Spanish DSM initiatives

26th March 2008
Task XV Meeting
Index

1. The Spanish electricity system
2. Electricity demand in Spain
3. DSM in Spain
4. Conclusions
# The Spanish electricity system

<table>
<thead>
<tr>
<th>Small producers</th>
<th>International exchanges · REE</th>
<th>Generators</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Wind turbines" /></td>
<td><img src="image2.png" alt="Map of Spain" /></td>
<td><img src="image3.png" alt="Power plants" /></td>
</tr>
</tbody>
</table>

- **Transmission network · REE**
- **System Operator · REE**
- **External TSO**
- **Market Operator· OMEL**
- **Customers under regulated tariffs**
- **Distribution companies**
- **Qualified customers**

### Key Players:
- **REE**: System Operator
- **OMEL**: Market Operator
- **Red de distribución < 132 kV**: Distribution network
- **Subestación de distribución**: Distribution substation

### Markets:
- **Daily Market**
- **Operational Markets**

### Technical Constraints:
- **Network unavailability**
- **Accepted offers**
- **Technical constraints**
- **Demand Bids**
- **Communications**
- **Energy flow**
The activities according to Law 54/1997

Before Law 54/1997
- International exchanges
- Production
- Dispatch
- Transmission
- Distribution
- Supply
- Subscribers

Law 54/1997
- International exchanges
  - Freely negotiated, authorization required
- Production
  - Installation subject to administrative authorization
- DM + IDM
  - Spot market (OMEL)
- System operation
  - System operation and ancillary services (REE)
- Transmission
- Distribution
- Retailing
  - TPA to the grid
  - TPA to the grid & transmission grid manager
  - New activity
- Qualified consumers
  - Transition period to full eligibility established

Legend:
- Regulated activities
- Liberalized activities
Mission and activities of Red Eléctrica

Management of the grid and transmission of energy

• Transmission Grid Planning and Development
• Management of Interconnections exchanges with E.U. and other countries
• Management of Transmission Grid Access
• Design, Build, Maintenance and Operation of Transmission Facilities (overhead lines and substations)

System Operation

• Guarantee the security of electricity supply
• Coordination of Transmission and Generation
• Ancillary Services Management
• Operate Transmission Grid
• Generation Operation Planning as of electricity market results
• Coordinate Maintenance Planning of Transmission Facilities
• Power demand tracking in real time
## REE Transmission Assets

<table>
<thead>
<tr>
<th>Asset Type</th>
<th>Quantity/Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission Lines</td>
<td>33.396 km</td>
</tr>
<tr>
<td>400 kV</td>
<td>16.844 km</td>
</tr>
<tr>
<td>220 kV</td>
<td>16.552 km</td>
</tr>
<tr>
<td>Substations</td>
<td>2.624</td>
</tr>
<tr>
<td>Transformers</td>
<td>51.072 MVA</td>
</tr>
<tr>
<td>FO Grid</td>
<td>13.412 km</td>
</tr>
<tr>
<td>Employees</td>
<td>1.294</td>
</tr>
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</table>
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Load Demand in Spain

1. High increase

- Annual evolution of electricity demand
- 5% Average Interannual increase since 1996

2. Interannual increase of load peak

- Higher load peak increase than energy increase
Load Demand in Spain

3. Big gradients in daily demand

- Peak/off peak ratio between 1.35 and 1.75

4. High demand concentrated in specific areas

- Concentrated around city areas
Challenges

Need of network reinforcement

Difficult to integrate renewable energies

Over capacity to cover peak load

Big difficulties for developing new infrastructures

22,000 MW of Wind power installed in 2010

3.700 MW needed to cover 300 hours of maximum demand
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### DSM Initiatives in Spain

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<th>Regulated tariffs</th>
<th>Liberalized market</th>
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<td>Interruptibility</td>
<td>New Interruptibility</td>
<td>Time of use tariffs</td>
</tr>
<tr>
<td>Time of use tariffs</td>
<td>Market prices</td>
<td>Reactive control</td>
</tr>
<tr>
<td>Reactive control</td>
<td>Operational services</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medium services customers</th>
<th>Time of use tariffs</th>
<th>Market prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Night tariffs</td>
<td>Access to network tariffs</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Residential customers</th>
<th></th>
<th>Operational services</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Price signals</td>
<td></td>
</tr>
</tbody>
</table>
Load interruption contracts

Load interruption order sent from 17:30 to 23:30 1st March 2005

- Interruption of consumption
- Load interruption order sent from 17:30 to 23:30 1st March 2005
- Coincident with low wind production

Reduction of consumption of large customers to agreed values and with specific warning times as a request from the SO or distribution companies
Load interruption contracts

Reduction of consumption of large customers to agreed values and with specific warning times as a request from the SO or distribution companies.

19th November 2007

- Load interruption orders type “C” from 17:40 to 20:40 hours and from 17:45 to 20:45 19-11-07
- Load interruption orders type “C” from 19:00 to 22:00 hours and from 19:05 to 22:05 19-11-07
**Time of use tariffs**

**Regulated tariffs**

<table>
<thead>
<tr>
<th>Type</th>
<th>Modality</th>
<th>Aplicabilidad</th>
<th>NP Periodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tipo 0</td>
<td>2.0</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Tipo 1</td>
<td>Uso General (No 2.0)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tipo 2</td>
<td>Uso General (No 2.0)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Tipo 3</td>
<td>Uso General (No 2.0)</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Tipo 4</td>
<td>Uso General (No 2.0)</td>
<td>3 + Sábados y Festivos</td>
<td></td>
</tr>
<tr>
<td>Tipo 5</td>
<td>Uso general pero incompatible con complemento por estacionalidad y con R 1 y R, 2.0</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>THP</td>
<td>AT: P&gt;20 MW en algún periodo y P&lt;5 MW en todos los periodos</td>
<td></td>
<td>7</td>
</tr>
</tbody>
</table>

✓ Tariff supplement for hourly discrimination

**Large customers**

- **Type 3**
- **Type 4**
- **Type 5**

Adjustment of load profile to the needs of the system increasing their consumption in valley hours and reducing their consumption in peak hours as a response to price signals.
Expectations and future trends: Residential sector

- **Improvement of measurement and operation equipment:**
  Regulation contemplates providing residential customers with metering appliances integrated in a system with demand management capacity aimed at reducing load under specific circumstances.

- **Feed-back on consumption:**
  Development of European Directives: Final customers should get information about their energy consumption in order to allow them regulate their own energy consumption.
Energy saving:
Energy saving requirements based on: limitation of electricity demand, performance of thermal installation, efficient lighting systems, solar minimal contribution to hot water and PV minimal contribution to electric energy.

Energy efficiency certificates:
Energy efficiency certificates for new buildings: Methodology taking into account final hourly energy consumption that will provide information of final use profiles.
Expectations and future trends: Industrial sector

- **Disappearance of regulated tariffs** for high voltage customers in 1/07/2008:
  It may lead to the lost of modulation for the whole sector due to the lost of incentives introduced by tariff supplements (time of use tariffs).

- **Energy Audits:**
  They will allow detecting potential in saving and best practices in the industrial sector.
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Conclusions

- Large tradition in large industrial customers providing operational services under regulated tariffs
- New challenge due to liberalization of supply side: evolution to new services into the market
- Existing measures: Interruptibility and modulation, both representing a big value for the electricity system and meaning an economical benefit for the industry.
- Need of introducing DSM in planning of the transmission system
- Residential customers need of information of consumption
- Large smart metering substitution plan