Activation and marketing of B2B customers' flexibility in Portugal

European Workshop

Aggregators as enablers of prosumers participation in the energy market

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Gisela Mendes, EDP CNET

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Agenda

- EDP at glance
- EDP's case study in BestRES project
  - Context
  - Goals
  - Validation environments of EDP's BM
  - Main results
- Conclusions

EDP at glance

Global energy company

EDP at glance – global energy company

- **Vertically integrated** with presence in generation, transmission, distribution and supply (electricity and gas)
- 4th **Largest** producer of wind energy **worldwide**
- 1st **European SmartGrid** city
- **#1 in the World in Sustainability among integrated utilities**, by the Dow Jones Sustainability Indexes

Installed Capacity:	Employees:	EBITDA:	Net Profit:	Assets:
26,8 GW	11,657	€3.99bn	€1.11bn	€42bn

Note: YE2017 Figures

… a diversified group

Wind & Solar Power

39% of EBITDA
(17% North America; 9% Spain; 6% Portugal; 2% Brazil; 6% Other)
Listed subsidiary: EDP Renováveis (EDP has 82.6%)
IPO in Jun-08
Wind & Solar Power: 10.7GW
A worldwide renewable market leader

Portugal

32% of EBITDA
Privatisation in 1997 (IPO)
Single electricity distributor
Power generation: 10.1 GW (ex-wind)
(from which 6.8GW is hydro)

Spain

12% of EBITDA
Presence since 2001
Power generation 3.5 GW (ex-wind)

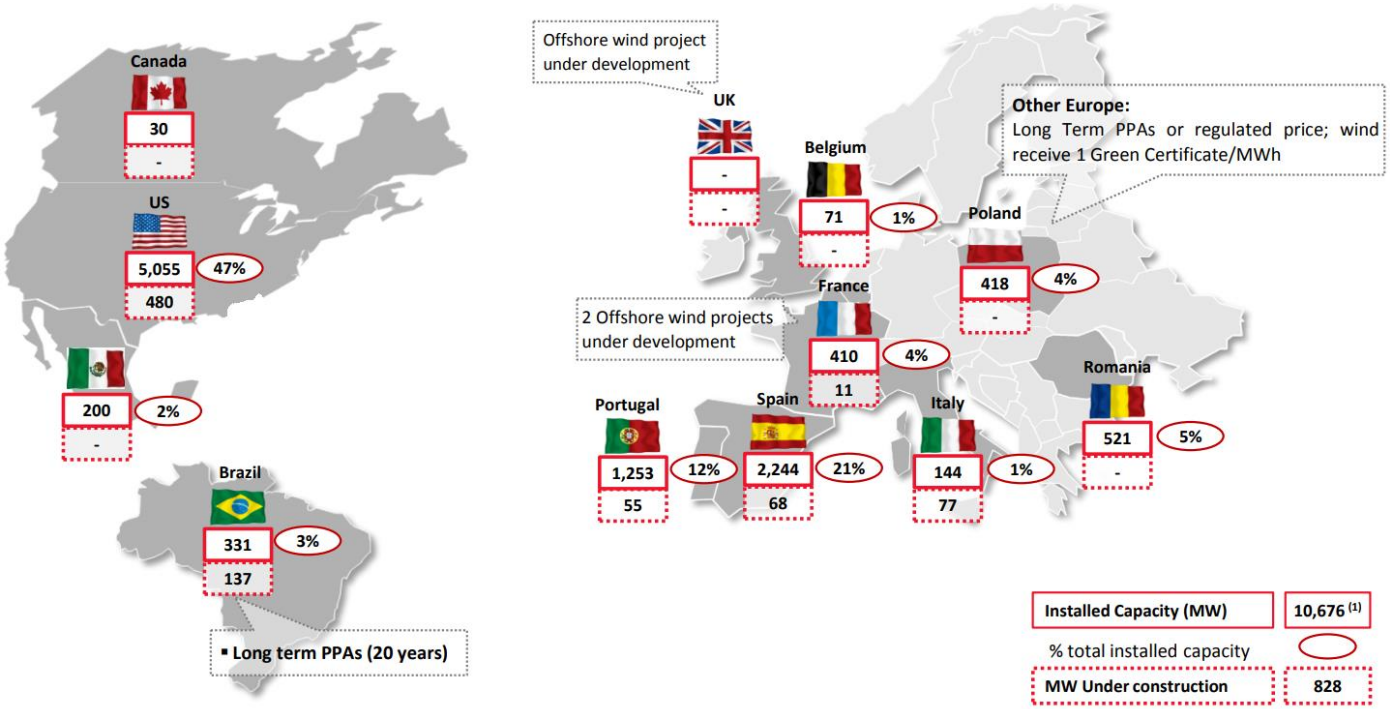
- 4 continents
- 14 countries
- 41 different nationalities
- 9.9 million electricity customers
- 1.6 million gas customers
- 70 TWh generated
- 27 GW of Installed Capacity:
  - 39% Wind
  - 34% Hydro
  - 14% CCGT
  - 12% Coal
  - 1% Others
- 338.179 Km of Network:
  - 84% overhead lines
  - 16% underground cables

EDP Brasil

17% of EBITDA
Listed subsidiary: EDP Brasil (EDP has 51%)
Presence since 1996
Power generation: 2.5 GW (hydro and coal)
2 electricity distribution concessions
5 transmissions lines (under construction)

Note: YE2017 Figures

and a leader in renewable Energy…



- 11GW Installed Capacity worldwide
- 27,6 TWh generated in 2017

Note: YE2017 Figures

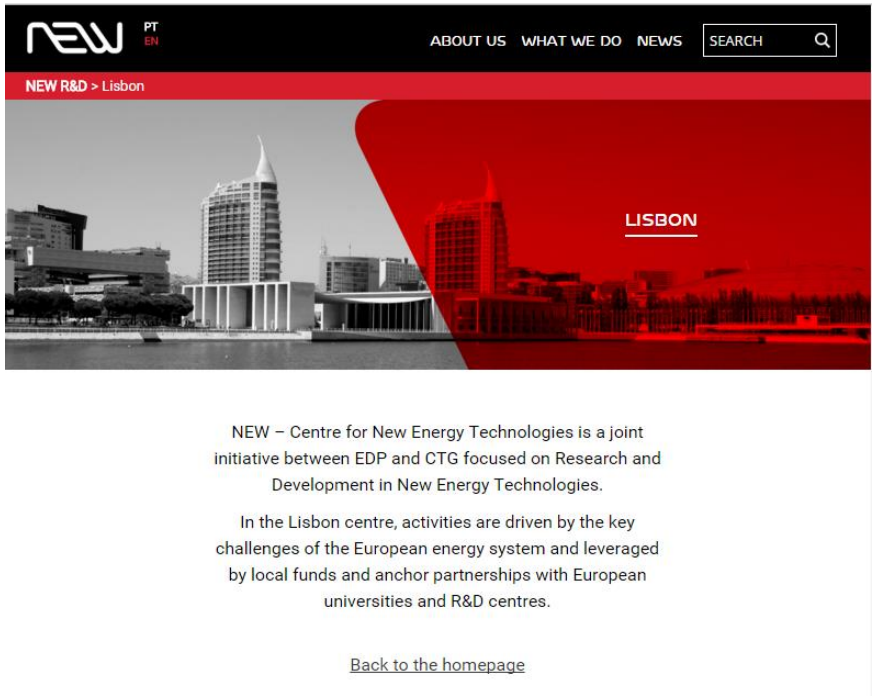
BestRES

EDP has created a vehicle (EDP NEW R&D) to conduct R&D in the energy sector leveraging on competitive funding

NEW R&D – Centre for New Energy Technologies

Lisbon

- A corporate **applied R&D Centre** incorporated in Dec. 2014
- Mainly funded by **H2020** and other competitive funding for R&D
- **10 projects:**
  - **150+ top tier partners** (Industry, Academia, Technology)
  - Global budget of **138 M€**
  - EDP Budget of **20 M€**
  - EDP staff allocated **34 FTE**
- **4 priority areas:**
  - Energy storage and energy management
  - Smart grids and digitalization
  - Flexibility in Energy systems
  - Renewable Energy



BestRES

EDP’s case study in BestRES project

Activation of customers flexibility for retailer’s value

Although there are some technical, market and regulatory barriers in Portugal, EDP is investigating the feasibility of demand response schemes in BestRES project

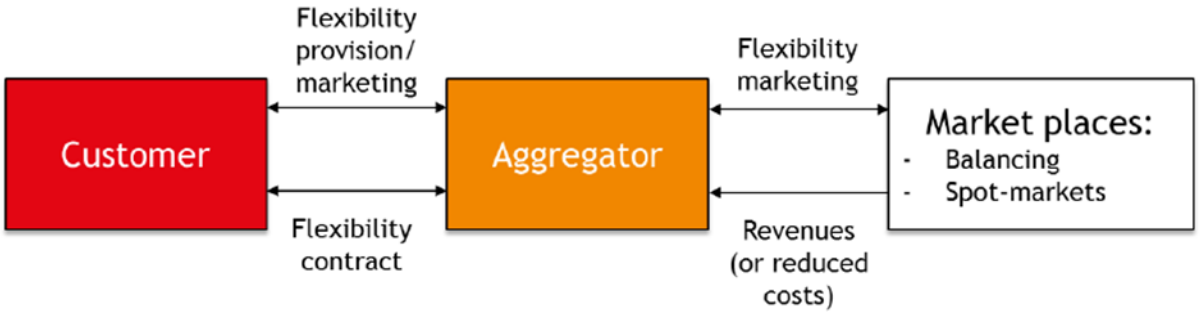
1. Currently, there is no regulatory framework for demand response aggregators
2. Real time consumption data and the required infrastructure to implement DR are very limited
3. Energy markets with limited options for aggregators:

Wholesale market	• Mibel prices are quite stable since negative prices are not allowed and there is a capped price of 180,3 Eur/MWh • Trading volumes start on 0.1 MWh (minimum) for the organized market
Ancillary Services	• Demand Response does not have access to ancillary services due to strict rules
Interruptible Contracts	• The interruptible service does not allow aggregation and is tailored for large industrial consumers • TSO service
Distribution Network Services	• There are no Demand Response programs, nevertheless several pilot projects have been implemented to validate the concept

BestRES

In the scope of BestRES, EDP has chosen to focus on the supplying activities where clients' flexibility will be valued at the wholesale market and for minimization of deviations costs

- EDP's business model is marketing the clients flexibility in addition to suppling the customers with electricity



Target clients	Goals	Aggregator benefits	Clients remuneration
• Big consumers such industrial clients and service buildings	• Optimal participation in the wholesale market • Minimization of deviations	• Portfolio optimization • Closer relationship between retailer and customer promoting customer' loyalty	• Energy cost reduction • Compensation for the activated flexibility • Savings sharing

Validation of EDP’s BM

Our case study has been validated through two different approaches: simulations and demo pilot in Lisbon

E.g. Office building demo in Lisbon

Pilot project conduced by EDP Comercial (EDP's retailer) tailored to office buildings whose goals are:

- Optimise clients energy demand
- Activate flexibility from HVAC systems
- Proof of concept of a BM based on buildings' thermal inertia

Simulations performed by TUW

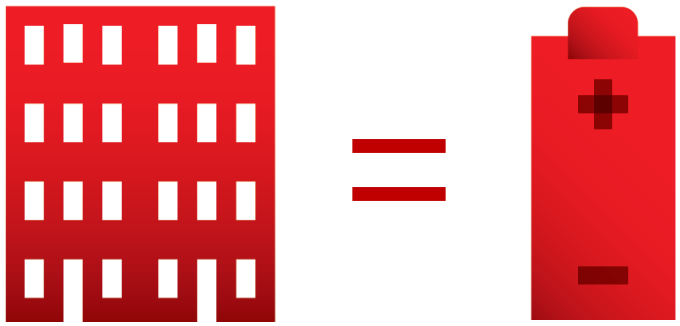
Model to determine the optimal dispatch of flexibility options of different load profiles aiming at

- Day-ahead sourcing optimization
- Deviations minimization

Validation of EDP’s BM

1. Office building demo in Lisbon

EDPC is investigating the HVAC systems of services buildings as flexibility providers



- Determine the thermal inertia of the building at each time
- Calculate the available flexibility, ensuring the thermal comfort
- **Create new revenues streams**

Monitoring and control infrastructure:

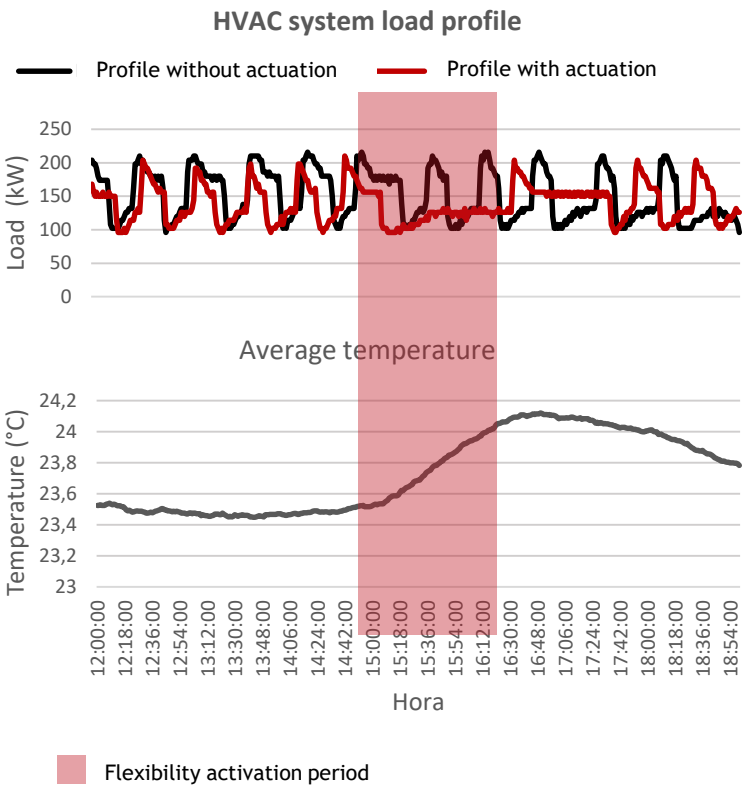
- 173 temperature measurement and control points spread over the 7-story building
- Local sensors for monitoring the building's total energy consumption and HVAC energy consumption (2 chillers)
- The total estimated CapEx of the system was 3000€/building. Viable costs consist of the cost of load shifting whenever the flexibility is activated at client's site

Preliminary results show the existence of flexibility from HVAC system without real impact on occupants' thermal comfort

- Thermal model inputs are indoor temperature, weather data (temperature, humidity, wind speed, sunrise and sunset time, etc.) and the day of the week

- Flexibility forecast model comprises several steps:
  - Modelling and prediction of the electric load of the chiller
  - Experimental analysis to estimate the flexibility available under different conditions (e.g. time of day…) as a percentage of the load of the chiller
  - Combine the two points above to estimate the flexibility available in the future

- Preliminary results
  - Building consumption: 1.392,6 MWh
  - HVAC system consumption: 416,4 MWh
  - During the test periods, heating rate ranges between 0,15 and 0,3º C/ hour



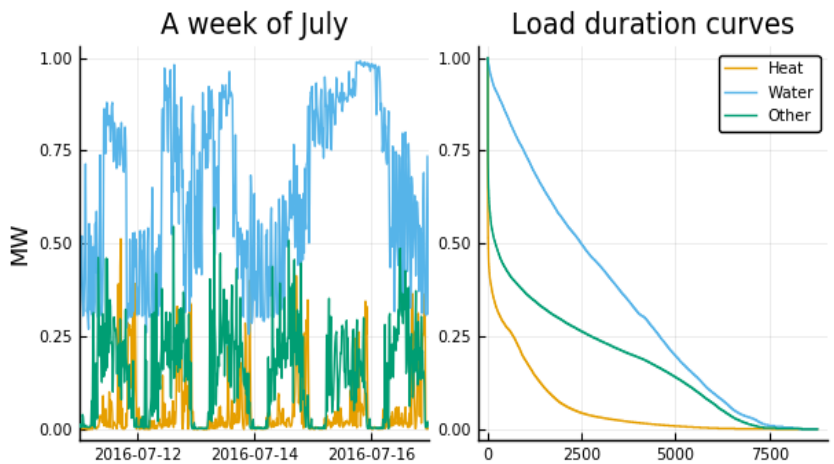
BestRES

Validation of EDP's BM

2. Optimal dispatch model of flexibility

Simulations considered three different customers, three flexibility profiles and three scenarios

Customer loads: Heat, Water and Other



Flexibility activation profiles

Flex1
- Maximal relative load change of ±10% for each time step.
- Flexibility activations must not change the total daily consumption.

Flex2
- Maximal two load changes for each 15 minutes per day
- Flexibility activations must not change the total daily consumption.

Flex3
- Maximal load change of ±0.1 MW.
- Maximal 3 load changes/day for each at most 2 hours
- Flexibility activations must not change the total weekly consumption.

Scenarios

*Market data from Mibel

Spot: The flexibility is used exclusively to reduce electricity purchase cost from the day-ahead spot market.

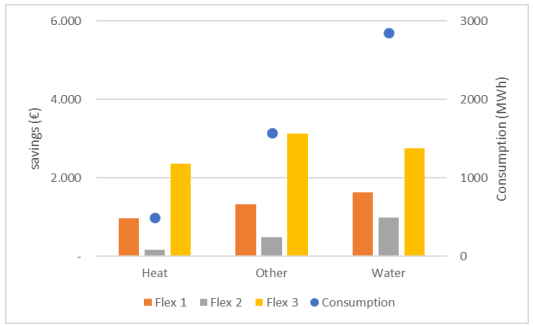
Imbalance: Available flexibility is used to reduce the deviation of EDP's portfolio.

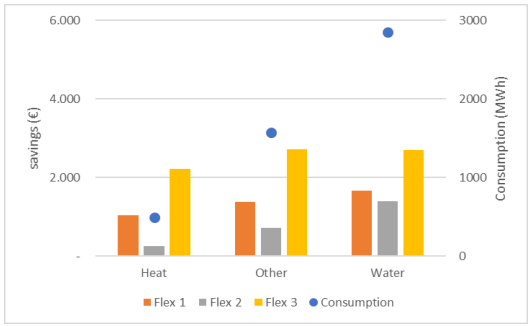
Optimal - Theoretical optimum: The model chooses the optimal marketplace for the flexibilities, depending on which option provides more cost reduction. It's and unrealistic scenario because imbalance prices are only settled after reserve market activations.

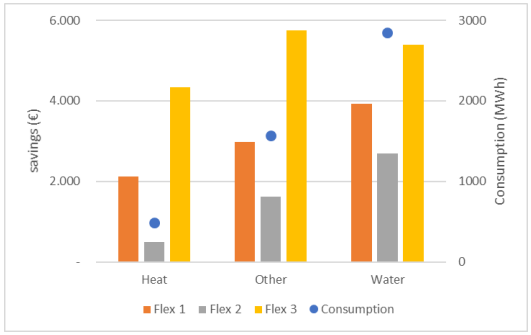
Savings strongly depend on the load profile and flexibility pattern. Flexibility activations lead to similar savings for spot and deviation scenarios

Spot scenario | Deviations scenario | Optimal scenario

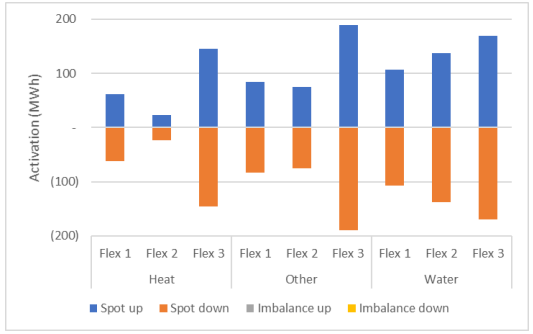
Savings

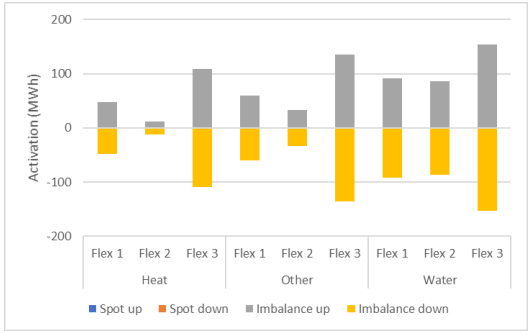


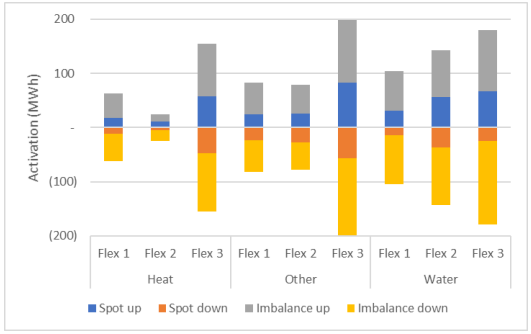




Flex. Activations







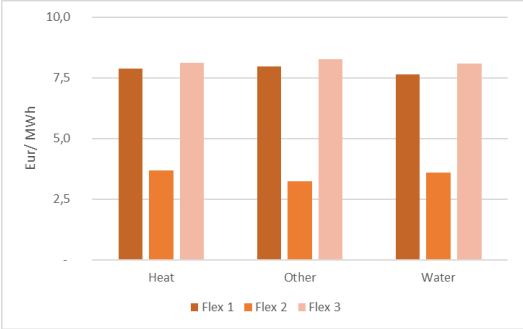
- Unsurprisingly, the optimal scenario delivers the best results.
- Smaller volumes of flexibility are required in the deviation Scenario to ensure similar savings than in Spot scenario.

BestRES

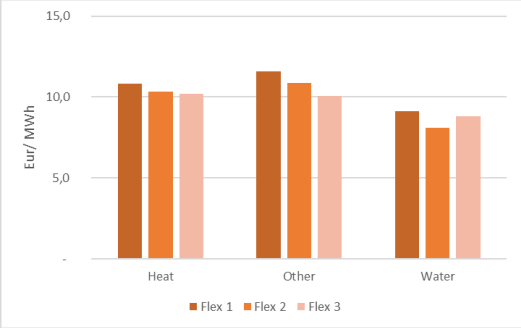
Flexibility valorisation is between 3 Eur/MWh and 12 Eur/MWh and it is used more efficiently in Deviation scenario than in Spot Scenario. In the Optimal scenarios, this value can reach 19 Eur/MWh.

Flexibility valorisation

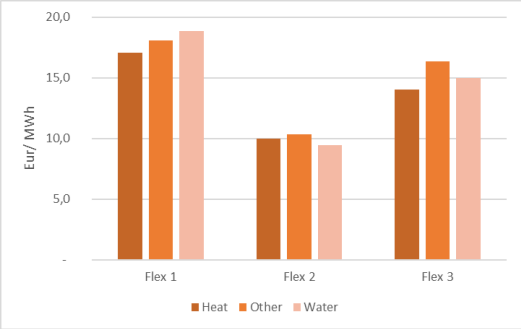
Spot scenario



Deviations scenario



Optimal scenario



These results could give us hints about how to compensate the clients for being flexibility providers, for instance:

- Sharing the savings with clients. But which percentage retailers are willing to share with clients?
- Remunerate clients for each flexibility activation. But how much per activated kWh?

Despite the market condition in Portugal, demand response BM are economic feasible for some of the analysed profiles delivering an attractive IRR/WACC

- Three scenarios were investigated:
  - Pay nothing to our clients
  - Pay 2,5 eur/MWh of activated flexibility
  - Sharing 50% of savings with clients
- Results of Spot and Deviation scenarios are similar and indicate that for several profiles the BM is feasible
- EDPC could benefit from economies of scale when this BM is implemented in a wide range of clients
- Notice, however, that Capex may change according to clients' characteristics and segments

Spot scenario

Capex = 3000€

	Flex	Pay nothing	2,5 Eur/MWh	50% savings
Heat	1	✓	X	X
	2	X	X	X
	3	✓	✓	✓
Other	1	✓	✓	X
	2	X	X	X
	3	✓	✓	✓
Water	1	✓	✓	✓
	2	✓	X	X
	3	✓	✓	✓

Capex = 2000€

	Flex	Pay nothing	2,5 Eur/MWh	50% savings
Heat	1	✓	✓	X
	2	X	X	X
	3	✓	✓	✓
Other	1	✓	✓	✓
	2	X	X	X
	3	✓	✓	✓
Water	1	✓	✓	✓
	2	✓	X	X
	3	✓	✓	✓

Conclusions and next steps

Conclusions and next steps

- There are some technical, market and regulatory barriers in Portugal for demand response aggregators
- From the economics' point of view, the results of BestRES project enable the implementation of these BMs for several clients
- EDP is working on R&D projects to conclude about its technical and economical feasibility as well as to review the regulatory framework
  - EDPC intends to develop its first product for flexibility management
  - Include emergency generators in EDPC product
- ERSE has launched a public consultation about the rules of a pilot project addressing the demand side participation in reserve market, which might pave the way for more attractive DSM markets in Portugal

Thank you!

Gisela Mendes, EDP CNET
gisela.mendes@edp.pt
rd-new.com