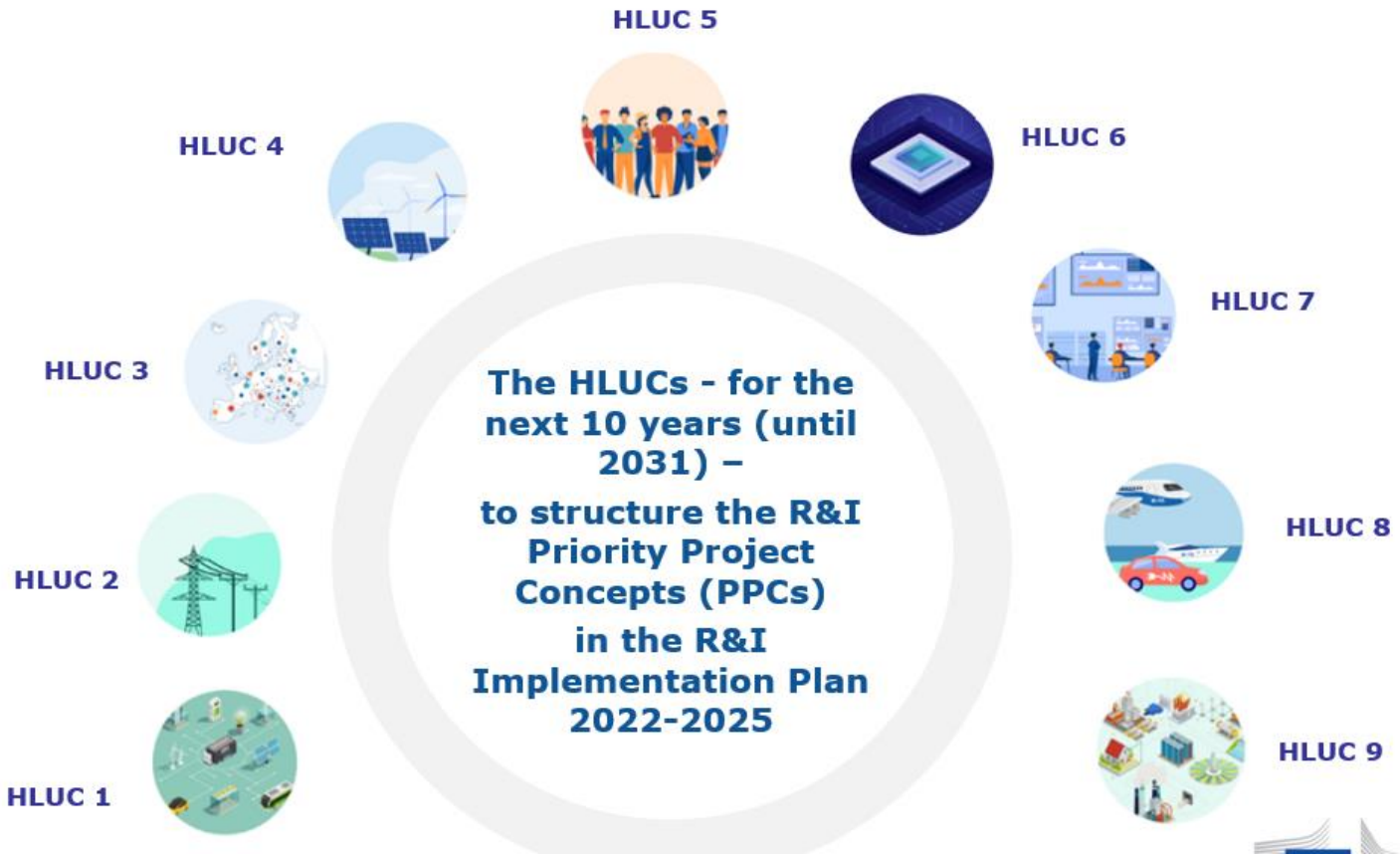




- PPCs might extend to more than one IP
- Research Tasks are associated with PPCs
- More than one Task might be needed for one PPC

European Commission

High Level Use Cases



European Commission

High Level Use Cases

HLUC 1: Optimal Cross sector Integration and Grid Scale Storage

Total Budget: 130M€

HLUC 3: Pan European Wholesale Markets, Regional and Local Markets

Total Budget: 80M€

HLUC 5: One stop shop and Digital Technologies for market participation of consumers (citizens) at the center

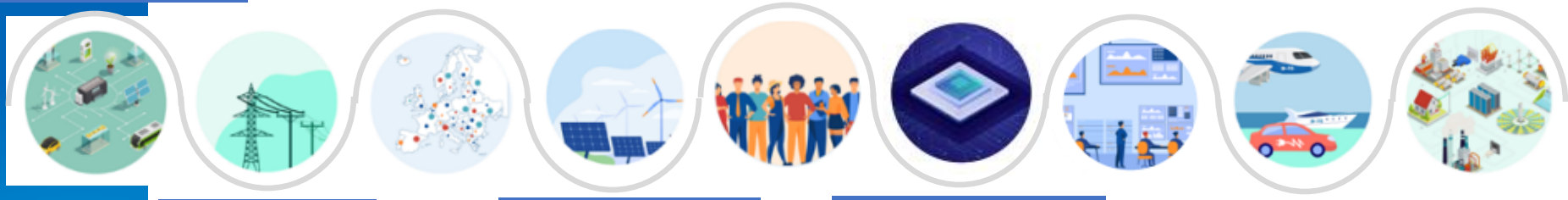
Total Budget : 120M€

HLUC 7: Enhance System Supervision and Control including Cyber Security

Total Budget 135M€

HLUC 9: Flexibility provision by Building, Districts and Industrial Processes

Total Budget: 100M€



HLUC 2: Market-driven TSO–DSO–System User Interactions

Total Budget: 90M€

HLUC 4: Massive Penetration of RES into the transmission and distribution grid

Total Budget: 145M€

HLUC 6: Secure operation of widespread use of power electronics at all systems levels

Total Budget: 100M

HLUC 8: Transportation Integration & Storage

Totl Budget: 100M€

European Commission

Publication of Roadmap

The ETIP SNET R&I Roadmap 2022-2031 will be published this week

Please follow us on the following socials to be notified of its release

BRIDGE and ETIP SNET Social Media:

- **Twitter**: **@Energy4Europe**
- **LinkedIn**: **CINEA corporate account**.

Hashtags: **#ETIPSNET** and **#bridgeEU**.

European Commission

Panel Session: Regional /National Representative

Moderator: Ludwig Karg

CEO, BAUM Consult

Key Ideas from Funding Programmes

Panelists

- **Lucy Corcoran -** SEAI *(EI)*
- **Paulo Partidário –** DGEG *(PT)*
- **Nadine Berthomieu –** ADEME *(FR)*
- **Marina Sopeña Escalona – CDTI** *(ES)*

Key Ideas from Funding Programmes

Marina Sopeña
CDTI *(ES)*

Introduction and Overview

- **SPAIN'S NATIONAL INNOVATION AGENCY**

- Activities

Main purpose: Enhance Spanish companies' competitiveness & internalization through INNOVATION

- CDTI takes part of Smart Energy Systems ERA-NET and CETP.

Aligning our R&D&I policy with Horizon Europe

Is the multi-year reference framework whose objectives are shared by the General State Administration (AGE) and the Autonomous Regions in the field of promoting scientific, technical and innovation research.

It is the reference to elaborate the PEICTI

Is the main instrument of the General State Administration for the development and achievement of the objectives of the Spanish Strategy for Science and Technology and Innovation (EECTI)

The Energy Systems Implementation Working Group is supported by the ETIP smart networks for energy transition (SNET) and European Research Area Network for Smart Energy Systems (ERA-NET SES and CETP)

Participación del CDTI Innovación en los Partenariados Cofund de Horizonte Europa

El CDTI Innovación participa, actualmente, en los siguientes Partenariados Cofund de Horizonte Europa, que se recogen en la siguiente tabla.

Acrónimo	Temática
CETP	Energía
DUT	Ciudades Sostenibles
Water4all	Tecnologías del agua
Biodiversa+	Biodiversidad
SBEP	Bioeconomía azul
Pymes innovadoras (Eurostars-3 e InnoWwide)	Pymes

European Commission

Relevant projects. CDTI participation in cofund calls (SG+, REGSYS, ENERDIGIT and CETP)

8 funded projects:

- **SMARES** – Configurable energy management system for renewable power plants and smart grids
  https://www.eranet-smartenergysystems.eu/global/images/cms/Content/Fact%20Sheets/ERANetSmartGridsPlus_SMARES_FactSheet.pdf
- **SIES 2022** – Smart Integrated Energy Systems 2022
  https://eranet-smartenergysystems.eu/global/images/cms/Content/Fact%20Sheets/ERANetSES_ProjectFactSheet_RegSys2018_SIES2022.pdf
- **MULTIPORTGRID** – Cross-Sectoral Energy Control through Interconnected Microgrids by Multiport Converter
  https://eranet-smartenergysystems.eu/global/images/cms/Content/Fact%20Sheets/ERANetSES_ProjectFactSheet_RegSys2018_Multiportgrid.pdf
- **FLEXI-SYNC** – Flexible energy system integration using concept development, demonstration and replication
  https://www.flexisync.eu/
- **BEYOND** – Blockchain based Electricity trading for the integration Of National and Decentralized local markets
  https://beyond-project.eu/
- **EPC4SES** – EPC based Digital Building Twins for Smart Energy Systems SES
  https://eranet-smartenergysystems.eu/global/images/cms/Content/Fact%20Sheets/ERANetSES_ProjectFactSheet_RegSys2018_EPC4SES.pdf
- **GENTE** – Distributed Governance for green ENergy communiTiEs
  https://genteproject.com/
- **HydroG(re)EnergY-Env** –New technology to produce hydrogen from Renewable Energy Sources
  https://www.eranet-smartenergysystems.eu/global/images/cms/Content/Projects/ERA-Net_SES_JointCall2020_funded_projects.pdf

Future of collaboration: Clean Energy Transition

- ✓ New framework for participants. No specific calls only for Energy Systems. One large call per year with thematically related Transition Initiatives.
- ✓ After the first call (currently in full proposal phase), all actors still have to get used to the new instrument.
- ✓ Synchronisation of dates and harmonisation of national procedures remains a challenge.
- ✓ However, the possibility to collaborate with other partners on aligned research lines is clear: one large timeframe with new opportunities every year.

Key Ideas from Funding Programmes

Dr Lucy Corcoran – Programme Manager
Research Development & Demonstration, SEAI

We work with Government, homeowners, business and communities to create a cleaner energy future

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

SEAI Research & Innovation Activities

Lead & coordinate energy research supports in Ireland

SEAI National Energy RD&D Programme - Overarching go

2023 Call will open for applications in March 2023!

Accelerate **development & deployment** of competitive energy products, processes & systems

Enable barriers to **market uptake** to be overcome

Grow **Ireland's capacity** to access, develop & apply **international class energy RD&D**

Provide **energy policy guidance & support**

- Annual competitive call – funds innovative energy RD&D projects
- Open to companies, research organisations, public sector and semi-state bodies

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Marine & Renewable Energy Test Facilities

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Key Ideas from Funding Programmes

Nadine Berthomieu, Anne Varet
ADEME (*FR*)

France 2030 – an investment program to promote :

- Better understanding of technologies
- Industrial innovative technologies productions

PREMIER MINISTRE
Liberté
Égalité
Fraternité

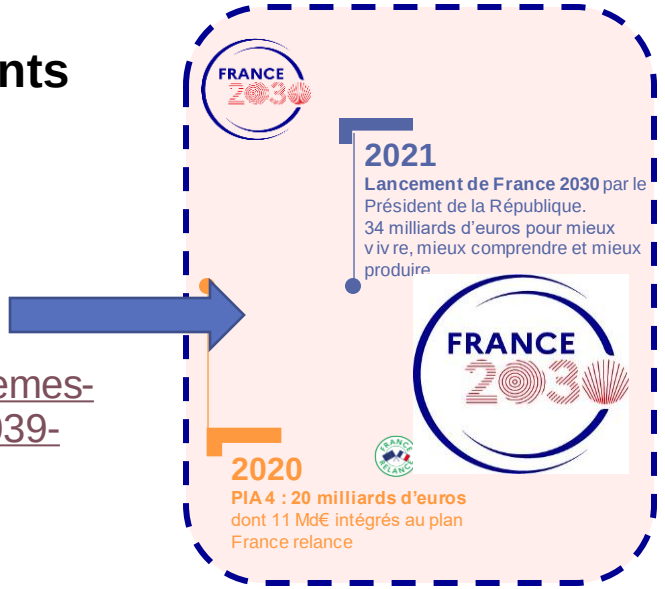
FRANCE 2030 : a new program following 10 years of investment in Innovation through a specific previous program called : « Investissements d'Avenir »

Two main reports from this specific « Investissements d'Avenir » program on Smart Grids and Numerical approach of energy :

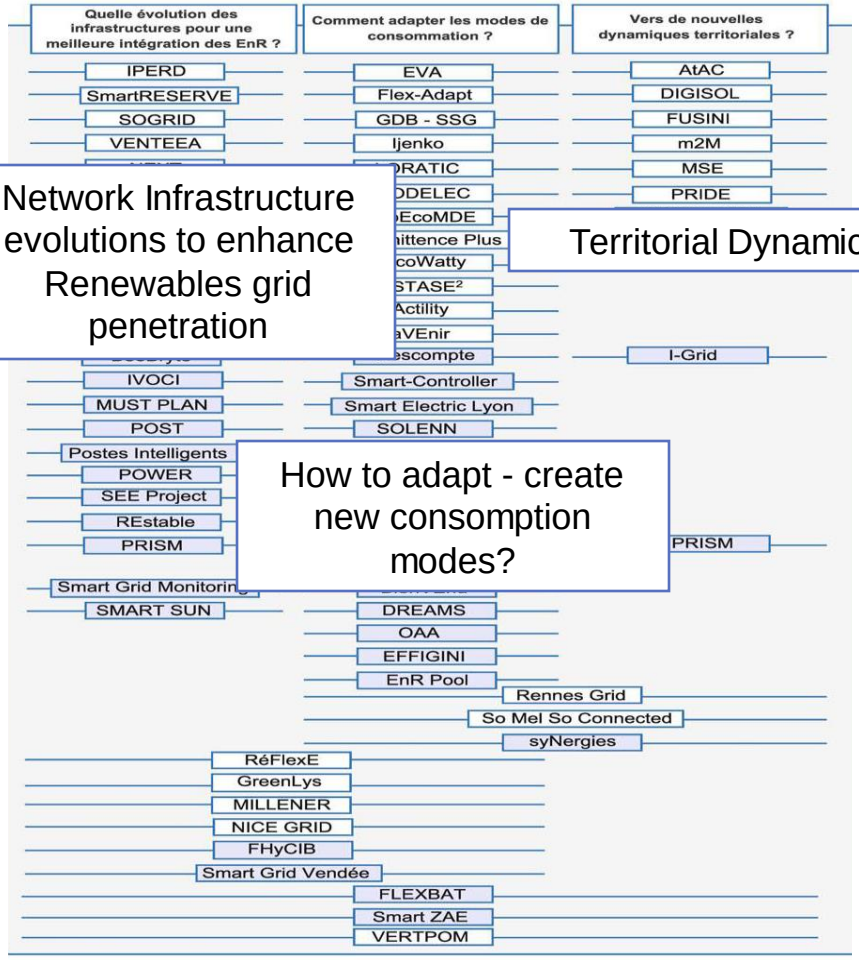
- From 2012 to 2015 : https://www.ademe.fr/sites/default/files/assets/documents/systemes-electriques-intelligents-premiers-resultats-demonstrateurs-010039-rapport.pdf

- From 2015 to 2019 :

https://www.ademe.fr/systemes-electriques-intelligents-soutien- lademe-a-linnovation-depuis-2010



Main topics covered by the PIA program



Different promotion tools completing each others in the New France 2030 program

Dedicated to Industrial Technologies : « AAP DEMO TASE » and « PME TASE »

- Innovative projects dealing with a specific « innovation brick » or a demonstrator for industrialisation (TRL 4 to 6 to start with)
  - DEMO TASE : **indutries alone or consortiums**
  - PME TASE : dedicated to **small business units**

Dedicated to Industrial Production : « Indus ENR »

- **Investing in new capacities** : priority to emerging sectors and products essential to reduce dependance. Subsidies possible on the overall industrial chain, including upstream (i.e. silicilum for PV) and downstream (recycling).

DEMO TASE program, Network and Energy Systems

Main Goal :
2 additional topics
1. **Infrastructure** optimisation : corresponding to ETIP High Level **Use Case 6**
2. **Real Time** optimisation level : corresponding to ETIP High Level **Use Case 3**
A special attention is set to technologies with a high potential for export

Expected projects :

1. Infrastructure Optimisation

- Planification of infrastructures, productions (lines, transformers…), system flexibilities on various network scales ;
- Sector coupling for flexibility purposes and a better *supply demand balance* or better efficiency ;
- Improving network performance thanks to innovative tools (digitalisation).

2. Real Time Networks developement

- Innovative Power Electronics to operate stability regardless of conventional systems;
- Numeric solutions allowing massification of diffuse flexibilities at a masterised cost.

TASE PME : targeted towards a small business unit

Main Goal

The Tender aims at financing innovative projects developped withn **Small Business Units** (PME) with high potential for french economy

Grid Networks themes : Use Case 4 mainly :

Enhancing massive **Renewables** introduction within Energy Networks

Projects selective critera

Innovation *(DEMO TASE et TASE PME)*

- State of the Art and Technological Barrier
- Expected TRL 8 à 9 at the end of the project

Financial and operational capacity

Evolution of self funding – versus subventions during projects' lifespan

(rule 1 : 1 to be satisfied)

Social Impact

- Employment
- Geographical region where the industry is created

- **Replicability**
- Incitativity of the subsidy

Environnemental Impact

- CO2 Reduction
- Energy economy and material economy, etc...

Economical Impact

- 5 years ahead sales revenue and beyonf
- Competitivness

European Commission

Key Ideas from Funding Programmes

Direção Geral de Energia e Geologia

Paulo Partidário
DGEG (*PT*)

Key Ideas from Funding Programmes

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COFFEE BREAK

11:00 - 11:30

Projects Panel Session 1
Integrated Energy Networks

- Cross Sector Coupling
- Transport & Storage
- Energy Markets

High Level Use Cases

HLUC 1: Optimal Cross sector Integration and Grid Scale Storage

Total Budget: 130M€

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Total Budget: 80M€

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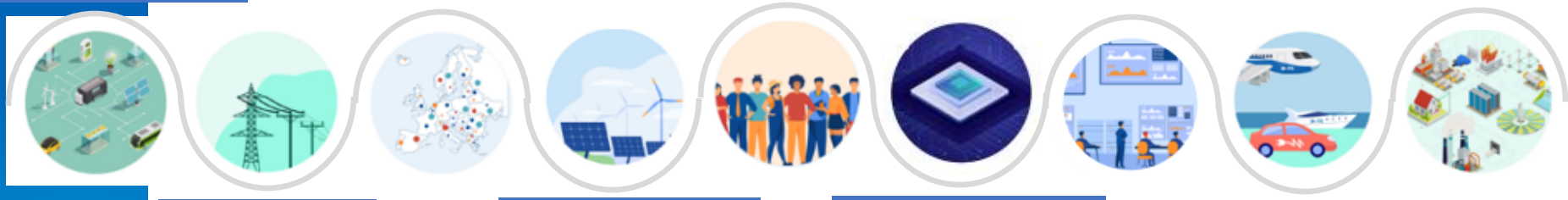

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Total Budget: 100M

HLUC 8: Transportation Integration & Storage

Totl Budget: 100M€

European Commission

Priority Project Concepts (PPCs) 2022-2025, 2025+, 2026+

HLUC 1: Optimal Cross Sector Integration and Grid Scale Storage
PPC 1.1: Value of cross sector integration and storage (IP 2022--2025)
PPC 1.2: Control and operation tools for multi-energy systems (IP 2022-2025)
PPC 1.3: Smart asset management for a circular economy (IP 2022-2025)
PPC 1.4: Integrating hydrogen and CO2-neutral gases (IP 2025+)
PPC 1.5: Regulatory framework for cross sector integration (IP 2025+)
PPC 1.6: Cross sector resilience (IP 2026+)
PPC 1.7: Future cross-vector infrastructure design (IP 2026+)

HLUC 3: Pan European Wholesale Markets, Regional and Local Markets
PPC 3.1: Fundamental market design (IP 2022-2025)
PPC 3.2: Regulatory framework and strategic investments (IP 2022-2025)
PPC 3.3: IT systems for cross-border trading (IP 2022- 2025)
PPC 3.4: Validation of new market concepts (IP 2025+)
PPC 3.5: IT systems for TSO/DSO control to support real time balancing (IP 2026+)

Priority Project Concepts (PPCs) 2022-2025, 2025+, 2026+

HLUC 8: Sustainable Transportation Integration
PPC 8.1: Technical and economic implication of decarbonisation of transport sector (IP 2022-2025)
PPC 8.2: Enhancing effectiveness of energy system operation and resilience with electromobility (IP 2022- 2025)
PPC 8.3: Integrated planning of energy and transport sectors (IP 2022-2025)
PPC 8.4: Adapting policy and market for seamless cost-effective merging of transport and energy sectors (IP 2025+)
PPC 8.5: Demonstration activities (IP 2026+)

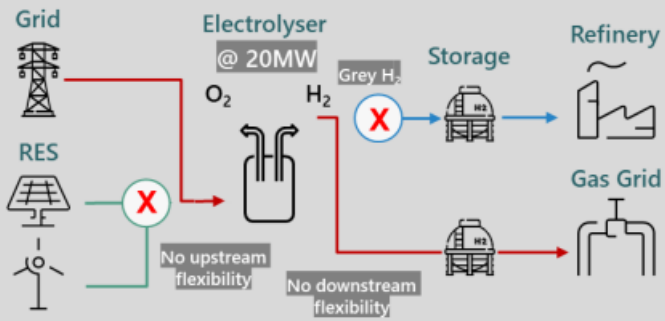
GreenH2Atlantique / Horizon Europe

João Peças Lopes / INESC TEC

Project Description

Green hydrogen production in the EU as of today...

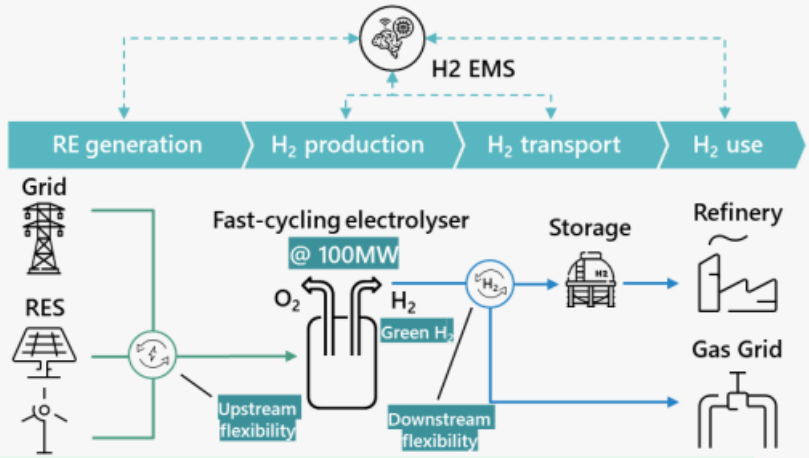
- × Limited to 20 MW-scale & scalability potential
- × Only parts of the hydrogen value chain covered
- × Insufficient contribution to EU LTS goals for 2050
- × Limited ramp rates of the electrolyser
- × Large electrolyser plant footprint
- × Uncompetitive hydrogen price
- × High electrolyser plant CAPEX
- × Low flexibility potential
- × No dedicated RE absorption



... remains at small-scale and supplies grey hydrogen to individual offtakers.

Green hydrogen production in the EU with GREENH2SINES...

- ✓ Scalable 100 MW plant for GW-scale
- ✓ Covering the full hydrogen value chain
- ✓ Dedicated hybrid RE plant
- ✓ Flexible green hydrogen production process
- ✓ Reduced BoP & footprint
- ✓ Affordable hydrogen due to reduced CAPEX & RE LCOE



... will reach 100 MW scale and supply affordable green hydrogen to multiple offtakers.

Introduction and Overview to GreenH2Atlantique

❖ Main Goals:

- Provide Europe with green and affordable electrolysis in the GW scale by 2030
- Help in supporting the electrical grid and integrating renewable sources to it
- Creating a great amount of direct and indirect job opportunities (approx. 3000)
- Enhance the promising H2 valleys within Europe, thus encouraging and facilitating investment plans
- Provide actionable input for EU harmonization and regulations

Two area model for the IB

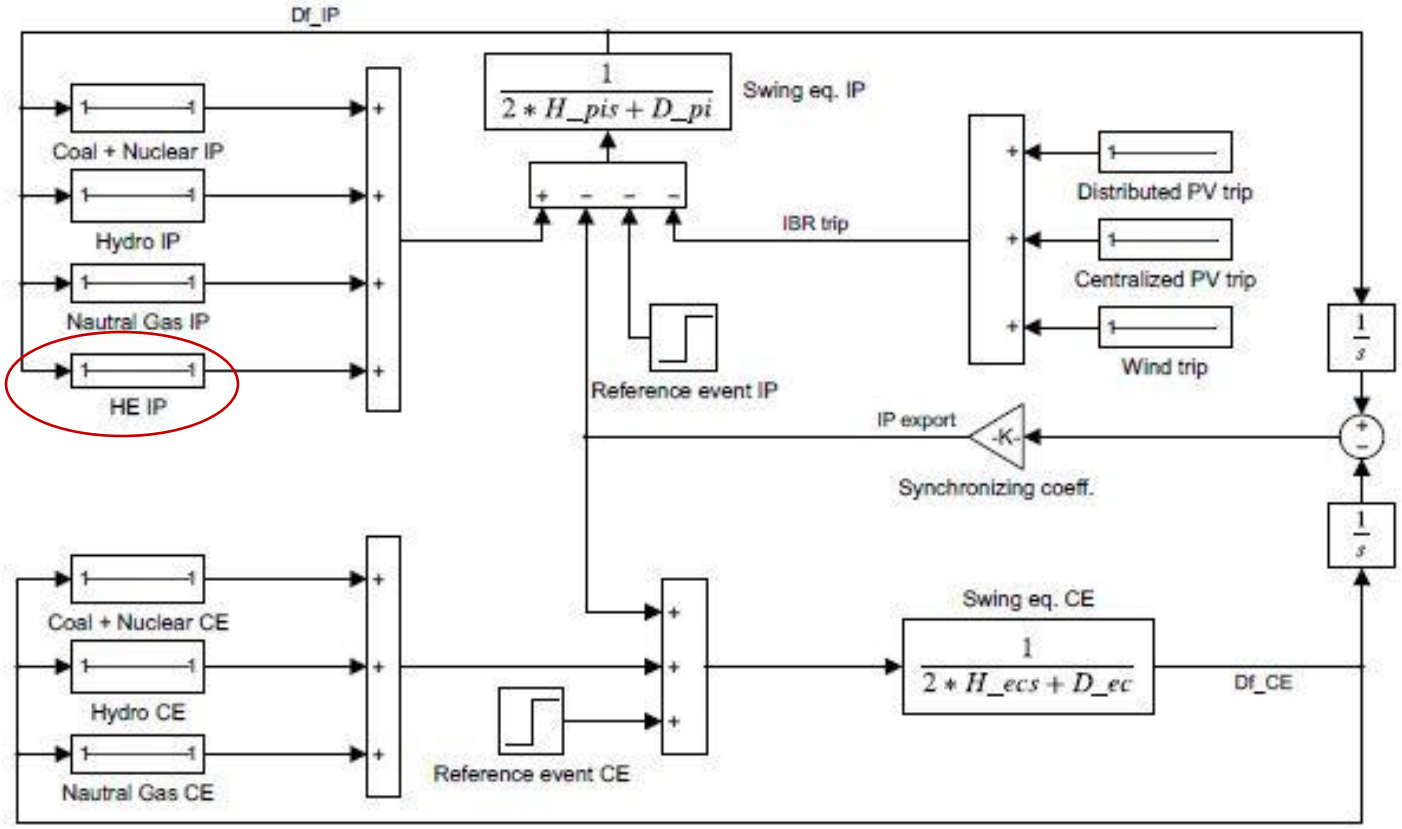


Fig. 1. MATLAB/Simulink simulation platform

Eletrolysers Dynamic Response

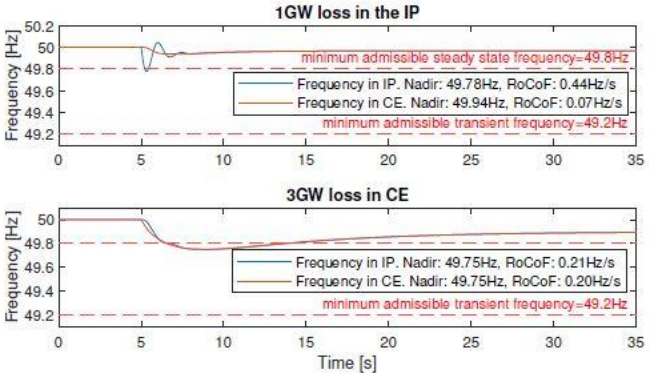


Fig. 4. Frequency in IP and CE after reference incident in IP and CE. FCR provided by conventional technologies.

- Two simulations cases, where FCR is provided by either conventional sources (hydro and CCGT) or HEs (slow PEM and alkaline).
- Regarding the reference incident, HEs' FCR provision, improves the robustness of operation (frequency nadir is reduced).

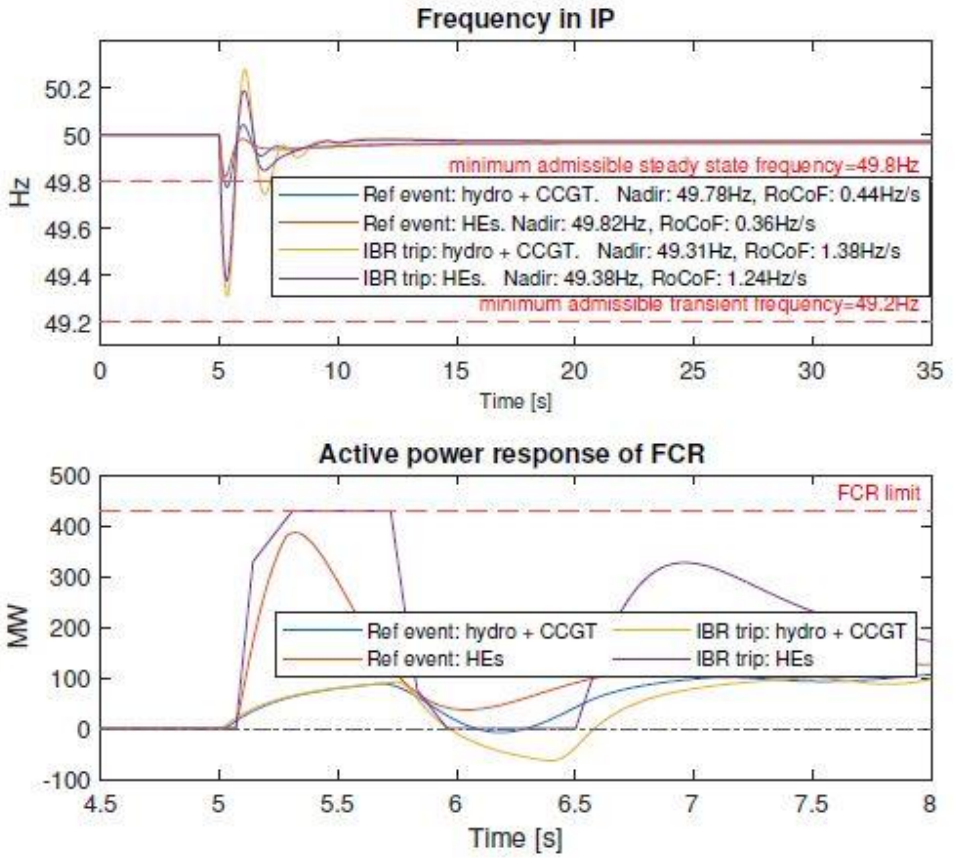


Fig. 5. Frequency in IP after reference incident and IBR trip, FCR in IP provided either by conventional technologies orHEs

As a general requirement for water electrolysers providing grid services, they must be able to react to power changes as fast it is required depending on the service (FCR, FRR, etc), respecting the tolerances and grid constraints defined by each grid operator.

HLUC relevance

project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
GreenH2Atlantic	●●		●●	●● ●						

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Key findings

from project / program	finding(s)	relevant for HLUC(s) no.
Horizon 2020 Call: H2020-LC-GD-2020	• H2 used for seasonal storage and assure security of supply • Electrolysers will provide relevant ancillary balancing services (FCR, aFRR, mFRR, RR) and other flexibility services in scenarios of large scale renewable generation – PPC4.2, PPC 4.3, PPC4.5 • Market design considerations for the provision of system services by electrolysers are required – PPC3.1, PPC3.4	

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
GreenH2Atlantique	• Requirements for the provision of ancillary services from electrolysers (control loops, typical ramp rates) • Potential for the provision of non-frequency ancillary services • Type of dynamic behaviour analysis studies (using electrolysers alone or within a VPP with other renewable power plants like solar PV or wind power)	

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project / program	proposal(s) / recommendation(s)	relevant for HLUC(s)
GreenH2Atlantique	• Define technical requirements and identify the type of balancing products that electrolysers can provide when operating as providers of ancillary services	PPC4.2 and PPC4.3
GreenH2Atlantique	• Develop models of electrolysers and their frequency control loops for the provision of frequency control services • Define dynamic behaviour analysis studies where electrolysers are participating in frequency control	PPC4.3 and PPC4.4

REgions

Stefan Übermasser,
Austrian Institute of Technology

Ancillary services of regions with high shares of renewable energies for regional and European markets

Main Goals:

- Regional market design

Design of a new regional market and inter-regional coordination of VPPs for re-dispatch/voltage support. The design is based on technical, social and regulatory aspects as well as evaluation and tests.

- Coordinated cross-layer support

Increase the coordinated support of fluctuating renewable energy sources to regional, inter-regional and European layers of ancillary services and markets

Project Website: https://www.regions-project.info/

WP specific goals

- WP3: Define, analyse and evaluate **use cases and market designs** corresponding to regional markets, market interaction and various configurations of VPPs.
- WP4: Model, implement and evaluate the **full chain of forecasting**, via VPP optimization for several markets (regional, inter-regional level and markets).
- WP5: **Develop solutions for coordination measures in regional VPPs** and between regional and interregional VPPs regarding testing, implementation, data exchange and control.
- WP6: **Demonstration of solutions** from WP5 in real settings and definition of KPIs for VPP controller on regional level and as platform solution on interregional level.
- WP7: **Evaluation of VPP solutions** on regional and interregional level regarding technical readiness, economic assessment, regulatory framework and stakeholder needs.

Use-Cases – VPP Functions

- UC1: Congestion management / Redispatch
- UC2: Voltage Support
- UC3: RE participation in the redispatch process
- UC4: Redispatch with PV
- UC5: PV participation in the balancing market
- UC6: Combined value streams for PV systems from wholesale markets and ancillary services provision
- UC7: Collateralsation of balancing reserve during congestion

HLUC relevance

of project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
REgions		●●	●● ●	●● ●	●				●	●● ●

HLUC 2: Market-driven TSO–DSO–System User Interactions

HLUC 3: Pan European Wholesale Markets, Regional and Local Markets

HLUC 4: Massive Penetration of RES into the transmission and distribution grid

HLUC 5: One stop shop and Digital Technologies for market participation of consumers (citizens) at the center

HLUC 9: Flexibility provision by Building, Districts and Industrial Processes

relevant
evant
o some degree
t know

Key findings from project REgions

Regions finding(s)	relevant for HLUC(s) no.
New **market design for local flexibility markets** dealing with congestion management at an electrical regional scale	3
Successful set-up of an interregional **RES VPP with >160 MW** installed capacity using the interfaces of the operator or OEM including the corresponding security measures.	4
Development of a **Smart Dispatch algorithm to ensure a reliable ancillary service provision** of a pool of RES. In case of service delivery failure of single assets, the service is compensated by the other energy plants within the pool. This feature can be used by aggregators or grid operators to increase reliability of ancillary service provision.	2,4,9
The use cases congestion management (UC1), reactive power (UC2), Antimetric Redispatch (UC3) as well as international collateralization of balancing reserve during grid congestion (UC7) have been **demonstrated with real assets in more then 20 field-tests** in total.	4,9
High effort to connect real assets to a VPP and enable control. Therefore a **combination of virtual and real assets is recommended** in order to demonstrate and evaluate new approaches risk free and at an earlier stage.	4
The concept of **energy data spaces** and/or common internet of energy promote a standardized, interoperable, secure and cross-sectoral data sharing accelerating the energy transition. These efforts should be accompanied by high open data engagement e.g. in terms of spatial congestion management forecasts.	5
As ancillary service provision by RES is not stable during low production a **generation mix** including flexible assets (e.g. CHPs, batteries) is recommended for better compensation and reliability.	4
The **experience of frequently communication failure** emphasized the need of reliable (redundant) ICT backup strategies and robust distribution strategies.	4,5

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
REgions	To work on a model that could estimate the available Reactive Power, as did for Active Power, to compensate the lack of provision or control of one plant by another.	

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project	proposal(s) / recommendation(s)	relevant for HLUC(s)
REgions – Local Market Design	The proposed local market uses local bids dedicated to the European intraday market in order to meet specific bids submitted by System Operators called swap bids. Swap bids form an original type of bids submitted by the system operator to express a need to swap power injection or consumption from a zone to another. It is used by the system operator to relieve a congestion or to manage other technical issues, such as limiting power losses. We also propose another original type of bids called loop block orders (or loop bids)to be submitted by flexibility providers who want to benefit from their capacity to swap injection or consumption from a time-step to another.	3
REgions – RES data	The concept of energy data spaces and/or common internet of energy promote a standardized, interoperable, secure and cross-sectoral data sharing accelerating the energy transition. These efforts should be accompanied by high open data engagement e.g. in terms of spatial congestion management forecasts.	5
REgions – Regulatory framework	The regulatory framework would have to be adapted to allow the collateralization of balancing reserves across control areas.	3
REgions – Antimetric Redispatch	to use the antimetric approach to perform redispatch in order to minimize impacts on the system balance, to introduce a unique Redispatch ID in order to clearly assign related redispatch measures to each other, to take into account the grid frequency and aFRR prices to economically assess the costs of non-antimetry of a redispatch.	3,4

ENERIsla / Spain

Pilar Meneses de Quevedo (CIDETEC)

Introduction and Overview – ENERISLA Project

Strategic objectives of the network

Technology transfer | R&D&I | Network expansion | Knowledge transfer | Dissemination

Develop the **technological capabilities** needed to begin setting up **100% fully renewable isolated microgrids** taking advantage of the energy system developments.

https://www.enerisla.es/en/enerisla-project/

Pillar 1
Development and integration of energy produced by renewable generation technology

Pillar 2
Improved control and operation of isolated microgrids

Pillar 3
Development of mechanisms to manage consumption and electrify loads

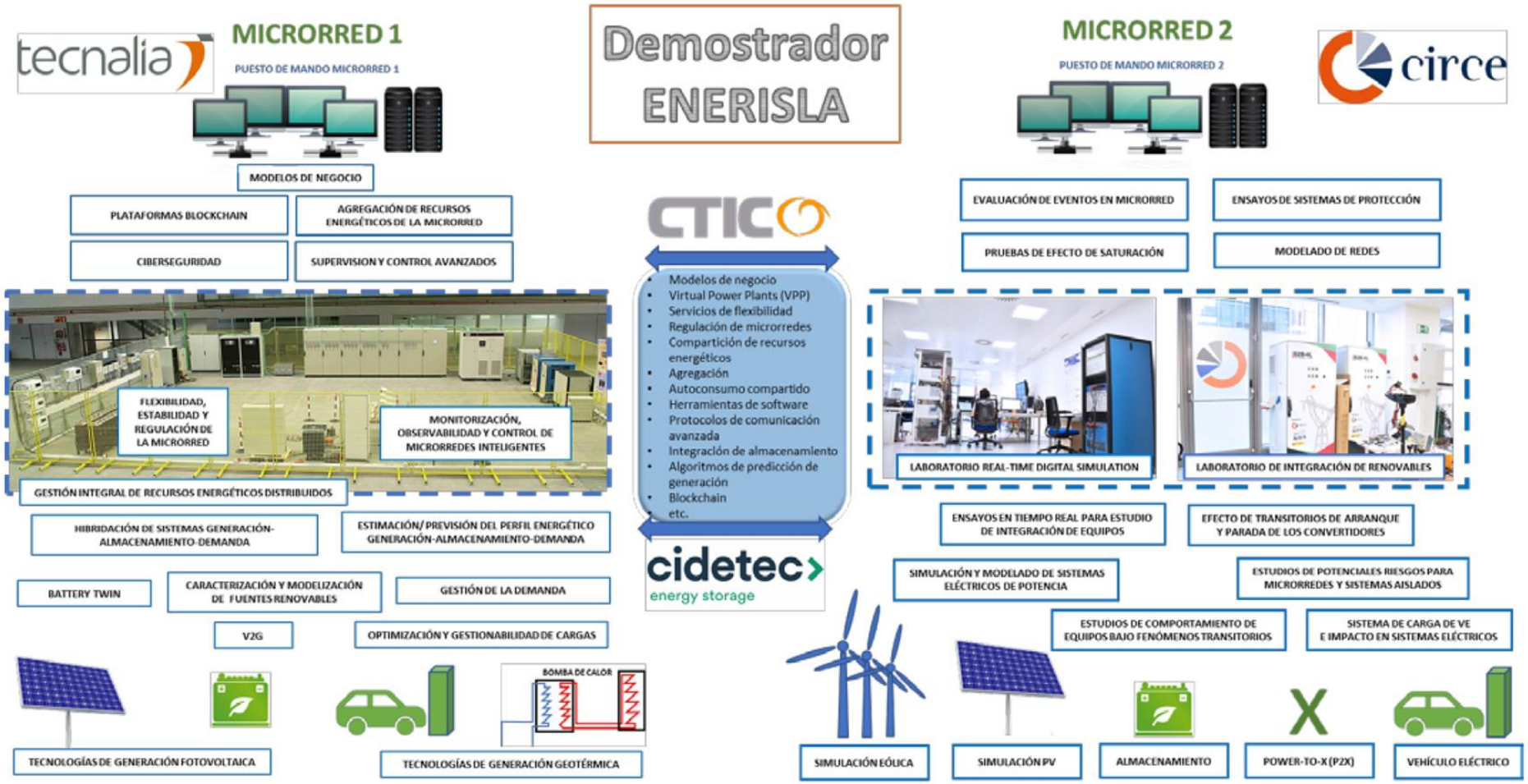
Pillar 4
Integration, management and operation of electrical storage

Pillar 5
Digitalisation of microgrids and development of innovative ICT services

circe | cidetec energy storage | CTIC centro tecnológico | tecnalia

Ministerio de Ciencia, Innovación y Universidades | CDTI Centro para el Desarrollo Tecnológico Industrial

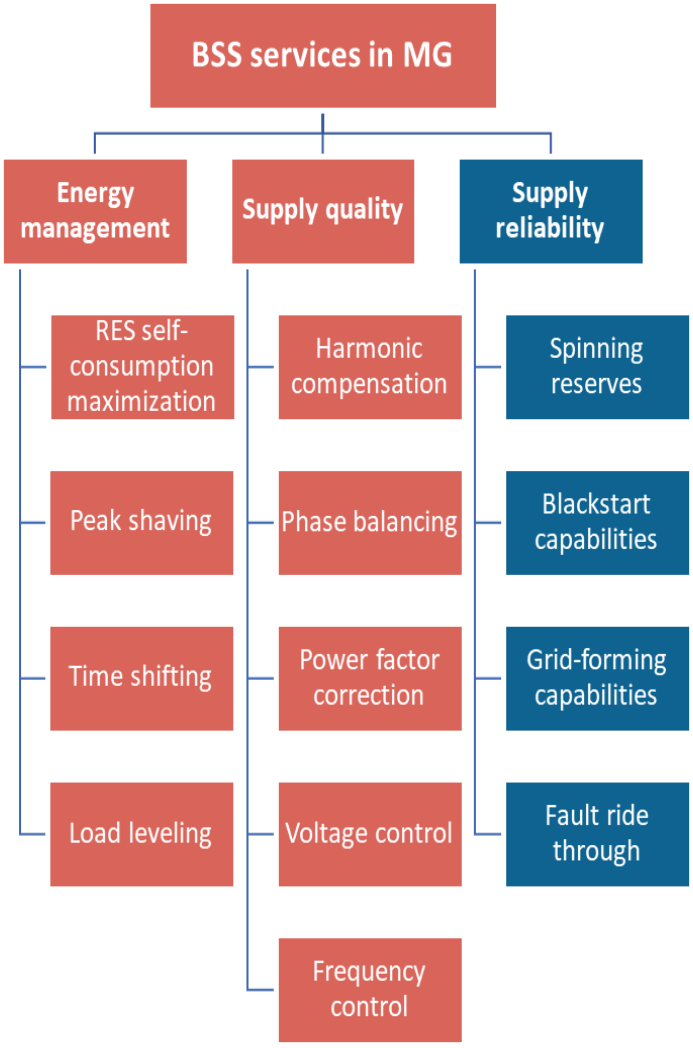
Introduction and Overview – ENERISLA Project



Introduction and Overview – ENERISLA Project

CID activities

- Technological services based on Li-ion pouch **cell prototyping** and designing and manufacturing high-density "**post-Li-ion"** cells and high-tech "**beyond-Li-ion**" cells.
- **Characterisation** and **testing** services on pouch cells, modules, battery packs, etc.
- Cell modelling concerning a variety of technology, such as **multi-physical modelling** to analyse behaviour, degradation and **life-cycle estimation**, empirical modelling to analyse electro-thermal behaviour.
- **Tools for optimal dimensioning** the batteries and techno-economical assessment in stationary applications.
- Advanced **energy management** strategies for operating the batteries.
- **Smart charging** solutions for EV: integration and management of the electric vehicle, characterization of the flexibility in different charging scenarios.



Introduction and Overview –

CIDETEC tool for:

- Optimal dimensioning the batteries
- Advanced management strategies
- Techno-economical assessment in stationary applications

ENER ISLA

almagrid

applications

- Develop advanced storage systems to respond to the needs for massive integration of renewable generation technologies

cidetec energy storage

IK4 TEKNIKER

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Ministerio de Ciencia, Innovación y Universidades

CDTI Centro para el Desarrollo Tecnológico Industrial

https://www.almagrid.es/es/almagrid

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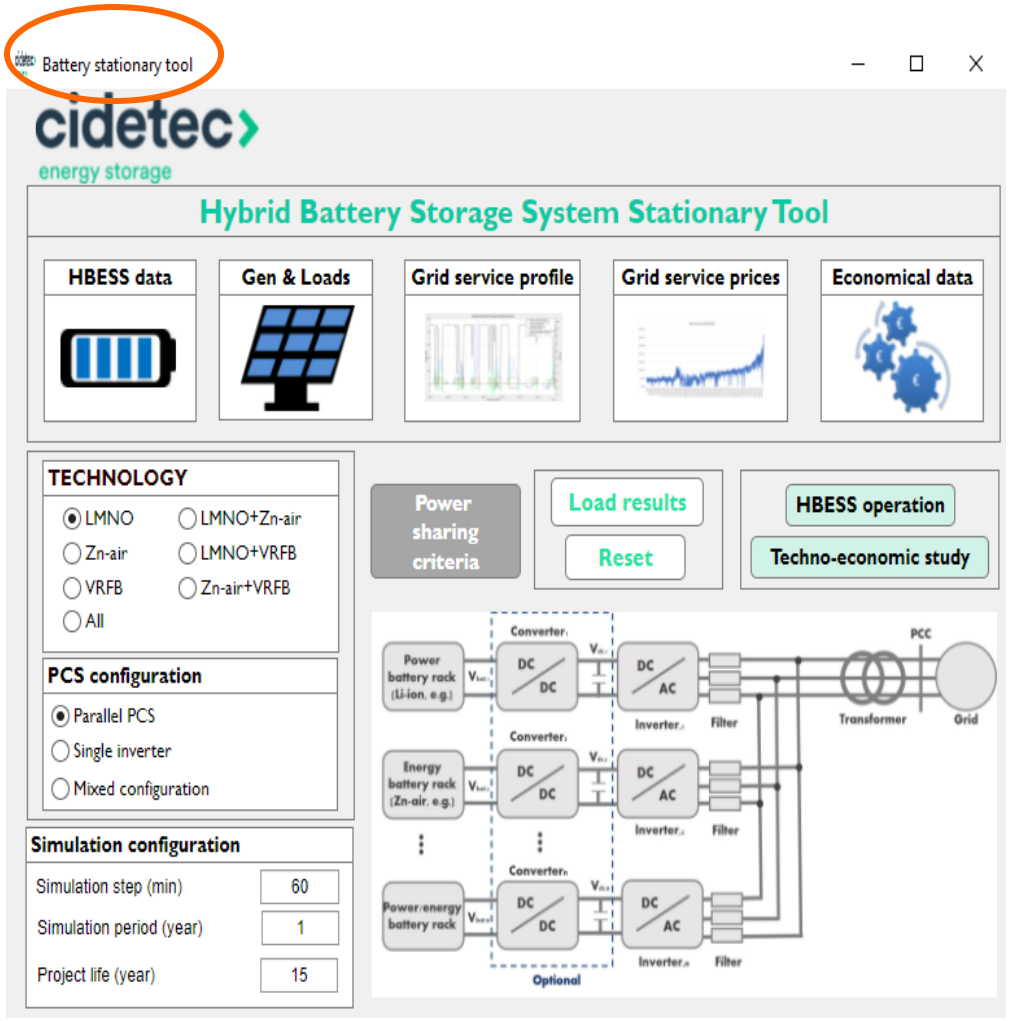
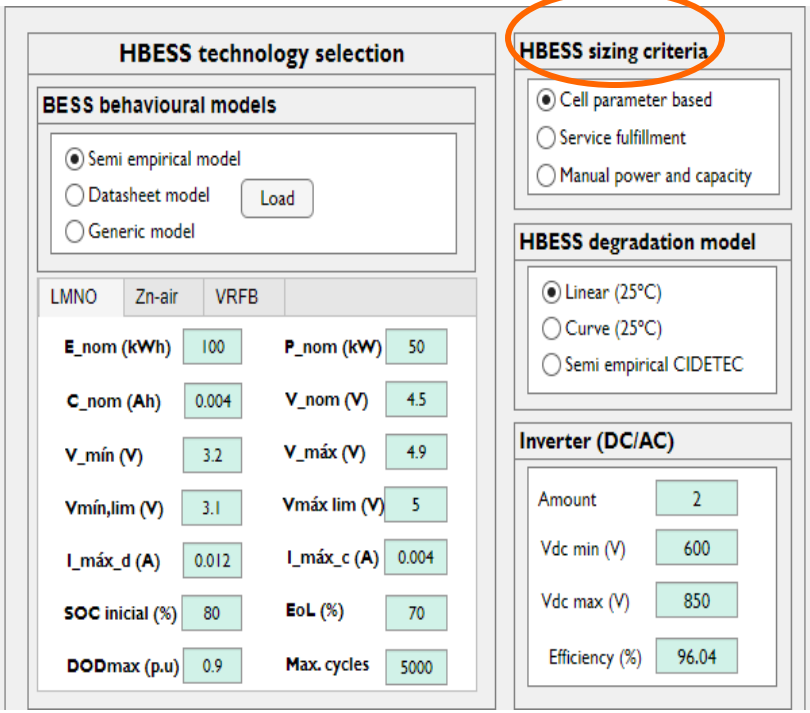
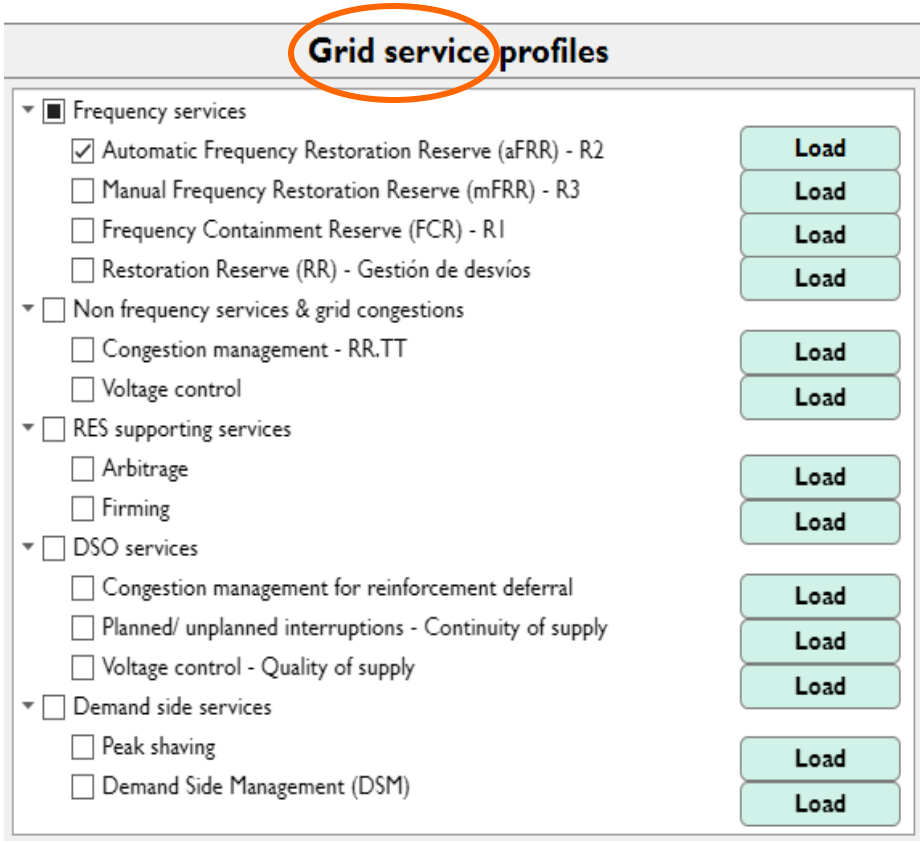
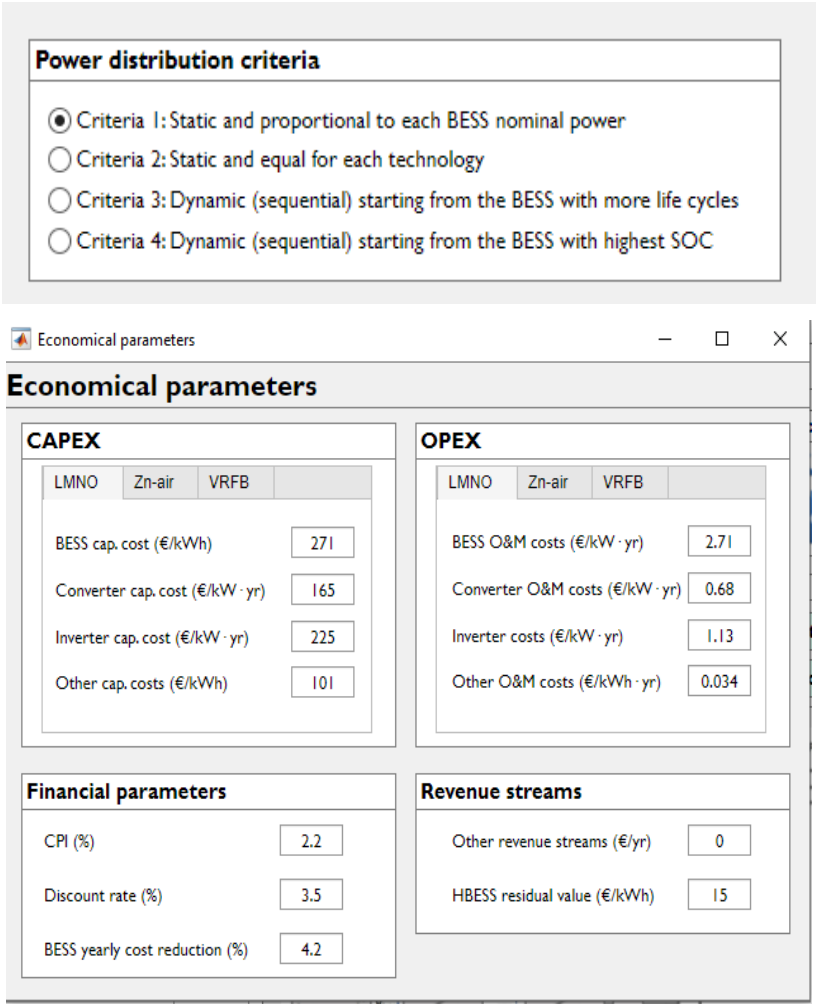




ntroduction and Overview – ENERISLA Project





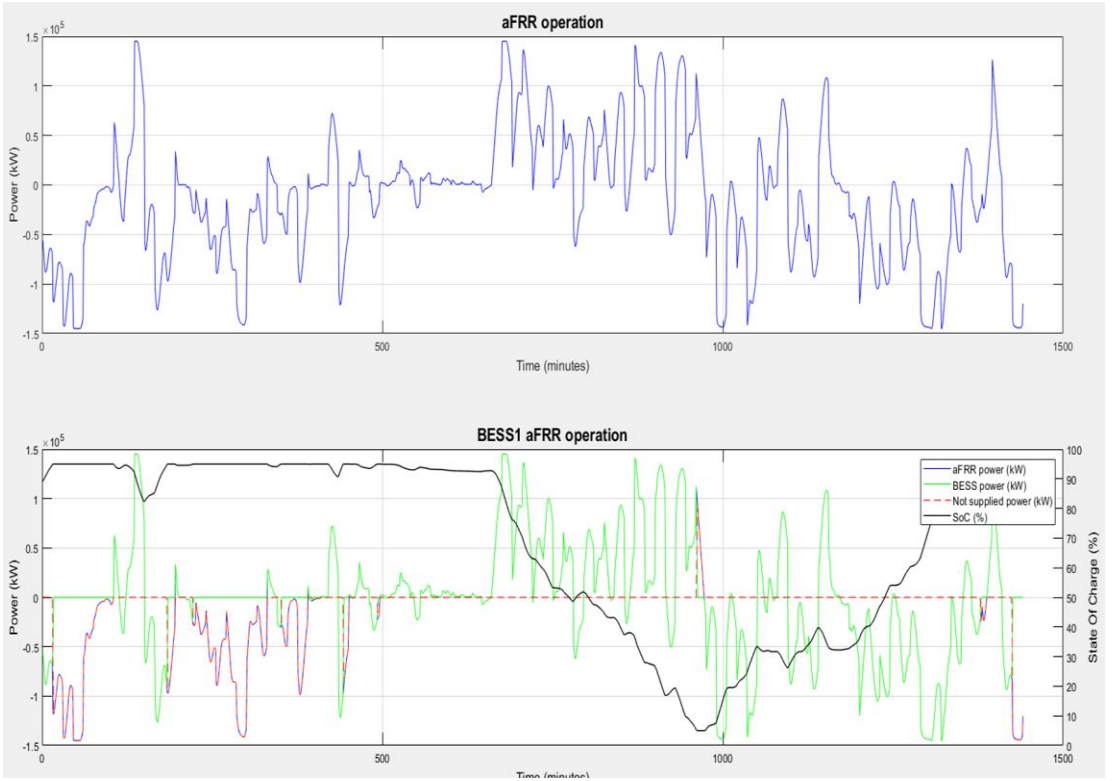
Introduction and Overview – ENERISLA Project

1.- LMNO (Lithium Nickel Manganese Oxide) battery technical and economic simulation results to provide secondary reserv

Simulation results

Technical		Economic	
HBESS	LMNO	Profitable	Yes
HBESS total capacity (kWh)	3.075e+05		
HBESS total power (kW)	1.451e+05	Total income (€)	4.277e+08
HBESS demanded energy (kWh)	2.259e+09	Total expenses (€)	3.64e+08
HBESS supplied energy (kWh)	1.48e+09	Total CAPEX (€)	2.602e+08
HBESS non supplied energy (kWh)	7.789e+08	Total OPEX (€)	1.458e+07
Service coverage percentage (%)	65.5	Net Present Value (€)	6.204e+07
		Internal Rate of Return (%)	7.6
		PayBack period (Years)	15
FECs/year	481.3	Levelized Cost of Storage (€/MWh)	166.6
RES generated energy (kWh)	0		
EoL reaching period (Years)	10.4		
Power distribution criteria	1		

Sizing | Plot | Export



Introduction and Overview – ENERISLA Project

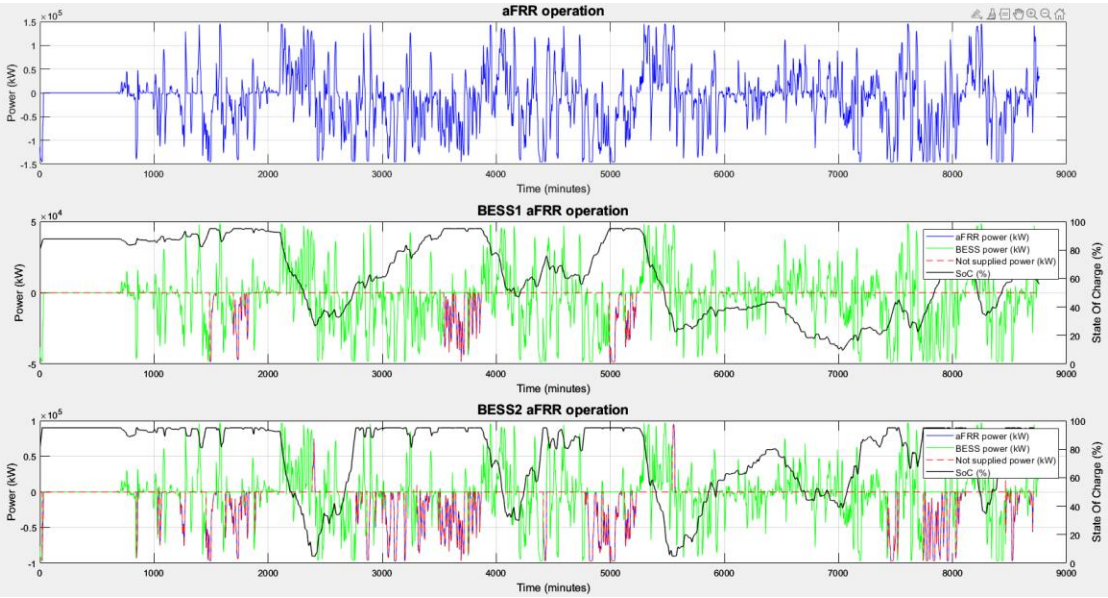
2.- Hybridization LMNO (Lithium Nickel Manganese Oxide) + **Vanadium redox** flow battery (VRFB)

technical and economic simulation results to provide secondary reserve

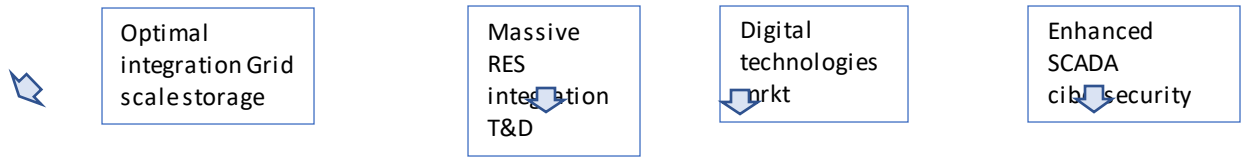
Simulation results

Technical		Economic	
HBESS	LMNO +VRFB	Profitable	Yes
HBESS total capacity (kWh)	3.869e+05	Total income (€)	7.215e+08
HBESS total power (kW)	1.451e+05	Total expenses (€)	3.662e+08
HBESS demanded energy (kWh)	2.259e+09	Total CAPEX (€)	2.921e+08
HBESS supplied energy (kWh)	1.579e+09	Total OPEX (€)	1.804e+07
HBESS non supplied energy (kWh)	6.801e+08	Net Present Value (€)	2.289e+08
Service coverage percentage (%)	69.9	Internal Rate of Return (%)	13.4
		PayBack period (Years)	8
FECs/year	408.1	Levelized Cost of Storage (€/MWh)	169.3
RES generated energy (kWh)	0		
EoL reaching period (Years)	9.9		
Power distribution criteria	1		

Sizing | Plot | Export



HLUC relevance



of project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
ENERISLA	●● ●	●	●	●● ●	●●	●	●●	●		

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Key findings

from project / program	finding(s)	relevant for HLUC(s) no.
ENERISLA	• Regulatory barriers to provide remuneration schemes to deploy the storage in microgrids.	**HLUC 3**
ENERISLA	• Promote the hybridization of energy storage technologies into the integration to provide power and energy services.	**HLUC 1**
ENERISLA	• New technologies to provide flexibility services. These can be batteries (advanced Li-ion, Na, supercapacitor, fuel cells,etc), digitization of microgrids as well as innovative services.	**HLUC 1**
ENERISLA	• New generation for the microgrid operators of the future (communication with the external distribution grid).	**HLUC 7**

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
ENERISLA	• Standardisation activities for microgrids at EU level (regulation, control, grid codes, tools, flexible multi-options, digitalisation, protocols communication)	**HLUC 6**

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project / program	proposal(s) / recommendation(s)	relevant for HLUC(s)
ENERISLA	• Next generation of renewable energy technologies: hybrid electricity generation solutions.	**HLUC 1, HLUC 4**
ENERISLA	• Increase black-out procedures and protocols due to the energy transition to electrification, uncertainty, cyber attacks, increase in more electronic devices that could fail, etc.	**HLUC 7**

Projects Panel Session 2
Renewable Energy Systems

- Massive RES Penetration
- System Operators' Collaboration
- Power Electronics Challenges

High Level Use Cases

HLUC 1: Optimal Cross sector Integration and Grid Scale Storage

Total Budget: 130M€

HLUC 3: Pan European Wholesale Markets, Regional and Local Markets

Total Budget: 80M€

HLUC 5: One stop shop and Digital Technologies for market participation of consumers (citizens) at the center

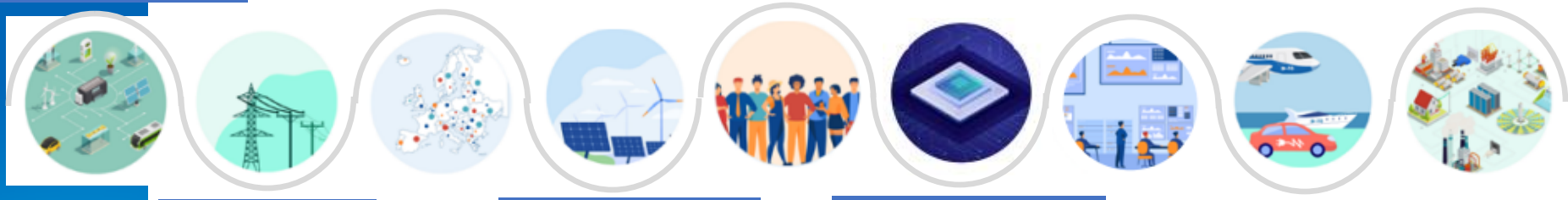
Total Budget : 120M€

HLUC 7: Enhance System Supervision and Control including Cyber Security

Total Budget 135M€

HLUC 9: Flexibility provision by Building, Districts and Industrial Processes

Total Budget: 100M€



HLUC 2: Market-driven TSO–DSO–System User Interactions

Total Budget: 90M€

HLUC 4: Massive Penetration of RES into the transmission and distribution grid

Total Budget: 145M€

HLUC 6: Secure operation of widespread use of power electronics at all systems levels

Total Budget: 100M

HLUC 8: Transportation Integration & Storage

Totl Budget: 100M€

European Commission

Priority Project Concepts (PPCs) 2022-2025, 2025+, 2026+

HLUC 2: Market-driven TSO–DSO– System User Interactions
PPC 2.1: Market models and architecture for TSO-DSO- System User interactions (IP 2022-2025)
PPC 2.2: Control and operation for enhanced TSO-DSO- System User interactions (IP 2022-2025)
PPC 2.3: Platform Development for TSO-DSO cooperation (IP 2022-2025)
PPC 2.4: Planning tools for TSO-DSO cooperation (IP 2022-2025)
PPC 2.5: Develop a Digital Twin of the European Electricity Grid (IP 2025+)
PPC 2.6: Viable business cases through market mechanisms and incentives (IP 2025+)
PPC 2.7: Governance for TSO, DSO and System Users (IP 2025+)

HLUC 4: Massive Penetration of RES into the Transmission and Distribution Grid
PPC 4.1: Technical barriers and technical measures for integration of RES at multiple levels and sectors (IP 2022- 2025)
PPC 4.2: Control and operation tools for a RES based energy system (IP 2022-2025)
PPC 4.3: Infrastructure requirements and network technologies as solutions for integration of massive RES (IP 2022-2025)
PPC 4.4: Planning for a resilient system with massive penetration of RES (IP 2022-2025)
PPC 4.5: Well-functioning markets for a RES based energy system (IP 2025+)
PPC 4.6: Policies and governance for a RES based energy system (IP 2025+)

Priority Project Concepts (PPCs) 2022-2025, 2025+, 2026+

HLUC 6: Secure Operation of Widespread Use of Power Electronics at all System Levels

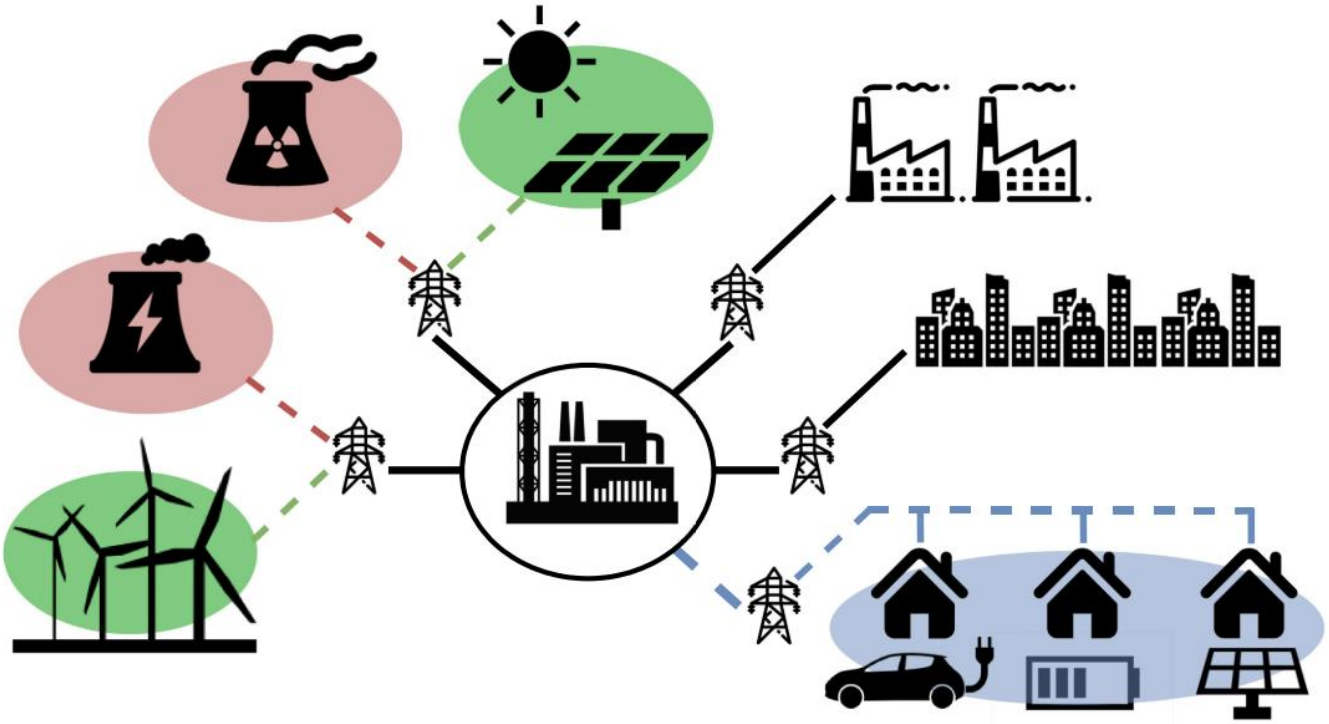
PPC 6.1: Control solutions for next generation PV and battery inverters (IP 2022-2025)
PPC 6.2: Hybrid transmission/distribution and hybrid distribution AC/DC grids (IP 2022-2025)
PPC 6.3: Next generation distribution substation (IP 2022-2025)
PPC 6.4: Simulation methods and digital twins at distribution and transmission level for power electronics driven networks (IP 2022-2025)
PPC 6.5: HVDC interoperability, multi-terminal configurations, meshed grids (IP 2026+)
PPC 6.6: Large Scale Demonstration activities (IP 2026+)
PPC 6.7: Standardisation activities (IP 2026+)

FST & RESET

Paula Tomás Pérez CIRCE

Introduction and Overview

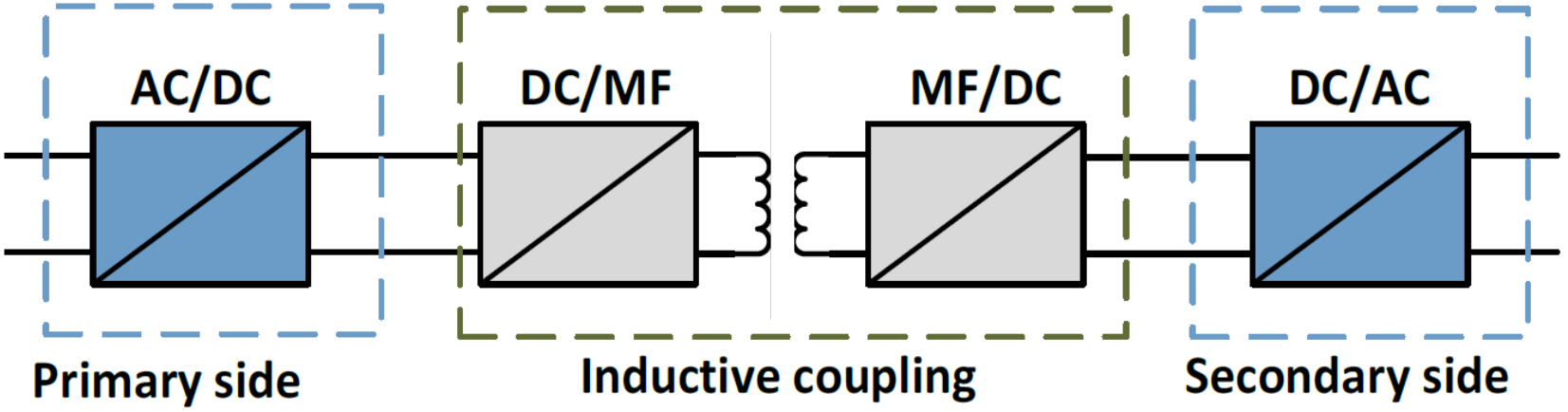
- Energy transition towards a decarbonized economy is changing profoundly the infrastructure of power grids



Ballestín-Fuertes, J.; Muñoz-Cruzado-Alba, J.; Sanz-Osorio, J.F.; Laporta-Puyal, E. Role of Wide Bandgap Materials in Power Electronics for Smart Grids Applications. *Electronics* **2021**, *10*, 677. https://doi.org/10.3390/electronics10060677

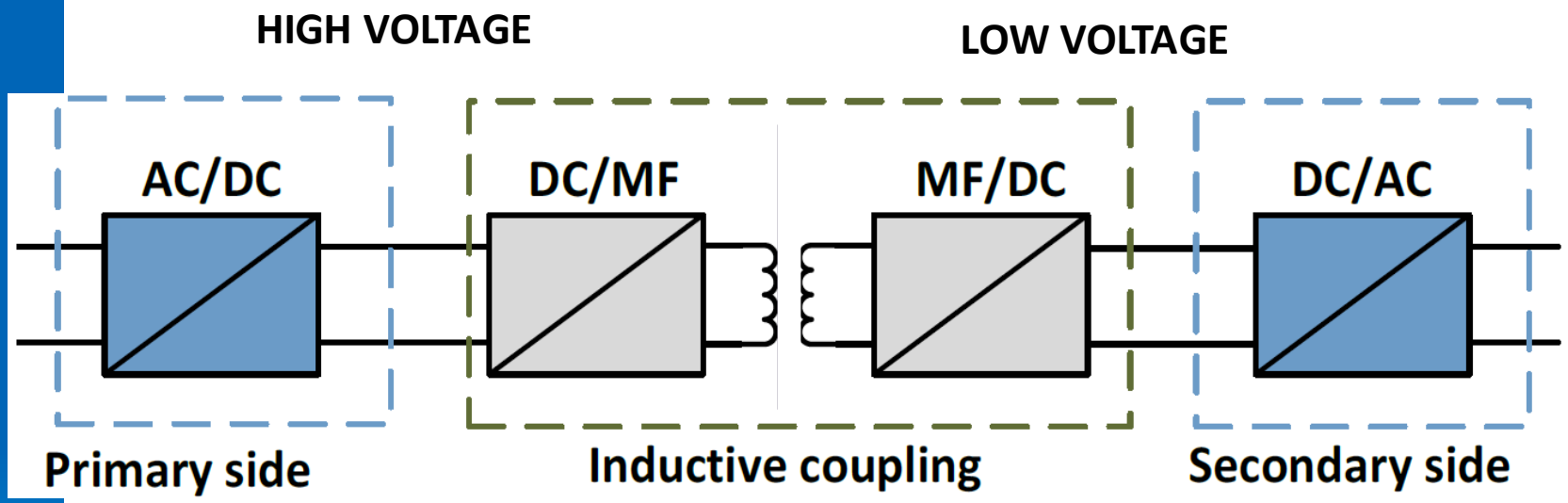
Solid State Transformer (SSTs)

- SSTs are power electronics devices designed to act in a similar way to traditional power transformers.
- Can interconnect separate electric AC or DC grids with different range of voltage or frequency providing galvanic isolation between them.

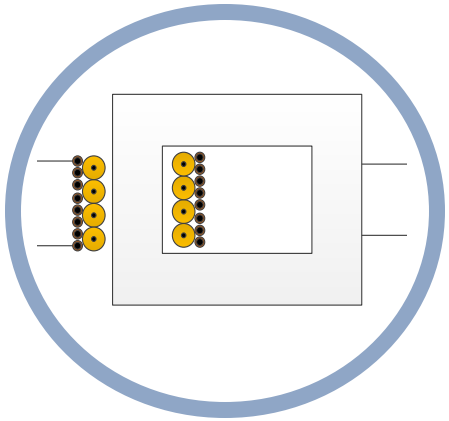


ISOLATION PROBLEM

PROPOSED SOLUTION

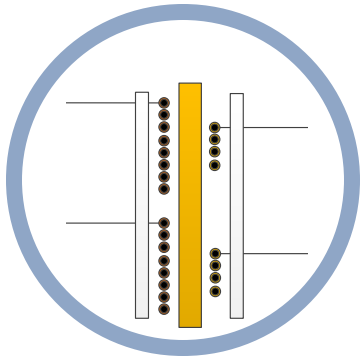


Isolation problem



Classic coupling

- Isolation material suffer more stress at high frequency operation
- Poor cooling capability
- Difficult to inspect isolation faults



Air gap coupling

Patent EP3605793B1 - Inductive coupling device and electronic transformer associated therewith - CIRCE

FST Project Use Case

Flexible Smart Transformer (FST) Project

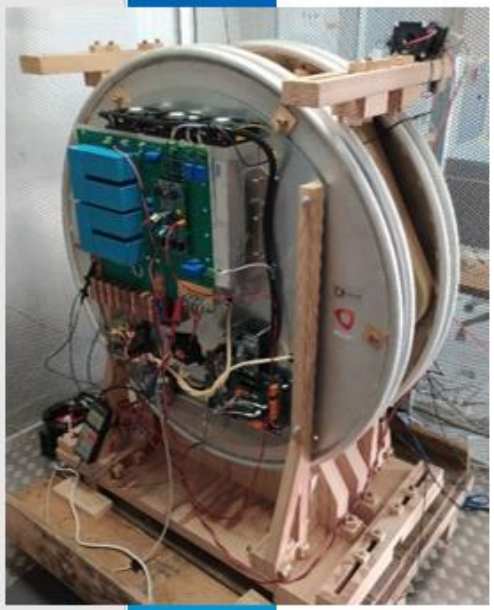
efacec empowering the future

RED ELÉCTRICA DE ESPAÑA

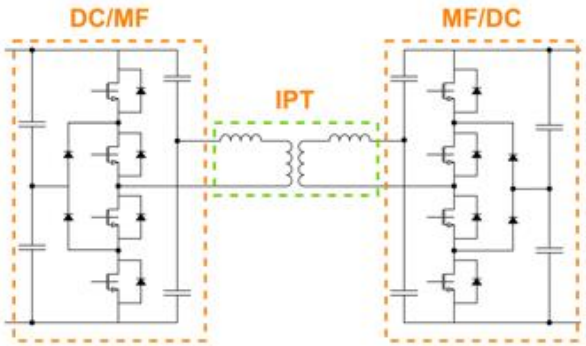
Grid 2030 Innovating tomorrow's grid today *Engineered with InnoEnergy*

circe RESEARCH CENTRE FOR ENERGY RESOURCES AND CONSUMPTION

Challenge 1: Accelerate the wide implementation of power electronics in the system.



max TRL4- *Technology Readdiness Level 4*



https://www.ree.es/es/sostenibilidad/anticipacion-y-accion-para-el-cambio/programa-grid2030

European Commission

PRESENT SST PROJECTS

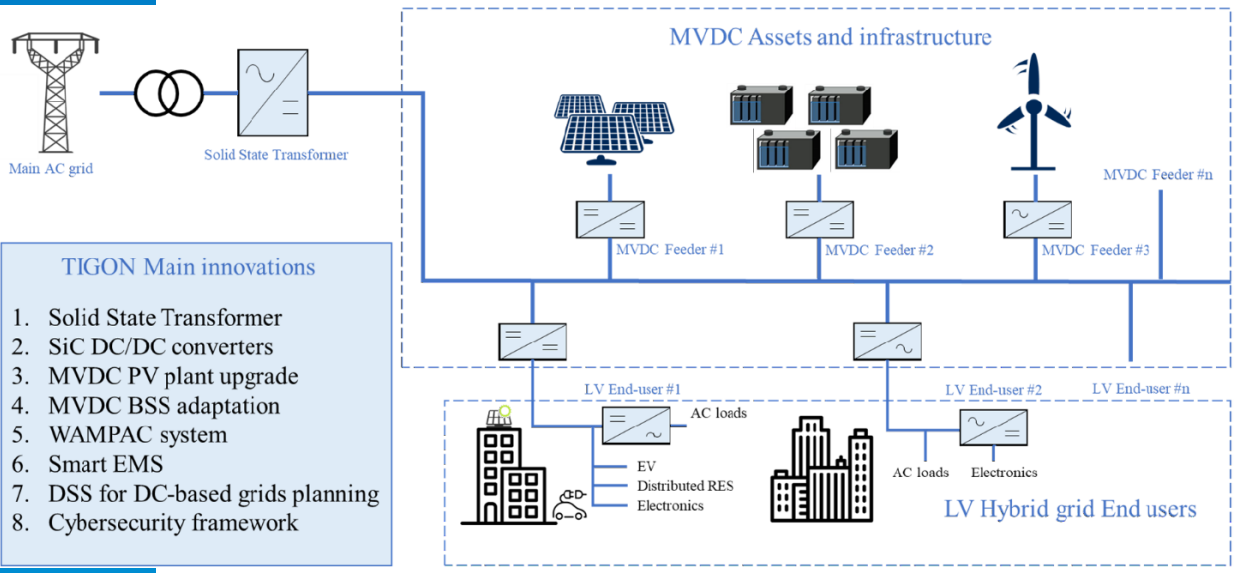
TIGON

- Topic: LC-SC3-ES-10-2020

DC – AC/DC hybrid grid for a modular, resilient and high RES share grid development

- Type of action: Innovation Action
- Total Costs: 7'996'115€
- Max. Grant Amount: 6'957'197€
- Coordinator: CIRCE
- Number of partners: 15 + 1LTP

https://tigon-project.eu/



TIGON Main innovations

1. Solid State Transformer
2. SiC DC/DC converters
3. MVDC PV plant upgrade
4. MVDC BSS adaptation
5. WAMPAC system
6. Smart EMS
7. DSS for DC-based grids planning
8. Cybersecurity framework

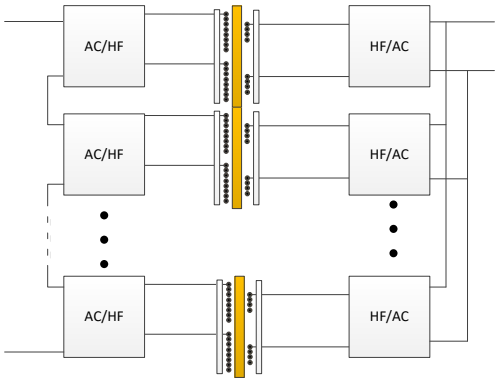
Demonstrating hybrid microgrid innovations for greener, more resilient and more secure power networks

PRESENT SST PROJECTS

Innovative HV Solid-State TrAnsformer for maximizing Renewable energy penetration in energy distribution and transmission systems

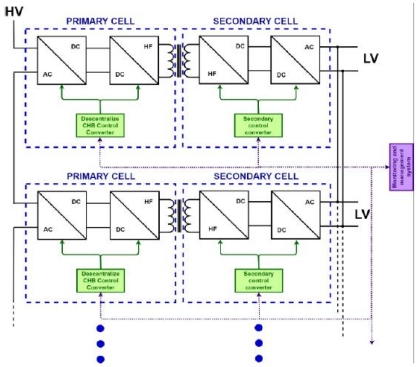
- Total Costs: 2499437.50€
- Max. Grant Amount: 2499437.50€
- Duration: 42 months (2022-2025)
- Coordinator: CIRCE
- Number of partners: 6

sstar



Innovative SST module based on a bidirectional IPT static system

- HV isolation module
- HV working voltage module
- CFD/FEA simulations



- Biobased and biodegradable dielectric fluid.

- Decentralization of the control in cascade H-bridge topology.
- Stabilization of the DC bus module.

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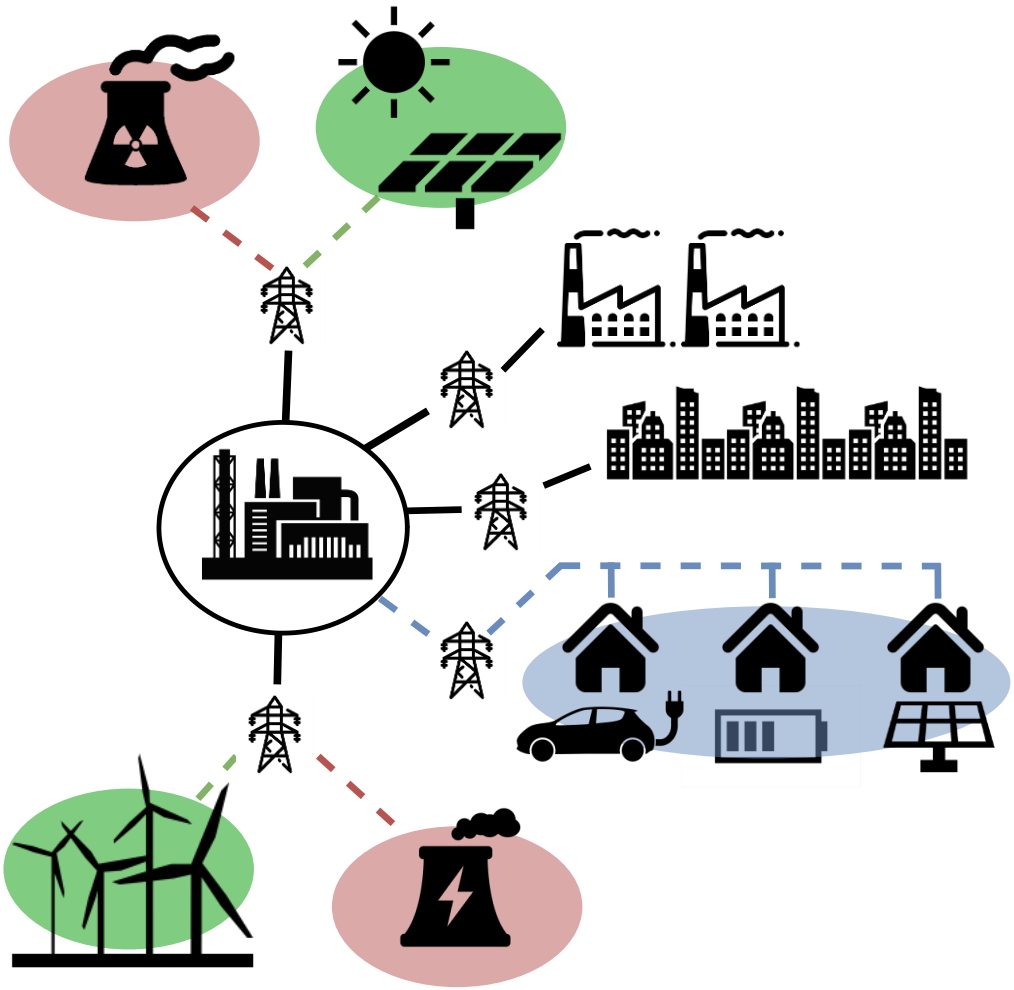
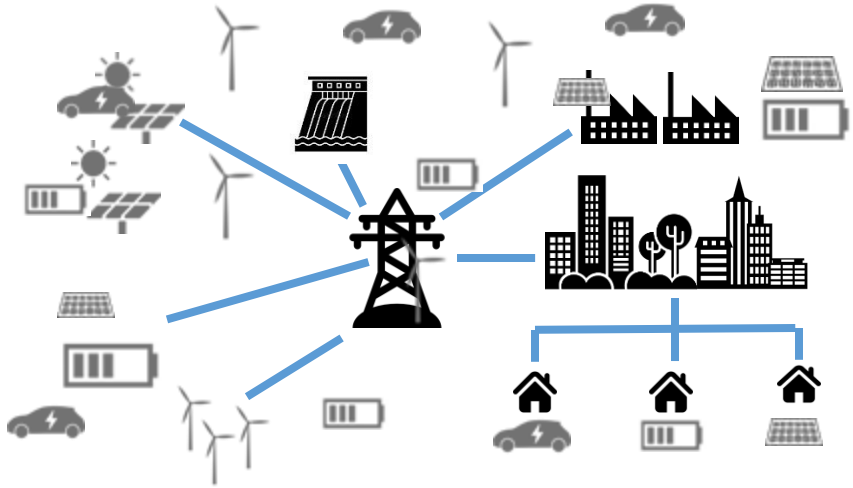


RESET

PROBLEMS CAUSED BY GRID UNBALANCES

- Overload of lines and neutral conductor
- Overheating of the distribution transformer and reduction of its efficiency
- Reduced network quality
- Increased line losses
- Vibration and malfunctioning of induction machines
- Malfunctioning of protection relays
- Increased neutral to ground voltage (NGV)
- Increased network maintenance costs

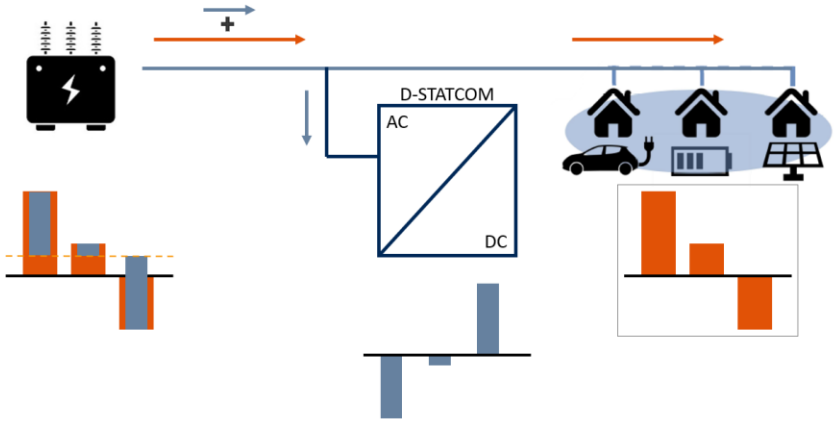


PROPOSED SOLUTION

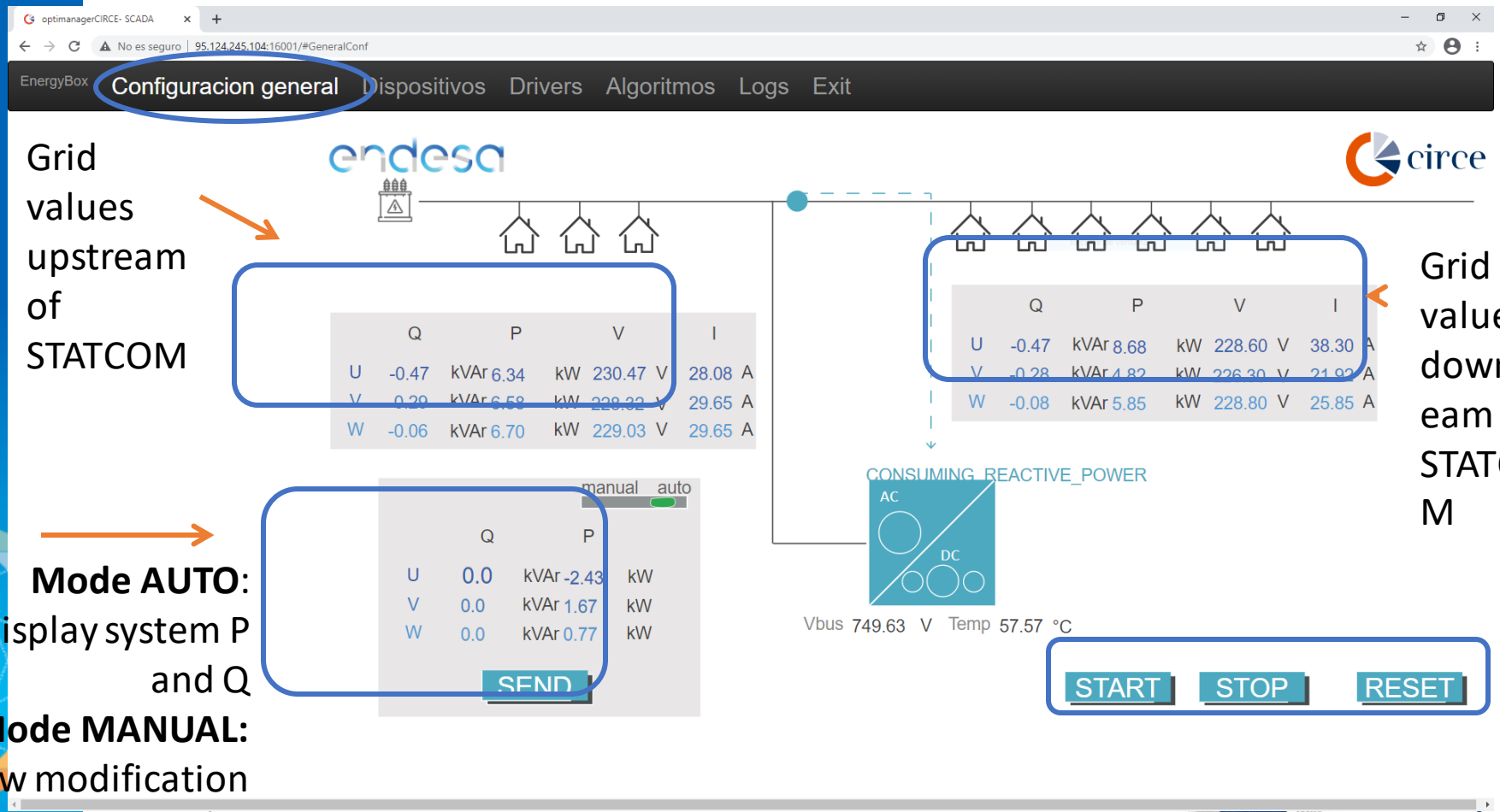
D-STATCOM

- Mode *AUTO*:
  - Active power balancing
  - Voltage stabilization
  - Harmonics filtering
  - Dip voltage compensation

- Mode *MANUAL:*
  - Remotely controlled



SCADA – Mode MANUAL



Grid values upstream of STATCOM

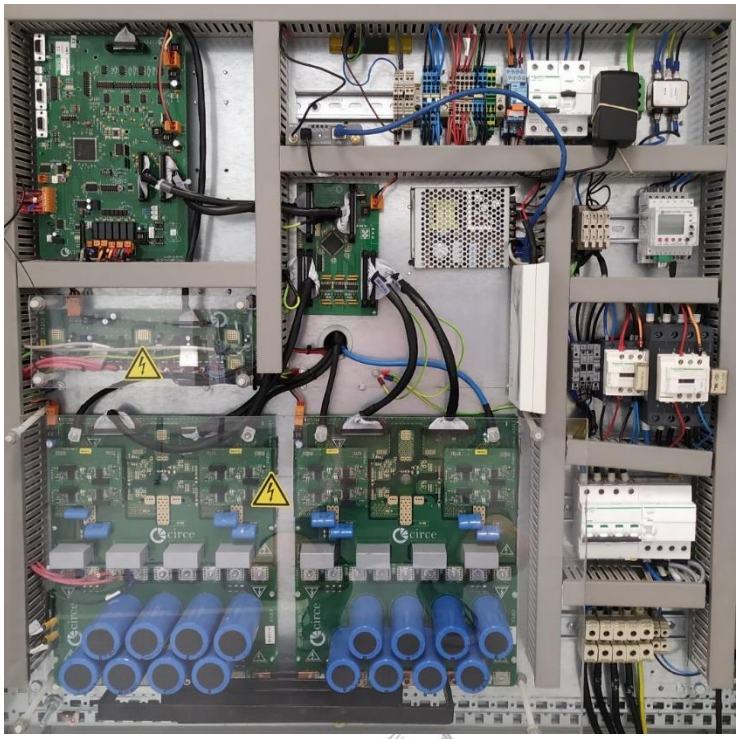
Grid values downstream of STATCOM

Mode AUTO: display system P and Q

Mode MANUAL: allow modification P and Q

4-LEGS SYSTEM FOR CURRENT BALANCE

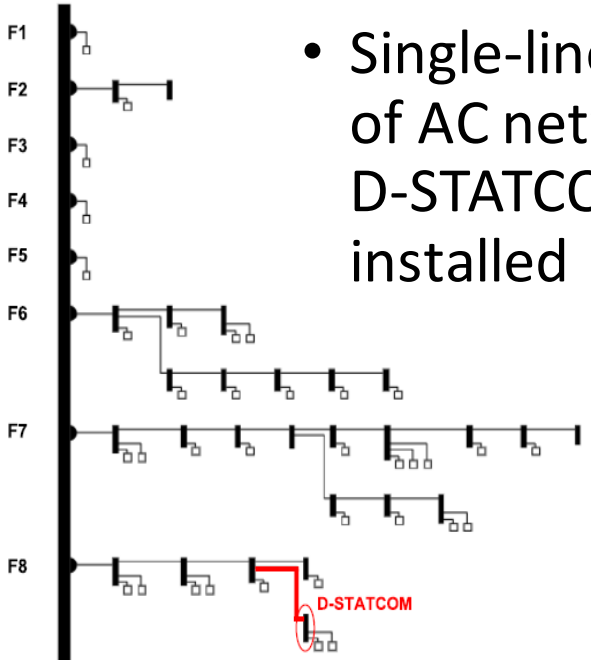
PROTOTYPE



VALIDATION

D-STATCOM

- 30 kVA Prototype
- Single-line diagram of AC network where D-STATCOM is installed



- Installed in a residential neighbourhood – MÁLAGA
- 1 year data collected
- Data acquisition every 2 sec

EU PROJECT – PARITY

Pro-sumer AwaRe, Transactive Markets for Valorization of Distributed flexibility enabled by Smart Energy Contracts

❖ To be used in Spanish demo in Granada

ELECTRICAL CHARACTERISTICS	
Max. Power	50 kVA
Rated voltage	400 V
Max. Current	72 A
Frequency range	50 Hz ± 5 %
Power factor	Controllable
THD	< 3 %
Efficiency	> 95 %

PARITY

https://parity-h2020.eu/

European Commission

HLUC relevance

PROJECT	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9
FST, TIGON, SSTAR	●●	●●	●	●●●		●●●	●●●	●●	●
RESET, PARITY	●●●	●●●	●	●●●	●●	●●		●●	●

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Feb. 28, 2023

Key findings

PROJECT	finding(s)	relevant for HLUC(s) no.
FST	• Development of a DCDC for an SST with a high degree of isolation between primary and secondary, paving the way for very high voltage SSTs. • SST acting as UPFC: simulations to check attenuation of inter-area oscillations	HLUC 6, HLUC 4
RESET	• Design of a converter able to handle unbalanced loads • Prototype operation study shows improvement in the line efficiency (13% losses reduction) and reduction of peak current in the conductors (73% in neutral wire)	HLUC 2, HLUC 4

Open questions

Project	open RDI questions / topics	relevant for HLUC(s) no.
FST	• Improve efficiency and size • Sudy and optimisation of how the misalignments between primary and secondary winding affect • Enhace the galvanic isolation between primary and secundary to reach 400 kV grids • Checking the performance in a relevant environment	HLUC 6
RESET	• Testing more on the grid, especially in grid with high renewable penetration	HLUC 6
RESET	• Adding functionalities to imrove grid quality (voltage regulation, harmonic filtering, etc.) • Improvement of size and volume to minimise them • Combination with other existing technologies: their use in the deployment of vehicle charger infraestructures (V2G)	HLUC 4

Paula Tomás Pérez, CIRCE
ptomas@fcirce.es
Jesús Muñoz, CIRCE
jmunoz@fcirce.es

¡Thank you for your attention!

European Commission

EPC4SES

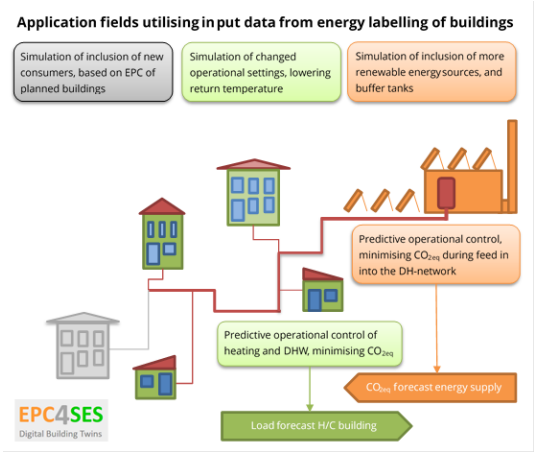
Digital Building Twins

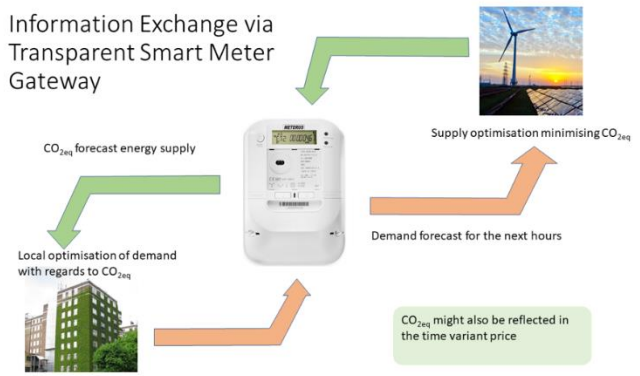
EPC4SES:

Gerfried Cebrat, effiziente.st

Introduction and Overview

- EPC4SES is a ERANet REGSYS project having 6 partners from Germany, Spain, Austria, Norway.
- EPC4SES developed an Model Predictive Control approach for HVAC, which is based on a digital twin, using data from the XML from energy certification of buildings.
- We demonstrated that by using MPC significant savings are possible for
  - Modulating the set temperature in rooms
  - Controlling charging of Domestic hot Water tanks
  - Modulating the tank temperature of buffer tanks fed with solar energy
- Exchange of load forecast and CO_2 prognosis over the Transparent Smart Meter Gateway TSMGW was envisaged
- Apart from two MPC use cases, 4 other uses cases were developed (see uc.smartenergy.nu)
- Spain would profit from CO_2 forecast, so A/C might be operated more at times with low CO_2 intensity applying MPC.





Feb. 28, 2023

European Commission

HLUC relevance for project EPC4SES

project / program	**HLUC 1**	**HLUC 2**	**HLUC 3**	**HLUC 4**	**HLUC 5**	**HLUC 6**	**HLUC 7**	**HLUC 8**	**HLUC 9**	**other**
EPC4SES	●●			●	●●		●	●●	●● ●	

HLUC 1: Optimal Cross sector Integration and Grid Scale Storage

HLUC 5: One stop shop and Digital Technologies for market participation of consumers (citizens) at the center

HLUC 8: Transportation Integration & Storage

HLUC 9: Flexibility provision by Building, Districts and Industrial Processes

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don't know

European Commission

Key findings from project EPC4SES.eu

project / program	**finding(s)**	**relevant for HLUC(s)**
EPC4SES	The XML from Energy Performance Certification of Buildings may be exploited to assess and pre-plan the potential for flexibility services, it also can play a role in model predictive control and digital twins of the buildings help identifying demand response potential.	9
EPC4SES	Integration of electric mobility into cross sectoral demand control may profit from open APIs, which should be required when labelling HVAC and charging products	8,1
EPC4SES	Transparent Smart Meter Gateways may help setting up business models for CO2 responsive demand control using MPC, but check out fixed cost when assessing the approach	5

Open questions

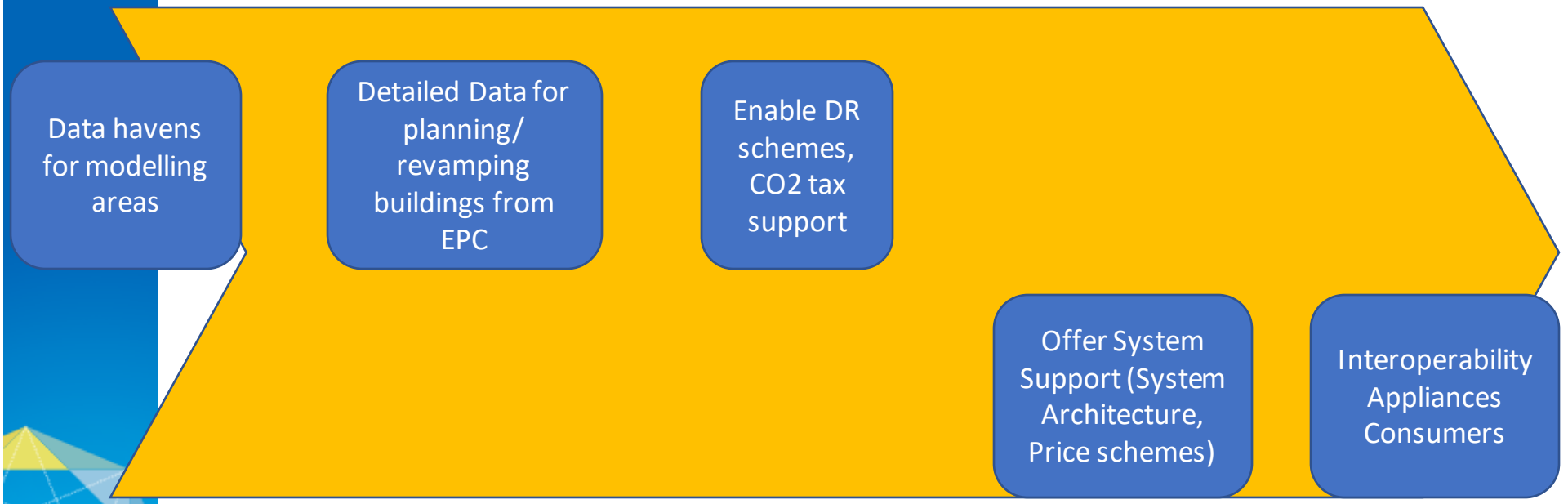
project / program	open RDI questions / topics	relevant for HLUC(s) no.
EPC4SES	What is the most beneficial building data storage scheme and persisting register data format in Energy Performance Certification of Buildings? Investigate buildingcard.eu	9
EPC4SES	What are the best schemes for all electric households at the end of the electric network, focusing on demand control and energy communities?	8,1
EPC4SES	Is it secure allowing transactions over the web, not via Transparent Smart Meter Gateways?	5

Proposals and recommendations for ETIP SNET IP / RM 2025+

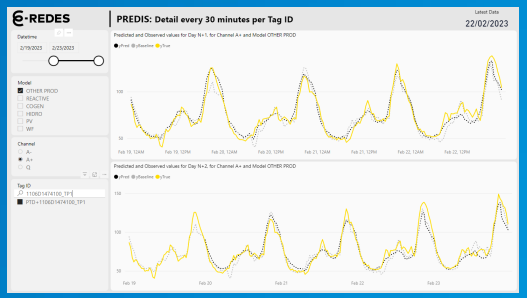
project / program	**proposal(s) / recommendation(s)**	**relevant for HLUC(s)**
FinSESCo	All intelligent metering systems shall be prepared to serve in energy (saving) contracting schemes.	5
EPC4SES	The XML Scheme from Energy Performance Certification of Buildings shall be tested against use cases and minimum requirements defined in the EPBD.	9
EPC4SES	Open APIs shall be required in eco-labelling of HVAC and charging products.	8,1
EPC4SES	Transparent Smart Meter Gateways shall be accessible more easily and use cases defined for **negotiated** demand response schemes.	5

European Commission

Proposal Structured Approach



European Commission



PREDIS

Miguel Louro
E-REDES Portugal

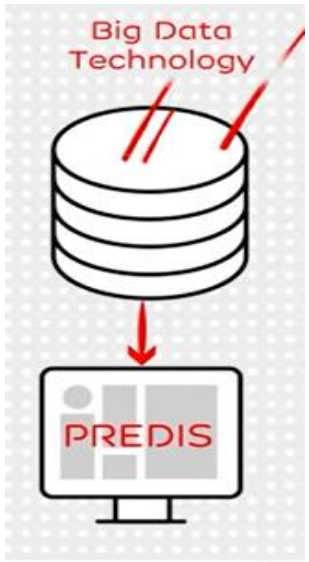
Introduction and Overview

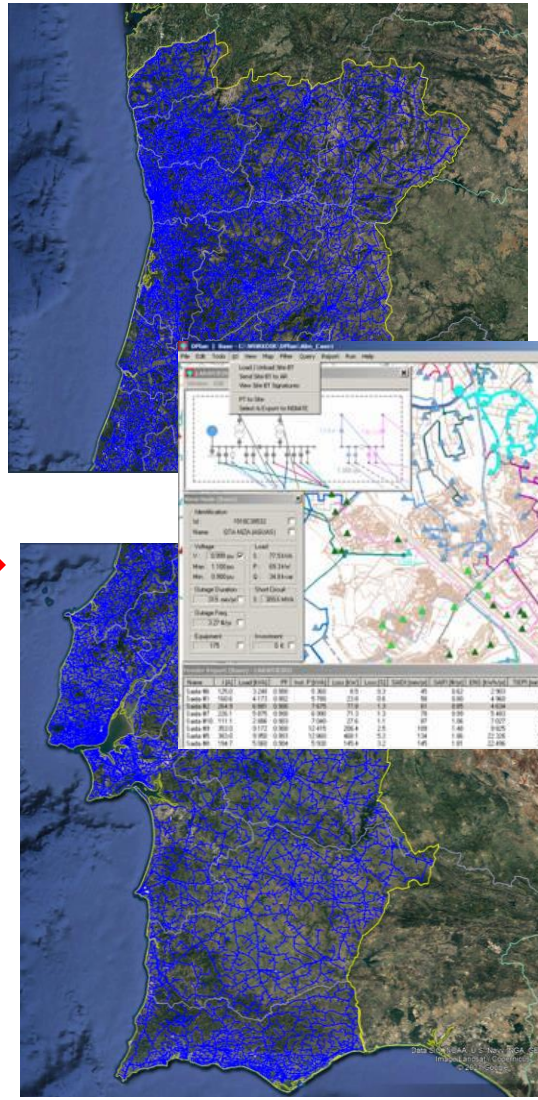
- E-REDES is the main DSO in Portugal
- Manages:
  - ~84.000 km of HV and MV network
  - ~70k DSO owned secondary substations
  - ~26k HV and MV clients
  - ~1k HV and MV connected distributed generation
- Preparing to have an interventive role in the load flow of the network to allow added connection of load and generation to the distribution network

Introduction and Overview

Weather forecast data

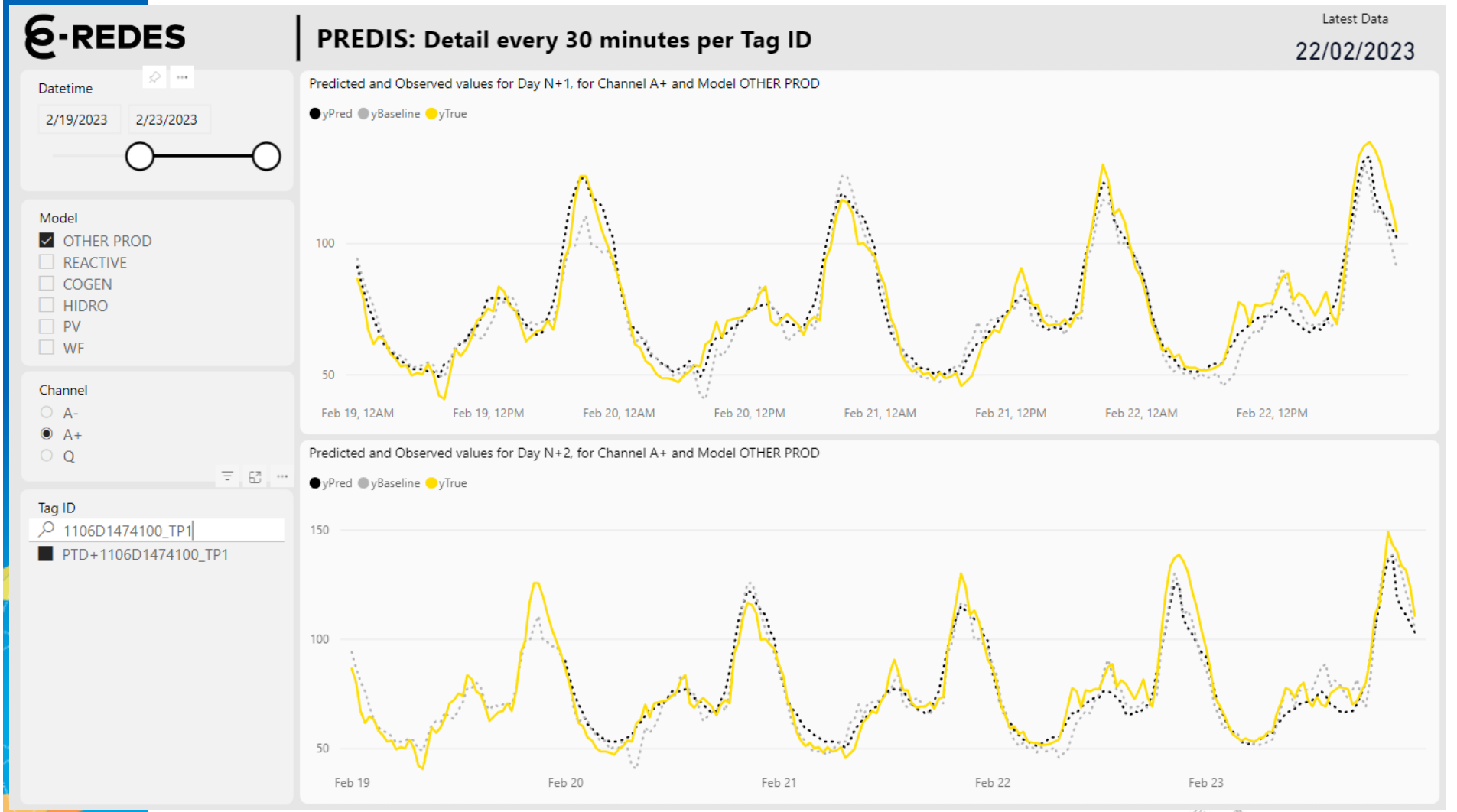
Meter data





DPlan

Introduction and Overview



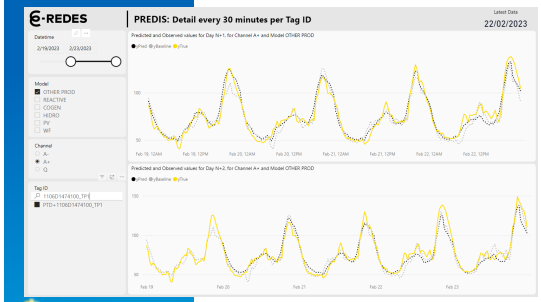
Introduction and Overview

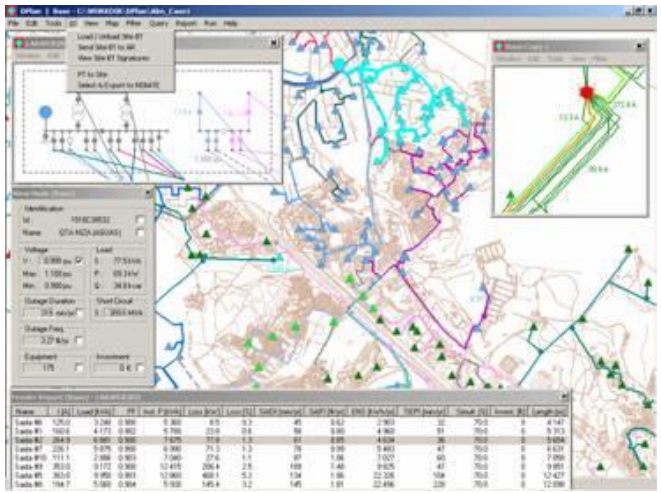
Dplan

(PowerFlow and Optimization)

PREDIS

(5day load and generation forecast)





Overcurrents

Over/Under voltages

Next days Q optimization

Network configurati optimization

Flexibility needs

HLUC relevance

of project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
PREDIS	●● ●	●●	n/a	●● ●	●	●	●●	●● ●	●● ●	●● ●

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Feb. 28, 2023

Key findings

from project / program	finding(s)	relevant for HLUC(s) no.
PREDIS	• Weather data extremely relevant for forecast • It is possible to have a good estimate of load and generation for the next few days • It is possible to have a power flow of the entire grid and to detect contingencies	HLUC1; HLUC4; HLUC8; HLUC9

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
PREDIS	• How to deal with abrupt changes in load behaviour? • How to determine if a given DG is undergoing maintenance?	HLUC1; HLUC4; HLUC8; HLUC9

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project / program	proposal(s) / recommendation(s)	relevant for HLUC(s)
PREDIS	• Determine weather variables in smaller meshes • Investigate ways to forecast abrupt load changes • Investigate ways to forecast generator maintenance	HLUC1; HLUC4; HLUC8; HLUC9

Prot4HiRes

Mateo Toro-Cárdenas, *R&D Nester*
(with Ricardo Cartaxo and Rui Pestana)

Background on R&D Nester

- Established in 2013
- Strong collaboration with the Portuguese TSO
- R&D relevant entity recognition by Portuguese Ministry of Science and Education and Ministry of Economy
- Works frequently in Horizon 2020 and Horizon Europe projects (among other programs) with 100+ partners from 30+ countries
- Participates in several international Working Groups (ETIP-SNET, BRIDGE, CIGRE, IEEE, IEC)
- International recognition with frequent high reputation publications (e.g., IEEE, CIGRE)

cigré
INTERNATIONAL COUNCIL ON LARGE ELECTRIC SYSTEMS

(R&D Nester is National Representative in Study Committee SC5 – Markets and Regulation)

ETIP SNET

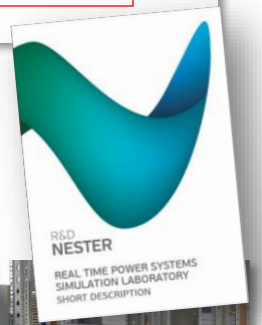
European Technology and Innovation Platform – Smart Networks for Energy Transition

R&D NESTER
CREATING A SMART ENERGY FUTURE

Background on R&D Nester

R&D Nester laboratory listed in EU Joint Research Centre (JRC) Smart Grids Laboratories Inventory

- Princeton University (Princeton Laboratory for Energy Systems Analysis) – USA
- L2EP (Laboratory of Electrical Engineering and power electronics) – France
- Durham University (Smart Grid Lab) – UK
- Florida State University (Center for Advanced Power Systems, CAPS) – USA
- Lawrence Berkeley National Laboratory – LBNL (FLEXLAB) – USA
- Imperial College of London (Smart Energy Laboratory) – UK
- Centro de Investigação em Energia, REN-StateGrid, S.A. (R&D Nester Real Time Power Systems Simulation Laboratory) – Portugal
- IMEC (Photovoltaics Department) – Belgium



Possible Applications:

- *Equipment/system testing*
- *Modelling*
- *Power systems scenario simulation*
- *Communications*
- *Co-simulation*
- *Training*

Prot4HiRes – Overview

Motivation

- RES are expected to provide less infeed current during faults compared to traditional generators
- Therefore, traditional protection might fail to recognize fault conditions
- In a system where many RES are installed, bigger voltage deeps are expected during faults
- Internal project, developed in house, with cooperation from REN (Portuguese TSO)

Objective

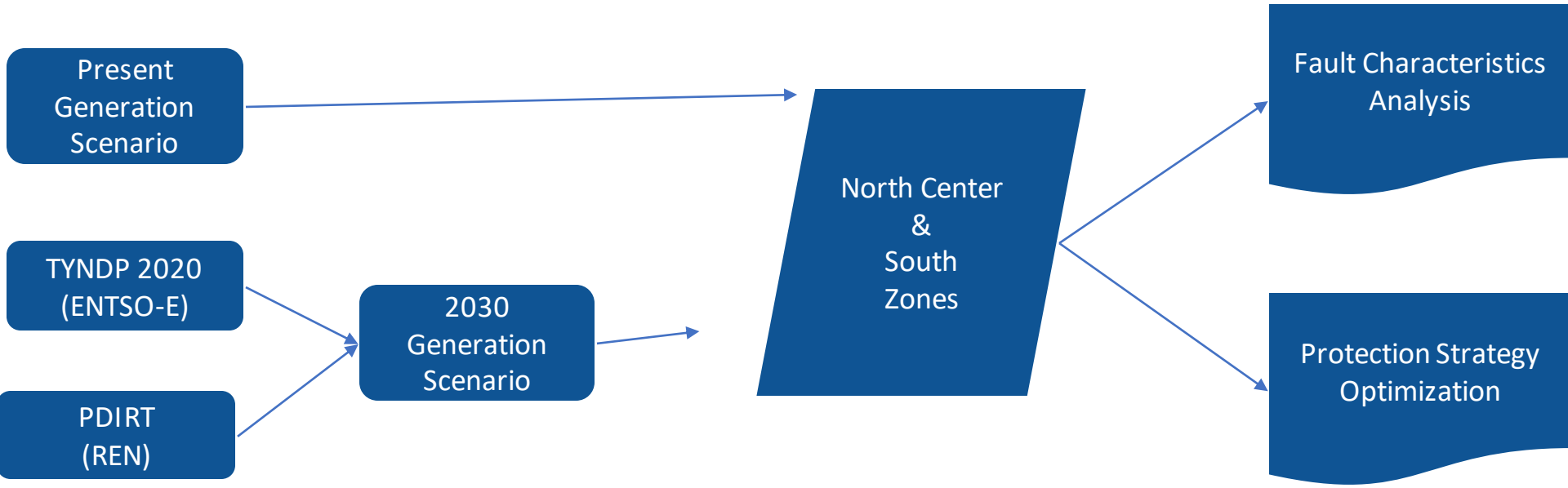
- Research on protection systems configuration and schemes adequate for transmission grids with high penetration of RES

Duration

- 25 Months (October 2021 to October 2023) – work still ongoing

R&D NESTER
CREATING A SMART ENERGY FUTURE

Prot4HiRes – Planning



Task 1 Simulation modeling and fault characteristics analysis of renewable energy delivery system

Task 2 Research on protection strategy optimization and setting calculation method

Task 3 Development of a novel protection specification for 220kV AC transmission line in high penetration renewable energy supply system

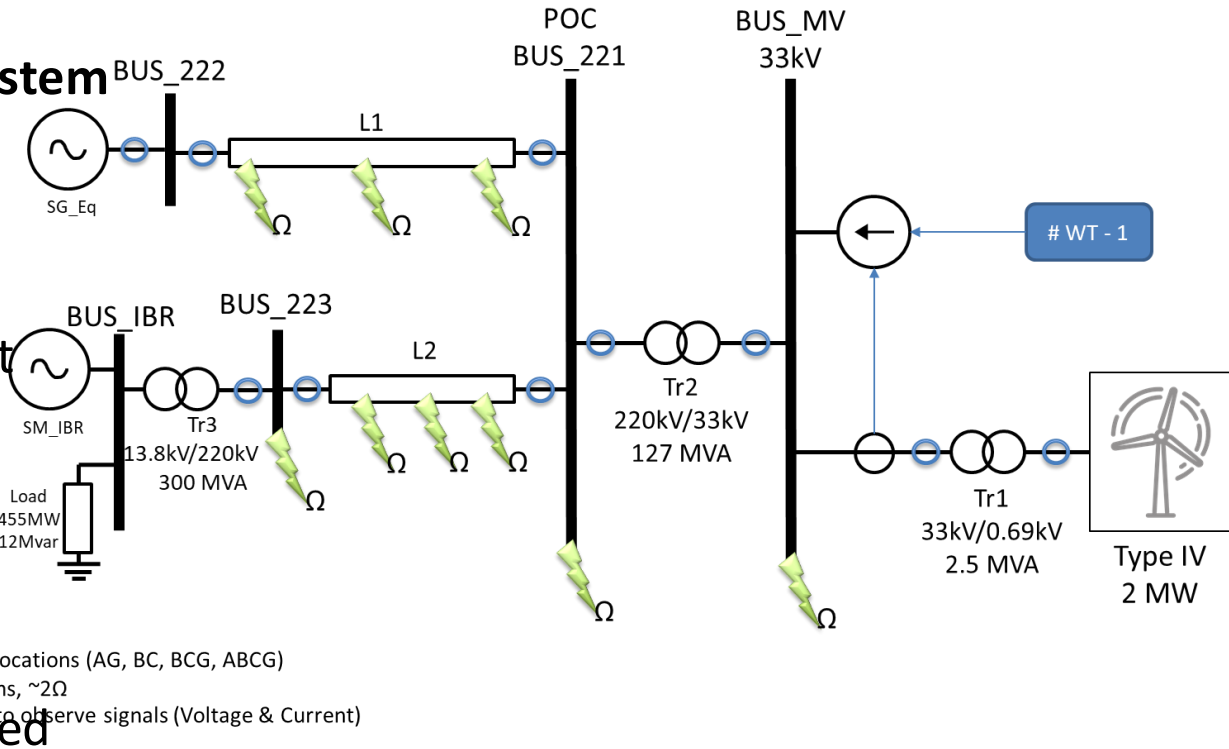
Prot4HiRes – Simulation models

2 Equivalents Transmission System

- Up to 60 MW Wind Farm
- 2 Transmission lines
- 1 Voltage Source equivalent
- 1 Synchronous Generator

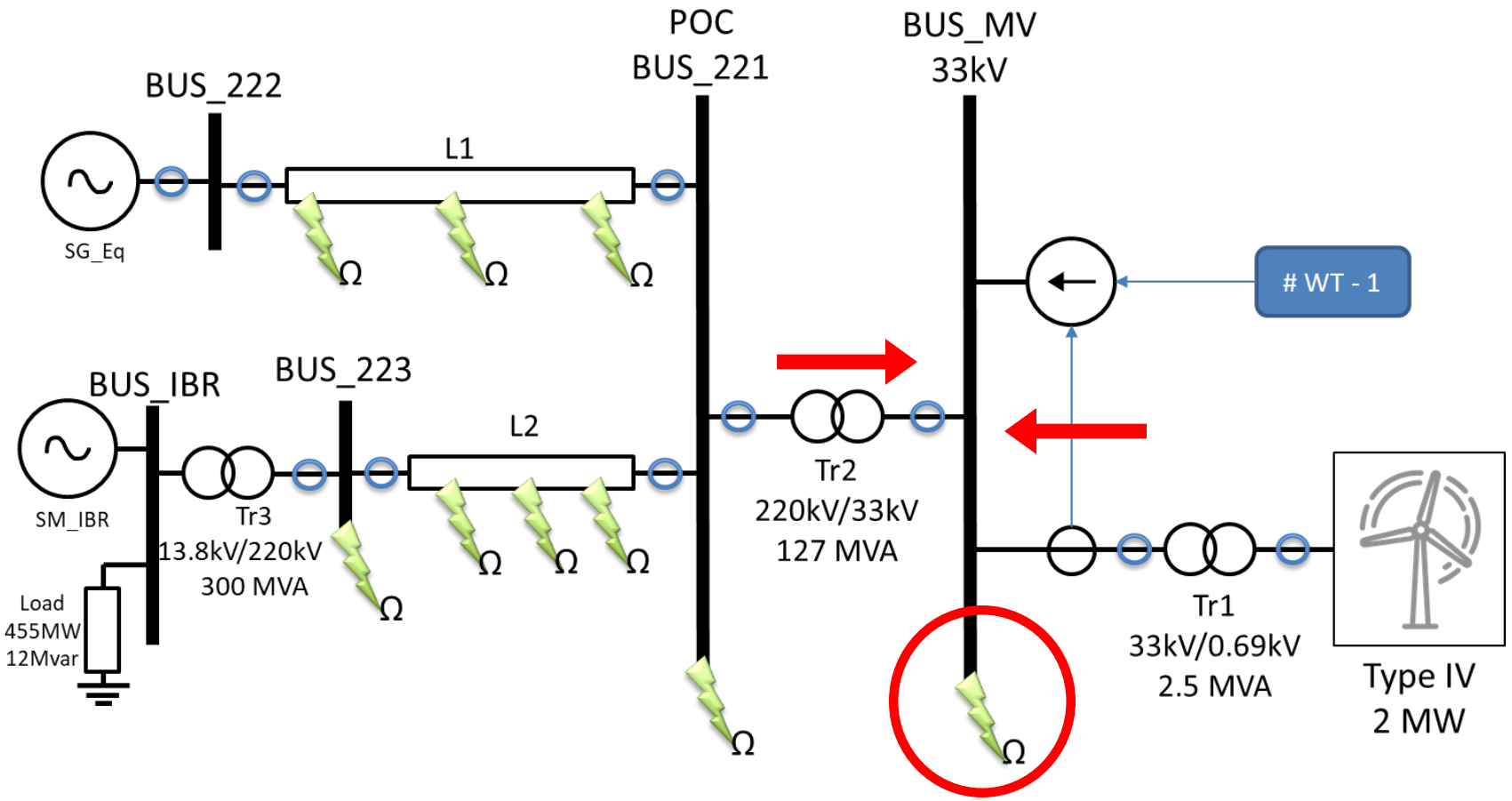
Wind Turbine

- 2 MW
- 11.3 m/s nominal wind speed
- Type IV WT



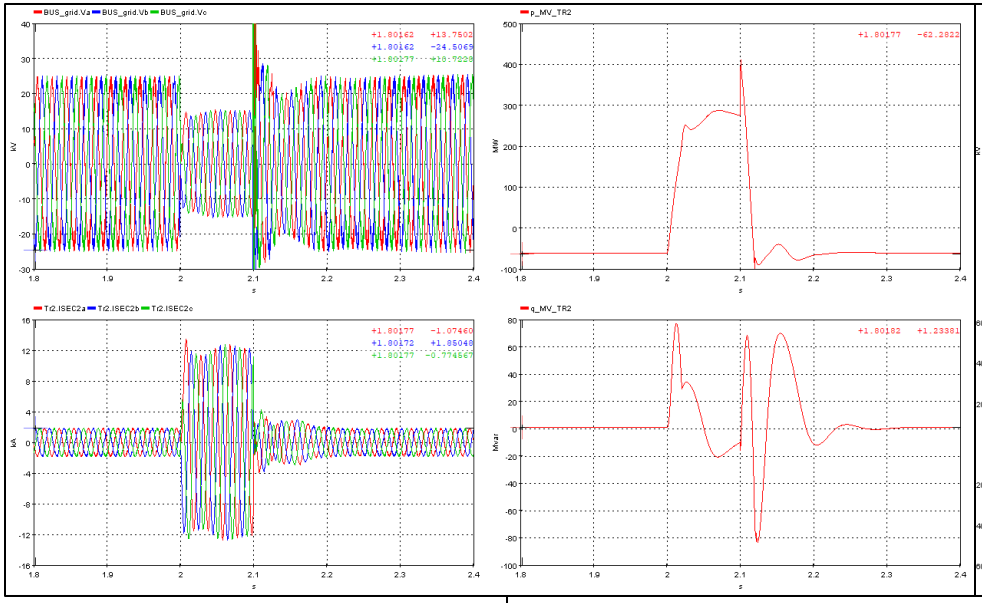
R&D NESTER
CREATING A SMART ENERGY FUTURE

Prot4HiRes – Simulations

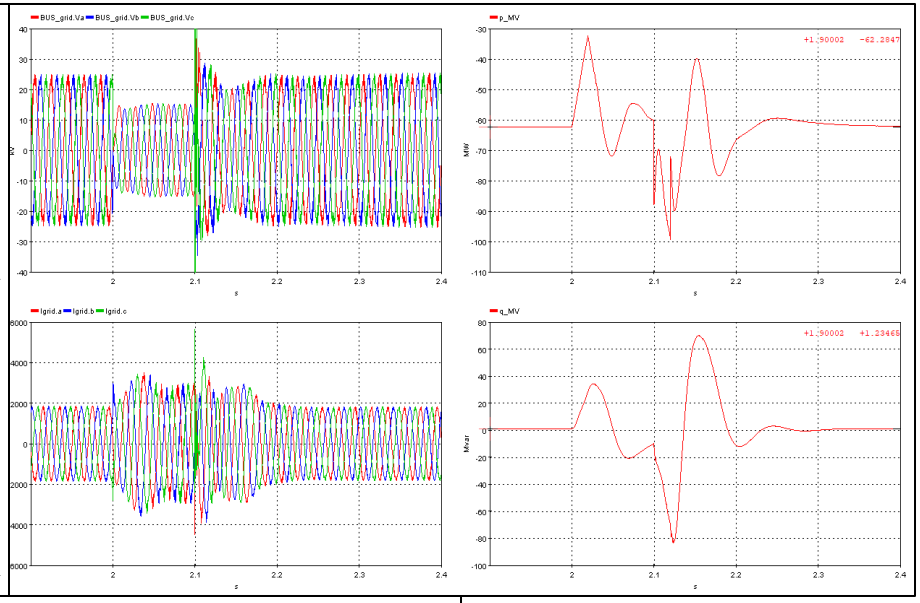


ABCG at MV Bus, 100 ms, 1.33 Ω

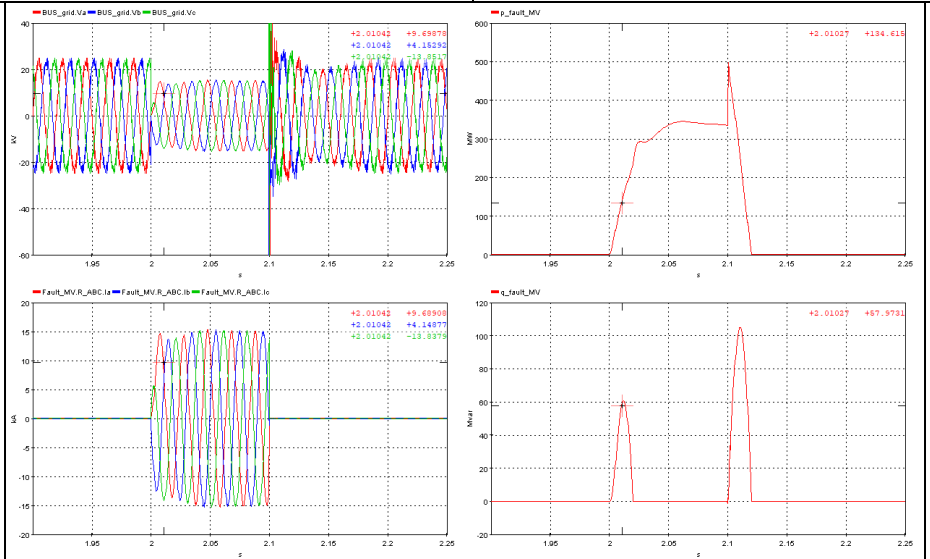
Prot4HiRes – Simulations



Contribution from TR2

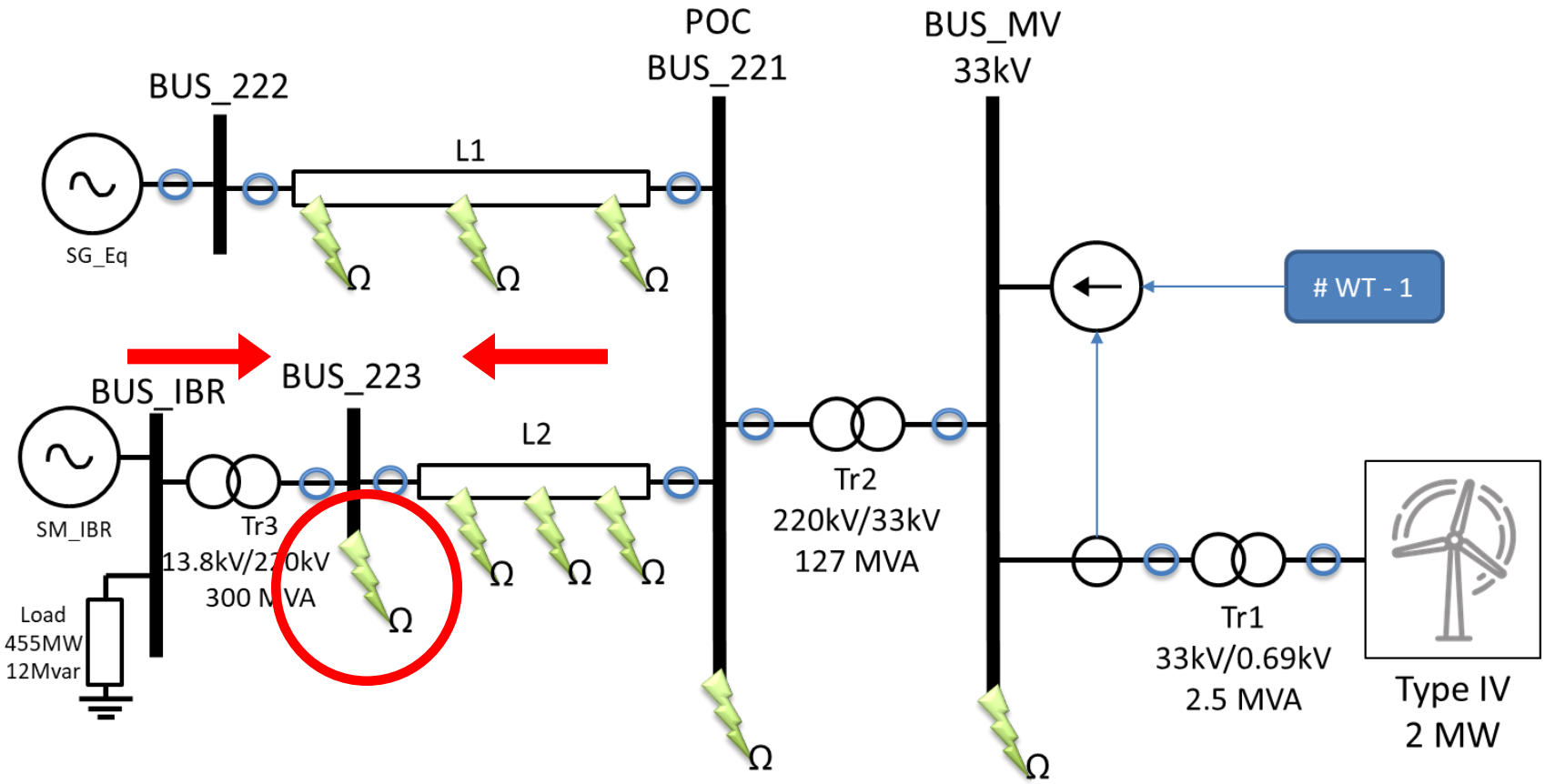


Contribution from WF



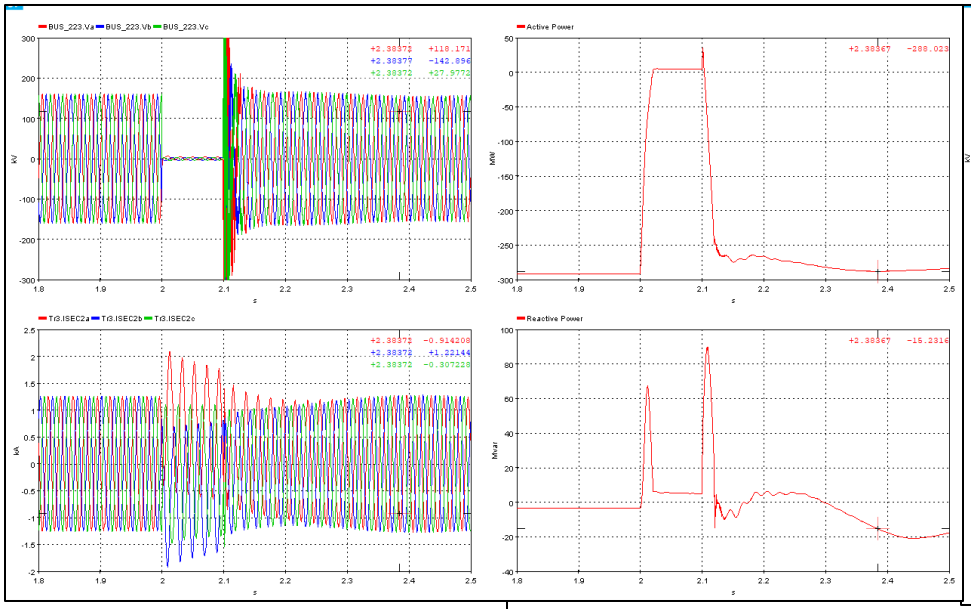
ABCG at MV Bus, 100 ms, 1.33 Ω

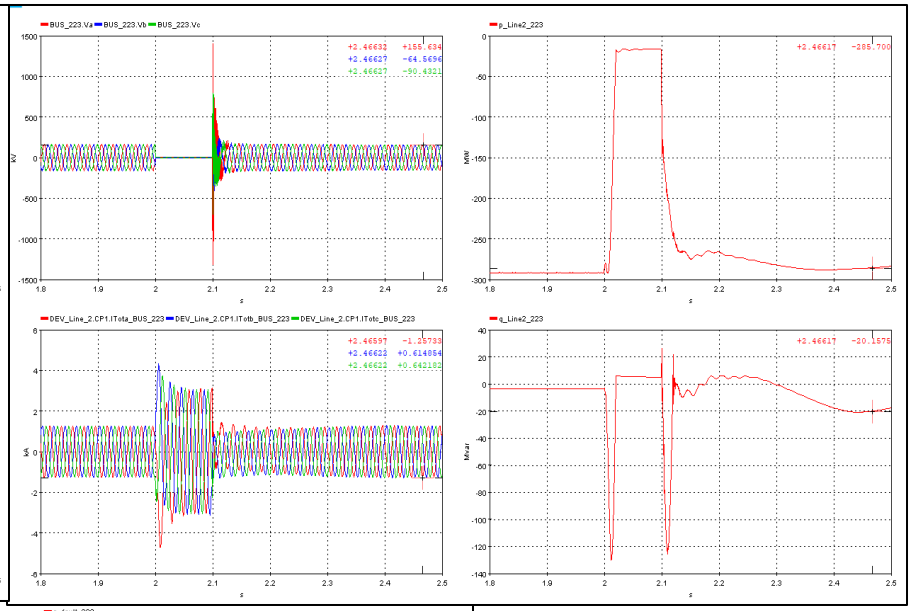
Prot4HiRes – Simulations



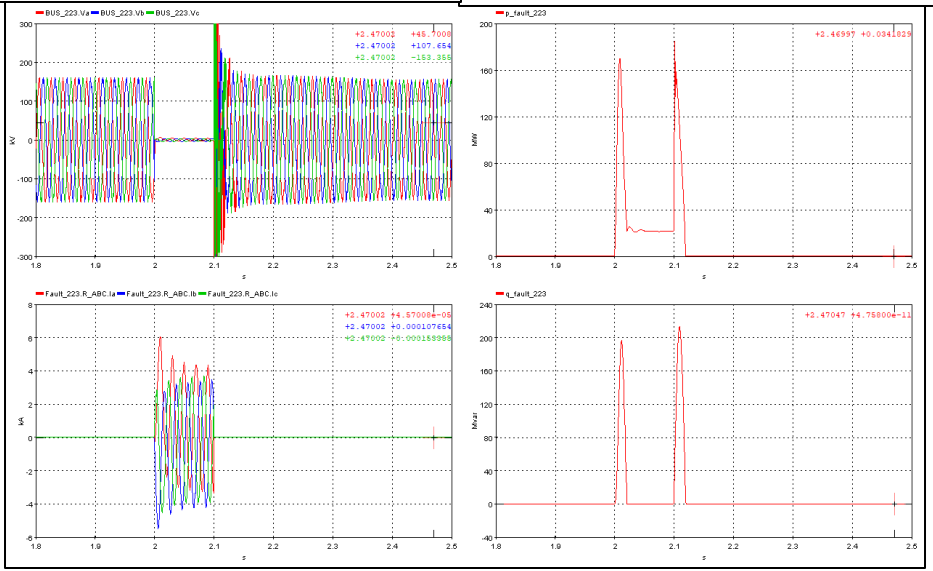
ABCG at BUS_223, 100 ms, 1.33 Ω

Prot4HiRes – Simulations





Contribution from TR3

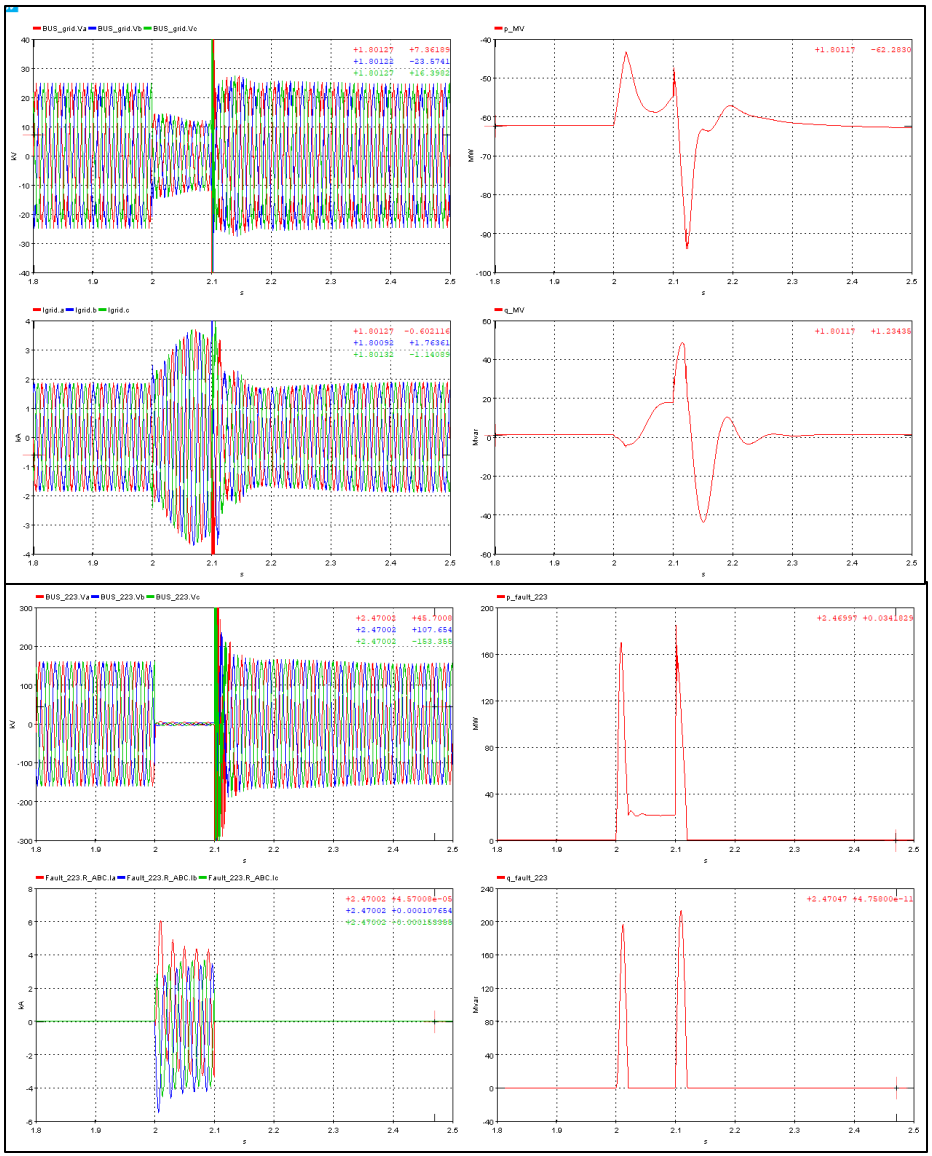


Contribution from Line 2

ABCG at BUS_223, 100ms, 1.33 Ω

Prot4HiRes – Simulations

Contribution from WF



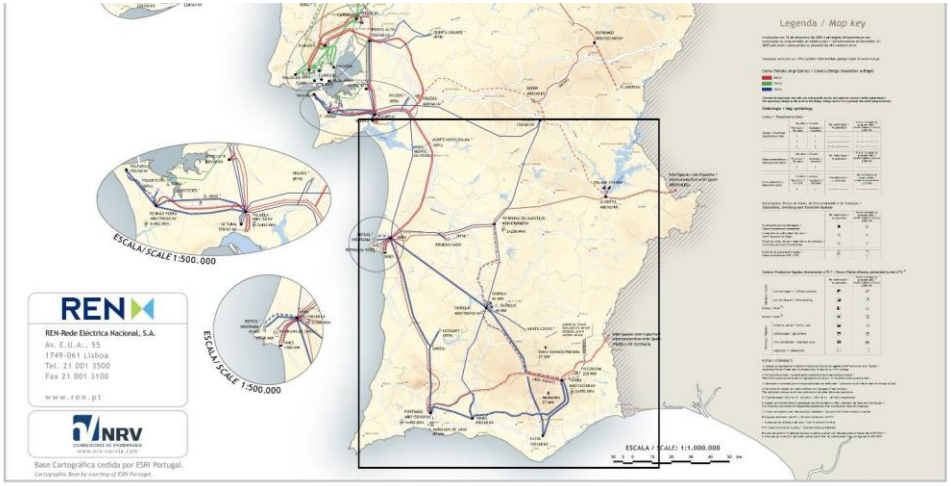
How does the WF react to not-near events?

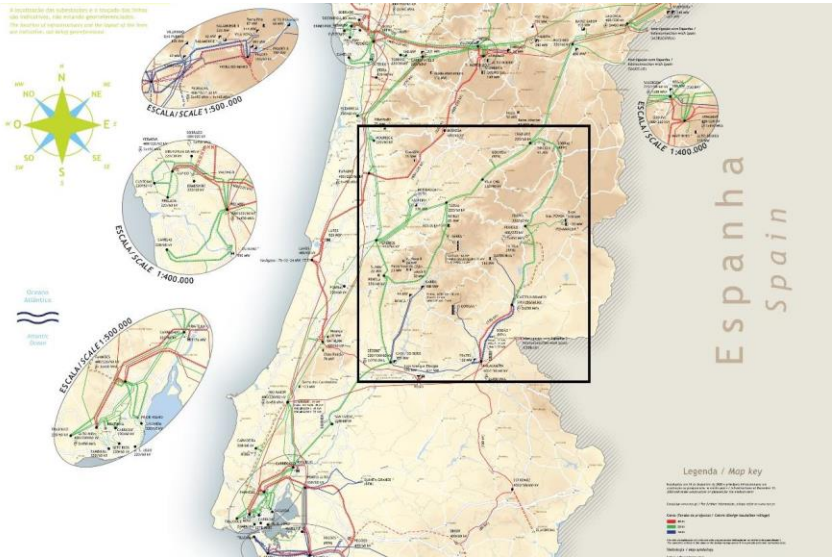
ABCG at BUS_223, 100ms, 1.33 Ω

R&D NESTER
CREATING A SMART ENERGY FUTURE

Prot4HiRes – Future Steps

- Inclusion of type III Wind Turbine and Solar PV models
- Generation Scenarios for actual and future state
- Deployment and Simulations on Zonal Power Systems representing a portion of the Portuguese Transmission Grid





South Zone

- Solar predominant
- 400 kV and 150 kV
- 9 Substations with RES Generation
- 24 Transmission lines

North Center Zone

- Wind predominant
- 220 kV
- 7 Substations with RES Generation
- 6 Transmission lines

HLUC relevance

of project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
Research on the key technology of relay protection for high permeability renewable energy delivery system	●	n/a	n/a	●● ●	●	●●	●	n/a	●	

HLUC 4: Massive Penetration of RES into the transmission and distribution grid

PPC 4.1: Technical barriers and measures
PPC 4.2: Control and operation tools
PPC 4.3: Infrastructure requirements and network technologies
PPC 4.4: Resilient system

PPC 6.1: Control solutions for next generation
PPC 6.4: Simulation methods and digital twins
PPC 6.6: Large Scale Demonstration

HLUC 6: Secure operation of widespread use of power electronics at all systems levels

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don't know

Key findings (work still ongoing)

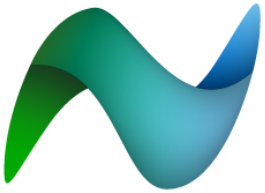
from project / program	finding(s)	relevant for HLUC(s) no.
Research on the key technology of relay protection for high permeability renewable energy delivery system	• We expect to find a critical point where traditional protection systems might start to fail, either due to low infeed currents or due to bigger voltage deeps	4
	• We expect to develop a set of parameters that lead to the design of a new transmission line protection located in a system with massive RES penetration	4
	• We expect to generate simulation scenarios to evaluate the need of new requirements for the installation and operation of RES	6

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
Research on the key technology of relay protection for high permeability renewable energy delivery system	• Is there a need to allocate or arrange in a certain way the future RES installations in order to not compromise the stability and safe operation of the system?	4 & 6
	• Which are the capacity limits of installing RES in a given area? Should that follow a common practice in Europe?	6 & 7

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project / program	proposal(s) / recommendation(s)	relevant for HLUC(s)
Research on the key technology of relay protection for high permeability renewable energy delivery system	• Target a revision and improvement of the requirements for installations of new RES	4 & 6
	• Include the development of a specification for protection systems for transmission grids with high penetration of RES.	4



Mateo Toro-Cárdenas
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Projects Panel Session 3 – Digitalisation & Citizens Involvement

- Empowering Consumers & Smart Communities
- System Control
- Cybersecurity

High Level Use Cases

HLUC 1: Optimal Cross sector Integration and Grid Scale Storage

HLUC 2: Market-driven TSO–DSO–System User Interactions

HLUC 3: Pan European Wholesale Markets, Regional and Local Markets

HLUC 4: Massive Penetration of RES into the transmission and distribution grid

HLUC 5: One s
Digital Technolog
participation o
(citizens) at

HLUC 6: Secure operation of widespread use of power electronics at all systems levels

HLUC 7: Enhance System Supervision and Control including Cyber Security

HLUC 8: Sustainable Transportation Integration

HLUC 9: Flexibility provision by Building, Districts and Industrial Processes

European Commission

Project Concepts (PPCs) 2022-2025, 2025+, 2026+

HLUC 5: One Stop Shop and Digital Technologies for Market Participation Consumers (Citizens) at the Center

PPC 5.1 Value of Consumer/Customer acceptance and engagement (IP 2022-2025)
PPC 5.2: Plug and play devices and IoT (Internet of things) including security by design (IP 2022-2025)
PPC 5.3: Utilisation of Communication Networks including cyber security (IP 2022-2025)
PPC 5.4: Cross-sectorial flexibility use cases (IP 2022-2025)
PPC 5.5: Data Spaces (IP 2025+)
PPC 5.6: Building a Skilled Workforce to accelerate the digital transition (IP 2025+)
PPC 5.7: Service management and operations (IP 2025+)
PPC 5.8: Sharing IT infrastructure investments (IP 2025+)
PPC 5.9: Large Scale Demonstration activities (IP 2026+)
PPC 5.10: Creating consensus on consumer solutions (IP 2026+)

Priority Project Concepts (PPCs) 2022-2025, 2025+, 2026+

HLUC 7: Enhance System Supervision and Control including Cyber Securi

PPC 7.1: Next Generation of TSO control room (IP 2022-2025)

PPC 7.2: Next generation of DMS (Distribution Management Systems (IP 2022-2025)

PPC 7.3: Next generation of measurements and GIS for distribution grids (IP 2022-2025)

PPC 7.4: Wide area monitoring, control and protections (IP 2022-2025)

PPC 7.5: Grid operator of the future (IP 2025+)

PPC 7.6 Grid field workforce of the future (IP 2025+)

PPC 7.7: Human machine interface (HMI) (IP 2025+)

PPC 7.8: Cybersecurity of Energy Networks (IP 2025+)

PPC 7.9: Large scale demonstration activities (IP 2026+)

PPC 7.10: Standardisation activities (IP 2026+)

HLUC 9: Flexibility Provision by Building, Districts and Industrial Process

PPC 9.1: Value assessment of the integration of buildings, infrastructure and smart communities in a RES based (IP 2022-2025)

PPC 9.2: Control and operation tools for the integration of buildings and smart communities (IP 2022-2025)

PPC 9.3: Planning for reliable integration of buildings and infrastructures in an integrated energy system (IP 20

PPC 9.4: Governance for an effective integration of buildings and smart energy communities (IP 2025+)

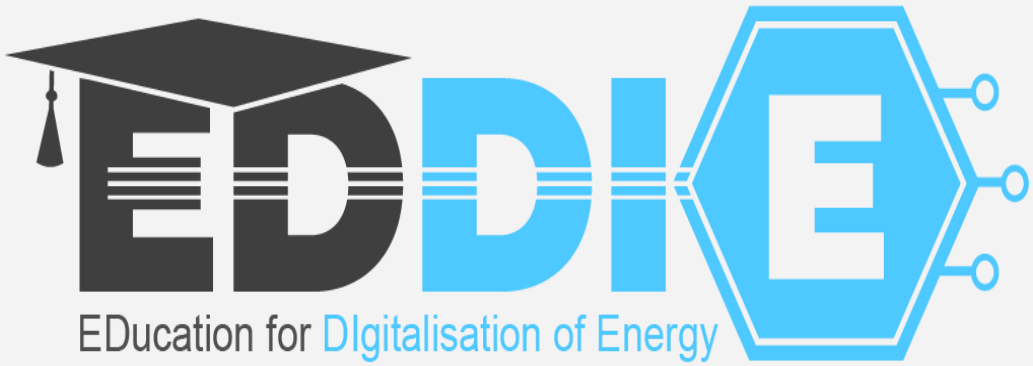
PPC 9.5: Evolved markets for enabling buildings and energy community facilities actively participating in sup-p energy transition

European Commission

EDDIE
EDucation for DIgitalisation of Energy

EDDIE (EDucation for DIgitalisation of Energy)

Miguel Angel Sanchez Fornié (University of Comillas)



EDDIE: EDucation for DIgitalisation of Energy

SUPPORTING DIGITAL ACTION PLAN
Skilled workforce to accelerate the digital transition

With the support of the Erasmus+ Programme of the European Union

Bilbao, 28th February 2023

Miguel Ángel Sánchez Fornié,
University of Comillas

About the Project

EDDIE is a **four-year** (starting January 2020) Erasmus+ European Union funded collaborative project creating a **Sector Skill Alliance** (SSA) to develop a long-driven **Blueprint (**or **strategy)** for the digitalisation of the European Energy sector.

The Consortium is coordinated by **COMILLAS** and brings together **16** partners from **10** EU Countries.

Digital Energy Education – Briefly

Title: Education for Digitalisation of Energy

Type of action: Sector Skill Alliance

Total Funding: € 3,995,690.00

Start Date: 01/01/2020

End date: 31/12/2023

Duration: 48 months

Web Site: *www.eddie-erasmus.eu*

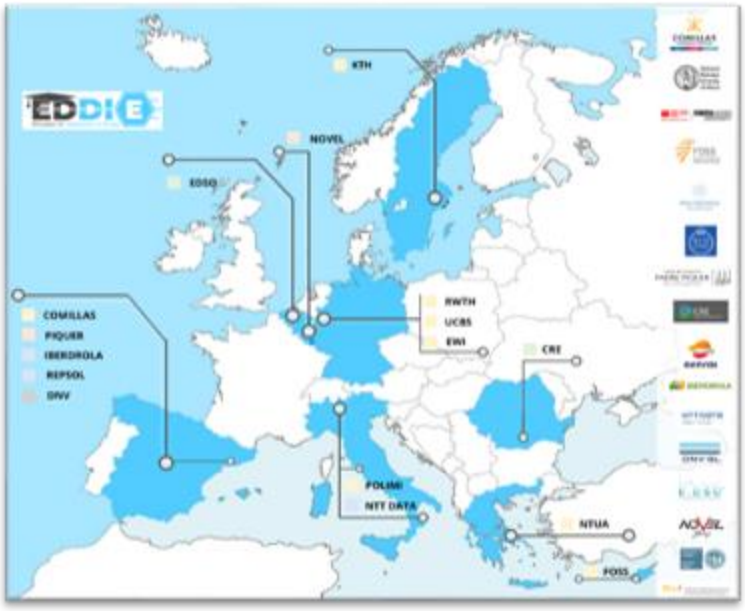
Keywords: Digitalisation, Energy, Education, SSA, VET

Project Coordinator: COMILLAS

With the support of the Erasmus+ Programme of the European Union

Partners and Advisory Board

TYPE	PARTNER NAME	COUNTRY
UNIVERSITIES	COMILLAS univ. (COORDINATOR)	SP
	NTUA	GR
	RWTH (AACHEN univ.)	GE
	FOSS univ.	CY
	POLITECNICO DI MILANO univ.	IT
	KTH univ.	SW
	UCBS	GE
	EWI	GE
VET EDUCATION	PADRE PIQUER	SP
	NOVEL	LX
PRIVATE COMPANIES IN THE ENERGY SECTOR	REPSOL	SP
	IBERDROLA	SP
	NTT DATA	ITA
INDUSTRIAL ASSOCIATIONS	EDSO4SG	BE
	ROMANIAN ENERGY CENTER (CRE)	RO
CERTIFICATION	DNV	SP
WORKERS ASSOC.	International Advisory Board	
CAREER GUIDANCE	International Advisory Board	
AUTHORITIES	International Advisory Board	



INTERNATIONAL ADVISORY BOARD: CITY OF AACHEN, CITY OF HERNE, DAFNI, DERLAB, EERA/ CIEMAT, ENTSO-E, EUROGAS, FISMIC CONFSAL, FLORENCE SCHOOL OF REGULATION, GD4S, INNOENERGY, T&D EUROPE.

With the support of the Erasmus+ Programme of the European Union

Objectives

- The EDDIE project aims at creating a **Sector Skills Alliance** (SSA) by bringing together all the relevant stakeholders in the Energy value chain, such as **industry**, **education and training providers**, **European organisations**, **recruiters**, **social partners,** and **public authorities.**

- The main **objective** of this SSA is to develop a **long-driven Blueprint** (or **strategy**) **for the digitalisation of the European Energy sector** to enable the **matching** between:
  a) DEMAND: the current and future demand of skills necessary for the digitalisation of the Energy sector, and
  b) SUPPLY: the supply of improved Vocational Education and Training (VET) systems and beyond (University, Long-Life Learning)

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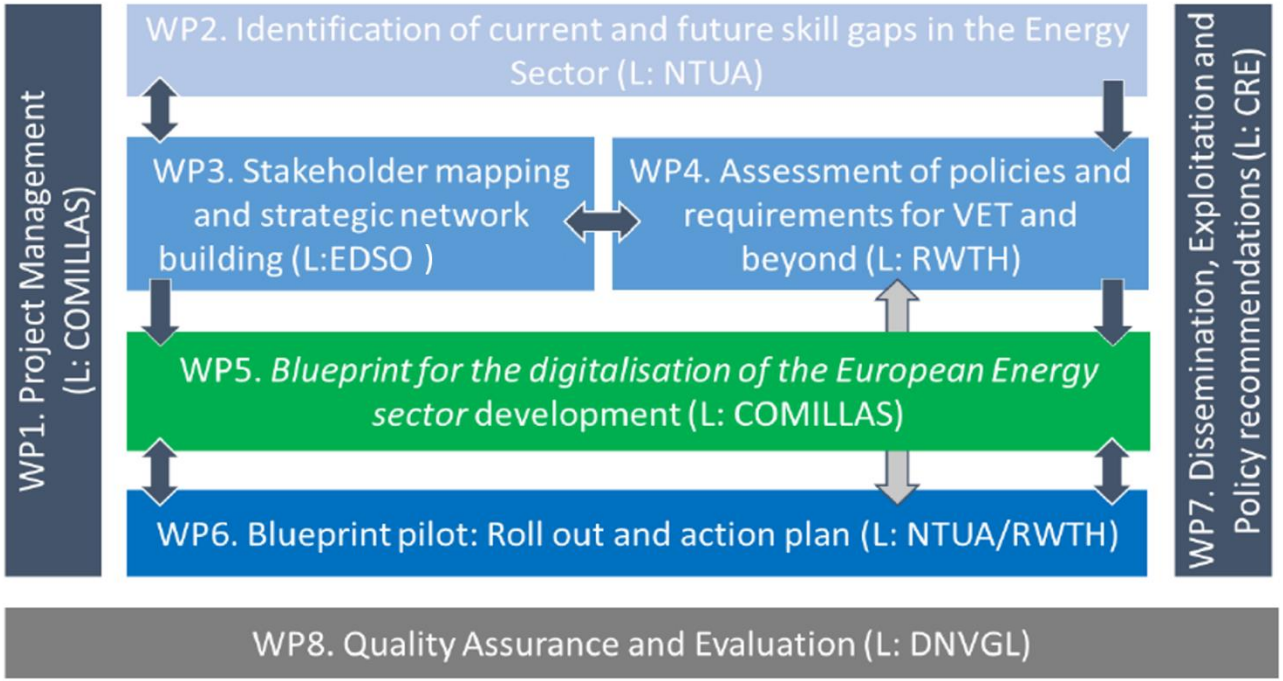
Work packages



WPs structure

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Project Results M1- M36

- Management, Monitoring and Dissemination (WP1, WP7, WP8)
- Skills, needs, and gaps (demand/supply), trends (D2.1, D2.2)
- Identification/classification of stakeholders, Database, and network (D3.1, D3.2, D3.3)
- VET systems analysis, and Best practices identification for VET, University education and Life Long Learning (D4.1, D4.2, D4.3, D4.4)
- Educational programs templates and BSDE strategic roadmap (D5.1, D5.2, D5.3, D5.5)
- Pilot activities (D6.1, D6.2, D6.4)

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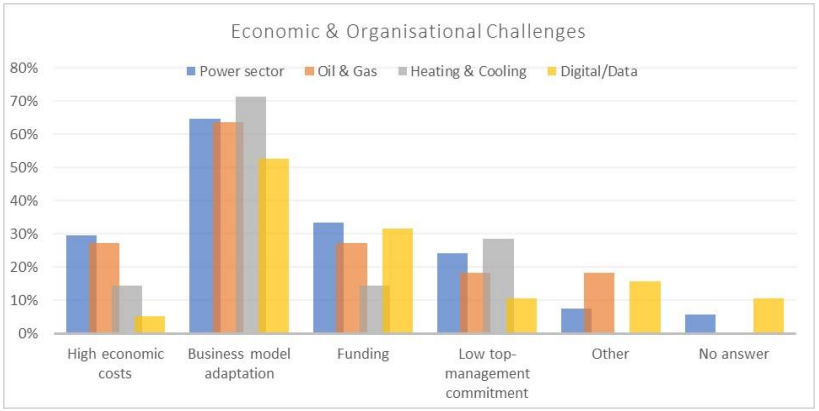
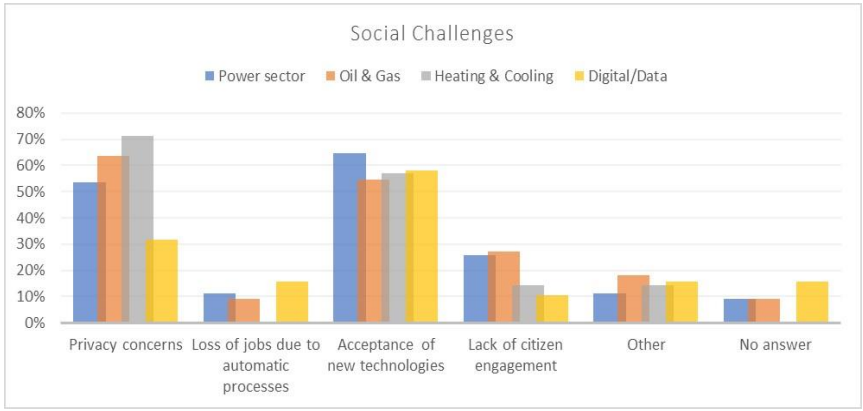
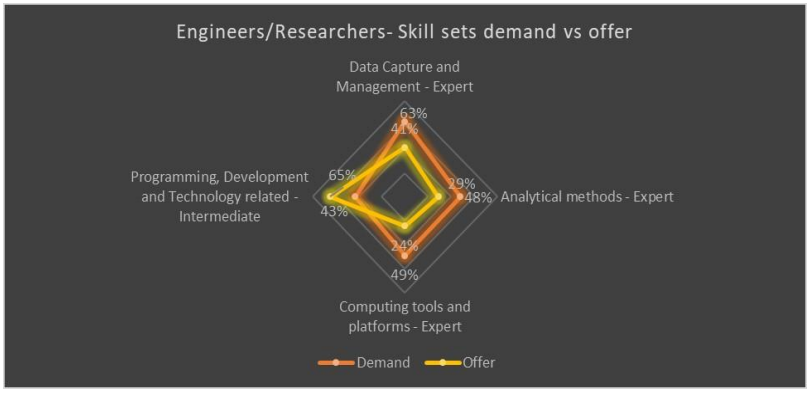
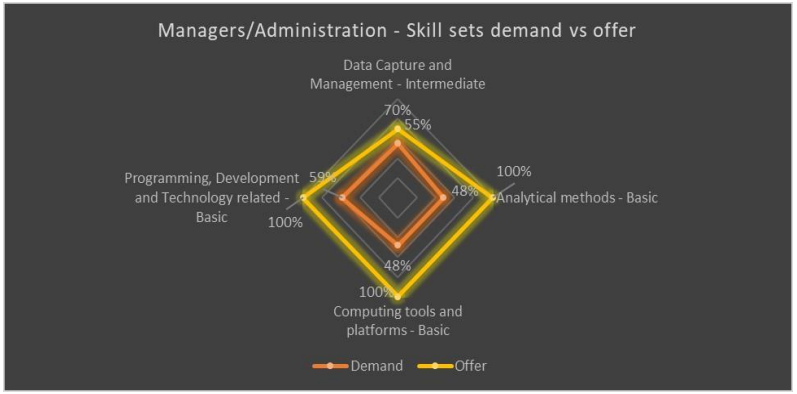
Showcase skill gaps and need
(D2.1, D2.2)









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- Pilot activities (D6.1, D6.2, D6.4)

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EDDIE Data Base (WP3)

Stakeholder mapping and strategic network building

The main objective is to perform Stakeholder mapping and strategic network building. The work involves the creation of a Stakeholders' map as a database of sector occupations and job profiles, with skills content analysis and set the ground for a strategic cooperation. The stakeholder mapping will start by identifying all relevant areas involved in the energy sector and then desk research to identify institutions, companies, organizations and all other interest groups that are relevant to the energy transformation system in Europe.

PUBLIC Area

RESTRICTED Area

https://www.eddie-erasmus.eu/registration-page-members/

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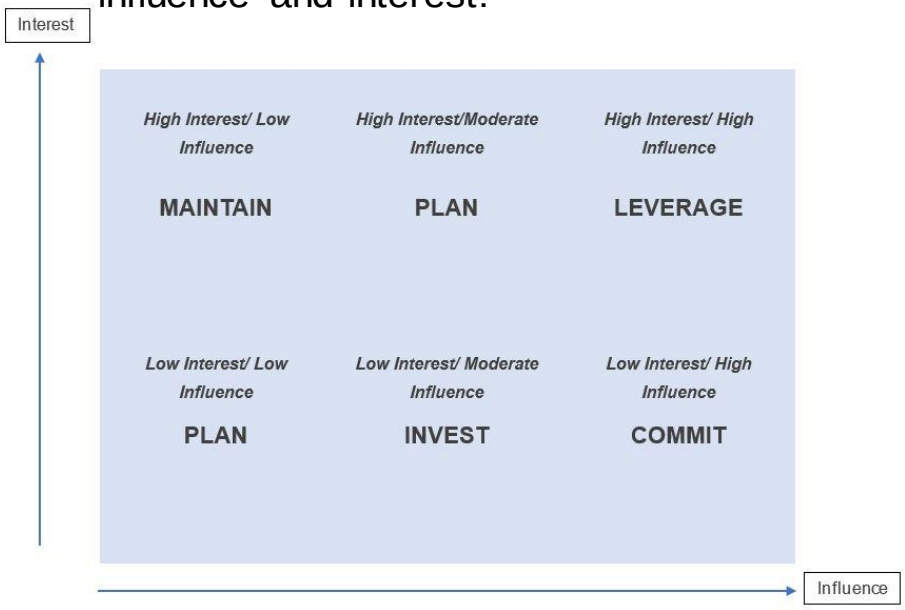
Stakeholders

Stakeholder categories identified:

- Industry Energy
- Industry ICT technologies
- Industry Equipment or infrastructure
- Industry Engineering
- Education
- Social and others
- Administration

Mapping of stakeholders according to their influence and interest:



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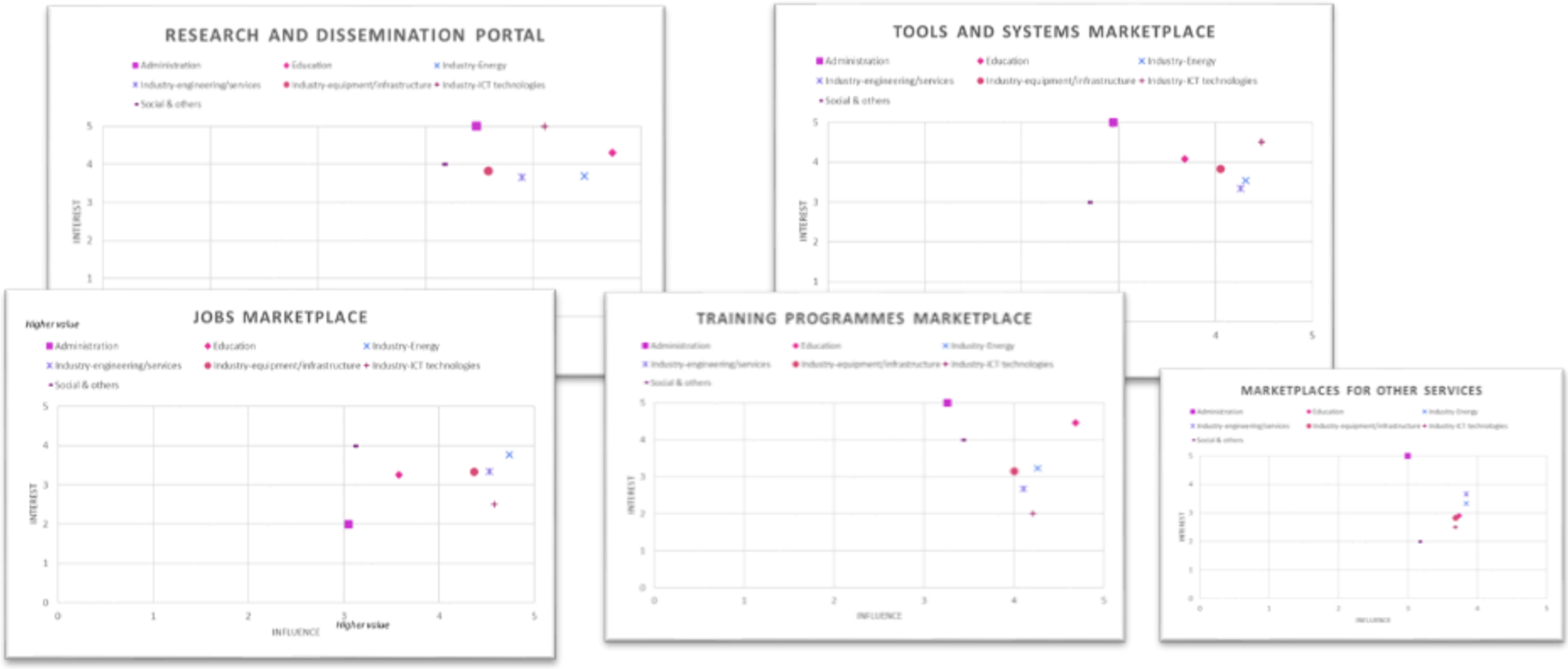
Stakeholders Mapping



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- Pilot activities (D6.1, D6.2, D6.4)

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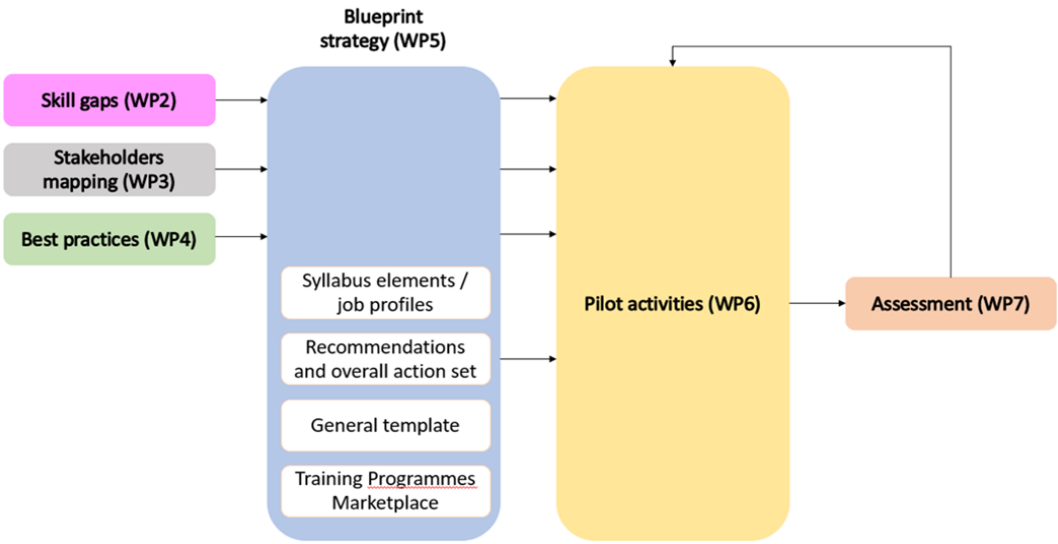
Pilot Activites (WP6)

Site	Partner	EQF Levels	Piloting activities
Aachen, Germany	RWTH	1-8	8 (3 in implementation)
Athens, Greece	NTUA	6-7	4
Milan, Italy	POLIMI	5-6	1
Cologne, Germany	EWI	4-6	3
Madrid, Spain	PIQUER	4	1
			Total 17

Relation WPs- Pilots with the Strategy:



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EDDIE and the BLUEPRINT (Strategy)

- **EDDIE project** is funded with the **clear requirement** of establishing a **Blueprint** (Strategy) according to other Sectors Skills Alliances projects.
- The Strategy has to **ensure sustainability** after the project ends (Dec. 2023) becoming so a major reference in the education of the sector in the future.

- How to materialise EDDIE's Strategy? Creation of an **ENTITY**

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EC Digital Action Plan for Energy

- SWD4.4. "*A skilled workforce to accelerate the digital transition*":
- *"Support the establishment of a large-scale partnership as part of the Pact for skills (End of 2023)"*
- The EDDIE Entity would provide at a short term the structure to establish the large scale partnership in accordance with the Pact for skills principles:
  - Best examples of other Blueprints for sectorial cooperation on skills and creating large-scale partnerships
  - Guidance handbook.introducing and setting up skills partnerships.
  - With the support of ECORYS (EC's contractor)

With the support of the Erasmus+ Programme of the European Union

FLEXENER / Spain

David Martin Utrilla, Rafael Bellido
IBERDROLA

Introduction and Overview

- **FLEXENER project**: Flexible Energy System for the Efficient Integration of New Decarbonisation Technologies.
- **Iberdrola** leads the project together with 6 other partners (Siemens-Gamesa, Ingeteam R&D Europe, Indar, OSI Digital Grid Solutions, Balantia and Wallbox).
- The goal is to identify flexibility capacities in generation, demand and the distribution network, to achieve a 100% renewable electricity system.
- The **€7.6 million project** runs from 2021 to 2023. The Spanish Ministry of Science and Innovation through its Centre for the Development of Industrial Technology is providing funding.

Consortium

IBERDROLA

i-DE Grupo IBERDROLA

OSI

BALANTIA ENERGY TRANSITION PARTNERS

wallbox

Ingeteam

Indar

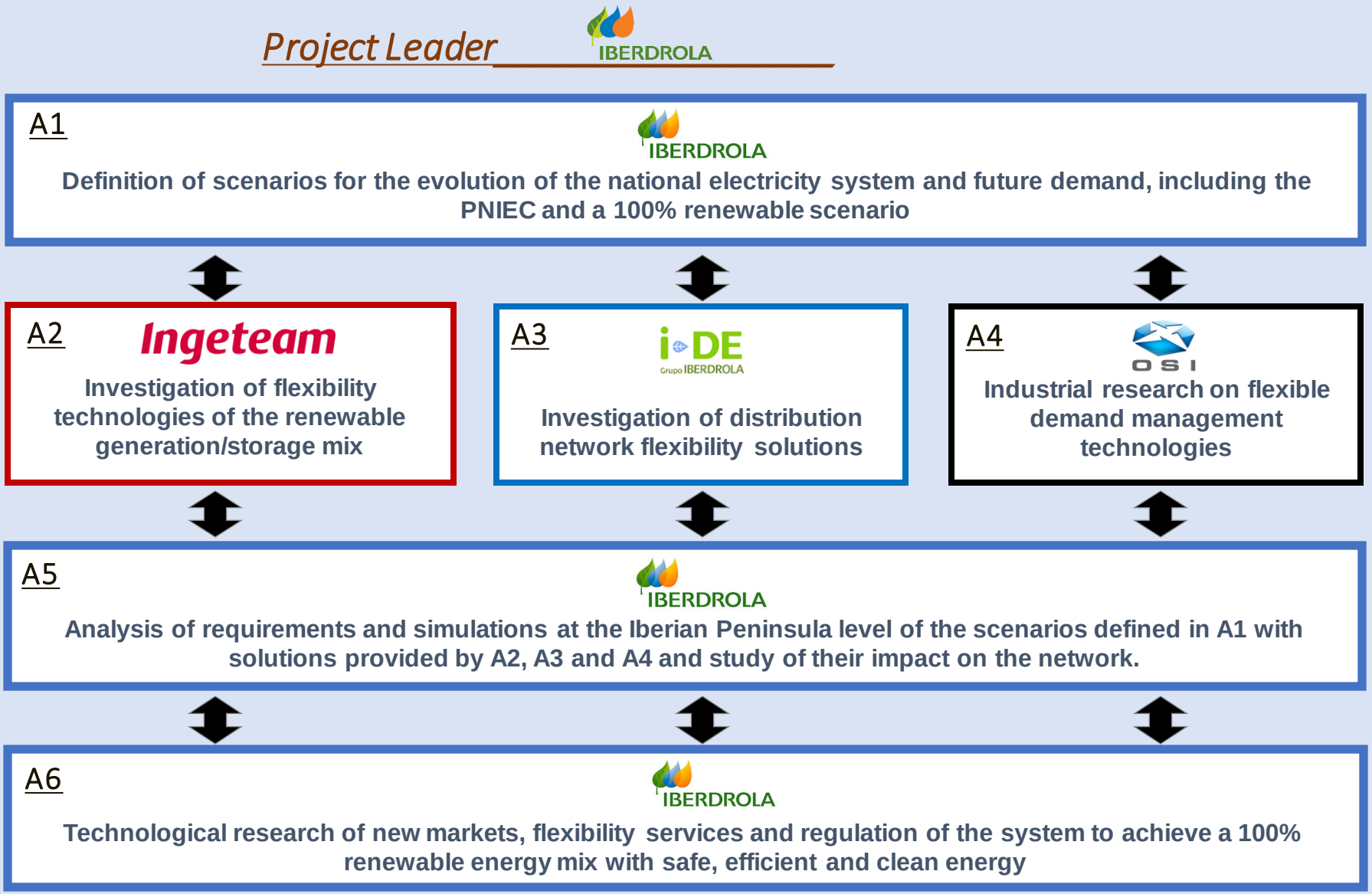
SIEMENS Gamesa RENEWABLE ENERGY

Financed by

GOBIERNO DE ESPAÑA MINISTERIO DE CIENCIA E INNOVACIÓN

CDTI INNOVACIÓN

Introduction and Overview



HLUC relevance

of project FLEXENER for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
Distribution	●	●●●	●●●	●●●	●	●●	●	●	●●	●●●
Renewables	●	●	●	●●●	●	●●●	●●	●●	●	●●●
Retail	●●	●	●●	●	●	●●	●●●	●	●●●	●●●

- Flexener models future scenarios and solutions to maintain system reliability.
- In terms of networks, it explores models for flexible solutions of the network itself.

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Key findings

of project FLEXENER for	First finding(s) – project will end in 2023	relevant for HLUC(s) no.
Distribution	• The location of flexible services in the network even within the same node is decisive for the efficiency. • DSOs can assist in the provision of services to the TSO. • The flexibility inherent in the network entails risks.	2,3,4
Renewables	• High penetration of renewables in 2030, specially in solar • 100% of renewable power is costly but feasible • Grid forming and sincronous compensator models	4,6
Retail	• Demand flexibility will reduce power system capacity • Impact on peak consumption is high	4,7,9

Open questions

of project FLEXENER for	open RDI questions / topics	relevant for HLUC(s) no.
Distribution	• How to incentivise DSOs to take risks in order to explore the flexibility of the network itself? • Market vs bilateral contracts as procurement mechanism for distribution needs	2,4
Renewables	• Development of findings in grid forming solutions • System stability control strategies implementation	4,6,7
Retail	• How to engage customers to provide flexibility	5,9

Proposals and recommendations for ETIP SNET IP / RM 2025+

of project FLEXENER for	proposal(s) / recommendation(s)	relevant for HLUC(s)
Distribution	• Demand Response participation scheemes • DSOs incentives to explore new solutions	3,4
Renewables	• Balancing and voltage control provision only with renewables • Hybridation with storage	1,4,6
Retail	• Demand Side Response Digitalization	5,9

European Commission

goiener

Dr. Chris Merveille
R&D coordinator

Introduction and Overview

- GoiEner S. Coop.
  - Citizen Energy Cooperative (a REScoop): energy a basic common good.
  - Grass-roots movement since 2012: just & inclusive energy transition
  - Active in Spanish Basque Country
  - 17000 members (mainly private citizens)
- Activities:
  - Electricity supply with renewables GoO (20000 consumer contracts; 100 GWh/y
  - Renewables generation (citizen funded): rooftop PV, mini-hydropower
  - Promotion and support to creation of RECs
  - Power poverty, bioenergy, behaviour change, renovation
  - R&D projects: use cases and pilots, citizen involvement, diversification

HLUC relevance for GoiEner projects

project / program	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
H2020-WHY	●	●	●●	●●	●●●			●●	●●●	
H2020-BECoop	●				●●				●●	
H2020-CHESTER	●●●	●●●	●●	●●	●					
Euroregion Hidro-Ttipi				●	●●●				●●	
Regional: GoiEner Soziala	●			●	●●●				●●●	

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Consumers (Citizens) at the Center (PPC5.1)

Key findings from GoiEner projects

project / program	finding(s)	relevant for HLUC(s)
H2020-WHY	Citizen ability to displace consumption is still limited, but willingness is relatively high and can be increased through empowerment and (impartial) information. Price signals are not well understood.	5, 9
H2020-BECoop	Community engagement and organisation takes time and can be stimulated through the support of local trusted actors (local administrations, non-profits…). There is room for other REC activities: local bioenergy-based district heating.	5, 9
H2020-CHESTER	Carnot batteries may be useful to grid and local communities in future scenarios, to increase renewables penetration, offer flexibility, avoid curtailment impact etc (e.g. RES+DH)	1, 2
Euroregion Hidro-Ttipi	There is potential for small-scale hydropower to supply self-consuming communities. Environmental concerns.	5, 9
Regional: GoiEner Soziala	Community engagement and organisation takes time and can be stimulated through the support of local trusted actors (local administrations, non-profits…). Most communities in Spain initially opt for CSC. With changes in regulation, REC could offer grid services in the future.	5, 9

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
H2020-WHY	• Provide more **actionable information** (consumption, efficiency) • **Integrated energy** data and management (electricity, gas, heat/cold, water, transport...) • Avoid **digital technology increasing social divide**	5
H2020-BECoop	• Holistic perspective of residential energy management (home to district): integrated demand response; use local resources	5, 9
H2020-CHESTER	• Prices of components/materials (HP, PCM) must come down; demonstration of reliability and viable business cases. • Distributed medium-term storage to avoid LV grid congestion and local/regional **energy autonomy**	1, 4
Euroregion Hidro-Ttipi	• LCA and local social **impact analysis** for small-scale hydro (distributed generation). Use it or loose it? • Reduce environmental impact (appropriate and affordable fish ladders) • Increase local mix of renewables for **increased self-consumption**	1, 5, 9
Regional: GoiEner Soziala	• Energy Communities are a **social construct**. Organisation and **governance** are independent of RES technology used. **Tools** for community organisation and self-governance. Digital technology increases social divide.	5

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project / program	proposal(s) / recommendation(s)	relevant for HLUC(s)
All (H2020, LIFE, regional programmes)	✓ **Energy Communities** are a way of getting citizens involved and motivated towards the energy transition ✓ Participation and transparency increase **trust** and **acceptance** ✓ Transition will be **just** and **inclusive** or will not happen ✓ **Holistic** energy view ❑ HLUCs and PPCs are more difficult to understand than the roadmap concepts (Research areas, Functionalities) ❑ HLUC5: OSS should be community-based, impartial ❑ Less technology oriented – more citizen oriented language ❑ PPC 5.1 formulated from System, not citizen perspective. ❑ **Demo cases** closer to present-day reality	5, mainly but not exclusively

BEYOND

Pedro Crespo del Granado **(NTNU)**

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

BEYOND

*ain based **E**lectricit**Y** trading*
*ntegration **O**f **N**ational and*
entralized local markets

ts # Prosumers # Blockchain

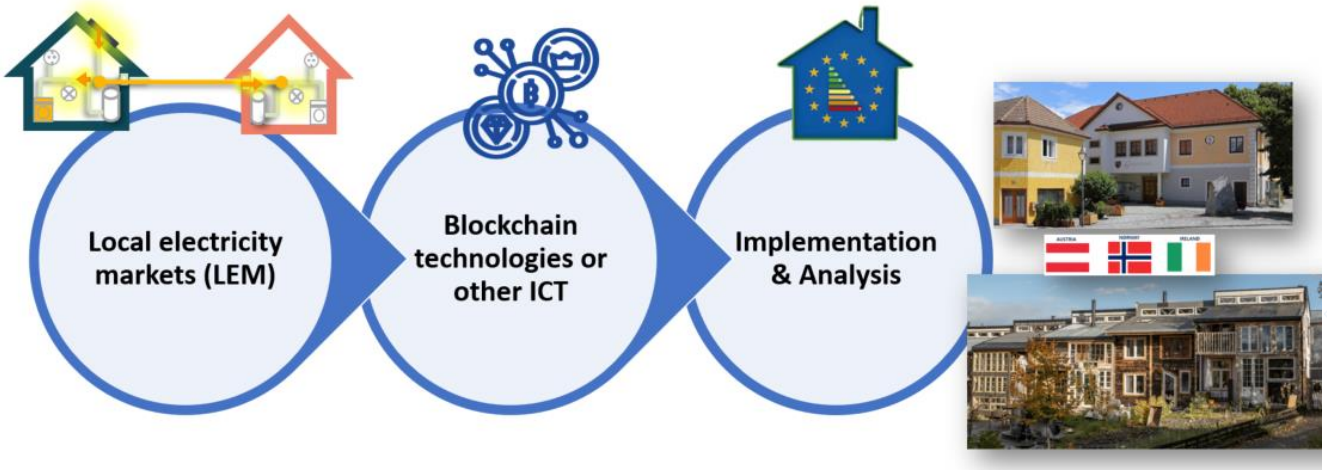
This project has received funding in the framework of the joint programming initiative ERA-Net Smart Energy Systems' focus initiative Integrated
Systems, with support from the European Union's Horizon 2020 research and innovation programme under grant agreement No 775970

BEYOND project scope and objectives

Main goal: Investigate the integration of local energy markets based on smart contracts and blockchain technologies.

Objectives:

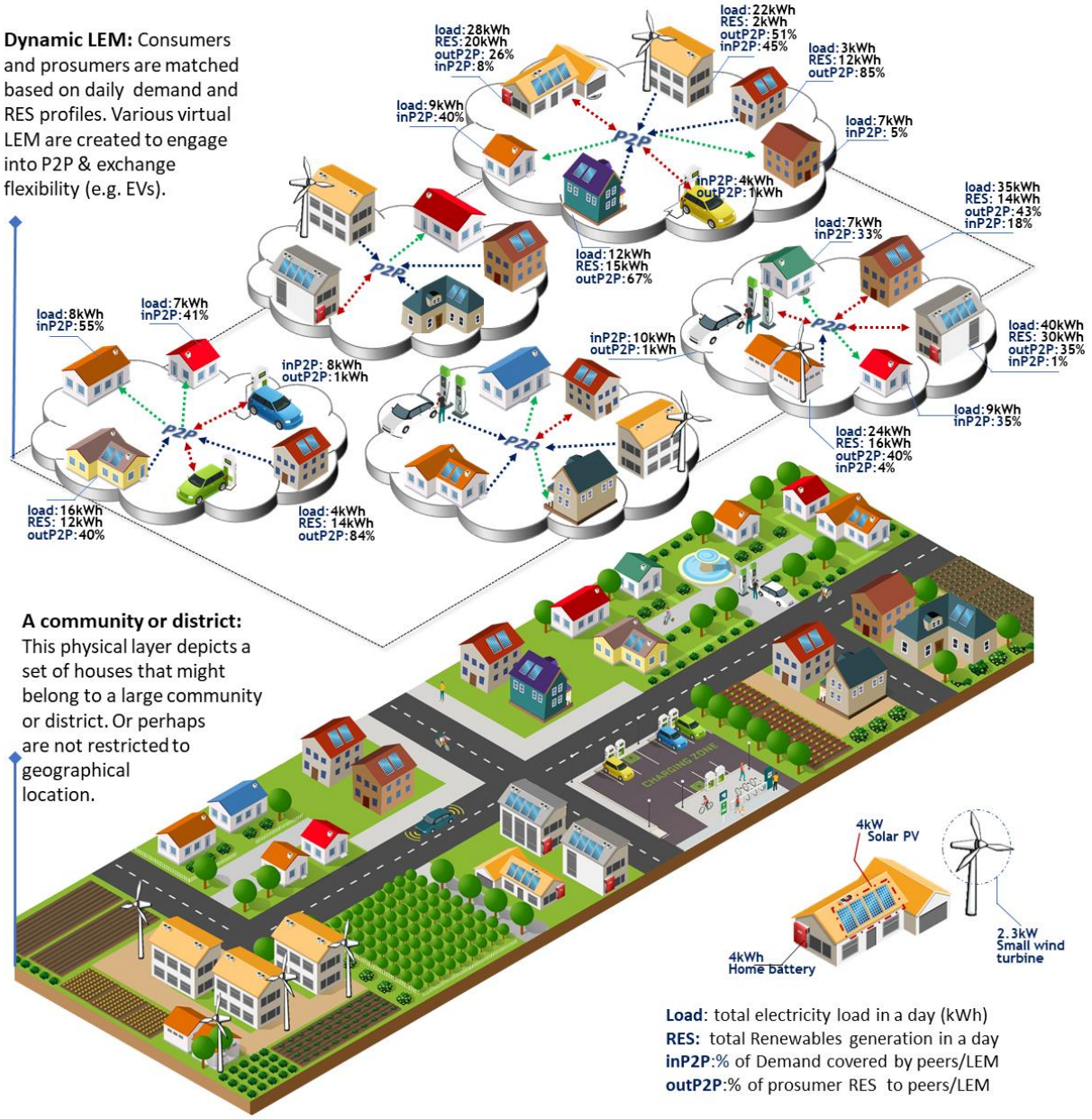
1. Adoption of local energy markets under current regulatory frameworks
2. Development of digital and user-centred solutions, considering relevant stakeholder (i.e., DSOs)
3. Simulation and real-life testing of local market solutions
4. Testing the trans-regional implications of local energy markets (e.g., short and long-term flexibility requirements)
5. Enable end-users such as businesses, industries and households to be active actors in the future energy system



BEYOND
Blockchain-based electricity trading for the integration of national and decentralized local markets

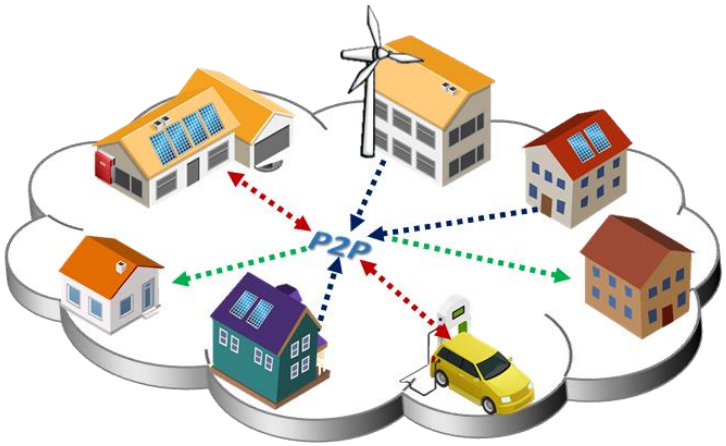
BEYOND

- New Business models to realize Energy Communities
- **Virtual Clustering** consumers-and-prosumers
- Clustering filters any grid related issues
- Tokens and Blockchain domains on shaping new ideas for energy sharing
- EVs role in shaping the formation of LEMs



Key results

- Multiple open-source models and tools developed
- **New market designs and Business models** for LEM
- On-site demonstrators and collected end-user perspectives (experiences)
- 3+ SMEs using the results and insights for market uptake
- Around 20 publications in peer-reviewed journals and conferences
- Digital platforms for LEMs developed
- New notions on exploiting the digitalization of the power system to the formation of LEMs
- Various new Spin-off and projects initiated



Smart Energy Systems ERA-Net

HLUC relevance

of project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9	other
BEYOND		●●	●●●	●●	●●●		●	●	●●●	

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don‘t know

Key findings

from project / program	finding(s)	relevant for HLUC(s) no.
BEYOND	• End-user flexibility can be available to DSO operations and support its coordination with the TSO. For example, BEYOND developed a new marketplace on inter-Community trading which brings TSO-DSO a setting to trade or procure flexibility	2
BEYOND	• Multiple development and validation of market concepts center on prosumer-consumer interactions. Also proposed mechanisms to participation in wholesale markets, e.g. development of retailers owned/tailored to consumer-prosumer markets or energy communities	3
BEYOND	• Developed mechanisms to raise flexibility from local markets and energy communities to handle RES penetration while not distorting the local market clearing. Various results on technical grid challenges and opportunities related to the coordination with local markets and energy communities	4
BEYOND	• Test project solutions and innovations in 4 demo sites. Main challenge is that we need more experiences and demonstration to make it more main stream.	5
BEYOND	• Local markets are ready for deployment and uptake. Multiple market design features developed proving how energy communities are ready to enabling buildings participation.	9

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
BEYOND	• What is a meaningful reward/incentive from TSO-DSO coordination signals to local markets? Can it be market-based or establish a grid-standard rule/price?	2
BEYOND	• What new marketplaces will accelerate the integration of local markets? How to sync them with wholesale markets? What is the role of retailers?	3
BEYOND	• How the value of flexibility from local markets and energy communities facilitates grid planning and enhance grid flexibility? How reliable it is in the long-run?	4
BEYOND	• How to make local markets and energy communities more mainstream? How to create the Uber/Airbnb of energy sharing?	5
BEYOND	• Is flexibility from buildings reliable and cost-benefit worth it for grid services? How smart design of digital platforms will accelerate automatization? Open source?	9

R2D2 / HORIZON EUROPE CL5-2021-D3-02

René Alba Menéndez, EDP Spain

What?

- **Improve** overall resilience of the current electrical systems against cyber, physical and natural/climatic threats.
- **Guarantee** the uninterrupted functionality of the energy-related business operations and their protection against cyberattacks.
- **Reduce** the risk involved in the necessary sharing of data between TSO-TSO and TSO-DSO.
- **Utilize** the insights gained from internal and external stakeholders during post-event analysis.
- **Develop** proactive measures to ensure the reliability of physical assets.

How?

Development of the following 4 tools:

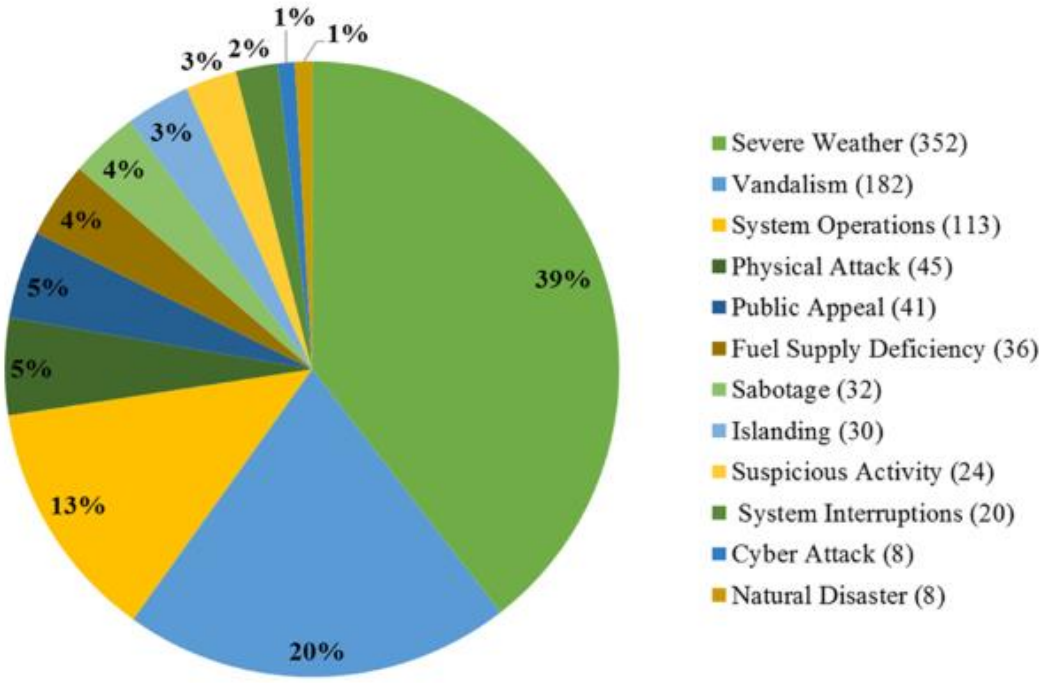
- **Multi-risk assessment framework for power system (P1 – C3PO):** it deploys a systematic, disciplined, and repeatable approach for evaluating an energy system security strategy.

- **Resilience suite for TSO & DSO Prevention Systems For Energy Infrastructures Security (P2 - IRIS):** it is the tool that will be used when system operators need to coordinate for security reasons.

- **Prevention Systems For Energy Infrastructures Security (P3 - PRECOG):** it offers a cybersecurity framework regarding both OT and IT.

- **Enhanced Assets Maintenance And Management Toolkit (P4 - EMMA):** it helps the enhancement of the physical assets' reliability and accelerates the grid recovery in case of an outage.

Why?



Different events of power outages reported in OE-417 (2014–2018)

Where?

- **Serbia: SCC**, the Security Coordination Centre, will be acting as end-user of Product 2 and demo leader of the Serbian Pilot Site. **EMSS** will be representing the Serbian TSO.

- **Greece**: **HEDNO**, the Greek DSO, will be the demo leaser and end-user of the developed tools.

- **Spain**: **EDP NEW** will be the pilot coordinator along with **EDP Spain** which is EDP NEW third-party and pilot host.

- **Slovenia**: Elektro Ljubljana (**ELEK**) is one of Slovenia's DSOs and will give available a part of its infrastructure.

HLUC relevance

"A HLUC represents the practical realisation-related dimension to achieve the integrated energy system needs of the year 2031."

of project / program … for	HLUC 1	HLUC 2	HLUC 3	HLUC 4	HLUC 5	HLUC 6	HLUC 7	HLUC 8	HLUC 9
R2D2/HORIZON EUROPE CL5-2021-D3-02	●●●	●●	●	●●	●	●	●●●	●	●

●●● extremely relevant
●● highly relevant
● relevant to some degree
n/a – don't know

Key findings

from project / program	finding(s)
R2D2/HORIZON EUROPE CL5-2021-D3-02	• The project started recently • Several meetings have been held

Open questions

project / program	open RDI questions / topics	relevant for HLUC(s) no.
R2D2/HORIZON EUROPE CL5-2021-D3-02	• How to develop an integrated model to measure Cybersecurity and Resilience risk? • How to effectively select cybersecurity controls to implement Zero Trust architecture in Critical Infrastructures? • How to develop sector specific Security Operation Centres (SOCs) and Threat Intelligence sources? • How to measure effectively cyber security risk considering existing technical vulnerabilities by adopting Dynamic risk Assessment in Critical Infrastructures? • How to manage effectively cyber security supply chain risk in Critical Infrastructures?	HLUC 2,5,7

Proposals and recommendations for ETIP SNET IP / RM 2025+

from project / program	proposal(s) / recommendation(s)	relevant for HLUC(s)
R2D2/HORIZON EUROPE CL5-2021-D3-02	• **Define** risk measurement models that can represent properly all the TSO-DSO System cybersecurity and resilience risks. • **Facilitate** entities to operate as Security Operation Centres (SOCs) and Threat Intelligence sources. • **Develop:** -Regulatory framework for supporting effective cybersecurity and resilience risk assessment. -Regulatory framework for supporting supply chain security risk measurement. -Advanced technologies and tools (SIEM/SOAR solutions) for the implementation of a proactive security strategy supporting threat hunting in SOCs. -Methodologies capable to assist in Design and Implementation of Zero Trust Architectures. -Advanced Threat Intelligence Platforms. -Dynamic Risk & Vulnerability assessment platforms.	HLUC 2,5,7

Thank you!

R2D2 / HORIZON EUROPE CL5-2021-D3-02

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WRAP UP

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CLOSING REMARKS

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THANK YOU