1. PORTUGAL’S CONSUMPTION EFFICIENCY PROMOTION PLAN PPEC

Three quarters of the gas emissions derive from the energy sector. So, it must be at the heart of the climate change solution. Portugal has set a map towards carbon neutrality:

- Coal has been eliminated since 2021
- Oil consumption will drop sharply by 2050
- Oil will be replaced by natural gas in the transitory phase, and then by renewable energy.

The EU has set a plan known as “Fit for 55” which sets a goal of reducing the GHG emissions in the Union by 55% by 2030 compared to 1995 levels.

**PPEC** is a tender mechanism which offers the possibility to choose the best measures with the highest benefit-cost ratio to be implemented.

The PPEC financed 85% of the costs in its first edition, and dropped to 56% in its 6th edition, with most of the rest of the financing being paid by the beneficiaries themselves.

PPEC 2017-2018 has an expected accumulated savings of 1,289 GWh, roughly equivalent to the yearly consumption of 500,000 families.

The previous six PPECs have cost 75 million Euros, but in return, they have generated 979 million Euros of savings which is more than 13 times the initial investment.

**RECOMMENDATIONS**

**Tariffs** should recover all the efficient costs associated to each activity, they should have several billing variables to convey accurate price signals to the consumers, and they should have price structures adherent to marginal or incremental costs.

**Regulators** should ensure that the regulatory incentives are closely aligned with the objective of energy efficiency, and that the regulation is friendly to innovative new service providers.

**DISCLAIMER** | This publication was produced with the financial support of the European Union. Its contents are the sole responsibility of MEDREG and do not necessarily reflect the views of the European Union.
2. SELF-CONSUMPTION, DEMAND SIDE MANAGEMENT, AND RENEWABLE ENERGY COMMUNITIES

Portugal adopted a National Energy and Climate Plan 2030 to reduce its emissions and increase the use of clean energy in its energy sources.

2.1. A RENEWABLE ENERGY COMMUNITY (REC)

is an autonomous legal entity, based on voluntary participation controlled by shareholders or members of the community.

This legal entity is located next to renewable energy projects owned and operated by it.

2.2. SELF-CONSUMPTION

The Portuguese Energy Regulator ERSE developed:
- A specific regulation for electricity self-consumption.
- Specific rules for topics such as metering, commercial applications, and tariffs.
- Pilot-projects to serve as regulatory sandboxes.

2.3. DEMAND-SIDE MANAGEMENT (DSM)

is the act of planning and monitoring the activities and designing them in a way to motivate the consumer to change his patterns of electricity usage, including the timing and level of demand.

- Tariffs can be used to control DSM by pricing peak hours at high prices and low demand hours at low prices, so the demand would shift from the peak hours to low demand hours.
- DSM and energy storage could help an average European household reach a rate of self-consumption of 65-75%.

3. FUTURE OF ENERGY STORAGE

Predictions in Portugal:
- The share of renewable energies in the primary energy consumption has been consistently increasing, reaching a total of 31% of the market in 2020.
- Renewable energy production is expected to grow to 85% by 2050.
- Energy efficiency will rise by 40% reducing the consumption from 241 to 145 TWh/year by 2050.
- Energy dependence is expected to drop from 66% to 15% by 2050.
- Forecasted energy consumption of 58 TWh in 2030. Of this consumption:
  - 36 TWh are expected to come from non-flexible generation systems like PV and wind.
  - The available pumping hydro could help store 2.6 TWh.
  - 0.2 TWh would have to be curtailed without further flexibility solutions.

- Self-consumption, DSM, and distributed renewable resources contribute to:
  - accelerate decarbonisation,
  - enhance security of supply, and
  - keep affordable prices.
- Digitalisation is essential for energy sharing and for activating the demand side.
- Regulators must adapt the regulations in a way not to harm the advancement of these technologies.
4. THE ROLE OF ELECTRIC VEHICLES IN COUPLING DEMAND SIDE MANAGEMENT AND ENERGY STORAGE

- **Energy efficiency measures** can be promoted through time of use tariff, critical peak pricing, and real time pricing.
- **Several technologies** can assist with DSM and their contribution can vary from instantaneous to long term action.
- **Ancillary services** aim at preserving the different parameters of the power system and consist mainly of:
  - frequency containment reserves,
  - automatic frequency restoration reserve, and
  - manual frequency restoration reserve.
- **An aggregator** is a service provider that may be a supplier, and operates directly or indirectly a group of consumption, generation, or storage facilities in a way to trade flexibility.
- **Aggregation requires**:
  - a regulatory framework that allows aggregators to participate in the market,
  - an advanced metering infrastructure, and
  - advanced forecasting tools and techniques.
- **Electric Vehicles (EVs)**:
  - When aggregated, Electric Vehicles may contribute to the reliability of energy systems by providing ancillary services.
  - They can be programmed to avoid charging during peak demand.
  - In the long term, they may help postponing investments in power plants built to respond to peak demand.
  - The yearly electric consumption of one EV would be around 2.5 MWh, almost doubling the average domestic consumption.
  - When connected to a single phase, EV charging may cause imbalance in the voltage phases, as well as significant harmonics and super-harmonics in the system.

**Recommendations**

- **Cooperation between TSOs and DSOs** will be crucial for the operation of the system.
- The regulatory framework should be technologically indifferent and non-discriminatory.
- It should also well define the different parameters in the power system.

**Table:**

<table>
<thead>
<tr>
<th>#EV</th>
<th>Yearly consumption of EVs [GWh / year]</th>
<th>% of annual electric consumption</th>
<th>Maximum capacity needed</th>
<th>% of consumption in valley hours*</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 000</td>
<td>25</td>
<td>0,05%</td>
<td>10 MW</td>
<td>0,25%</td>
</tr>
<tr>
<td>100 000</td>
<td>250</td>
<td>0,5%</td>
<td>100 MW</td>
<td>2,5%</td>
</tr>
<tr>
<td>500 000</td>
<td>1250</td>
<td>2,5%</td>
<td>500 MW</td>
<td>12,5%</td>
</tr>
</tbody>
</table>

*Source: José Bigares’s presentation “The role of EV in coupling DSM and energy storage” in MEDREG study visit to the Portuguese Regulator ERSE, 4 July 2022*
Distribution System Operators (DSOs) operate, maintain, and develop the distribution network to ensure that electricity is delivered to end-users in a secure, reliable and efficient manner.

Main challenges that E-Redes will be facing in the coming years:

- **The smart grid** is complex and requires important changes both at the technological level and at the organisational level because everything must be connected to a central IT communications unit that will be handling arising problems.
- **The smart grid campaign** aimed at delivering the best experience to the consumer by:
  - informing him/her on time,
  - being flexible, and by
  - listening to the complaints and improving the process.
- 900 employees were involved in the campaign with the aim to reach 3,000 installations per day.
- Due to the **roll out of the smart grid**, the volume of collected data and remote operations on the grid has been growing continuously.
- Every single day, more than 400 million data records are collected detailing all the parameters of the system.

Nowadays, DSOs are facing lots of challenges especially with the rise of topics such as decarbonisation, decentralisation, and digitalisation.

These challenges include:

- the integration of distributed energy generation
- the development of new energy markets and services
- the growth of customer connections
- the increase of electric vehicles
- the electrification of demand
- facilitate the energy transition
- renew the network
- attract and retain talent
- proactively manage the unpredictable

**E-Redes:**

- **Main Portuguese DSO**
- **6th largest DSO**
- **3rd largest DSO**
- **6.4 million customers**
- **Connected to the distribution network**
- **45 TWh of energy**
- **230k km of distribution lines**
- **70k transformer stations**

**5. A CONCRETE ILLUSTRATION: THE PORTUGUESE DISTRIBUTION SYSTEM OPERATOR E-REDES**

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Figure 4. Layout of the supervision centre

Source: E-Redes

6. FOR MORE INFORMATION ON THE TOPIC

Consult our related publications:

- Technical report on this subject based on our Study Visit "Exploring Energy Storage and Demand Management", November 2022
- Report on Energy efficiency programmes and electric mobility in Mediterranean countries, March 2022

**REVENUE ASSURANCE**

- Planning, monitoring field inspection’s results
- Field work orders generation and team’s remote support
- Address fraud events and theft reports

**SMARTGRID OPERATIONS**

- Smartgrid SLAs monitoring - consumption data, remote services, selfconsumption, etc.
- Field operations support - commissioning, equipment remote set-up
- Failure detection and generation of field work orders

**DIGITAL PLATFORM**

- Supervision - Network & Security operation centers
- Call answering and incident registration
- Incident screening, address typified situations

**HIGH VOLTAGE ASSET MANAGEMENT**

- Monitoring high voltage substation distribution transformers