Presentation of the European Electricity Grid Initiative

Contractors Meeting
Brussels 25th September 2009
Outline

- Electricity Network Scenario
- European Electricity Grids Initiative
- DSOs Smart Grids Model
- DSOs Demonstration and Research Projects
- Budget and integration with other EIIs
- Conclusions and next steps
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Electricity Network Scenario and New Challenges

**External drivers**
- 20-20-20 EU Goals
- Electricity consumption growth
- Replacement of ageing infrastructures
- Large increase of unpredictable renewable sources
- Extension of market liberalization process
- Security of supply
- The Third Energy Package

**Internal drivers**
- Reduce the total costs of the power system
- Integrate low-carbon generation sources
- Support energy efficient demand side technologies
- Enable the active participation of customers to the energy market
- Enable new technologies e.g. electrification of the transport sector
- Develop a flexible network to the future scenarios

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European Electricity Grid Initiative
Objectives

Give a concrete contribution to the definition of the EII on Electricity Grids by:

- defining a **framework** of a common research and demonstration program to foster the development of smart grids.
- identifying the medium and long term **investments** necessary for the **development of a European integrated Smart Grids infrastructure**
- highlighting shared **action plans** covering the main steps of this development.
Eurpoean Electricity Grid Initative
Founding members

7 TSOs
- amprion
- Red Eléctrica de España
- RTE
- Tennet
- transpower
- Vattenfall

7 DSOs
- Enel
- CEZ
- ERDF
- Iberdrola
- RWE
- e-on
- Vattenfall

* MUC = Multi Utility Communication
* ICT = Information and Communication Technology

Smarter and stronger grids
Transmission and Distribution of Electricity

Production
Virtual Power Plant
Transit
Storage
Consumption
e-Mobility
Trading
SmartHome
Metering
Market Places
European Electricity Grid Initiative
The RD&D Program

The TSOs and DSOs have prepared a joint Research, Development and Demonstration program that addresses:

- **Technology** to make networks smarter and stronger
- **Market design** to allow integration of DER, active demand and active participation of customers.
- **Organization and data exchange** at pan-European level to maintain reliability at affordable cost
- **Regulation** to further optimize European electricity customer welfare

The EEGI document represents a framework for the EII on Electricity grids
European Electricity Grid Initiative
Smart Grids Vision

**BY 2020:**

**TSOs and DSOs should:**
- Host any innovative electricity generation or consumption model that increases efficiency
- Handle emergency situations minimizing drawbacks for consumers

**50% of DSO network in Europe should:**
- Enable the seamless integration of new intermittent renewable energy sources
- Operate network infrastructures based on a thorough understanding of demand
- Provide power and information to make customers 'smarter'

**All TSOs should:**
- Coordinate planning and operations of the pan-European Network with tool boxes delivered through ENTSO-E
- Integrate both renewable energy sources and active demand with the help of full scale validated power technologies
- Study and propose new market rules that maximize European welfare

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*BY 2020:*

- Coordinate planning and operations of the pan-European Network with tool boxes delivered through ENTSO-E
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Smart Grids Model

**Level 5: Smart Customers**
Customers aware and actively participating

**Level 4: Smart Energy Management**
Management of end-use energy efficiency, aggregation, retail

**Level 3: Smart Integration**
Renewable energy, DG, electric vehicles, electricity storage and aggregation

**Level 2: Smart network and processes**
More automated MV distribution networks with self healing capabilities.
Monitored and controlled LV networks
IT supported monitoring process

**Level 1: Smart Pan-European Transmission network**
Innovative transmission grid architectures
State-of-the-art transmission/power technologies
Novel monitoring, control and storage methodologies
Shared electricity market simulators

**Level 0: New generation technologies**
DSOs Functional Demonstration Projects

**DSOs SMART GRIDS MODEL**

**Level 5: Smart Customers**
Customers aware and actively participating

**Level 4: Smart Energy Management**
Management of end-use energy efficiency, aggregation, retail

**Level 3: Smart Integration**
Renewable energy, DG, electric vehicles, electricity storage and aggregation

**Level 2: Smart Distribution network**
More automated MV distribution networks with self healing capabilities. Monitored and controlled LV networks ICT supported processes

**Functional demonstrators**

1. Active Demand Response
2. Energy Efficiency from integration with Smart Homes
3. Metering infrastructure
4. Smart metering data processing
5. DSO integration of small DER
6. System integration of medium DER
7. Integration of storage in network mgmt
8. Infrastructure to host EV/PHEV
9. Monitoring and control of LV network
10. Automation and control of MV network
11. Methods and system support
12. Integrated communication solutions
The expected benefits from the DSO program

1. **Improved peak consumption management**

2. **More efficient use of energy** and further **reduction of carbon emissions** from the electricity industry.

3. **Pave the way to the advent of electric vehicles**

4. **Start reducing the future investment and operational costs of the EU electricity distribution grids**

5. **Bring industrial benefits to European manufacturers** by:
   - Mitigating engineering and business deployment risks
   - Converging towards European technology standards
   - Validating the technology scalability and replication
## DSO Program benefits and KPIs

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Project KPIs</th>
<th>Target*</th>
<th>Functional demonstrators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System</strong></td>
<td>Reduction in electricity consumption</td>
<td>5-10%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Reduction in peak to average load ratio</td>
<td>5-20%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Increased above existing design hosting capacity to integrate DER</td>
<td>20%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Reduction in CO2 emissions</td>
<td>5-20%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Reduction in distribution losses</td>
<td>0-2%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Increase in EV integration capacity</td>
<td>100%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td><strong>Customers</strong></td>
<td>Increased quality of supply</td>
<td>2-10%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Reduction in outage time</td>
<td>2-10%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Reduction in electricity bill</td>
<td>0-10%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Increased customer satisfaction</td>
<td>5-10%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Increased customer choice</td>
<td>10-20%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td><strong>DSOs</strong></td>
<td>Increased lifespan of electric infrastructure</td>
<td>10-20%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td></td>
<td>Reduction in operation costs</td>
<td>0-30%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td><strong>Retailers</strong></td>
<td>Increased number of new products offered to the customers</td>
<td>10-50%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
<tr>
<td><strong>Suppliers</strong></td>
<td>Increased number of new products offered to the DSOs and customers</td>
<td>10-50%</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
</tr>
</tbody>
</table>

![Primary contribution](image1.png) ![Secondary contribution](image2.png)

*estimates based on international studies and DSOs experience
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From DSOs functional demonstrators to local implementation projects

**Main pre-conditions**
- Open standards and interoperability policies
- System upgrade policies
- Increase of reliability policies

**Main selection criteria**
- Coverage of the energy value chain
- Geography and climate differentiation
- Customer density
- Type of regulatory and market conditions
- Statistical significance
- Electricity network structure
List of DSOs local implementation projects

1. Smart urban network
2. Smart rural network
3. Smart solar district
4. Web based information portal
5. Smart Grids for rural areas
6. Smart substation monitoring
7. Utilization of HVDC light 4 high penetration of RES
8. LV network monitoring and control
9. Grid integration of RES
10. E-mobility concept validation
11. AMI uses and Smart Homes
12. Active Informed Customers
13. Renewables & storage
14. Meshed Infrastructure Network
15. PHEV recharging infrastructure
16. IP Communication Infrastructure
17. Urban area Smart Grids with DSM + PHEV
18. Large scale integration of PV
19. Design of a self healing MV grid

- 1,5 Mln customers involved
- 50.000 km of power lines
- 20.000 substations
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EEGI Program budget and funding

- Program cost estimation is around € 2 bn in 9 years (2010 – 2018)

<table>
<thead>
<tr>
<th>Programme</th>
<th>Duration</th>
<th>Total costs (€M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint TSO/DSO</td>
<td>5 years starting 2010</td>
<td>230</td>
</tr>
<tr>
<td>TSO</td>
<td>9 years starting 2010</td>
<td>510</td>
</tr>
<tr>
<td>DSO</td>
<td>5 years starting 2010</td>
<td>1200</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>1940</strong></td>
</tr>
</tbody>
</table>

- The results are beneficial for the whole European energy value chain, requiring a comprehensive funding that must involve EC, the Member States, the regulators and industry.
Integration with other EIIs

The integration activities with the other EIIs focus on:

- What can the **network** bring to facilitate the use of new technologies?
- What can **the new technologies** bring to the network?
- What are the features of the future networks that will **secure further integration**?
- What are the **interoperability and common standards** needed?

A first attempt to define the integration activities with SOLAR and WIND has been **included in the EEGI program** proposal.
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Conclusions and next steps

- The large-scale demonstration and research program proposed by the EEGI represents a framework for the EII on Electricity Grids

- A long term and stable funding scheme for the EEGI must be implemented now for effectively involving industrial and energy partners

- The FP7 call on Active Distribution Networks could represent a “quick start” for the EEGI, but does not represent a solution for the long term funding of the program.
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