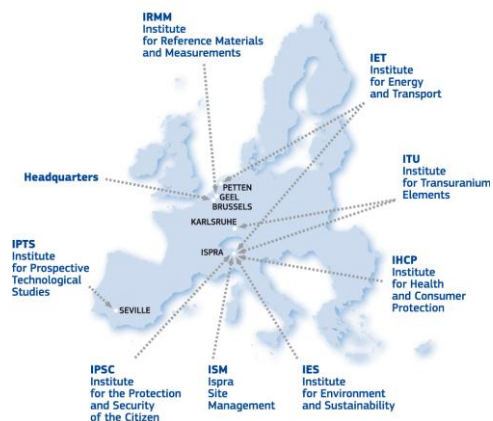


# Joint Research Centre

The European Commission's in-house scientific service



JRC Sites

Serving society  
Stimulating innovation  
Supporting legislation

[www.jrc.ec.europa.eu](http://www.jrc.ec.europa.eu)

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

European Commission  
Joint Research Centre (JRC)  
*Institute for Energy and Transport (IET)*  
*Smart Electricity Systems and Interoperability*

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## SESI in a nutshell

Smart Electricity Systems and Interoperability



## WHAT IS AT STAKE

The European power grid, one of the largest and most complex systems in the world, is undergoing challenging technological, social and regulatory modifications. Meeting the EU's climate change and energy policy objectives for 2020 and beyond requires a major transformation of our electricity infrastructure. Upgrading and reshaping the existing networks is of paramount importance to foster sustainability, increase energy efficiency, enhance grid security and attain the internal energy market objectives. Many countries - in Europe and worldwide - are thus promoting super and smarter grid concepts for the integration in the power system of new actors and technologies such as renewable energies, distributed generation, storage devices and electric vehicles. The pervasive deployment of Information and Communication Technology (ICT) for upgraded monitoring, control, and protection functionalities is a key prerequisite and enabler for these changes to happen. The move towards renewed and redesigned power grids shall be carefully monitored and studied system-wise and technology-wise.

## WHAT WE DO

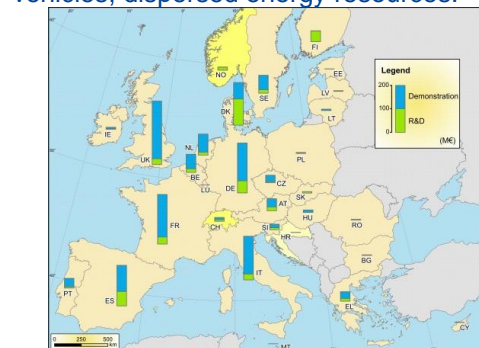
We, as European Commission's in-house science service, perform independent scientific research and support EU policy-making on transformations towards smarter and interoperable electricity systems.

**Our work revolves around four pillars:**

### • **Data Gathering and Processing** -

We constantly develop, update our extensive databases of power systems/networks and smart grid projects in Europe. This work feeds into our modelling, experimental and dissemination activities as explained below.

• **Smart Grid Simulation Centre** - Our Centre analyses behaviours and characteristics of evolving power grids incorporating more renewables, electric vehicles, dispersed energy resources.



• **Integrated Assessment** - Our aim is to support policy initiative and study smart grids as complex techno-socio-economic systems with multiple physical, cyber, social, policy, and decision making layers.

• **Cooperation and Dissemination** - We work with selected stakeholders on different projects/networks and we deploy tailored communication initiatives/tools to get our message across.

## SOME OF OUR ACHIEVEMENTS AND PLANS

• **The Europe-wide smart grids inventory.** Intelligent electricity networks – Smart Grids – are a key component in the EU energy strategy. In the last few years, Smart Grid projects have been growing in number, size and scope throughout Europe. Where are they taking place? What are they dealing with? Who is leading them? What progress have we made? To answer some of these questions, in 2011 the JRC launched the



first comprehensive inventory of Smart Grid projects in Europe. The response was overwhelmingly positive: we heard back from over 200 Smart Grid projects scattered across Europe. Project results provide an encouraging indication of how Smart Grids can help integrate more renewables, accommodate electric vehicles, give more control to consumers over their energy consumption, avoid blackouts and restore power quickly when outages occur.

• **European-wide electricity grid model.** We built the model starting from data from the European Transmission System Operators, which was complemented by other datasets from the European power system.

The power grid model includes more than 10,000 elements (nodes and lines) of Europe's transmission grid and can be used to run static and dynamic analyses of the European transmission network via advanced power simulation platforms.

• **Cost-benefit analysis of smart grids.** We have defined a comprehensive assessment framework of Smart Grid projects centred on a cost-benefit analysis (CBA). A European Smart Grid project (InovGrid) has been used as a case study to fine-tune and illustrate the proposed assessment framework. To the best of our knowledge, this is the first study to actually test a CBA on a real project. This work draws on a methodology proposed by EPRI (Electric Power Research Institute) and on the existing collaboration between the EC and the US Department of Energy (DoE) in the framework of the EU-US Energy Council.

• **Smart grid interoperability testing and real time simulation.** We developed laboratories equipped with power components (cables, batteries, electric vehicles,...), Information and Communication Technology (ICT) systems and advanced power system real-time simulators, to study the behaviour of emerging electricity systems in high power applications and perform integration tests with physical Hardware-in-the-Loop (HIL) simulation. The experimental set-ups are being used, among other things, to perform interoperability and integration studies on complex power transmission and distribution grids including renewables (onshore/offshore wind, solar power,...), electric vehicles, and storage systems.

• **Interactive tools and maps.** We develop several interactive tools to explain the public the challenges and merits of smart grids deployment and to make the results of our research available in an intuitive way.