



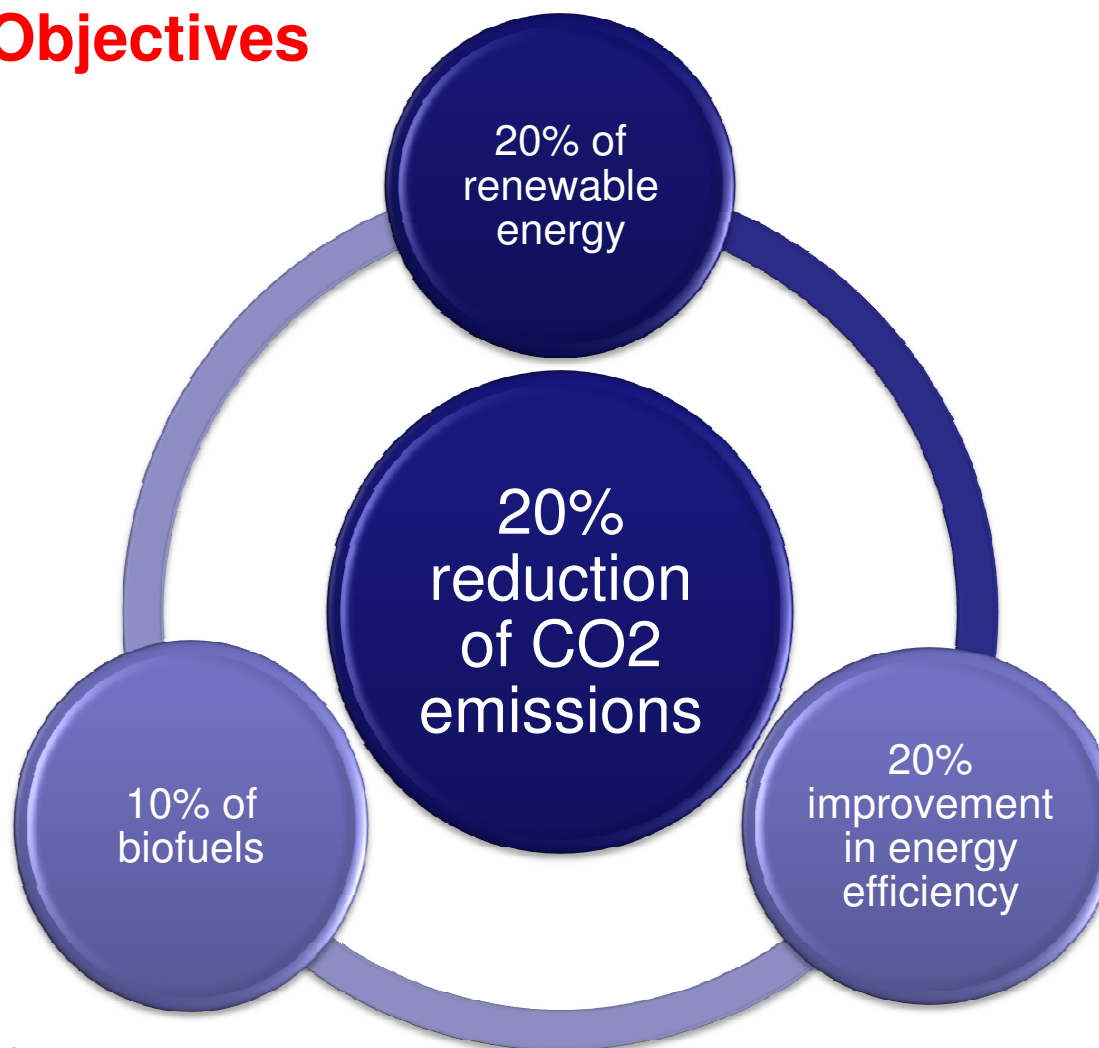
Transmitting wind



RED ELÉCTRICA DE ESPAÑA

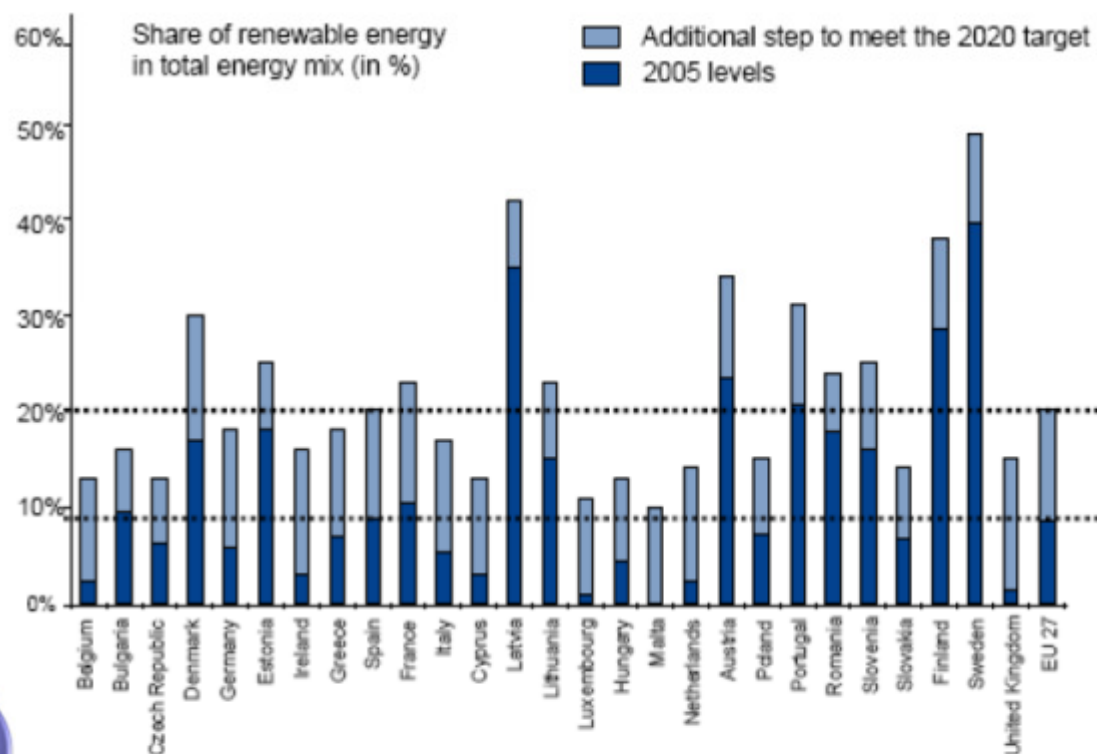
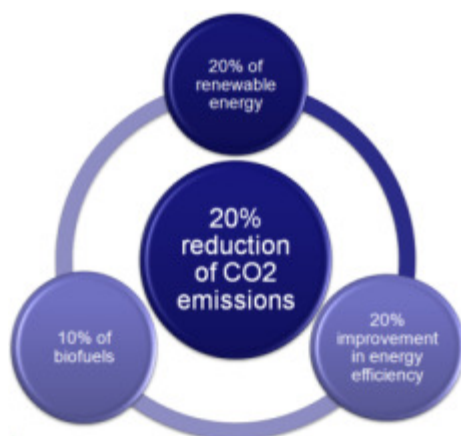
TWENTIES PROJECT
TPWind Energy R&D Event
October 4th 2011

EU 2020 Objectives



Increase the share of RES to 20%

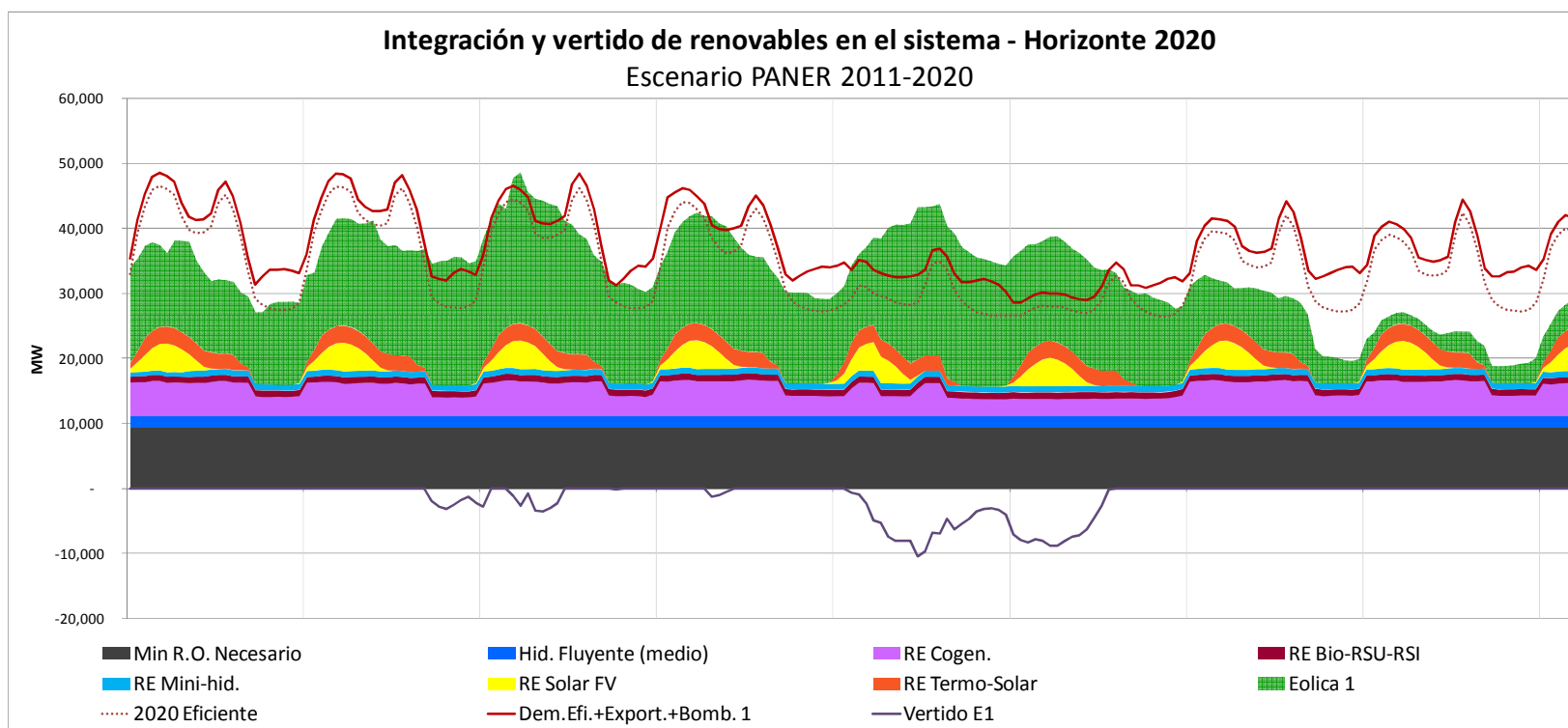
**Will Europe
be able to
fulfill them?**



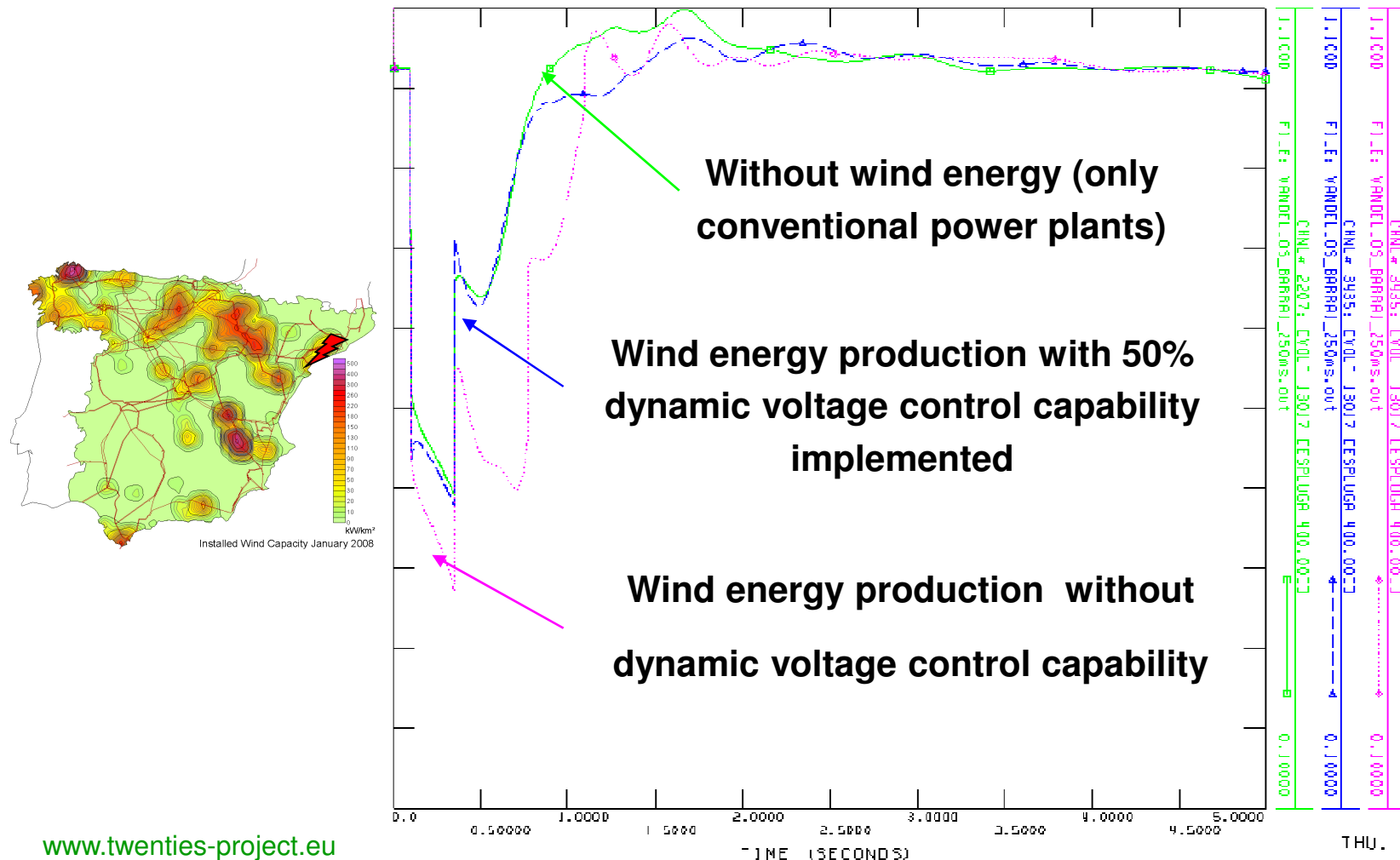
Source: Eurostat and European Commission

Market Observatory for Energy

Barriers: manage highly variable production



Barriers: system variables stressed



Barriers: a need for an offshore grid



Source: www.trec-uk.org.uk,

Concept-Idea

The TWENTIES project aims at:

*“**demonstrating** by early 2014 through real life, large scale demonstrations, **the benefits and impacts of several critical technologies** required to **improve the pan-European transmission network**, thus giving Europe a capability of responding to the increasing share of renewable in its **energy mix by 2020** and beyond while **keeping its present level of reliability performance.**”*

To this extent it will be focused in removing several barriers which prevent:

- **pan European electric system** from welcoming more renewable generated electricity.
- **renewable-generated electricity** from contributing more efficiently to the **single European electric market.**

Project objectives

What are the valuable contributions that intermittent generation and flexible load can bring to system services?

What should the network operators implement to allow for off-shore wind development?

How to give more flexibility to the transmission grid?

How scalable and replicable are the results within the entire pan-European electricity system?

**6 high level
demonstration
objectives**

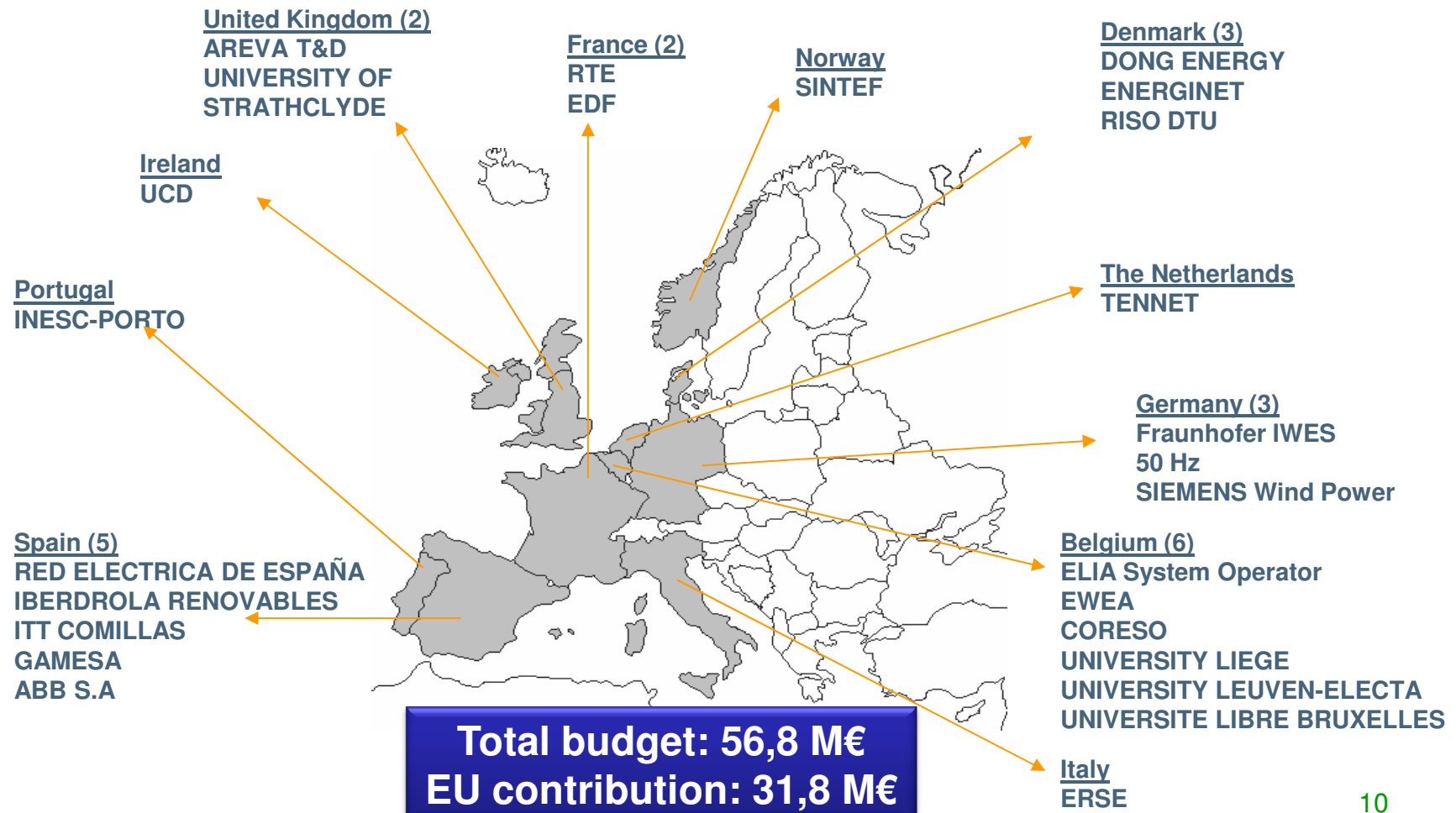
**2 replication
objectives**

Twenties orchestra



Consortium and budget

- ✓ 10 European Member States
- ✓ 1 Associated Country



DEMO 1 SYSERWIND (Leader: IBR)

Main objective

- Tests to provide **new active and reactive power control services to the system (EMS level)**, using improved **systems, devices and tools**, but keeping the **current hardware** at wind farm level.

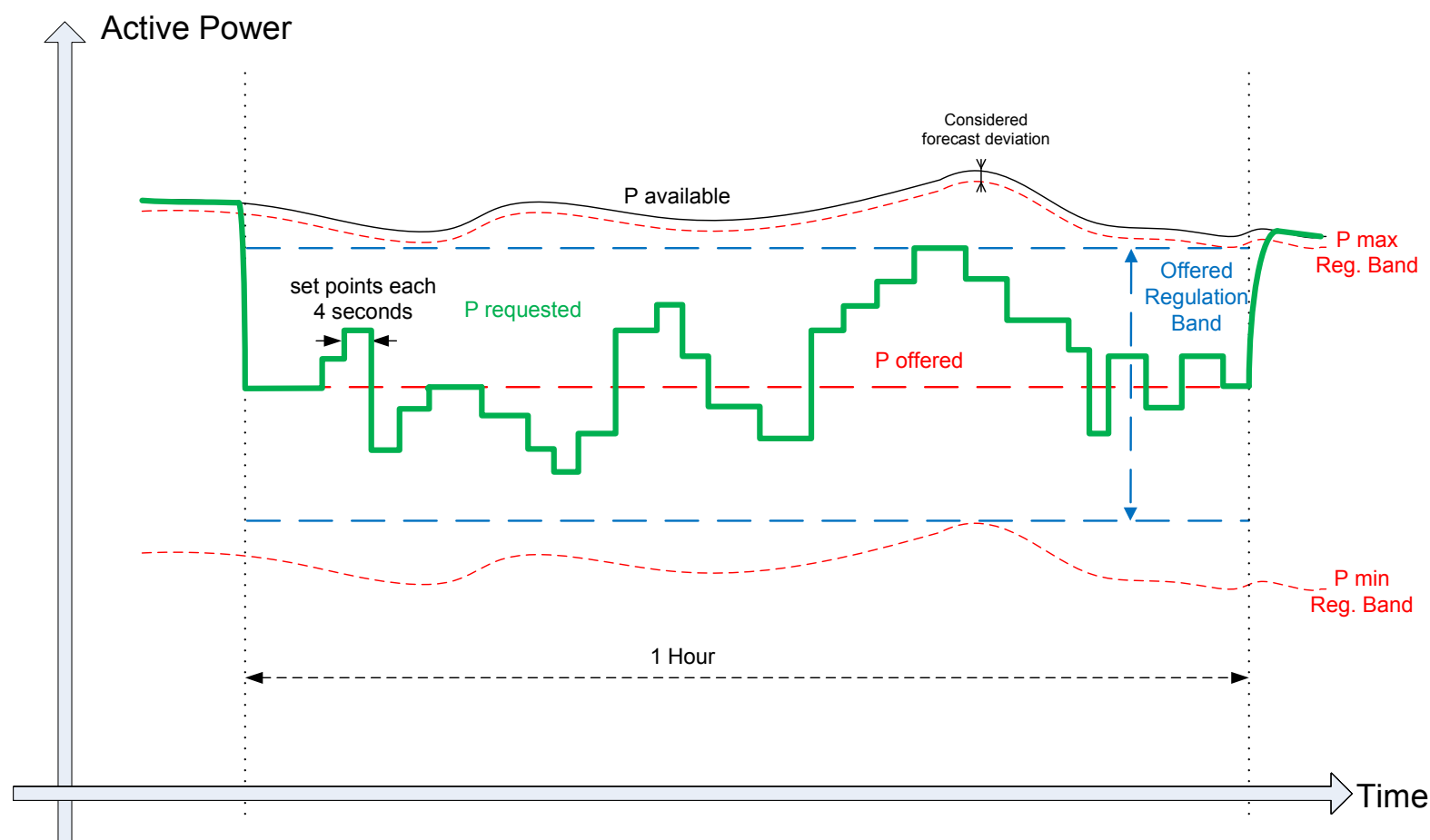
Approach

- **Active power regulation:** several wind farms aggregated to provide **secondary frequency regulation**.
- **Reactive power regulation:** several wind farms aggregated to provide **voltage regulation**.
- **Expected impact:**
 - Preserving **stability and security of the energy transmission system**
 - Higher **controllability of the wind energy**
 - Deeper **penetration of wind power** into the Transmission Network.

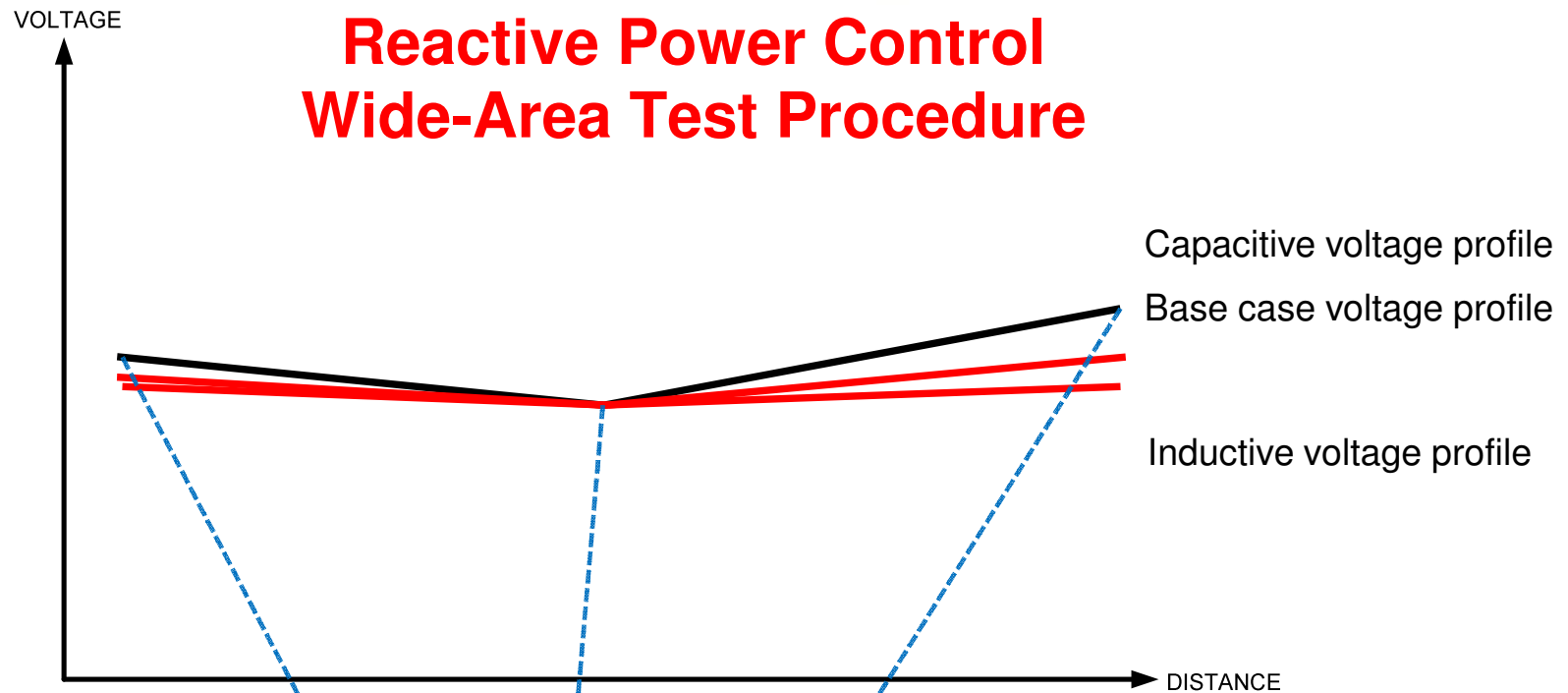
480 MW
2 control centers:
CORE & CECRE



Active Power Control – Test Procedure



Reactive Power Control Wide-Area Test Procedure



DEMO 2 DERINT (Leader: DONG)

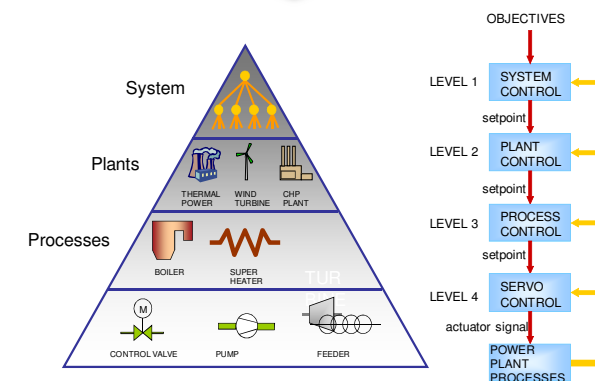
Main objective

- Improve wind integration based on **intelligent energy management of central CHPs, off-shore wind, and local generation and load units in the distribution grid**

Approach

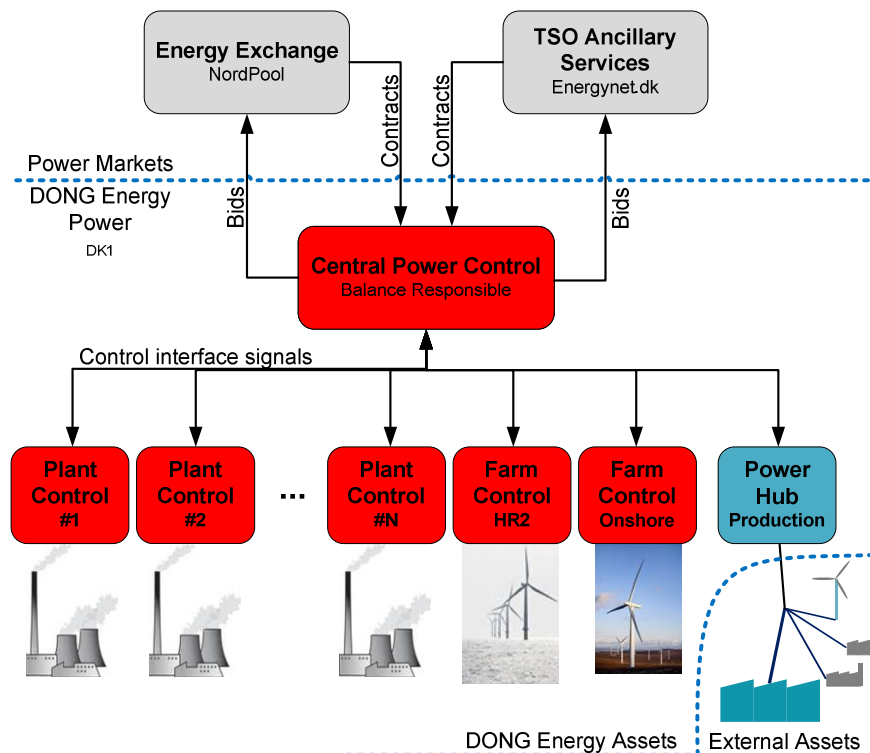
- Mobilization of the **entire value chain** across central and local units
- Focus is on shorter time scale with the goal to **balance wind better** i.e. for a longer time and more cost efficiently
- **Market** shaping, **regulatory** recommendations and **scale up** rules
- 3 year iterative roll-out, growing in scale and complexity

Portfolio optimization
of market positions
across energy and AS
markets



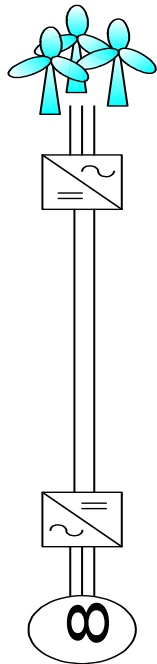
Integrating the VPP
with central power
control

Defining the role of a virtual power plant



- The virtual power plant is intended to produce services similar to a traditional power plant, but based on DER's (decentralized energy resources)
- In the Danish setting the Production VPP is controlled by the central power control
- In the Danish setting the VPP's services is offered to a market (based on frequent auctions)
- The VPP controls the DER's under full respect for the DER's primary purpose
- Each DER serves multiple purposes in the VPP

DEMO 3 DC GRID: Steps to reach the offshore grid



Kriegers Flak source



Airtricity source

DEMO 3 DC GRID (Leader: RTE)

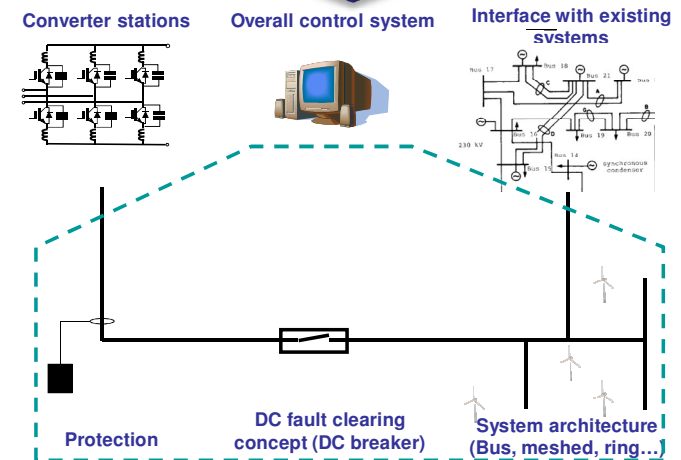
Main objective

- Assess main drivers for the development of off-shore HVDC networks

Approach

- Optimal planning and operation of AC/DC interconnected power systems
- Local control of HVDC networks
- Operation under normal and emergency conditions
- Design and quantify experimental DC networks (N-1, faults)
- Design and test control functions, protection systems...
- Benchmark several network topologies

Knowledge and components for connecting offshore resources: multi-terminal DC networks and interaction with on-shore AC system



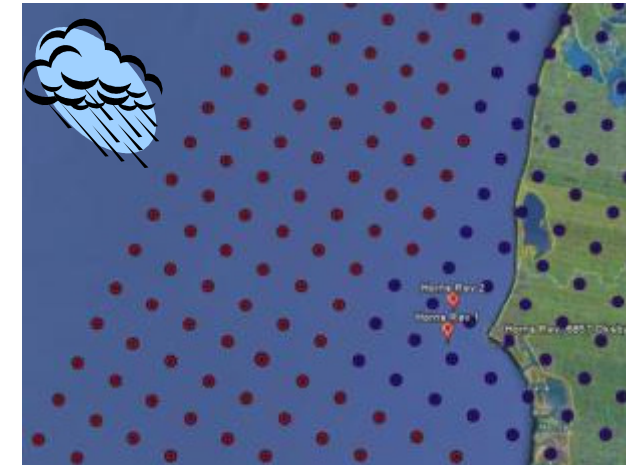
DEMO 4 STORM MANAGEMENT (Leader: ENERGINET)

Main objective

- Demonstrate shut down of wind farms under stormy conditions without jeopardizing safety of the system

Approach

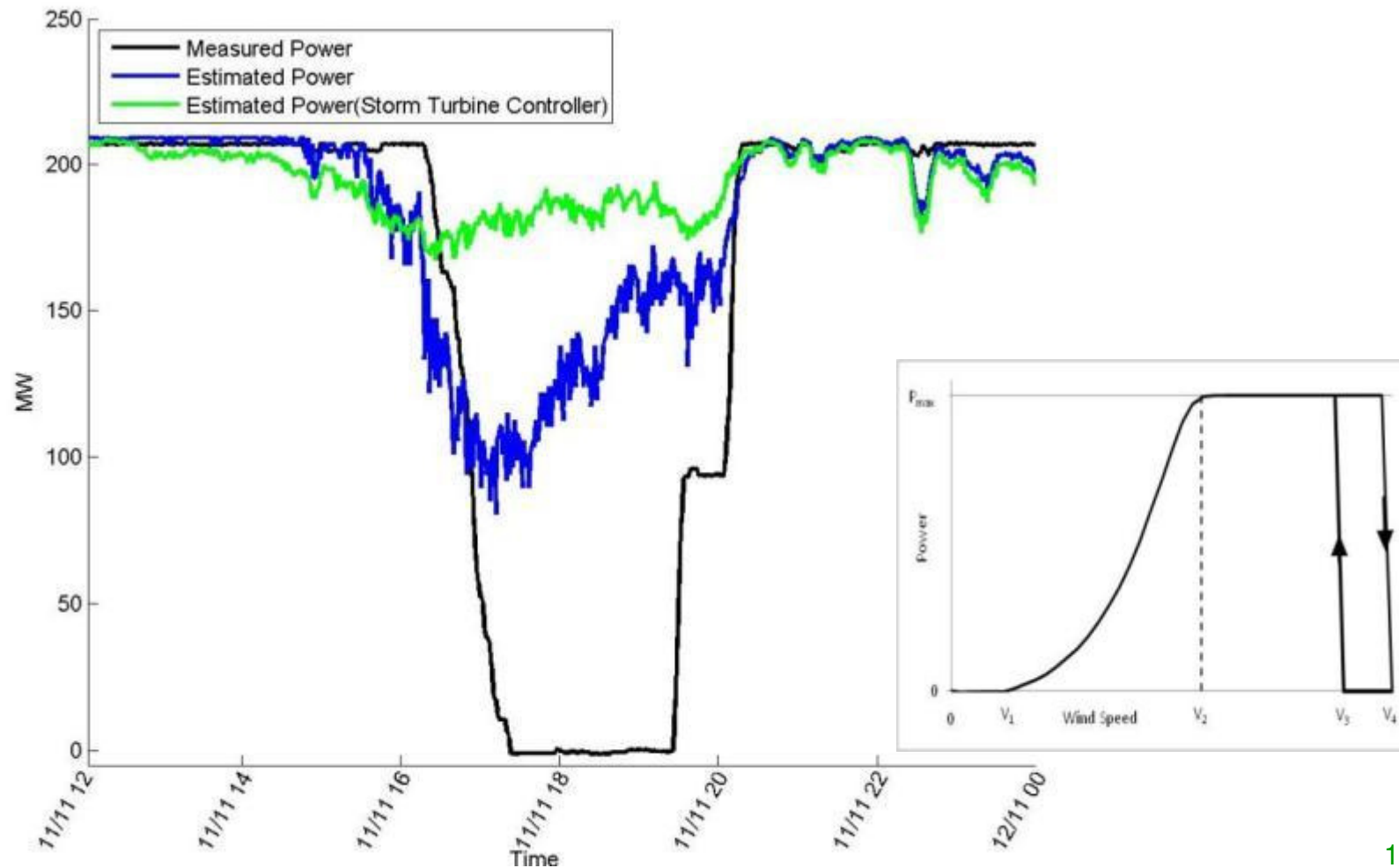
- Horns Rev 2 (200MW)
- Flexible turbine control
- Storm front forecasts
- Investigate cost of changed production associated with the planned down regulation
- Coordinate wind farm control with HVDC interconnector control and with hydro power plant operation



Wind power

Water power

Wind power



DEMO 5 NETFLEX (Leader: ELIA)

Main objective

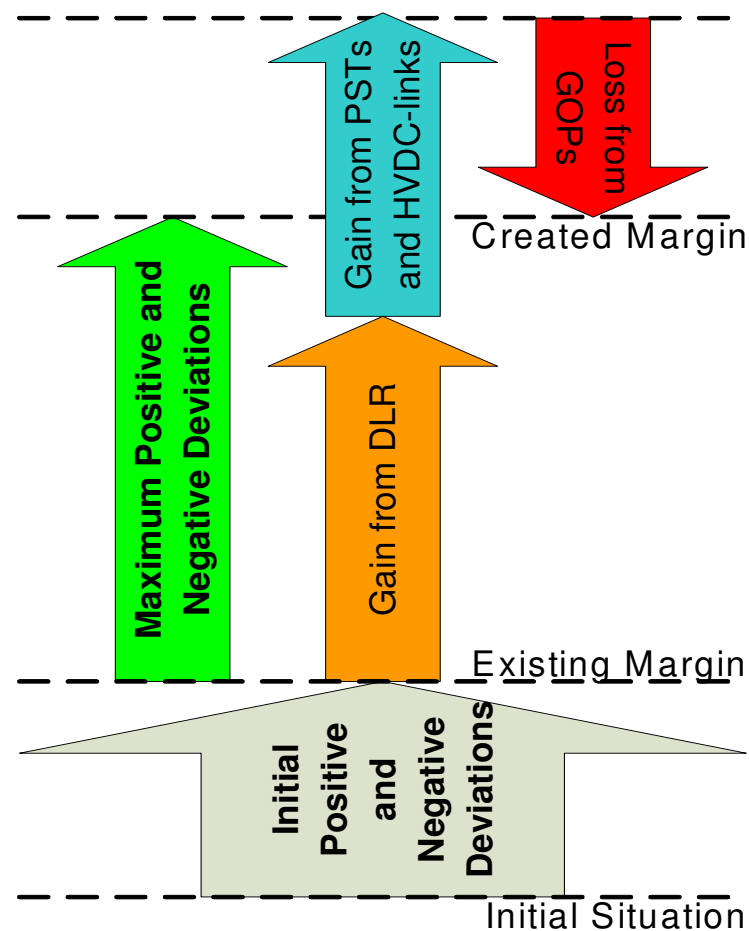
- Demonstrate at regional level (CWE) how much **additional wind generation** can be handled thanks to **DLR** (Dynamic Line Ratings), **coordination of controllable devices** (PSTs & HVDCs) and usage of **WAMS**

Approach

- **Dynamic Line Rating (DLR)**
 - Install 10 Ampacimons to monitor the line capacities
 - Forecasting Model
- **Wide Area Measurement System (WAMS)**
 - 3 Phase Measurement Units (PMUs) to assess good operating practices
- **Smart Power Flow Control (Smart-PFC)**
 - Coordinated use of PSTs and HVDCs on international basis using smart tools
 - Assess available margin for additional wind generation



Expanding network margin



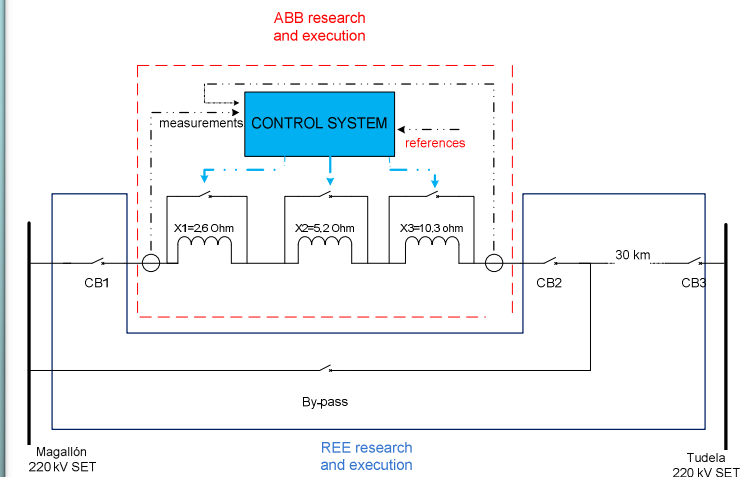
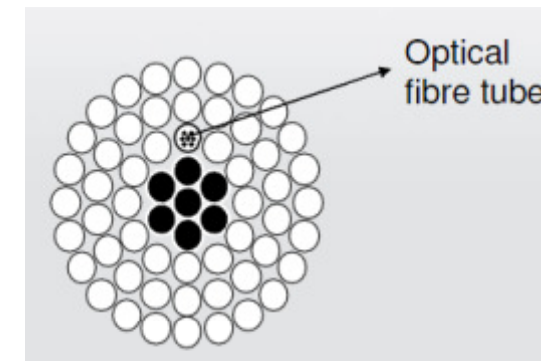
DEMO 6 FLEXGRID (Leader: REE)

Main objective

- Demonstrating that current transmission network can meet demands of renewable energy by **extending system operational limits**, maintaining safety criteria.

Approach

- **Real-time thermal rating**
 - Benchmarking of different commercial devices
 - Analysis on wind power generation and correlation with monitored lines
- **Innovative FACTS (mobility)**
 - Selection of the location of the FACTS
 - Specification, construction and installation of the prototype.



Monitoring System: Optical Phase Conductor

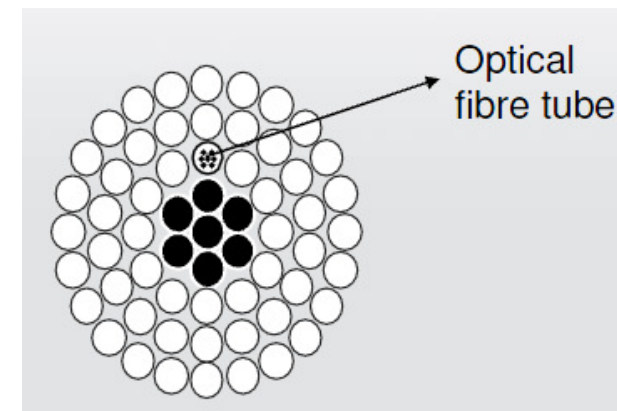
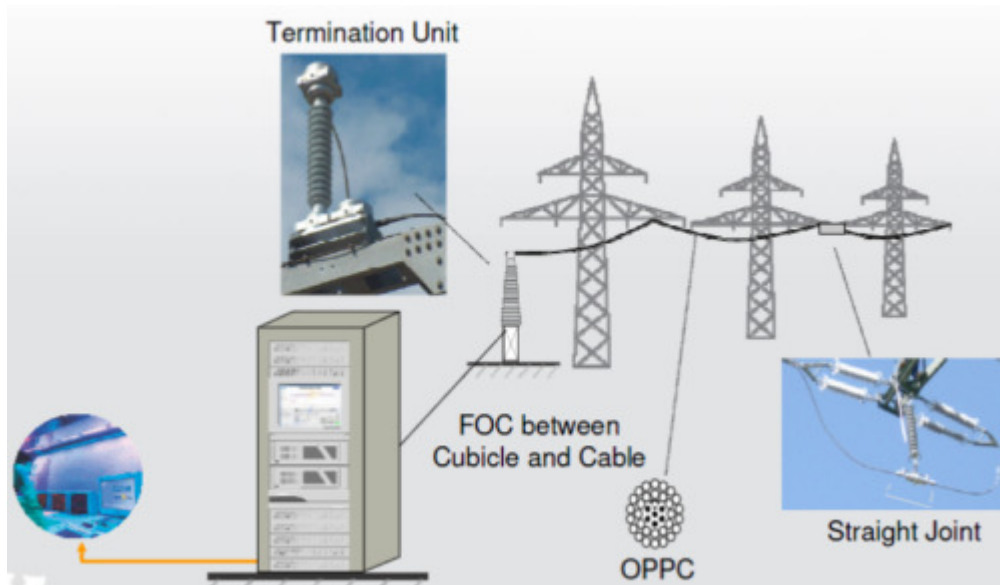
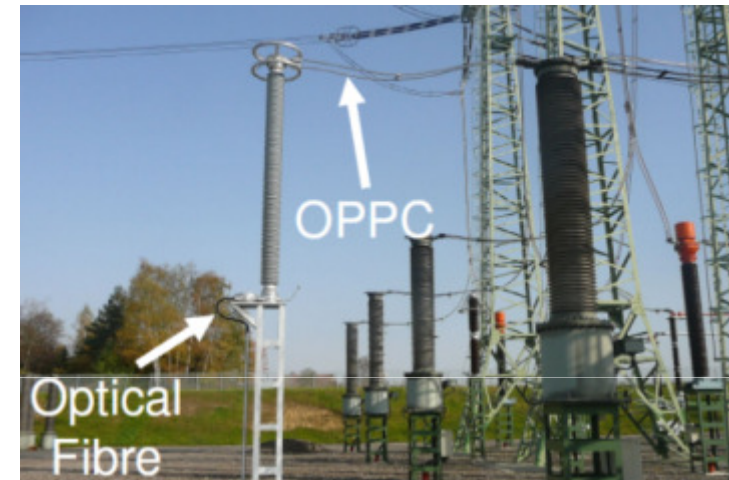
Calculation each 5 minutes.

Monitorization 4 to 12 FO (optical switch)

Temperature accuracy: Between 1 y 3 °C.

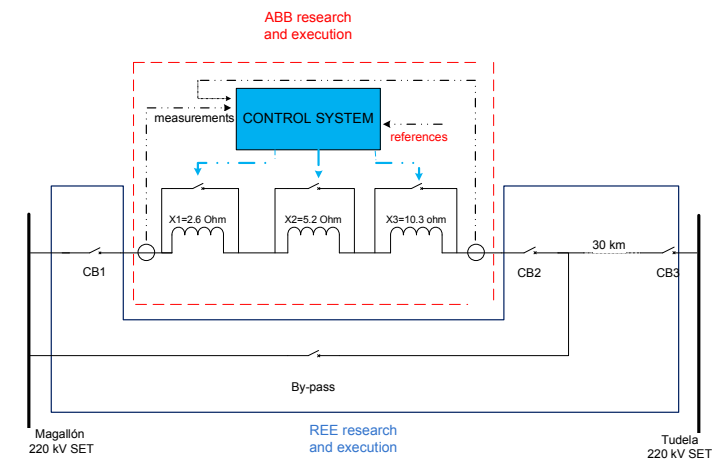
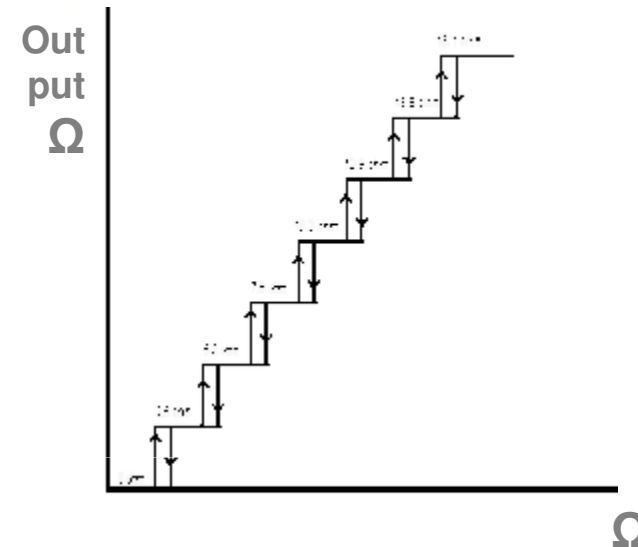
Location of hot point accuracy: 10 m.

Technology maximum 100km



TWENTIES OLC basic outline

N OPERATION	N/N-1 OPERATION	TRANSIENT OPERATION
Phase Shifter Transformer (PST)		
Overload Power Flow Controller (OLC)		
Thyristor Switched Series Capacitors (TSSC)		



Replication work packages: barriers and up scaling

WP 15: Economic impacts of the demonstrations, barriers towards scaling up and solutions (Leader: IIT)

- Assess the local **economic and/or technological impact** of each demo.
- Identify the **barriers to scale-up** the outcomes at a member-state or regional level, and propose **solutions** to overcome these barriers.

WP 16: EU wide integrating assessment of demonstration replication potential (Leader: RISOE)

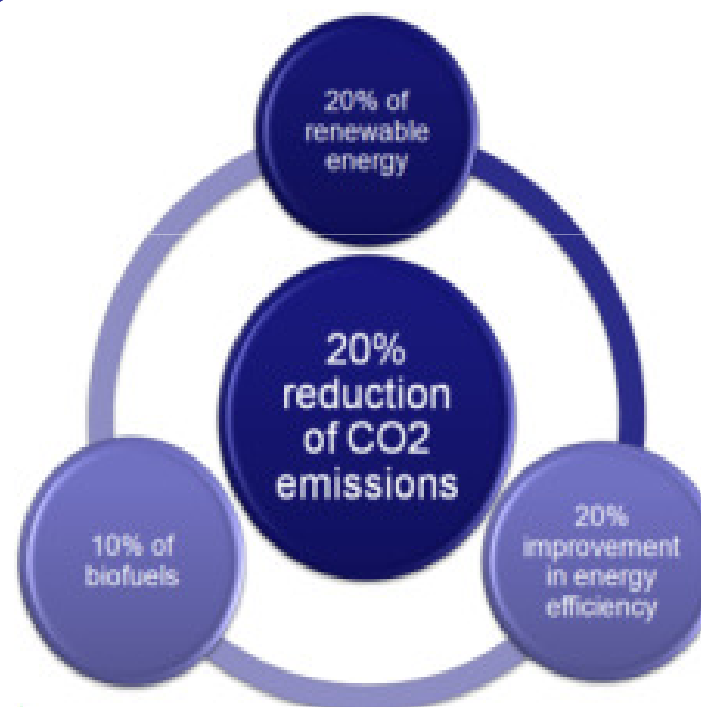
- Assess **portability** of voltage control, frequency control and VPP model **to other countries and regions**.
- Evaluate North European 2020 **offshore wind power variability, hydro potential and barriers** and **grid restriction** studies.
- Pan European economic impact study.

WP 17: EU Offshore barriers (Leader: TENNET)

- Address the issues of **smart licensing of submarine interconnectors** with and without wind parks in the North Sea and Baltic Sea.
- Identify **common licensing barriers** and propose regulatory measures.

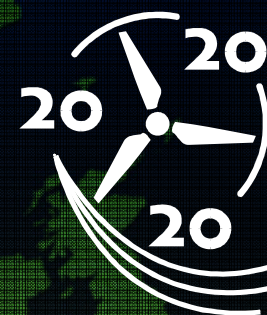
Conclusions

**With TWENTIES:
YES, WE CAN**



THANKS FOR YOUR ATTENTION





Transmitting wind



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www.twenties-project.eu