BENEFITS FROM PARTICIPATION OF RENEWABLES IN SYSTEM BALANCING

Session 4: Smart Renewable
ESAP IEA
SCARCITY, FLEXIBILITY PRICING AND DSM
July 2014
CONTROL SERVICES AND NON MANAGEABLE GENERATION
CONTROL SERVICES NOWADAYS

1st Steep: Observability and Controllability

RE FACILITIES AGGREGATION

- RE facilities aggregation P > 10 MW
- RE facilities aggregation 1 MW < P < 10 MW

Connected to a RESCC

OBSERVABILITY & CONTROLLABILITY

CECRE

Connected to a RESCC or Distribution Companies

OBSERVABILITY

12 second cycles
Frequency control

- Wind farms adapt their production to the given set-point within 15 minutes

GEMAS: Analysis in real time the maximum wind generation supported by the system.

REAL TIME MEASUREMENTS

CECRE

RES CC \textsubscript{1} \; ... \; RES CC \textsubscript{n}

Set points

GEMAS

20 minutes calculation frequency
CONTROL SERVICES NOWADAYS

Voltage control

From November 2010 with the RD 1565/2010:

RES Installations

If P < 10 MW

NEW POWER FACTOR BONUS/PENALIZATION

- 3 %  0 %  + 4 %  0 %  - 3 %

0.98  0.995  0.995  0.98

Inductive  Capacitive

- Non hourly dependant
- Bonus for cos phi = 1
- Penalization if lower than 0.98

If P > 10 MW

TSO PARTICULAR INSTRUCTIONS
CONTROL SERVICES: LAST RESULTS

Inside the framework of the Demo 1 of the TWENTIES project

- **Demos:**
  1.1. Voltage Control/Reactive power regulation
  1.2. Active power regulation

- **Main objective:**

  On-site test of system control services provided by wind generation, based on new operation strategies using improved systems, devices and tools.

<table>
<thead>
<tr>
<th></th>
<th>Arcos</th>
<th>tajo</th>
<th>Hueneja</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participating</td>
<td>112</td>
<td>122</td>
<td>248</td>
<td>482</td>
</tr>
<tr>
<td>Total</td>
<td>321</td>
<td>327</td>
<td>521</td>
<td>1169</td>
</tr>
<tr>
<td>%</td>
<td>35%</td>
<td>37%</td>
<td>48%</td>
<td>41%</td>
</tr>
</tbody>
</table>
CONTROL SERVICES: LAST RESULTS
DYNAMIC VOLTAGE CONTROL
CONTROL SERVICES: LAST RESULTS

DYNAMIC VOLTAGE CONTROL

Wide-Area Voltage tests

More than 15 kV difference

Less than 2 kV difference

Saturation
CONTROL SERVICES: LAST RESULTS
FREQUENCY CONTROL
CONTROL SERVICES: LAST RESULTS
FREQUENCY CONTROL

Description of the test
Secondary frequency control tests
CONTROL SERVICES: CONCLUSIONS

Wind farms are able to:

- Work coordinately in order to control the voltage in the point of common coupling in the transmission grid, by means of a coordinated control with the SO. They can manage the voltage profile in a 400 kV corridor.
- Control their active power output in real time and in a coordinated way, complying the secondary frequency regulation requirements (PSR) given by the SO.

Cost:

- The additional technology that was used to provide this services have a low cost (lost of profit aside), because the innovation lies in the development of new control algorithms and the deployment of more powerful communication.
- According to the analysis of the forecast system, the more wind farms are grouped and the shorter the forecast period is, the smaller is the amount of energy that has to be spilled.

Active power control: Conditions for a high economic impact:

- Systems in which up and down reserve constraints highly condition the resulting generation scheduling.
  - High share of technologies that do not provide active power control (nuclear, other RES).
  - Low share of flexible generating sources, such as pumped storage hydro plants.
THANKS FOR YOUR ATTENTION!