Smart Grids: anticipated trends and policy directions

JRC
-
SMART
ELECTRICITY
SYSTEMS

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Energy Security

Issue

Assessing the energy systems and prioritising challenges and risks to Europe's energy supply.

JRC Work

Development of databases and methodologies to identify hazards and to evaluate potential impacts on the European energy system.

Development of laboratory on smart energy systems.

Impact

Support DG ENER on electricity, gas and oil related policies.

Joint Research Centre

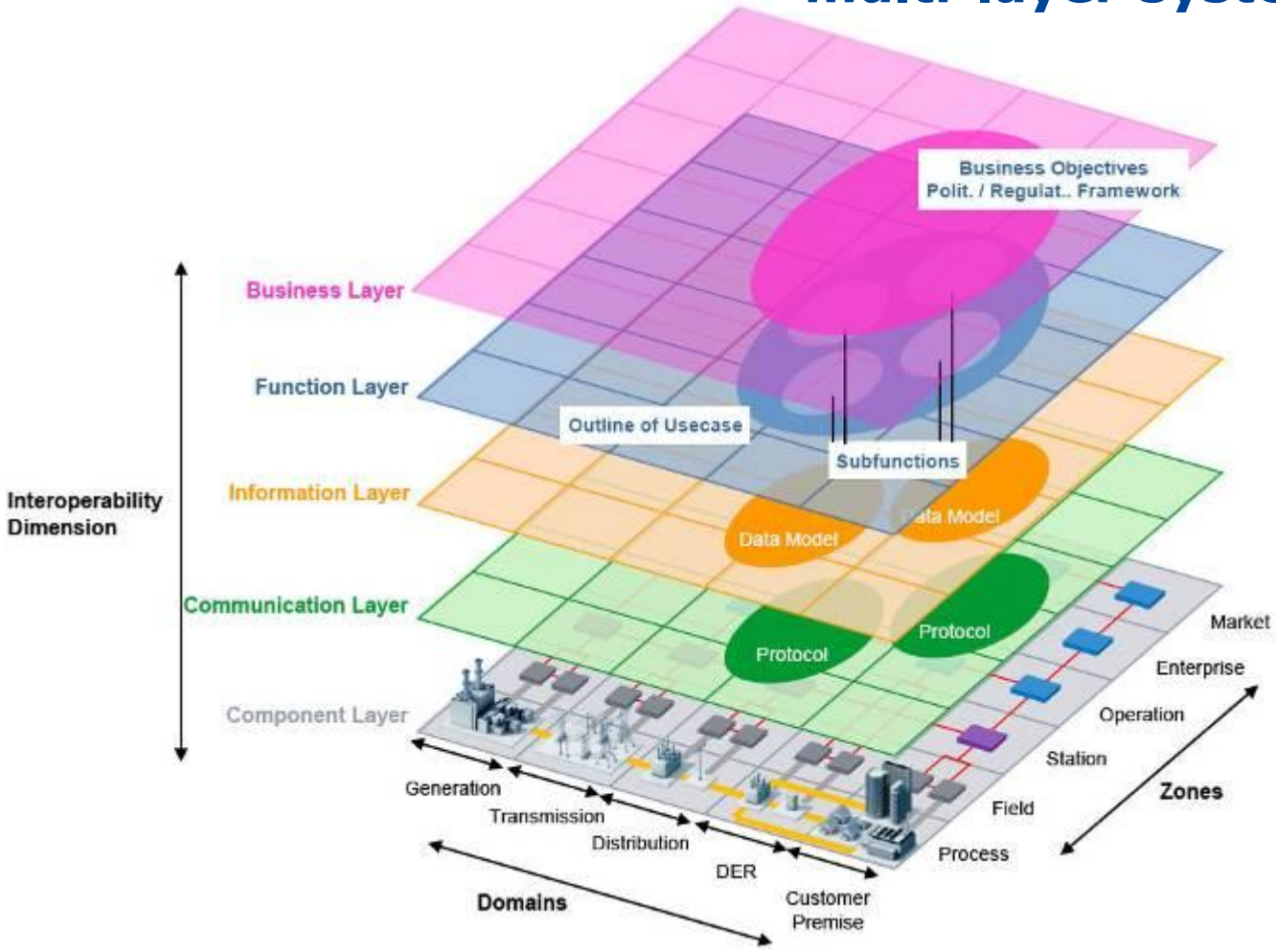
European Commission

Smart grid: possible future

Research Centre

European Commission

Smart grid: multi-actor, multi-layer system



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Source: EC Smart Grid Standardisation Reference Group

Our core activities

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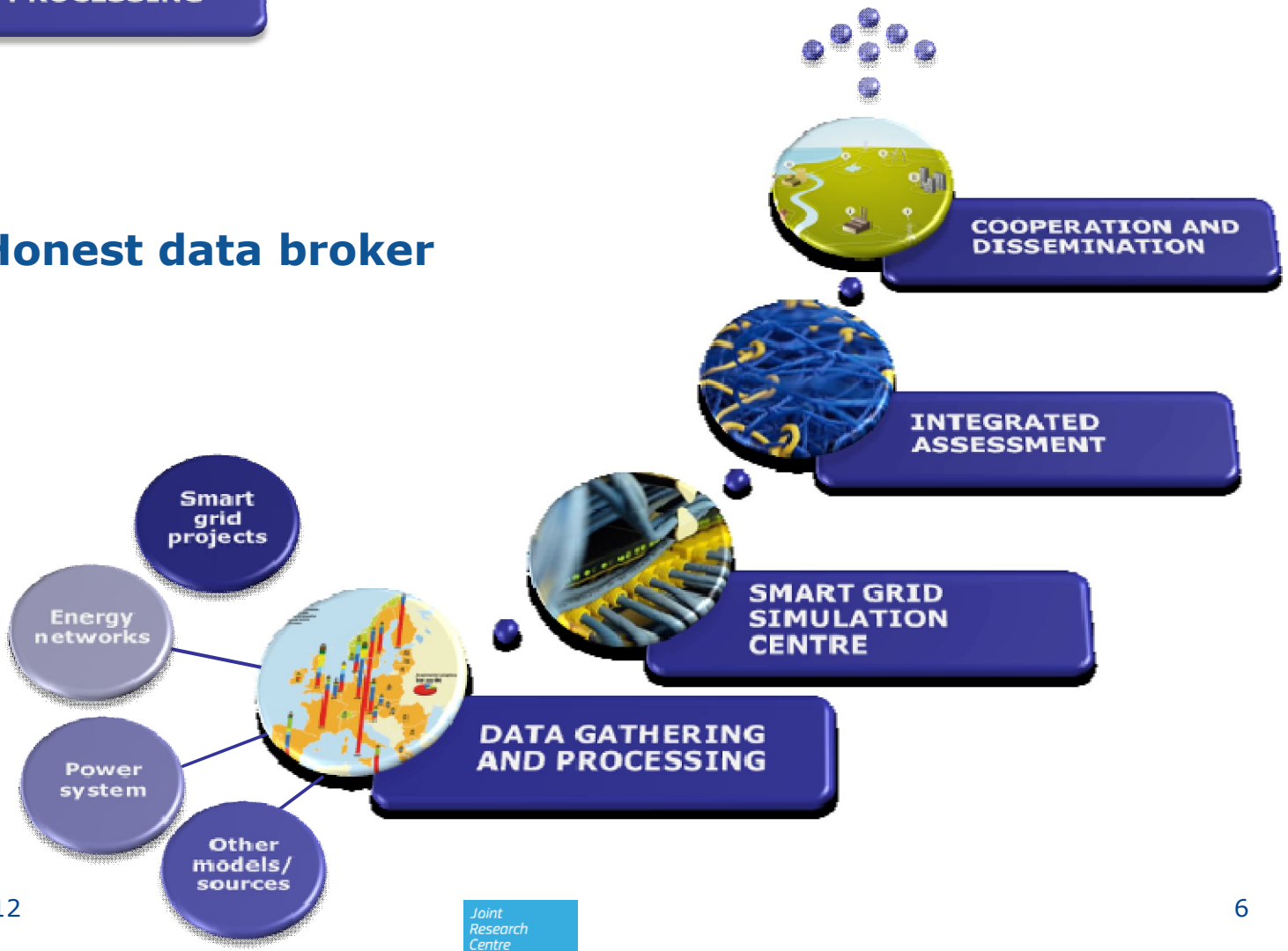
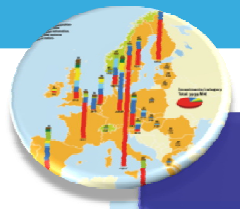
SMART ELECTRICITY SYSTEMS

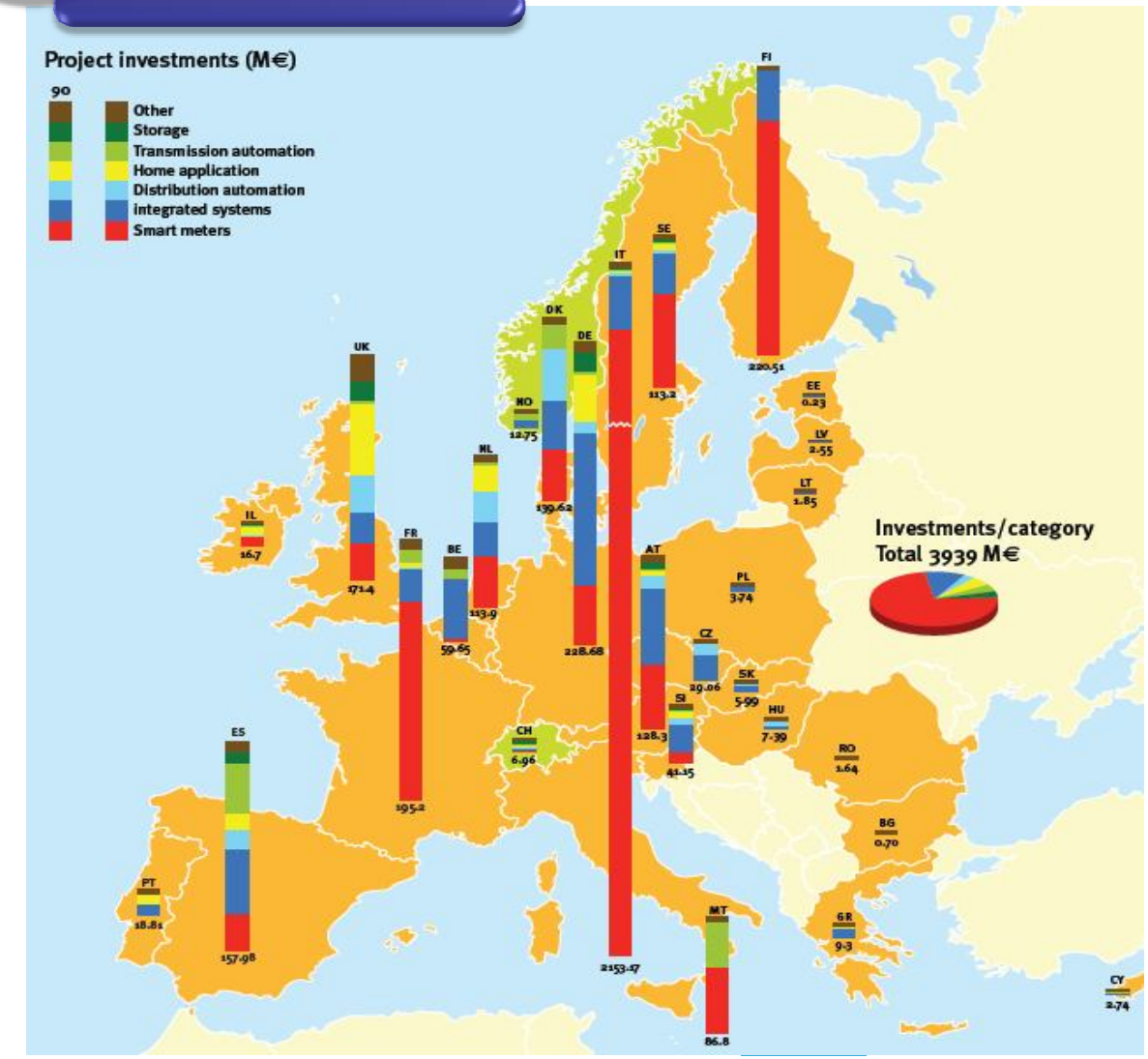
- **Honest data broker**



Smart grid inventory



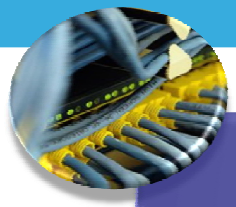
DATA GATHERING AND PROCESSING



- Uneven distribution of investments across Europe. Most of investments in EU-15 Countries
- Over **5 billion EUR investments**, but still at the beginning of the Smart Grid transition

Projects can span over more than country and can include more than one category. The picture does not include the Smart Meter Roll-out in Sweden, spanning approx. 150 projects and amounting to approx.1500 M€, as a detailed description of the projects was not received.

Functions and capabilities



SMART GRID SIMULATION CENTRE

OFFLINE POWER SYSTEM SIMULATION

REAL TIME SIMULATION AND COMPONENT TESTING

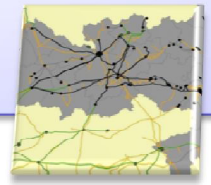
INTEROPERABILITY AND COMMUNICATIONS

SIMULATION

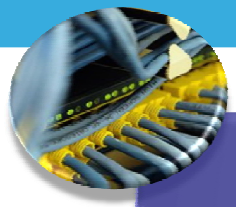
EVALUATION

MOBILE LAB AND FIELD TESTING

VISUALISATION



VISUALISATION AND INTERACTION

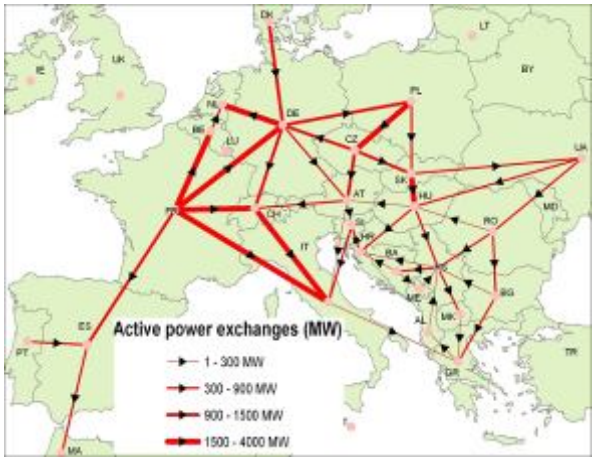


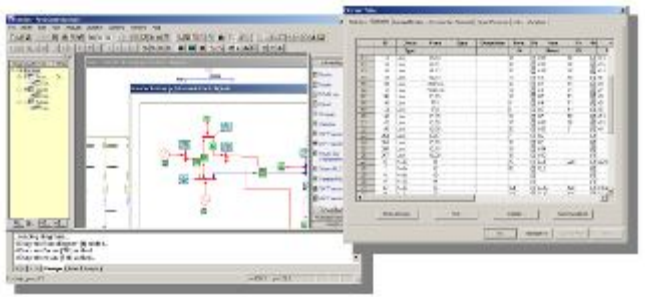
SMART GRID SIMULATION CENTRE

European Commission

The JRC's European power grid model

- **European-wide electricity grid** model
  - *data from the European Transmission System Operators, complemented by datasets from the European power system*
  - *more than **10,000 elements** (nodes and lines)*
  - *analyses of the European transmission network via advanced power simulation platforms*
- Links with **TIMES** (**techno-economic** modelling)





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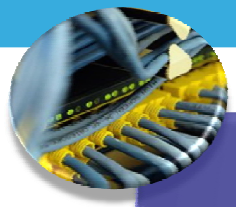
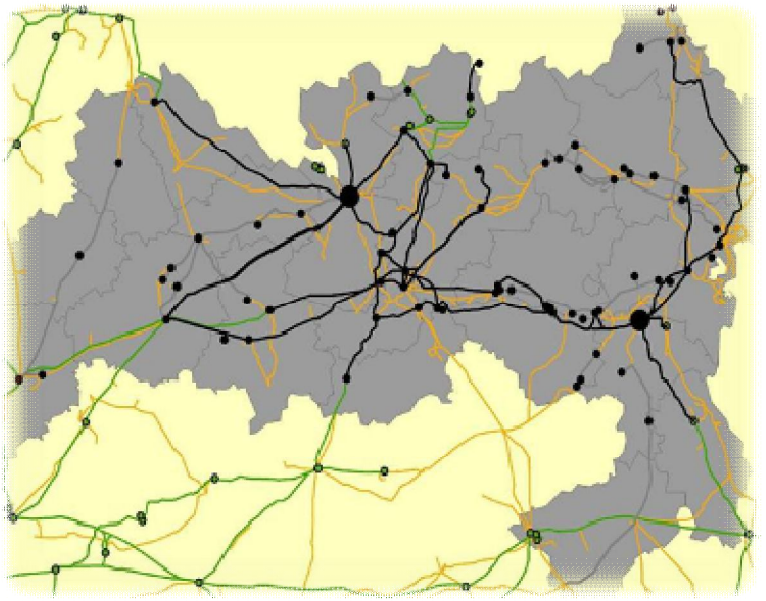


European Commission

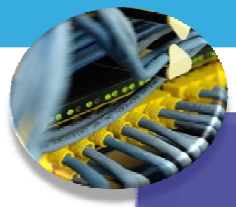
Critical energy infrastructure

- Identification of '**European critical infrastructure**' (whose disruption has a significant impact on at least 2 Member States)

- **Web-based** application for the **visualisation** of Europe-wide electricity systems and for the assessment of energy network criticality and vulnerability



Joint Research Centre



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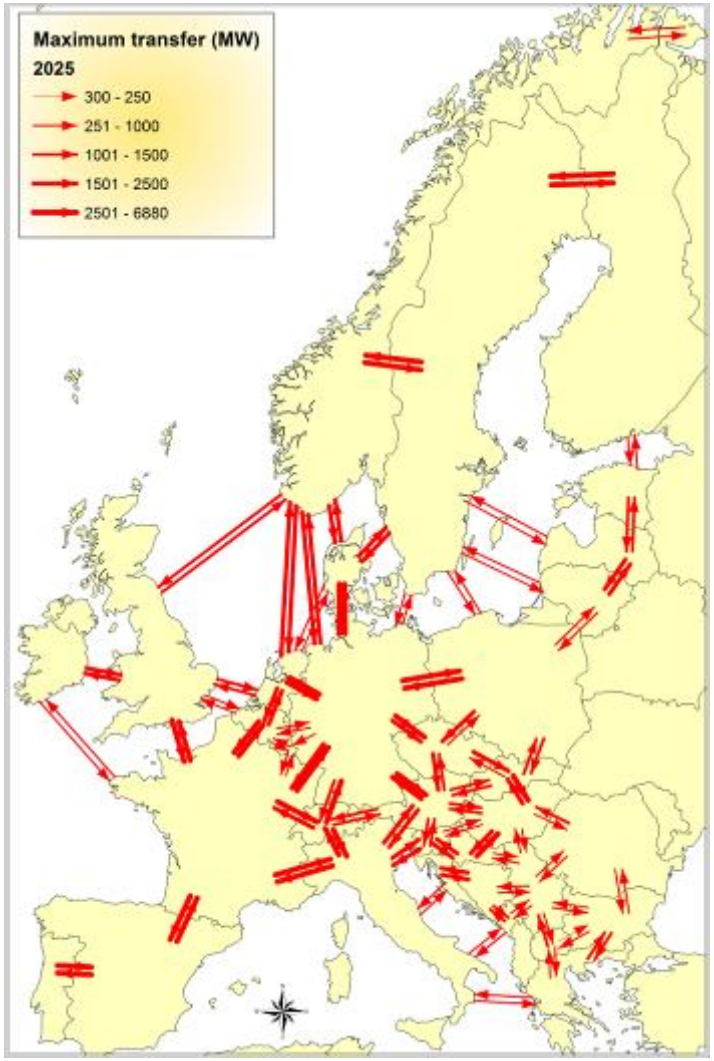
European Commission

Renewables integration in Europe/Mediterranean

- The **EUPowerDispatch** model analyses the impacts of variable renewable energy increase on the European cross-border transmission capacity needs
  - Minimum Cost Flow Problem (MCFP) taking into account generation and transmission constraints
- The model minimises the annual electricity variable production costs in the interconnected European system



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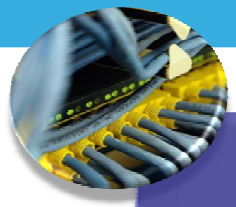
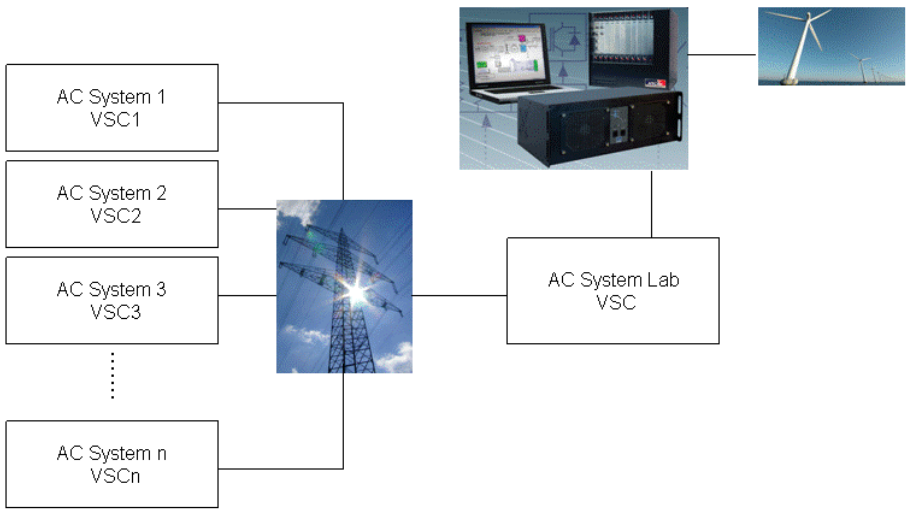


SMART GRID SIMULATION CENTRE

European Commission

Multi-terminal grid for offshore wind

- Assessment of **multi-terminal DC (MTDC) grids** to integrate large scale **offshore wind power** in the North Sea (in cooperation with **ECN** and **TU Delft)**
- Set-up and testing of a stand-alone configuration with three small-scale **Voltage Source Converters (VSCs)**
- Real-time digital simulator interconnection with the VSC-based multi-terminal DC grid for testing and validation of different models and control strategies



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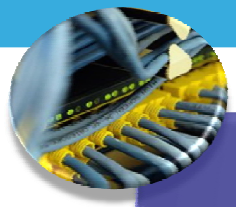

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Storage/interoperability

- **Ambitious purchase list of coordinated equipment**
  - Storage sources, load/generation sources, strengthened real time simulation capabilities
- **Smaller scale integrated storage/PV system purchase under way (50 kW/25 kWh)**
- **Large scale storage purchase**
  - Technical specifications under preparation, modular installation (up to 1 MW / 10 MWh)
  - Peak shaving large scale demo
  - Back-up/supply function for battery/component testing lab

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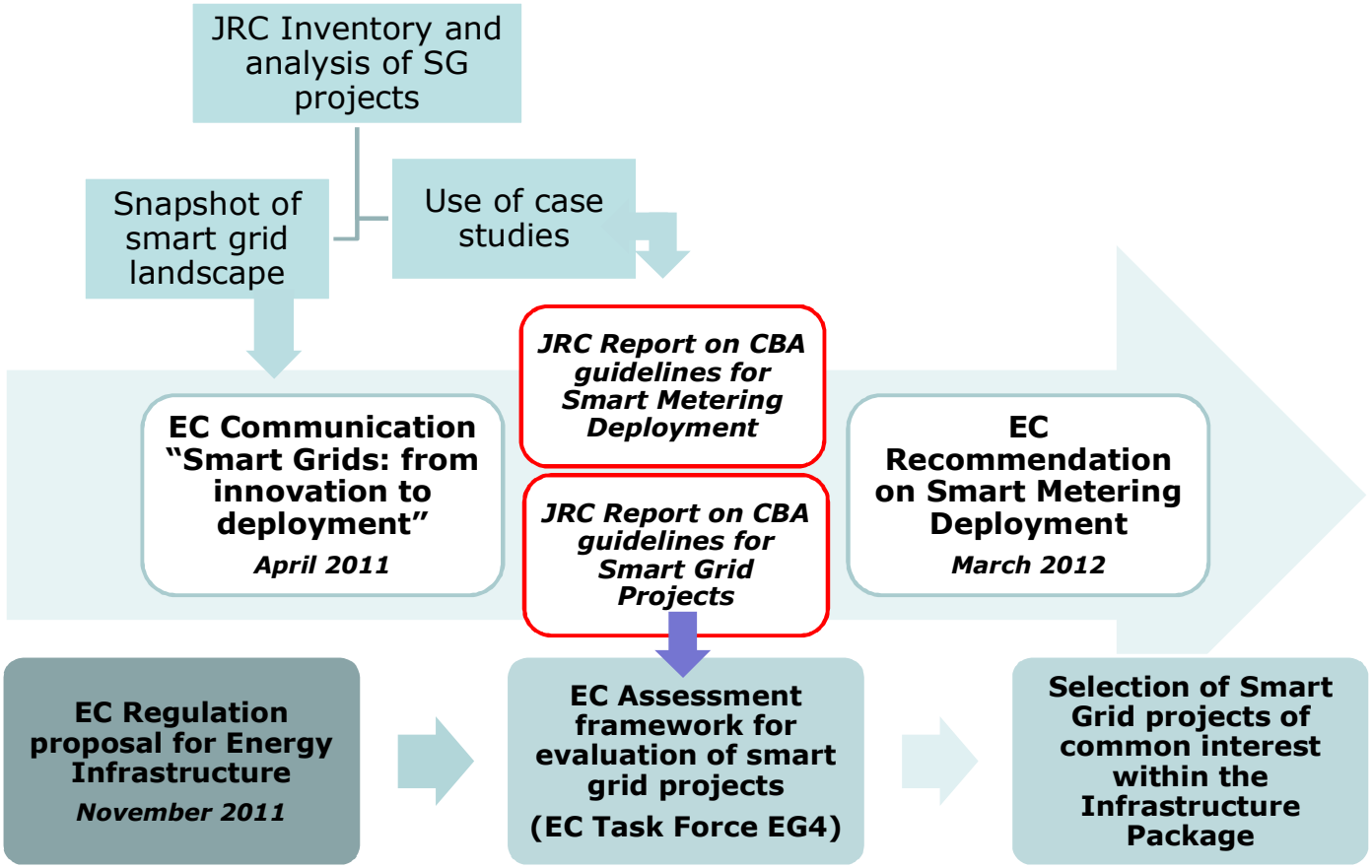
Smart grids policies

- Contribution to Communication COM(2011) 202 "Smart Grids: from innovation to deployment"
  - leading the first Europe-wide analysis exercise on smart grid real life experiences
  - producing a unique interactive mapping tool with all the collected smart grid projects
- Reference Report "Smart grid projects in Europe: lessons learned and policy developments"

Smart grids policies

INTEGRATED ASSESSMENT



INTEGRATED ASSESSMENT

European Commission

Cost-Benefit Analysis for smart meters/grids

- Assessment framework to provide guidance for conducting cost benefit analyses of **Smart Grid (**and **smart metering)** projects.
  - based on **EPRI** (Electric Power Research Institute)'s work and on collaboration between EC and US (DoE) in the **EU-US Energy Council**
  - Contribution to Recommendation 2012/148/EU "roll-out of smart metering systems"
- A European Smart Grid project from the JRC inventory (**InovGrid**, led by EDP) used to fine-tune and illustrate the framework

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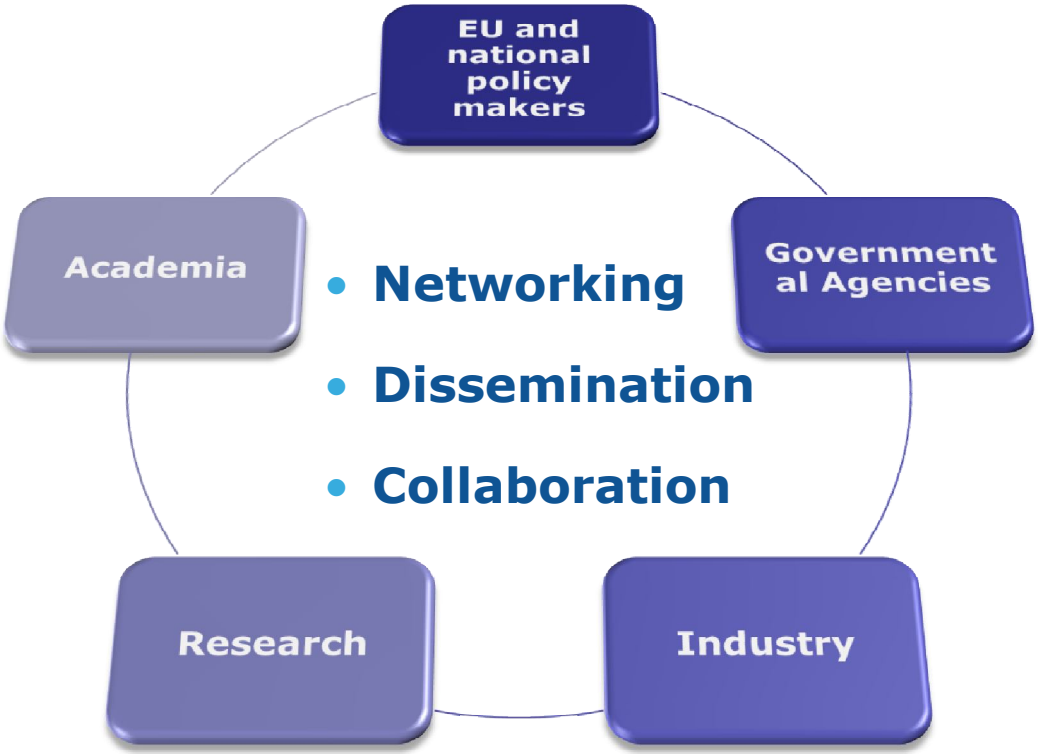
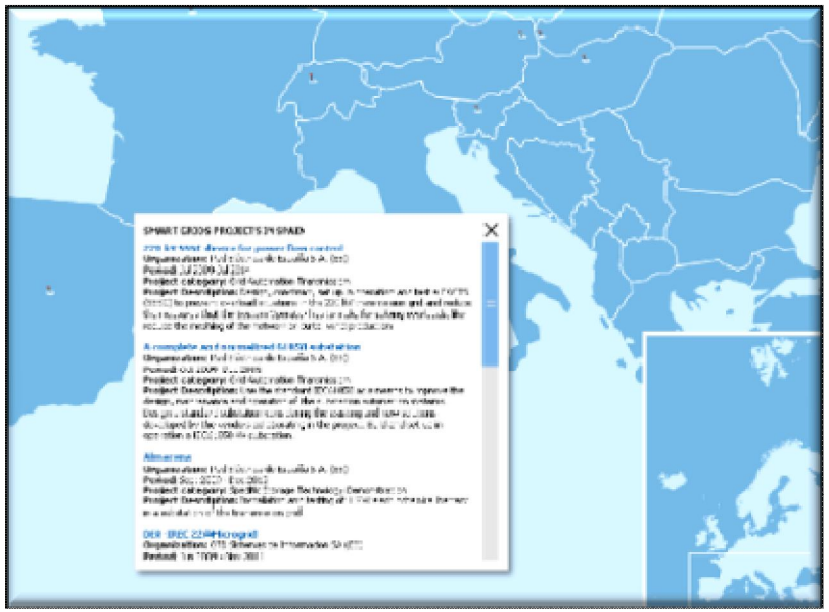
COOPERATION AND DISSEMINATION



COOPERATION AND DISSEMINATION

European Commission

http://www.smartgridsprojects.eu/



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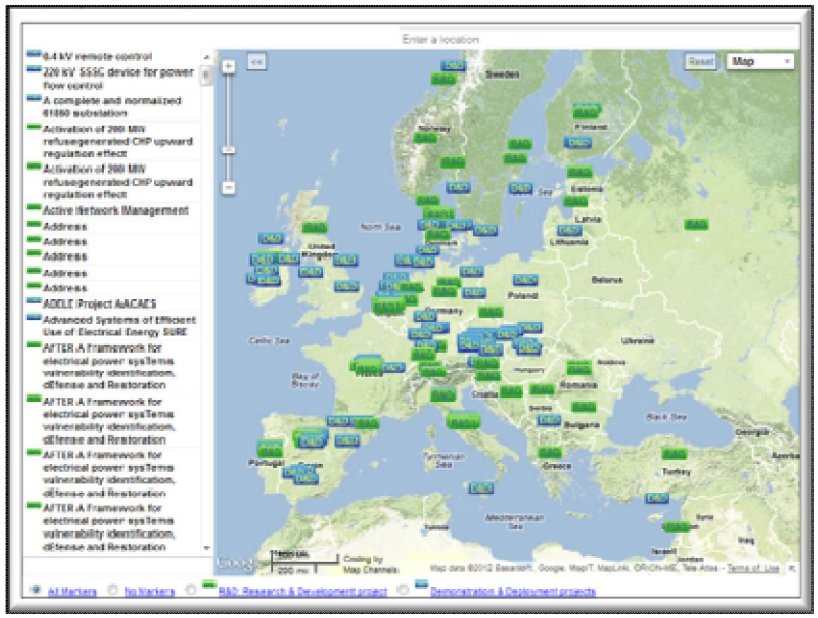

JRC-EURELECTRIC Smart Grids Knowledge Sharing Platform

JRC Smart Grids Mapping Tool

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Smart Electricity Systems

http://ses.jrc.ec.europa.eu/

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Thank you for your attention

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