Integration of DSM, Distributed Generation, Renewable Energy sources and Energy Storages Issues in the Spanish system

IEA DSM agreement

Task XVII Washington Experts meeting
March 11th 2008

Demand side management department
Integration of DSM, Distributed Generation, Renewable Energy sources and Energy Storages Issues in the Spanish system

March 11th 2008

Demand side management department
The Spanish electricity system

- Small producers
- International Exchanges
- Generators
- Transmission Grid (High voltage)
- Other companies
- Distribution activities (Medium and Low Voltage)
- System Operator Red Eléctrica
- Foreign TSO
- Market operator OMEL
- Suppliers
- Consumers under approved tariffs
- Qualified consumers

Energy flow
Information flow
Market bids
The activities according to Law 54/1997

Before Law 54/1997 – Legal stable framework

- International exchanges
- Production
- Dispatch
- Transmission
- Distribution
- Supply
- Subscribers

Law 54/1997 (reviewed by Law 17/2007)

- 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
  - TPA to the grid & transmission grid manager
- Distribution
  - TPA to the grid
- Reselling
  - New activity
- Qualified consumers
  - Transition period to full eligibility established

Subscribers

Regulated activities
Liberalized activities

Legend:
General scheme of the electricity market

Producers
Producers under Special Regime
Reseller seller
External agent seller

FORWARD MARKET (OMIP)
BILATERAL CONTRACTS (OTC & other)
DAILY AND INTRA-DAILY MARKET (OMIE)
OPERATION MARKETS (REE)

Electricity Sector Management: REE

Distributor
Qualified consumer
Reseller buyer
External agent buyer

Final consumer at a tariff
# Scheduling Scheme

<table>
<thead>
<tr>
<th>Day D-1</th>
<th>Day D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 8 9 10 11 12 13 14 15 16 17 18 19 22 23 24</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 22 23 24</td>
</tr>
</tbody>
</table>

**WHOLESALE ENERGY MARKET OPERATOR**
- Daily Market
- Intradaily 1
- Intradaily 2
- Intradaily 3
- Intradaily 4
- Intradaily 5
- Intradaily 6

**RED ELÉCTRICA DE ESPAÑA, AS SYSTEM OPERATOR**
- Previous information sent to agents by REE
- Capacity daily auction Spain-France (RTE)
- Daily energy sched. sent to REE by agents
- Build up of base energy program
- Specific constraint bids sent to REE
- Build up of base energy program

**Daily constraints solving process**
- Secondary reserve market
- Intradaily capacity auction (I) S-F (REE)
- Forecasted deviations management
- Tertiary reserve usage
- Real Time constraints solving process

**Intradaily capacity auction (II) S-F (REE)**

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**DSM and DER integration Spain Task XVIII IEA DSM**
Electricity demand behavior

1. Sustained growth

Demand evolution 1996-2007

Average year-to-year growth of 5% since 1996

2. Peak demand growth

Monthly peak evolution

Peak demand growth is higher than average demand increase
Increasing need for infrastructure. Geographic vision

Geographically unbalanced growth in generation and demand, which requires new infrastructure → Difficult development
Demand behavior

- Black lines represent the 120 h peak hours in 2005, 2006 and 2007
Policies for DG, RES, DR/DSM

DG/RES: Royal Decree 661/2007

- RES, CHP & Waste up to 50 MW
- Establishes administrative procedures to be followed to install the facility
- Provides two options to sell electricity: guaranteed price / premium
- Offers incentives for frequency control
- Offers higher payment for most efficient CHP plants

DR/DSM: Smart metering down to household consumers
Policies for DR/DSM

From a tariff supplement...

- Tariff supplement
- Load interruption supplement
- Time of use tariffs
- Reactive power supplement

... to a operation service

- Market framework
- Load interruption service
- Market prices
- Voltage control service
Interruptibility service

Power reduction from big consumers down to previously agreed values and with a determined warning time, as a request of the TSO or the DSOs

- Interruptibility “C” used from 17:40 to 20:40 h & from 17:45 to 20:45
- Interruptibility “C” used from 19:00 to 22:00 h & from 19:05 to 22:05

19 of November of 2007
Status and target for DG, RES, DR/DSM

System Installed capacity August 2007 (MW): Total: 82,689 MW
Record peak demand: 44,880 MW

System Installed capacity 2011 (MW): Total: 96,626 MW
Produced Energy DG 2006

**Distributed Generation**

<table>
<thead>
<tr>
<th>Energy (GWh)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renewable</td>
<td>28,188</td>
</tr>
<tr>
<td>Cogeneration</td>
<td>15,133</td>
</tr>
<tr>
<td>Waste Treatment (natural gas)</td>
<td>3,367</td>
</tr>
<tr>
<td>Industrial/Urban Waste</td>
<td>2,022</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>48,711</strong></td>
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</table>

**Renewable Energy**

<table>
<thead>
<tr>
<th>Energy (GWh)</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Wind</td>
<td>21,977</td>
</tr>
<tr>
<td>Hydro</td>
<td>4,049</td>
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<tr>
<td>Agricultural and Forest Waste</td>
<td>1,485</td>
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<tr>
<td>Biogas</td>
<td>581</td>
</tr>
<tr>
<td>Photovoltaic</td>
<td>96</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>28,188</strong></td>
</tr>
</tbody>
</table>
Geographic distribution of wind, CHP and RD and demand

Installed Wind Capacity August 20

Large industrial operable loads

Cogeneration

Demand distribution
DG Access

Network Access


Market Access

- Whole sale market (1 MW)
- Ancillary services
Network Access. Voltage Dip Generation Tripping
01/06/05-31/05/07

Operational Procedure 12.3

- New wind turbines installed (1/1/2008)
- Already installed wind turbines: deadline for compliance 1/1/2010
Thanks for your attention!
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