



European
Workshops on
Demand Response
2024



DR4EU
DEMAND RESPONSE FOR EUROPE

Demand Response in Portugal

State of play, evolutions and perspectives

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FURTADO LOPES**



When?

1st March 2024

11:00 - 11:55 CET

(10:00 am Lisbon time)

On-line

*55 min to be
Fit for 55!*

Agenda



- Adriana GUTH, DG ENER
 - José CAPELO
 - Pedro PEREIRA
 - João RAFAEL
- Jorge MENDONÇA e COSTA
 - Diogo FURTADO LOPES



Q&A + questions on-going => in the chat box please



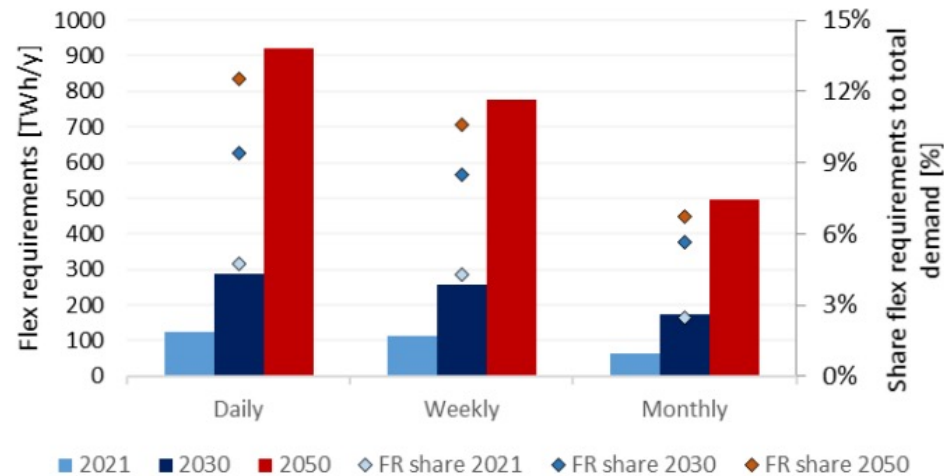
Demand Response – EMD reform and the implementation of the Clean Energy Package

DR4EU Workshop

01 March 2024

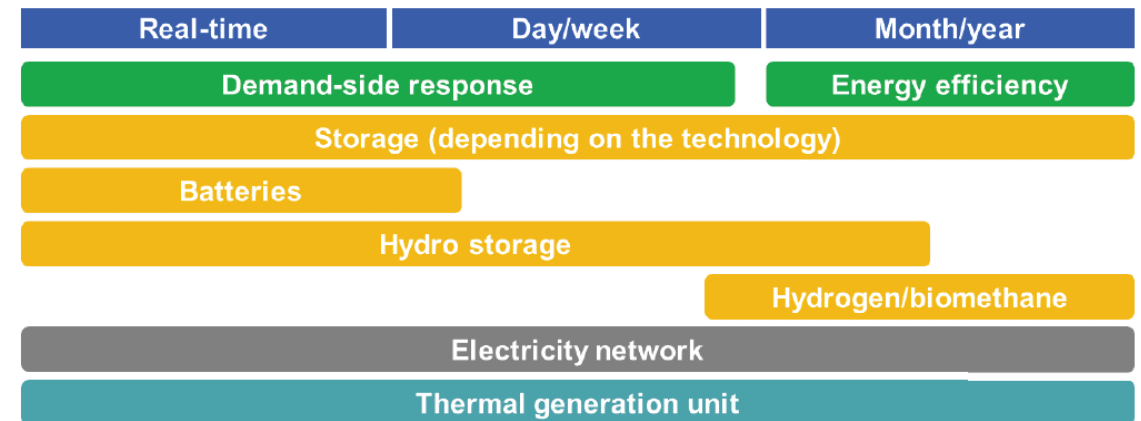
*European Commission – DG Energy
Internal Energy Market*

Flexibility needs are increasing



Increase of flexibility needs, source: JRC

Figure 18: Flexibility services provided by various technologies



Source: ACER.

Note: The list of technologies is non-exhaustive (with e.g. the storage category covering several different technologies). As mentioned, coupling electricity with other energy sectors (sector integration) may provide significant flexibility services.

The EU electricity system will require more than twice (2.4) the current quantify of flexibility resources by 2030. This increase applies for daily, weekly and monthly flexibility, to be provided by different flexibility sources.

First, implementation of Clean Energy Package

- **Non-discriminatory access** of demand response to **all electricity markets**, either directly or through aggregation (Art. 17)
- Full recognition of (independent) **aggregators** as market participants (Art. 17)
- Customer entitlement to contract with **independent aggregator** of their choice, without need for consent or prior agreement of their supplier (Art. 13)
- **Strict limits to compensation payments** (Art 17(4))
- **Use of flexibility services** by system operators, in particular from distribution networks, for flexibility services including congestion management (Art. 32)

Complement the existing framework with rules on Demand Response

→ Address remaining regulatory barriers for the development of demand side flexibility and other flexibility resources in the electricity market.

- New **network code on demand response**, including rules on aggregation, energy storage and demand curtailment based on Art. 59(1) Electricity Regulation.
- Draft to be submitted by ENTSO-E and EU DSO Entity by May 2024. ACER will conduct a public consultation and finalize it by the end of this year for submission to European Commission.
- Current draft covers in particular:
 - Market access (aggregation models, baseline, settlement)
 - Prequalification and process to engage in the market
 - Market design for congestion management and voltage control
 - TSO-DSO coordination, data exchange

Looking forward: The reform of the electricity market design

→ **Boost non-fossil flexibility to accelerate RES, impact positively the prices, reduce dependency from fossils and provide system/grid services.**

- **Assessment of flexibility needs** at member state level:
 - Based on an EU methodology
 - ACER analysis at EU level and recommendations of cross-border relevance, including on removing barriers
- **Indicative national objective for non-fossil flexibility**, including specific contributions of both demand response and energy storage
- **Non-fossil flexibility support scheme**
- **Enhance the use of flexibility services by system operators:**
 - Network tariffs to incentivize the use of flexibility services
 - Possibility to use data from dedicated metering devices

Demand Response in Portugal

State of play, evolutions and perspectives

José Capelo

Portuguese Energy Services Regulatory Authority

1.3.2024

Portuguese Legal framework

The **Decree-Law n.º 15/2022**, of 14 January, establishes the organization and operation of the National Electricity System, transposing Directive (EU) 2019/944 and Directive (EU) 2018/2001. It provides the framework for **the Networks Operation Code (ROR)**, which is approved by ERSE, establishing, among others:

- The conditions for managing electricity flows in the networks, including procuring and activating flexibility resources, in accordance with the European network codes and ensuring their interoperability
- The conditions for the technical verification of network operation and for ensuring the real-time demand-generation equilibrium through **procurement and activation of balancing services**
- The rules for calculating and billing system imbalance costs
- The conditions by which the global system manager monitors the availability of the power plants and network elements, promoting the coordination of the planned outages.

ROR was approved by **Regulation n.º 816/2023**, of 27 July, following Public Consultation n.º 113.

ROR foresees the **Manual of Procedures for the Global Management of the Electric Sector System (MPGGS)**, approved by **Directive n.º 19/2023**, of 26 December, under revision



Pilot Project for Demand Participation in the Regulation Reserve Market

The Pilot Project, which started on April 2, 2019 and lasted for **1 year**, aimed to ensure **equal treatment** in the participation of **qualified consumers**, or their representatives, in the **regulation reserve market**.

Consumers qualified by the Transmission System Operator (TSO) who have a demand capacity equal to or greater than **1 MW** could participate in the Pilot Project, obtained the necessary authorization from the TSO that proves **the technical and operational capacity** to provide the regulation reserve, and are connected to the grid at a voltage level **equal to or greater than medium voltage**.

On December 28, 2018, ERSE approved **Directive n.º 4/2019**, of January 15, defining the **rules of the Pilot Project** for the participation of demand in the regulation reserve market.

Directive n.º 20 April, approved that the rules established by Directive n.º 4/2019 and, the parties willing, the respective contracts, continue to apply.

On 30 July 2020, ERSE approved the **Operational Report of the Pilot Project**, during its execution phase, which includes the Report prepared by **REN** and the Contributions of the **agents directly involved**.

On 27 July 2023, the **ROR was approved** incorporating the rules that allow demand to participate in the ancillary services markets on a **regular and permanent basis**.

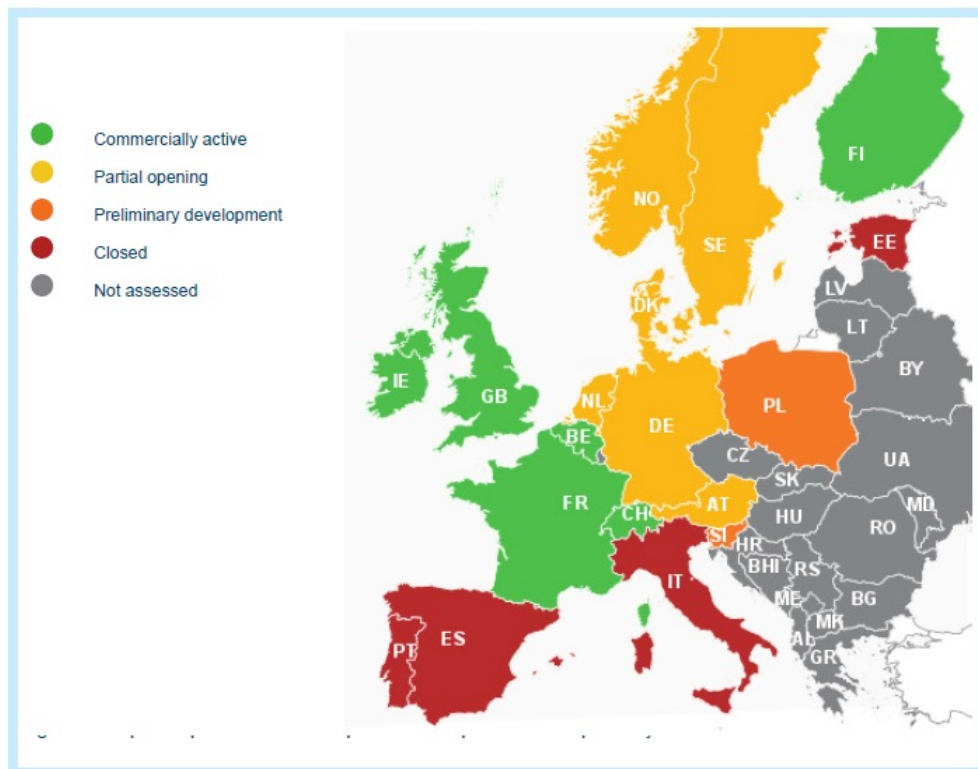
Motivation

Consumer participation in the ancillary services market is an issue that has been raised by consumers or their representatives in meetings with ERSE.

The possibility for consumers to participate in all components of the electricity market, which includes all aspects of the ancillary services market, is provided for in European regulations and contributes to competition, security of supply and the sustainability of the electricity system.

As part of the 2017 regulatory review, the Network Operation Code was amended explicitly allowing the participation of demand in the ancillary services market on an equal condition with generation.

Given that neither electricity network operators nor consumers have any experience, it was decided to start by developing a pilot project for consumer participation in the system services market that would allow "learning by doing".





Cooperation - Meetings and public consultation

Active participation of all parties involved:

1 to 31.10.2018 – 67th public consultation of ERSE

15.10.2018 – Meeting with ERSE's Advisory Board

18.10.2018 – Meeting with REN, the Portuguese TSO

23.10.2018 – Meeting with APIGCEE, the Portuguese Association of Industrial Large Consumers of Electric Energy

30.11.2018 – Meeting with the suppliers

13.12.2018 – Meeting with the main actors in the pilot project

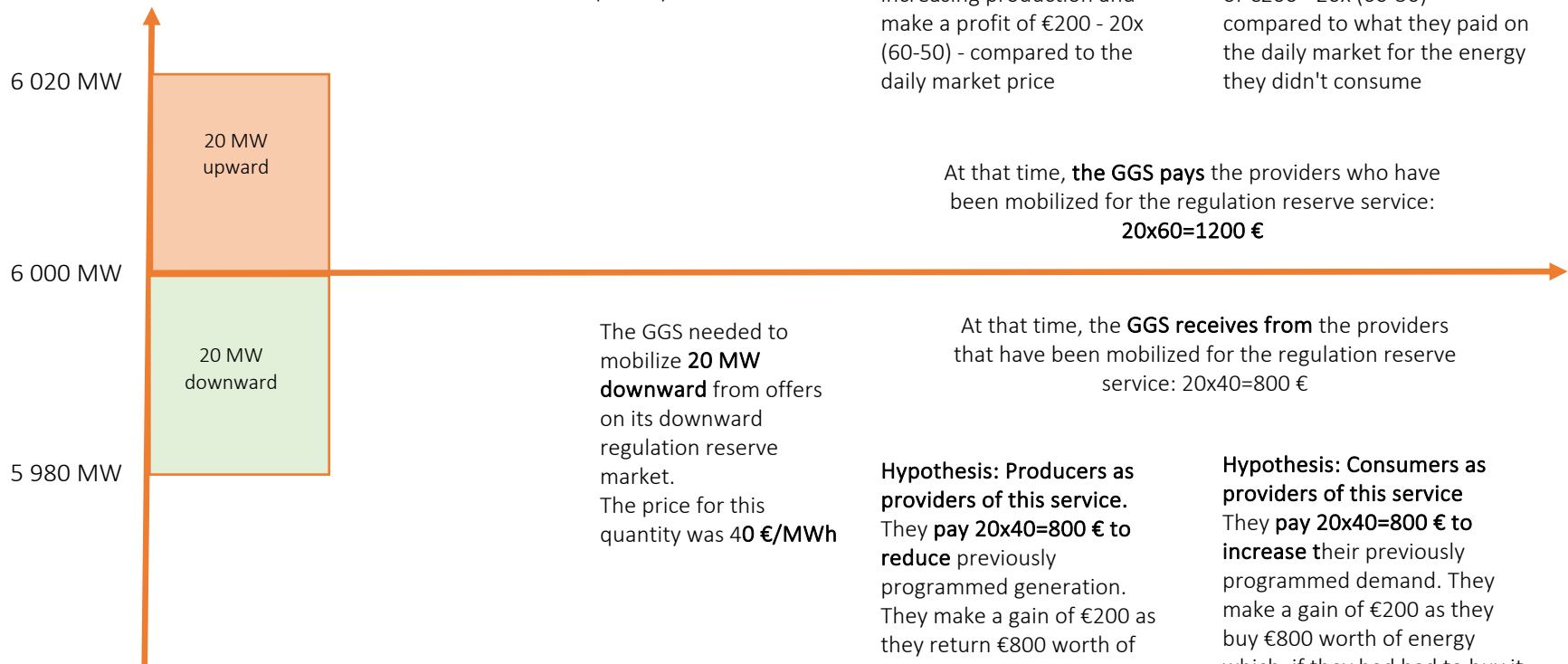
28.12.2018 – Approval of Directive 4/2019 defining the rules of the Pilot Project for the participation of demand in the regulation reserve market.

15.1.2019 – Publication of Directive 4/2019

Demand response in Portugal – main aspects of the process



Before the regulation reserve market, the following were negotiated for that hour
 Generation=demand: 6 000 MW Daily market price: **50 €/MWh**



The GGS needed to mobilize **20 MW upward** from offers on its regulation reserve market.
 The price for this quantity was **60 €/MWh**

Hypothesis: Producers as providers of this service
 They **receive** $20 \times 60 = 1200 \text{ €}$ to **increase** previously programmed production. They cover the costs of increasing production and make a profit of $\text{€}200 - 20 \times (60 - 50)$ - compared to the daily market price

Hypothesis: Consumers as providers of this service
 They **receive** $20 \times 60 = 1200 \text{ €}$ to **reduce** their previously programmed demand. They stop working, but make a gain of $\text{€}200 - 20 \times (60 - 50)$ - compared to what they paid on the daily market for the energy they didn't consume

At that time, **the GGS pays** the providers who have been mobilized for the regulation reserve service:
 $20 \times 60 = 1200 \text{ €}$

The GGS needed to mobilize **20 MW downward** from offers on its downward regulation reserve market.
 The price for this quantity was **40 €/MWh**

At that time, **the GGS receives from** the providers that have been mobilized for the regulation reserve service: $20 \times 40 = 800 \text{ €}$

Hypothesis: Producers as providers of this service.
 They **pay** $20 \times 40 = 800 \text{ €}$ to **reduce** previously programmed generation. They make a gain of $\text{€}200$ as they return $\text{€}800$ worth of energy that they didn't produce and had sold for $50 \times 20 = 1000 \text{ €}$ on the daily market

Hypothesis: Consumers as providers of this service
 They **pay** $20 \times 40 = 800 \text{ €}$ to **increase** their previously programmed demand. They make a gain of $\text{€}200$ as they buy $\text{€}800$ worth of energy which, if they had had to buy it on the daily market, would have cost $\text{€}50 \times 20 = \text{€}1000$

Demand response in Portugal – main aspects of the process

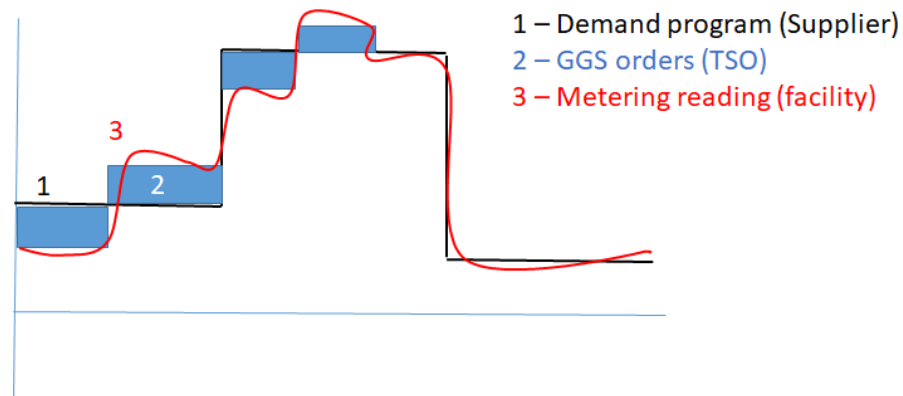


Business volume in 2023

National demand (MWh)	50 729 000		
Daily Market Price (€/MWh)	87,72		
Energy regulation upwards (MWh)	1 215 000	2,40	% National demand
Price (€/MWh)	111,20	126,8	% Daily Market Price
Business volume upwards reserve (€)	135 108 000		
Energy regulation downwards (MWh)	1 752 000	3,45	% National demand
Price (€/MWh)	47,54	54,2	% Daily Market Price
Business volume downwards reserve (€)	83 290 080		
Total energy mobilised (MWh)	2 967 000	5,85	% National demand
Business volume (€)	218 398 080		

Daily programme, tariffs and readings

Participants: Consumer installations or traders representing a specific consumer installation
Constant hourly product until the end of the hour, only mobilisable up to 15 minutes before the hour



Knowing that Reading = Programme + GGS Orders + Imbalances $\Leftrightarrow R=P+O+I$,

Energy billing (E): $E = R - O$

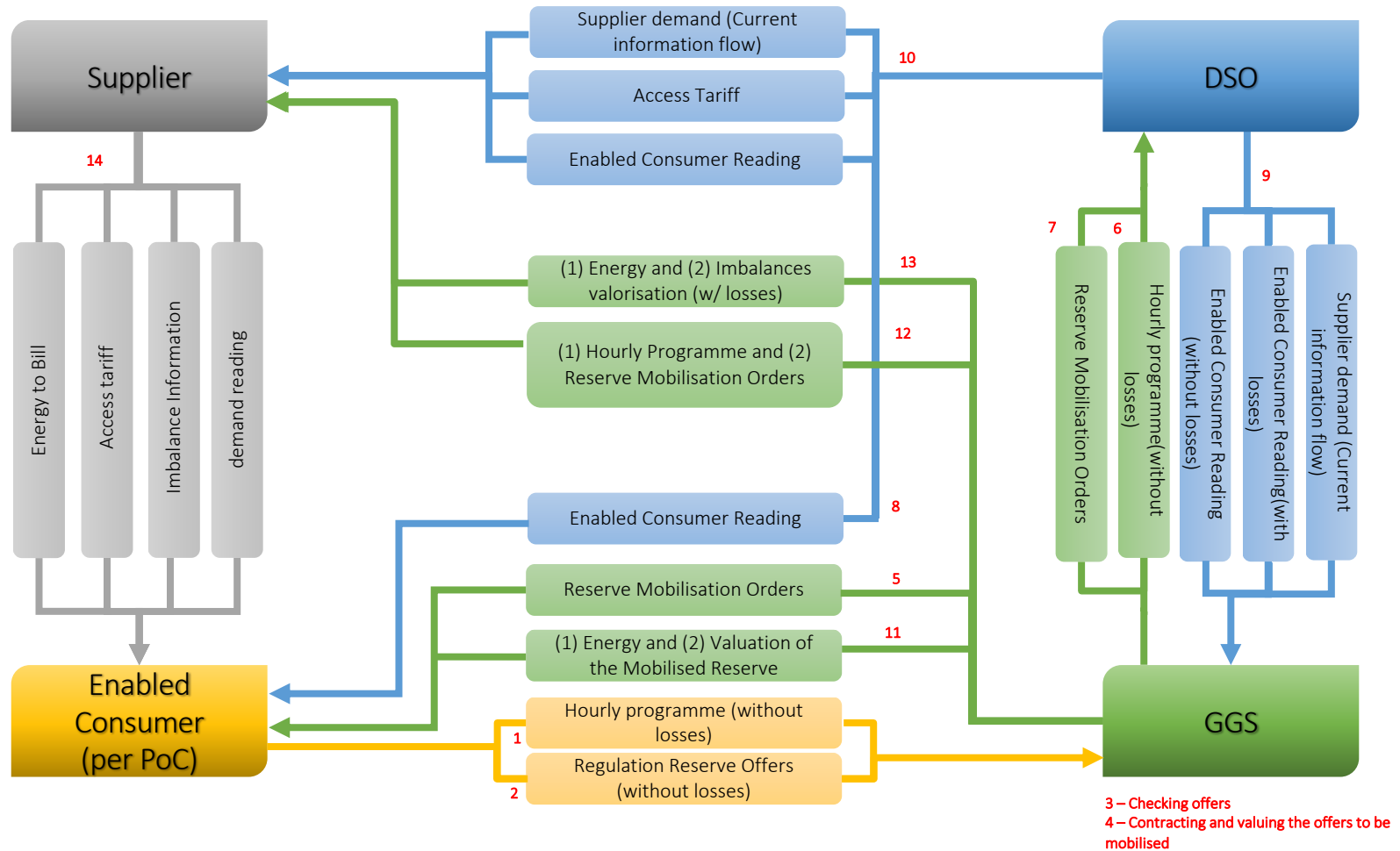
The meter reading is adjusted from the GGS mobilization orders

Demand facility's contribution to Portfolio Imbalances: Assumption that GGS orders are fully complied with

GGs mobilization orders are not subject to access tariffs

GGs orders are not adjusted for losses

Information flows





Directive n.º 4/2019, of January 15

Theme	Rule
Pre-qualification	1 MW, technical qualification, MV or higher
Delivery period	1 hour
Aggregation	Not allowed
Network access tariff	Downwards activation (increase in demand) not subject to payment of network access charges
Adjustment for losses	Not applicable
Imbalances	Orders fully complied with
Settlement and invoicing	Provisions of the MPGGS
Penalties for non-compliance	Not applicable
Information flows	Specifies the obligations of each entity



ERSE Report

On 30 July 2020, ERSE approved the **Operational Report of the Pilot Project**, during its execution phase, which includes the Report prepared by **REN** and the Contributions of the **agents directly involved**.



PROJETO-PILOTO DE PARTICIPAÇÃO DO CONSUMO NO
MERCADO DE RESERVA DE REGULAÇÃO

RELATÓRIO PREVISTO NO ARTIGO 16.º
DA DIRETIVA N.º 4/2019

Julho 2020

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Demand response in Portugal – Characteristic data



Participating agents and business volume

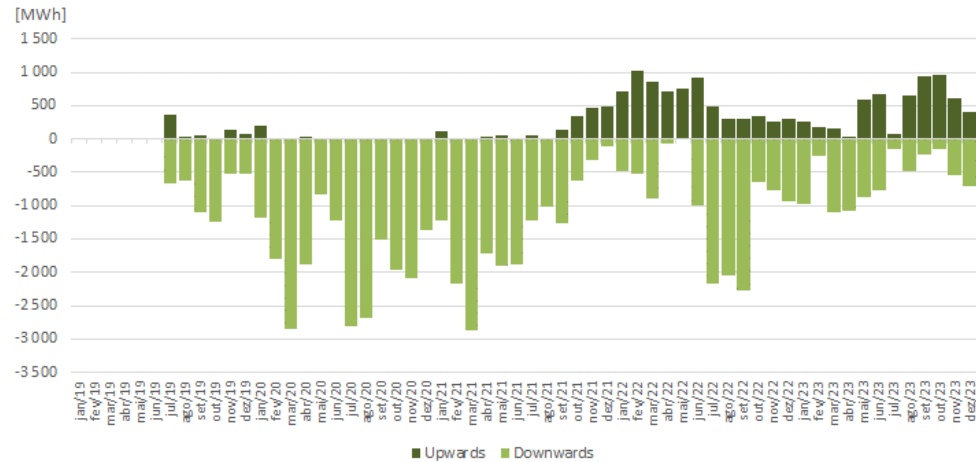
MWh	2019 2nd semester	2020	2021	2022	2023
Pilot Project					
Active agents	4	9	11	23	27
Mobilizations	1 757	5 776	3 896	5 161	3 263
MWh upwards	680	259	1 702	6 992	5 546
MWh downwards	-4 693	-22 221	-16 262	-11 787	-7 313
MWh total	5 372	22 480	17 964	18 779	12 858
Business volume (€)	185 480	469 843	1 489 261	2 690 054	964 316
(%)	0,25%	0,91%	0,95%	1,12%	0,44%
Regulation reserve market					
Tertiary reserve upwards	693 000	707 000	619 000	521 000	1 215 000
Tertiary reserve downwards	1 096 000	1 151 000	1 000 000	1 240 000	1 752 000
Weighted average price upwards	60,20	38,96	127,26	196,92	111,20
Weighted average price downward	30,80	20,69	78,26	111,41	47,54
Average daily market price PT	47,87	33,99	112,01	167,89	87,72
Business volume (€)	75 475 400	51 358 910	157 033 940	240 743 720	218 398 080

Demand response in Portugal – Characteristic data

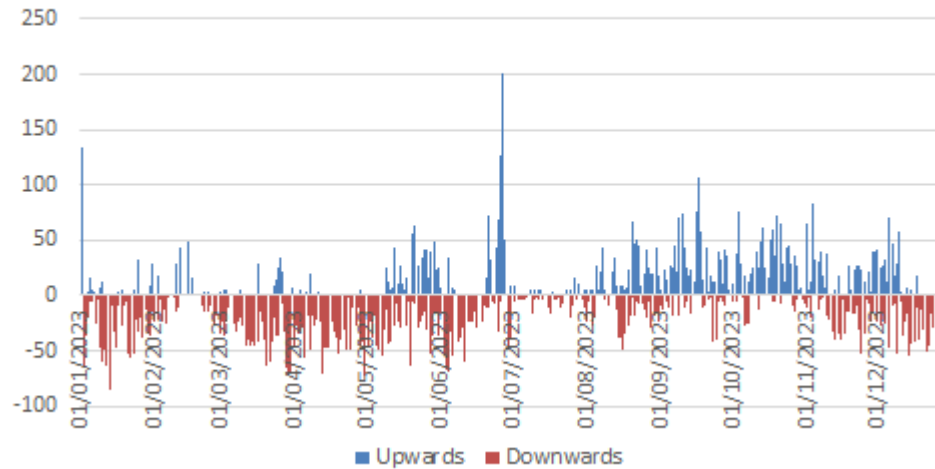


Energy and hourly mobilizations

Energy mobilized in the Pilot Project since 2019



Hourly mobilizations in 2023



Demand response in Portugal – The future at a glance



ROR was approved by Regulation no. [816/2023](#), of 27 July

The rules of Directive 4/2019 become part of the current regulatory framework (ROR, MPGGS)

Theme	Rule incorporated into the regulatory framework
Pre-qualification	MPGGS
Delivery period	MPGGS – 15 minutes (mFRR)
Agregation	MPGGS – Capacity \geq 1 MW
Adjustment for losses	ROR
Imbalances	MPGGS
Settlement and invoicing	MPGGS
Penalties for non-compliance	MPGGS – specific tolerance and penalties for demand
Information flows	MPGGS

Demand response in Portugal – The future at a glance

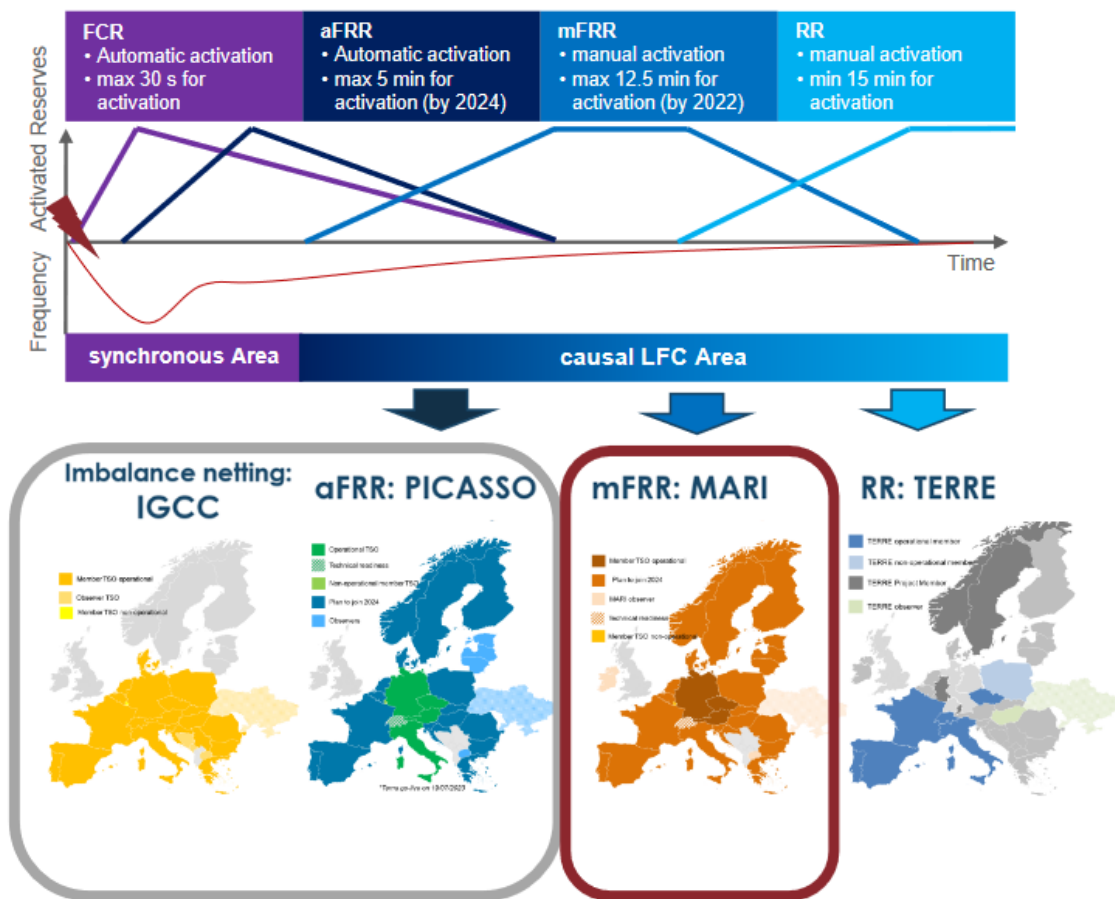


Old problems, new challenges

Old problems: system security and balancing, renewables integration, clean Energy Package targets

New challenges: aggregation, self-consumption, energy communities, EV, storage

New platforms for TSOs procurement of balancing needs



Platform	Date
IGCC	12.2020
aFRR PT PICASSO	
mFRR PT MARI	soon
TERRE	29.2.2020

Being part of the system, all players are called to contribute to new solutions for system security and management under ancillary services markets.

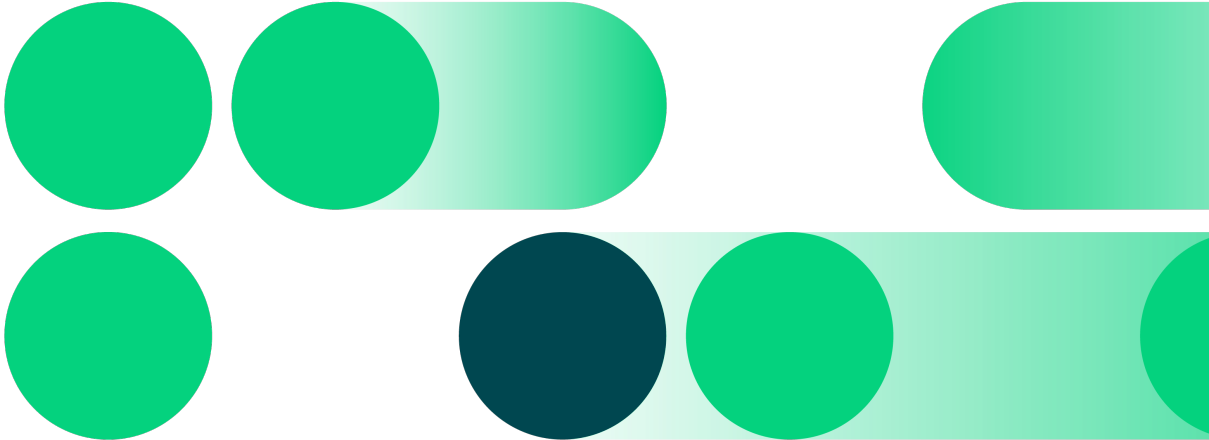


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Thank you!

José Capelo
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European workshop on Demand Response in Portugal



01/03/2024 – Online

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PILOT PROJECT FOR THE PARTICIPATION OF DEMAND FACILITIES

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BALANCING CAPACITY PRODUCTS

01

PILOT PROJECT FOR THE PARTICIPATION OF DEMAND FACILITIES

Pilot Project for the Participation of Demand Facilities

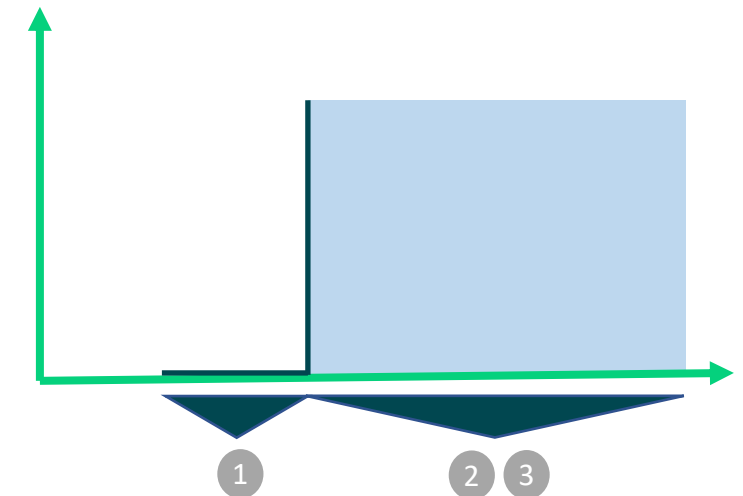
Regulatory
Framework

Manual de Procedimentos da Gestão Global do Sistema (MPGGS)

National Regulatory Agency Directive n.º 4/2019, of 15 of January, that approves the rules for the Pilot-Project for the participation of consumption facilities on the Reserva de Regulação Market

Pilot Project for the Participation of Demand Facilities

Main Features		
Mode of Activation		Manual
Activation Type		Scheduled
Full Activation Time	1	15 minutos
Minimum Quantity		1 MW
Maximum Quantity		Limited to the available power of the Facility
Minimum duration of the delivery period	2	60 minutes
Maximum duration of the delivery period	3	60 minutos
Location		Balancing Area =Physical Unit



Bids

Type of Bids:	Divisible Bids
Bid Granularity:	Minimum of 1MW and, afterwards, 0,1 MW
Price Resolution:	0,01 €/MWh

Pilot Project for the Participation of Demand Facilities



Downwards activations (increase in consumption) are not subject to grid access tariffs

Activations on the Balancing Market are not subject to grid losses

It is assumed that the activations are fulfilled by the Market Parties

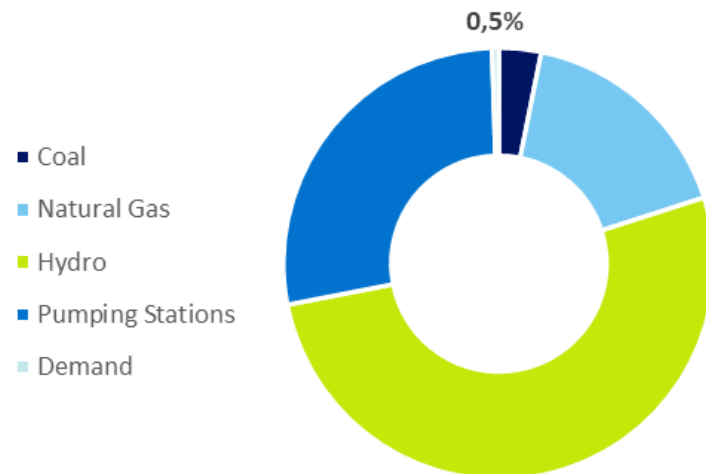
Exemption to install real time measurements equipment and communications

Pilot Project for the Participation of Demand Facilities

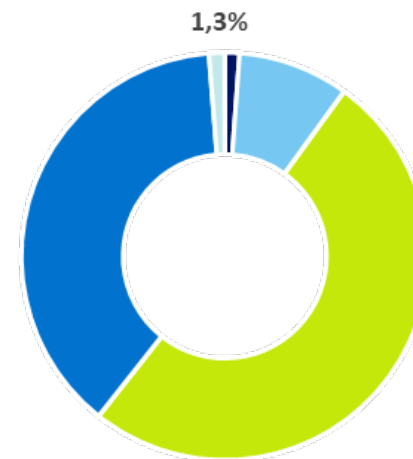
Energy	Upwards Regulation	
	[GWh]	[%]
Coal	94,3	3,2%
Natural Gas	503,7	16,9%
Hydro	1 548,0	51,9%
Pumping Stations	821,7	27,5%
Demand	15,2	0,5%
Total	2 983,0	

Energy	Downwards Regulation	
	[GWh]	[%]
Coal	57,9	1,2%
Natural Gas	439,7	8,8%
Hydro	2 523,0	50,7%
Pumping Stations	1 897,4	38,1%
Demand	62,3	1,3%
Total	4 980,3	

Contribution of the Demand to the Total of Upwards Regulation Ativations

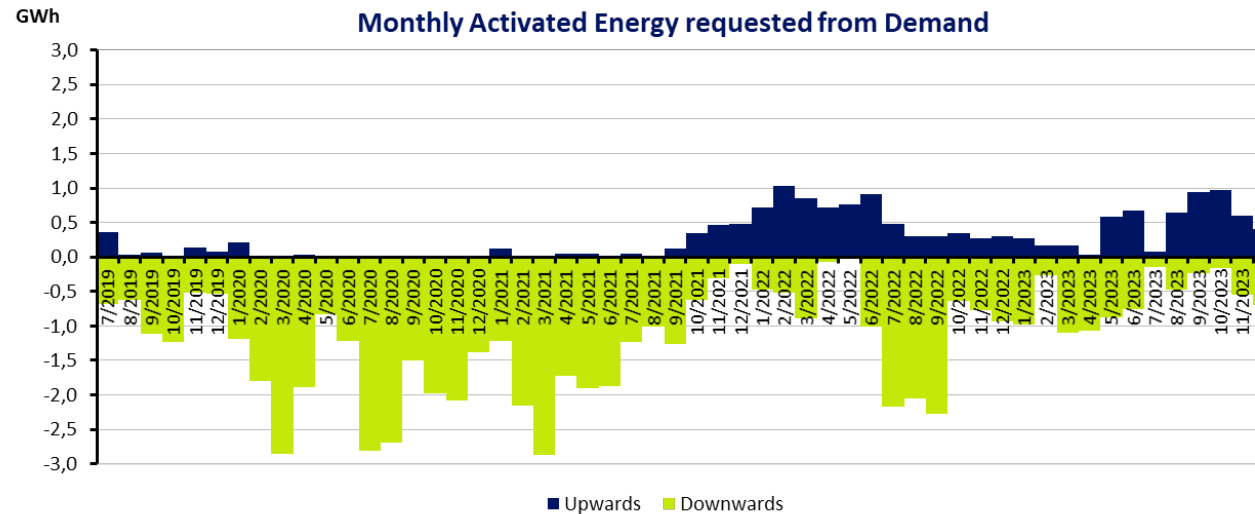
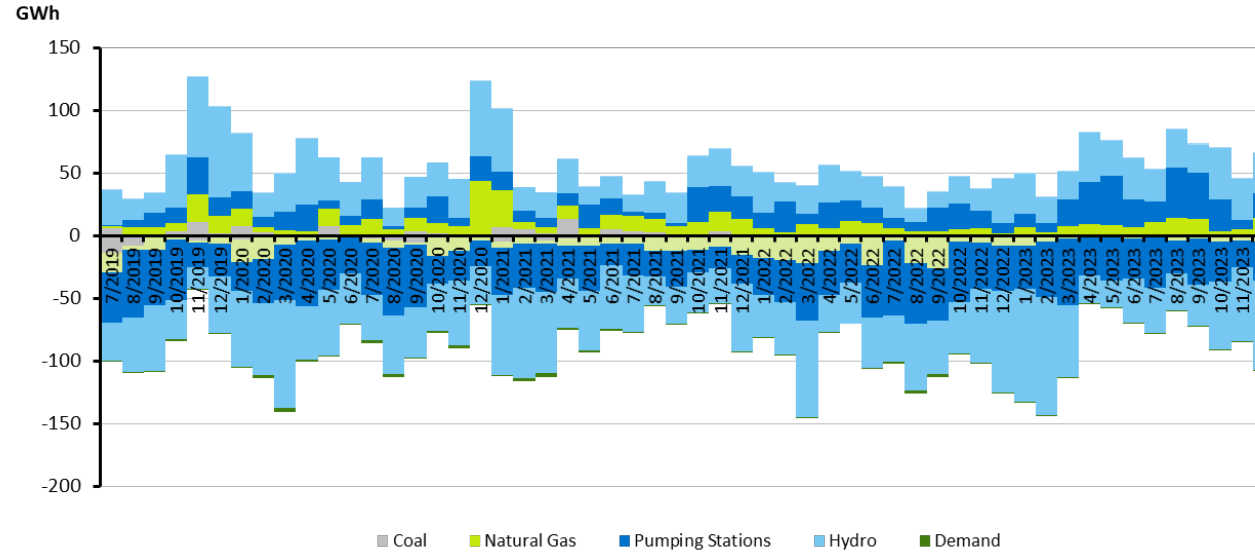


Contribution of the Demand to the Total of Downwards Regulation Ativations



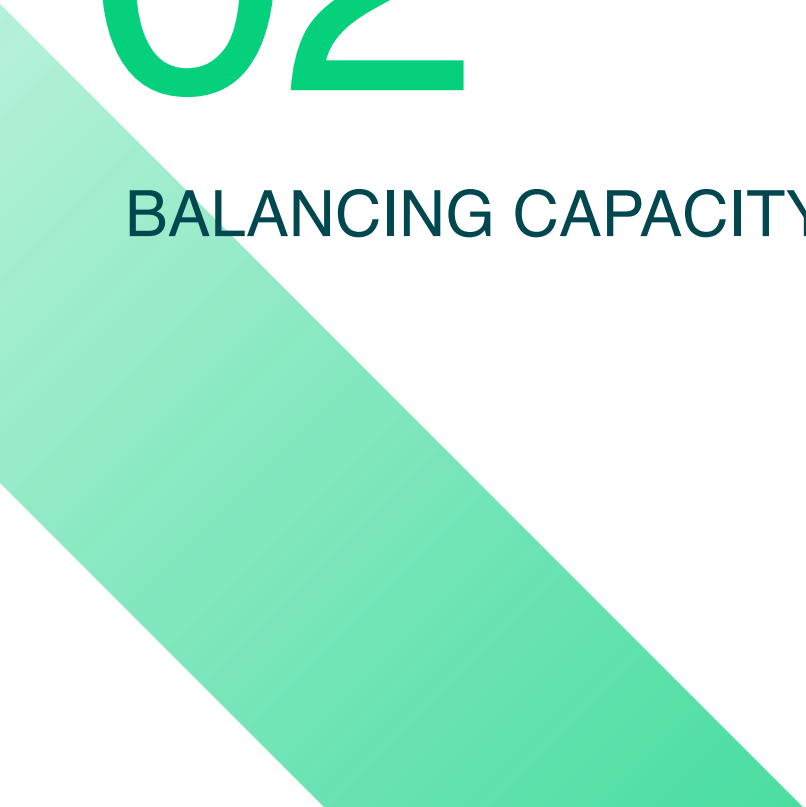
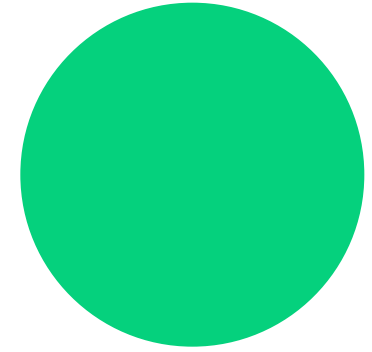


Pilot Project for the Participation of Demand Facilities

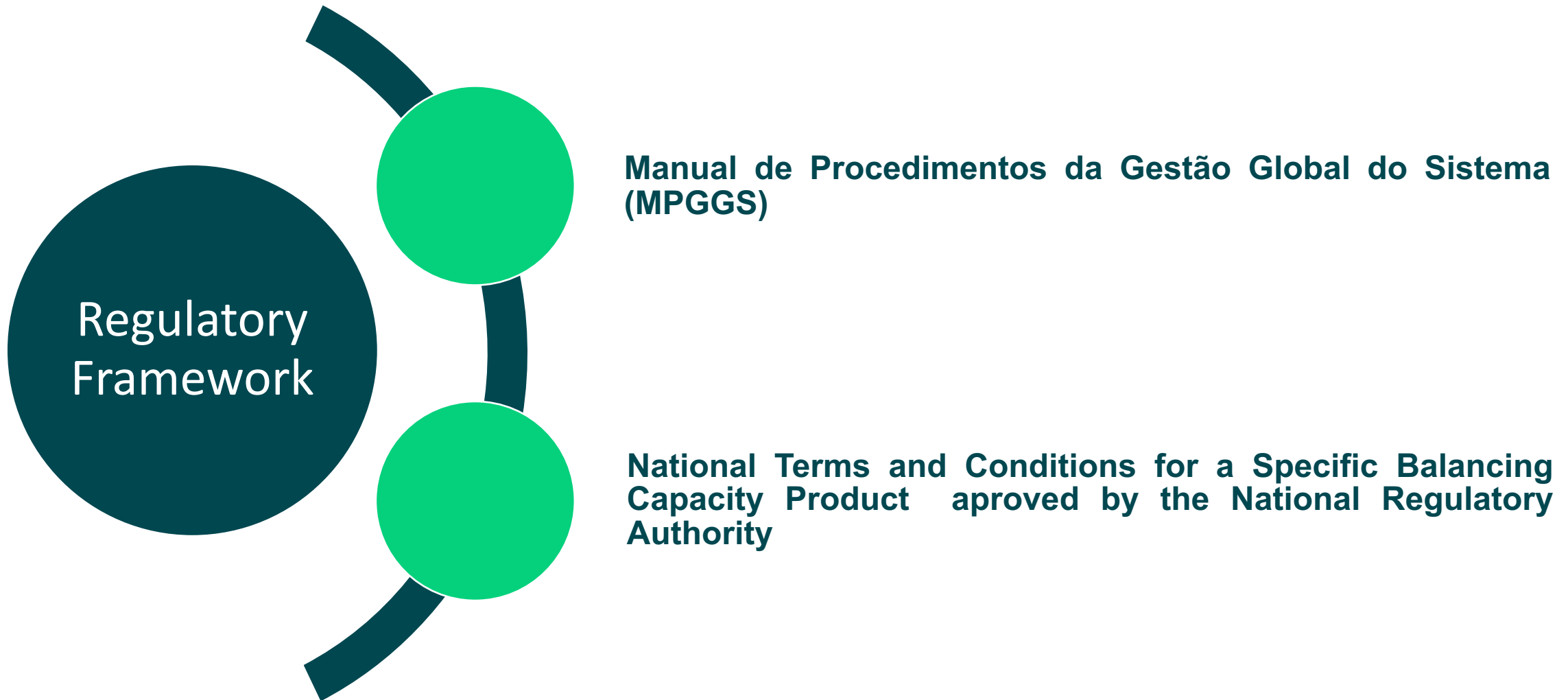


02

BALANCING CAPACITY PRODUCTS



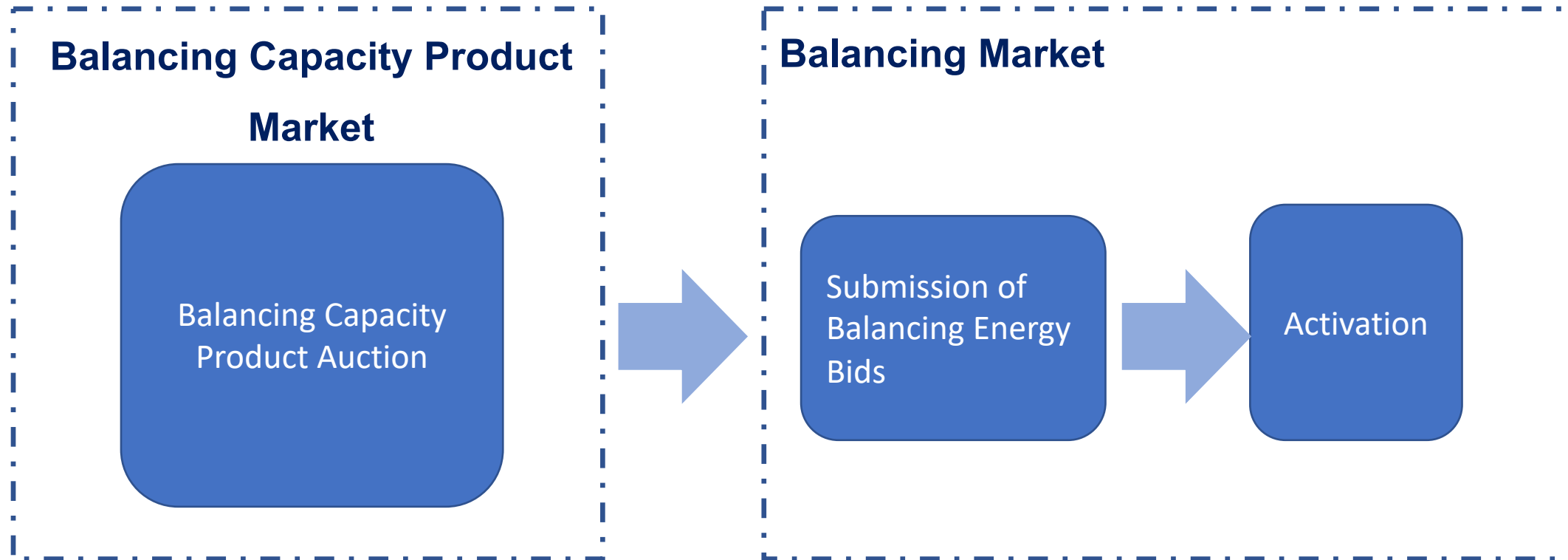
Balancing Capacity Products





Balancing Capacity Products

Balancing Capacity Product



Balancing Capacity Products

Balancing Capacity Product

Main Features		Reserva de Regulação Capacity Product (2022 -2023)	mFRR Schedule Capacity Product (2024 -...)
Product		Upwards Regulation Reserve	Upwards Regulation Reserve
Minimum Quantity		4 MW	1 MW
Maximum Quantity		Limited to the available power of the Facility	Limited to the available power of the Balancing Area
Location		Balancing Area = 1 Physical Unit	Balancing Area
Tecnologies		Consumers connected to VHV, HV and MV	Tecnology Neutral
Duration of the delivery period		Year	Year, Quarter & Month
Ativação		Reserva de Regulação	mFRR schedule



Balancing Capacity Products

Reserva de Regulação Capacity Product (2022-2023)

Maturity	Required (MW)	Allocated (MW)	# of Demand Facilities	Price (€/MW per hour)
2022	425	304,4	21	20
2023	800	316,9	23	44



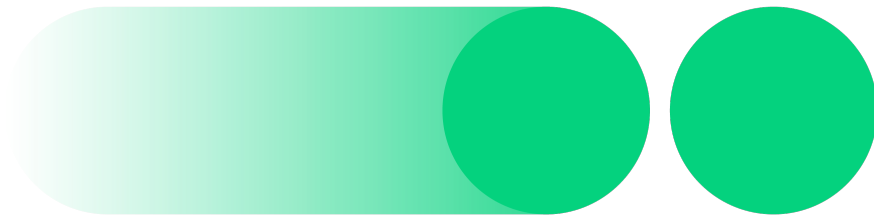
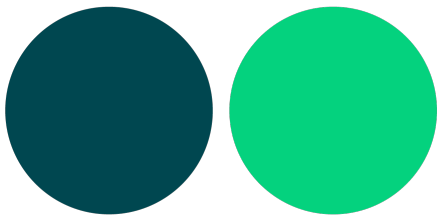
Balancing Capacity Products

mFRR Capacity Product

Maturity	Required (MW)	Allocated		Price (€/MW per hour)
		(MW)	# of Demand Facilities	
YR 2024	450	360,6	21	48
Q1 2024	200	25	3	44
Jan 2024	150	0	0	n.a.
Feb 2024	150	0	0	n.a.
Mar 2024	150	6	1	38



OBRIGADO
Thank you





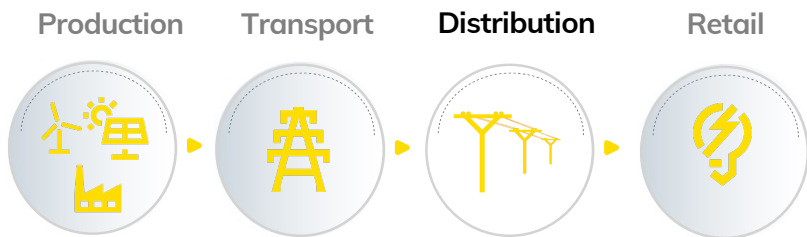
Demand Response in Portugal – DR4EU Workshop

State of play, evolutions and perspectives in E-REDES

João Rafael (Strategy and Regulation)

1 March 2024

E-REDES is Portugal's mainland DSO and ensures the supply of electricity with quality, safety and efficiency, in a context of great change associated with the energy transition



E-REDES activity in Portugal

 ~6,5 M

Customers connected to the Distribution Network


 **46 TWh**
Distributed Energy

 ~2.700
Employees

 ~7.400
ESP Employees

 ~235 k

Kms of Distribution Network

 **71 k**
Secondary Substations

 E-REDES

Integrated operation of the high, medium and low voltage distribution network in mainland Portugal:

- 1 HV/MV concession
- 278 municipal LV concessions

The acceleration of the energy transition has created additional pressure on distribution networks, and this is a transversal reality in the vast majority of European countries

CHALLENGES



Integration of **distributed generation**



Electrification of **demand**



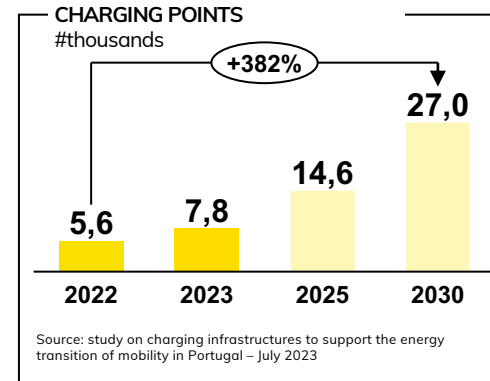
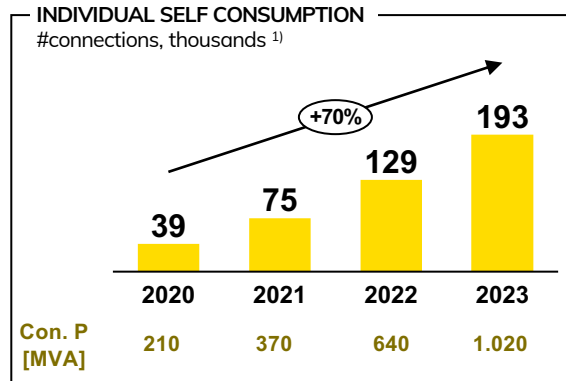
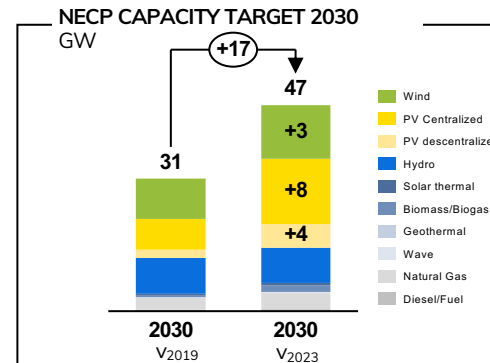
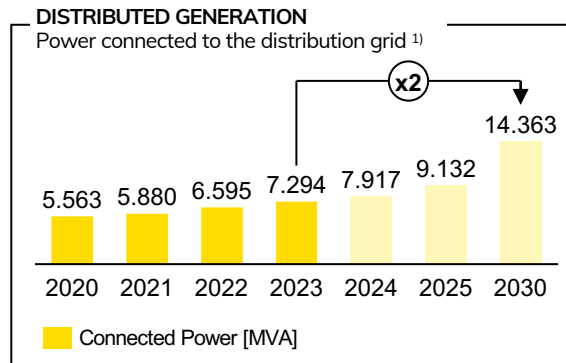
Development of **new energy services and markets**



Growth of **customer connections**

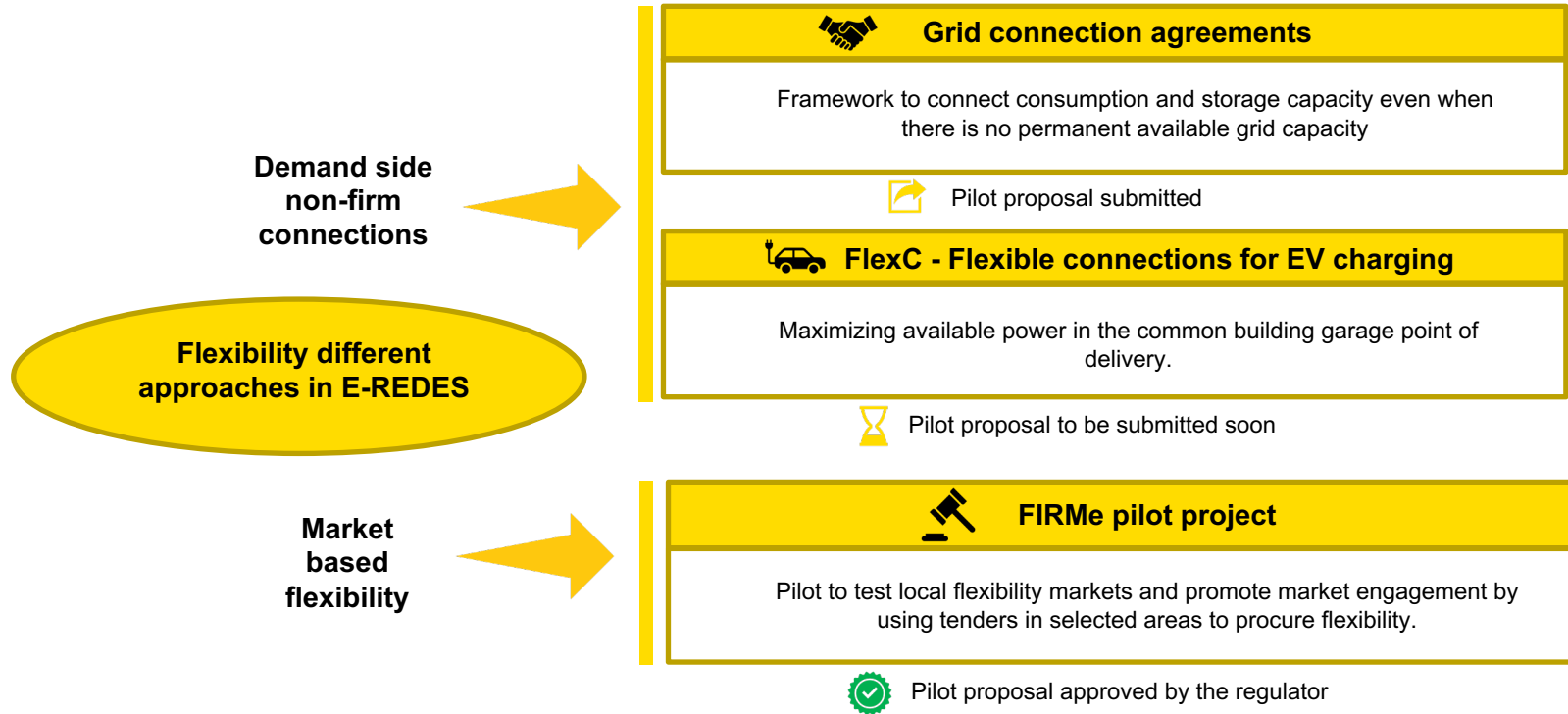


Growth of **electric vehicles**



1) E-REDES internal data

In order to respond to the paradigm shift of the energy transition, new solutions must be sought for planning and operating the network, especially ones with more flexibility



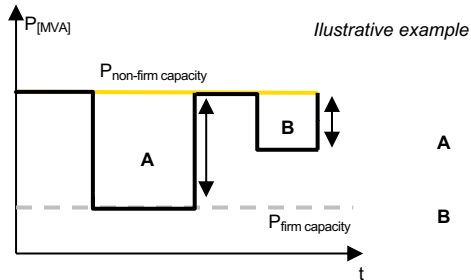
Setting up non-firm connections for network users is one of the concepts that E-REDES is developing as flexibility mechanisms

Pilot proposal for grid connection agreements

- Model to be applied for consumption connection requests > 2MVA



- Non-firm connection opportunity: If there is an option that decreases cost and/or time
- Non-firm capacity = Requested capacity
- Firm capacity = Requested capacity – Biggest restriction
- E-REDES should identify the restrictions with probability, period and dimension



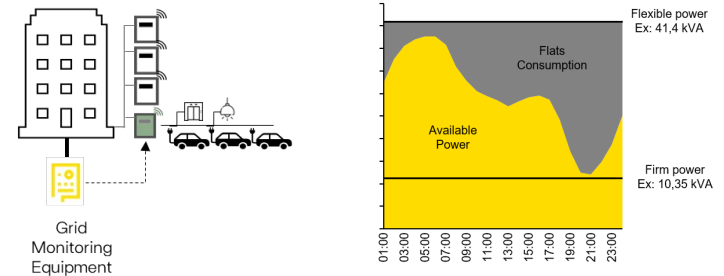
	Probability	Period	Dimension
A	40%	Weekdays 10h – 14h	5MVA
B	30%	Weekdays 18h – 22h	2MVA

FlexC – Pilot proposal for flexible connections

Utilizing a grid monitoring device to access real time available power in collective buildings and direct it to charge EV via a flexible connection in the common building garage point of delivery.

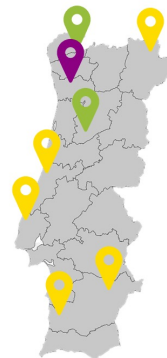
- Possibility to charge a large number of EV without the need for grid connection reinforcement (less time and money)
- Improving grid utilization and enabling these flexible connections to provide additional flexibility services

Illustrative example






FIRMe project is a key tool to start building local flexibility markets in Portugal that will allow all stakeholders to gain hands-on experience

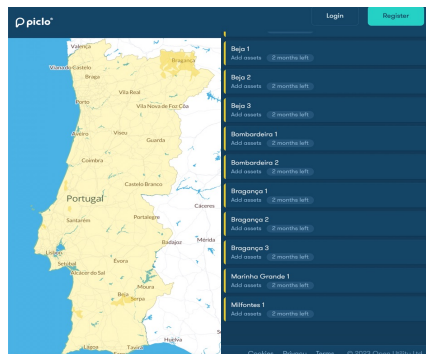
Scope	Goals
<ol style="list-style-type: none">1. Identify grid opportunities to provide flex2. Tenders to procure Flexibility3. Sign contracts4. Use contracts for network operation	<ol style="list-style-type: none">1. Develop internal skills (planning, procuring, operation)2. Engage stakeholders and develop the flex market



Identified 8 flexibility opportunities

-  **Secure** – Grid normal operation support
-  **Restore** – Support to restore the service in case of supply constraints
-  **Dynamic** – To use on scheduled interruptions (e.g. maintenances)

Piclo Platform to support tenders



FIRMe webpage



Results

- +100 flex assets registered in the platform
- **1st set of tenders concluded:** 623 bids from 21 distinct FSPs (Flexibility Service Providers)
- **15 FSPs with accepted competitive bids**
- Contracts to be sign March 14th
- New tenders to come in 2024

FIRMe - Conclusions/Lessons learnt so far

Flexibility valuation



- When comparing traditional investment vs a flexibility alternative, the **investment** almost always **appears to be the better option** in a long-term perspective (has impact on losses reduction).
- **Benchmark** with other DSOs helped **improving methodologies**.

Finding appealing products



- **It's not all about price**: Dynamic product (that had an advance notice of **1 week ahead**) raised much more interest when compared to the other products who had a short notice activation.

Engaging the market



- Difficulty to approach as this is a new and **complex business model**.
- DSO reality: Affects market liquidity - **Small geographical areas** to procure flexibility (vs TSO reality)
- E-REDES **customer managers** gave an important push for engaging market agents, in particular industrial customers.
- The **importance of DSR**: 19/21 entities who bided for FIRMe were industrial customers.
- Having a **price signal disclosure** seems to be advised before opening the bids.

Thank you!

Keep in contact!

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DEMAND RESPONSE IN PORTUGAL THE LARGE CONSUMERS PERSPECTIVE

APIGCEE - ASSOCIAÇÃO PORTUGUESA DOS INDUSTRIAIS GRANDES CONSUMIDORES DE ENERGIA ELÉCTRICA

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APIGCEE

Associação Portuguesa dos Industriais Grandes Consumidores de Energia Eléctrica

1. Large consumers characterisation
2. Demand response – Large consumers perspective
3. Conclusions



- AAPICO
- AIR LIQUIDE
- ALTRI
- BA GLASS
- BONDALTI
- CIMPOR
- LUSO FINSA
- MEGASA
- NAVIGATOR
- SECIL
- SOLVAY/HYCHEM
- SOMINCOR
- VIDRALA

APIGCEE FACTS AND FIGURES



- Industrial installations: **33**
- Turnover: \approx **5 000 M€**
- Exports: **3 500 M€** (**70 %** of total sales)
- Gross Value Added (GVA): **1 500 M€**
- Annual Investment: **400 M€**
- Direct employment: **20 000**
- Electrical energy consumption: **5 200 GWh/year**
- Electricity costs: **30 – 50%** of production variable costs
- **10%** of the total electricity consumption in Portugal
- **25%** of the industrial electricity consumption

1. Large consumers characterisation
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DEMAND RESPONSE - LARGE CONSUMERS PERSPECTIVE

Drawbacks:

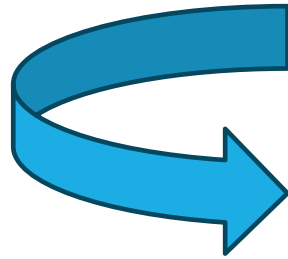
- Grid balancing services is not the core business of electrointensive consumers;
- Adaptation of the production processes to load shedding (or ramp-up) within very short notice (e.g. very short activation time);
- Risk of missing TSO orders of load shedding (or ramp-up) due to communication problems (e.g. webservice) with a very short time for using backup communication solutions;

Advantages:

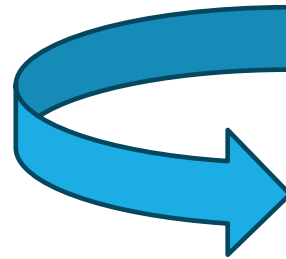
- The demand response provided by large consumers improves the grid resilience and is an additional tool for grid balancing services;
- Better integration with other grid balancing services provided by electricity generators;
- Additional flexibility in the presence of large embedded renewable production that introduce uncertainty in the electrical system management (e.g. intermittency).

DEMAND RESPONSE – CONSUMERS PARTICIPATION

Pilot –
project



Regulation
Reserve



Manual Frequency
Restoration Reserve

18.12.2023

DEMAND RESPONSE – PILOT PROJECT

Industrial Installation	Operation start
Solvay Portugal, S.A.	12.07.2019
Air Liquide (Sines)	12.07.2019
Cimpor S.A. (Loulé)	16.10.2019
Bondalti Chemicals S.A.	14.11.2019
Megasa (Seixal)	14.11.2019
Megasa (Maia)	14.11.2019

AUCTIONS – REGULATION RESERVE AND MANUAL FREQUENCY RESTORATION RESERVE

Auction	Date	No. of total Installations	No. of Installations (APIGCEE)	Available Power for auction (MW)	Total Power auctioned (MW)	Power auctioned by APIGCEE (MW)
1 st BRR	14.12.2021	21	19	425.0	304.4	292.1
2 nd BRR	24.11.2022	23	19	800.0	316.9	292.1
3 rd BRR	18.01.2023	0	0	483.0	0	0
BmFRR	18.12.2023	21	19	450.0	360.06	347.4

1. Large consumers characterisation
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Large Consumers:

- They provide the basis of national electricity consumption and at the same time are the “engine” of the economy of exported tradable goods;
- Exhibit electrical load diagrams that are predictable, stable, interruptible and quite often modulable which allow them to participate in grid balancing services;
- Can absorb much of the electrical energy produced by renewable technologies (intermittency) during peak and off-peak periods;
- Future participation in other European balancing services platforms (e.g. *PICASSO – Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation*).

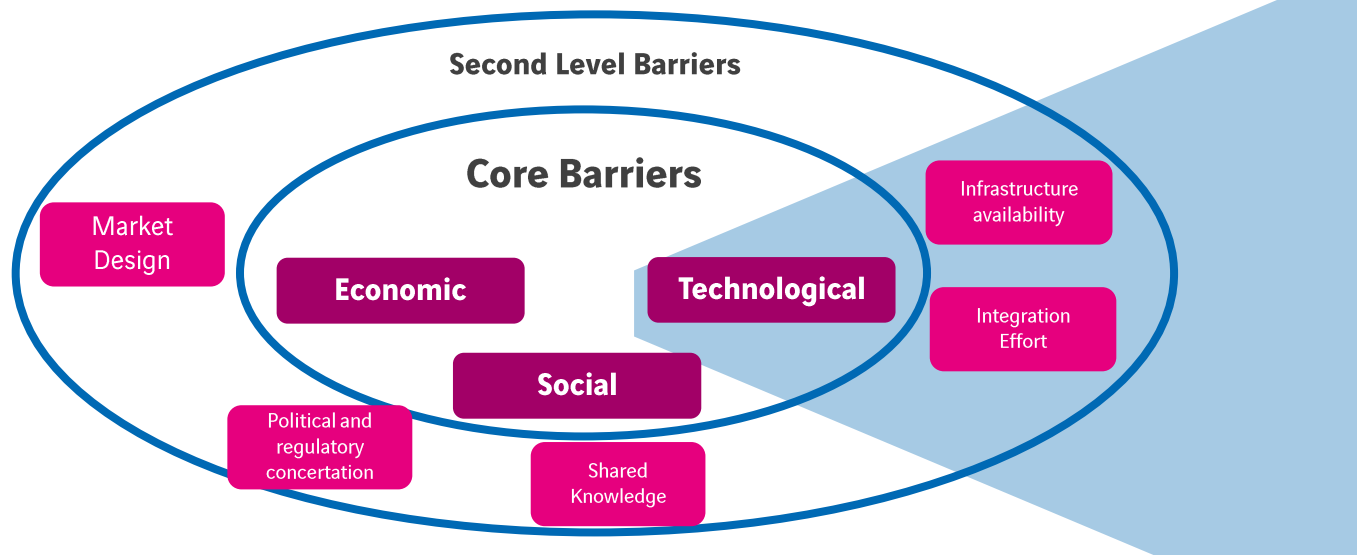
axians



Enabling Market Operations for Demand Response

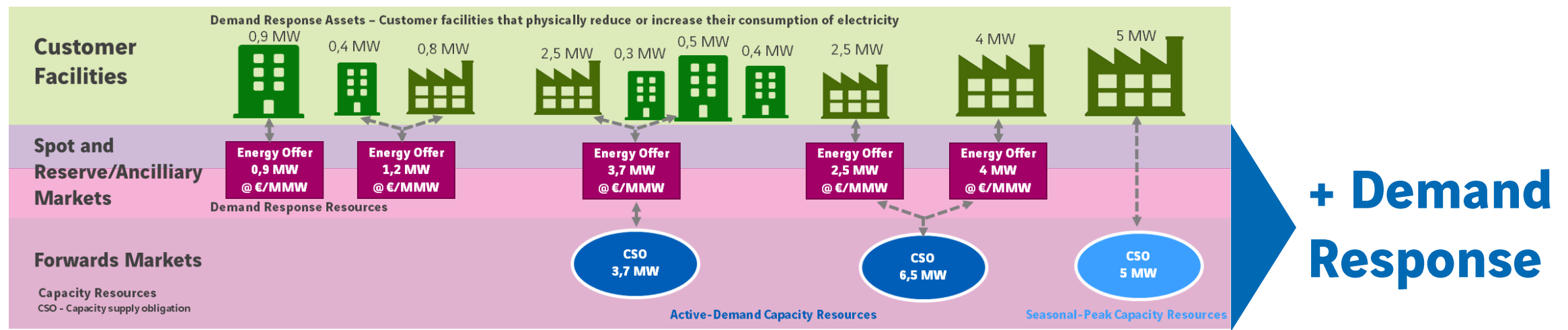
March 2024

ENABLING MARKET OPERATIONS FOR DEMAND RESPONSE



There are no relevant technology barriers to the deployment of a Demand Response Market

Sensing	
Metering	<ul style="list-style-type: none"> Installation of metering at necessary resolution.
Energy service sensors	<ul style="list-style-type: none"> Monitoring of final energy services. Good requirement elicitation, to ensure DR schemes compensate according to user preferences on various energy services.
Computing	
Computing power	<ul style="list-style-type: none"> Optimisation simplification. Distribution of computation load. Leveraging of additional network resources, e.g., cloud
Communication	
Interoperability	<ul style="list-style-type: none"> Open, agnostic technologies. Plugin-based architectures. Alliances/collaboration to develop standards. Agreement on semantics, to develop a common language across industries.
Data security & Privacy	<ul style="list-style-type: none"> Adopt Security & Privacy by design. Have a data life cycle management strategy. Allow for intuitive end-user configuration tagging of data. Adopt current state of the art.
Standardisation	
Multiple competing standards	<ul style="list-style-type: none"> Consolidation of standards amongst energy industry.
Technology skills	
Workforce skillset	<ul style="list-style-type: none"> Outsourcing as an option. Address identified factors for retaining talent. Know the requisite skills mix. Target continual learners with tolerance of ambiguity



Source Adapted from "Price-responsive demand explained", Yoshimura H.



(48) ...Member States that already apply a capacity mechanism should consider to promote the participation of non-fossil flexibility such as demand response and energy storage by redesigning criteria or features without prejudice to the application of Article 22 of Regulation (EU) 2019/943.”

Source: Regulation Of The European Parliament And Of The Council amending Regulations (EU) 2019/943 and (EU) 2019/942 to improve the Union's electricity market design. 19 of December 2023



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