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

IEA DSM agreement
Task XVII Seoul Workshop
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Demand side management department
INDEX

- The Spanish electricity system
- Electricity demand behaviour
- DG, RES, DR/DSM
  - Policies
  - Status and Target
  - Perspective
- Renewable energy challenges
- Control Centre for the special Regime (CECRE)
- Interruptibility service
The Spanish electricity system

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

Energy flow: Orange
Information flow: Red
Market bids: Green
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 and ancillary services (REE)
  - TPA to the grid & transmission grid manager

- System operation
  - TPA to the grid

- Transmission

- Distribution

- Reselling
  - New activity
  - Transition period to full eligibility established

- Qualified consumers

Legend:
- Regulated activities
- Liberalized activities

DSM and DER integration Spain Task XVIII IEA DSM
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 (OMEL)
OPERATION MARKETS (REE)

Electricity Sector Management: REE

Distributor
Qualified consumer
Reseller buyer
External agent buyer

Final consumer at a tariff
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

1

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 for Special Regime**

- 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**
Status and target for DG, RES, DR/DSM

System Installed capacity* - May 2008: 87,919 MW

Record peak demand – December 17th 2007 (19-20h): 44,880 MW

* Inland System
Energy sold to the system by DG in 2007

Total Gross Generation

<table>
<thead>
<tr>
<th></th>
<th>Energy (GWh)</th>
<th>%</th>
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<tbody>
<tr>
<td>Total</td>
<td>280 127</td>
<td>100</td>
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<tr>
<td>Distributed Generation</td>
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<tr>
<td>(Special Regime)</td>
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<tr>
<td>Renewable</td>
<td>35 730</td>
<td>12.8</td>
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<td>Non Renewable</td>
<td>20 574</td>
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<td>Total</td>
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<td>Renewable</td>
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<tr>
<td>Wind</td>
<td>26 888</td>
<td>9.6</td>
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<tr>
<td>Solar</td>
<td>457</td>
<td>0.2</td>
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<tr>
<td>Rest of Renewable</td>
<td>8 385</td>
<td>3.0</td>
</tr>
<tr>
<td>Total</td>
<td>35 730</td>
<td>12.8</td>
</tr>
</tbody>
</table>
Geographic distribution of wind - DR and CHP - demand
Perspectives for DG  (S.O. prevision for years 2011 and 2016)

System Installed capacity* 2011: 100,586 MW

- Wind Power: 22%
- Combined Cycle: 28%
- Hydro Power: 18%
- Coal: 9%
- Nuclear: 8%
- Fuel-gas: 1%

Special Regime capacity* 2011: 36,380 MW

- Wind Power: 61%
- Cogeneration: 20%
- Solar: 5%
- Small hydro: 6%
- Biomass: 6%
- Wastes: 2%

System Installed capacity* 2016: 121,643 MW

- Wind Power: 24%
- Combined Cycle: 29%
- Hydro Power: 16%
- Nuclear: 6%
- Coal: 7%
- Fuel-gas: 3%

Special Regime capacity* 2016: 47,670 MW

- Wind Power: 61%
- Cogeneration: 17%
- Solar: 9%
- Small hydro: 5%
- Biomass: 5%
- Wastes: 2%

* Inland System
Renewable Energy Challenges

- Challenging characteristics of intermittent power sources:
  - Uncontrollability
  - Variable production
  - Difficult forecast
  - Wind: ride through capabilities (with high penetration)

- Consequences:
  - Increasing need for balance power and reserve capacity
  - Possible grid congestions
  - Increase of grid losses in some cases
  - More reactive power compensation might be needed in some cases
  - In some cases, load flows can affect neighbouring transmission systems and/or the available cross border trading capacities
Control Centre for the Special Regime (CECRE)

- **Generation Control Centres (CCG):** Installations over 10 MW must be attached to a control centre that maintains communication with the System Operator and that transmits instructions from the S.O. to the producer, with the scope of keeping the reliability of the system at desired levels. (RD 1454/2005)

- **System Operator’s position:**
  - Elaboration of legislative proposals
  - Creation of the Control Centre for the Special Regime (CECRE)
    - For the Supervision and control of all installations included in the Special Regime (renewable, cogeneration and wastes) over 10 MW
    - It seeks to maximise the penetration of Special Regime generation technologies in the operation of the system without endangering its security and efficiency
    - It communicates with installations through Generation Control Centres
    - It is associated to the CECOEL/CECORE, the Electric Control Centre
Main objectives and functions of the CCRE:

- Integrate the Special Regime energy production taking into account the necessities of the electrical system
- Receive in real time the relevant information to manage the system
- Give to the CCGs the setting of the maximum power output per node
- Coordinate maintenance plans of the transmission system with those of the rest of the system
- Get the dispatchable generation programs and give generation previsions for non-dispatchable generation (wind energy)
Operational Procedure 12.3

- New wind turbines installed (1/1/2008)
- Already installed wind turbines: deadline for compliance 1/1/2010
Wind energy production curve in November 19th, 2007
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
Thanks for your attention!
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