SET PLAN
Conference 2015
Research, innovation and competitiveness for the Energy Union

TITLE
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CEO EDP Inovação

SESSION 1
Accelerating the energy system transformation
Monday 21 September 2015
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Business Portfolio

EDP Brasil

17% of EBITDA
Listed subsidiary: EDP Brasil (EDP has 51%)
Presence since 1996
Power generation: 1.8 GW (hydro)
2 electricity distribution concessions

Portugal

44% of EBITDA
Privatization in 1997 (IPO)
Single electricity distributor
Power generation: 8.7 GW (ex-wind)
(from which 5.4GW is hydro)

Spain

14% of EBITDA
Presence since 2001
Power generation 3.8 GW (ex-wind)
# 2 in gas distribution

Wind & Solar Power

25% of EBITDA
(10% North America; 6% Spain; 4% Portugal; 5% Other)
Listed subsidiary: EDP Renováveis (EDP has 77.5%)
IPO in Jun-08
Wind & Solar Power: 8.1GW
A worldwide renewable market leader

Note: Data as of Dec-14
EDPR: Diversified portfolio and stable revenue stream

- 60% stake in 2.4GW wind offshore project
- ~90% LT PPAs/Hedged
- ~10% Merchant price
- Long term PPAs (15 years)
- 180 MW under development

Installed Capacity (MW) 8,149
% total installed capacity
MW Under construction 601

Other Europe:
- Long Term PPAs or market price + green certificates

Note: Data as of Mar-15
Innovation in the electric sector is advancing at a fast pace, changing the value chain paradigm and influencing the role of the stakeholders.
In generation, wind and solar technologies present a high potential for cost reduction, which will have impact in its future mass adoption

Reference year 2011 = 100

The development of smart grids will improve supply reliability and enhance new products and services

Smart grids

Smart grids differ from traditional grids by allowing bidirectional communication and flows between utilities and consumers, working through a set of controls, automation and interconnected equipment in order to give a quick response to demand needs.

Intelligent meters that allow a bidirectional flow of energy and information and real-time consumption monitoring.

Source: Smartgrid.gov, Smartgridtech, GE Digital Energy, uSwitch, British Gas
In what concerns distributed and retail resources, the changes: consumers as producers, storage and new products & services

**Downstream Trends**

1. **Micro cogeneration**
   > Growing installation and operation of distributed generation systems, including solar PV and mini cogeneration

2. **Electric Vehicles and infrastructure**
   > Electric vehicle adoption and development of the charging infrastructure

3. **Storage**
   > Battery installation and operation for electricity storage at local distribution level

4. **New products and services**
   > Providing new products oriented to promote energy efficiency and client well-being

5. **Energy flow optimization**
   > Exploitation of local resources for grid load management (DSM, EV, storage) in order to:
     - Optimize energy flow
     - Capture arbitrage opportunities (ex. changing consumption to cheaper hours)
   > Implementation of Energy Efficiency measures

**Source:** Eurelectric Innovation Action Plan Taskforce analysis
EDP Innovation was created in 2007 to provide innovative solutions across the EDP Group. EDP has budgeted 200 m€ for innovation until 2020.
**Key innovation areas**

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<td><strong>Smart Pricing and Bundling</strong></td>
<td><strong>Smart Grids</strong></td>
<td><strong>Renewable Energy</strong></td>
<td><strong>Cloud computing</strong></td>
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<td>Develop innovative pricing schemes that leverage on technology / SG</td>
<td>Adequate smart grid infrastructures</td>
<td>Wind Onshore, Offshore and new concepts</td>
<td>Provide agility in leveraging IT resources by enabling dynamic management of infrastructure, lowering capital investments</td>
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<td>Explore synergies with innovative gas / electricity bundles</td>
<td>Software applications leveraging on SG elements to improve operational excellence</td>
<td>Solar: current and new concepts</td>
<td>Big data</td>
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<td><strong>Energy Efficiency</strong></td>
<td><strong>Energy Management / Storage</strong></td>
<td><strong>Thermal &amp; Big Hydro Generation</strong></td>
<td><strong>Generate business and customer intelligence to help optimize operations and drive creation of new products and services</strong></td>
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<td>Home / office / industry Energy Management solutions</td>
<td>Energy Storage Solutions</td>
<td>Flexibility &amp; interface with Smart Grids</td>
<td><strong>Web 3.0</strong></td>
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<td>Efficient Lighting Solutions</td>
<td>Other energy management solutions such as DSM, etc.</td>
<td>Impact mitigation solutions</td>
<td><strong>Bring people and technology seamlessly together, bridge business and social and increase productivity in collaborative work</strong></td>
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<td><strong>Increase Electrification</strong></td>
<td><strong>Access to Energy</strong></td>
<td><strong>Smart Pricing and Bundling</strong></td>
<td><strong>Develop innovative pricing schemes that leverage on technology / SG</strong></td>
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<td>Electric Mobility</td>
<td>Leverage renewables and storage to create off-grid and mini-grid solutions</td>
<td><strong>Explore synergies with innovative gas / electricity bundles</strong></td>
<td><strong>Smart Pricing and Bundling</strong></td>
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<tr>
<td>Other</td>
<td><strong>Solar: current and new concepts</strong></td>
<td><strong>Quest for disruptive renewable concepts</strong></td>
<td><strong>Generate business and customer intelligence to help optimize operations and drive creation of new products and services</strong></td>
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**EDP PRESENTLY HAS FOUR KEY AREAS FOR INNOVATION**
Examples of what we are doing: WindFloat

Offshore demonstration project in deep waters using a floating platform inspired in years of knowledge from the oil & gas industry

- Demonstrate the technical and economic viability of the WindFloat Technology
- Leadership in floating deep offshore wind
Examples of what we are doing: re:dy
“Unlock downstream innovation”.

Re:dy is a system that allows the user to have full remote control over his home, as well as analyzing electric consumption of one’s home appliances. Controllable over web or smartphone app.

- **re:dy box**
  - The core of the product
  - Communications: ZigBee, PLC and Ethernet

- **re:dy plug**
  - Individual appliance monitor
  - Communications: ZigBee;
    - On/off local button

- **re:dy meter**
  - Circuit meter: allows measuring up to three different single phase circuits or a three-phase one. As a stand-alone device, it can act (on/off) over two circuits.
  - Communications: PLC;
    - Buttons for on/off/auto on the two actuation circuits
EDP’s R&D is strongly leveraged by EU Funding. FP5/6/7 and more recently H2020 have been and continue to be important R&D and innovation drivers.

- **SUSTAINABLE**
  - FP7 – Smart Grids

- **T-CLOUD / SEGRID**
  - FP7 – Cyber Security

- **UPGRID**
  - H2020 – Smart Grids

- **SENSIBLE**
  - H2020 – Energy Storage

- **STABALID**
  - FP7 – Energy Storage

- **WINDFLOAT**
  - NER300 – Floating offshore wind

- **DEMOWFLOAT**
  - FP7 – Floating offshore wind

- **DEMOGRAVII**
  - H2020 – Offshore wind gravity foundation

- **LEANWIND**
  - FP7 – Offshore wind logistics

- **ECOGRID**
  - FP7 – RES Grid Integration

- **EVOLVEDSO**
  - FP7 – Smart Grids / DSO

- **VIRGO**
  - CIP – Smart Grids, Data management

- **PLANGRIDEV**
  - FP7 – Electric Mobility

- **INSMART**
  - FP7 – Smart Cities

- **S3C**
  - FP7 – Smart Grids, User engagement

- **SHAR-LLM**
  - H2020 – LightHouse Smart Cities
Innovation is one of the 5 dimensions of the Energy Union Strategy, and cuts across all elements of the Strategy - it is at the heart of the Energy Union.

EDP, as a Member of EURELECTRIC, welcomes the SET Plan Communication as a basis for future work and consultation.

We agree that innovation is key to achieve the transformation of the energy system, therefore new investments at all stages of the innovation chain are needed.

Some preliminary comments and recommendations:

- We welcome the emphasis put on Public-Private Dynamics, system approach as well as demonstration and commercialisation and more downstream innovation approach. More coordination among Member States and more joint projects are seen as necessary.

- It is most important to establish a functional and efficient supportive Governance structure. Streamlined processes should be achieved, making it easy for all stakeholders to understand them and to interact minimizing fragmentation and duplication of efforts.

- Set Plan and the Electricity Market Design
They are closely connected and their consistency should be ensured.
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