Delegation of Electricity Regulatory Commissioners, India

Allowed revenues and efficiency parameters

12th February 2026

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Agenda

1. Where and how ERSE acts (allowed revenues perspective)

2. Regulatory methodologies applied to allowed revenues (ERSE's TOTEX "light" approach)

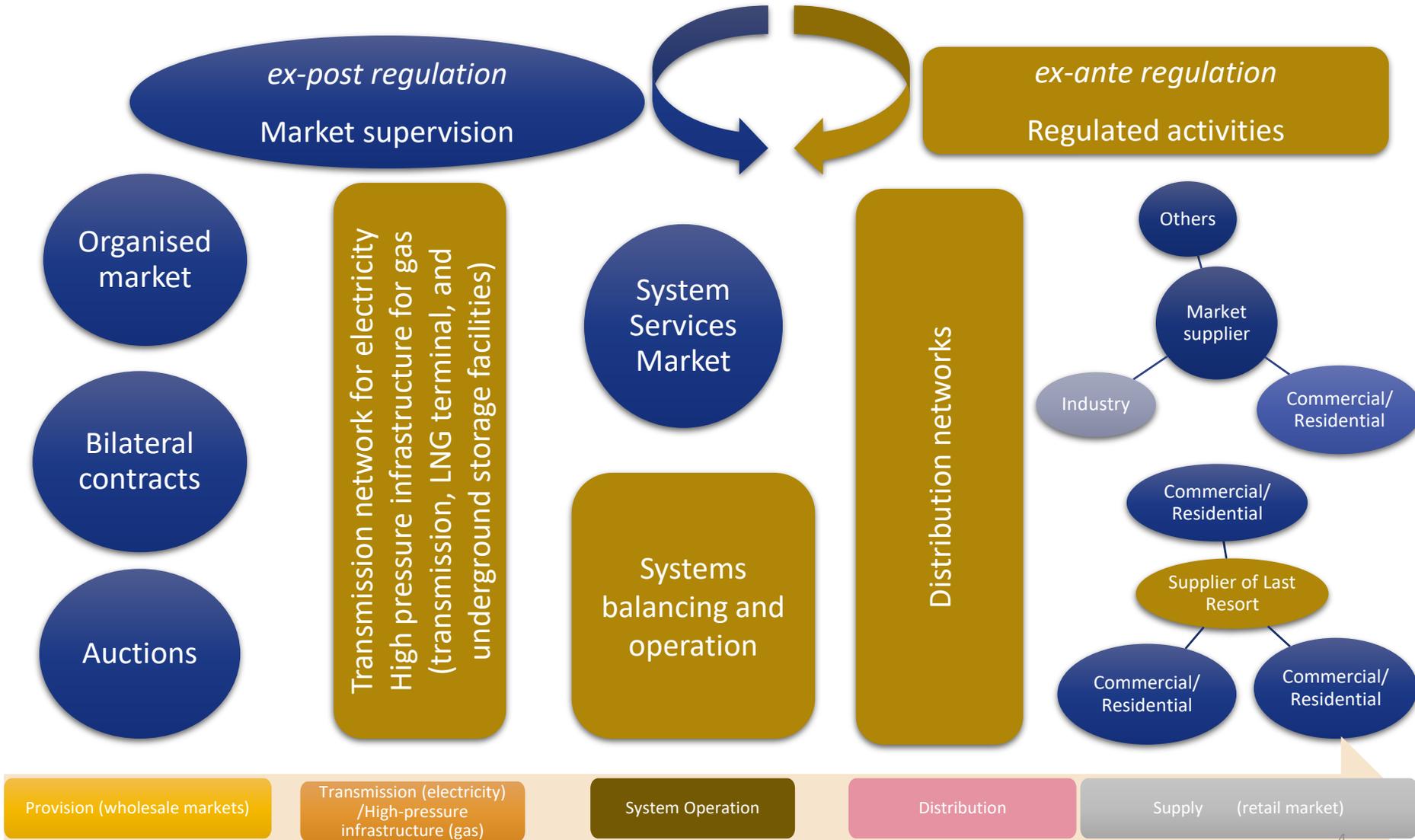3. Efficiency parameters - latest benchmark example

Allowed revenues and efficiency parameters

1. **Where and how ERSE operates** (allowed revenues perspective)

2. Regulatory methodologies applied to allowed revenues (ERSE's TOTEX "light" approach)

3. Efficiency parameters - latest benchmark example

Energy sectors (electricity and natural gas) - regulated activities

ex-post regulation
Market supervision

ex-ante regulation
Regulated activities

Organised market

Bilateral contracts

Auctions

Transmission network for electricity
High pressure infrastructure for gas (transmission, LNG terminal, and underground storage facilities)

System Services Market

Systems balancing and operation

Distribution networks

Others

Market supplier

Industry

Commercial/ Residential

Commercial/ Residential

Supplier of Last Resort

Commercial/ Residential

Commercial/ Residential

| Provision (wholesale markets) | Transmission (electricity) /High-pressure infrastructure (gas) | System Operation | Distribution | Supply   (retail market) |

ERSE competencies

Opinions on investment and development plans for electricity and gas networks

Regulatory/Codes

- Drawing up and approving the regulations necessary for the fulfilment of its duties

Regulation and Supervision

- Establishing tariffs for regulated activities
- Supervising and inspecting operation of regulated sectors

Advisory

- Issuing opinions required by law
- Other opinions requested by: Government, Parliament, Competition authority (AdC), Directorate-General (DGEG)

Sanctioning

- Entities involved in regulated sectors are subject to ERSE's sanctioning powers

- Calculate allowed revenues of regulated activities, which allow costs of these activities to be borne under conditions of efficient management
- Calculate tariffs to recover the allowed revenues/profits

- Tariffs Code (electricity sector and gas sector), which establishes the regulatory methodologies by activity and principles for tariff structure

Regulatory action to set prices of regulated tariffs (1/2)

Regulatory period – currently the "rules of the game" are kept for 4 years

- In the year prior to the beginning of each regulatory period, the **methodologies** (subject to public consultation) and the **regulatory parameters** (subject to opinion of Tariff Council*****) **are defined**, which allow for the practical application of the methodologies in each year of the regulatory period.

- The definition of methodologies and parameters is **preceded by a performance assessment of the regulated activities over the years**, namely those preceding the beginning of the regulatory period

- That analysis is considered in the definition of:

  - Costs to be subjected, or not, to the application of efficiency targets (**cost base**)

  - **Efficiency targets** (X factors)

  - **Cost drivers**

  - **Incentives** (recalibrate existing or define new)

* Tariff Council is an advisory body of ERSE on tariffs issues, that is composed of representatives from the main stakeholders.

Regulatory action to set prices of regulated tariffs (2/2)

Allowed revenues and network tariffs are set annually (15 December for electricity 31 May for natural gas)

Allowed revenues

Network tariffs

Demand

- Application of regulation methodologies for each activity
- Forecast of variables that influence revenues (physical, macroeconomic)
- Include adjustments of revenues from previous years

- Depend on the type of regulated service (transmission, distribution, system management)
- Tariffs structure varies by types of consumer and tariff options
- Physical billing variables (energy, capacity, peak power, different prices by time-of-use)

- Forecast of variables for tariffs invoicing (energy, power, peak power, time-of-use)

$$\text{Network Tariffs} = \frac{\text{Allowed revenues}}{\text{Demand}}$$

Factors that drive price evolution - Electricity Sector Focus

Financial flows

"Drastic" change in the cost structure in 2022 and 2023, due to the huge increase in prices in the wholesale electricity market (GN price effect, end of COVID, and Ukraine War)

Reapproaching the previous cost structure?

ERSE allowed revenues (1630M€ Tariffs 2026)

Energy policy and costs of general economic interest (1286M€ Tariffs 2026)

Costs follow the market

	Tarifas 2018	Tarifas 2019	Tarifas 2020	Tarifas 2021	Tarifas 2022 (Dez2021)	Tarifas 2022 (Jun2022)	Tarifas 2023 (Dez2022)	Tarifas 2023 (Jun2023)	Tarifas 2024 (Dez2023)	Tarifas 2024 (Mai2024)	Tarifas 2025	Tarifas 2026
Networks	21%	20%	19%	21%	19%	18%	15%	17%	19%	20%	20%	22%
Global System Usage	34%	26%	29%	33%	-3%	-16%	-39%	-15%	7%	20%	18%	17%
Energy + Supply	45%	54%	53%	46%	84%	98%	124%	98%	75%	60%	62%	61%

■ Energy + Supply   ■ Global System Usage   ■ Networks

Source: ERSE

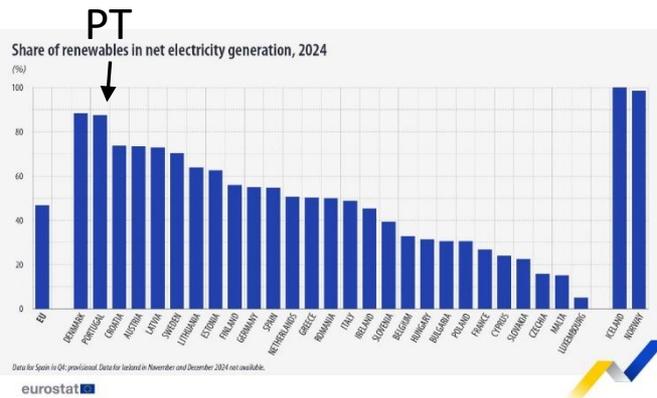8

Current context – Electricity Sector focus

Electricity prices for household consumers, second half 2024 (€ per kWh)
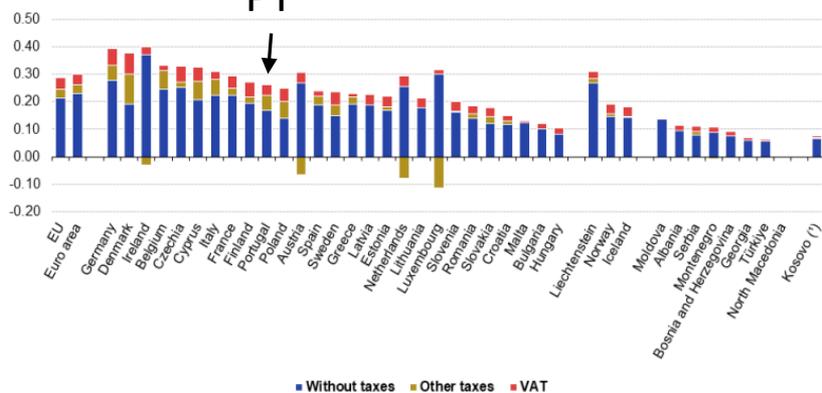
Electricity prices for non-household consumers, second half 2024 (€ per kWh)
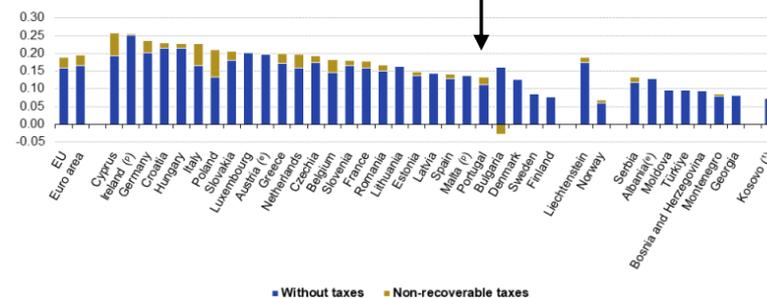
(¹) This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.
(ᵉ) Estimate
(ᵖ) Provisional
No data available for Iceland and North Macedonia
Source: Eurostat (online data code: nrg_pc_205)

Share of renewables in net electricity generation, 2024 (%)

Data for Spain in Q4: provisional. Data for Iceland in November and December 2024 not available.

Economic regulation of natural monopolies in the electricity sector

1. Where and how ERSE acts (allowed revenues perspective)

2. **Regulatory methodologies applied to allowed revenues** (ERSE's TOTEX "light" approach)

3. Efficiency parameters - latest benchmark example

Two main aspects of the economic regulation of a natural monopoly

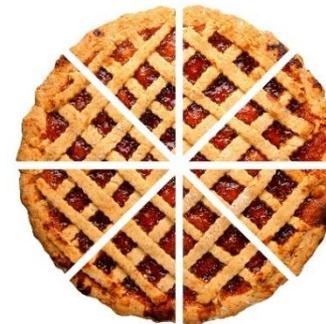To establish allowed revenues from network infrastructure management

"Simulation" of the market in order to overcome the drawbacks of natural monopolies (input based (cost control), output based (improving service quality, innovation, etc.))
> Impacts regulated companies, affecting them and consumers at large

To establish tariffs for the use of network infrastructure that recover allowed revenues

Ensure that prices equitably reflect the cost structure and send the right signals to consumers
> Impacts consumers, with differentiated effects per consumer

In short:

Allowed revenues
=
define pie size

Tariffs
=
define pie slices

Methodologies for defining allowed revenues

Type of regulation	Description	Effects / Impacts	Cost to consumer	Firm's economic equilibrium	Service quality
Cost-plus or rate-of-return regulation methodologies	Focuses on careful acceptance of service costs, including a **rate of return on assets** that compensates shareholders for their invested capital (also called rate of return)	**Ensures cost recovery** but may **lack efficiency incentives** due to information asymmetry and limited motivation for cost reduction or service improvements.	😐 ☹️	🙂	😐
Incentive regulation (e.g. price-cap or revenue-cap regulation)	Sets costs, results, or service targets, allowing companies **flexibility** in achieving them, and allows companies to **retain a portion** of the savings achieved through cost reduction or efficiency improvements. **Price Cap**: A mechanism that sets a maximum price, adjusted periodically with inflation, efficiency targets, and other factors. Companies are incentivized to reduce costs, as they can keep the savings below the capped price. **Revenue Cap**: A mechanism that sets the total revenue a company can earn. It can allow adjustments based on demand/cost drivers and cost-efficiency improvements.	**Companies retain/bear part of the gains/losses** resulting from achieving or failing to achieve the objectives set by the regulator. The **calibration of parameters** (targets, sharing factors of results, cost drivers) **introduces risks**, as it may lead to gains or losses.	🙂	😐	🙂 😐 ☹️ (The impact on service quality greatly depends on the incentive scheme)

Incentive regulation applied to OPEX_"Hybrid regulation" (most common)

Process for defining allowed revenues during a regulatory period
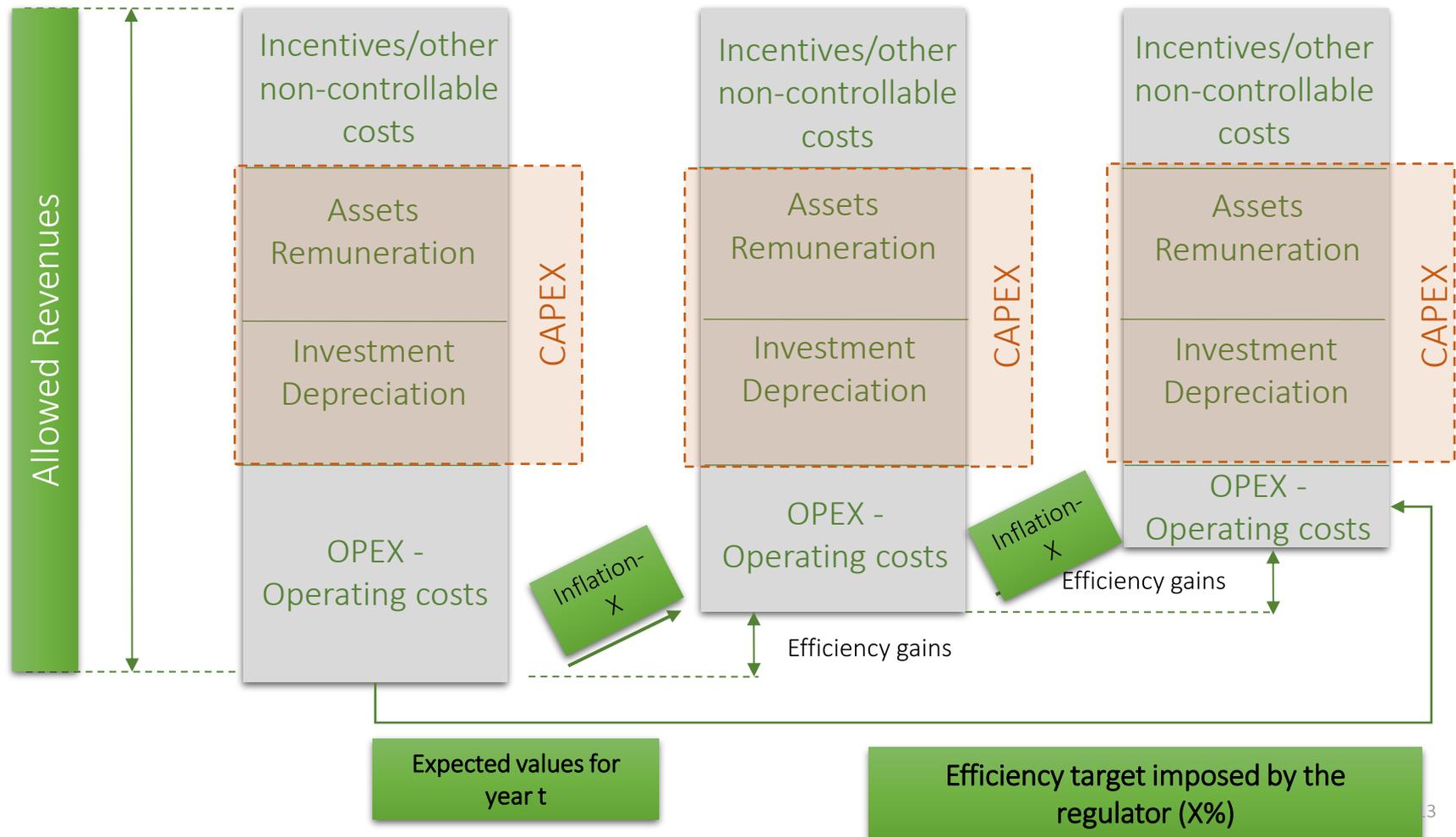
Reasons to move away from hybrid regulation

➢ Hybrid Regulation

- Addresses asymmetric information and eficiency issues at the OPEX level.

- Does not pose a major risk for both firms and consumers (CAPEX recovery and **tariff stability**).

- However, it may result in **CAPEX bias (**Operators favor CAPEX for stable long-term returns, especially if remuneration rates exceed their cost of capital**)**

➢ Consequences of CAPEX bias

- Reconsidering capital expenditure, leading to **over-investment**, i.e., innefficient CAPEX.

- **Hindering innovation, which is less capital-intensive**, namely that based on digitalization, such as smart grids.

- In short: **increased network tariffs**.

Reasons to move away from hybrid regulation

➢ **CAPEX bias matters**

- EU energy policy and decarbonization targets seem to require a **huge need for investment** in electricity networks

EU energy ministers plan power grid beyond 2030. Šefčovič: "600 billion needed for infrastructure"

Forty per cent of plant networks and energy transport corridors in the EU are already more than 40 years old, and cross-border electricity infrastructure needs to be doubled by 2030. But "funding is currently insufficient", the Connecting Europe Facility is not eno...

EU 'needs €584bn' to roll out electricity grid action plan

The European Commission's action plan to accelerate the rollout of electricity grids calls for investments of €584 billion to upgrade decades-old distribution grids and double transmission capacity by 2030.

Energy Source   Utilities   (+ Add to myFT)

Who will pay for Europe's power grid

The EU will not meet its ambitious green goals without vast investment

Europe's grid investment needs to grow to €67bn annually – report

Failure to meet the investment targets could put at risk up to 74% of potential connections for crucial decarbonisation technologies.

Jackie Park | May 22, 2024

- There are **supply chain bottlenecks**

✓ "It's clear that both policymakers and industry must together address this supply chain bottleneck today …" (Eureletric, 2024)

TOTEX implementation

➤ **Coming from the hybrid approach, TOTEX was quickly implemented for 2022-2025 regulatory period**

- TOTEX was first implemented for the LV DSO in 2018 (2018-2021).
- It encompassed the TSO and DSO HV/MV after one year of discussion.
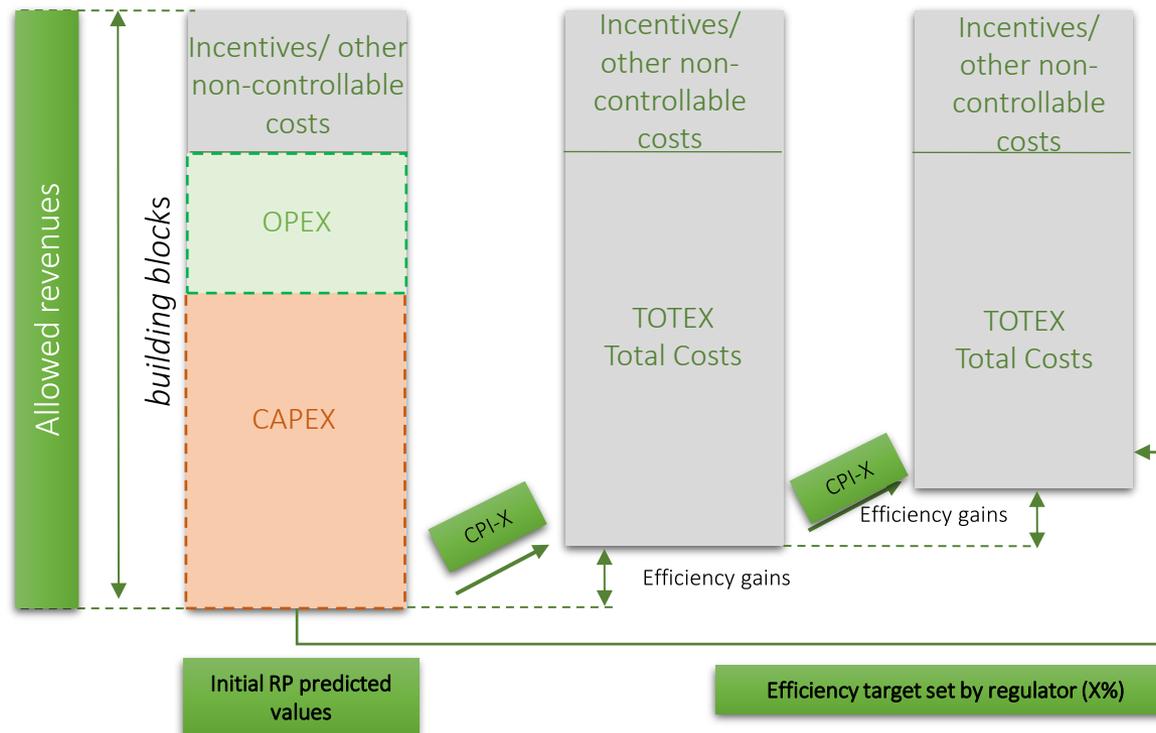
➤ **Based on the building blocks approach**

- The **same efficiency targets** (RPI-X) are imposed on **OPEX** and new **CAPEX**.

- However, the specificities of OPEX and CAPEX are also considered:

  - ✓ OPEX baseline takes into account companies performance regarding OPEX in the previous regulatory period, sharing the results with consumers.

  - ✓ As for the CAPEX baseline, the annual CAPEX was estimated for the 4 years of the regulatory period, based on ERSE's opinion of the operators' business plans and NDPs.

- Building blocks were turned into an equivalent constant payment, using the new WACC as the discount rate.

TOTEX implementation

➢ The Portuguese approach is closer to a revenue cap than to a pure TOTEX approach (like Ofgem's FOCS approach).

TOTEX implementation
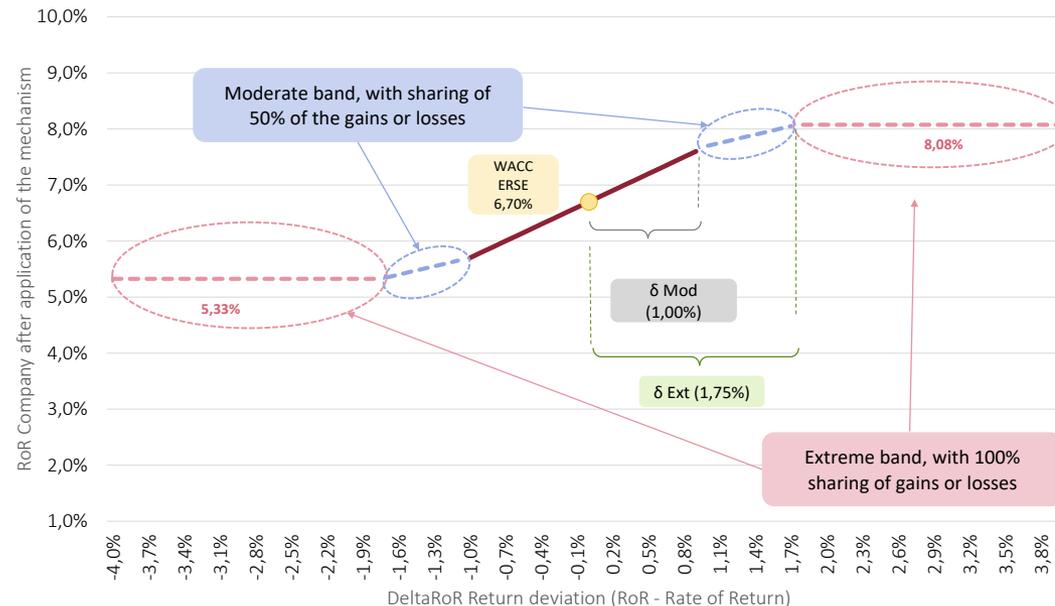
➢ Given the uncertainties and concerns of stakeholders, TOTEX was complemented with a profitability control mechanism:

- This is illustrated as follows for the DSO case:

- This mechanism **prevents the effects of "inflated" business plans**.
- The relatively narrow bands of the profit/loss sharing mechanism also **mitigate the risk of rent creation**

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Beyond input Regulation (DSO example)

➢ **Output-Based incentives (outside TOTEX/Revenue Cap)**

In 2024, around 5% of DSO allowed revenues were recovered through output-based regulation incentives:

- Incentive for Loss Reduction in Distribution Networks
  - ✓ **Objective**: Encourage investment and operational decisions aimed at reducing grid losses.
- Incentive for Innovation and New Services in LV Installations
  - ✓ **Objective**: Encourage the LV DSO to develop and provide services that enable integration of installations into smart grids, ensuring consumers benefit fully from smart grid integration.
- Incentive for Service Continuity Improvement
  - ✓ **Objective**: Promote overall continuity of electricity supply and improve service quality for the worst-served customers.

From 2026 onward, another **incentive was implemented to promote the availability of non-firm connections to grid users, providing more incentive for flexible grid use.**

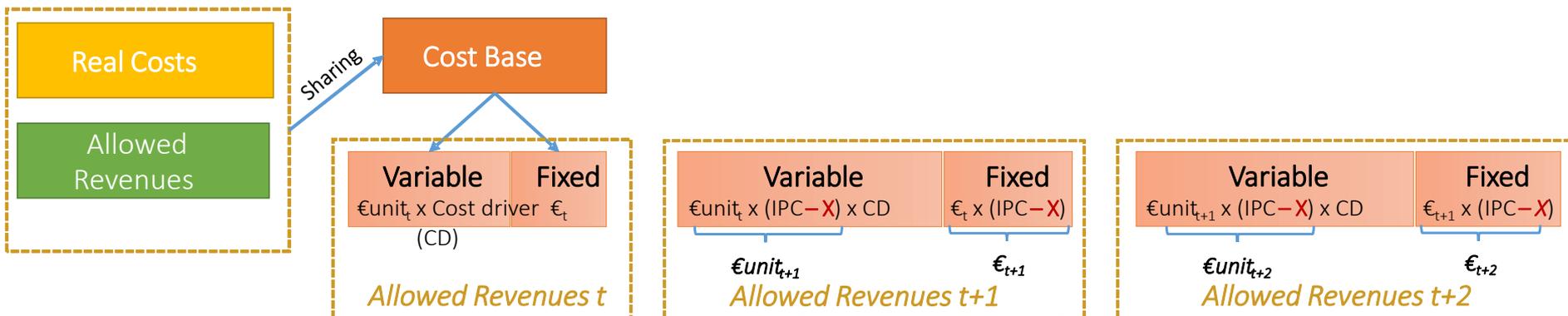# Economic regulation of natural monopolies in the electricity sector

1. Where and how ERSE acts

2. Regulatory methodologies applied to allowed revenues (ERSE's TOTEX "light" approach)

3. **Efficiency parameters - latest DSO benchmark example**

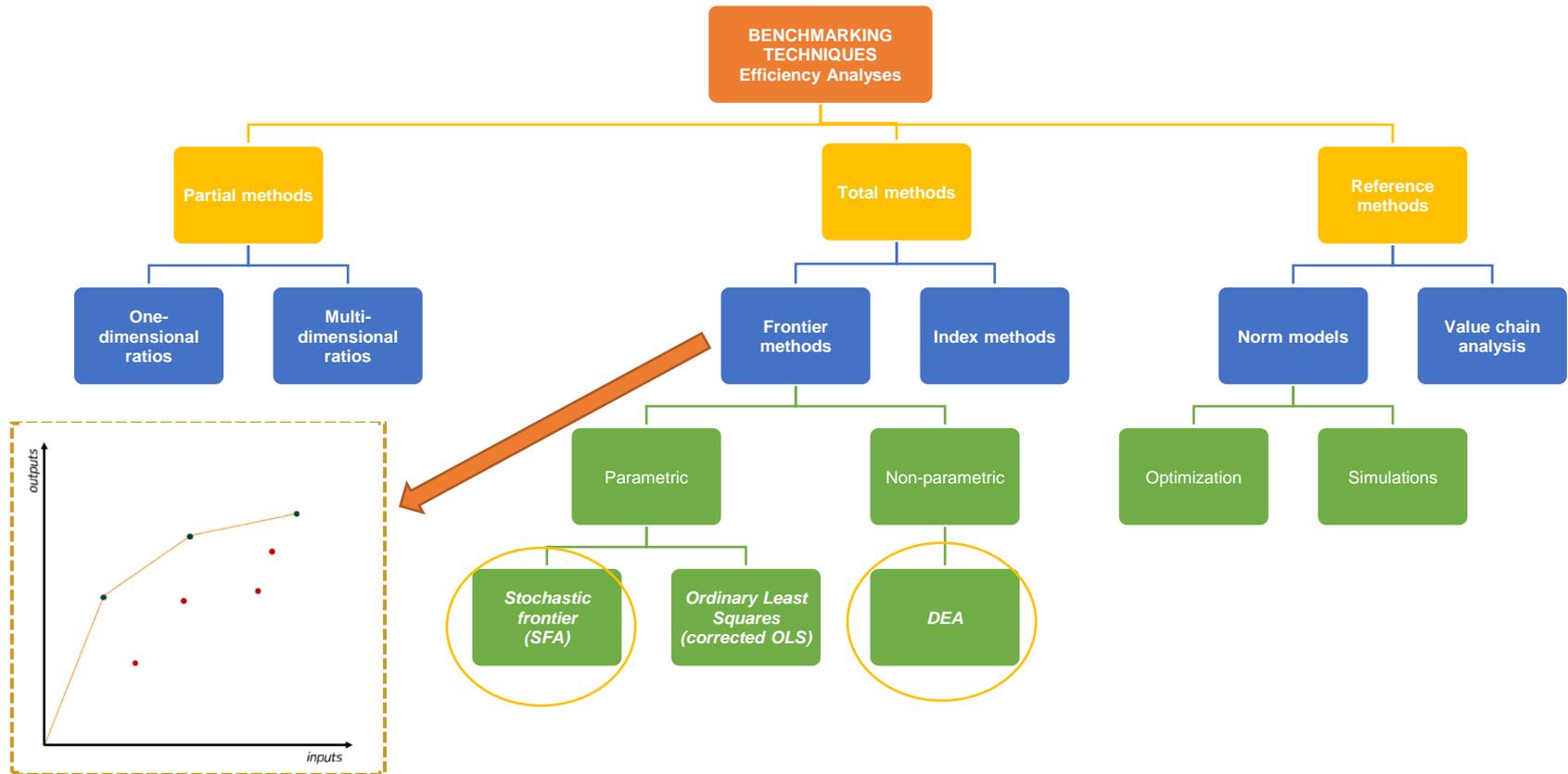## Allowed revenues definition during a regulatory period

The allowed revenues from electricity distribution activities are calculated using a revenue cap to total controllable costs (TOTEX to bring the company closer to the appropriate level of efficiency (efficiency frontier - which corresponds to the optimal level of efficiency of the activity).

How to assess efficiency performance of an (almost) sole DSO in mainland Portugal ?

- In 2025, ERSE carried out a European benchmarking analysis similar to that **carried out in 2021 for the 2022-2025 regulatory period**, which aims to generate efficient cost estimates for DSOs, which in turn supported the definition of the efficiency target applied to E-REDES.

Benchmarking Techniques to evaluate efficiency

Frontier methods

Non-parametric methodologies - There is no need to define and estimate a production function.

In this approach, Data Envelopment Analysis (DEA) is the most widely used methodology.
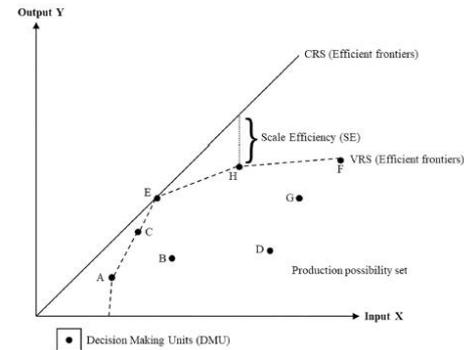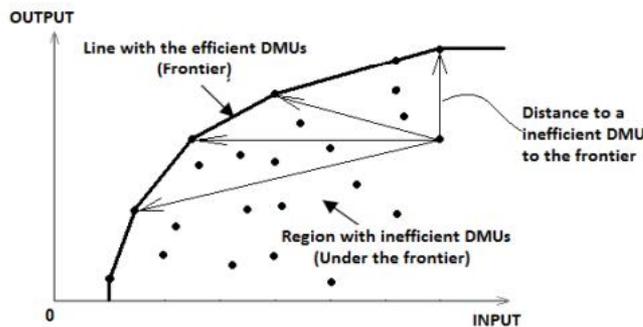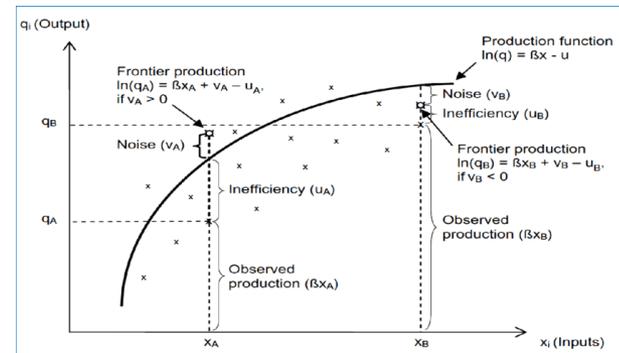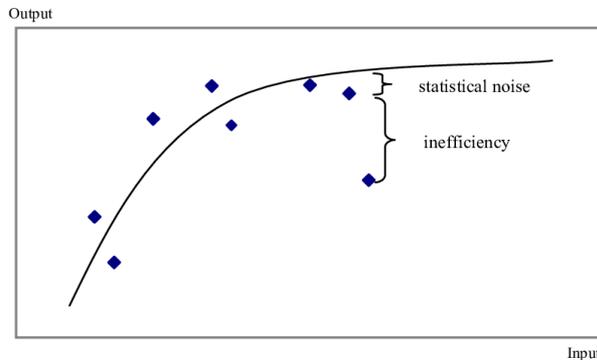

Parametric methodologies - these involve defining a production function that must be estimated.

In this approach, the Stochastic Frontier Model (SFA) is the most commonly used methodology.

Data – Sampling Challenges

- Collection of physical and economic data from energy distribution operators, specifically regarding distribution activities:
  - ✓ provided by their respective National Regulatory Authority (NRA) following a request for collaboration to the Council of European Energy Regulators.

- Accountability of the specific characteristics and context:
  - ✓ Highly discretionary costs, which depend on specific operator or national policies, were excluded from the analysis.

- Harmonization of economic specificities:
  - ✓ Costs were standardised using purchasing power parity ad adjust to constant prices to ensure comparability.

Sample – Data Collection

This collection resulted in two samples. The second sample, referred to as NRA+UK, includes 52 distribution operators from 15 European countries.

Descriptive Statistics

	Network Extension	Supply Points	SAIDI LV	OPEX$_{PPP}$	TOTEX$_{withoutPPP}$	TOTEX$_{withPPP}$
Unit	Km	Number	Minutos	EUROS$_{PPP}$	EUROS	EUROS$_{PPP}$
Mean	136 073	3 494 948	58,42	643 074 660	1 086 563 817	1 073 135 440
Median	31 160	696 151	26,75	108 625 447	233 565 404	205 066 011
Standard Deviation	293 788	8 229 606	74,38	2 034 497 496	2 962 913 330	2 894 249 434
Minimum	5 011	36 015	1,97	10 214 447	29 016 514	22 455 627
Maximum	1 401 479	38 152 547	353,72	12 072 883 284	17 130 496 431	16 655 299 834
Confidence Level (95,0%)	56 855	1 592 632	15,07	393 725 409	573 396 755	560 108 599

NRA + UK	Network Extension	Supply Points	SAIDI LV	OPEX$_{PPP}$	TOTEX$_{withoutPPP}$	TOTEX$_{withPPP}$
Unit	Km	Number	Minutos	EUROS$_{PPP}$	EUROS	EUROS$_{PPP}$
Mean	125 303	3 424 877	48	595 519 201	1 041 289 037	1 015 663 398
Median	53 449	963 870	27	125 598 735	284 767 924	294 366 142
Standard Deviation	274 604	7 680 726	65	1 999 950 852	2 906 823 227	2 839 243 755
Minimum	5 011	36 015	2	10 214 447	29 211 266	22 455 627
Maximum	1 401 479	38 152 547	354	12 072 883 284	17 130 496 431	16 655 299 834
Confidence Level (95,0%)	53 143	1 486 410	13	387 039 782	562 541 938	549 463 644

Note: OPEX economic values were normalized by Purchasing Power Parity. In the case of asset items, they were analyzed with and without this normalization.

Results – DEA and SFA Methodology

- Several models were estimated, considering: TOTEX or OPEX as outputs; # supply points and network length as inputs; quality of service indicator (SAIDI) as a contextual variable.

- In TOTEX models, E-Redes ranks in the 10th percentile, i.e., effectively in the efficiency frontier.

Models TOTEX with PPP

Percentile	DSO	SFA mean 3 years	DSO	VRS mean 3 years	DSO	CRS mean 3 years
10	E-REDES	0,968	DSO#10	0,991	E-REDES	0,979
	DSO#17	0,959	E-REDES	0,984	DSO#22	0,964
	DSO#10	0,911	DSO#22	0,968	DSO#26	0,894
	DSO#22	0,891	DSO#18	0,960	DSO#17	0,883
20	DSO#26	0,844	DSO#17	0,956	DSO#32	0,861
	DSO#25	0,821	DSO#23	0,950	DSO#25	0,851
	DSO#32	0,805	DSO#26	0,896	DSO#30	0,757
25	DSO#27	0,723	DSO#5	0,895	DSO23	0,732
50	DSO#3	0,688	DSO#25	0,873	DSO#3	0,685
	DSO#23	0,660	DSO#32	0,863	DSO#33	0,673
	DSO#5	0,641	DSO#9	0,778	DSO#27	0,646
	DSO#6	0,611	DSO#30	0,763	DSO#10	0,642
	DSO#33	0,601	DSO#3	0,720	DSO#6	0,618
	DSO#19	0,590	DSO#27	0,706	DSO#5	0,603
	DSO#30	0,574	DSO#33	0,674	DSO#9	0,586
	DSO#9	0,568	DSO#6	0,631	DSO#31	0,476
75	DSO#15	0,565	DSO#19	0,613	DSO#2	0,462
	DSO#18	0,556	DSO#15	0,595	DSO#15	0,419
	DSO#34	0,512	DSO#1	0,529	DSO#14	0,385
	DSO#14	0,491	DSO#31	0,488	DSO#7	0,379
	DSO#1	0,488	DSO#14	0,482	EEM	0,378
	DSO#7	0,446	DSO#34	0,468	DSO#13	0,365
	DSO#31	0,424	DSO#2	0,464	EDA	0,355
	DSO#13	0,372	EDA	0,450	DSO#1	0,332
100	DSO#2	0,349	EEM	0,444	DSO#19	0,317
	EEM	0,341	DSO#7	0,432	DSO#18	0,308
	EDA	0,339	DSO#4	0,394	DSO#28	0,263
	DSO#16	0,299	DSO#13	0,368	DSO#34	0,250
	DSO#28	0,246	DSO#28	0,271	DSO#4	0,244
	DSO#21	0,231	DSO#16	0,262	DSO#21	0,216
	DSO#11	0,192	DSO#11	0,223	DSO#11	0,215
	DSO#4	0,156	DSO#21	0,218	DSO#16	0,182

Models TOTEX s/PPP

DSO	SFA mean 3 years	DSO	VRS mean 3 years	DSO	CRS mean 3 years
E-Redes	0,933	E-Redes	0,998	E-REDES	0,991
DSO#17	0,903	DSO#10	0,988	DSO#22	0,968
DSO#24	0,891	DSO#17	0,976	DSO#32	0,921
DSO#10	0,861	DSO#22	0,971	DSO#26	0,886
DSO#19	0,850	DSO#18	0,964	DSO#25	0,882
DSO#24	0,840	DSO#23	0,955	DSO#17	0,871
DSO#34	0,834	DSO#32	0,938	DSO#3	0,721
EEM	0,816	DSO#26	0,934	DSO#23	0,703
DSO#32	0,813	DSO#25	0,891	DSO#25	0,647
DSO#26	0,813	DSO#5	0,860	DSO#5	0,615
DSO#22	0,811	DSO#9	0,789	DSO#24	0,609
DSO#30	0,805	DSO#3	0,726	DSO#27	0,608
DSO#33	0,803	DSO#27	0,674	DSO#10	0,599
DSO#31	0,793	DSO#24	0,665	DSO#30	0,573
DSO#27	0,779	DSO#33	0,652	DSO#9	0,565
DSO#5	0,766	EDA	0,625	DSO#6	0,545
DSO23	0,757	EEM	0,620	DSO#14	0,471
DSO#3	0,754	DSO#1	0,620	DSO#31	0,445
DSO#6	0,747	DSO#30	0,605	DSO#1	0,445
DSO#1	0,713	DSO#14	0,594	DSO#7	0,444
DSO#7	0,684	DSO#6	0,548	DSO#2	0,429
DSO#9	0,653	DSO#19	0,541	DSO#13	0,419
DSO#14	0,653	DSO#31	0,532	DSO#29	0,414
EDA	0,644	DSO#7	0,490	EDA	0,408
DSO13	0,635	DSO#34	0,452	EEM	0,382
DSO#29	0,627	DSO#29	0,445	DSO#29	0,335
DSO#18	0,583	DSO#2	0,443	DSO#34	0,285
DSO2	0,562	DSO#13	0,419	DSO#18	0,281
DSO#28	0,438	DSO#28	0,308	DSO#28	0,251
DSO#16	0,416	DSO#16	0,262	DSO#21	0,246
DSO#11	0,378	DSO#11	0,259	DSO#11	0,202
DSO21	0,301	DSO#16	0,248	DSO#16	0,189

Models TOTEX with PPP + SAIDI

Percentile	DSO	SFA mean 3 years
10	DSO#17	0,959
	DSO#22	0,939
	E-Redes	0,916
20	DSO#26	0,861
	DSO#25	0,836
	DSO#32	0,829
25	DSO#10	0,801
50	DSO#27	0,726
	DSO#3	0,705
	DSO#5	0,638
	DSO#23	0,614
	DSO#6	0,600
	DSO#33	0,567
	DSO#19	0,554
75	DSO#15	0,524
	DSO#30	0,523
	DSO#1	0,478
	DSO#34	0,470
	DSO#18	0,460
	DSO#7	0,418
	DSO#31	0,396
100	DSO#13	0,355
	EDA	0,327
	DSO#2	0,326
	EEM	0,309
	DSO#16	0,287
	DSO#21	0,239
	DSO#4	0,182
	DSO#11	0,181

Correlation Matrix

	$SFA_{withppp}$	$VRS_{withppp}$	$CRS_{withppp}$		$SFA_{withoutppp}$	$VRS_{withoutppp}$	$CRS_{withoutppp}$
$SFA_{withppp}$	1,000			$SFA_{withoutppp}$	1,000		
$VRS_{withppp}$	0,978	1,000		$VRS_{withoutppp}$	0,930	1,000	
$CRS_{withppp}$	0,979	0,981	1,000	$CRS_{withoutppp}$	0,891	0,964	1,000

Results – Malmquist Methodology – Technological Impact

- The values for technological progress (frontier shift) during the most recent period (2021-2022) vary between 0.1% and 0.4%:
  - ✓ An average technological progress value of around 0.25% is considered as a reference, corresponding to the average of the values observed in the period 2021-2022.

Efficiency associated with technological progress (Malmquist):

| Malmquist productvity index - INPUT Oriented DEA -Results (OPEX)						
Period	DMU	Total Factor Productivity	Efficiency Change Effect	Technical Efficiency Effect	Pure Efficiency Effect	Scale Efficiency Effect
2021-2022	E-Redes	1,004	1,000	1,004	1,000	1,000

| Malmquist productvity index - INPUT Oriented DEA -Results (TOTEX)						
Period	DMU	Total Factor Productivity	Efficiency Change Effect	Technical Efficiency Effect	Pure Efficiency Effect	Scale Efficiency Effect
2021-2022	E-Redes	0,999	0,998	1,001	1,000	0,998

Efficiency Targets

The following graph illustrates the evolution of the efficiency targets applied to E-REDES over time.

Trend in Efficiency Scores

Q & A

ERSE

ENTIDADE
REGULADORA
DOS SERVIÇOS
ENERGÉTICOS
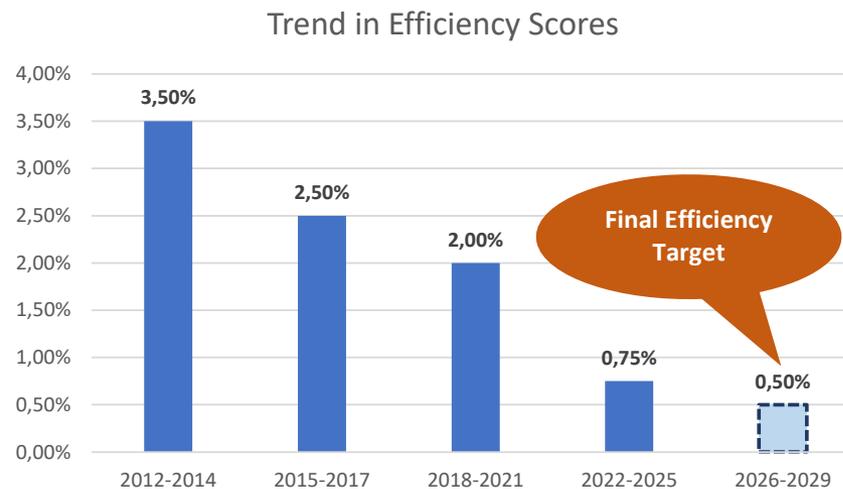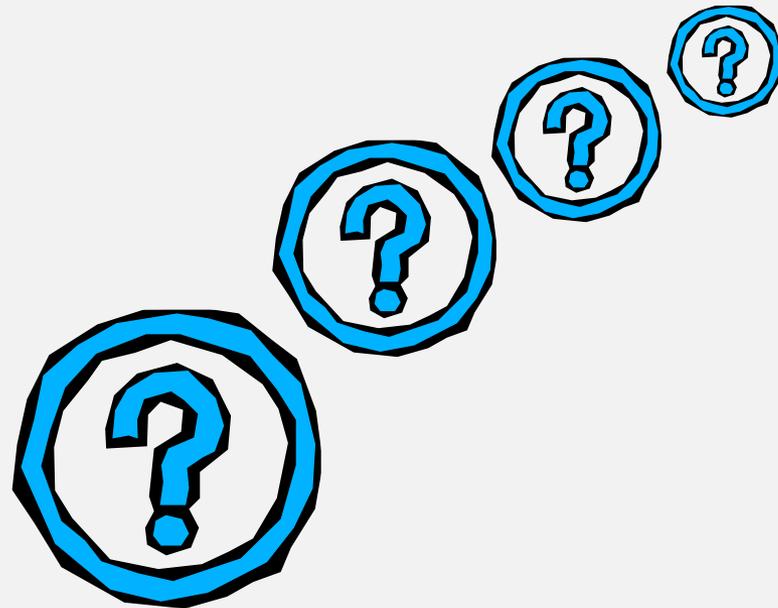
THANK YOU!

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