ERSE
ENTIDADE REGULADORA
DOS SERVIÇOS ENERGÉTICOS

Technical Quality of Service Regulation in Portugal

Study visit

anre
الهيئة الوطنية لضبط الكهرباء
ⴰⵏⴰⵔ ⵏ ⵜⵙⵏⴰⵙⵜ ⵏ ⵜⵣⵔⴼⵜ
NATIONAL ELECTRICITY REGULATORY AUTHORITY

27th October 2022

Index

1. Electricity sector organization
2. Electricity quality of service regulation in Portugal
3. Continuity of supply
4. Power quality
5. Audits and reports

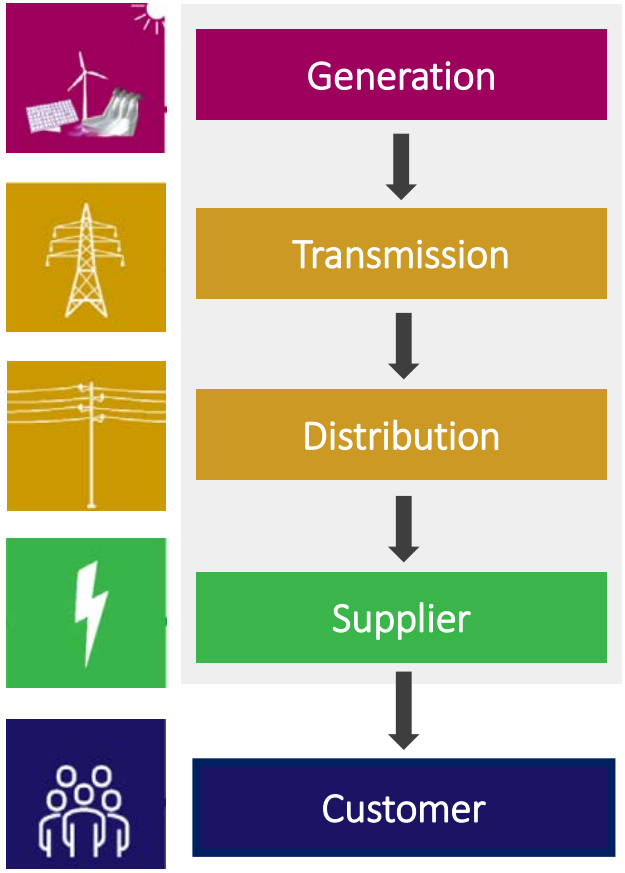
ERSE
ENTIDADE REGULADORA
DOS SERVIÇOS ENERGÉTICOS

Index

Electricity sector organization

Before 1996, the Portuguese electricity sector was:

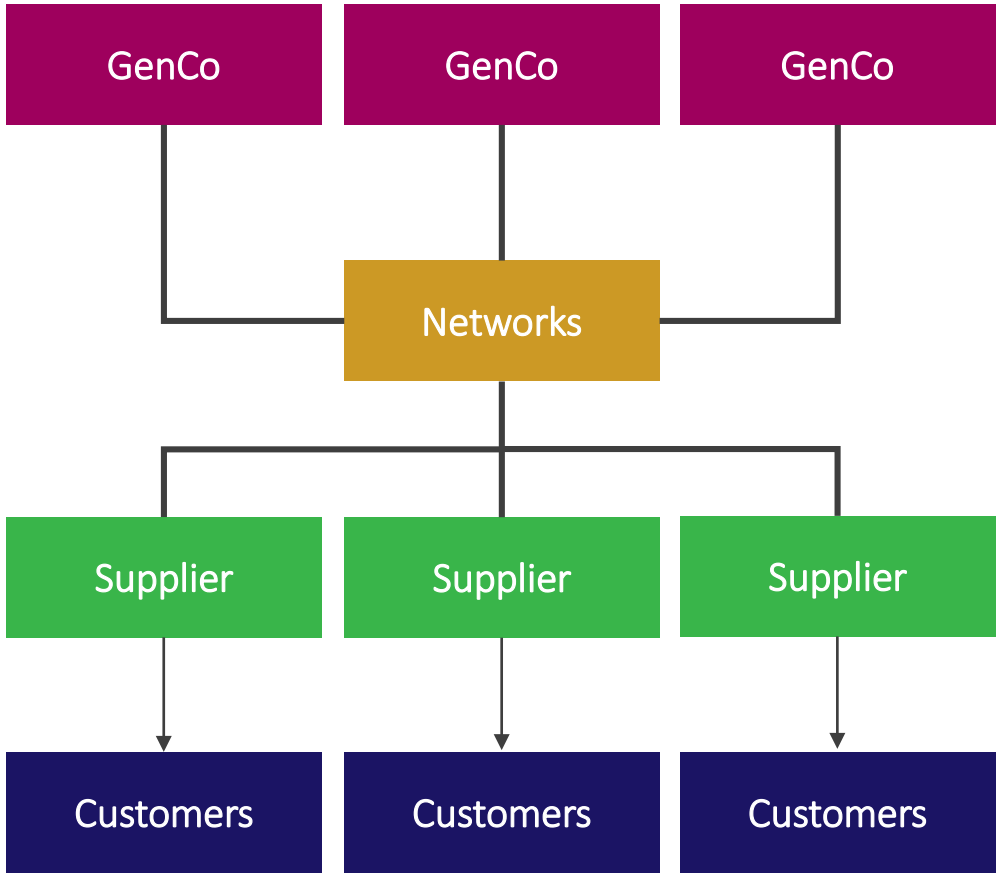
- Vertically integrated
- State ownership
- Monopoly
- Consumers pay a full tariff with no choice



Electricity sector organization: unbundled sector

From 1996, the Portuguese electricity sector was:

- Competition
- Natural monopoly
- Regulated
- Third party access
- Competition
- Right to choose a supplier



Electricity sector organization: unbundled sector

Mainland Portugal

Generation

edp, endesa portugal, Co-Geradores, energias renováveis, IBERDROLA

Liberalized market

Transmission

REN – Rede Eléctrica Nacional

Public Services Concessions

Distribuition

E-REDES

Ten other Distribution Network Operators exclusively in LV:

- Cooperativa Eléctrica de Vale D'Este
- Cooperativa Eléctrica de Vilarinho
- Cooperativa Eléctrica de Loureiro
- Cooproriz - Cooperativa de Abastecimento de Energia Eléctrica
- A Eléctrica Moreira de Cónegos
- A Celer - Cooperativa Electrificação de Rebordosa
- Casa do Povo de Valongo do Vouga
- Junta de Freguesia de Cortes do Meio
- Cooperativa Electrificação A Lord
- Cooperativa Eléctrica S. Simão de Novais

Public Service Concessions and Licenses

Supplier

SU ELETRICIDADE, acciona energia, edp, endesa, FORTIA, G9 Energy, usenergy, ALFA ENERGIA, holaluz, audax energia, elergone energias, logica energy, LUZBOA, Naturgy, CBPOWER ENERGY, Coopérnico, EZU ENERGIA, aspo, galp power, IBERDROLA, gold energy, LUZ GÁS, capWatt, aldro, PLENO ENERGIA, yes ENERGY, JAFplus, Energia viva nabalia, yaluz!

Liberalized market

Customers

~ 6.1 million customers of which 5.4 million are in the liberalized market
National consumption 2021: ~ 50 TWh of which 41.7 TWh in the liberalized market

ERSE
ENTIDADE REGULADORA
DOS SERVIÇOS ENERGÉTICOS

Index

Electricity quality of service regulation in Portugal

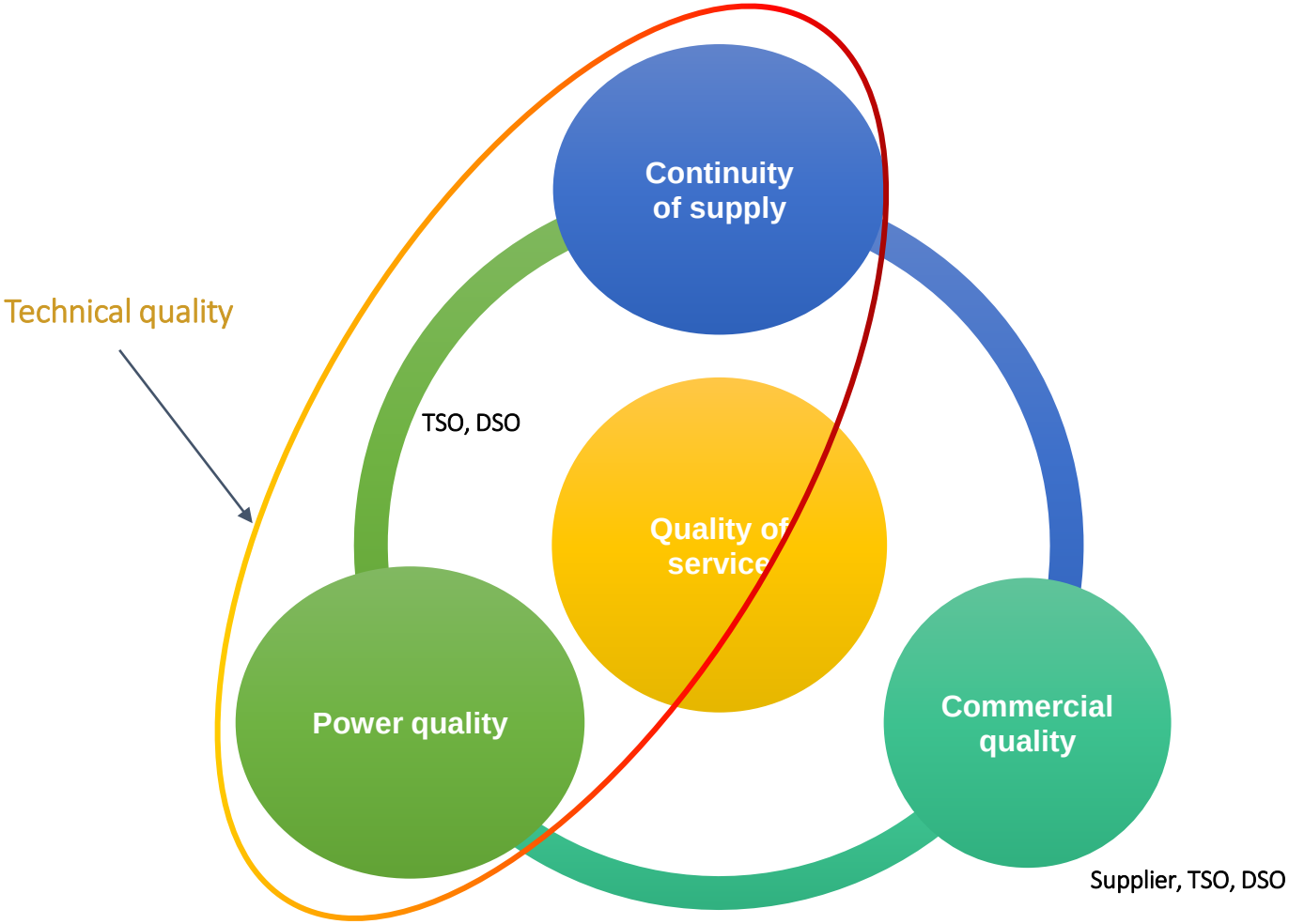
Quality of Service Code (QSC)

- Electricity sector
- Gas sector

The QSC have the same approach but some specificities considering the sectors and the systems.

Electricity quality of service regulation in Portugal

Quality of service dimensions



Electricity quality of service regulation in Portugal

Quality of service dimensions

- Commercial quality
  - Duties of the supplier and the network operator: Communication, problem solving, contractual issues
- Technical quality
  - **Continuity of supply:**
    - Number and duration of interruptions
  - **Power quality:**
    - Voltage dips, swells, frequency, flicker, harmonic distortion

ERSE's regulation contributes to the quality of service

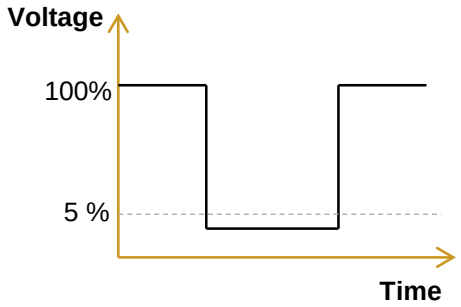
ERSE
ENTIDADE REGULADORA
DOS SERVIÇOS ENERGÉTICOS

Index

Continuity of supply

Definition of interruption:

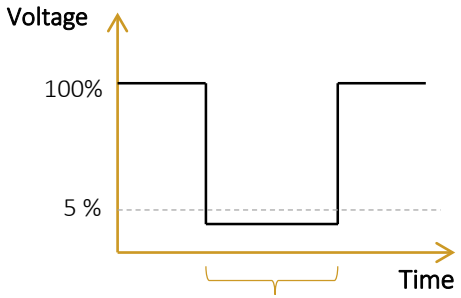
A condition in which the voltage at the supply is lower than 5% of the declared voltage



Long Interruption *versus* Short Interruption

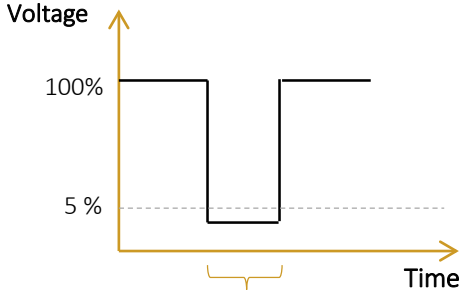
- Long: interruption with duration greater than 3 min.
- Short: interruption with duration equal or above than 1 second and equal or below than 3 min.

Long Interruption



t > 3 min

Short Interruption



1 sec ≤ t ≤ 3 min

Continuity of supply

Interruption type

- **Unplanned interruption:**

  Interruption without notice (due to faults in the electrical network)

- **Planned interruption:**

  Notice in advance by the network operator to allow the TSO/DSO to carry out scheduled work on the network

Planned interruptions aim to ensure the high performance of the networks

Continuity of supply

Interruption type

➢ Planned Interruptions - Impact in terms of quality of service:

- interruptions to carry out maintenance work on the networks in order to improve the quality of service

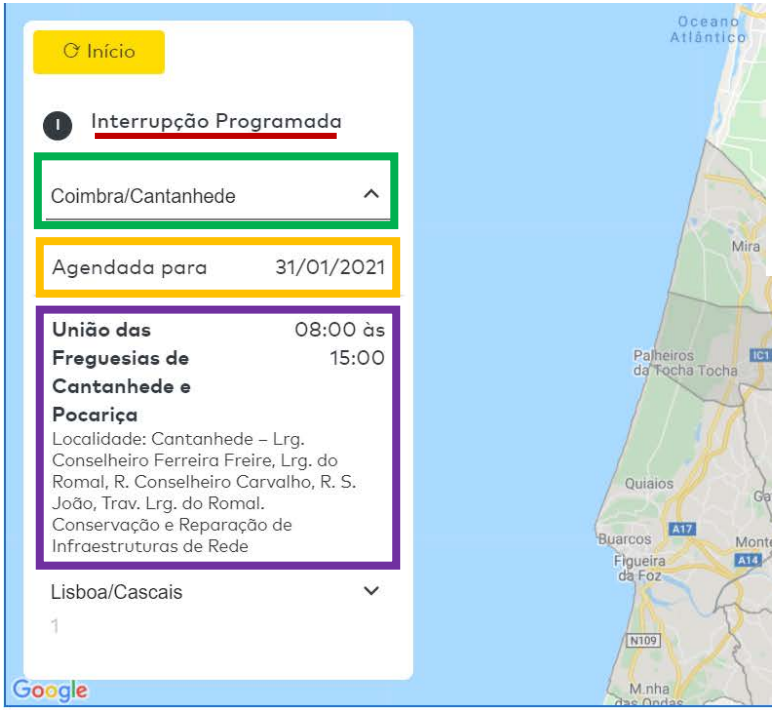
- the maximum number of interruptions is 5 per year and per affected customer and each interruption can only have a duration of less than or equal to 8 hours

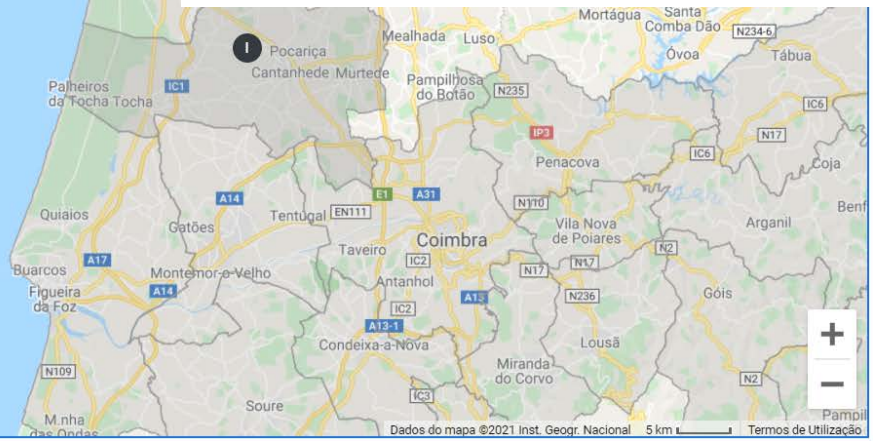
- the communication to customers is made at least 36 hours in advance, by individual notice or by means of social communication, to mitigate the impact of its occurrence

Continuity of supply

Planned interruption

- Communication of planned interruptions by the network operator





Notícias

Interrupções Programadas: 31 de Janeiro

27/01/2021 - 06:24

A EDP Distribuição-Energia, SA informa que para garantir a qualidade de serviço vai efetuar trabalhos localizados na sua rede de distribuição, sendo para tal necessário proceder à interrupção pontual da alimentação de energia elétrica no dia 31 de Janeiro de 2021 (domingo), nos concelhos de Cantanhede e Cascais.

Consulte aqui os locais afetados e respetivos períodos de interrupção.

Continuity of supply

Continuity of supply indicators

Continuity of supply

General quality

Individual quality

For the entire electrical system

Average quality of service

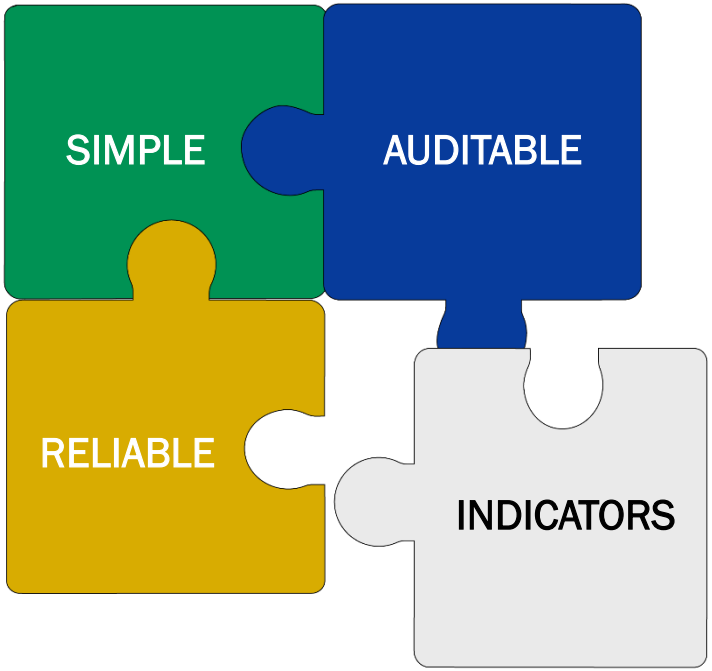
To measure the quality of service at each customer

General Indicators

Individual Indicators

Continuity of supply indicators

- Quality characterization/quantification



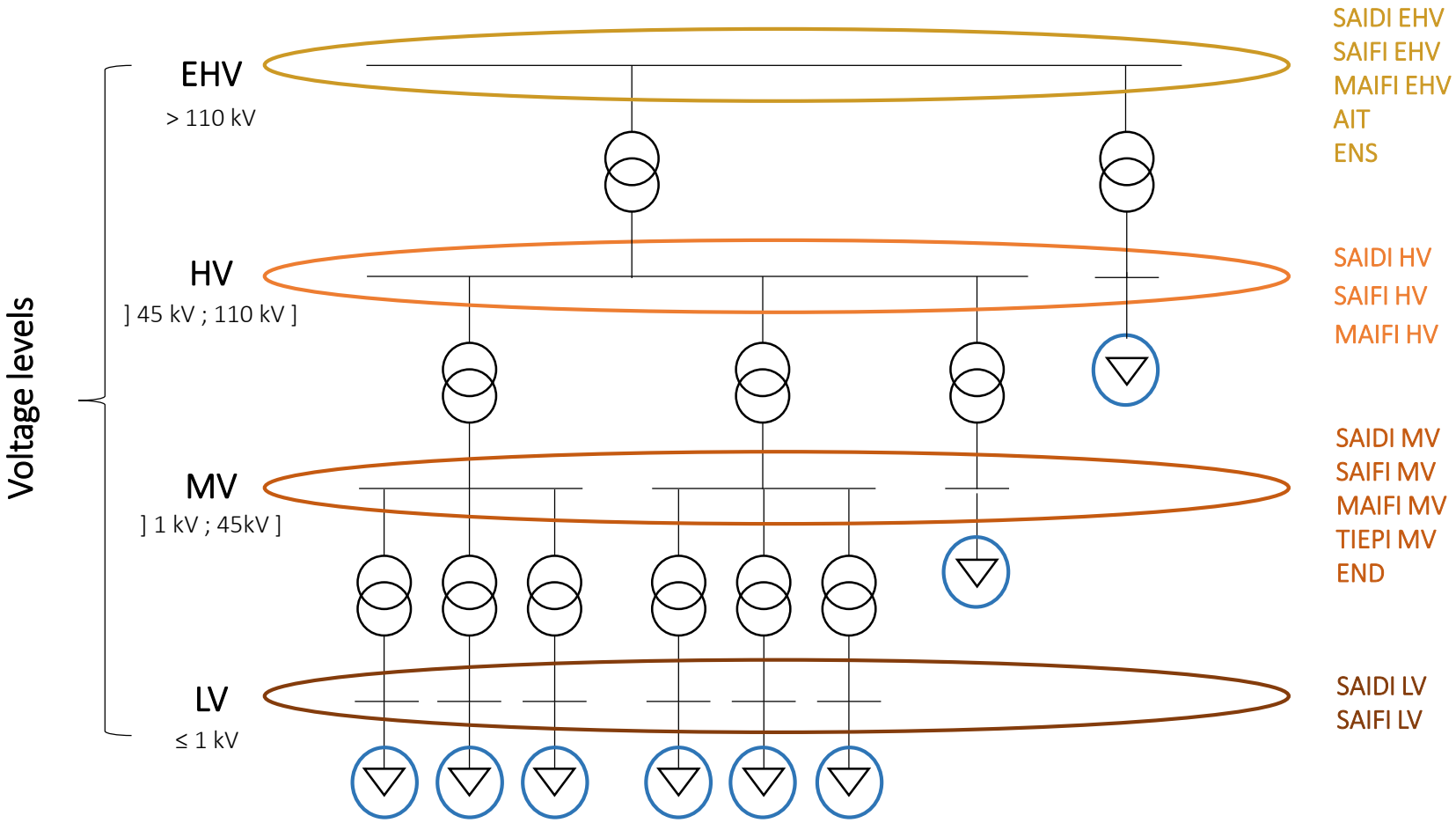
- Properties that indicators must have:
  - **Simple:** …to understand, …to determine, …to implement
  - **Reliable:** the data used for its calculation must be objective and its collection must be highly reliable
  - **Auditable:** possibility to check the data used in its calculation, as well as the calculations performed

Continuity of supply: general indicators

General indicators	Quantity	Duration	System	
			Transmission	Distribution
SAIFI	✓ (F – frequency)		✓	✓
SAIDI		✓ (D – duration)	✓	✓
MAIFI	✓ (F – frequency)		✓	✓
AIT			✓	
TIEPI				✓
ENS			✓	
END				✓

- System Average Interruption Frequency Index (SAIFI)
- System Average Interruption Duration Index (SAIDI)
- Momentary Average Interruption Frequency Index (MAIFI)
- Average Interruption Time (AIT)
- Equivalent Interruption Time of Installed Power (TIEPI)
- Energy Non Supplied (ENS)
- Energy Non Distributed (END)

Continuity of supply: general indicators



Individual indicators:

- Number of interruptions
- Duration of interruptions

Continuity of supply: general indicators

$$SAIFI = \frac{\sum_{i=1}^{N} N_i}{N_{tot}}$$

SAIFI: average number of "long" (D_i > 3 min) interruptions per customer per year

$$SAIDI = \frac{\sum_{i=1}^{K} N_i D_i}{N_{tot}}$$

SAIDI: average duration of interruption per customer per year

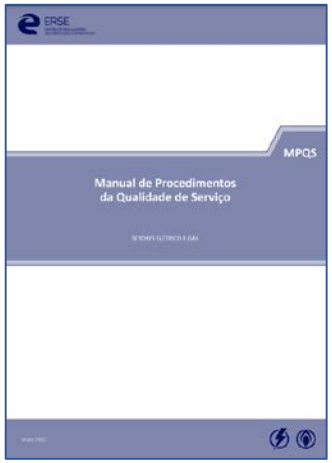
$$MAIFI = \frac{\sum_{i=1}^{N} N_i}{N_{tot}}$$

MAIFI as SAIFI, but for short ("momentary", 1 sec < D_i < 3 min) interruptions

$$AIT = \frac{ENS}{P_{me}}$$

AIT: relation between Energy Non Supplied (ENS) and expected average power (Pme), if no interruptions had been recorded

$$P_{me} = \frac{ENS + ES}{T}$$



Continuity of supply: general indicators

Exercise – Annual Interruptions reported by TSO:

Code of interruption	Code of Substation	Date	Interruption type	Causes	Duration (minutes)	ENS (MWh)
1/2021	SA	26/03/21 11:13:12	Unplanned	Human	0.4	0.3
2/2021	SB	21/04/21 07:44:31	Unplanned	Technical equipment	4.1	3.5
3/2021	SC	03/07/21 03:50:28	Unplanned	Human	3.0	1.4
4/2021	SD	13/10/21 09:20:28	Planned	Service reasons	5.9	8.7
5/2021	SE	13/12/21 19:05:07	Unplanned	Technical equipment	8.0	10.1

Addictional data: Total substations = 86 | Energy Supplied = 49 528 527 MWh | T= 365 x 24 x 60 = 525 600 minutes

$$SAIDI = \frac{\sum_{i=1}^{K} N_i D_i}{N_{tot}} \rightarrow \text{SAIDI EHV} = \frac{4.1 + 5.9 + 8.0}{86} = 0.21 \text{ min./PdE}$$

$$SAIFI = \frac{\sum_{i=1}^{N} N_i}{N_{tot}} \rightarrow \text{SAIFI EHV} = \frac{1 + 1 + 1}{86} = 0.03 \text{ interruptions/PdE}$$

$$MAIFI = \frac{\sum_{i=1}^{N} N_i}{N_{tot}} \rightarrow \text{MAIFI EHV} = \frac{1 + 1}{86} = 0.02 \text{ interruptions/PdE}$$

Continuity of supply: general indicators

Exercise – Annual Interruptions reported by TSO:

Code of interruption	Code of Substation	Date	Interruption type	Causes	Duration (minutes)	ENS (MWh)
1/2021	SA	26/03/21 11:13:12	Unplanned	Human	0.4	0.3
2/2021	SB	21/04/21 07:44:31	Unplanned	Technical equipment	4.1	3.5
3/2021	SC	03/07/21 03:50:28	Unplanned	Human	3.0	1.4
4/2021	SD	13/10/21 09:20:28	Planned	Service reasons	5.9	8.7
5/2021	SE	13/12/21 19:05:07	Unplanned	Technical equipment	8.0	10.1

Addictional data: Total substations = 86 | Energy Supplied = 49 528 527 MWh | T= 365 x 24 x 60 = 525 600 minutes

$$ENS = \sum_{i=1}^{N} ENS_i$$

ENS = 3.5 + 8.7 + 10.1 = 22.30 MWh

$$AIT = \frac{ENS}{P_{me}}$$

$$P_{me} = \frac{ENS + ES}{T}$$

$$AIT = \frac{T \times ENS}{ENS + ES}$$

$$AIT = \frac{365 \times 24 \times 60 \times 22.30}{22.30 + 49\,528\,527} = 0.24 \text{ min.}$$

Continuity of supply: individual indicators

- The customer is only interested in having information regarding the interruptions that occurred in his installation

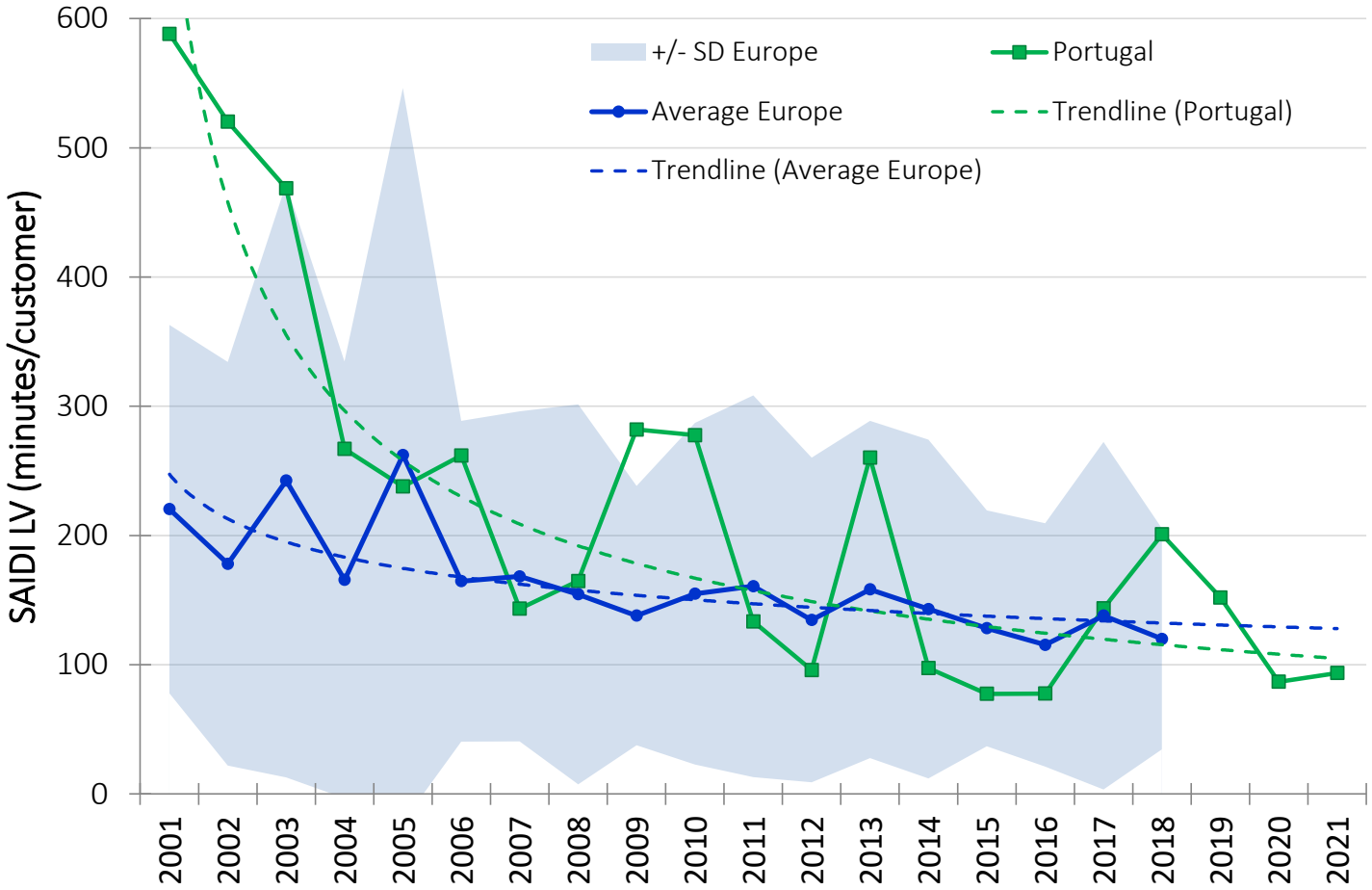
- **Individual Indicators**:
  - Number of interruptions: total number of interruptions experienced by each consumer
  - Duration of interruptions: total duration of interruptions experienced by each consumer

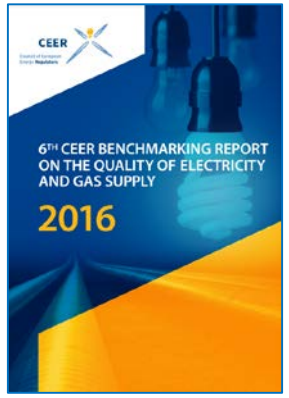
- **Interruptions to consider**: Long (interruptions greater than 3 minutes)

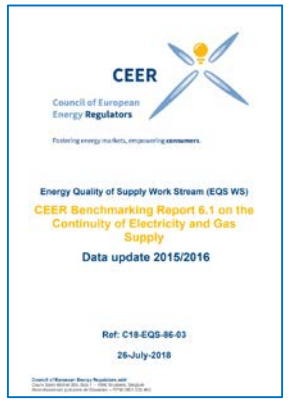
- **Calculation periodicity**: Yearly

Continuity of supply

Evolution of the duration of all interruptions in low voltage







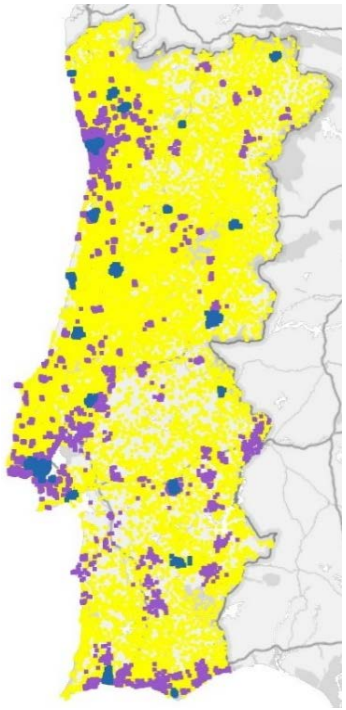
- In all interruptions (planned and unplanned) experienced by LV customers, there is a strong convergence of Portugal's general indicator with the European average.

Continuity of supply

Quality of service zones

- Quality of service zone → set of installation with equal characteristics related to quality of service

- The QSC considers 3 different Quality of Service Zones:
  - Zone A – Places with more than 25000 customers (urban areas);
  - Zone B – Places with customers number between 2500 and 25000 (semi-urban areas);
  - Zone C – Other places (rural areas).



- Locations with higher customer density

→ More demanding quality levels

Number of customers per QS zone in mainland Portugal

QS Zone	N.º de customers
A	1 667 216
B	1 805 116
C	2 774 031

Continuity of supply standards

- Indicators determined taking into account unplanned interruptions
- Long interruptions, not covering interruptions due to Exceptional Events

Exceptional events are deemed to have all of the following characteristics:

- Low probability of the occurrence of the event or its consequences
- They cause a significant reduction in the quality of service provided
- It is not economically reasonable for the network operator to avoid all their consequences
- The event and its consequences are not attributable to the network operator

- An event is only considered exceptional after approval by ERSE, following a request from a network operator or supplier
- Classification as an exceptional event allows its consequences to be excluded when verifying compliance with standards for general and individual indicators

Continuity of supply standards

General standards applicable to long unplanned interruptions in MV and LV distribution networks, per year

Voltage level	Indicator	QS Zone	Standard
MV	SAIDI MT (hours)	A	3
		B	4
		C	7
	SAIFI MT (interruption)	A	3
		B	5
		C	7
LV	SAIDI BT (hours)	A	3
		B	5
		C	8
	SAIFI BT (interruption)	A	3
		B	5
		C	7

- Locations with higher customer density
- Higher voltage levels

More demanding quality levels

Individual standards applicable to long unplanned interruptions in HV, MV and LV distribution networks, per year and per customer

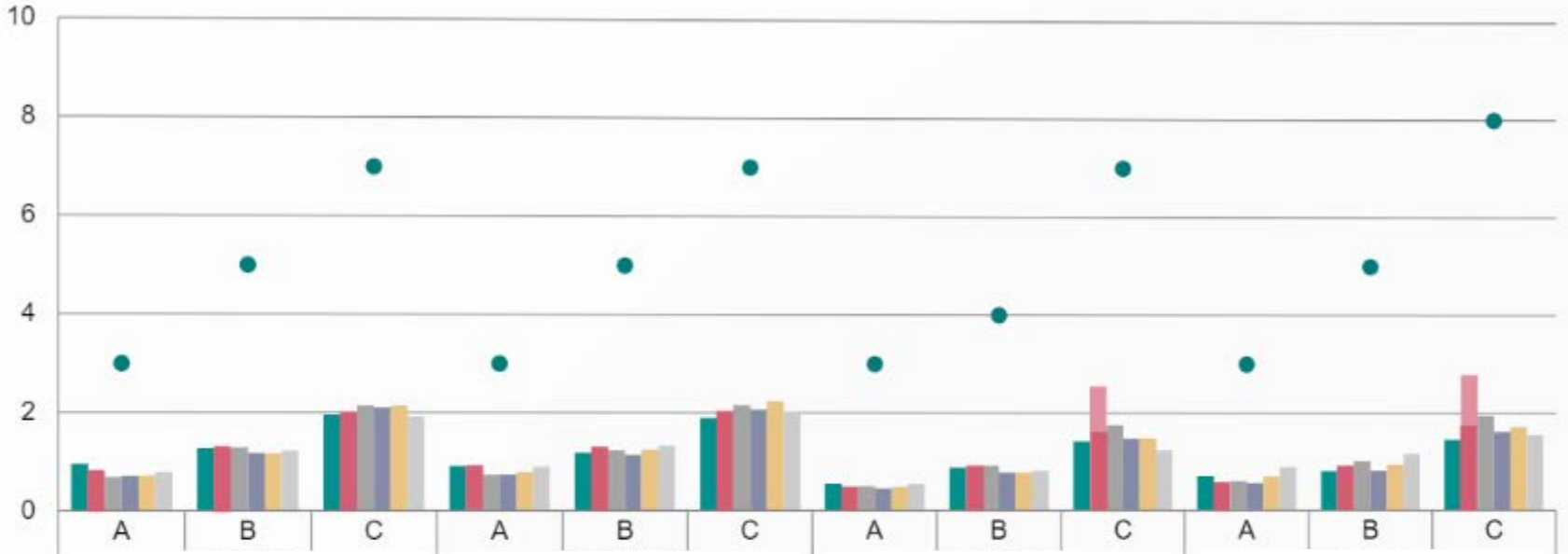
Voltage level	Indicator	QS Zone	Standard
HV	Number of interruptions	A	6
		B	6
		C	6
	Duration of interruptions (hours)	A	3
		B	3
		C	3
MV	Number of interruptions	A	8
		B	12
		C	18
	Duration of interruptions (hours)	A	4
		B	8
		C	12
LV	Number of interruptions	A	10
		B	15
		C	22
	Duration of interruptions (hours)	A	6
		B	10
		C	17

Individual standards applicable to long unplanned interruptions in EHV transmission networks, per year and per customer

Voltage level	Indicator	Standard
EHV	Duration of interruptions (hours)	0.75
	Number of interruptions	3

General standards

General standards and continuity of supply indicators by Zone (mainland Portugal)



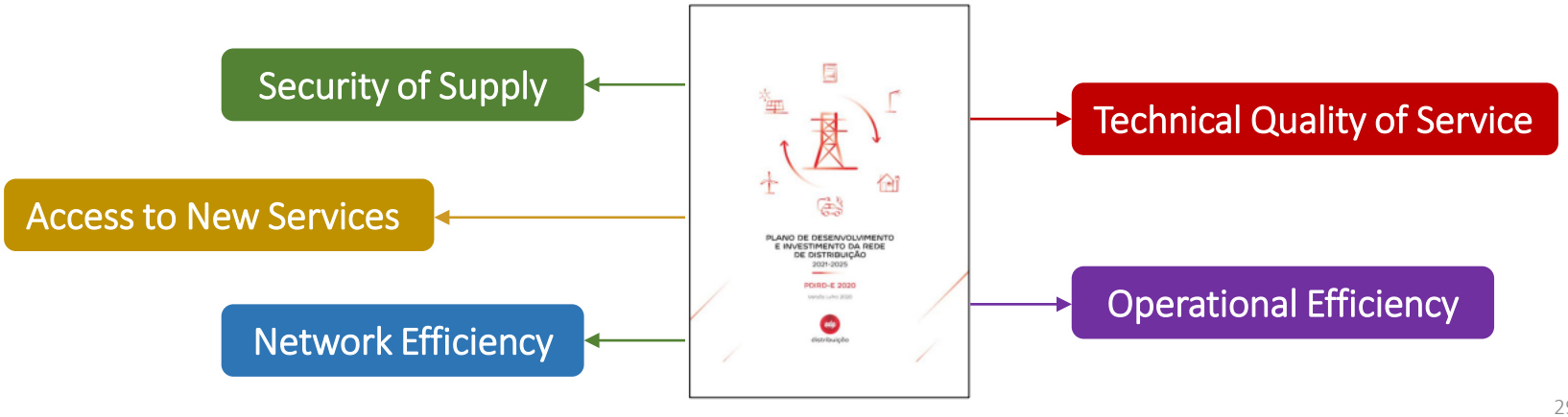
	SAIFI MV (Interruption/Point of delivery)			SAIFI LV (Interruption/customer)			SAIDI MV (hours/Point of delivery			SAIDI LV (hours/customer)		
	A	B	C	A	B	C	A	B	C	A	B	C
2016	1,0	1,3	2,0	0,9	1,2	1,9	0,6	0,9	1,4	0,7	0,8	1,5
2017	0,8	1,2	2,0	0,8	1,2	2,0	0,5	0,9	2,5	0,5	0,9	2,8
2018	0,7	1,3	2,1	0,7	1,2	2,2	0,5	0,9	1,8	0,6	1,0	1,9
2019	0,7	1,2	2,1	0,7	1,1	2,1	0,5	0,8	1,5	0,6	0,8	1,6
2020	0,7	1,2	2,1	0,8	1,2	2,2	0,5	0,8	1,5	0,7	0,9	1,7
2021	0,8	1,2	1,9	0,9	1,3	2,0	0,5	0,8	1,2	0,9	1,2	1,5
Standard	3,0	5,0	7,0	3,0	5,0	7,0	3,0	4,0	7,0	3,0	5,0	8,0

Service Quality Improvement Plan

- Network operators must develop a plan to improve the quality of service when they identify difficulties in complying with power quality thresholds or general standards established in the Code.

- These plans are considered in the **network development and investment plans** (subject to ERSE's opinion, discussion in Parliament and approval by the Government).

- Main investment vectors:



Compensation for non-compliance with individual standards

- Right to compensation
  - Failure to comply with individual standards of continuity of service
- Payment method
  - **Automatic** payment through the bill (no customer request required)
- When?
  - On the invoice of the 1st quarter subsequent to the calendar year to which the compensation relates
- Compensation for non-compliance with individual standards: Number of interruptions and Duration of interruptions
- If, for a given customer, both standards are exceeded, the customer will only receive one compensation (the standard with higher compensation value)

Compensation for non-compliance with individual standards

- Compensation for non-compliance with the standard for the number of interruptions (NI)

$$CN = [\ (NI - NI_p)] \times FC$$

CN - amount of compensation, in €
NI - number of interruptions
NI_P - standard value associated with the number of interruptions
FC - unit value of compensation for the number of interruptions, in €

- Compensation for non-compliance with the standard for the duration of interruptions (DI)

$$CD = [\ (DI - DI_p)] \times PC \times KC$$

CD - amount of compensation, in €
DI - total duration of interruptions, in hours
DI_P - standard associated with the duration of interruptions
PC - average value of contracted power during the year, in kW
KC - unit value of compensation for the duration of interruptions, in €/kWh

	LV	MV	HV and EHV
FC (€)	1.20	24.0	120.0
KC (€/kWh)	0.45	0.35	0.20

Exercise: Compensation for non-compliance with individual standards

In 2021, the distribution network operator verified that **Customer A** was **interrupted** for **730 minutes** (12.17 hours).

Customer A, connected to the **low voltage** network, belongs to **Quality of Service Zone A** and has a **contracted power of 3.45 kVA**.

Calculate the amount of compensation:

- Individual standard for total duration of interruptions (DI_P): 6 hours (360 minutes)
- Compensation unit value (KC): 0.45 €/kWh

Applying the formula **$CD = (DI - DI_P) \times PC \times KC$** , results:

CD_{2021} = (12.17 - 6) x 3.45 x 0.45

CD_{2021} = 9.58 € (total value of the compensation)

Incentive for TSO

➢ Incentive for the increasing of availability of network equipment

- **Objective**: to promote the reliability of the transmission network, in order to improve the quality of service at the delivery points provided by this network
- Applies to the transmission network operator in **Extra High Voltage**
- The relevant indicator is the **combined average availability rate** (TCD), which results from the weight of the average availability rate of **line circuits** and **power transformers**

$$TCD = \alpha \times Td_{cl} + (1 - \alpha) \times Td_{tp}$$

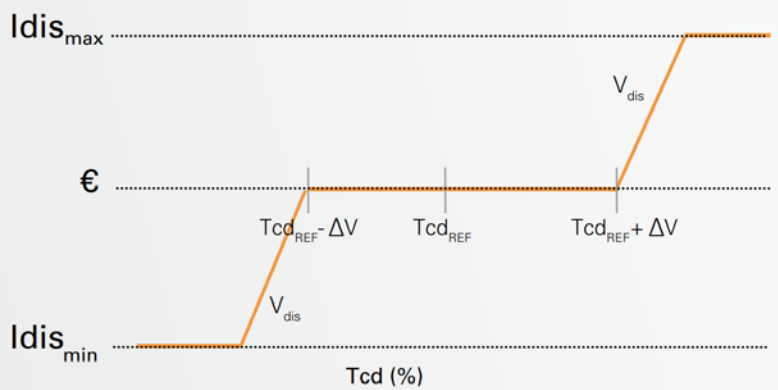
α: Weighting factor calculated as the relation between the line circuits average thermal capacity and the sum of the line circuits average thermal capacity and the power transformers average power;

Td_{cl}: Line circuits average availability rate, in %;

Td_{tp}: Power transformers average availability rate, in %.

Continuity of supply

➢ Incentive for the increasing of availability of network equipment



Parameters of the incentive:

$Idis_{min}$: Maximum penalty value, in €

$Idis_{max}$: Maximum reward value, in €

Tcd_{REF}: Reference value for the combined availability rate, in (%)

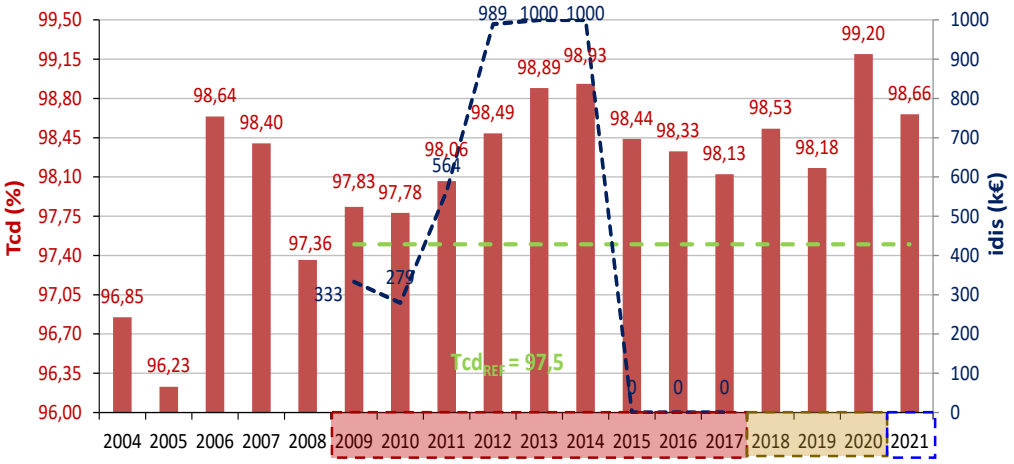
V_{dis}: Valorization of the combined average availability rate, in €

±ΔV: Dead band, variation of Tcd_{ref}, in %

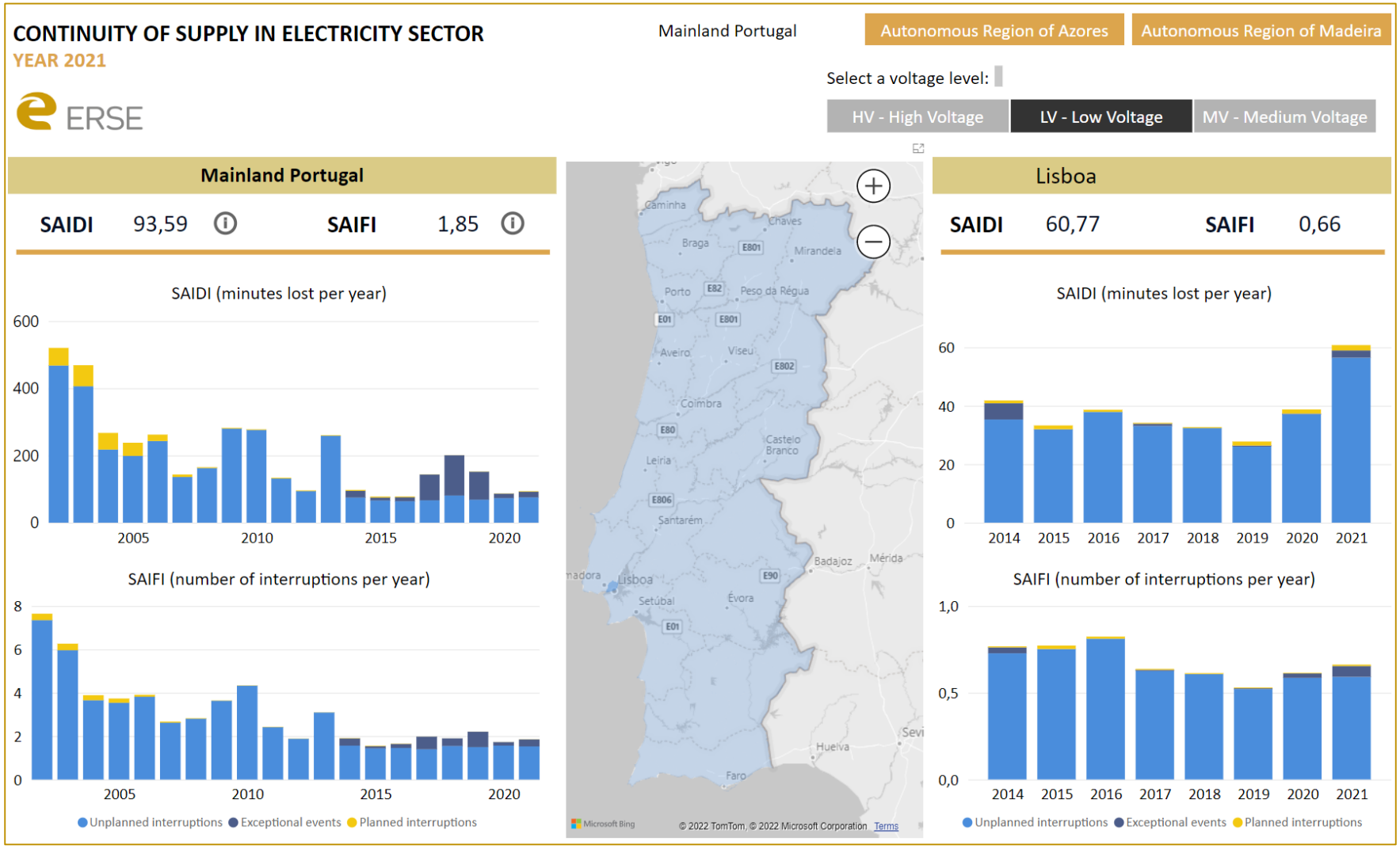
As the system is symmetric, the reward and the penalty have the same maximum value:

- $|\ Idis_{max}\ | = |\ Idis_{min}\ |$ = 1,000,000 € (approx. 0.34% allowed revenues of the transmission activity)
- Target value: Tcd_{REF} = 97.5%
- ΔV = 0% (no tolerance band)
- V_{dis} = 1,000,000 €
- α = 0.75

Combined availability rate and incentive amounts



Continuity of supply



Continuity of supply indicators are disaggregated by Regions, NUTS III (similar to districts) and National level

NUTS: Nomenclature of Territorial Units for Statistics

ERSE
ENTIDADE REGULADORA
DOS SERVIÇOS ENERGÉTICOS

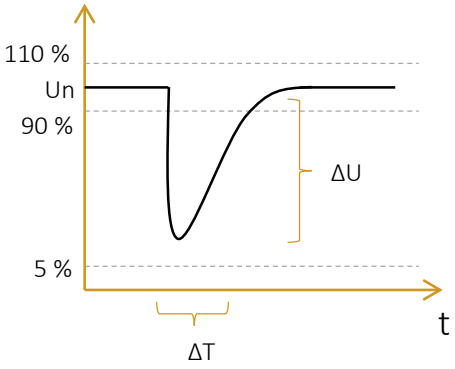
Index

Power quality

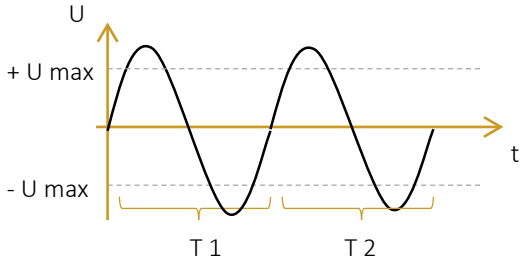
- Characteristics of the voltage wave are defined in the standard NP EN 50160

Low voltage supply characteristics			
Disturbance	Limits	Evaluation range	Percentage of measurements within limits during the range
Frequency	± 1%	year	99,5%
	+ 4% / - 6%		100,0%
Amplitude	± 10%	Each week	95,0%
	+ 10% / - 15%		100,0%
Flicker	$P_{lt} < 1$	Each week	95,0%
Total harmonic distortion	THD < 8%	Each week	95,0%

Voltage dips



Swells



Power quality

Power quality monitoring plans

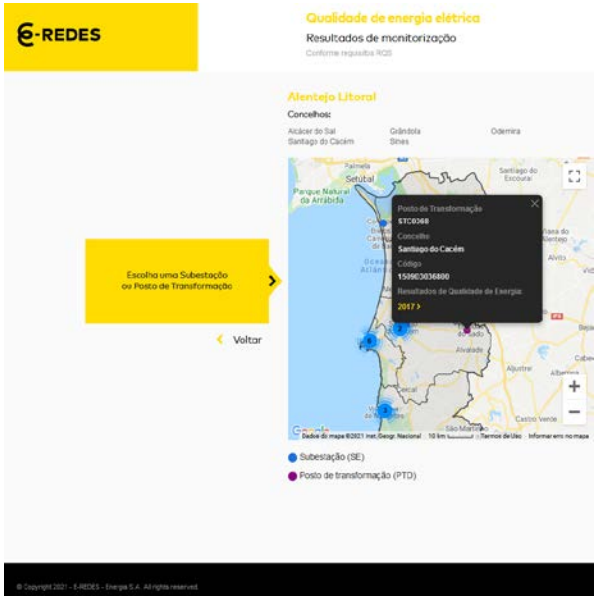
- **Network operators** must **develop power quality monitoring plans** to characterize the performance of the networks and verify compliance with the limits established for the different characteristics of the voltage waveform.

- Power quality monitoring may be carried out through **permanent monitoring** or **periodic campaigns**. The selection of points to be monitored must consider a balanced geographical distribution and ensure the coverage of customers identified by the network operators as being more susceptible to variations in power quality.

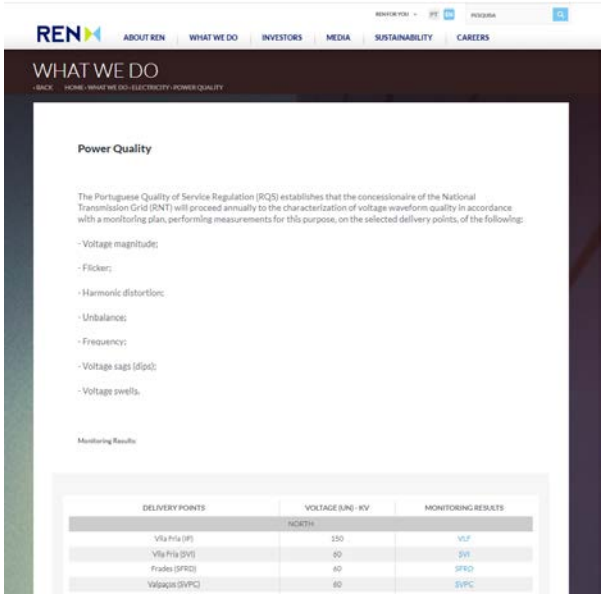
- The power quality monitoring plans have a **time horizon** of **two consecutive years** and must be sent to ERSE.

Power quality

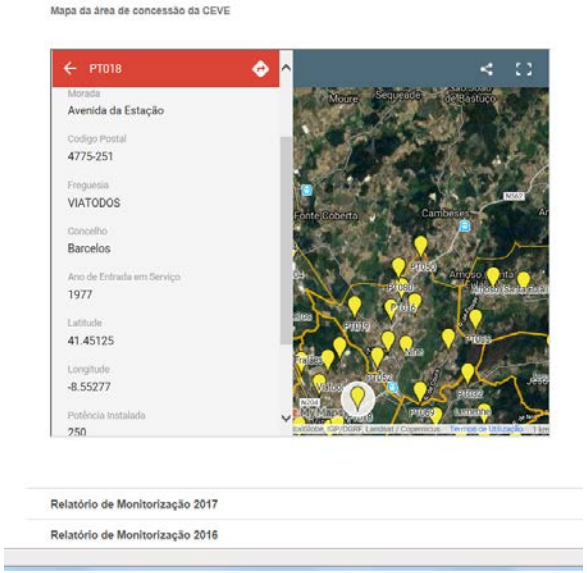
- Information available for customers



https://e-redes-qualidade.wntech.com/



https://www.ren.pt/en-GB/o_que_fazemos/eletricidade/qualidade_de_energia_electrica



http://www.ceve.pt/index.php?id=156

ERSE
ENTIDADE REGULADORA
DOS SERVIÇOS ENERGÉTICOS

Index

Audits and Reports

Quality of Service Reports

- **Network operators** and suppliers must send to Portuguese Regulator by email and publish on their websites the quality of service **report**.

Until May 31nd

- The **Portuguese Regulator** annually publishes the quality of service **report** for the electricity sector.

Until October 15th

Audits to verify regulatory compliance

- The Portuguese Regulator may carry out audits to verify compliance with regulatory provisions.

- Audits may focus on all or part of the regulation's provisions.

Audits and Reports

Steps for on-site inspections

1. Planning
   A. Choice of the company to be audited
   B. Preparation of "check-list", according to specific situations
2. Formal decision for inspection

   Approved by the Board and published in the website not identifying the companies
3. The week ahead: notification

   The operator is notified on the date/place of the audit
4. During the audit:
   A. Filling the check-list regarding operator business administration, procedures of interruptions management, telecontrol system, …)
   B. Random sampling interruptions to be checked
   C. Final minutes of the audit operation
5. After the audit:
   A. Report of the audit communicated to the company
   B. Juridical cross-examination company is informed and can ask to be formally heared
   C. Final decision for approving or rejecting on the basis of indexes' levels

Technical quality of service: data report obligations

Data on technical quality of service

- Each quarter and year, TSO/DSO provide to ERSE the continuity of supply indicators, adequately splitted according to regulatory guidance

- For each interruption, the TSO/DSO must record the following data in the "interruption register":

  - Type of interruption (planned/unplanned)
  - Starting time
  - Duration (for each group of customers with same duration)
  - Number of customer affected
  - Voltage level (EHV, HV, MV, LV)
  - Code of the affected installation
  - Cause of interruption (external damages, other)

- At the end of the year, an electronic copy of the register is uploaded in the data collection system of the regulator

Technical quality of service data exchange

Data reported by the TSO to ERSE

	Content
File #1	Non-compliance with individual standards (number of interruptions)
	Non-compliance with individual standards (duration of interruptions)
	List of Exceptional Events
	List of substations

	Content
File #2	General Indicators
	List of interruptions

Technical quality of service data exchange

List of substations

Code of substation	Name of substation	Location (District)	Geographic coordinates		Transformer power	Uc (kV)	Transformation relation	No. of busbars	Busbar arrangement	Year of commissioning	Year of last renovation	Transformers in service		Number of backup transformers
			Latitude	Longitude								Number	Last replacement year	
SAV	Alqueva Substation	Vidigueira	38.1859	-7.4981	340	60	400/60	2	2 bars	2007	n.a.	2	N/A	0
SBA	Bodiosa Substation	Bodiosa	40.7018	-7.9926	340	60	400/60	2	2 bars	2006	n.a.	2	2010	0
SBL	Batalha Substation	Batalha	39.6505	-8.7892	510	60	400/60	2	2 bars	1973	2006	3	2011	0

List of interruptions

Code of interruption	Date	Hour	Interruption			Duration (min.)	Equipament	Observations	ENS (MWh)
			Type	Cause	Description				
GI_23/2020	21-02-2020	05:38:01	Unplanned	Odd objects in the netwoks	Storks	1.9	TR 1 150/60 SOQ	n.a.	0.2
GI_48/2020	12-03-2020	13:36:03	Unplanned	Human	Errors in conservation, assemblies and tests	1.7	Bar II 60 SPN	n.a.	0.1
GI_136/2020	28-05-2020	10:30:15	Unplanned	Odd objects in the netwokrs	Other birds	6.5	TR 2 150/60 SER	n.a.	2.8

Technical quality of service data exchange

List of Exceptional Events

Code of incident	Voltage level (kV)	Name of substation	Duration (min.)	Delivery points	Contribution to the general indicators					Exceptional event? (Yes/No)	
					SAIFI	SAIDI (min)	MAIFI	TIE (min)	ENF (MWh)	Requested? (Y/N)	ERSE Classification (Y/N/Await)
GI_23/2020	60	SOQ	1,9	1	0,00	0,00	0,01	0,00	0,2	N	-
GI_136/2020	60	SER	6,5	1	0,01	0,08	0,00	0,03	2,8	N	-

Non-compliance with individual standards (number of interruptions)

Delivery Point	EHV			
	Compensation Paid		Investment Fund	
	Number	Amount	Number	Amount
	0	0	0	0

Non-compliance with individual standards (duration of interruptions)

Delivery Point	EHV			
	Compensation Paid		Investment Fund	
	Number	Amount	Number	Amount
	0	0	0	0

Technical quality of service data exchange

General Indicators

Indicator	Planned interruptions				Unplanned interruptions															Exceptional events								TOTAL
	Public interest reasons	Service reasons	Other networks or installations	**Total**	Security reasons	Strikes	Extreme natural conditions	Odd objects in the networkrs	Fire or flood	Vandalism	Third party	Atmospheric conditions	Maintenance	Network protections	Electric equipment	Technical reasons	Human intervention	Unknown reasons	External entities	**Total**	Security reasons	Strikes	Extreme natural condition	Odd objects in the networkrs	Fire or flood	Vandalism	Third party	**Total**	
SAIFI	0,01	0	0	0,01	0	0	0	0,01	0	0	0	0	0	0	0	0	0	0	0	0,01	0	0	0	0	0	0	0	0	0,01
SAIDI (min.)	24,26	0	0	24,26	0	0	0	0,08	0	0	0	0	0	0	0	0	0	0	0	0,08	0	0	0	0	0	0	0	0	0,08
MAIFI	0	0	0	0	0	0	0	0,01	0	0	0	0	0	0	0	0	0,01	0	0	0,02	0	0	0	0	0	0	0	0	0,02
TIE (min.)	0	0	0	0	0	0	0	0,03	0	0	0	0	0	0	0	0	0	0	0	0,03	0	0	0	0	0	0	0	0	0,03
ENF (MWh)	0	0	0	0	0	0	0	2,8	0	0	0	0	0	0	0	0	0	0	0	2,8	0	0	0	0	0	0	0	0	2,8

ERSE
ENTIDADE
REGULADORA
DOS SERVIÇOS
ENERGÉTICOS

EDIFÍCIO RESTELO
Rua Dom Cristóvão da Gama, 1, 3º
1400-113 Lisboa
Portugal
Tel: +(351) 21 303 32 00
Fax: +(351) 21 303 32 01 • **e-mail**: erse@erse.pt
url: http://www.erse.pt