Med-TSO
MEDITERRANEAN TRANSMISSION SYSTEM OPERATORS

Deliverable 1.2.1

Proposal of a Common Target Regulatory Framework (CTRF) for all the Mediterranean electricity systems

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"Mediterranean Project"

Task 1 "Common Set of Rules for a Mediterranean Power System and Transmission Grid Code"

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1 Executive summary

The present report constitutes the final deliverable of Subtask 1.2.1 of the Mediterranean Project. The objective of this activity has been to develop a proposal of technical aspects to regulate TSO-TSO relationship within the Mediterranean region identifying a concrete set of requirements for compliance that could be translated into rules for the whole region. In this first step the aim is that this potential set of rules will be applied on a voluntary basis by each country.

The Mediterranean Project (described in chapter 1), is carried out by MedTSO, and has as main objective the progressive harmonization of the electricity markets in the Mediterranean region, following a bottom-up approach (with the direct involvement of MedTSO members) through the following activity lines: developing a common set of basic rules, elaborating guidelines for network planning and the corresponding studies to analyse potential interconnections, promoting the development of a Mediterranean Electricity System analysing the mechanisms for sharing resources through cross border exchanges (especially in presence of renewables), sharing the knowledge between TSOs and creating a Mediterranean database with all the information of the different power systems. Security, stability and socio – economic development in the Mediterranean countries strongly depends on reliability energy supply and on the possibility to develop an integrated regional energy market. This project will strongly require to meet the future and valuable energy exchanges between all the countries which are actively or not yet working on it.

This deliverable focus on developing a common set of basic rules for the entire region, with a particular focus on those rules related to TSOs responsibilities and functions, and which are associated to the following fields:

- Legal and regulatory aspects. Further coordination with regulators is needed in this field.
- Connection of users (generation, distribution and consumption units) to the grid.
- Operation of the interconnected systems.
- Markets; particularly those associated to the system services management.

The work has been performed by MedTSO Technical Committee 2 (TC2) on Regulation and Institutions. The methodology used (as described in chapter 2) has been the use of surveys for equal consideration of all the members (13 TSOs have actively participated as shown in the image below) in order to maximize the participation. This cooperative approach is accompanied with the creation of specific task forces for each area and also an iterative approach between the results of the survey and the final proposal.

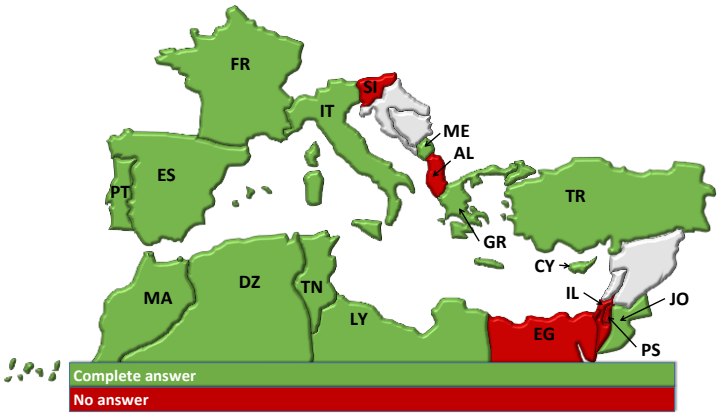


Figure 1 – MedTSO members' participation

In chapter 3 the results of the survey are shown. These results include the TSO responses about the need of harmonization of the regulatory framework in Mediterranean region of each technical issue and also the desired rule format for the potential proposal. The analysis of the TSO responses reaches to a global decision of which aspect should be included in the proposal. From the 135 issues included in the survey 49% of the total (66) have been classified as priority and a concrete proposal of each of them is included in chapter 4.

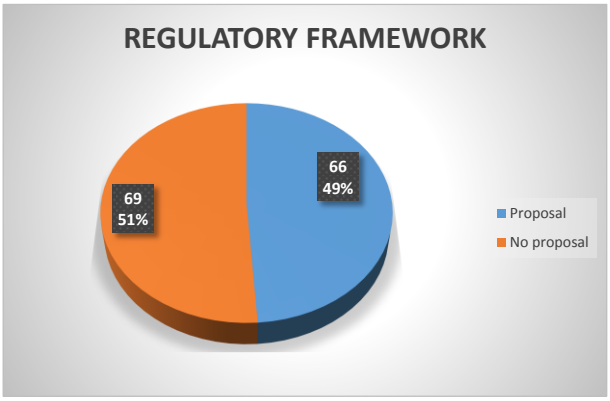


Figure 2 – Number of issues included in CTRF

Almost half of the proposed issues come from the operation are (32 out of 66). In general, a high percentage of the issues from the operation and the system service markets areas are included in the proposal while legal and regulatory and connection areas are represented in a lower percentage.

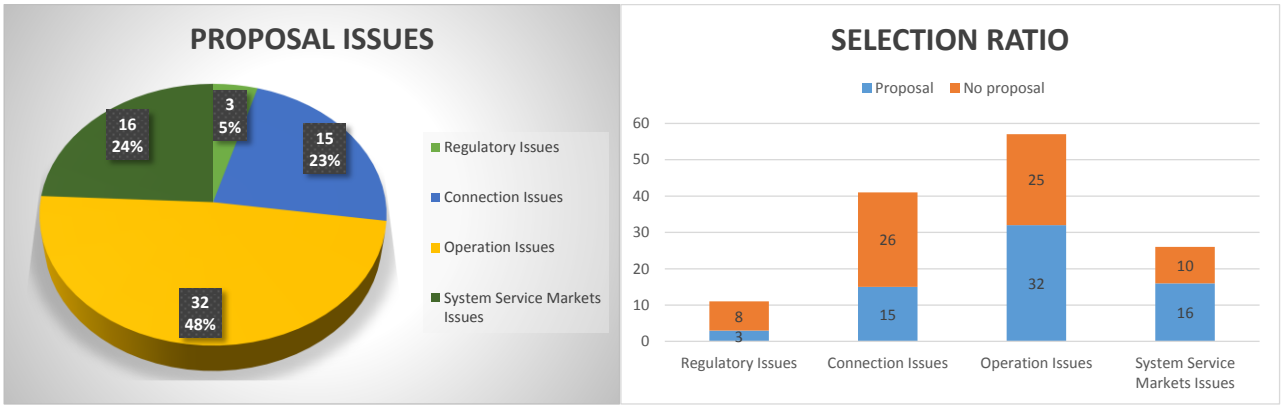


Figure 3 – Number of issues included in CTRP per thematic area

From the legal and regulatory area 3 issues are prioritized for future harmonization: need of having a coordinated regulation for international interconnections, need of unbundling between regulated and non-regulated activities and need of a responsible authority (independent body) with transparent and neutral dispute settlement procedures between stakeholders.

From the connection area a total of 15 issues, the majority of them regarding frequency, voltage and control requirements; and also from the connection procedure (anyway only 2 out of 10 from this block have been considered). No issues have been selected from the following blocks: short circuit requirements, demand side response services and compliance and monitoring.

From the operation area 32 issues have been selected, the majority of them regarding technical requirements, information exchange, contingency analysis, load frequency control and exchange of reserves

and system defence plan. From HVDC block although 4 issues were originally considered, not a single issue was selected so this block of issues became less relevant. No issues have been selected from the following blocks: dynamic stability studies and dispatch priority.

From the system service markets area 16 issues have been selected, mainly about capacity calculation, capacity allocation, dispatching and balancing and transparency.

The next task to be performed by MedTSO TC2 is the elaboration of a proposal of tentative roadmap for adoption and compliance of the issues included in the proposal for common target regulatory framework. For this aim a survey will be conducted asking to each TSO about the temporal prioritization.

On a later stage this proposal will be analysed from a zonal perspective taking into consideration the similarities and current degree of harmonization in neighbouring countries from the same geographical area. This new analysis will end in specific proposals for different zones in the Mediterranean region.

2 Introduction

Security and socio – economic development in the Mediterranean strongly depends on energy and on the possibility to develop an integrated regional energy market.

Energy infrastructures are key for achieving this goal, especially as regards the development of a reliable, secure and sustainable transmission network, capable of interconnecting the power systems and allowing the exchange of electricity and integration of new generation sources.

Based on multilateral cooperation as a strategic approach to regional development for facilitating the integration of the Mediterranean Power Systems, MedTSO has received a three-year grant from the European Commission (Directorate-General for Neighborhood and Enlargement Negotiations - DG NEAR) to carry out the so called "Mediterranean Project" (February 2015 – January 2018).

The Project aims at the progressive harmonization and strengthening of the electricity markets in the Mediterranean region, following a bottom-up approach and with a direct involvement of MedTSO Members, through the following activity lines:

a) Rules

Developing and sharing a common set of basic rules, in cooperation with the association of the Mediterranean Regulators for energy (MedReg), for the interoperability of the Mediterranean power systems, facilitating electricity exchanges, development of infrastructures and institutional cooperation.

b) Infrastructure

Preparing and sharing guidelines for Network Planning and implementing a Euro-Mediterranean Electricity Reference Grid for studies and coordinated development of interconnections.

c) International Electricity Exchanges.

Promoting the development of a Mediterranean Electricity System, focusing on methodologies, procedures and mechanisms for sharing resources through cross border exchanges, based on power systems complementarities and the optimized use of generation and transmission infrastructures.

d) Knowledge Sharing.

Establishing a forum among the relevant professionals working in the fields related to the scope of the project (a sort of "MedTSO Academy"), supporting also MedTSO members and other relevant organizations through the organization of specific and oriented knowledge activities.

e) Med-TSO Database.

Creation of a Mediterranean database for managing all the information shared in the frame of the project, dealing with network characteristics, energy scenarios and market data.

In line with the abovementioned mandate as regards the "rules" or assessment of regulatory frameworks, MedTSO members have conducted a preliminary assessment of the current regulatory situation in the various MedTSO members´ countries. This was the object of a preliminary deliverable, entitled "***Starting Regulatory Framework (Technical Rules) in the Mediterranean Region***" which was approved by the MedTSO General Assembly on the 25th of May 2016.

This first deliverable aimed at presenting an overview and overall analysis of the power sector regulatory framework in the MedTSO countries, with a particular focus on those rules related to TSOs responsibilities and functions, which are associated to the following fields:

- Connection of users (generation, distribution and consumption units) to the grid.
- Operation of the interconnected systems.
- Markets; particularly those associated to the system services management.

The objective of both the "Starting Regulatory Framework" document and of this new document is framed within a more general purpose of advancing towards harmonisation of rules for the coordinated operation and development of interconnected systems in those aspects more related with the TSOs activities.

The present document constitutes the deliverable D1.2.1, as a result of Subtask 1.2 within Task 1 of the Mediterranean Project (Rules), which is structured as follows:

Activity 1.1- Compilation of relevant regulatory framework

- ✓ Deliverable 1.1 Starting Regulatory Framework (SRF).

Activity 1.2- Elaboration of common target regulatory framework.

- ✓ Deliverable 1.2.1 Proposal of Common Target Regulatory Framework (CTRF).
- ✓ Deliverable 1.2.2 Proposal of tentative roadmap.

Activity 1.3- Elaboration of draft set of Mediterranean network rules.

- ✓ Deliverable 1.3 Models of rules and contracts.

The present document, entitled "Proposal of Common Target Regulatory Framework" is a stepping stone towards the development of a common set of basic rules in the MedTSO region

This Task is being developed by MedTSO Technical Committee 2 on Regulation and Institutions (TC2) with the support and contribution of its members.

3 Methodology and general considerations

The development of this deliverable has been structured in several steps. A first step, built with the previously identified parameters or regulatory aspects identified under the "*Starting Regulatory Framework*" deliverable, MedTSO members have been requested to answer a survey, and to indicate, according to their understanding, to which extent those regulatory aspects require a certain **degree of harmonization**. This harmonization relevance has been ranked as follows:

- "0"= No need to harmonize;
- "1, 2 and 3" = Low priority;
- "4, 5 and 6" = Medium priority;
- "7, 8 and 9" = High priority.

A second analysis has been performed as regards the clarification of the **rule format** in the different national Systems:

- **External regulation**: Grid codes or other types of regulation approved by other entities different from the than TSOs. These could be national or regional (if applicable to more than one country).
- **Internal regulation**: Agreements or contracts adopted between TSOs or between TSOs and other stakeholders.

3A1. Which contingencies are considered in your power system?				COMPLETE THE ROW CONCERNING YOUR NATIONAL POWER SYSTEM								
Country	N-1	Partial N-2	Loss of biggest generation plant	NEED FOR HARMONIZATION (No / Low / Medium / High) According to your view, quantify in increasing degree of relevance: 0: No need 1, 2, 3: Low priority 4, 5, 6: Medium priority 7, 8, 9: High priority *(cells in blank will not be coonsidered for the average score)*	RULE FORMAT **External regulation:** Grid Codes or other types of regulation approved by other entities rather than TSOs. It could be national or regional (if applies to more than one country) **Internal regulation:** Agreements or contracts adopted between TSOs or between TSOs and other stakeholders						
					Which is the current situation in your power system? *(cells in blank will be considered as "No")*			Which is the desired situation for the future harmonized regulation? (3-Best option; 2-Medium option: 1-Worst option) *Select an option for each cell (possible to repeat) (cells in blank will not be coonsidered for the average score)*			Relevance of this issue in countries/power systems interconnected only with HVDC links compared with AC links (3-More ; 2-Equal; 1-Less) *(cells in blank will not be coonsidered for the average score)*	
					External regulation - National or supranational - (Grid Codes) (Yes/No)	Internal regulation TSO - TSO (Yes/No)	Internal regulation TSO - User (Yes/No)	External regulation - national or supranational - (Grid Codes)	Internal regulation TSO - TSO	Internal regulation TSO - User		

Figure 4 – Methodology (I)

In line with the above, MedTSO members have indicated both what the current rule format is under their respective systems and the level of priority for each of the technical issues considered.

Technical requirements	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)															
	DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	External	Internal TSO - TSO	Internal TSO - User
2A. What is the system states in each frequency range?	6	9	7	9	9	8	7	9	9	9	9	8	9	11	11	2
2B1. What are the voltage ranges in normal conditions (for unlimited operation) in your system?	6	6	7	6	6	6	5	6	6	5	7	5	5	11	9	3
2B2. What are the voltage ranges in extraordinary conditions (for unlimited operation) in your system?	6	5	7	4	6	6	5	6	6	5	7	6	5	11	9	3
2C. Specific voltage ranges in international interconnections?				4	6	6	4	3	6	3	3	5	5	11	9	3
2D. Which measures apply in your system for rea power management?		4	5	4	3	5	3	4	5	3	6	3	3	10	7	4
2E. Specific reactive power management for international interconnections?	9	9	6	9	9	8	7	7	9	9	7	7	9	8	10	2
2G. System protection coordination criteria in interconnection lines?	6	8	8	8	9	7	7	7	9	7	7	8	8	8	9	2

Example

Figure 5 – Methodology (II)

Subsequently, and based of the answers received, TC2 members have agreed on a global degree of prioritization and a desired rule format in the future target Mediterranean regulatory framework for each of the identified parameters.

Technical requirements	GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)				
	DEGREE OF PRIORITIZATION*	External	Internal TSO - TSO	Internal TSO - User	RULE FORMAT
2A. What is the system states in each frequency range?	8	3	2	1	External
2B1. What are the voltage ranges in normal conditions (for unlimited operation) in your system?	6	3	2	1	External
2B2. What are the voltage ranges in extraordinary (for unlimited operation) in your system?	6	3	2	1	External
2C. Specific voltage ranges in international int ions?	5	3	2	1	External
2D. Which measures apply in your system for reactive power management?	4	3	2	1	External
2E. Specific reactive power management for international interconnections?	8	2	2	1	External / Internal TSO-TSO
2G. System protection coordination criteria in interconnection lines?	8	2	3	1	Internal TSO-TSO

Example

Figure 6 – Methodology (III)

Regarding the rule format, TC2 members have also indicated the relevance of the different issues in countries or power systems only interconnected with HVDC links. This aspect has not been considered for the analysis presented in this report but could be useful for future tasks within the Mediterranean Project.

As a result of the described analysis, the TC2 has come up with a set of proposed “solutions” or priorities as regards the potential need, and format, of a harmonized set or rules. An iterative approach has been used, so some technical aspects not considered in a first step have been finally included due to the further analysis and debates within TC2 members.

The present document is structured in 2 main chapters:

- In chapter 3 the results of the survey completed by MedTSO members are presented identifying those aspects that will be considered for the proposal.
- In chapter 4 the concrete proposal for the aspects considered as prioritary is included.

Both chapters are divided in 4 technical subchapters as follows:

- Legal and regulatory
- Connection to the grid
- Operation of interconnected systems
- System service markets

In total 141 aspects have been considered in the survey, divided as indicated in the following table:

REGULATORY FRAMEWORK : 34 Issues ⇨ 141 Aspects		
1 Regulatory Issue (8 Aspects). REE &STEG		
13 Connection Issues (47 Aspects)	14 Operation Issues(57 Aspects)	6 System Services Markets Issues (29 Aspects)
• Connection procedure (REE) • Frequency requirements (IPTO) • Voltage requirements (REN) • Reactive power requirements (Cyprus) • Short circuit requirements (IPTO) • Protection requirements (Cyprus) • Control requirements (SonelgazOS) • Power quality (REN) • Demand disconnection schemes (IPTO) • System restoration capabilities (IPTO) • Demand side response services (IPTO) • HVDC requirements (IPTO) • Compliance and monitoring (SonelgazOS)	• System states (REE) • Technical requirements (REE) • Information exchange (REE) • Contingency analysis (REE) • Dynamic stability (TEIAS) • Management of international exchange programs (TEIAS) • HVDC technologies (TEIAS) • Outage coordination (ONEE) • Load frequency control (ONEE) • Reserve management (ONEE) • Defence plan (TEIAS) • Restoration plan (TEIAS) • Training (NEPCO) • Dispatch priority (NEPCO)	• Legal issues (TERNA) • Capacity calculation (STEG) • Capacity allocation (STEG) • Dispatching and balancing (RTE) • Settlement and metering (GECOL) • Transparency (REE)

Figure 7 – Summary of aspects included in the survey

The results of the survey consider the responses received from 13 TSOs, members of MedTSO.

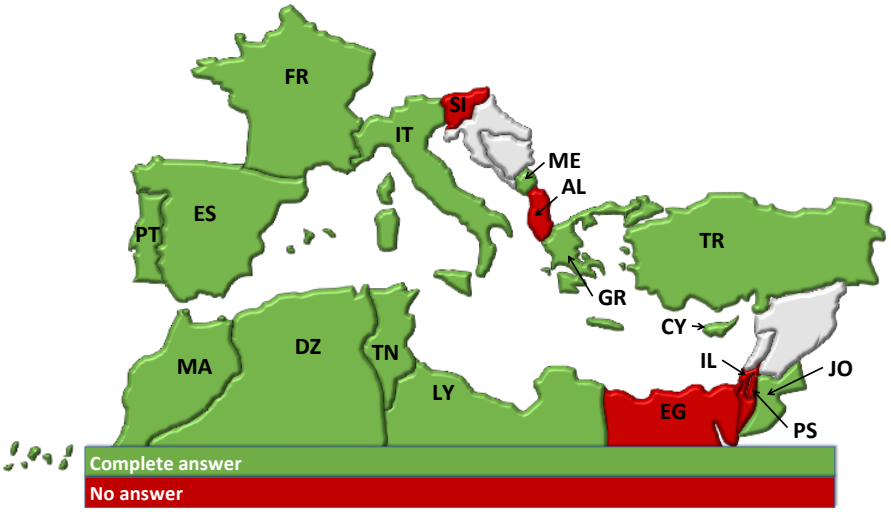


Figure 8 – MedTSO members' participation in the survey

4 Survey on need of harmonization of regulatory framework in Mediterranean area

In this chapter the results of the survey about the need of harmonization of the regulatory framework in Mediterranean area is presented, including an overview of the existing or short-term expected rules in the Mediterranean region for all aspects examined using the conclusions from the previous report in which the Starting Regulatory Framework in the Mediterranean region was presented.

Based on the existing situation and the results of the survey, the different aspects have been prioritized according to their degree of relevance for future harmonization (low/medium/high) and a desired suitable rule format for the common target regulatory framework is proposed for each aspect. In addition, the relevance of the different aspects was evaluated for the case of countries/power systems interconnected only with HVDC links and compared with AC links.

In **Annex 2** a summary of the TSO responses about the survey on prioritization of issues to be included in common target regulatory framework is included.

For some aspects, individual clarifications have been provided where the TSO prioritization point of view differs substantially from the global result, in order to know and understand why the TSO answered in a different way from the average of the answers.

4.1 Legal and regulatory issues

In order to have a clear understanding of the structure and functioning of the power systems of the different countries, it is important to have a global view of the overall legal and regulatory framework.

Furthermore, transparent, stable and predictable legal and regulatory conditions are most desirable both for companies willing to invest in a particular country, and for stakeholders and consumers that are subject or bound by such legal and regulatory frameworks.

Chapter 3.1 aims at having a clearer picture of the suitable level of harmonization needed in the different areas identified as relevant, based on the previous analysis made and the opinion of MedTSO members. Notwithstanding of the present analysis, one must understand the particular circumstances and evolution of the power systems in both shores of the Mediterranean, basin as:

- more mature and more or less integrated “internal energy market” in the north (European Union)
- less mature markets (where they exist) on the south shore of the Mediterranean.

In addition, when reading this report, it should be noticed that the analysis has been carried out by TSOs, with a technical perspective. The required coordination with regulators is not considered in the analysis.

The prioritization level proposed by MedTSO members for the different legal and regulatory issues considered as more relevant by the TC2 members are presented in the following tables.

According to the inputs received and the assessment made within TC2, there is a general understanding that most of the identified areas or issues have been classified as having a medium level of priority (ranging, on

average, between 4 and 6), as regards their importance for future harmonization[1]. On the basis of the referred classification and analysis a proposal has been made for all the issues analysed.

Additionally, as regards the rule format for most of the aspects analysed, most TSOs consider that they should adopt the form of an external rule.

	Legal and Regualatory issues	NATIONAL SCOPE (DEGREE OF PRIORITIZATION(I) FOR REGULATORY HARMONIZATION)													CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY		DEGREE OF PRIORITY(I)	RULE FORMAT
A	Should the responsible body for the development and/or approval of technical rules be harmonized?	3	4	3	5	7	4	4	3	2	2	4	3	4	External	4	External
B	Should the responsible authority for the settlement of disputes among stakeholders (eg. Conflict of access to the network...) be the same in all MedTSO countries?	6	5	5	5	9	5	6	4	2	2	4	4	5	External	5	External
C	Should stakeholders have the possibility to appeal NRA´s decisions at a higher instance?	6	7	3	6	9	5	6	4	5	7	5	5	5	External	6	External / TSO-TSO
D	Should stakeholders be involved/partipate in the elaboration of technical rules/regulations	6	7	3	6	7	5	1	4	5	6	6	6		External	5	External
E	Should new entrants (TSO/DSO/suppliers) be allowed?	6	6	7	6		6		6	5	6	6	6	5	External	6	External
F	Should regulated (transmission/distribution) and non regulated activities (generation/supply) be unbundled?	7	9	7	9	4	6		6	8	9	4	7	4	External	7	External
G	Is there a need for a coordinated regulation in order to make feasible and viable an international interconnection?	7	7	7	6	8	7		6	6	6		7	5	External	7	External
H	Should the subjects involved in international interconnections be the same in all systems?	6	8	6	6	7	7		5	5	7	5	7	4	External	6	External
I	Should the requirements for participation on the Electricity Markets in MedTSO countries be harmonized?	6	5	4	5	5	7	6	5	5	5	4	6	5	External	5	External / TSO-TSO
J	With reference to the following activities: Production, transmission, distribution; trading on injection; trading on consumption; metering, it is important to asses whether, in the differente systems, these are carried out on a free (open) market model; and whether there is a presence of a single subject (monopoly) or more subjects/counterparties."	6	7	3	7	7	6	6	5	7	7	6	7	5	External	6	External
K	With reference to the following activities: Production, transmission, distribution; trading on injection; trading on consumption) it is important to assess the diferent typologies of authorizatins and the corresponding competent authorities (Ministry, NRA, TSO, independent body.	6	7	2	7	6			3	5	7	5	6	5	External	5	External

(I) **Priority level** - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 9 – Legal and regulatory area. Compilation of TSO answers

Note: Blank means that no answer has been provided by the concerned TSO.

A. Should the responsible body for the development and/or approval of technical rules be harmonized (be the same authority/ entity in the MedTSO countries)?

PROPOSAL 1: *Stakeholders should be consulted (exante) in the process of elaboration of technical rules which are, in most cases, drafted by TSOs and approved by the corresponding Ministry or NRA.*

B. Should the responsible authority for the settlement of disputes among stakeholders (e.g. Conflict of access to the network) be the same in all MedTSO countries?

PROPOSAL 2: *Dispute settlement procedures should be transparent and neutral. TSOs should not be both judge and jury to a dispute settlement. The "arbitrator", with the authority to settle the dispute, should be the relevant Ministry, the (independent) NRA or a third independent body.*

C. Should stakeholders have the possibility to appeal NRA´s decisions at a higher instance?

PROPOSAL 3: *The possibility of appeal should be granted at a higher instance, different from the one issuing the first decision.*

[1] Being "10" the maximum priority for harmonization and "0" meaning that there is no need to harmonize.

D. Should stakeholders be involved/participate in the elaboration of technical rules/regulations?

PROPOSAL 4: *Being the case in most systems, no particular need for further action is considered. Stakeholders' participation should be a requisite in the overall regulatory process.*

E. Should new entrants (TSO/DSO/suppliers) be allowed?

PROPOSAL 5: *New entrants, particularly at the level of generation and supply should be allowed to create appropriate market conditions[2]. This should be done by law.*

F. Should regulated (transmission/distribution) and non-regulated activities (generation/supply) be unbundled?

PROPOSAL 6: *Concerning the question on the need of unbundling of regulated (transmission/distribution) and non- regulated activities (generation/supply), most MedTSO members agree on the need to harmonize. In line with this, it should be noted that in most countries these activities are already unbundled. In most MedTSO countries external regulation is the rule format currently adopted for the unbundling of these activities. As regards the desired situation for the future harmonized regulation, most TSOs consider that the best option for the regulation of unbundling is via external regulation (national or supranational - Grid Codes.*

G. Is there a need for a coordinated regulation in order to make feasible and viable an international interconnection?

PROPOSAL 7: *In order to make feasible and viable an international interconnection, certain issues require a coordinated regulation - this should be done on a coordinated basis between the concerned countries TSOs and NRAs. In most MedTSO countries the current rule format adopted is the external regulation. As regards the desired situation for the future harmonized regulation most TC2 members consider that the best option is via external regulation (national or supranational - Grid Codes).*

H. Should the subjects involved in international interconnections be the same in all systems?

PROPOSAL 8: *The subjects involved in international interconnections should, in principle be the same in all systems. However this is considered as a medium priority issue since different circumstances may exist in the different systems[3].*

[2] This would bring more competition, lower prices and additional benefits for consumers.
[3] Competent authorities may be different in the concerned countries (e.g. Ministry vs. NRA/ TSO having a leading role).

I. Should the requirements for participation in the Electricity Markets in MedTSO countries be harmonized?

PROPOSAL 9: *Authorization for participation in the electricity market should be granted on a transparent and non-discriminatory basis. Ideally by the relevant Ministry responsible for energy or by the corresponding NRA.*

J. With reference to the following activities: Production, transmission, distribution; trading on injection; trading on consumption; metering, it is important to assess whether, in the different systems, these are carried out on a free (open) market model; and whether there is a presence of a single subject (monopoly) or more subjects/counterparties."

PROPOSAL 10: *Regulation should ensure free, transparent and non-discriminatory access to the market (generation, supply, metering and distribution). This would contribute to increasing competition, lowering prices and ultimately would benefit consumers.*

K. With reference to the following activities: Production, transmission, distribution; trading on injection; trading on consumption) it is important to assess the different typologies of authorizations and the corresponding competent authorities (Ministry, NRA, TSO, independent body.

PROPOSAL 11: *Authorisation required for the performance of the different activities (production, transmission, distribution, metering...) should be issued by an independent body (Ministry, NRA or other independent body). This should be guaranteed by regulation.*

4.2 Connection to the grid

The results of the survey for the different connection aspects are presented below in the following subchapters.

4.2.1 Connection procedure

OVERVIEW: The questions included on this chapter show how the connection procedure is managed in each country. In general, the situation is quite homogeneous regarding the studies performed, the horizons and criteria considered in the studies, the obligations for users to send simulation models, the capacity connection priority or the limiting magnitudes required to connect to the transmission grid (with obvious differences depending on the size of each power system). Regarding the payment of these connection studies, the situation varies between different countries, but there is not a clear relationship between different countries as could be expected (i.e. between European countries or between Maghreb countries). In addition, the obligation of paying for the transmission assets needed for the connection of non-transmission facilities (generation, distribution or consumption) is again not homogenous with many differences depending on each power system.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the connection procedure is presented in the following table. Based on the answers received, which for most aspects are rather homogeneous, connection procedure aspects are globally ranked as of medium and low importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Connection procedure		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
2A	Studies performed for Access and Connection	6	6	2	4	3	6	5	6	4	2	7	5	5	External/Internal	5	External/Internal
2B	Horizons used for access capacity calculation	4	4	2	4	2	4	5	4	4	2	5	5	4	External	4	External/Internal TSO-TSO
2C	Criteria used for access capacity calculation	3	7	5	7	3	6	5	6	4	4	5	5	4	External	5	External/Internal TSO-TSO
2E	Remuneration mechanism for connection studies performed by TSOs (by the applicants or other)	3	3	0	2	2	3	5	4	3	1	4	4	5	External	3	External/Internal TSO-TSO
2F	Responsibility of payment for the transmission assets needed for the connection of generation	3	5	1	4	2	4	7	4	4	1	4	4	3	External	4	External
2G	Responsibility of payment for the transmission assets needed for the connection of distribution	4	5	2	4	2	4	7	4	3	1	5	4	5	External/Internal TSO-User	4	External
2H	Responsibility of payment for the transmission assets needed for the connection of consumption units	4	5	1	4	2	4	7	4	3	1	4	4	3	External	4	External
2I	Limiting magnitudes for connection to the transmission grid	4	5	1	4	2	4	7	4	3	2	4	4	5	External	4	External/Internal TSO-TSO
2J	Design criteria used for new transmission facilities needed for connection	4	6	1	4	2	5	5	4	3	1	4	4	3	External	4	External/Internal TSO-TSO
2L	Obligation of users to provide simulation models to network operators	5	4	5	4	2	6	5	4	6	4	5	4	3	External	4	External/Internal TSO-TSO
2N	Capacity connection priority	5	4	4	4	3	4	5	4	3	4	5	4	3	External	4	External
2O	Binding relationship between planning and connection authorization	5	4	5	4	3	4	5	4	3	3	5	4	3	External	4	External/Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 10 - Connection area. Connection procedure. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Harmonization of Studies for access and connection to the network are considered of high priority by STEG (TN) in order to provide specifications for renewables to be incorporated in the new grid code which is being drafted.
- The application of the N-1 criterion[4] for access capacity calculation is considered of high priority by Cyprus TSO, especially in cases where system security is highly dependent on interconnections (e.g. single interconnection link between systems of different sizes).
- According to IPTO (GR) certain N-2 cases, which could put in risk system security, should also be examined, following bilateral agreements (e.g. cases of contingencies in a 400kV double-circuit line on common tower close to the border, resulting in the loss of a large production unit).

4.2.2 Frequency requirements

OVERVIEW: This chapter focuses on the requirements requested by the users when they are connecting to the system, with emphasis on three major aspects, namely the frequency/time range limits for users to withstand without damage, the rate of change of frequency withstand capability and the application of limited frequency sensitive mode. In general, frequency range operation is rather homogeneous in most countries and is performed without time limitation from 49,5Hz to 50,5Hz. In frequency ranges lower than 47Hz, operation is limited to less than 1min in all countries, with the exception of Turkey and Montenegro, where it applies only for 10 minutes, and Morocco with no time limitation. The rate of frequency withstand capability ranges from 1 to 2 Hz/sec, with the exception of France and Jordan, where such rate is not specified and Montenegro where the frequency withstand capability is expressed in terms of maximal allowed frequency deviation for quasi-steady and dynamic state. Requirements for overfrequency and underfrequency schemes exist in all countries (where applicable), with the exception of Montenegro for overfrequency and of Algeria, Turkey and Libya for RES. Above mentioned schemes apply for all generation units above certain MW threshold defined by each TSO. In general, such requirements are harmonised (or there is provision for future regulation) in all European countries including Turkey, while similar provisions exist in the Maghreb countries, where the services are applicable.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of frequency requirements is presented in the following table. Based on the answers received, which are rather homogeneous, frequency requirements are globally ranked as of medium/high importance for future harmonization, while the most suitable rule format in the target regulatory framework is external regulation.

[4] The N-1 criterion is an expression of a level of system security entailing that a power system can handle the loss of any single component (production units, lines, transformers, bus bars, consumption etc.)

Frequency requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
3A	Frequency/time range limits for users to withstand without damage	6	6	6	8		6	5	4	6	8	6	6	5	External	6	External/Internal TSO-TSO
3B	Rate of change of frequency withstand capability	5	6		6		5	5	4	6	7	5	4	5	External	5	External
3C	Limited frequency sensitive mode – overfrequency and underfrequency schemes	6	7	8	6		6	3	6	6	7	7	7	4	External	6	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 11 - Connection area. Frequency requirements. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Time/frequency ranges harmonization is considered by REE (ES) as a high priority issue in case of synchronous interconnection between different power systems and harmonisation of this aspect is required at least at synchronous area level.
- The rate of change of frequency harmonization should also be highly prioritised according to REE (ES), in view of the expected high penetration of renewables.
- According to RTE (FR), high level of harmonization is required in general towards frequency behaviour.

4.2.3 Voltage requirements

OVERVIEW: This chapter focuses on the requirements requested by the users when they are connecting to the system, with emphasis on two major aspects, namely the voltage/time range limits for users to withstand without damage and the technologies with obligation to comply with fault ride through capability requirements. As a general conclusion, in all countries for voltage levels between 300kV to 400kV the operation voltage range from 0,95pu to 1.05pu is performed without time limitation, while for voltage levels between 110kV to 300kV, the operation voltage range from 0,90pu to 1,11pu[5] is also performed without any time limitation. However, for voltages outside this band, some countries defined time limitations (ranging from 5 to 90 minutes or others). Regarding the fault ride through capability requirements for transmission grid users, FRT profiles curves for different technologies (wind, solar or Synchronous generation) have been defined by most countries. In some countries, the FRT specification is not yet fully completed for all generation technologies, but it is expected that some of them will have this definition

[5] Except for Morocco transmission grid, that in this country the operation voltage range with unlimited time is only between 0,90pu to 1,087pu.

performed soon. In the case of ENTSO-E members, the *Network Code on Requirements for Grid Connection of Generators* was approved and will be implemented in the next two years. In this network code, the requirements will be specified for all generator technologies.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of voltage requirements is presented in the following table. Based on the answers received, which are rather homogeneous, voltage requirements are globally ranked as of medium/high importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Voltage requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
4A	Voltage/time range limits for users to withstand without damage	6	6	5	6		6	4	4	5	6	7	5	6	External	6	External
4B	Requirements for compliance with fault ride through capability (per technology)	5	6	5	6		6	5	6	7	7	5	5	4	External/Internal TSO-User	6	External/Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 12 - Connection area. Voltage requirements. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Time/voltage ranges harmonization is considered by several countries as a medium priority because of the border links, in particular in case of synchronous interconnection between different power systems. The harmonisation of this aspect is required at least at the border links by internal regulation (agreements among neighbour TSOs).
- According to REE and REN, high level of harmonization is required for fault ride through capability requirements, in particular in case of synchronous interconnection (but not exclusively, because when the countries are interconnected by HVDC link, the fault ride through capability requirements can be relevant too), because of the large penetration of RES connected to the transmission and distribution systems of several countries in the Mediterranean region. It is an important technical aspect that may have a supranational effect, especially in case of high penetration of renewables in the system, both existing and anticipated in the future. Global harmonization of this characteristic is not required, but harmonization of certain minimum requirements should be established in all countries in order to minimize/avoid the effect of perturbations at the grid of neighbouring countries (e.g. after short-circuit).

4.2.4 Reactive power requirements

OVERVIEW: This chapter focuses on the way reactive power requirements are managed in each country. Answers indicate that in 6 out of 12 TSOs (Algeria, Cyprus, Montenegro, Morocco, Tunisia and Turkey) the limits of reactive power requirement are differentiated per technology, while there is no difference in the other 6 (France, Greece, Italy, Jordan, Portugal and Spain).

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of reactive power requirements is presented in the following table. Based on the answers received, which are very homogeneous, reactive power requirements are globally ranked as of medium/high importance for future harmonization, while the most suitable rule format in the target regulatory framework is external regulation.

Reactive power requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
5A	Limits of reactive power contribution	6	6	4	6		6	5	4	7	6	5	5	6	External	6	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 13 - Connection area. Reactive power requirements. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Harmonization of reactive power requirements of transmission connected users is considered of high priority by REN (PT). The large penetration of renewables connected in transmission system, both existing and anticipated in the future, justifies the need to harmonize the "Limits of reactive power contribution" (the maximum range of Q /Pmax = between - % of P and + % of P). This harmonization is more relevant in situations where the possible impact of the generation can appear, like Power Plants near the neighbouring countries. Of course, the need of this harmonization can be mitigated, if each TSO provides the reactive power contribution directly. However, it's better if all the countries have the same defined range (more or less) Q/Pmax Range or P-Q/Pmax profile.
- Algeria stresses that the compensation of the reactive energy deficit caused by the integration of RES in the transmission system should be highly prioritized for future harmonization, so that this issue is resolved in the target regulatory framework.

4.2.5 Short circuit requirements

OVERVIEW: This chapter focuses on the short circuit requirements used by the TSOs. Concerning currently existing short circuit limits for switch equipment, TSOs use different limits ranging from 16 kA to 63 kA (depending on the voltage level), with the exception of Italy where it is not specified in regulation, while in most cases short circuit ratio limits are not specified in regulatory frameworks.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of short circuit requirements is presented in the following table. Based on the answers received, which are less homogeneous, short circuit requirements are globally ranked as of low importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Short circuit requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
6A	Short Circuit current limits for switch equipment	3	6	4	4	1	4	3	4	3	1	3	4	3	External	3	External
6B	Short Circuit ratio limits for thermal, CCGT, HPP		4		3		0	1	1	0	0	2	3	2	External	2	External/Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 14 - Connection area. Short circuit requirements. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Cyprus TSO emphasizes on the impact of short circuit current limits for switch equipment on the long term system design and also on the need of harmonization of short circuit ratio limits for generators to the extent of possible practical implementation

4.2.6 Protection requirements

OVERVIEW: This chapter focuses on the way protection requirements are managed in each country. In most countries (8 out of 12) general criteria are applied regarding protection schemes to be used for non-transmission facilities connected to the transmission grid. These criteria generally include similar aspects in the protection schemes (short circuit, both internal and external, over and under frequency, over and under voltage, demand circuit protection and unit transformer protection). Redundancy in the protection schemes is required in all MedTSO countries and the main functions included in the relays are rather similar (distance and differential are the most widely implemented).

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of protection requirements is presented in the following table. Based on the answers received, which are rather homogeneous, protection requirements are globally ranked as of low and medium importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Among the protection requirements, redundancy in telecommunication and protection schemes is considered to have the highest importance for future harmonization, followed by the required aspects of protection schemes.

Protection requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
7A	Type of protection criteria (general Vs particular or each case) for non-transmission facilities connected to the transmission grid		3	2	2		4	2	2	3	3	3	2	3	External	3	External/Internal TSO-TSO
7B	Aspects included in the protection schemes for non-transmission facilities connected to the transmission grid? (e.g. external short-circuit, internal short-circuit, over and under frequency, over and under voltage, demand circuit protection, unit transformer protection, backup schemes)	5	4	3	4		5	4	4	3	3	4	4	3	External	4	External/Internal TSO-TSO
7C	Isolation levels in the transmission grid (based on international standards Vs specific regulation)	3	2	3	2	3	3	3	2	3	2	3	2	3	External	3	External/Internal TSO-TSO
7D	Redundancy required for telecommunication and protection schemes	5	4	5	4		6	4	6	4	3	5	5	5	External	5	External/Internal TSO-TSO
7E	Main functions required inside the multifunctional relays installed in the transmission grid	4	3	3	3		3	2	2	3	3	3	3	3	External	3	External/Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 15 - Connection area. Protection requirements. Compilation of TSO answers

4.2.7 Control requirements

OVERVIEW: This chapter focuses on the control requirements used by the TSOs. In what concerns the global architecture and schemes required for controllability and observability of non-transmission facilities connected to the transmission grid, in general, the situation is quite homogeneous since in all MedTSO countries direct communication between user and TSO control centre is required, with the exception of Spain where in some cases (small renewables) communication is mandatory through intermediate control centres. Observability and controllability requirements depend on the magnitude of power (between 1 MW and 10 MW) and in some countries also of the voltage. The communication system characteristics are similar in all MedTSO countries: IEC standard protocol is always required, while double communication channel, optic fiber and dedicated channels are widely required but not in all power systems.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of control requirements is presented in the following table. Based on the answers received, which are rather homogeneous, control requirements are globally ranked as of medium and low importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Control requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
8A	Global architecture and schemes required for controllability and observability of non-transmission facilities connected to the transmission grid?	6	6	5	5		5	4	2	7	4	4	4	4	External	5	External/Internal TSO-TSO
8B	Observability of non-transmission facilities by TSO control systems (real time monitoring)	5	5	5	5		5	5	4	4	7	5	5	6	External	5	External/Internal TSO-TSO
8C	Magnitudes provided in real time from non-transmission facilities to TSO control centre	6	6	4	6		6	5	6	4	7	6	4	4	External	5	External
8D	Controlability of non-transmission facilities by TSO control systems	5	4	6	5		6	5	5	5	6	6	5	4	External	5	External
8E	Characteristics required for the communication system	3	3	2	3		4	3	3	3	2	3	3	2	External	3	External/Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 16 - Connection area. Control requirements. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Harmonization of the communication between Users - TSO control centre should be highly prioritised according to REN (PT), due to the large penetration of renewables (in particular wind and solar) connected in the transmission system, both existing and anticipated in the future, the impact of which in the neighbouring countries can be significant, depending on their scale.

- For the same reason according to REE (ES) harmonisation is required both of the non-transmission facilities that should be observable and the magnitudes to be monitored from the TSO control room, as well as of the status (On/Off) of these facilities according to GECOL (Libya).
- Algeria stresses that due to the intermittent nature of RES and their influence on the load curve, it is essential that all these productions are observable by the TSO control center. In particular for RES connected to the distribution network, the distributor must send to the TSO control center information in real time (or forecast of the consumption curve) on RES production.

4.2.8 Power quality

OVERVIEW: The chapter on power quality focuses on the normative and requirements considered in the transmission system, with emphasis on six major aspects, namely the normative standards used as reference for power quality regulation, the maximum number of voltages dips per voltage level (or node), the total harmonic distortion (THD) factor, the flicker limit values and the reference levels for voltage unbalances and transient overvoltage. As a general conclusion, all countries have established normative standards for power quality in their transmission network, with most of them considering the IEC 61000 normative and others the EN50160 normative or their national grid code. Regarding the maximum number of voltage dips on the network, only one country (IT) has established limit value (per voltage level) for voltage dips, which however are not imposed by any normative, but are expected values on the basis of specific measurement campaigns. All countries have established limits to the THD, with 70% of them considering the same THD value for all voltage levels, while 30% consider different THD values per voltage level (lowest THD values for the highest voltage level). The THD values are between 1.5% and 8% and the THD values equals 3% and 5% are the most common in the Mediterranean region. All countries have established limits to flicker, with most of them not considering different flicker values per voltage level. The flicker limit value equal to 1 is the most common in the Mediterranean region. All countries consider some limit levels in their systems regarding the voltage unbalances in the transmission grid, ranging from 1% to 5% with most common value 2%. Most countries (10 out of 13) have established limits for the transient overvoltage, some of them considering transient overvoltage limits per voltage range/voltage level, with the most common value 110%.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of power quality is presented in the following table. Based on the answers received, which are less homogeneous, power quality aspects are globally ranked as of low and medium importance for future harmonization, while external and internal regulation are both considered as the most suitable rule format in the target regulatory framework.

Power quality		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
10A	Reference normative standards for power quality regulation in the transmission grid (e.g. EN 50160, IEC 61000...)	5	4	3	3	1	5	3	5	3	3	4	3	4	External	4	External/Internal
10B	Limit total number of voltages dips per node in the system (per voltage level if needed)	3	4	1	3	0	3	2	4	2	1	3	3	2	Internal TSO-User	2	External/Internal
10C	Total Harmonic Distortion (THD) factor in the system	4	4	2	3	0	4	4	3	2	2	3	2	3	External/Internal TSO-User	3	External/Internal
10D	Flicker limit values in the system (planning/emission limits included)	4	6	2	2	0	4	4	3	2	2	3	2	1	Internal TSO-User	3	External/Internal
10E	Reference levels for voltage unbalances in the system	3	4	2	2	1	3	4	3	2	2	4	2	3	Internal TSO-User	3	External/Internal
10F	Reference levels for transient overvoltage in the system	3	5	4	4	0	4	3	4	2	2	4	2	3	Internal TSO-User	3	External/Internal

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 17 - Connection area. Power quality. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Cyprus TSO emphasizes that certain power quality aspects such as voltage dips, flicker and overvoltages are a measure of the system design level and the quality of supply to the consumer
- According to ONEE (MA) the effort to harmonize the way TSOs deal with voltage sags will definitely help enhance power quality between interconnected power systems.

4.2.9 Demand disconnection schemes

OVERVIEW: This chapter focuses on the demand disconnection schemes used by the TSOs. 6 out of 12 TSOs have both low frequency and low voltage demand disconnection schemes while 7 TSOs have only low frequency demand disconnection scheme.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of demand disconnection schemes is presented in the following table. Based on the answers received, which are rather homogeneous, demand disconnection schemes are globally ranked as of medium/high importance for future harmonization, while the most suitable rule format in the target regulatory framework is external regulation.

	Demand disconnection schemes	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
12A	Existence of demand disconnection schemes (low frequency and/or low voltage) in the system	6	7	8	7		6		6	5	7	6	5	6	External/Internal TSO-TSO	6	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 18 - Connection area. Demand disconnection schemes. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- According to RTE (FR) low frequency disconnection scheme should be highly prioritised, in order to ensure impartial, efficient and 'as expected' load disconnection among frequency control areas.

4.2.10 System restoration capabilities

OVERVIEW: This chapter focuses on the system restoration capabilities required by the TSOs, in particular black start and island operation. In general, all countries that include system restoration capabilities requirements in their regulation (both black start and island operation) include obligation for thermal units to provide this service. In some cases, hydro power plants are also included. Nevertheless, it is important to stress that many countries do not have these requirements included in their regulation.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of system restoration capabilities is presented in the following table. Based on the answers received, the existence of system restoration capabilities in the different technologies is globally ranked as of low/medium importance for future harmonization: Black Start Capability with answers less homogeneous has low ranking, while Island Operation Capability with rather homogeneous answers has medium ranking. In both cases the most suitable rule format in the target regulatory framework being external regulation.

	System restoration capabilities	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
13A	Existence of Black Start Capability per technology	4	2	2	2		3	6	3	3	2	2	2	1	External	3	External
13B	Existence of Island Operation Capability per technology	4	4	4	4		3	6	6	3	4	4	5	4	External	4	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 19 - Connection area. System restoration capabilities. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- ONEE (MA) focuses on the implications of having different capabilities of operating isolated power generation means on the capacity transfers and the need of requiring the same level of preparation by TSOs and also stresses that island mode generators are usually connected in a parallel mode and therefore can successfully respond in case of grid power supply failure.
- CGES (ME) stresses the need of island operation capability on generation facilities with installed capacity of ≥ 30 MW.

4.2.11 Demand side response services

OVERVIEW: This chapter focuses on the demand side response services required by the TSOs. The provision of DSR services is included, being optional in 10 of the 13 countries that have responded to the survey, with the exception of Cyprus, Jordan and Libya where there is no regulation developed in this aspect yet.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of demand side response services is presented in the following table. Based on the answers received, which are rather homogeneous, demand side response services are globally ranked as of medium/low importance for future harmonization, while the most suitable rule format in the target regulatory framework is external regulation.

	Demand side response services	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
14A	Existence and type of demand side response services in the system	4	4	3	3		4	4	5	3	3	3	3	4	External/Internal TSO-User	4	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 20 - Connection area. Demand side response services. Compilation of TSO answers

4.2.12 HVDC requirements

OVERVIEW: In this chapter the existence of specific HVDC requirements or criteria in each power system has been analysed. HVDC technology exists in 9 of the 13 countries that have responded to the survey, with the exception of Jordan, Libya, Morocco and Cyprus. In all countries where HVDC technology applies, no special regulation for HVDC has been established yet with the exception of France and Italy that have already developed national HVDC regulation in this aspect. European Network Codes on HVDC were recently approved in comitology by the European Commission and are expected to apply in all European countries.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of HVDC requirements is presented in the following table. Based on the answers received, which are heterogeneous, HVDC requirements are globally ranked as of medium importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

HVDC requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
15A	Existence of specific HVDC requirements or criteria in the system	1	4	7	6	4	5	4		7	6		4	4	External	5	External/Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 21 - Connection area. HVDC requirements. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- REN (PT) and RTE (FR) stress the need of harmonization of HVDC requirements/criteria in Med-TSO region in view of the large penetration of renewables in neighbouring countries and the increase of AC and/or DC interconnections, which will create new challenges in planning and operation of the grids. An HVDC link could have a significant impact not only on the two countries connected, but also on neighbouring systems, depending on their scale and on the capacity of the HVDC link. With the aim to mitigate eventual problems in near future, the ENTSO-E countries are currently in the process of harmonization of HVDC requirements.

Aspects concerning HVDC requirements are considered of higher relevance in the case of countries/power systems interconnected only with HVDC links compared with AC links, while for the rest of the connection aspects analysed relevance is considered equal in both cases.

4.2.13 Compliance and monitoring

OVERVIEW: This chapter focuses on procedures related to compliance and monitoring performed by the TSOs. In all MedTSO countries (except Jordan), the TSOs are entitled to perform tests and simulations in order to verify the compliance of the requirements included in their regulation. In 5 of these countries (Cyprus, France, Greece, Italy and Spain) third party entities have the responsibility of certifying compliance; while in Cyprus and Portugal a user declaration could also be used depending on the specific case.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of compliance and monitoring is presented in the following table. Based on the answers received, which are rather homogeneous, compliance and monitoring are globally ranked as medium importance for future harmonization, while external and internal regulation are both considered as the most suitable rule format in the target regulatory framework.

Compliance and monitoring		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	ME	MA	PT	ES	TN	TR	LY	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
16A	Compliance scheme(s) used in the system	4	4	4	5	3	5	6	3	4	5	6	5	4	External	4	External/Internal

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 22 - Connection area. Compliance and monitoring. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- In view of the implementation on the new law on renewable energy, STEG (TN) stresses the need of harmonization of the standards of TSO studies, tests and simulations performed.

4.3 Operation of the interconnected systems

4.3.1 System States

OVERVIEW: This chapter shows the level of harmonization regarding the classification of system states in each country. In almost all countries, 5 different possibilities are considered, as follows:

- Normal state: operation of the concerned TSO's control area is and will remain within operational security limits even after occurrence of a contingency.
- Alert state: at least one of a list of conditions is satisfied.
- Emergency state: operational security limits are violated in N state or frequency deviations outside larger thresholds. Activation of defence plan measures.
- Blackout state: loss of more than 50% of demand in the affected TSO's control area or total absence of voltage for at least 3 minutes in the affected TSO's control area.
- Restoration state: when a TSO, being in the emergency or blackout state, has started to activate measures of its restoration plan.

In Jordan, an additional state (System Stress) is also considered; while in Turkey the previous classification is not defined in regulation. But regarding the frequency of the system there is a definition of system states as "normal" (49,8 Hz ≤ f ≤50,2 Hz), "acceptable" (49,5 Hz ≤ f < 49,8 Hz and 50,2 Hz < f ≤ 50,5 Hz), "critical" (47,5Hz ≤ f < 49,5Hz and 50,5Hz < f ≤ 52,5Hz) and "unstable" (f < 47,5 Hz and 52,5 Hz < f).

ANALYSIS: The prioritization level proposed by the TSOs for the system states classification is presented in the following table. Based on the answers received, which are rather homogeneous, system states classification is ranked as of high importance for future harmonization, while external regulation is considered the most suitable rule format in the target regulatory framework.

System states		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
1A	1A. What is the classification of system states in your system?	7	7	8	7	7	7	6	8	6	7	8	7	5	External	7	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 23 – Operation area. System sates. Compilation of TSO answers

4.3.2 Technical requirements

OVERVIEW: The questions included in this chapter show an overview of the technical issues required in real time operation regarding quality parameters for frequency, voltage ranges, reactive power management and system protection coordination criteria. Both frequency and voltage parameters could be considered similar in all countries. As an example, in 400 kV grid minimum values differ from 340 kV (in Turkey) to 390 kV (in Spain); being the most repeated value 380 kV. Regarding maximum value in general all countries consider 420 kV (415 kV in Italy and 435 kV in Morocco). In 220 kV grid the minimum values differ from 198 kV (in Cyprus) to 210 kV (in Morocco). Regarding maximum value all countries consider values between 231 kV and 245 kV. Specific voltage ranges in the interconnection lines only apply in some countries: Algeria, Greece, Jordan, Montenegro, Turkey and Tunisia.

Reactive power management measures are similar including the switching of reactors and capacitors; power factor control by distribution companies; on load tap changers transformers; opening lines; etc. Nevertheless, regarding how reactive power is managed through international interconnections, two main blocks of countries could be considered:

- On the one side the European countries, in which reactive power is managed in a coordinated manner: TSOs interconnected with AC interconnectors shall jointly define the voltage and/or reactive power flow limits on these interconnectors, in order to use the reactive power capabilities in the most efficient way and ensure adequate voltage control.
- On the other side Maghreb countries and Jordan, where reactive power is managed autonomously, avoiding MVAr flow through the interconnections.

In addition, the system protection coordinated criteria is agreed with neighbouring TSOs through common protocols or bilateral agreements/contracts, not being the criteria previously specified in the regulation.

ANALYSIS: The prioritization level proposed by the TSOs for the technical requirements is presented in the following table. Based on the answers received, which are rather homogeneous, the importance for the future harmonization depends on the specific issue. While frequency ranges and reactive management and system protection criteria in the international interconnections are ranked as of high importance, voltage ranges are considered of medium importance.

Regarding the most suitable rule format in the target regulatory framework, in most cases external regulation is considered the most suitable, except reactive management and system protection criteria in the international interconnections where internal agreements between TSOs are also considered.

Technical requirements		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
2A	2A. What is the system states in each frequency range?	6	9	7	9	9	8	7	9	9	9	9	8	9	External / Internal TSO-TSO	8	External
2B1	2B1. What are the voltage ranges in normal conditions (for unlimited operation) in your system?	6	6	7	6	6	6	5	6	6	5	7	5	5	External / Internal TSO-TSO	6	External
2B2	2B2. What are the voltage ranges in extraordinary conditions (for unlimited operation) in your system?	6	5	7	4	6	6	5	6	6	5	7	6	5	External / Internal TSO-TSO	6	External
2C	2C. Specific voltage ranges in international interconnections?	6	5	6	4	6	6	4	3	6	3	3	5	5	External / Internal TSO-TSO	5	External
2D	2D. Which measures apply in your system for reactive power management?	6	4	5	4	3	5	3	4	5	3	6	3	3	External	4	External
2E	2E. Specific reactive power management for international interconnections?	9	9	6	9	9	8	7	7	9	9	7	7	9	Internal TSO-TSO	8	External / Internal TSO-TSO
2G	2G. System protection coordination criteria in interconnection lines?	6	8	8	8	9	7	7	7	9	7	7	8	8	External / Internal TSO-TSO	8	Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 24 – Operation area. Technical requirements. Compilation of TSO answers

4.3.3 Information exchange

OVERVIEW: This chapter focuses on the situation regarding the information exchange between neighbouring TSOs in different time frames: real time, scheduled and structural data.

Regarding real time data exchange, in general SCADA values of neighbouring substations are exchanged in real time and observed by both TSOs. In addition, European countries exchange with all the TSOs in the same synchronous areas general data such as frequency, aggregated generation, system state, set value of the FR controller or power exchange. Additional data from the observability area is also exchanged between European countries (substation topology, bus bar voltage, active and reactive power in lines and transformers, regulating positions of transformers or power restrictions within the observability area). Algeria and Tunisia do not exchange data between their SCADA systems.

On the other hand, an heterogeneous situation is considered regarding the exchange of scheduled data and structural data with important differences between European and Maghreb countries.

ANALYSIS: The prioritization level proposed by the TSOs for the system states classification is presented in the following table. Based on the answers received, which are rather homogeneous, information exchange requirements are ranked as of medium-high importance for future harmonization, while internal agreements between TSOs regulation are considered the most suitable rule format in the target regulatory framework. Anyway real time data exchange has the higher degree of prioritization.

Information exchange		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
3D	3D. Real time data exchange with other TSOs?	9	9	8	9	9	8	8	9	9	9	9	7	9	Internal TSO-TSO	9	External / Internal TSO-TSO
3E	3E. Scheduled time data exchange with other TSOs?	6	6	6	6	8	6	4	5	5	5	5	7	6	Internal TSO-TSO	6	Internal TSO-TSO
3F	3F. Structural data exchange with other TSOs?	6	6	6	6	8	6	4	5	6	5	5	5	6	Internal TSO-TSO	6	Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 25 – Operation area. Information exchange. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Regarding scheduled and structural data Italy has given a relatively higher level of prioritization (8) than the average score (6), because Italy considers than in an interconnected system the coordination on schedule timing is essential in order to achieve coherent power exchange among TSOs.

4.3.4 Contingency analysis

OVERVIEW: This chapter focuses on the management of the contingency analysis performed by each TSO regarding the following aspects:

- Contingencies considered: In all countries the N-1 contingency is considered, while the loss of the biggest generation plant is considered in all countries except Jordan; and partial N-2 in all countries except in Algeria, Jordan and Morocco.
- Issues to be included in the contingency list: In general, includes both grid (single or double lines, bus bars, transformers) and generation facilities considered as influential (with impact in the neighbouring system).
- Operational security limits: In all countries the security limit considered in N conditions is 100% but several specific criteria should be considered in each power system.
- Joint remedial actions after a contingency: In all countries are agreed and coordinated between TSOs. The most common actions performed are topology actions, countertrading, coordinated re-dispatching, lines tripping and PST tap changing. In general, only non-costly actions are considered to solve congestions linked to outage planning management

ANALYSIS: The prioritization level proposed by the TSOs for the contingency analysis issues is presented in the following table. Based on the answers received, which are rather homogeneous, contingency analysis issues are ranked as of high importance for future harmonization (except the harmonization of the operational security limits which are considered of low importance), while internal agreements between TSOs regulation are considered the most suitable rule format in the target regulatory framework. Anyway real time data exchange has the higher degree of prioritization.

Contingency analysis		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
4A1 (4	3A1. Which contingencies are considered in your power system?	6	7	7	7	9	7	7	7	7	7	7	7	7	External / Internal TSO-TSO	7	External
4A2 (4	3A2. Contingency list (both internal and external)	9	8	8	8	7	8	8	7	7	8	8	7	8	External / Internal TSO-TSO	8	Internal TSO-TSO
4B1	4B1. Which are the operational security limits in your power system?	4	5	2	5	6	5	3	5	4	4	4	4	4	External	4	Internal TSO-TSO
4B2	4B2. Which are the operational security limits in the interconnection lines?	6	5	7	5	6	5	3	5	4	4	8	4	4	External	5	Internal TSO-TSO
4B3 (4	3B. Joint remedial actions agreed between TSOs after a contingency in the different time horizons?	9	9	8	9	7	7	7	8	9	8	8	8	8	External / Internal TSO-TSO	8	External
4C	4C. Which is the periodicity of state estimation calculations? ("Snapshots")	6	7	6	7	6	7	6	7	7	7	7	7	7	External	7	Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 26 – Operation area. Contingency analysis. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- In the specific case of harmonization of the operational security limits in interconnection lines the opinion of France, Greece and Spain is rather different than the average score. Greece and Spain consider that harmonization is important because it applies to interconnection lines between different TSOs, while for France this harmonization will imply trying to improve exchange capacity with optimized operation rules.

4.3.5 Dynamic stability

OVERVIEW: Studies about dynamic stability in real time are performed in 7 out of 12 countries that have provided information on this topic. From those, only Algeria perform them regularly on a day-ahead basis, while in the rest of the countries such studies are performed only occasionally, in specific situations identified as possible risk for the system or upon request.

ANALYSIS: The prioritization level proposed by the TSOs for the dynamic stability issues is presented in the following table. Based on the answers received, which are rather homogeneous, dynamic stability issues are ranked as of medium importance for future harmonization, while internal agreements between TSOs are considered the suitable rule format in the target regulatory framework. The opinion of Libya and Spain is rather different than the average score.

Dynamic stability		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
5A	5A. Performance of dynamic stability studies	6	6	5	6	5	6	3	5		4	2	5	5	External	5	Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 27– Operation area. Dynamic stability. Compilation of TSO answers

4.3.6 Management of international exchanges

OVERVIEW: Programming and management of scheduled international exchanges performed in all the European countries including Turkey, that have provided information on this topic (where applicable), in accordance with coordinated rules and mechanisms (such as Operational Handbook and ENTSO-E standards). From the countries of the Maghreb area that have provided information, Algeria and Tunisia perform day ahead scheduling of international exchanges, while in Morocco and Jordan energy trading is performed according to bilateral contracts and mainly in cases of emergency.

ANALYSIS: The prioritization level proposed by the TSOs for the management of international exchange issues is presented in the following table. Based on the answers received, which are rather homogeneous, management of international exchange issues are generally ranked as of high importance for future harmonization, while internal agreements between TSOs are considered the most suitable rule format in the target regulatory framework. Among all the countries which had considered the issue to have a high priority, Algeria gave medium-high priority to the scheduled exchanges and programming, management of international exchange programs between TSOs.

Management of international exchanges		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
6A	6A. Management of international exchange programs between TSOs	6	9	9	9	9	7	7	9	9	9	9	8	9	Internal TSO-TSO	8	Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 28 – Operation area. Management of international exchanges. Compilation of TSO answers

4.3.7 HVDC technology

OVERVIEW: HVDC technology exists in 9 of the 12 countries that have responded to the survey, with the exception of Jordan, Morocco and Cyprus. Among them, only Spain and France have both LCC and VSC technologies installed, while in the rest of the countries only LCC technology exists. In all countries where HVDC technology is applied no special regulation for HVDC has been established yet with the exception of France and Italy that have already developed national HVDC regulation in this aspect. European Network Codes on HVDC were recently approved in comitology by the European Commission and are expected to be applied in all European countries. Only few TSOs report their experience from the operation of the HVDC interconnectors. In particular; France from the operation of the LCC link with the UK in which the need for management of inverse flows and voltage deviations has been identified and Greece from the operation of the LCC link with Italy which in the past withstood major disturbances in the South East Europe without being affected. The experience from the operation of the VSC link between France and Spain and of the LCC link between Turkey and Georgia is rather short to provide currently any feedback. The HVDC interconnectors of France with the UK and Spain are in fact the only HVDC links in the Mediterranean Region, which operate in parallel with AC lines and until today no special operational problems or unexpected behaviour have been identified.

ANALYSIS: The prioritization level proposed by the TSOs for the HVDC technology issues is presented in the following table. Based on the answers received, which are roughly homogeneous, the importance for the future harmonization depends on the specific issue. Operation security limits are ranked as of low importance. The harmonization requirement on considering the type (LCC or VSC) of the HVDC technology is also ranked as low importance. On the other hand, based on the operational experience (such as dealing with tripping of HVDC lines, special protection and control schemes and specific operation procedures considered to keep system in security limits) harmonization is ranked as of medium importance. Operation practices considering the HDVC interconnection lines that are operated synchronously in parallel with AC interconnection lines is also ranked as of medium importance for future harmonization. For most of the issues regarding the HVDC technology the opinion of Italy is rather different than the average score.

Regarding the most suitable rule format in the target regulatory framework, for all cases both external regulation and internal agreements between TSOs are considered the most suitable.

HVDC technology		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
7A	7A. Need of operational security limits for HVDC facilities	0	3	4	3	7			3		3	2		3	No	3	External / Internal TSO-TSO
7B	7B. HDVC technology	0	0	0	0	7			3		0	0		0	No	1	External / Internal TSO-TSO
7C	7C. Based on the experience in operation of HVDC interconnection lines, should HVDC operation practices be	0	5	5	5	7			4		6	5		5	External	5	External / Internal TSO-TSO
7D	7D. Should operation practices be harmonized if HVDC interconnection lines are operated synchronously in pa	0	5	5	5				0		6	5		3	No	4	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 29 – Operation area. HVDC technology. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Harmonization of HVDC specific operational security limits is considered of high priority by TERNA (IT), with the clarification that harmonization on operational limits should be considered for HVDC connecting different TSOs and not for internal HVDC systems.
- Referring to the “Network Code on HVDC Connections”, new European Commission grid code on HVDC, harmonization of HVDC technology is considered of high priority by TERNA (IT).
- Harmonization of operation practices based on the experience in operation of HVDC interconnection lines is considered of high priority by TERNA (IT), with the clarification that harmonization on operational limits should be considered for HVDC connecting different TSOs and not for internal HVDC systems.

4.3.8 Outage coordination

OVERVIEW: All countries except Cyprus, which has no interconnections, have asserted that they do coordinate with neighbouring countries for any outage that affects the NTC[6]. However, some countries like France, Spain and Portugal rely on detailed step by step procedures that help figure out the availability status of relevant grid elements.

ANALYSIS: The prioritization level proposed by the TSOs for outage coordination is presented in the following table. Based on the answers received which are rather homogeneous, outage coordination is considered of high importance for future harmonization for most countries. On the other hand, countries such as Algeria, Jordan, Libya, Montenegro and Portugal assign a medium importance to this issue. However, the final appreciation of this issue remains important for future harmonization. As to the rule format, internal agreements between TSOs are preferred to be part of the target regulatory framework.

Outage coordination		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
9A	9A. What are the criteria and procedure* for outage coordination (corrective or predictive maintenance) when affects NTC	6	7	7	7	9	6	5	5	9	6	8	7	7	External / Internal TSO-TSO	7	External

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 30 – Operation area. Outage coordination. Compilation of TSO answers

4.3.9 Load frequency control

OVERVIEW: Regarding FCR, all countries require from their power generation units to provide it, taking into account some restrictions related to either the size of the unit or the type of generation (conventional Vs. renewable). Provision of FCR is compensated only in Cyprus, France, Greece, Italy and Turkey. In order to establish the quantity of FCR, countries such as Algeria, Jordan, Libya, Morocco and Tunisia favour the loss-of-the-biggest-unit criterion whereas the rest of the countries act under mutual agreements on a regional level. Most countries have compliance schemes for providing FCR except Jordan, Libya, Montenegro, Morocco and Tunisia. As to potential economic penalties, only Cyprus, France, Italy and Turkey apply them.

[6] The Net Transfer Capacity **(**NTC) is the maximum exchange program between two areas compatible with security standards applicable in both areas and taking into account the technical uncertainties on future network conditions.

Regarding FRR, only Jordan, Morocco, Spain and Turkey don't require their power generation units to provide it. Provision of FRR is not compensated in Algeria, Jordan, Libya, Morocco and Turkey. In order to establish the quantity of FRR, all countries adopt the loss-of-the-biggest-unit criterion with the exception of Cyprus that adopts the criteria of the frequency of past incidents, the production unit mix and the RES penetration and cost. Jordan, Libya, Montenegro, Morocco and Tunisia don't adopt any compliance scheme for providing FRR. On the other hand, in Cyprus, France, Greece and Italy economic penalties are applied.

Regarding RR, Cyprus, France, Jordan, Libya, Morocco and Spain don't require RR provision. Provision of FRR is not compensated in Algeria, Greece, Jordan, Libya, Montenegro, Morocco and Turkey. Criteria for establishing the quantity of RR are variable in all countries except in Morocco and Turkey where this quantity corresponds to a fixed amount and in Algeria where the criterion that applies is the biggest unit as well. Jordan, Libya, Montenegro and Morocco don't adopt any compliance scheme for providing RR. On the other hand, in Cyprus, France, Greece, Italy and Portugal economic penalties are applied.

ANALYSIS: The prioritization level proposed by the TSOs for the outage coordination is presented in the following table. The criteria used for establishing the quantity of both frequency containment reserve (FCR) needed and frequency restoration reserve (FRR) are considered of high importance for future harmonization for most countries. On the other hand, the criteria used for establishing the quantity of replacement reserve (RR) are generally considered of low importance for future harmonization, with the exception of countries such as France, Italy and Jordan that consider this issue of medium importance. Issues such as mandatory or not provision of FCR, FRR and RR, responsibility, compliance scheme and consequences for non-provision of these services are considered of medium importance by most countries. On the other hand, compensation for providing FCR, FRR and RR is considered of low importance for future harmonization for most countries. As to the rule format, an external regulation is preferred to be part of the target regulatory framework.

	Load frequency control	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
11A1	11A1. Load Frequency Control. Frequency Containment Reserve (FCR)It is mandatory to provide FCR? Who?	4	4	5	3	7	4	1	3	4	4	5	3	4	External	4	External
11A2	11A2. Load Frequency Control. Frequency Containment Reserve (FCR)Are users paid for providing FCR?	1	2	3	2	4	5	1	1	3	2	2	2	2	External	2	External / Internal TSO-TSO
11A3	11A3. Load Frequency Control. Frequency Containment Reserve (FCR)Criteria used for establishing the quantity of FCR ne	6	9	8	9	9	7	7	5	7	9	9	8	9	External / Internal TSO-TSO	8	External / Internal TSO-TSO
11A4	11A4. Load Frequency Control. Frequency Containment Reserve (FCR)Is there any compliance scheme for FCR? Are there a	6	7	8	7	4	5	6	1	7	7	7	5	6	External	6	External
11B1	11B1. Load Frequency Control. Frequency Restoration Reserve (FRR)It is mandatory to provide FRR? Who?	6	7	5	7	7	5	6	5	7	7	3	7	6	External	6	External
11B2	11B2. Load Frequency Control. Frequency Restoration Reserve (FRR)	1	2	2	2	7	6	1	3	3	2	2	2	2	External	3	0
11B3	11B3. Load Frequency Control. Frequency Restoration Reserve (FRR)	6	8	8	8	7	7	7	7	7	8	8	8	8	External	7	External
11B4	11B4. Load Frequency Control. Frequency Restoration Reserve (FRR)Is there any compliance scheme for FRR? Are there an	6	7	5	7	4	6	6	3	7	7	7	6	7	External	6	Internal TSO-TSO
11C1	11C1. Load Frequency Control. Replacement Reserve (RR)	6	5	4	5	7	5	3	4	4	4	5	5	3	External	5	External / Internal TSO-TSO
11C2	11C2. Load Frequency Control. Replacement Reserve (RR)	1	3	5	3	5	4	1	3	3	2	2	3	2	External	3	External / Internal TSO-TSO
11C3	11C3. Load Frequency Control. Replacement Reserve (RR)	3	3	4	3	4	5	1	3	3	2	2	3	2	External	3	External / Internal TSO-TSO
11C4	11C4. Load Frequency Control. Replacement Reserve (RR)Is there any compliance scheme for RR? Are there any conseque	6	5	4	4	4	5	2	3	4	4	4	5	4	External	4	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 31 – Operation area. Load frequency control. Compilation of TSO answers

CLARIFICATIONS: Algeria clarifies that although remuneration is not explicitly paid, a charge is included in the tariff.

4.3.10 Reserves management

OVERVIEW: With the exception of Cyprus that has no interconnection, all countries recognize that reserve can be exchanges with some limitations. Whereas the European side of Mediterranean is preparing for common criteria to be adopted for the sake of exchanging the reserve, the picture remains not unified in the southern part where the exchange of FRR is the only reserve that could be exchange in Maghreb countries and where FCR and FRR exchange is allowed in Jordan and Libya.

ANALYSIS: The prioritization level proposed by the TSOs for the reserves management is presented in the following table. Based on the answers received which are rather homogeneous, reserve management has got a high importance for future harmonization for all countries except for Algeria that has assigned a medium importance to this issue. As to the preferred rule format to be adopted in the target regulatory framework, there is a tie between external regulations and internal agreements between TSOs.

	Reserves management	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
12A	12A. Reserves management (exchange and sharing)Possibilities of reserve exchange and share between TSOs. Implemen	6	9	8	9	9	8	7	8	7	8	8	7	8	External / Internal TSO-TSO	8	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 32 – Operation area. Reserves management. Compilation of TSO answers

4.3.11 System defence plan

OVERVIEW: In general, all TSOs use the same frequency deviation management procedure, normally automatically using reserves and taking advantage of the interconnections. In addition, automatic under-frequency control schemes (based on load shedding) and over-frequency control schemes (disconnection of generation) are also in use. Regarding the voltage deviation management procedure similar measures are considered in all MedTSO countries, mainly connection and disconnection of capacitors/reactors; generation reactive power (P, Q curves); transformers tap changing; switching of lines and load shedding in very extreme cases. In emergency states coordination and inter-TSO assistance is used, but some differences appear between European and Maghreb countries.

ANALYSIS: The prioritization level proposed by the TSOs for the power system defence plan issues is presented in the following table. The answers received are rather homogeneous. Among the system defence plan issues frequency deviation management procedure, setting of the demand disconnection schemes and inter-TSO assistance and coordination in emergency state are ranked as of high importance for future harmonization. On the other hand, voltage deviation management procedure, power flow management procedure and manual demand disconnection procedure are ranked as of medium importance for future harmonization. In the specific case of harmonization of the system defence plan, the opinion of France and Libya is lower than the average score in the manual demand disconnection procedures.

The most suitable rule format in the target regulatory framework differs depending on the issue. The most suitable rule format in the target regulatory framework for the issues regarding demand disconnection (i.e. setting of the demand disconnection schemes and manual demand disconnection procedure) are considered to be external regulations. For the rest of the other issues regarding system defence plan, both external regulation and internal agreements between TSOs are considered as the most suitable rule format in the target regulatory framework.

	System defence plan	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
14A	14A. Frequency deviation management procedure (Automatic Under/Over-Frequency control scheme)	9	9	9	9	9	8	7	5	7	9	9	7	9	External / Internal TSO-TSO	8	External / Internal TSO-TSO
14B	14B. Setting of demand disconnection schemes (low frequency and/or low voltage)	6	7	9	7	9	7	6	7	9	7	7	7	7	External	7	External
14C	14C. Voltage deviation management procedure	6	7	4	6	5	7	6	5	7	6	6	7	6	External / Internal TSO-TSO	6	External / Internal TSO-TSO
14D	14D. Power flow management procedure	6	7	5	7	8	6	6	5	6	6	6	6	6	External / Internal TSO-TSO	6	External / Internal TSO-TSO
14E	14E. Manual demand disconnection procedure	6	6	2	5	7	5	3	4	4	5	5	5	5	External	5	External
14F	14F. Inter-TSO assistance and coordination in emergency state	6	9	7	9	9	7	6	7	9	8	8	7	8	Internal TSO-TSO	8	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 33 – Operation area. System defence plan. Compilation of TSO answers

CLARIFICATIONS: For the aspects that were highly ranked by certain TSOs, further clarifications were provided. More specifically:

- Harmonization of power flow management procedure is considered of high priority by TERNA (IT), with the clarification that harmonization on operational limits should be considered for links interconnecting different TSOs and not for internal power flow management.
- Harmonization of manual demand disconnection procedure is considered of high priority by TERNA (IT) as it may have an impact on other interconnected TSOs. TERNA (IT) also considers it as a matter of European Commission Regulation of "Emergency and restoration".

4.3.12 Restoration plan

OVERVIEW: The strategies used in each power system regarding the restoration plan are similar in all MedTSO countries. In general, two main strategies are considered. 1) Bottom-up re-energization strategy: Strategy where the system (or part of the system) of a TSO can be re-energized without the assistance from other TSOs, using generation units equipped with the "black start" capability in order to restore the backbone of the high voltage grid in priority. 2) Top-down re-energization strategy: Strategy that requires the assistance of other TSOs to re-energize the system (or part of the system) of a TSO, is based on the use of the international interconnections and normally through bilateral agreements with neighbouring TSOs.

ANALYSIS: The prioritization level proposed by the TSOs for the restoration plan classification is presented in the following table. Based on the answers received, which are rather homogeneous, restoration plan classification is ranked as of high importance for future harmonization, while both external regulation and internal agreements between TSOs regulation are considered the most suitable rule format in the target regulatory framework.

Restoration plan		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
15	15A + 15B. Rules and types of restoration plans	9	9	6	9	9	7	7	7	9	8	8	8	7	External / Internal TSO-TSO	8	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 34 – Operation area. Restoration plan. Compilation of TSO answers

4.3.13 Training and certification

OVERVIEW: Regarding Training issues, in general, the situation is rather homogeneous ranking training and certification issues as of medium importance for future harmonization for most countries.

ANALYSIS: The prioritization level proposed by the TSOs for the training and certification issues is presented in the following table. Based on the answers received, which are rather homogeneous, with the exception of Italy which provided a high rank of importance, the training and certification issues are ranked as of medium importance for future harmonization (except the harmonization of the similar requirements which are considered of low importance), while internal agreements between TSOs regulation are considered the most suitable rule format in the target regulatory framework. Anyway the training and certification issues have almost the medium degree of prioritization.

	Training and certification	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
16A	16A. Training and certification of system operator employees in charge of real-time operation.Is there certification of the o	6	5	6	5	9	5	3	5	4	5	7	5	5	No	5	External
16B	16B. Training and certification of system operator employees in charge of real-time operation.The certification is delivered	3	3	3	5	7	6	4	5	2	4	3	5	5	No	4	External
16C	16C. Training and certification of system operator employees in charge of real-time operation.How long time the certificate	6	4	3	4	5	5	4	5	2	4	1	5	4	No	4	External
16D	16D. Training and certification of system operator employees in charge of real-time operation.The TSO use a simulator for	6	4	5	5	7	6	4	5	4	4	1	5	4	No	5	External
16E	16E. Training and certification of system operator employees in charge of real-time operation.The training of operators rea	6	5	3	5	7	6	4	6	4	5	6	5	4	No	5	External
16F	16F. Training and certification of system operator employees in charge of real-time operation.The periodicity of the trainin	6	3	3	5	7	5	4	5	3	4	1	5	4	No	4	External / Internal TSO-TSO
16G	16G. Training and certification of system operator employees in charge of real-time operation.The different levels of the o	6	3	2	5	7	5	3	5	3	4	1	4	4	No	4	External / Internal TSO-TSO
16H	16H. Training and certification of system operator employees in charge of real-time operation.How long time the activity o	6	3	3	3	5	5	4	4	3	4	1	3	3	No	4	External / Internal TSO-TSO
16I	16I. Training and certification of system operator employees in charge of real-time operation.Is there any language require	6	5	6	5	9	6	4	5	4	5	5	5	7	External	6	External / Internal TSO-TSO
16J	16J. Training and certification of system operator employees in charge of real-time operation.Is there any systematically es	6	3	5	5	9	6	5	5	4	5	6	5	3	External / Internal TSO-TSO	5	External / Internal TSO-TSO
16K	16K. Training and certification of system operator employees in charge of real-time operation.Do you have similar requirer	4	3	2	4		4	3	3	3	4	3	3	2	No	3	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 35 – Operation area. Training and certification. Compilation of TSO answers

4.3.14 Dispatch priority

OVERVIEW: Regarding dispatch priority issues, in general, the situation is rather homogeneous, and the dispatch priority has been set for low priority for most countries.

ANALYSIS: The prioritization level proposed by the TSOs for the dispatch priority issues is presented in the following table. Based on the answers received, which are rather homogeneous, with the exception of Italy, which has a very high rank of importance, dispatch priority issues are ranked as of “no need” importance for future harmonization.

	Dispatch priority	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)													GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MA	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
18A	18A. What dispacth criteria (including priority) applies in your system?	6	3	4	3	9		2		5	3	2	3	3	External	4	External / Internal TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 36 – Operation area. Dispatch priority. Compilation of TSO answers

4.4 System service markets

Concerning system service markets area, the analysis achieved drives to follow focus points:

- To define a basic framework of market requirements to enable and make eligible public -and progressively- private subjects to act on each domestic market and consequently on an integrated/interconnected market;
- Therefore, it is necessary to agree on a set of mutual rules including some main principles such as technical and financial requirements to operate on cross border activities;
- Consequently, to define the categories of operators for import/export activities on the basis of the national domestic models.

It is envisaged that a set of joint proposal (e.g. elaborated by a task force dedicated Team) will enhance the efficiency of the existing cross-border procedures and the elaboration of a shared mechanism.

4.4.1 Legal Issues

OVERVIEW: The questions included on this chapter show that the structure of the market around the region is based on two reference models: a market based, typically European systems adhering to the ENTSO-E perimeter; and a non-market based, typically North African and Middle East systems.

Among the "Market Based" systems: Cyprus, France, Greece, Italy, Montenegro, Portugal, Spain and Turkey.
Among the "Non-Market Based" systems: Algeria, Jordan, Morocco and Tunisia.

In addition to the two reference models, some systemic and geographical peculiarities consent to justify also the classification of “Hybrid” systems, which allow the import/export of energy through bilateral agreements and through multilateral agreements. Montenegro (in the ENTSO-E perimeter and bordering with European countries outside of it) and Turkey (in the ENTSO-E perimeter, representing the boundary with the Asian and Middle Eastern systems) constitute the most distinctive example of “Hybrid” systems.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the legal issues is presented in the following table. Based on the answers received, which for most aspects are rather homogeneous, Legal Issues aspects are globally ranked as of medium importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

	Legal Issues	NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MO	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
1A	Current requirements for participation on the cross-border electricity trade in each individual system.	3	6	7	5	8	7	6	5	5	5	7	5	7	TSO-TSO	6	TSO-TSO
1B	Current rules for export/import of cross-border electricity in each individual system.	6	6	8	5	8	6	7	4	5	6	7	6	6	External	6	External / TSO-TSO
1C	Categories of operators enabled for import/export activities.	3	6	7	6	8	6	6	4	5	5	7	5	7	External / TSO-TSO	6	TSO-TSO
1D	Presence of a Market Operator.	3	6	6	6	9	5	5	6	5	5	7	6	6	External	6	External
1E	Requirements for stipulating and executing contracts with market players relevant for the Cross Border Trade with other relevant market players in each country.	0	5	6	5	8	6	5	6	5	5	6	5	5	External	5	External
1F	Presence of any international agreements on either bilateral or multilateral basis which each country has concluded with other countries concerning further development and liberalization of energy markets.	6	6	4	6	3		7	6	4	5	6	5	5	External	5	External / TSO-TSO
1G	Possibility in each country to buy transmission rights already bought under the Transfer Capacity Allocation (TCA).	1	4	5	4	6		4	3	3	3	2	2	2	External	3	External
1H	Trading activities of electricity in each country (made between market participants or between TSO's?).	6	5	5	5	8	5	5	4	4	5	7	5	7	External	5	External
1I	Requirements to satisfy for using the interconnections (e.g. demand/offer equilibrium, congestion management at national, and if possible, at international level, balancing of the exchange program in real time, coordinated dispatching).	6	6	6	6	5	6	7	7	6	6	7	5	7	TSO-TSO	6	TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 37 – System service markets area. Legal issues. Compilation of TSO answers

4.4.2 Capacity Calculation

OVERVIEW: Regarding the analysis of the rules and methodology for capacity calculation and allocation, it is also quite different around the region. General principles (like the N-1 criterion) and the modality of finalization of the Net Transfer Capacity (mainly jointly TSO-TSO) are quite similar but specific details in each power system are significantly different and need to be heavily harmonized.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the capacity calculation issues is presented in the following table. Based on the answers received, which for most aspects are rather homogeneous, capacity calculation aspects are globally ranked as of medium-high importance for future harmonization, while internal agreements between TSOs are considered as the most suitable rule format in the target regulatory framework.

Capacity Calculation		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MO	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
2A	Which security criteria is used for calculating the Net Transfer Capacity (NTC)? Do you apply a security criteria?	6	7	8	6	9	7	7	6	6	6	6	5	6	External / TSO-TSO	7	TSO-TSO
2B	What is the process for finalization of Net Transfert Capacity?	7	7	8	6	8	7	7	7	5	5	6	5	6	TSO-TSO	6	TSO-TSO
2C	Which are the time horizons used for capacity calculation? What is the process for calculating capacity in the different time horizons?	6	6	7	5	8	6	6	6	6	6	6	5	5	TSO-TSO	6	TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 38 – System service markets area. Capacity calculation. Compilation of TSO answers

4.4.3 Capacity Allocation

OVERVIEW: Regarding the analysis of the rules and methodology for capacity allocation, as mentioned in the previous paragraph, specific details in each power system are significantly different and need to be heavily harmonized. In particular, this assumption is mostly evident about the allocation of single products for each system and the allocation of these products linked to its time horizons and reference boundaries (i.e. possibility of allocation only on monthly base or the activation of market coupling only in a few systems. Regarding the future harmonization, particular attention should be put in place about the system of guarantees.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the capacity allocation issues is presented in the following table. Based on the answers received, which for most aspects are rather homogeneous with the exception of those included in question 3E, capacity allocation aspects are globally ranked as of medium importance for future harmonization, while internal agreements between TSOs are considered as the most suitable rule format in the target regulatory framework.

Capacity Allocation		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MO	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
3A	Which method applies in your system for transmission capacity allocation?	0	7	8	7	5		5	7	5	7	7	6	7	TSO-TSO	6	TSO-TSO
3B	Obligation to use allocated capacity?	0	7	7	7	7		6	6	6	5	7	6	5	TSO-TSO / TSO-User	6	TSO-TSO
3C	Kind of capacity products	0	7	7	7	4		7	7	3	7	7	6	6	TSO-TSO	6	TSO-TSO
3D	What kind of procedures do you use or do you intend to use for the PTR allocation (e.g. public auction, tender procedures, ...)? How do you manage congestions in phase of PTR allocation? Which rules do you have for the management of physical and commercial use of PTR? Which related time schedule?	0	7	5	7	8		7	7	5	7	7	6	7	TSO-TSO	6	TSO-TSO
3E	Which system of liabilities, guarantees and penalties (technical and commercial) do you apply for each subject involved? Risk management: The auction rules shall contain provisions concerning risk management, possibly with an obligation for the market participants to offer collateral securities to the auction office. One possibility would be bank guarantees. a. Are there any provisions in national legislation which have to be taken into consideration? b. Does national legislation permit this tool of risk management?. c. Are there any difficulties to be expected with possible different standards for bank guarantees in your country (e.g. concerning terms of duration or the right of the beneficiary to make use of the bank guarantee?) or any other limitations which have to be taken into consideration for the purpose of introducing bank guarantees as a tool for risk management?	0	4	5	5	7		5	6	4	6	5	5	4	TSO-User	5	TSO-TSO
3F	Who is the subject responsible for the management procedure?	3	7	6	7	8		6	7	5	6	7	7	6	TSO-TSO	6	TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 39 – System service markets area. Capacity allocation. Compilation of TSO answers

4.4.4 Dispatching & Balancing

OVERVIEW: Regarding Dispatching & Balancing issues, in general, the situation is quite homogeneous in particular with reference to the treatment of the unintentional deviations on international interconnections that reflects the distinction among market and no-market based models.
The guarantee of security, at domestic level and for coordinated management of exchanges at the borders, is the principle that underlies the operation of all the electrical systems analysed in the Mediterranean perimeter.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the dispatching & balancing issues is presented in the following table. Based on the answers received, which for most aspects are rather homogeneous with the exception of those included in question 4C, dispatching & balancing aspects are globally ranked as of medium importance for future harmonization, while internal agreements between TSOs are considered as the most suitable rule format in the target regulatory framework. The issues under questions 4A and 4B are already included in the Operation Area (respectively in questions 4B3 and 6A), therefore are not considered in this chapter.

Dispatching & Balancing		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MO	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
4A	Actions foreseen in order to guarantee the exchange programs.	7	7	6	7	7	6	7	7	6	7	8	7	7	TSO-TSO	7	TSO-TSO
4B	Management of unintentional deviations on international interconnections (e.g. compensation mechanisms, pay in kind methods, …).	6	4	5	4	4	7	6	6	6	6	5	6	7	TSO-TSO	6	TSO-TSO
4C	Description of users which can provide balancing services in the international interconnections.	3	4	3	5	5		4	3	3	4	5	5	3	External	4	External / TSO-TSO
4D	Presence of any international agreements on emergency situations and/or support exchanges with other countries.	3	7	4	7	7		7	7	7	7	8	7	7	TSO-TSO	6	TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 40 – System service markets area. Dispatch and balancing. Compilation of TSO answers

4.4.5 Settlement & Metering

OVERVIEW: Regarding Settlement & Metering issues, it is evident the total homogeneity of the answers in the allocation of the competences (TSOs), but also the heterogeneity on Settlement's application with reference to the affinity with the market models.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the settlement & metering issues is presented in the following table. Based on the answers received, which for most aspects are homogeneous, settlement & metering aspects are globally ranked as of low importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Settlement & metering		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MO	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
5A	Subject responsible for settlement concerning international interconnections.	6	3	2	3	7	5	6	3	5	3	2	4	3	External	4	External
5B	Subject responsible for metering in the international interconnections.	6	3	2	3	7	6	6	3	4	2	2	4	2	TSO-TSO	4	TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority

Figure 41 – System service markets area. Settlement and metering. Compilation of TSO answers

4.4.6 Transparency

OVERVIEW: Transparency issues represent a new insert not included in the first Deliverable *"TC2 Regulation & Institutions - Task 1 – Rules"* and it is evident the total homogeneity with reference to the affinity with the market models.

ANALYSIS: The prioritization level proposed by the TSOs for the different aspects of the transparency issues is presented in the following table. Based on the answers received, which for most aspects are homogeneous, transparency aspects are globally ranked as of high importance for future harmonization, while external regulation and internal agreements between TSOs are both considered as the most suitable rule format in the target regulatory framework.

Transparency		NATIONAL SCOPE (DEGREE OF PRIORITIZATION* FOR REGULATORY HARMONIZATION)														GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)	
		DZ	CY	FR	GR	IT	JO	LY	ME	MO	PT	ES	TN	TR	CURRENT REGULATORY SITUATION (MOST COMMON RULE FORMAT)	DEGREE OF PRIORITIZATION*	RULE FORMAT
6A	Presence and modalities of publications (public information) on the Electricity Markets data in each country.	7	7	8	7	7		7	5	6	6	7	5	6	External / TSO-TSO	7	External / TSO-TSO
6B	Presence and modalities of publications (public information) on international interconnections data in each country.	7	7	8	7	7		7	5	7	6	7	7	7	TSO-TSO	7	TSO-TSO

* Priority level - 0: No need; 1, 2, 3: Low priority; 4, 5, 6: Medium priority; 7, 8, 9: High priority; In blank: no answer provided.

Figure 42 – System service markets area. Transparency. Compilation of TSO answers

5 Proposal on Common Target Regulatory Framework

Based on the results of the survey presented in chapter 3, in which the different aspects have been prioritized according to their degree of relevance for future harmonization (low/medium/high) and in which a suitable rule format for the common target regulatory framework has been proposed for each aspect, in this chapter the concrete proposal of those aspects with a higher global degree of prioritization (in general those aspects with a global degree of prioritization of 6) are presented.

5.1 Legal and regulatory issues

As a result of the analysis of the legal and regulatory issues considered of particular interest for most MedTSO members, as presented under chapter 4.1, the overall conclusion is that only 2 of the analysed issues have been granted a high level of priority (score between 7 and 9) as regards their need for harmonization in the Mediterranean area. Anyway, MedTSO members have decided to include another issue (proposal 3) in the common proposal.

More particularly, the referred issues are the following:

- ✓ **PROPOSAL 1.- INTERNATIONAL INTERCONNECTIONS**

  In order to make feasible and viable an international interconnection, certain issues require a coordinated regulation - this should be done on a coordinated basis between the concerned countries TSOs and NRAs.

  In most MedTSO countries the current rule format adopted is the external regulation[7]. As regards the desired situation for the future harmonized regulation most TC2 members consider that the best option is via external regulation (national or supranational - Grid Codes).

- ✓ **PROPOSAL 2.- UNBUNDLING OF REGULATED AND NON-REGULATED ACTIVITIES**

  Concerning the question on the need of unbundling of regulated (transmission/distribution) and non-regulated activities (generation/supply), most MedTSO members agree on the need to harmonize. In line with this, it should be noted that in most countries these activities are already unbundled.

  In most MedTSO countries external regulation is the rule format currently adopted for the unbundling of these activities. As regards the desired situation for the future harmonized regulation, most TSOs consider that the best option for the regulation of unbundling is via external regulation (national or supranational - Grid Codes).

- ✓ **PROPOSAL 3.- RESPONSIBLE AUTHORITY FOR THE SETTLEMENT OF DISPUTES AMONG STAKEHOLDERS**

  Dispute settlement procedures should be transparent and neutral. TSOs should not be both judge and jury to a dispute settlement. The "arbitrator", with the authority to settle the dispute, should be the relevant Ministry, the (independent) NRA or a third independent body.

These final “priority proposals” do not prejudge the need for an approximation of regulatory aspects (e.g. dispute settlement, allocation of competence for development/approval of technical rules, market opening

[7] Grid Codes or other types of regulation are approved by other entities rather than TSOs. These entities could be national or regional (if applies to more than one country).

to third parties). In line with this legal and regulatory analysis, MedTSO considers necessary to hold further coordination actions in the future with MedReg.

5.2 Connection to the grid

As a result of the analysis of the connection issues considered of particular interest for most MedTSO members, as presented under chapter 4.1, the overall conclusion is that 8 of the analysed issues should be included in the common proposal for future harmonization. More specifically, the referred issues are the following:

- **Connection procedure**

  The aspects of the connection procedure that are prioritized by TSOs for future harmonization are the following:

  - ***Studies performed for Access and Connection***

    Harmonization of Studies for access and connection to the network are considered of high priority, with the aim to provide specifications, particularly in the case of renewables. Following internal agreements between neighbouring TSOs (by bilateral agreements or others), load flow studies should be performed for access and connection. In addition, depending on particular cases identified by the TSOs concerned, more specialised analysis can be performed (short circuit, transient stability studies) the output of which could be documented in TSO-User agreements (e.g. contracts).

  - ***Criteria used for access capacity calculation***

    Following internal agreements between neighbour TSOs (by bilateral agreements or others), the application of the N-1 criterion for access capacity calculation is considered of high priority, especially in cases where system security is highly dependent on interconnections (e.g. single interconnection link between systems of different sizes). Moreover, certain N-2 cases which could put in risk system security should also be examined, following bilateral agreements between TSOs (e.g. cases of contingencies in a 400kV double-circuit line on common tower close to the border, resulting in the loss of a large production unit).

- **Frequency requirements**

  Based on the results of the Survey, high level of harmonization is required in general towards frequency behaviour, with focus in the following aspects:

  - ***Frequency/time range limits for users to withstand without damage***

    Time/frequency ranges harmonization is considered an issue of high priority in case of synchronous interconnection between different power systems. Based on the results of the survey the following time/frequency ranges are common in all MedTSO countries:

    [47.5 – 48.0 Hz] $\geq$ 3sec
    [48.0 – 48.5 Hz] $\geq$ 20sec
    [48.5 – 49.0 Hz] $\geq$ 30min

[49.0 – 49.5 Hz] ≥ 60min
[49.5 – 50.5 Hz] Unlimited
[50.5 – 51.0 Hz] ≥ 60min
[51.0- 51.5 Hz] ≥ 30min

As an External Rule, time/frequency ranges should be harmonized at least at synchronous area level, considering the relevant requirements for generators included in the Grid Code of ENTSO-E, as presented below:

Synchronous area	Frequency range	Time period for operation
Continental Europe	47,5 Hz – 48,5 Hz	To be specified by each TSO, but not less than 30 minutes
	48,5 Hz – 49,0 Hz	To be specified by each TSO, but not less than the period for 47,5 Hz – 48,5 Hz
	49,0 Hz – 51,0 Hz	Unlimited
	51,0 Hz – 51,5 Hz	30 minutes

The table shows the minimum time-period during which a power-generating module has to be capable of operation on different frequencies, deviating from a nominal value, without disconnecting from the network

Figure 43 – Frequency ranges proposal

- ***Rate of change of frequency withstand capability***

The harmonization of the rate of change of frequency withstand capability is highly prioritised, in view of the expected high penetration of renewables. As an External Rule, based on the results of the survey, a rate of change between 1 and 2 Hz/sec is proposed.

- ***Limited frequency sensitive mode***

Based on the results of the Survey, a certain level of harmonization of the overfrequency and underfrequency schemes adopted by interconnected transmission systems should be introduced at least at synchronous area level. In systems where there is high penetration of renewables (both existing and anticipated in the future), this generation category should also be included. As an External Rule, the following issues are proposed for harmonization:

- Frequency thresholds for the activation of the overfrequency and underfrequency schemes
- Level of generation disconnection (as a percentage of system size)

Therefore, as an External Rule, these issues should be harmonize at least at synchronous area level, considering also the relevant requirements for generators included in the European Grid Code.

- **Voltage requirements**

Due to the large penetration of renewables connected in the transmission system (in particular wind and solar), both existing and anticipated in the future, the impact of which in the neighbouring countries can be significant depending on their scale, high level of harmonization is required in general towards voltage requirements, with focus in aspects related to network voltage stability, namely voltage/time range limits for users to withstand without damage and technologies that comply with fault-ride-through capability. A proposal of future harmonization of those requirements is presented in this section in order to define

the main requests that the Med-TSO countries need to comply with for the different types of power generating modules installed in their transmission system.

- ***Voltage/time range limits for users to withstand without damage***

  According to the results for the 12 countries which responded to the Survey, the voltage/time range limits which are common in all Med-TSO countries are the following:

  For U=300 to 400kV:
  Voltage Range = 0.95 – 1.05 pu Time period unlimited
  For U=110 to 300kV:
  Voltage Range = 0.90 – 1.118 pu Time period unlimited

  If only 50% of the answers received are considered, the voltage/time range limits common are:

  For U=300 to 400kV:
  Voltage Range = 0.85 – 0.90 pu Time period ≥ 30min
  Voltage Range = 0.90 – 0.95 pu Time period unlimited
  Voltage Range = 0.95 – 1.05 pu Time period unlimited
  Voltage Range = 1.05 – 1.10 pu Time period ≥ 20min
  and
  For U=110 to 300kV:
  Voltage Range = 0.85 – 0.90 pu Time period ≥ 30min
  Voltage Range = 0.90 – 1.118 pu Time period = unlimited
  Voltage Range = 1.118 – 1.15 pu Time period ≥ 20min

  However, this common base is not enough for the current and future challenges at the operation of the transmission networks. Consequently, it is proposed, as an External Rule and in line with the ENTSO-E grid codes, that the power generating modules shall be capable of staying connected to the network and operating within the ranges of the network voltage at the connection point, expressed by the voltage at the connection point related to the reference 1pu voltage, and for the time periods specified below:

Synchronous area	Voltage range	Time period for operation
Med-TSO region (300kV to 400kV)	0.85 pu – 0.90 pu	60 minutes
	0.90 pu – 1.05 pu	Unlimited
	1.05 pu – 1.10 pu	To be specified by each TSO, but not less than 20 minutes and not more than 60 minutes

The table shows the minimum time periods during which a power-generating module must be capable of operating for voltages deviating from the reference 1 pu value at the connection point without disconnecting from the network where the voltage base for pu values is from 300 kV to 400 kV

Figure 44 – Voltage ranges proposal (between 300 kV and 400 kV)

Synchronous area	Voltage range	Time period for operation
Med-TSO region (110kV to 300kV)	0.85 pu – 0.90 pu	60 minutes
	0.90 pu – 1.118 pu	Unlimited
	1.118 pu – 1.15 pu	To be specified by each TSO, but not less than 20 minutes and not more than 60 minutes

The table shows the minimum time periods during which a power-generating module must be capable of operating for voltages deviating from the reference 1 pu value at the connection point without disconnecting from the network, where the voltage base for pu values is from 110 kV to 300 kV.

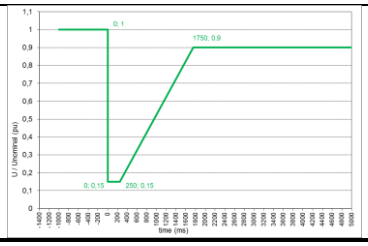
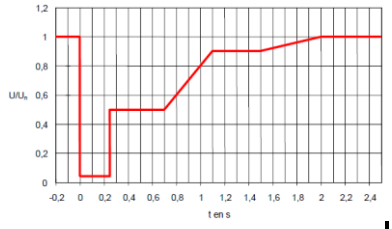
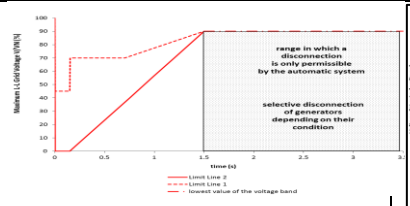
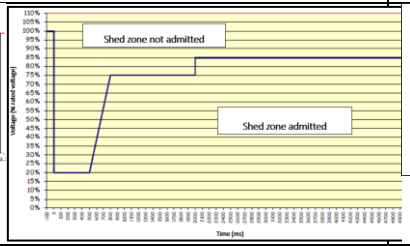
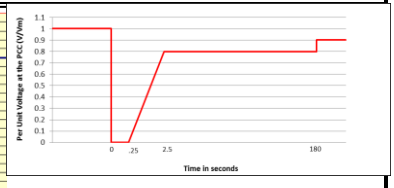
Figure 45 – Voltage ranges proposal (between 110 kV and 300 kV)

- ***Fault-ride-through8 capability***

The fault-ride through capability requirements for transmission grid users, which apply in the 12 countries that have responded to the survey, are illustrated in the following table, diagrams and maps. The responses received were heterogeneous. Although, some countries do not have specific FRT profiles curves for all generation technologies, most of them have defined fault-ride-through (FRT) profile curves for different technologies, like wind, solar or Synchronous generation.

In view of the new NC RfG[9] that will be applied in the near future in the European countries, it is expected that new FRT profiles curves will be clearly defined briefly for all technologies. In the next diagrams, different FRT profile curves considered in the Med-TSO region for the wind technology are presented as an example:

FRT profile curves considered for the wind technology in Med-TSO region

DZ	***CY***	***FR***
Not Required		
GR	***IT***	***JO***
		
ME	***MA***	***PT***

[8] Fault-ride-through - means the capability of electrical devices to be able to remain connected to the network and operate through periods of low voltage at the connection point caused by faults like short-circuits and others;

[9] NC RfG – network code on requirements for grid connection of generators (European grid code)

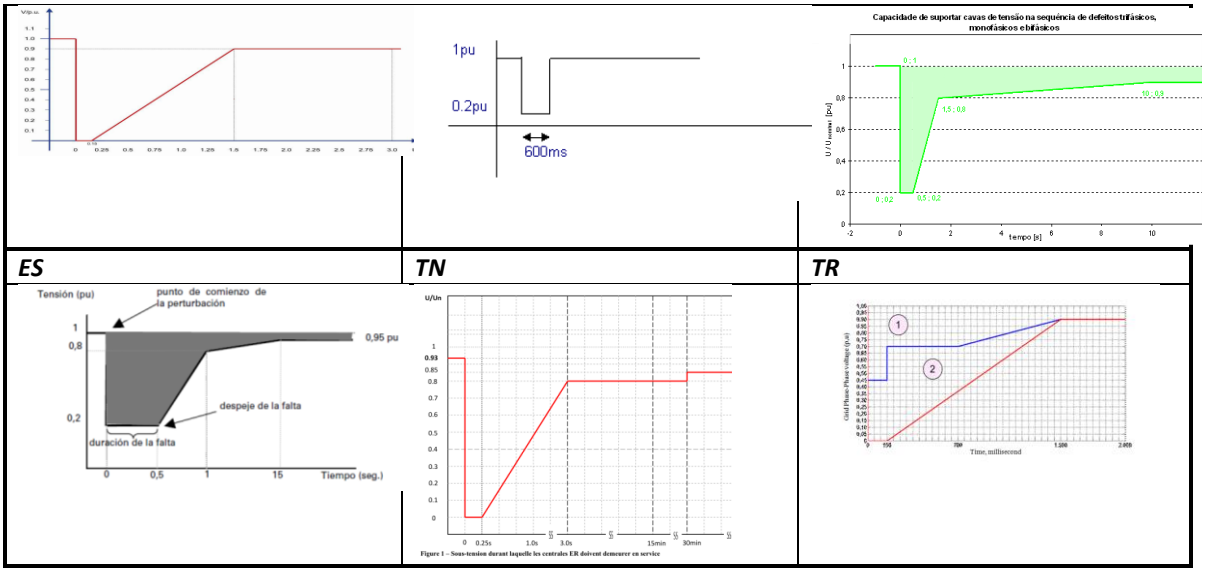


Figure 46 – FRT profile curves considered for the wind technology

However, this common base is not enough for the actual and future challenges at the operation of the transmission networks. Consequently, it is suggested, as an External Rule and in line with the ENTSO-E grid codes, that the Med-TSO countries need to define for the technologies PPM-Power Park Module10 and SPGM-Synchronous Power Generating Modules11, the fault-ride-through profile which is the most appropriate for their network, considering the upper limits profile (red line) indicated in the next figures:

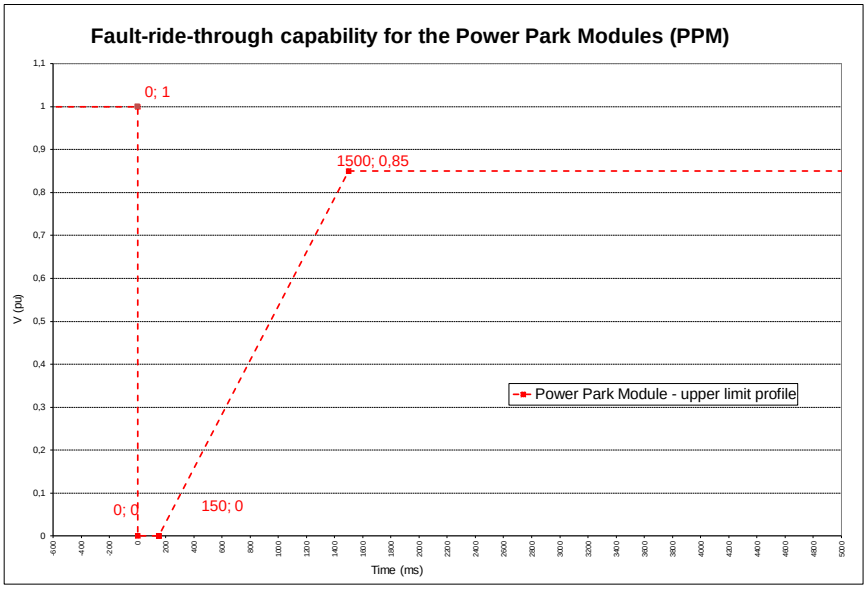


Figure 47- FRT capability proposal for PPMs

[10] Power Park Module - means a unit or ensemble of units generating electricity, which is either non-synchronously connected to the network or connected through power electronics, and that also has a single connection point to a transmission system, distribution system including closed distribution system or HVDC system;

[11] Synchronous Power Generating Module - means an indivisible set of installations which can generate electrical energy such that the frequency of the generated voltage, the generator speed and the frequency of network voltage are in a constant ratio and thus in synchronism;

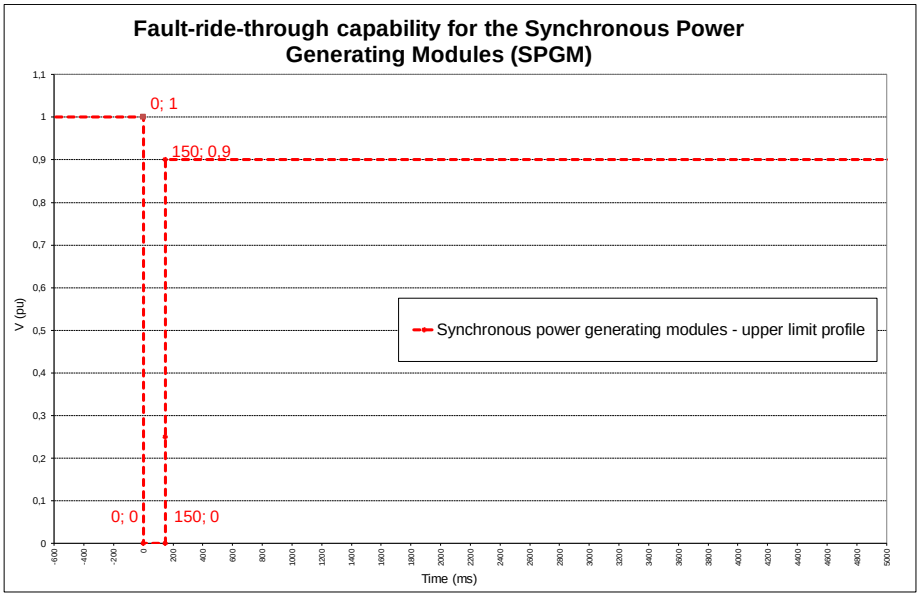


Figure 48 - FRT capability proposal for SPGMs

Moreover, the power generating modules shall be capable of remaining connected to the network and continuing to operate stably, when the actual course of the phase-to-phase voltages on the network voltage level at the connection point during a symmetrical fault remains above the limit of fault-ride-through profile specified by Med-TSO countries according to the limits in the figures, unless the protection scheme for internal electrical faults requires the disconnection of the power generating module from the network. The protection schemes and settings for internal electrical faults must not jeopardize fault-ride-through performance.

With regard to fault-ride-through capabilities in the case of asymmetric faults, they must be specified by each TSO, but it is strongly recommended that the profiles similar or equivalent to the profiles presented above to be considered.

- **Reactive power requirements**

Due to the large penetration of renewables connected in the transmission system, both existing and anticipated in the future, high level of harmonization is required in general towards reactive power requirements, especially related to the reactive power contribution for the different technologies.

As an External Rule, it is proposed that this contribution is set as an interval of adequate reactive requirement (the maximum range of Q /Pmax = between - % of P and + % of P), especially in situations where the possible impact of the generation can appear, like Power Plants near the neighbouring countries. However, there should be a difference in limits of reactive power contribution, which is expected in SPGM and PPM. Requirements for transmission connected consumers (with and without generation) and also transmission connected distribution facilities should be included.

So, in case of the Power Generations Modules, it is suggested that the Med-TSO countries define for the technologies PPM-Power Park Module and SPGM-Synchronous Power Generating Modules, the profile Q/Pmax in line with the European grid code.

- **Protection requirements**

  Based on the results of the Survey concerning protection requirements, it is proposed that redundancy requirements for telecommunication and protection schemes should be harmonized. More specifically:

  - ***Telecommunication and protection schemes***

    As an External Rule it is proposed that a double protection scheme should be applied by all TSOs for non-transmission facilities connected to the transmission grid. In addition, the adoption of double telecommunication scheme should also be examined, following internal agreements between TSOs and users.

- **Control requirements**

  Based on the results of the Survey, harmonization of the communication between Users and TSO Control Centres is proposed. This is mainly due, as mentioned above, to the large penetration of renewables, the impact of which in the neighbouring systems can be significant, depending on their scale. For the same reason, the need for observability and controllability of non-transmission facilities from the TSO control room should also be included for harmonization. More specifically, harmonization of the control requirements focuses in the following aspects:

  - ***Observability and Controllability of non-transmission facilities***

    As an External Rule or following agreements between TSOs, the observability and controllability of non-transmission facilities should be harmonized, without explicitly specifying the global architecture of the communication schemes between Users and TSO Control Centres. Communication should comply with performance requirements (speed, reliability, etc.) and may be direct user-TSO or via intermediate Control Centre delegated by User. Non-transmission facilities should be observable and controllable by TSO Control Centres, with respect to their size. Based on the results of the survey, concerning the observability and controllability magnitudes which are generally common in MedTSO countries and in compliance with the new Grid Code of ENTSO-E, it is proposed that non-transmission facilities of a magnitude higher than between 1 MW and 5 MW should be observable and higher than a magnitude between 5 MW and 10 MW should be controllable by TSO Control Centres. In any case, more exigent conditions could also be established at national level.

  - ***Magnitudes to be provided in real time***

    As an External Rule at least the magnitudes of V, P, Q and the status (On/Off) should be provided from non-transmission facilities to TSO control systems.

- **Demand disconnection schemes**

  With the aim to ensure impartial, efficient and 'as expected' load disconnection among frequency control areas, harmonization of the demand disconnection schemes, particularly low frequency, is proposed.

  As an External Rule, low frequency disconnection schemes should be set as a requirement. Settings and details of the schemes should be agreed between neighbouring TSOs in the same synchronous area and in line with the European grid codes and guidelines.

- **HVDC requirements**

  The large penetration of renewables in neighbouring countries and the increase of AC and/or DC interconnections will create new challenges in planning and operation of the grids. An HVDC link could have a significant impact not only on the two countries connected, but also on neighbouring systems, depending on their scale and on the capacity of the HVDC link. Harmonization of HVDC requirements/criteria can mitigate eventual problems in near future.

  In view of the harmonization process of HVDC requirements in ENTSO-E countries, harmonization of HVDC requirements/criteria in Med-TSO region should also be foreseen in line with the Network Code on High Voltage Direct Current Connections (NC HVDC). This NC HVDC specify the requirements for long distance DC connections, links between different synchronous areas and DC-connected Power Park Modules, such as offshore wind farms, which are becoming increasingly prominent in the electricity systems.

As an overview, the connection aspects to be included in the proposal for a common target regulatory framework is presented in **Annex 1**, along with the tentative proposal of specific rule for each aspect.

5.3 Operation of the interconnected systems

- **Classification of system states**

System states should be classified in an external rule in a homogeneous way, with clear specific characteristics for each state (operational security limits, frequency criteria, reserves, contingency list, and activation of defence or restoration plan). In principle the states that should be considered are: Normal, Alert, Emergency, Blackout and Restoration.

- Normal state. The following conditions should be fulfilled:
  - No violation of operational security limits, even after the occurrence of a contingency from the contingency list.
  - Steady state system frequency deviation is within the standard frequency range or not larger (in absolute value) than the maximum steady state frequency deviation without entering in alert state.
  - Active and reactive power reserves are sufficient to withstand contingencies from the contingency list without violating operational security limits.

  In general a system is in normal state if is within operational security limits in the N-situation and after the occurrence of any contingency, taking into account the effect of the available remedial Actions.

- Alert state. No violation of operational security limits and at least one of the following conditions:
  - (i) At least 1 contingency from the contingency list leads to a violation of the operational security limits (even after activation of remedial actions);
  - (ii) Steady state system frequency deviation is not larger (in absolute value) than the maximum steady state frequency deviation and has continuously exceed 50% of the maximum steady state frequency deviation for period larger than the alert state trigger;
  - (iii) Reserve capacity is reduced more than 20% for more than 30 minutes with no possibility to compensate in real time operation.

  In general, a system is in alert state if is within operational security limits, but a contingency has been detected, for which in case of occurrence, the available remedial actions are not sufficient to keep the normal state.

- Emergency state: At least one of the following conditions should be fulfilled:
  - At least one violation of operational security limits;
  - Frequency does not meet criteria of normal or alert states;
  - One measure of the defence plan is activated;
  - Unavailability of TSO tools for more than 30 minutes.

  In general, a system is in emergency state if operational security limits are violated and at least one of the operational parameters is outside of the respective limits.

- Blackout state. At least one of the following conditions should be fulfilled:
  - (i) Unexpected loss of more of 50% of the total national demand at a particular point in time;
  - (ii) Total absence of voltage for at least 3 minutes.

At a national level a "Partial Blackout state" could also be defined, if the blackout affects only a part of the system (not fulfilling the previous requirements).

- Restoration state: When any measure of the restoration plan is activated, partially of fully.

- **Technical requirements**
  - **Frequency ranges (quality parameters) in the different system states**

    The external rule should not only include the system state consideration in each frequency range (issue above) but also the frequency quality target parameters (nominal frequency, standard frequency range, maximum deviations both instantaneous and in steady state, maximum time out of range, time to restore frequency, etc.).

    For those countries synchronously connected these quality target parameters are:

    - Nominal frequency: 50 Hz.
    - Standard frequency range: between 20 and 200 mHz, but in the future should be harmonized to at least 50 mHz.
    - Maximum instantaneous frequency deviation: between 700 and 1500 mHz, but in the future should be harmonized to at least 800 mHz.
    - Maximum steady state frequency deviation: between 200 and 500 mHz, but in the future should be harmonized to the lower value (200 mHz).
    - Time to restore frequency: 10 to 20 minutes. In the future could be harmonized to the average value (15 minutes).

  - **Voltage ranges (for unlimited operation) in normal conditions.**

    As an external rule the classification of voltage ranges in normal conditions should be considered. Different ranges could be considered depending on the voltage level. As a first step the following could be considered:

    - Between 110 kV and 300 kV the voltage should stay between 0.9 pu and 1.118 pu.
    - Between 300 kV and 400 kV the voltage should stay between 0.9 pu and 1.05 pu.

    Anyway, more exigent conditions could also be established at national level.

  - **Voltage ranges (for unlimited operation) in extraordinary conditions.**

    As an external rule the classification of voltage ranges in extraordinary conditions (unexpected conditions not studied in real time by the TSO) should be considered. More wide ranges could be established at a national level. Different ranges could be considered depending on the voltage level.

  - **Specific reactive power management measures**

    A classification of the possible remedial actions to manage reactive power should be included in an external rule: switching of reactors and capacitors, on load tap changes transformers, instruction to distribution companies, set points to generation facilities, HVDC, etc. These remedial actions should be applied by a TSO when the voltage is outside the ranges defined for unlimited operation. In addition, specific management of reactive power flows in the

international interconnections should be included in internal agreements between neighbouring TSOs to respect common operational security limits.

- **System protection coordination criteria in the international interconnections**

  In the internal agreements between neighbouring TSOs the criteria for system protection coordination in the interconnection lines should be included (agreement on the definition of the set points and coordination prior to implementation).

- **Information exchange**
  - **List of scheduled and structural data to exchange with other TSOs**

    The list of structural and forecasted data to be exchanged between TSOs should be included in the internal agreements and possibly also in the external rule.

    The list of structural data should include at least the following data from the observability area that should be agreed between neighbouring TSOs (in principle, at least border substations should be included in the observability area):

    - Normal topology of substations.
    - Technical data on transmission lines.
    - Technical data on transformers, including phase-shifting transformers.
    - Technical data on HVDC systems.
    - Technical data on reactors, capacitors and other.
    - Reactive power limits from generation facilities.
    - Operational security limits.
    - Protection set points of transmission lines included as external contingencies.

    To coordinate operational security analysis TSOs from the same synchronous area should exchange at least the following:

    - Topology of the transmission grid above 220 kV (including 220 kV).
    - Model of the transmission grid below 220 kV, which has a significant impact.
    - Thermal limits of the transmission elements.
    - Aggregated generation forecast in each node of the transmission grid.
    - For dynamic stability studies, additional data should be exchanged.
  - **List of real time data to exchange with other TSOs**

    The list of real time data to be exchanged between TSOs of the same synchronous area should be included in the external rule. This list should include at least the following:

    - Frequency
    - Frequency restoration control error
    - Active power exchange between control areas
    - Aggregated generation
    - System state
    - Set point of the load frequency control

Also the list of real time data from the observability area to be exchanged between neighbouring TSOs should be included in both an external rule and in the internal agreements between TSOs. The observability area should be agreed between neighbouring TSOs. In principle, at least border substations should be included in the observability area. The list of information to be exchanged should include at least:

- Substation topology (including availability).
- Active and reactive power in line bay or transformer bay, including transmission and distribution
- Active and reactive power in generation bay
- Reactive power in reactor bay and capacitor bay
- Bus bar voltage
- Restrictions (if any) and outages.
- Positions of tap-changers transformers

- **Contingency analysis**
  - **Type of contingencies considered**

    The external rule should include the type of contingencies to be considered on the basis of whether it is ordinary, exceptional or out-of-range, taking into account the probability of occurrence. In principle N-1 contingencies should always be considered and "partial" N-2 contingencies in specific situations that could be determined at national level.

  - **Contingency list (both internal - in national power system - and external - in neighbouring power systems -)**

    The internal agreement between neighbouring TSOs should include the list of external contingencies that should be considered when performing the contingency analysis, together with the internal contingencies.

    The external rule should also include that each TSO should inform neighbouring TSOs about the external contingencies and also about any topological change included in the external contingency list.

  - **Operational security limits**

    The internal agreement between neighbouring TSOs should include the operational security limits that are taken into consideration when performing the contingency analysis. These limits are, at least, the following:

    - Voltage limits
    - Short-circuit current limits
    - Stability limits.
    - Current limits in terms of thermal rating including the transitory admissible overloads

  - **Operational security limits in the interconnection lines**

The internal agreement between neighbouring TSOs should include the exact operational security limits in the interconnection lines among both countries. In case of differences for the same interconnection line, the more restrictive limits should be considered.

- **List of joint remedial actions agreed between TSOs after a contingency**

The external rule should include the different categories of remedial actions that TSOs could use in case of a contingency (either when need or not need to be managed in a coordinated way) and also the criteria that shall apply. The remedial actions could be the following:

  - Topological actions
  - Reschedule of maintenance through the duration of outages
  - Voltage control and reactive power management
  - Re-dispatch of generation
  - Countertrading
  - Modification of active power flows through HVDC links

- **Periodicity of state estimation calculations**

The need to use state estimations when performing operational security analysis close to real time should be included in the external rule while the periodicity of these calculations should be agreed between neighbouring TSOs and included in the internal agreements.

- **Management of international exchanges**
  - **Management of international exchange programs between TSOs**

One of the benefits of interconnected power systems is the possibility of having long term and short term energy exchanges between the power systems. Realization of the energy exchanges between the power systems requires the coordination of TSOs. This coordination could only be achieved according to pre-defined rules and procedures. Based on this requirement, harmonization of management of international exchange programs is considered of high priority.

In this study it is considered that an internal agreement between the interconnected neighbouring TSOs should be realised. This agreement between the neighbouring TSOs should include the implementation of the scheduled exchange programming and management of international exchange programs between them. On the other hand, a general mechanism should be defined for the management of the international exchange programs. Data exchange formats, accuracy, period of data (15min, 30min, hourly, etc.) should be defined by agreement between interconnected neighbouring TSOs. Another issue of the interconnected power systems is the unintentional deviations which occur during the exchange of energy between neighbouring power systems. For this purpose, a compensation mechanism should also be considered for the unintentional deviations.

  - **Outage coordination**

The external rule should include the need of coordination between neighbouring TSOs in case of an outage that could affect NTC. . In addition, internal agreements between TSOs should

go a step further and include step by step procedures, which make clear and rational the way to deal with situations of outage affecting NTC.

Due to the importance of quick access to information about outages, all TSOs should abide by, under an external rule, the two following steps:

- Definition of assets (network elements and generation and consumption units) with cross border (XB) relevance.
- On a year ahead timeframe, outage planning agents of XB relevant generation and consumption shall provide their proposals for outages (Availability Plans) to the connecting TSO.

Based on mutual agreements, TSOs should:

- Perform individual assessment of XB relevant units (generation and consumption) outages, detecting possible incompatibilities (adequacy or network problems). If Outage Incompatibilities are detected, each TSO has to provide a solution, in coordination with the impacted Outage Planning Agents. In the event that no coordinated solution is reached, the lowest impact solution is proposed by the TSO. TSO informs the NRA of the not coordinated solution and of its technical and financial impacts for all parties. The conducted coordination processes are handled according to and in line with the current existing practices (regulations, law, contracts) as they are installed in the different Member States.
- Plan based on Availability Plans provided by Outage Planning Agents the Availability Statuses of its Relevant Grid Elements. The outages on the Relevant Grid Elements should minimize their impact on the market and preserve operational security. When a TSO detects outage incompatibilities, it should initiate coordination with the impacted parties in order to reach a solution taking into account if the work of the outage is relevant for maintaining the Operational Security.
- Share among them their individually assessed "preliminary Year-Ahead Availability Plans" (units and grid elements).
- Define the perimeter of the electrical interdependent (in terms of mutual affection of outages) region (Outage Coordination Region) in which has sense to jointly coordinate outages.
- Jointly assess, within the same Outage Coordination Region, the preliminary Y-A Availability Plans. If Outage Incompatibilities arise when combining the Availability Plans of all the Relevant Assets within the Outage Coordination Regions, a solution is found for each Outage Incompatibility in coordination with all concerned TSOs, each TSO being responsible for coordinating with its connected concerned Outage Planning Agents.
- Publish a final Y-A Availability Plan
- Update Year-Ahead Availability Plan. After a change has been initiated, the impact on the overall Availability Plans is assessed and a coordination phase is set up between affected TSOs, which coordinate possible Outages Incompatibilities with their connected Outage Planning Agents as affected, according to the applicable legal framework.

- **Load frequency control**

  Regarding load frequency control, an external rule should include the need of having an operational agreement for each synchronous area in which the load frequency control structure and process activation is defined.

  As a result of the survey the following aspects have been particularly emphasized and are proposed to be also included in the external rule:

  - FCR common technical requirements.
  - Criteria used for establishing the quantity of FCR, both the total quantity and the national one.
  - Compliance scheme for FCR.
  - Provision of FRR: the external rule should include the criteria to be fulfilled by units to deliver FRR, while internal agreements between TSOs should define the set of power plants that could provide FRR.
  - Criteria used for establishing the quantity of FRR, both the total quantity and the national one. In principle this criteria could be the loss of the biggest unit in operation.
  - Compliance scheme for FRR

- **Reserve management**

  Reserve management is a key issue when it comes to enhancing the performance of power systems. It should be from this perspective, possible to exchange the reserve whenever it is required and possible. TSOs should mutually agree on whether they can exchange the reserve. An external rule should include the type of reserves (FCR, FRR or RR) that could be exchanged differentiating between exchanges of reserves within the same synchronous area and between two different synchronous areas. In addition, the internal agreement between TSOs should detail the requirements and the process to share each type of reserve.

- **System defence plan**

  System security is an important aspect for the operation of the power systems. For this purpose system defence plan, which introduces all the measures to be implemented to prevent the propagation of an incident in the system, has to be considered as an important aspect. System defence plan is not compromised of a single method and a tool but it is comprised of a set of various power system control mechanisms and procedures. Among such control mechanisms and procedures frequency deviation management procedure, demand disconnection schemes, voltage deviation management procedure power flow management procedure and inter-TSO assistance in emergency state are analysed in this study. Among those methods and procedures especially harmonisation of frequency deviation management procedure, demand disconnection schemes with respect to low frequency and/or low voltage and inter-TSO assistance and coordination in emergency state are considered of high priority.

- **Frequency deviation management procedure (Automatic Under/Over-Frequency control scheme)**

Frequency deviation management procedures should be included in an external rule. These systems, that shall be almost instantaneous, should be designed considering dynamic studies in different scenarios from the whole synchronous area. Additionally, under frequency schemes (based on load shedding) or over frequency schemes (generation disconnection) could also be designed.

- **Setting of demand disconnection schemes (low frequency and/or low voltage)**

  An external rule could define the setting of disconnection schemes for low frequency and/or low voltage. In principle low frequency settings should be designed based on dynamic studies in different scenarios from the whole synchronous area. Low frequency settings could be included in the external rule while low voltage settings could be designed individually by each TSO.

- **Voltage deviation management procedure**

  The external rule should adopt the management of voltage deviation and an internal agreement between the neighbouring TSOs should include operational voltage limits for the bordering substations.

- **Power flow management procedure**

  An external rule should include the general criteria while the internal agreement between the neighbouring TSOs should include the procedure of the management of power flow and if there is a SPS system which also controls the power flow of the interconnection lines then settings of the SPS should be considered mutually.

- **Manual demand disconnection procedure**

  An external rule should include that each TSO should design the manual demand disconnection procedure in coordination with the other TSOs of the same synchronous area.

- **Inter-TSO assistance and coordination in emergency state**

  An external rule should include the general criteria while the internal agreement between the neighbouring TSOs should include the procedure for inter-TSO assistance and coordination in emergency state. A mechanism should also be defined for the compensation of the emergency exchange programs.

- **Restoration plan**
  - **Rules and types of restoration plans**

    Harmonization of restoration plans is considered of high priority. It is considered that having a developed restoration plan will serve the TSOs in case of a partial or a total blackout to quickly achieve a stabilized and reliable power system. To achieve this purpose, it is considered that every TSO should prepare and adopt their restoration plans periodically.

    Interconnected or not, every TSO's restoration plan should obviously include a bottom-up energization strategy by taking the generation units equipped with the "black start"

capability. By using the generation units equipped with the "black start" capability the backbone of the high voltage grid should be restored in case of a blackout. On the other hand, interconnected TSOs also have the possibility to adopt top-down energization strategy in their restoration plans. As top-down energization strategy is based on usage of the international interconnections, coordination between the neighbouring interconnected TSOs is a necessity.

To achieve the coordination effectively and quickly between the neighbouring TSOs, where at least one of them is subject to system restoration, the rules and procedures must be predefined. For this purpose, the procedures for the decision of an emergency exchange between neighbouring TSOs under the system restoration could be defined in the internal agreement between neighbouring TSOs. In addition to the internal agreement between the neighbouring TSOs, general criteria should be included in the external rule.

- **Training and certification (qualification)**
  - **Certification of operators in real time**

    The external rule should include as a requirement that operators in charge of real time have a certification.

  - **Language requirements**

    Both the external rule and the internal agreements between TSOs should include a requirement regarding the language to be used between real-time operators from different TSOs. In principle the predefined language could be English, unless other common language exists between the neighbouring TSOs (French, Arabic...).

As an overview the operation aspects to be included in the proposal for a common target regulatory framework are presented in Annex 1, along with the tentative proposal of specific rule for each aspect.

5.4 System service market

Based on the results of the survey presented in chapter 4, the different topics related to System Service Markets Area were prioritized according to their degree of relevance for future harmonization (Low/Medium/High) and a suitable rule format for the common target regulatory framework was proposed for each aspect. With respect to the global degree of prioritization proposed, the most relevant aspects selected as candidate to be included in the proposal for a common target regulatory framework, are the following.

- **Legal Issues**
  - **Contractual requirements for participation on the cross-border electricity trade**

    The harmonization of the Legal Issues is considered of high priority, with the purpose of integration of the electrical power systems involved, promoting the share of resources and electricity exchange under a specific regulation model.

These activities are developed with the aim to achieve in future a general context (target model) operating with the characteristics of an open electrical market model with the potential admission of new subjects both demand and offer side and for trading activities.

Under this main purpose it is necessary to clearly define the basic requirements for participation on the cross-border for the access to the procedures taking into account among other things:

- Registration requirements-database of market players;
- Possession for Market players of technical requirements as authorization to operate on a specific border e.g. in the form of contract with TSO (injection or withdrawal dispatching contract in Italy, injection for import or withdrawal for export);
- Allocation mechanism of the transmission capacity;
- Implementation of the scheduled exchange program and management of international exchange programs;
- Financial requirements in the form of guarantees "for entry", for monitoring the financial exposure (i.e. long-term and real time during the allocation procedure) and for "system compensation" for unbalances.

- **Current rules for export/import of cross-border electricity**

This scheme of requirements could be translated into mutual (bilateral/multilateral) rules including the main principles above.

The form could be an internal agreement between the interconnected neighbouring TSOs. A concrete example is the Auction Rules valid in ENTSO-E Area.

A scheme like this should progressively include next steps for a model to be periodically updated:

- Oriented to involving third subjects (market players in addition to TSOs) in the cross-border activities;
- Oriented to improve the existing cross-border procedures.

Considering a future shared model oriented to the mentioned Auction Rules model, a registration procedure for operating on the borders or on a specific border that should be implemented with an external rule format should be envisaged.

Each market player should follow a process finalized to obtain an authorization to operate on an interconnection and therefore to accomplish prescriptions required by the TSO which manages the link. More in details, it could be necessary to provide:

- Company data of each market participant including the VAT code (or tax registration number), and the company register certificate (e.g. with address of the registered office);
- A reference contact person for the registration/eligibility procedure, allocation procedure and for settlement/administration issues;
- Typology of activities of interest: import/export or both and related borders;

- Evaluation of an amount that it is necessary to cover with a form of guarantee, eventually remodulate on the basis of the volumes exchanged on the links.
- Subscription of a financial guarantee (e.g. a sort of bid bond/performance bond) on the basis of the "capacity ranges" elaborated by TSOs per volume of exchange capacity. This can be remodulated on the basis of the volumes exchanged on the links.

- **Presence of a Market Operator**

  Concerning a global system oriented to following evolutions, the presence of a Market Operator separated to TSO, is an example of a better identification and allocation of the responsibilities in terms of international exchange and system operation.

  Under the objective of the definition of rules harmonized in a shared regulatory framework, it is necessary to find quick-win solutions in order to get goals in a short-term period.

  In a context composed by systems with a different reference model "market or no market based" model, it is possible to consider a progressive degree of harmonization regarding at least some technical aspects that allow an interaction (or interoperability) between interconnected systems. Some examples are the criteria for calculating the Net Transfer Capacity and the coordinated use of dispatching and balancing issues and resources.

- **Categories of operators enabled**

  Independently of the reference system, it is necessary to separate the categories of operators enabled for import/export activities that are clearly based on the market model: monopoly-only TSO, open market-Market Players including producers, self-consumers, suppliers, traders.

  Also in case of systems linked to a different market model, it is possible to investigate some principles or schemes for a concrete operation of the interconnections. If the access to another system (from technical and commercial point of view) is considered as an opportunity, it could be considered as first interface between systems in order to find ad hoc solutions as a first step for integration of the systems.

- **Technical requirements to satisfy for using the interconnections**

  It is evident that technical requirements with an impact on the exchange programs (from technical and commercial point of view) need to be shared.

  While operating an interconnection, in order to manage correctly the international exchange programs - including data exchange formats, accuracy, relevant period of data (15min, 30min, hourly, etc.) - a compensation mechanism for the management of the unintentional deviations should also be defined.

- **Capacity Calculation:**

  In general, the harmonisation of the Capacity Calculation is considered of medium-high priority for all TSOs. The target is the coordination and harmonisation of the Capacity Calculation methodology

within the Capacity Calculation Region (CCR) and merging of Capacity Calculation Region when efficiency reasons justify doing so.

Coordinated capacity calculation means that when the capacity is calculated in the "coordinated" borders the interdependencies between them are considered to ensure that capacity calculation is reliable and that optimal capacity is made available to the market at regional level.

For the Capacity Calculation the following issues were considered of high priority for harmonisation:

- **Security criteria used for calculating the Net Transfer Capacity (NTC)**

  The implementation of the N-1 as a security criterion is considered of high priority for harmonisation. Internal agreements between TSOs are considered as the most suitable desired rule format in the target regulatory framework.

- **Characteristic process for finalization of Net Transfer Capacity (jointly or separately from other TSO's?)**

  The harmonisation of characteristic process for finalization of Net Transfer Capacity is considered of medium-high priority. The Net Transfer Capacities should be calculated jointly by the neighbouring TSOs. Internal agreements between TSOs are considered as the most suitable desired rule format in the target regulatory framework.

- **Reference time horizons used for capacity calculation and process for calculating capacity in the different time horizons.**

  The harmonisation of the time horizons used for capacity calculation for all TSOs is considered of medium-high priority. In general, the time horizons used for capacity calculation is yearly, monthly and daily. Internal agreements between TSOs are considered as the most suitable desired rule format in the target regulatory framework.

- **Capacity Allocation**
  - **Method and procedures applied for transmission capacity allocation (including the Physical Transmission Rights (PTR) allocation)**

    The harmonisation of the method and procedures applied in each system for transmission capacity allocation including the Physical Transmission Rights is considered of medium-high priority. The external rule should include the procedure for allocate transmission capacity. In principle this procedure should be a public auction (either PTR or FTR) with marginal price allocation. Management procedures for congestions in the interconnections should also be included in the external rule, in principle via market mechanisms (like market spread).

    In addition internal agreements between neighbouring TSOs are considered as the most suitable desired rule format to include more details about the allocation procedure in a specific border.

  - **Obligation regarding the use of capacity allocated - Use it or sell (or loose) it mechanism.**

The harmonisation of the obligation regarding the use of capacity allocated is considered of medium-high priority, due to the heterogeneity of the models market based in the Med-TSO country. Anyway the internal agreements between TSOs should include the existence or not and the type of the obligation (sell it or lose it). Anyway in some cases, if allocation is through FTR this issue is not applicable.

- **Kind of capacity products allocated (duration and time profiling).**

  The harmonisation of the Kind of capacity products allocated (duration and time profiling) is considered of medium-high priority. The external rule should include main characteristics that capacity products to be allocated in all the region should have, while the internal agreements between TSOs are considered as the most suitable desired rule format to include details about the specific capacity products in each border.

  In principle yearly, monthly, daily and intraday horizons could be considered.

- **System of liabilities, guarantees and penalties (technical and commercial) applied for each subject (Market Players) involved in the allocation procedure.**

  The harmonisation of the system of liabilities, guarantees and penalties applied for each market players is considered of medium priority. Currently, for the countries having model market, it is necessary to have a system of guarantees for the market players so it is proposed to include in the external rule the need of having a guarantee.

- **Subject responsible for the management of the allocation procedure**

  The harmonisation of the subject responsible for the management of the allocation procedure is considered of medium-high priority. In general, TSOs are responsible for the management of the allocation procedure in countries without market and supranational entities (managed by TSOs) in countries with market. The proposal is that the external rule should include which subject should be responsible for the management of the allocation procedure, while internal agreements between TSOs should include the details of obligations and responsibilities. The subject responsible should be the affected TSOs in a first stage and a regional entity (managed also by the TSOs) in a further stage when the level and use of interconnections increases substantially.

- **Dispatching and balancing**
  - **Actions foreseen in order to guarantee the exchange programs.**

    A multilateral procedure should propose common settlement rules of all intended exchanges of energy within a Synchronous Area, considering:

    - Frequency Restoration Process with automatic activation; or
    - Operating the Imbalance Netting Process.
    - Frequency Restoration Process with manual activation;
    - Reserve Replacement Process;
  - **Management of unintentional deviations on international interconnections**

The proposals of common settlement rules of unintended exchanges of energy between TSOs shall ensure fair and equal distribution of costs and benefits between TSOs, taking into account the prices for activated Balancing Energy for Frequency Restoration Process or Reserve Replacement Process.

- **Transparency**
  - **Public information on the Electricity Markets data**
  - **Public information on international interconnections data**

    An external rule should include the information that TSOs (and other market players) should make publically available for the sake of transparency, both regarding the electricity markets in general and specific information about the international interconnections. Information could be divided in three different levels:

    - Minimum information required: information related with capacity and use of generation, consumption and transmission units, including the scheduled outages. In addition total demand and generation figures should also be publically available.
    - Regional information: at a regional level should be made public (in the same platform if possible):
      - Use of the interconnection (in terms of programs, real measures and also percentage of utilization).
      - Daily and intraday market prices.
      - Information about the international exchanges mechanism.
      - Economic information.
    - Additional information: on a long-term stage other data could also be included such as countertrading programs used.

As an overview, the system service market aspects to be included in the proposal for a common target regulatory framework are presented in **Annex 1**, along with the tentative proposal of specific rule for each aspect.

6 Conclusions

This chapter provides an overview of the general results and conclusions that can be extracted from the study performed within MedTSO. According to the table below, a total of 135 issues were asked to the survey respondents in order to establish the proposal of common target regulatory framework in the Mediterranean region. From these issues a total of 66 topics have been selected to be included in the proposal considering their relevance and prioritization level.

Regulatory Framework			
	Total	Proposal	No proposal
	135	**66**	**69**

Figure 49 – Number of issues included in the proposal

The chart below shows that approximately half of the issues have been selected for the proposal.

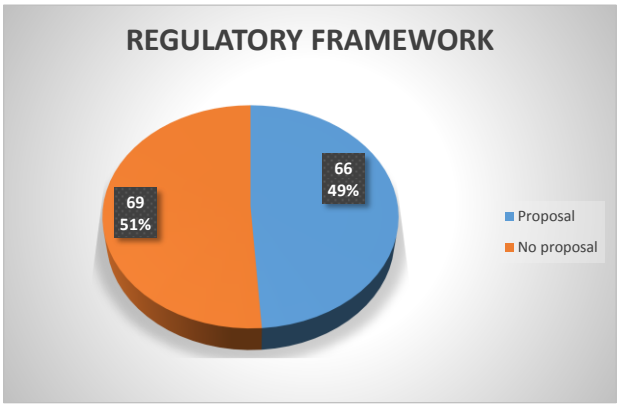


Figure 50 – Percentage of issues included in the proposal

As mentioned in previous chapters the survey has been divided in four main blocks: **legal and regulatory issues**, **connection to the grid**, **operation of the interconnected system** and **system service markets**. A first analysis shows some preliminary conclusions:

- Most of the proposed issues are related to the operation area, specifically 32 issues which represent the 48% of the total.
- From the connection area 15 issues were selected which represents the 23% of the total.
- From the system service market area 16 issues were selected which represents the 24% of the total.
- And finally from the legal and regulatory block only 3 issues were selected which represents just the 5% of the total. It must be highlighted that MedTSO considers necessary to hold further coordination actions in the future with MedReg as most of the issues included in this block should have the focus on the regulators.

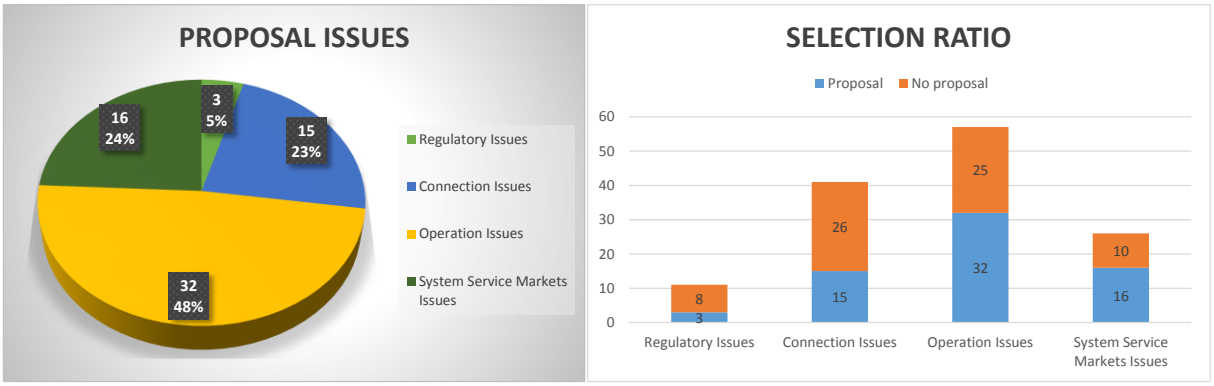


Figure 511 – Percentage of issues included in the proposal per technical area

In the following chapters an overview of each area is performed individually.

6.1 Legal and regulatory issues

From a total of 11 issues that were originally included in the survey only 3 have been selected as relevant. The numbers of issues that have been considered for the proposal represents the 27% of the total from this area.

Regulatory Issues

	Total	Proposal	No proposal
Legal and regulatory issues	11	3	8
	11	**3**	**8**

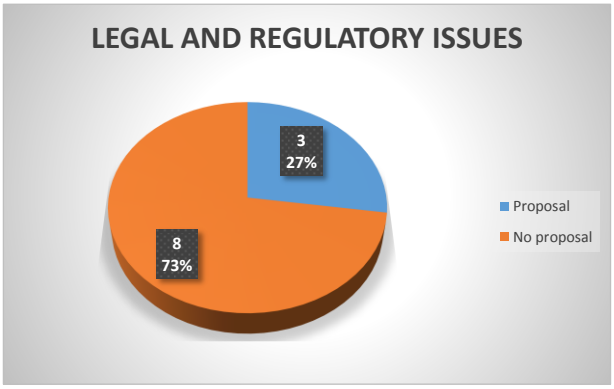


Figure 52 – Legal and regulatory area. Number and percentage of issues included in the proposal

More specifically, based on the results of the survey the following 3 issues are prioritized for future harmonization: need of having a coordinated regulation for international interconnections, need of unbundling between regulated and non-regulated activities and need of a responsible authority (independent body) with transparent and neutral dispute settlement procedures between stakeholders.

6.2 Connection to the grid

From a total of 41 issues that were originally included in the survey 14 have been selected as relevant. The numbers of those that have been considered for the proposal represents the 34% of the total from this area.

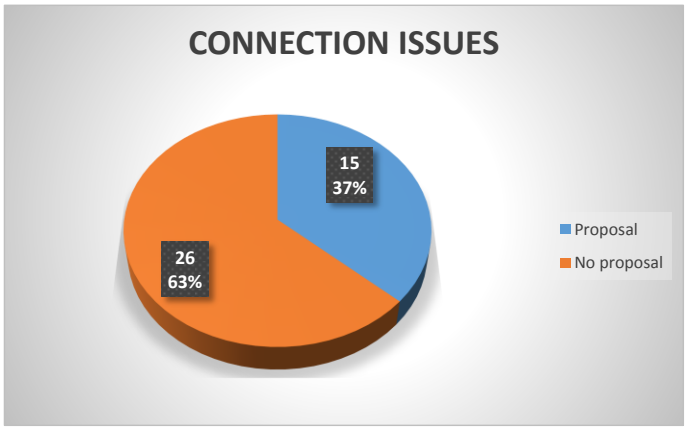


Figure 53 – Connection area. Number and percentage of issues included in the proposal

This area was subdivided in 13 different topics. The number of questions that were originally suggested and the number of those finally selected for each of the different topics are presented below.

Connection Issues

	Total	Proposal	No proposal
Connection procedure	10	2	8
Frequency requirements	3	3	0
Voltage requirements	2	2	0
Reactive power requirements	1	1	0
Short circuit requirements	2	0	2
Protection schemes	5	1	4
Control requirements	5	4	1
Power quality	6	0	6
Demand disconnection schemes	1	1	0
System restoration capabilities	3	0	3
Demand side response services	1	0	1
HVDC requirements	1	1	0
Compliance and monitoring	1	0	1
	41	**15**	**26**

Figure 54 – Connection area. Number of issues included in the proposal for each chapter

Additionally, the bar chart below has been plotted in order to better visualise which topics are the most significant. From the analysis of the charts below the following conclusion can be extracted:

- The majority of the issues focus on connection procedure, frequency, voltage and control requirements.
- Although 10 issues were originally considered regarding connection procedure, finally only 2 were selected. Consequently, this block of issues becomes less relevant compared to others, after conducting the survey.
- There are some topics from which no issues have been selected. More specifically, short circuit requirements, power quality, demand disconnection schemes, system restoration capabilities, demand side response services and compliance and monitoring.

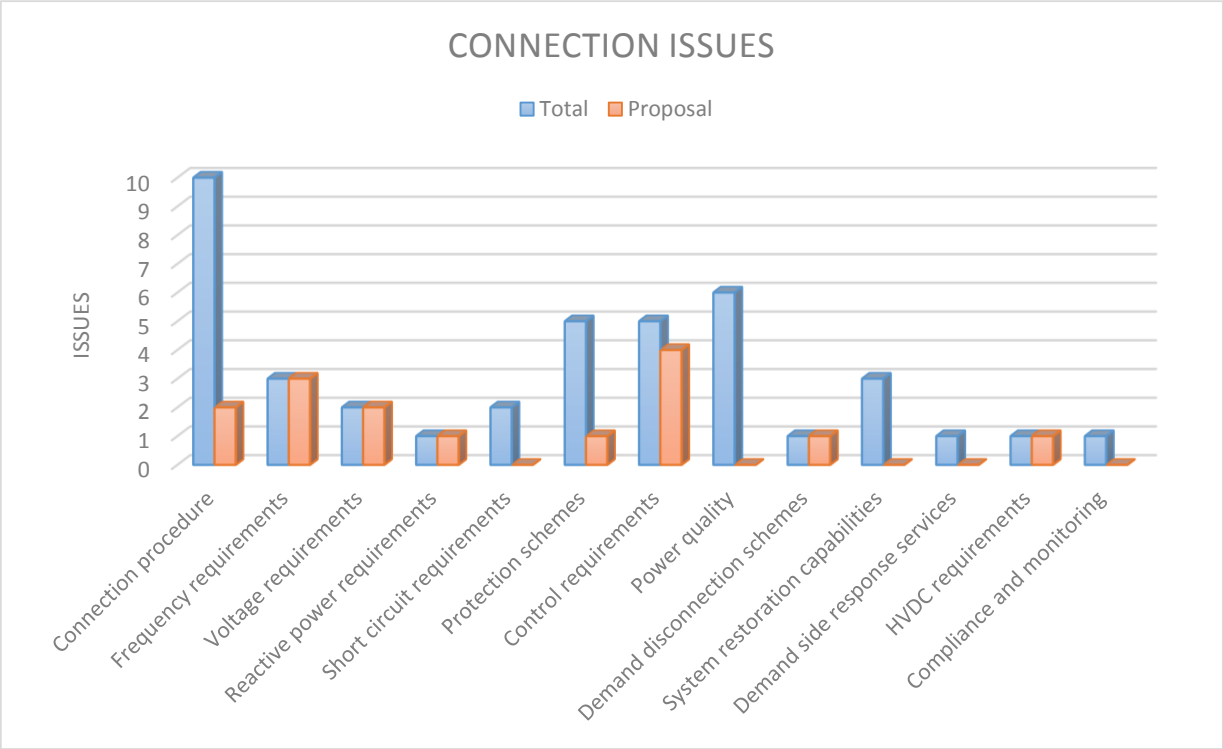


Figure 55 – Connection area. Percentage of issues included in the proposal

The main ideas of the proposal, based on the conclusions of the survey, concerning the Connection Area issues, can be summarized as follows:

- Harmonization of the connection procedure is proposed, to include the implementation of load flow studies for access and connection and the N-1 security criterion for access capacity calculation, following internal agreements between TSOs.
- High level of harmonization is required in general towards frequency, voltage and reactive power behaviour, at least at synchronous area level. The main driver behind this is the large penetration of renewables connected in the transmission system, both existing and anticipated in the near future, the impact of which in neighbouring systems can be significant, depending on their scale and the level of the Power Systems interconnection.
- For frequency and voltage behaviour in particular, although specific requirement were provided by most TSOs, creating a common base for the MedTSO area, this is not considered sufficient for the current and future challenges for the operation of the transmission networks. Consequently, it is proposed that the target regulatory framework in the MedTSO area should be in line with the Grid Code of ENTSO-E for the following frequency and voltage requirement: time/frequency and time/voltage range limits, rate of change of frequency withstand capability, overfrequency and underfrequency schemes and fault-ride-through capability.
- Concerning protection and control, harmonization of redundancy requirements for telecommunication and protection schemes is proposed, following internal agreements between TSOs and users, whereas observability and controllability of non-transmission facilities from the TSO control room should also be harmonized, with respect to their size and in compliance with the Grid Code of ENTSO-E.

- Harmonization of low frequency disconnection schemes is also proposed, following agreements between neighbouring TSOs in the same synchronous area.
- Concerning HVDC requirements, due to the anticipated increase of the number and the size of the HVDC links and in view of the harmonization process of HVDC requirements in ENTSO-E countries, the harmonization of HVDC requirements/criteria in Med-TSO region should also be foreseen, in particular where such interconnections may have a significant impact in the planning and operation of the grids.

6.3 Operation of the interconnected system

From a total of 57 issues that were originally included in the survey 31 have been selected as relevant. The numbers of those that have been considered for the proposal represents the 54% of the total.

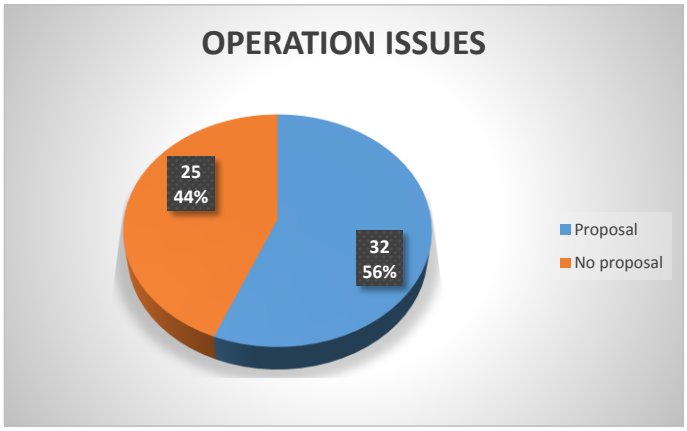


Figure 56 – Operation area. Number and percentage of issues included in the proposal

This area was subdivided into different topics (14). Below can be seen the number of questions that were originally suggested and the number of these that have been finally selected for each of the topics.

Operation Issues

	Total	Proposal	No proposal
System states	2	1	1
Technical requirements	7	5	2
Information exchange	3	3	0
Contingency analysis	6	6	0
Dynamic stability studies	1	0	1
Management of international exchanges programs	1	1	0
HVDC technologies	4	0	4
Outage coordination	1	1	0
Load frequency control	12	5	7
Reserves management	1	1	0
System defence plan	6	6	0
Restoration plan	1	1	0
Training and certification	11	2	9
Dispatch priority	1	0	1
	57	**32**	**25**

Figure 57 – Connection area. Number and percentage of issues included in the proposal for each chapter

Additionally, a bar chart has been plotted in order to better visualization of which topics are the most significant. From the analysis of the charts below the following conclusion can be extracted:

- The majority of the issues focus on technical requirements, information exchange, contingency analysis, load frequency control and system defence plan.
- Although 4 issues were originally considered regarding HVDC technologies, not a single issue was selected so, this block of issues became less relevant after conducting the survey.
- There are some topics from which no issues have been selected. More specifically, dynamic stability studies and dispatch priority.

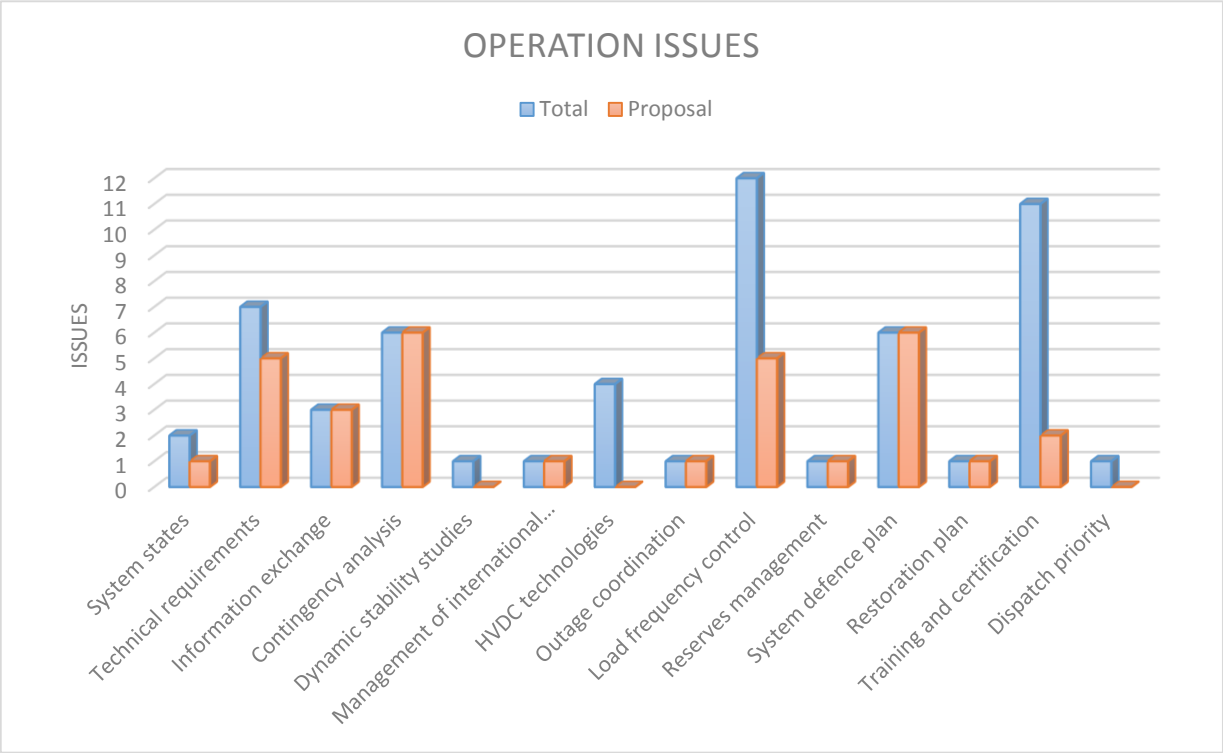


Figure 58 – Operation area. Percentage of issues included in the proposal

The main ideas of the proposal, based on the conclusions of the survey, concerning the Operation Area issues, can be summarized as follows:

- Harmonization of the system state classification is proposed including concrete and specific characteristics for each power system state regarding violation of operational security limits, frequency criteria, level of reserves, and activation of measures from the restoration plan.
- Concerning technical requirements, a minimum level of harmonization is proposed in the following fields: voltage ranges in normal and extraordinary conditions, reactive power management measures and system protection coordination criteria. Anyway, more exigent requirements could be established at national level.
- For information exchange issues harmonization is proposed for the minimum list of data to be exchanged between TSOs in the different time horizons; including more detailed data from the observability area.
- Regarding the contingency analysis, the minimum type of contingencies to be considered in both the internal and external list (between neighbouring TSOs) is proposed to be harmonized, as well as the treatment of operational security limits and the minimum list of joint remedial actions to be activated in a coordinated manner between neighbouring TSOs.

- Harmonization of the international exchanges management is considered of high priority.
- Harmonization of outage coordination procedures is considered of high priority, especially if it affects interconnection capacity between neighbouring TSOs.
- Concerning load frequency control, the compliance schemes and the criteria to establish the quantity of the different types of reserves (FRR, FCR and RR) are proposed to be harmonized, together with the reserves management exchange procedures.
- Coordination of the different mechanisms and procedures for the system defence plan is considered of high priority, in concrete, frequency deviation, voltage deviation, power flow, manual demand disconnection or inter-TSO assistance and coordination in emergency state. Restoration plans are also considered of extreme importance to be harmonized.
- Regarding training and certification (qualification), only two aspects are proposed to be included in the harmonization proposal: need of certification for real time operators and language requirements.

6.4 System service markets

From a total of 26 issues that were originally included in the survey 18 have been selected as relevant. The number of those that have been considered for the proposal represents the 69% of the total. This represents a high value of selected issues, so most of the issues that were originally suggested have been finally considered as relevant after making the survey.

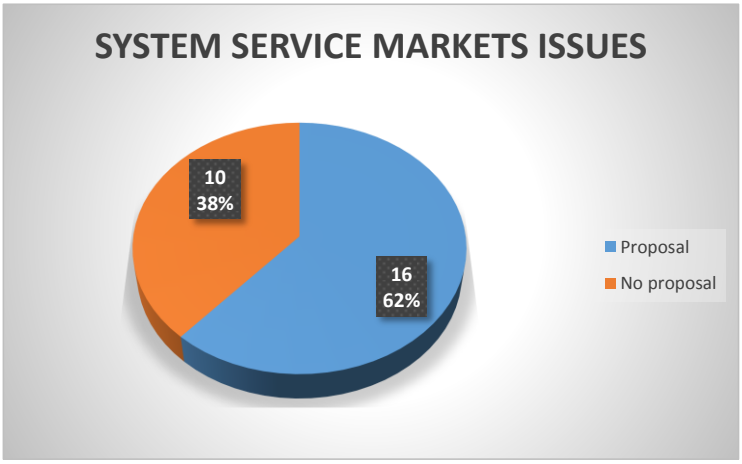


Figure 59 – System service markets area. Number and percentage of issues included in the proposal

This area was subdivided in 6 different topics. Below can be seen the number of questions that were originally suggested and the number of these that have been finally selected for each of the several topics.

System Service Markets Issues

	Total	Proposal	No proposal
Legal issues	9	4	5
Capacity calculation	3	3	0
Capacity allocation	6	5	1
Dispatching and balancing	4	2	2
Settlement and metering	2	0	2
Transparency	2	2	0
	26	**16**	**10**

Figure 60 – System service markets area. Number and percentage of issues included in the proposal for each chapter

Additionally, a bar chart has been plotted in order to better visualization of which topics are the most significant.

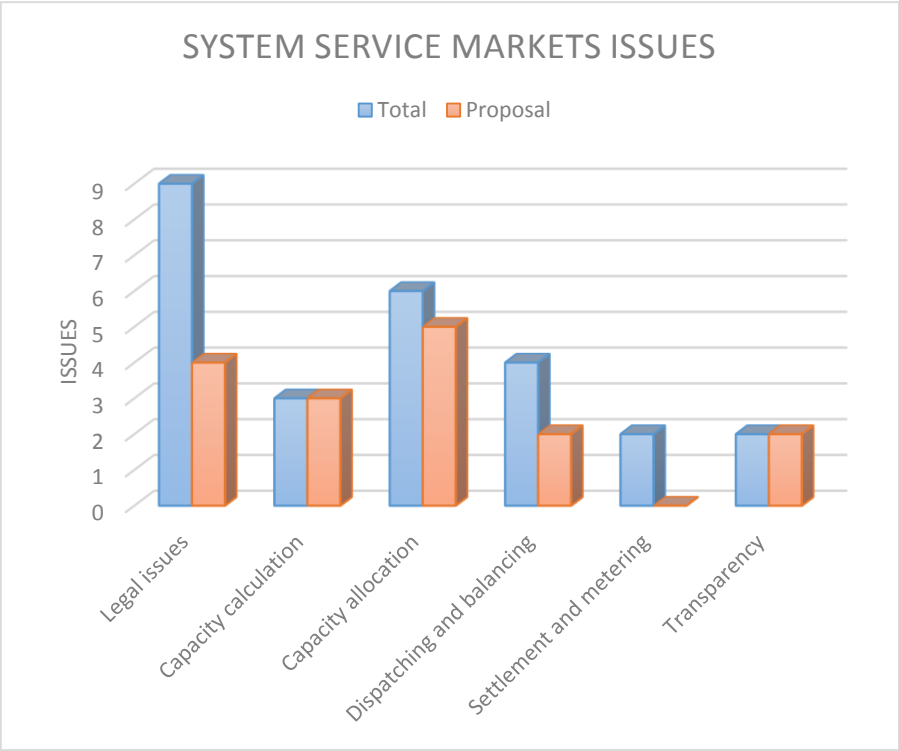


Figure 61 – System service markets area. Percentage of issues included in the proposal

The main ideas of the proposal, based on the conclusions of the survey, concerning the System Service Markets Area, can be summarized as follows:

- Necessity of harmonization of the contractual requirements for participation on the cross-border electricity trade enabling in all MedTSO countries other subjects (market participants) apart of TSOs to import and export electricity through international interconnections.
- Progressive degree of harmonization from “no market” to “market” based model:
    - From bilateral internal agreements (customized scheme applicable for example between country A and B or between country B and C) to multilateral internal agreements between all TSOs (some general rules for all countries as the auction rules valid in ENTSO-E area):
        - Scheme of technical and financial guarantees;
        - Exchange programs (scheduling and management of international exchange programs);
    - Identification of the duties of the Market Operator that in a preliminary model can be allocated under TSO’s competences and successively allocated under an independent subject;
    - Harmonization of the basic technical requirements for participation on the cross-border trading activities:
- Harmonization of the capacity calculation procedure is proposed, to include the implementation of N-1 security criterion for the calculation of the NTC. Such calculation should be done jointly by the neighbouring TSOs, following internal agreements between TSOs, using the same reference time horizons.

- Regarding capacity allocation an external rule should include the procedure for allocating transmission capacity in all interconnections through a public auction and the type of capacity products to be allocated (duration and time profiling), while the internal agreements between TSOs should include specific details for each border.
- The subject responsible for the management of the allocation procedure should be the TSO, but in a further stage, for regional coordination issues, a supranational body (managed also by the different TSOs) should be in charge,
- A multilateral procedure is foreseen in order to guarantee the exchange programs; as well as the treatment of the unintentional deviations.
- A minimum level of transparency is proposed to be reached by all the TSOs both about general information from the electricity markets and specific information from the management of the international interconnections.

7 Next steps

The next step of the study performed within MedTSO Technical Committee 2 is the elaboration of a proposal of tentative roadmap for adoption and compliance of the issues included in the proposal of common target regulatory framework. For this aim, a survey will be conducted asking to each TSO about the temporal prioritization, probably dividing into 3 horizons: short-term, medium-term and long-term actions.

On a later stage, this proposal will be analysed from a zonal perspective taking into consideration the similarities and current degree of harmonization in neighbouring countries from the same geographical area. This new analysis will conclude in specific proposals for different zones in the Mediterranean region.

8 Annex I. Summary tables with proposal of Common Target Regulatory framework

8.1 Legal and regulatory

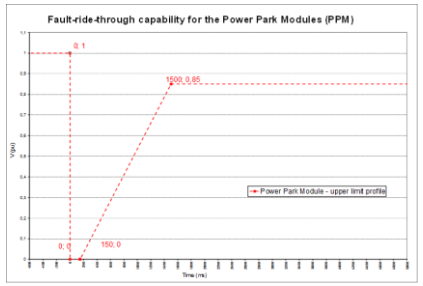
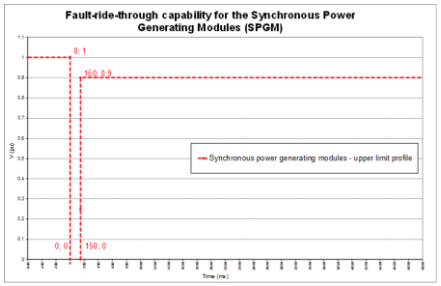
Legal and Regualatory issues		GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
		DEGREE OF PRIORITY(i)	RULE FORMAT	PROPOSAL
B	Should the responsible authority for the settlement of disputes among stakeholders (eg. Conflict of access to the network...) be the same in all MedTSO countries?	5	External	Dispute settlement procedures should be transparent and neutral. TSOs should not be both judge and jury to a dispute settlement. The "arbitrator", with the authority to settle the dispute, should be the relevant Ministry, the (independent) NRA or a third independent body.
F	Should regulated (transmission/distribution) and non regulated activities (generation/supply) be unbundled?	7	External	Concerning the question on the need of unbundling of regulated (transmission/distribution) and non- regulated activities (generation/supply), most MedTSO members agree on the need to harmonize. In line with this, it should be noted that in most countries these activities are already unbundled. In most MedTSO countries external regulation is the rule format currently adopted for the unbundling of these activities. As regards the desired situation for the future harmonized regulation, most TSOs consider that the best option for the regulation of unbundling is via external regulation (national or supranational - Grid Codes.
G	Is there a need for a coordinated regulation in order to make feasible and viable an international interconnection?	7	External	In order to make feasible and viable an international interconnection, certain issues require a coordinated regulation - this should be done on a coordinated basis between the concerned countries TSOs and NRAs. In most MedTSO countries the current rule format adopted is the external regulation . As regards the desired situation for the future harmonized regulation most TC2 members consider that the best option is via external regulation (national or supranational - Grid Codes).

8.2 Connection

<table>
<tr><th rowspan="2">Connection Issues</th><th colspan="2" rowspan="2">Question in Subtask 1.1</th><th colspan="3">GLOBAL MEDITERRANEAN SCOPE
(FOR FUTURE HARMONIZED REGULATION)</th></tr>
<tr><th>DEGREE OF PRIORITIZATION*</th><th>RULE FORMAT</th><th>Proposal</th></tr>
<tr><td rowspan="2">Connection procedure</td><td>2A</td><td>Studies performed for Access and Connection</td><td>5</td><td>External/Internal</td><td>Following internal agreements between TSOs, load flow studies should be performed for access and connection. In addition, depending on particular cases identified by the TSOs concerned, more specialised analysis can be performed (short circuit, transient stability studies) the output of which could be documented in TSO-User agreements (e.g. contracts).</td></tr>
<tr><td>2C</td><td>Criteria used for access capacity calculation</td><td>5</td><td>External/Internal TSO-TSO</td><td>Following internal agreements between TSOs, he N-1 criterion should be applied for access capacity calculation.
In addition, certain N-2 cases, related to system security should also be examined, following internal agreements between TSOs.</td></tr>
<tr><td rowspan="3">Frequency requirements</td><td>3A</td><td>Frequency/time range limits for users to withstand without damage</td><td>6</td><td>External/Internal TSO-TSO</td><td>As an External Rule, time/frequency ranges should be harmonized at least at synchronous area level, considering the relevant requirements for generators included in the Grid Code of ENTSO-E, as presented below:
<table><tr><th>Synchronous area</th><th>Frequency range</th><th>Time period for operation</th></tr><tr><td rowspan="4">Continental Europe</td><td>47,5 Hz – 48,5 Hz</td><td>To be specified by each TSO, but not less than 30 minutes</td></tr><tr><td>48,5 Hz – 49,0 Hz</td><td>To be specified by each TSO, but not less than the period for 47,5 Hz – 48,5 Hz</td></tr><tr><td>49,0 Hz – 51,0 Hz</td><td>Unlimited</td></tr><tr><td>51,0 Hz – 51,5 Hz</td><td>30 minutes</td></tr></table></td></tr>
<tr><td>3B</td><td>Rate of change of frequency withstand capability</td><td>5</td><td>External</td><td>As an External Rule 1÷2 Hz/sec</td></tr>
<tr><td>3C</td><td>Limited frequency sensitive mode – overfrequency and underfrequency schemes</td><td>6</td><td>External</td><td>A certain level of harmonization of the overfrequency and underfrequency schemes adopted by interconnected transmission systems, should be introduced at least at synchronous area level. In systems where there is high penetration of renewables (both existing and anticipated in the future) this generation category should also be included.

As an External Rule the following aspects should be harmonised:
- Frequency thresholds for the activation of the overfrequency and underfrequency schemes
- Level of generation disconnection (as a percentage of system size)</td></tr>
</table>

<table>
<tr><th rowspan="2">Connection Issues</th><th colspan="2" rowspan="2">Question in Subtask 1.1</th><th colspan="3">GLOBAL MEDITERRANEAN SCOPE
(FOR FUTURE HARMONIZED REGULATION)</th></tr>
<tr><th>DEGREE OF PRIORITIZATION*</th><th>RULE FORMAT</th><th>Proposal</th></tr>
<tr><td rowspan="2">Voltage requirements</td><td>4A</td><td>Voltage/time range limits for users to withstand without damage</td><td>6</td><td>External</td><td>The following voltage/time range limits are common in all Med-TSO countries :
For U=300 to 400kV: Voltage Range = 0.95 – 1.05 pu Time period unlimited
For U=110 to 300kV: Voltage Range = 0.90 – 1.118 pu Time period unlimited

However, this common base is not enough for the current and future challenges at the operation of the transmission networks. It is proposed, as an External Rule and in line with the ENTSO-E grid codes, that the power generating modules shall be capable of staying connected to the network and operating within the ranges of the network voltage at the connection point, expressed by the voltage at the connection point related to the reference 1pu voltage, and for the time periods specified below:
<table><tr><th>Synchronous area</th><th>Voltage range</th><th>Time period for operation</th></tr><tr><td rowspan="3">Med-TSO region (300kV to 400kV)</td><td>0.85 pu – 0.90 pu</td><td>60 minutes</td></tr><tr><td>0.90 pu – 1.05 pu</td><td>Unlimited</td></tr><tr><td>1.05 pu – 1.10 pu</td><td>To be specified by each TSO, but not less than 20 minutes and not more than 60 minutes</td></tr></table><table><tr><th>Synchronous area</th><th>Voltage range</th><th>Time period for operation</th></tr><tr><td rowspan="3">Med-TSO region (110kV to 300kV)</td><td>0.85 pu – 0.90 pu</td><td>60 minutes</td></tr><tr><td>0.90 pu – 1.118 pu</td><td>Unlimited</td></tr><tr><td>1.118 pu – 1.15 pu</td><td>To be specified by each TSO, but not less than 20 minutes and not more than 60 minutes</td></tr></table></td></tr>
<tr><td>4B</td><td>Requirements for compliance with fault ride through capability (per technology)</td><td>6</td><td>External/Internal TSO-TSO</td><td>As an External Rule and in line with the ENTSO-E grid codes, it is suggested that the Med-TSO countries need to define for the technologies PPM-Power Park Module and SPGM-Synchronous Power Generating Modules , the fault-ride-through profile which is the most appropriate for their network, considering the upper limits profile (red line) indicated in the next figures:
 
 
Moreover, the power generating modules shall be capable of remaining connected to the network and continuing to operate stably, when the actual course of the phase-to-phase voltages on the network voltage level at the connection point during a symmetrical fault remains above the limit of fault-ride-through profile specified by Med-TSO countries according to the limits in the figures, unless the protection scheme for internal electrical faults requires the disconnection of the power generating module from the network. The protection schemes and settings for internal electrical faults must not jeopardize fault-ride-through performance.

With regard to fault-ride-through capabilities in the case of asymmetric faults, they must be specified by each TSO, but it is strongly recommended that the profiles similar or equivalent to the profiles presented above to be considered.</td></tr>
</table>

Connection Issues	Question in Subtask 1.1		GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
			DEGREE OF PRIORITIZATION*	RULE FORMAT	Proposal
Reactive power requirements	5A	Limits of reactive power contribution	6	External	As an External Rule, it is psoposed that this contribution is set as an interval of required reactive requirement (the maximum range of Q /Pmax = between - % of P and + % of P, especially in situations where the possible impact of the generation can appear, like Power Plants near the neighboring countries. However, there should be a difference in limits of reactive power contribution which is expected in SPGM and PPM. Requirements for transmission connected consumers (with and without generation) and also transmission connected distribution facilities should be included.
Protection requirements	7D	Redundancy required for telecommunication and protection schemes	5	External/Internal TSO-TSO	Redundancy requirements for telecommunication and protection schemes should be harmonised. As an External Rule it is psoposed that a double protection scheme should be applied by all TSOs. In addition, double telecommunication scheme should also be examined, following internal agreements between TSOs.
Control requirements	8A	Global architecture and schemes required for controllability and observability of non-transmission facilities connected to the transmission grid?	5	External/Internal TSO-TSO	As an External Rule or following agreements berween TSOs,the observability and controllability of non-transmission facilities should be harmonized, without explicitly specifying the global architecture of the communication schemes between Users and TSO.
	8B	Observability of non-transmission facilities by TSO control systems (real time monitoring)	5	External/Internal TSO-TSO	Non-transmission facilities should be observable and controlable by TSO Control Centers, with respect to their size. Based on the results of the Survey concerning the observability and controlability magnitudes which are generally common in MedTSO countries and in compliance with the new Grid Code of ENTSO-E, it is proposed that non-transmission facilities of a magnitude higher than 1MW should be observable and higher than 5MW should be controlable by TSO Control Centers. In any case, more exigent conditions could also be established at national level.
	8D	Controlability of non-transmission facilities by TSO control systems	5	External	
	8C	Magnitudes provided in real time from non-transmission facilities to TSO control centre	5	External	As an External Rule at least the magnitudes of V, P, Q and the status (On/Off) should be provided from non-transmission facilities to TSO control systems.
Demand disconnection schemes	12A	Existence of demand disconnection schemes (low frequency and/or low voltage) in the system	6	External	As an External Rule, low frequency disconnection schemes should be set as a requirement. Setting and details of the schemes should be agreed between neighbouring TSOs in the same synchronous area.
HVDC requirements	15A	Existence of specific HVDC requirements or criteria in the system	5	External/Internal TSO-TSO	In view of the harmonization process of HVDC requirements in ENTSO-E countries, harmonization of HVDC requirements/criteria in Med-TSO region should be foreseen

8.3 Operation

Operation Issues	Relevant Aspect	GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
		DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
System states	1A. Classification of system states	7	External	System states should be classified in an external rule in a homogeneous way, with clear specific characteristics for each state (operational security limits, frequency criteria, reserves, contingency list, and activation of defence or restoration plan). In principle the states that should be considered are: Normal, Alert, Emergency, Blackout and Restoration. Clear characteristics for each state are included in the report.
Technical requirements	2A. Frequency ranges (quality parameters) in the different system states	8	External	The external rule should not only include the system state consideration in each frequency range (issue above) but also the frequency quality target parameters (nominal frequency, standard frequency range, maximum deviations both instantaneous and in steady state, maximum time out of range, time to restore frequency, etc.). For those countries synchronously connected these quality target parameters are: Nominal frequency: 50 Hz; Standard frequency range: between 20 and 150 mHz, but in the future should be harmonized to at least 50 mHz; Maximum instantaneous frequency deviation: between 700 and 1500 mHz, but in the future should be harmonized to at least 800 mHz; Maximum steady state frequency deviation: between 200 and 500 mHz, but in the future should be harmonized to the lower value (200 mHz); and Time to restore frequency: 15 to 20 minutes.
	2B1. Voltage ranges (for unlimited operation) in normal conditions	6	External	As an external rule the classification of voltage ranges in normal conditions should be considered. Different ranges could be considered depending on the voltage level. As a first step the following could be considered: o Between 110 kV and 300 kV the voltage should stay between 0.9 pu and 1.118 pu. o Between 300 kV and 400 kV the voltage should stay between 0.9 pu and 1.05 pu. Anyway, more exigent conditions could also be established at national level.
	2B2. Voltage ranges (for unlimited operation) in extraordinary conditions	6	External	As an external rule the classification of voltage ranges in extraordinary conditions (unexpected conditions not studied in real time by the TSO) should be considered. More wide ranges could be established at a national level. Different ranges could be considered depending on the voltage level
	2E. Specific reactive power management measures in the international interconnections	8	External / Internal TSO-TSO	A classification of the possible remedial actions to manage reactive power should be included in an external rule: switching of reactors and capacitors, on load tap changes transformers, instruction to distribution companies, set points to generation facilities, HVDC, etc. This remedial actions should be applied by a TSO when the voltage is outside the ranges defined for unlimited operation. In addition, specific management of reactive power flows in the international interconnections should be included in internal agreements between neighbouring TSOs to respect common operational security limits.
	2G. System protection coordination criteria in interconnection lines	8	Internal TSO-TSO	In the internal agreements between neighbouring TSOs the criteria for system protection coordination in the interconnection lines should be included (agreement on the definition of the set points and coordination prior to implementation).
Information exchange	3D. List of real time data to exchange with other TSOs	9	External / Internal TSO-TSO	The list of real time data to be exchanged between TSOs of the same synchronous area should be included in the external rule. This list should include at least the following: frequency, frequency restoration control error, active power exchange between control areas, aggregated generation, system state and setpoint of the load frequency control. Also the list of real time data from the observability area to be exchanged between neighbouring TSOs should be included in both an external rule and in the internal agreements between TSOs. The observability area should be agreed between neighbouring TSOs. In principle, at least border substations should be included in the observability area. The listof information to be exchanged should include at least the following: substation topology (including availability), active and reactive power in line bay or transformer bay, (including transmission and distribution), active and reactive power in generation bay, reactive power in reactor bay and capacitor bay, bus bar voltage, restrictions (if any) including outages and positions of tap-changers transformers.
	3E. List of sheduled data to exchange with other TSOs	6	Internal TSO-TSO	The list of structural and forecasted data to be exchanged between TSOs should be included in the internal agreements and possibly also in the external rule. The list of structural data should include at least the following data from the observability area, that should be agreed between neighbouring TSOs (in principle, at least border substations should be included in the observability area): normal topology of substations, technical data on transmission lines, transformers (including phase-shifting transformers), HVDC systems, reactors, capacitors and other, reactive power limits from generation facilities, operational security limits, protection setpoints of transmission lines included as external contingencies.
	3F. List of structural data to exchange with other TSOs	6	Internal TSO-TSO	In addition to coordinate operational security analysis TSOs from the same synchronous area should exchange at least the following: topology of the transmission grid above 220 kV (including 220 kV), model of the transmission grid below 220 kV which has a significant impact, thermal limits of the transmission elements and aggregated generation forecast in each node of the transmission grid. For dynamic stability studies additional data should be exchanged..

Operation Issues	Relevant Aspect	GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
		DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
Contingency analysis	4A1. Contingencies considered	7	External	The external rule should include the type of contingencies to be considered on the basis of whether it is ordinary, exceptional or out-of-range, taking into account the probability of occurrence. In principle N-1 contingencies should always be considered and "partial" N-2 contingencies in specific situations that could be determined at national level.
	4A2. Contingency list (both internal - in national power system - and external - in neighbouring power systems -)	8	Internal TSO-TSO	TThe internal agreement between neighbouring TSOs should include the list of external contingencies that should be considered when performing the contingency analysis, together with the internal contingencies. The external rule should also include that each TSO should inform neighbouring TSOs about the external contingencies and also about any topological change included in the external contingency list.
	4B1. Operational security limits	4	Internal TSO-TSO	The internal agreement between TSOs should include the operational security limits that are taken into consideration when performing the contingency analysis. These limits are, at least, the following: voltage limits, short-circuit current limits, stability limits and current limits in terms of thermal rating including the transitory admissible overloads.
	4B2. Operational security limits in the interconnection lines	5	Internal TSO-TSO	The internal agreement between TSOs should include the exact operational security limits in the interconnection lines. In case different for the same interconnection line the more restrictive should be considered.
	3B. List of joint remedial actions agreed between TSOs after a contingency	8	External	The external rule should include the different categories of remedial actions that TSOs could use in case of a contingency (either when need or not need to be managed in a coordinated way) and also the criteria that shall apply. The remedial actions could be the following: topological actions, reschedule of maintenance through the duration of outages, voltage control and reactive power management, re-dispatch of generation, countertrading and modification of active power flows through HVDC links.
	4C. Periodicity of state estimation calculations ("snapshots")	7	Internal TSO-TSO	The need to use state estimations when performing operational security analysis close to real time should be included in the external rule while the periodicity of these calculations should be agreed between neighbouring TSOs and included in the internal agreements.
Management of in	6A. Management of international exchange programs between TSOs	8	Internal TSO-TSO	One of the benefits of interconnected power systems is the possibility of having a long term and short term energy exchanges between the power systems. Realization of the energy exchanges between the power systems requires the TSOs' coordination. This coordination could only be achieved with the pre-defined rules and procedures. Based on this requirement, harmonisation of management of international exchange programs is considered of high priority. In this study it is considered that an internal agreement between the interconnected neighbouring TSOs should be realised. This agreement between the neighbouring TSOs should include the implementation of the scheduled exchange programming and management of international exchange programs between them. On the other hand, a general mechanism should be defined for the management of the international
Outage coordination	9A. Criteria and procedure for outage coordination (corrective or predictive maintenance) when affects NTC?	7	External	The external rule should include the need of coordination between neighbouring TSOs in case of an outage that could affect NTC. . In addition, internal agreements between TSOS should go a step further and include step by step procedures, which make clear and rational the way to deal with situations of outage affecting NTC. Due to the importance of quick access to information about outages, all TSOs should abide by, under an external rule, the two following steps: definition of assets (network elements and generation and consumption units) with cross border (XB) relevance; and on a year ahead timeframe, outage planning agents of XB relevant generation and consumption shall provide their proposals for outages (Availability Plans) to the connecting TSO. More detailed information on what should be included in the mutual agreements between TSOs is shown in the report.

Operation Issues	Relevant Aspect	GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
		DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
Load frequency control	11A3. Frequency Containment Reserve (FCR) Criteria used for establishing the quantity of FCR	8	External / Internal TSO-TSO	Regarding load frequency control, an external rule should include the need of having an operational agreement for each synchronous area in which the load frequency control structure and process activation is defined. As a result of the survey the following aspects have been particularly emphasized and are proposed to be also included in the external rule: FCR common technical requirements; criteria used for establishing the quantity of FCR, both the total quantity and the national one; compliance scheme for FCR; provision of FRR (the external rule should include the criteria to be fullfilled by units to deliver FRR, while internal agreements between TSOS should define the set of power plants that could provide FRR); criteria used for establishing the quantity of FRR, both the total quantity and the national one. In principle this criteria could be the loss of the biggest unit in operation; and compliance scheme for FRR.
	11A4. Frequency Containment Reserve (FCR) Compliance scheme and economic penalties for FCR?	6	External	Regarding load frequency control, an external rule should include the need of having an operational agreement for each synchronous area in which the load frequency control structure and process activation is defined. As a result of the survey the following aspects have been particularly emphasized and are proposed to be also included in the external rule: FCR common technical requirements; criteria used for establishing the quantity of FCR, both the total quantity and the national one; compliance scheme for FCR; provision of FRR (the external rule should include the criteria to be fullfilled by units to deliver FRR, while internal agreements between TSOS should define the set of power plants that could provide FRR); criteria used for establishing the quantity of FRR, both the total quantity and the national one. In principle this criteria could be the loss of the biggest unit in operation; and compliance scheme for FRR.
	11B1. Frequency Restoration Reserve (FRR). Provision of FRR	6	External	Regarding load frequency control, an external rule should include the need of having an operational agreement for each synchronous area in which the load frequency control structure and process activation is defined. As a result of the survey the following aspects have been particularly emphasized and are proposed to be also included in the external rule: FCR common technical requirements; criteria used for establishing the quantity of FCR, both the total quantity and the national one; compliance scheme for FCR; provision of FRR (the external rule should include the criteria to be fullfilled by units to deliver FRR, while internal agreements between TSOS should define the set of power plants that could provide FRR); criteria used for establishing the quantity of FRR, both the total quantity and the national one. In principle this criteria could be the loss of the biggest unit in operation; and compliance scheme for FRR.
	11B3. Frequency Restoration Reserve (FRR). Criteria used for establishing the quantity of FRR	7	External	Regarding load frequency control, an external rule should include the need of having an operational agreement for each synchronous area in which the load frequency control structure and process activation is defined. As a result of the survey the following aspects have been particularly emphasized and are proposed to be also included in the external rule: FCR common technical requirements; criteria used for establishing the quantity of FCR, both the total quantity and the national one; compliance scheme for FCR; provision of FRR (the external rule should include the criteria to be fullfilled by units to deliver FRR, while internal agreements between TSOS should define the set of power plants that could provide FRR); criteria used for establishing the quantity of FRR, both the total quantity and the national one. In principle this criteria could be the loss of the biggest unit in operation; and compliance scheme for FRR.
	11B4. Frequency Restoration Reserve (FRR) Compliance scheme and economic penalties for FRR?	6	Internal TSO-TSO	Regarding load frequency control, an external rule should include the need of having an operational agreement for each synchronous area in which the load frequency control structure and process activation is defined. As a result of the survey the following aspects have been particularly emphasized and are proposed to be also included in the external rule: FCR common technical requirements; criteria used for establishing the quantity of FCR, both the total quantity and the national one; compliance scheme for FCR; provision of FRR (the external rule should include the criteria to be fullfilled by units to deliver FRR, while internal agreements between TSOS should define the set of power plants that could provide FRR); criteria used for establishing the quantity of FRR, both the total quantity and the national one. In principle this criteria could be the loss of the biggest unit in operation; and compliance scheme for FRR.
Reserves management	12A. Mechanisms of reserves management (exchange and sharing)	8	External / Internal TSO-TSO	Reserve management is a key issue when it comes to enhancing the performance of power systems. It should be from this perspective, possible to exchange the reserve whenever it is required and possible. TSOs should mutually agree on whether they can exchange the reserve. An external rule should include the type of reserves (FCR, FRR or RR) that could be exchanged differentiating between exchanges of reserves within the same synchronous area and between two different synchronous areas. In addition, the internal agreement between TSOs should detail the requirements and the process to share each type of reserve.

Operation Issues	Relevant Aspect	GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
		DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
System defence plan	14A. Frequency deviation management procedure (Automatic Under/Over-Frequency control scheme)	8	External / Internal TSO-TSO	Frequency deviation management procedures should be included in an external rule. These systems, that shall be almost instantaneous, should be designed considering dynamic studies in different scenarios from the whole synchronous area. Additionally under frequency schemes (based on load shedding) or over frequency schemes (generation disconnection) could also be designed.
	14B. Setting of demand disconnection schemes (low frequency and/or low voltage)	7	External	An external rule could define the setting of disconnection schemes for low frequency and/or low voltage. In principle low frequency settings should be designed based on dynamic studies in different scenarios from the whole synchronous area. Low frequency settings could be included in the external rule while low voltage settings could be designed individually by each TSO.
	14C. Voltage deviation management procedure	6	External / Internal TSO-TSO	The external rule should adopt the management of voltage deviation and an internal agreement between the neighbouring TSOs should include operational voltage limits for the bordering substations.
	14D. Power flow management procedure	6	External / Internal TSO-TSO	An external rule should include the general criteria while the internal agreement between the neighbouring TSOs should include the procedure of the management of power flow and if there is a SPS system which also controls the power flow of the interconnection lines then settings of the SPS should be considered mutually.
	14E. Manual demand disconnection procedure	5	External	An external rule should include that each TSO should design the manual demand disconnection procedure in coordination with the other TSOs of the same synchronous area.
	14F. Inter-TSO assistance and coordination in emergency state	8	External / Internal TSO-TSO	An external rule should include the general criteria while the internal agreement between the neighbouring TSOs should include the procedure for inter-TSO assistance and coordination in emergency state. A mechanism should also be defined for the compensation of the emergency exchange programs.
Restoration plan	15A + 15B. Rules and types of restoration plans	8	External / Internal TSO-TSO	Harmonisation of restoration plans is considered of high priority. It is considered that having a developed restoration plan will serve the TSOs in case of a partial or a total blackout to quickly achieve a stabilized and reliable power system. To achieve this purpose, it is considered that every TSOs should prepare and adopt their restoration plans periodically. Interconnected or not, every TSOs' restoration plan should obviously include a bottom-up energization strategy by taking the generation units equipped with the "black start" capability. By using the generation units equipped with the "black start" capability the backbone of the high voltage grid should be restored in case of a blackout. On the other hand, interconnected TSOs also have the possibility to adopt top-down energization strategy in their restoration plans. As top-down energization strategy is based on usage of the international interconnections, coordination between the neighbouring interconnected TSOs is a necessity. To achieve the coordination effectively and quickly between the neighbouring TSOs, where at least one of them is subject to system restoration, the rules and procedures must be predefined. For this purpose the procedures for the decision of an emergency exchange between neighbouring TSOs under the system restoration could be defined in the internal agreement between neighbouring TSOs. In addition to the internal agreement between the neighbouring TSOs, general criteria should be included in the external rule.
Training and certification	16A. Certification of the operators in charge of real time	6	External	The external rule should include as a requirement that operators in charge of real time have a certification
	16I. Language requirements	6	External / Internal TSO-TSO	Both the external rule and the internal agreements between TSOs should include a requirement regarding the language to be used between real-time operators from different TSOs. In principle the predefined language could be English, unless other common language exists between the neighbouring TSOs (French, Arabic, ...)

8.4 System service market

System Service Markets Issues	Relevant Aspect		GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
			DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
Legal Issues	1A	Contractual requirements for participation on the cross-border electricity trade in each individual system.	6	TSO-TSO	The harmonisation of the contractual requirements for participation on the cross-border electricity trade is considered of medium-high priority. The purpose is the integration of the electrical power systems involved, promoting the share of resources and electricity exchange under a specific regulation model. These activities are developed with the aim to achieve in future a general context (target model) operating with the characteristics of an open electrical market model with the potential entrance admission of new subjects both demand and offer side and for trading activities.
	1B	Rules for export/import of cross-border electricity (including agents enabled for import/export activities)	6	External / TSO-TSO	The harmonisation of the rules for export/import of cross-border electricity is considered of medium-high priority The scheme of requirements could be translated into mutual (bilateral/multilateral) rules including the main principles above (1A). The form could be an internal agreement between the interconnected neighbouring TSOs. A concrete example is the Auction Rules valid in ENTSO-E Area. The external rule should include the basic requirements for participation on the cross-border for the access to the procedures taking into account among other things: - Registration requirements-database of market players; - Possession for Market players of technical requirements as authorization to operate on a specific border e.g. in the form of contract with TSO (injection or withdrawal dispatching contract in Italy, injection for import or withdrawal for export); - Allocation mechanism of the transmission capacity; - Implementation of the scheduled exchange program and management of international exchange programs; - Financial requirements in the form of guarantees "for entry", for monitoring the financial exposure (i.e. long-term and real time during the allocation procedure) and for "system compensation" for unbalances.
	1C	Categories of operators enabled for import/export activities.	6	TSO-TSO	The harmonisation of the categories of operators enabled for import/export activities is considered of medium-high priority. The categories of operators enabled for import/export activities are clearly based on the market model: monopoly-only TSO, open market-Market Players (including producers, self consumers, suppliers, traders). Next step should be a model progressively: - Involving third subjects in the cross-border activities; - Make an efficency of the existing cross-border procedures. Independently of the reference system, it is necessary to separate the categories of operators enabled for import/export activities that are clearly based on the market model: monopoly-only TSO, open market-Market Players including producers, self-consumers, suppliers, traders. Also in case of systems linked to a different market model, it is possible to investigate some principles or schemes for a concrete operation of the interconnections. If the access to another system (from technical and commercial point of view) is considered as an opportunity, it could be considered as first interface between systems in order to find ad hoc solutions as a first step for integration of the systems.
	1D	Presence of a Market Operator.	6	External	The harmonisation of the presence of a Market Operator is considered of medium-high priority. Concerning a global system oriented to following evolutions, the presence of a Market Operator separated to TSO, is an example of a better identification and allocation of the responsibilities in terms of international exchange and system operation. Under the objective of the definition of rules harmonized (internal according to the principles listed below, and external for the involvement of third subjects) in a shared regulatory framework, it is necessary to find quick-win solutions in order to get goals in a short term period. In a context composed by systems with a different reference model "market or no market based" model, it is possible to consider a progressive degree of harmonization regarding at least some technical aspects that allow in any case an interaction (or interoperability) between interconnected systems. Some examples are the criteria for calculating the Net Transfer Capacity and the coordinated use of dispatching and balancing issues and resources.
	1I	Requirements to satisfy for using the interconnections (e.g. demand/offer equilibrium, congestion management at national, and if possible, at international level, balancing of the exchange program in real time, coordinated dispatching).	6	TSO-TSO	The harmonisation of the requirements to satisfy for using the interconnections is considered of medium-high priority. It is evident that internal technical requirements that have an impact on the exchange programs (from technical and commercial point of view) need to be shared. While operating an interconnection, in order to manage correctly the international exchange programs - including data exchange formats, accuracy, relevant period of data (15min, 30min, hourly, etc.) - a compensation mechanism for the management of the unintentional deviations should also be defined.

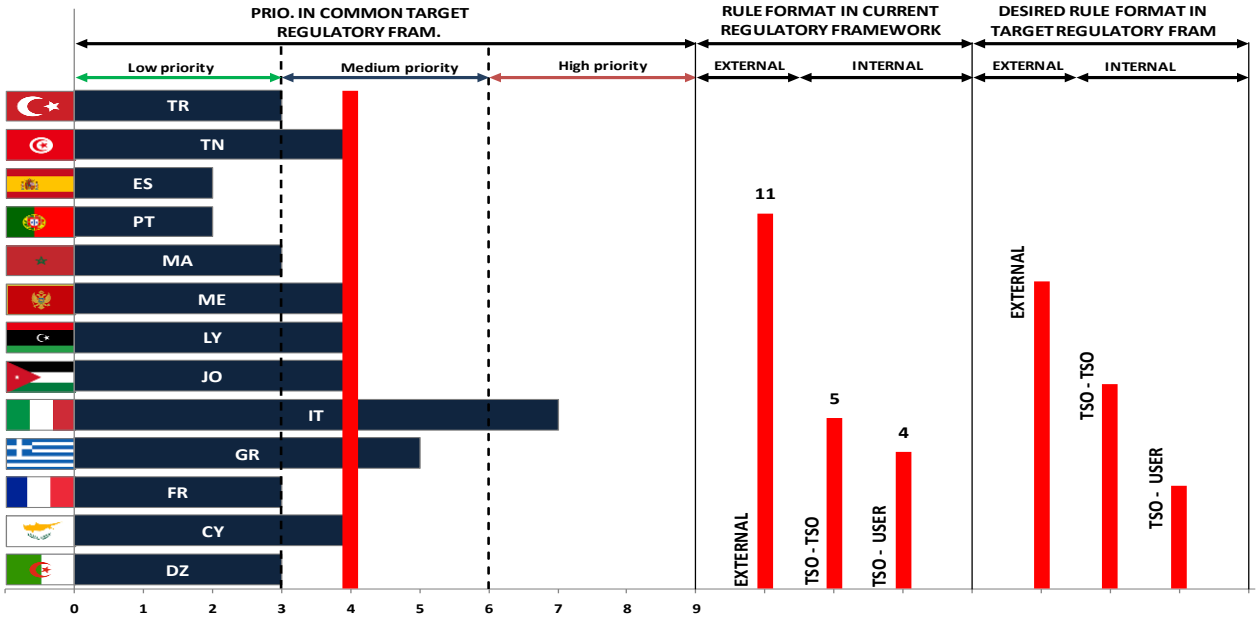
System Service Markets Issues	Relevant Aspect		GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
			DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
Capacity Calculation	2A	Security criteria used for calculating the Net Transfer Capacity (NTC).	7	TSO-TSO	The implementation of the N-1 as a security criterion is considered of high priority for harmonisation. Internal agreements between TSOs are considered as the most suitable desired rule format in the target regulatory framework.
	2B	Characteristic process for finalization of Net Transfert Capacity (jointly or separatly from other TSO's?).	6	TSO-TSO	The harmonisation of characteristic process for finalization of Net Transfer Capacity is considered of medium-high priority. The Net Transfer Capacities should be calculated jointly by the neighboring TSOs. Internal agreements between TSOs are considered as the most suitable desired rule format in the target regulatory framework.
	2C	Reference time horizons used for capacity calculation and process for calculating capacity in the different time horizons.	6	TSO-TSO	The harmonisation of the time horizons used for capacity calculation for all TSOs is considered of medium-high priority. In general, the time horizons used for capacity calculation is yearly, monthly and daily. Internal agreements between TSOs are considered as the most suitable desired rule format in the target regulatory framework.
Capacity Allocation	3B	Obligation regarding the use of the capacity allocated - Use it or sell (or loose) it mechanism	6	TSO-TSO	The harmonisation of the obligation regarding the use of capacity allocated is considered of medium-high priority, due to the heterogeneity of the models market based in the Med-TSO country. Anyway the internal agreements between TSOs should include it there is or not an obligation and if the obligation is to sell it or lose it. Anyway in some cases, if allocation is through FTR this issue is not applicable.
	3C	Kind of capacity products allocated (duration and time profiling)	6	TSO-TSO	The harmonisation of the Kind of capacity products allocated (duration and time profiling) is considered of medium-high priority. The external rule should include main characteristics that capacity products to be allocated in all the region should have, while the internal agreements between TSOs are considered as the most suitable desired rule format to include details about the specific capacity products in each border. In principle yearly, monthly, daily and intraday horizons could be considered.
	3D	Methods and procedures applied for transmission capacity allocation (e.g. public auction or tender procedures) including Physical Transmission Rights (PTR) allocation.	6	TSO-TSO	The harmonisation of the method and procedures applied in each system for transmission capacity allocation including the Physical Transmission Rights is considered of medium-high priority. The external rule should include the procedure for allocate transmission capacity. In principle this procedure should be a public auction (either PTR or FTR) with marginal price allocation. Management procedures for congestions in the interconnections should also be included in the external rule. In principle via market mechanisms (like market spread). In addition internal agreements between neighbouring TSOs are considered as the most suitable desired rule format to include more details about the allocation procedure in a specific border.
	3E	System of liabilities, guarantees and penalties (technical and commercial) applied for each subject (Market Players) involved in the allocation procedure	5	TSO-TSO	The harmonisation of the system of liabilities, guarantees and penalties applied for each market players is considered of medium priority. Currently, for the countries having model market, it is necessary to have a system of guarantees for the market players so it is proposed to include in the external rule the need of having a guarantee.
	3F	Subject responsible for the management of the allocation procedure.	6	TSO-TSO	The harmonisation of the subject responsible for the management of the allocation procedure is considered of medium-high priority. In general, TSOs are responsible for the management of the allocation procedure in countries without market and supranational entities (managed by TSOs) in countries with market. The proposal is that the external rule should include which subject should be responsible for the management of the allocation procedure, while internal agreements between TSOs should include the details of obligations and responsibilities. The subject responsible should be the affected TSOs in a first stage and a regional entity (managed also by the TSOs) in a further stage when the level and use of interconnections increases substantially.

System Service Markets Issues	Relevant Aspect		GLOBAL MEDITERRANEAN SCOPE (FOR FUTURE HARMONIZED REGULATION)		
			DEGREE OF PRIORITIZATION*	RULE FORMAT	PROPOSAL
Dispatching & Balancing	4A	Actions foreseen in order to guarantee the exchange programs.	7	TSO-TSO	A multilateral procedure should propose common settlement rules of all intended exchanges of energy within a Synchronous Area, considering: • Frequency Restoration Process with automatic activation; or • Operating the Imbalance Netting Process. • Frequency Restoration Process with manual activation; • Reserve Replacement Process;
	4B	Management of unintentional deviations on international interconnections (e.g. compensation mechanisms, pay in kind methods, ...).	6	TSO-TSO	The proposals of common settlement rules of unintended exchanges of energy between TSOs shall ensure fair and equal distribution of costs and benefits between TSOs, taking into account the prices for activated Balancing Energy for Frequency Restoration Process or Reserve Replacement Process.
Transparency	6A	Presence and modalities of publications (public information) on the Electricity Markets data in each country.	7	External / TSO-TSO	An external rule should include the information that TSOs (and other market players) should make be publically available for sake of transparency, both regarding the electricity markets in general and specific information about the international interconnections. Information could be divided in three different levels: o Minimum information required: information related with capacity and use of generation, consumption and transmission units, including the scheduled outages. In addition total demand and generation figures should also be publically available. o Regional information: at a regional level should be made public (in the same platform if possible) the use of the interconnection (in terms of programs, real measures and also percentage of utilization); daily and intraday market prices; information about the international exchanges mechanism; and economic information. o Additional information: on a long term stage other data could also be included such as countertrading programs used.
	6B	Presence and modalities of publications (public information) on international interconnections data in each country.	7	TSO-TSO	

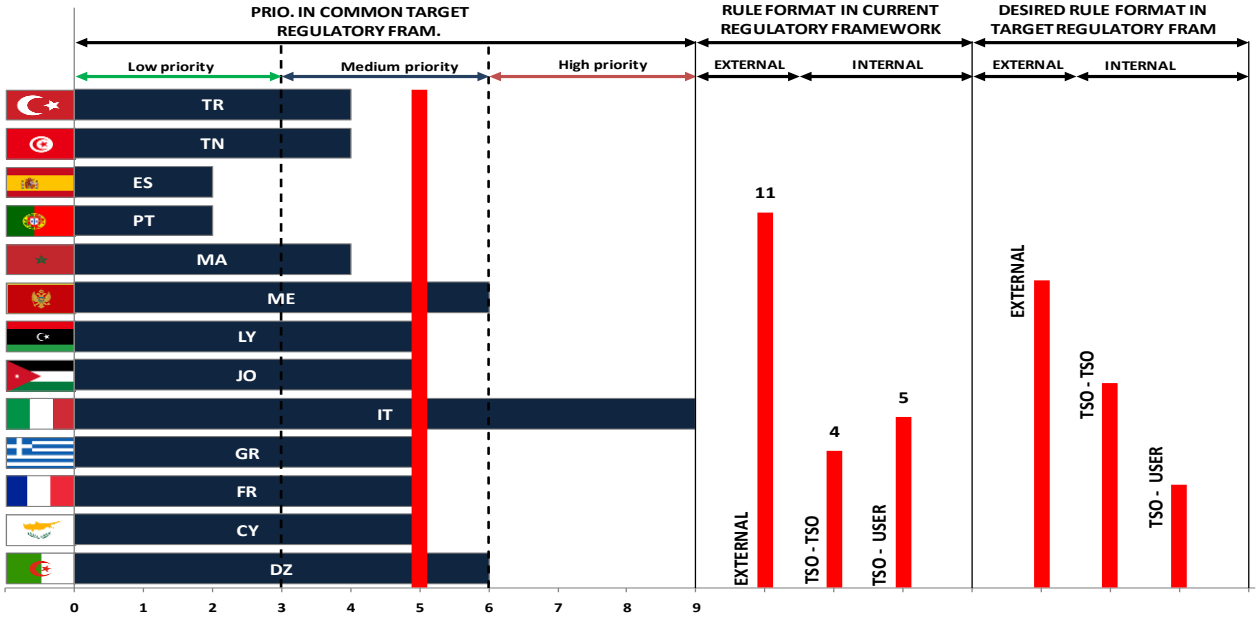
9 Annex II. Summary of TSO responses to survey about prioritization of issues to be included in common target regulatory framework.

9.1 Legal and regulatory issues

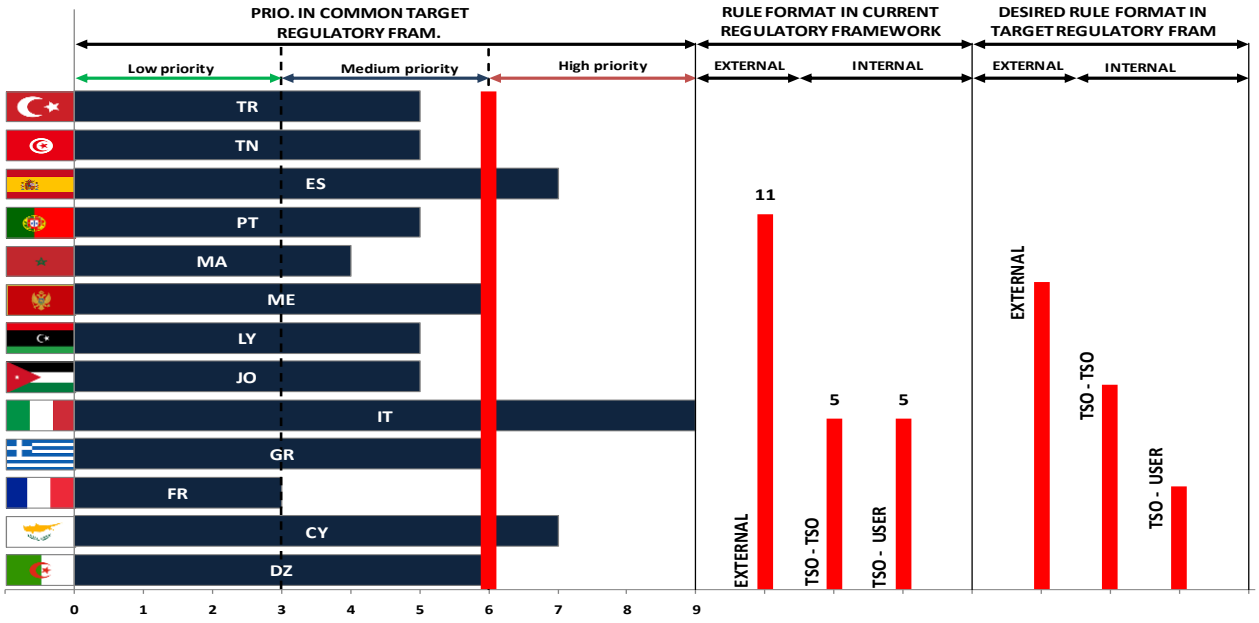
A. Should the responsible body for the development and/or approval of technical rules be harmonized (be the same authority/ entity in the Med countries)?



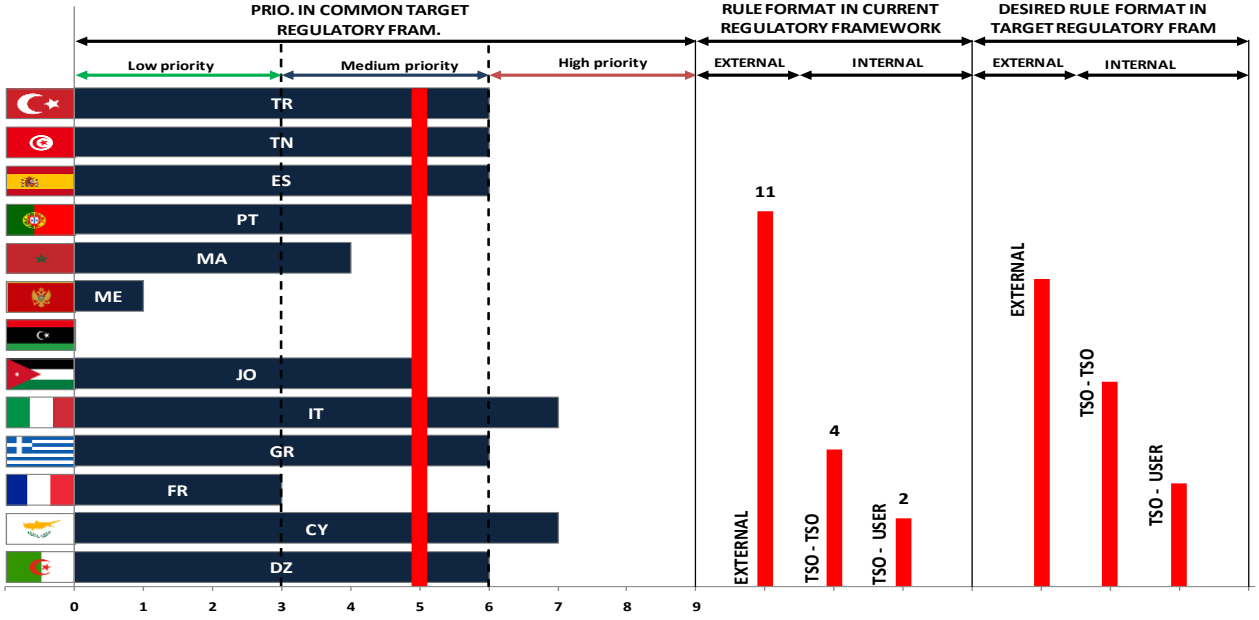
B. Should the responsible authority for the settlement of disputes among stakeholders (eg. Conflict of access to the network...) be the same in all MedTSO countries?



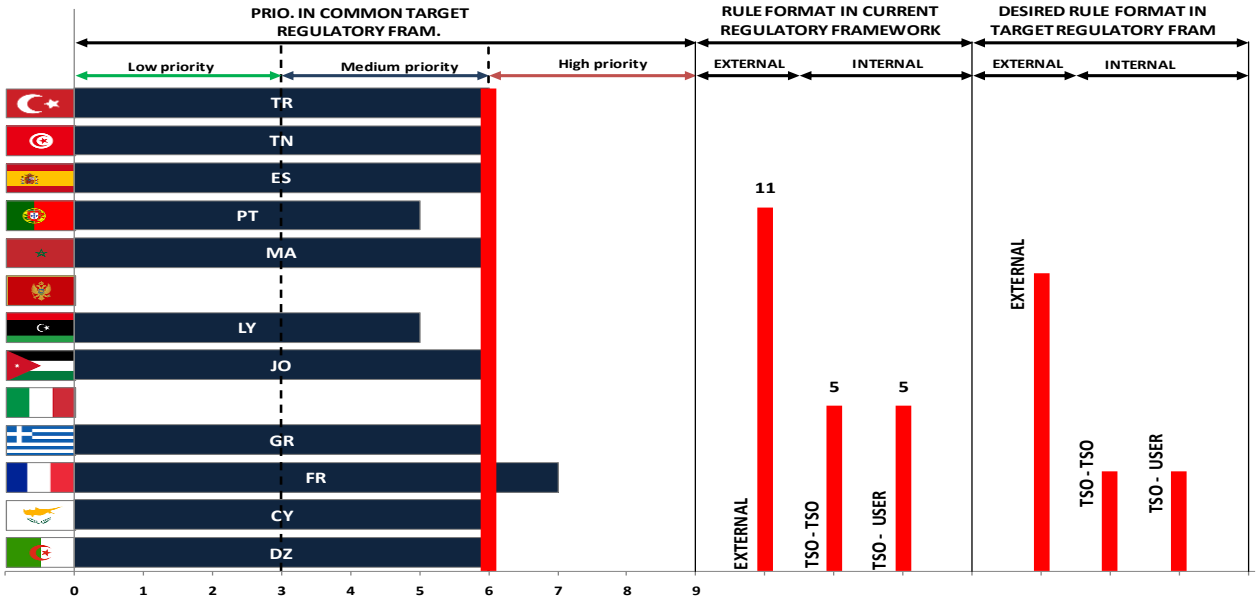
C. Should stakeholders have the possibility to appeal NRA´s decisions at a higher instance?



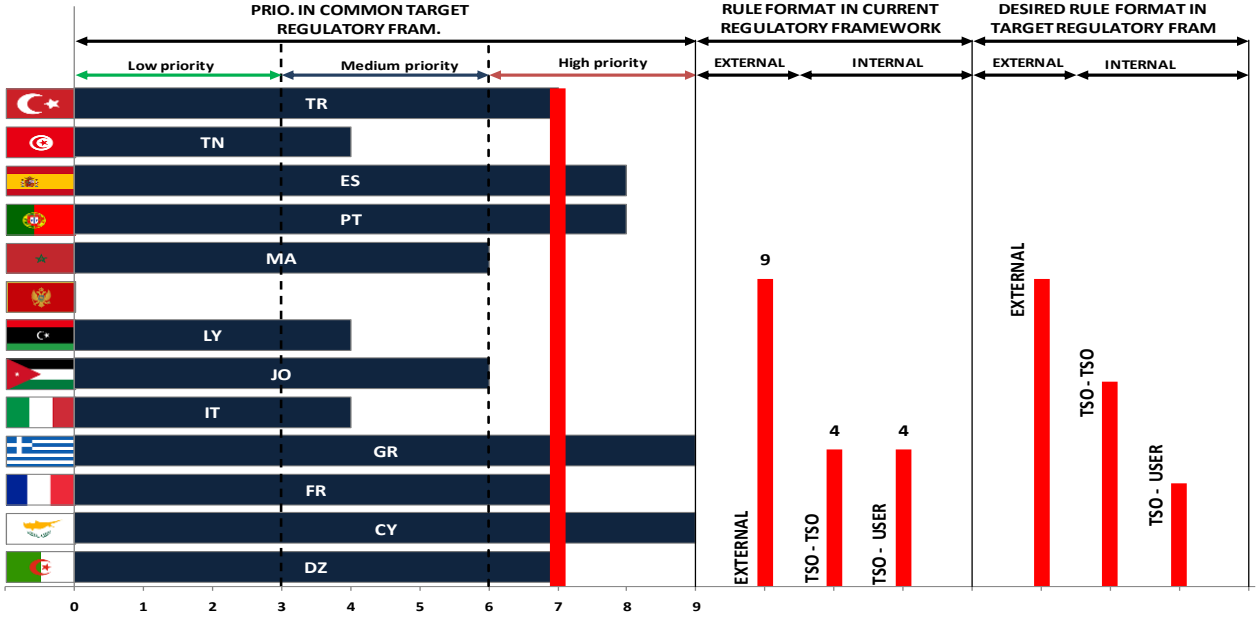
D. Should stakeholders be involved/participate in the elaboration of technical rules/regulations?



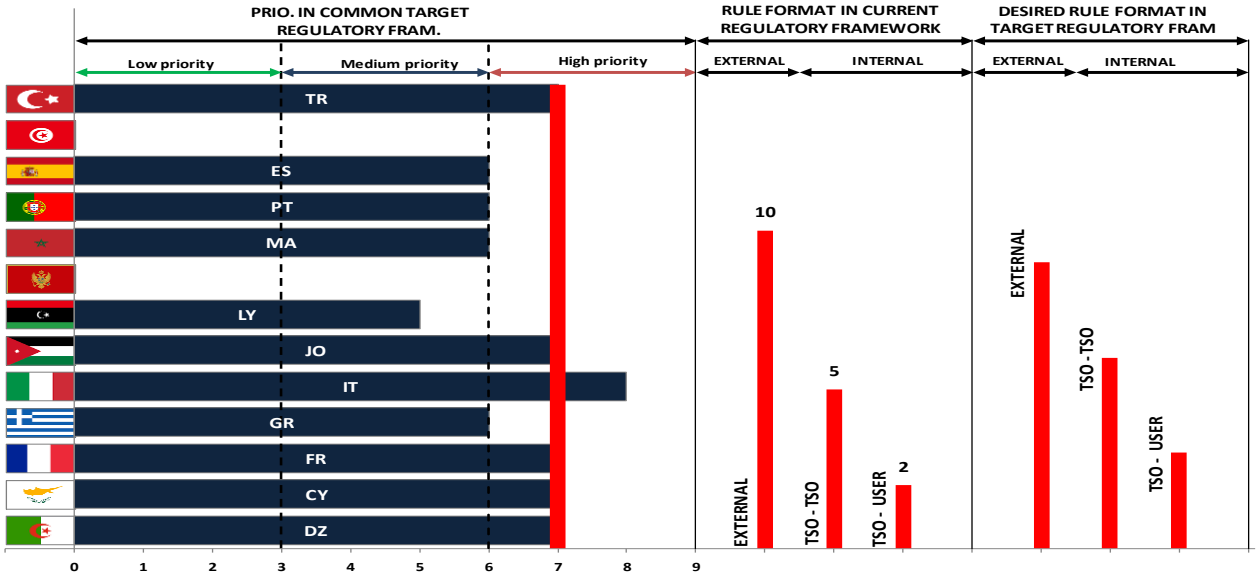
E. Should new entrants (TSO/DSO/suppliers) be allowed?



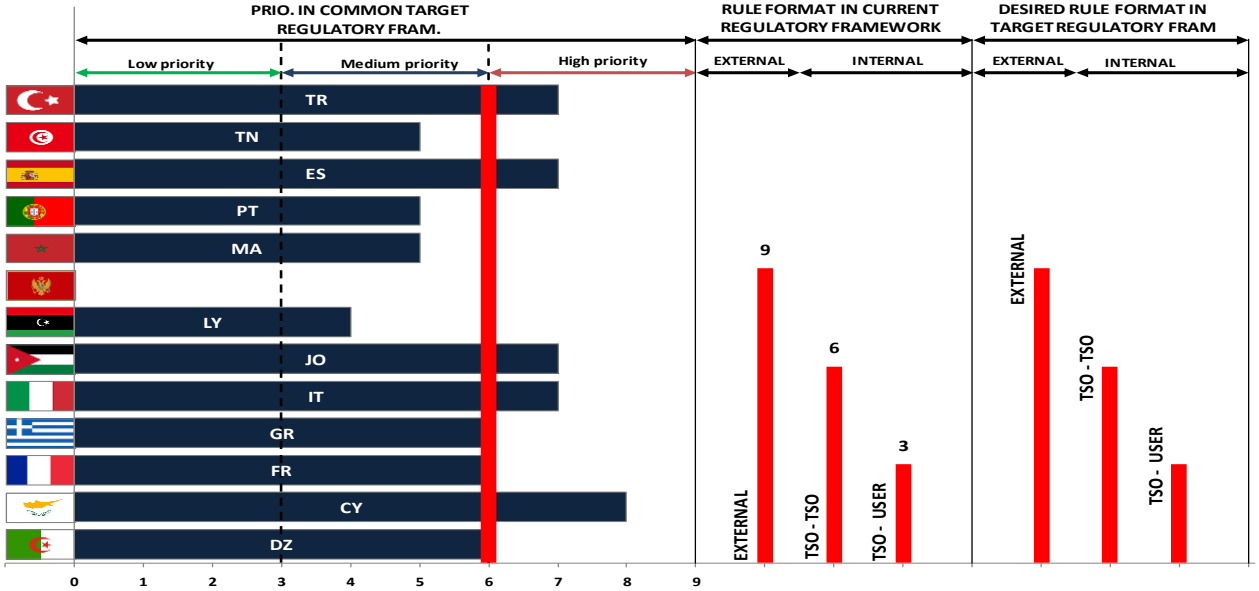
F. Should regulated (transmission/distribution) and non-regulated activities (generation/supply) be unbundled?



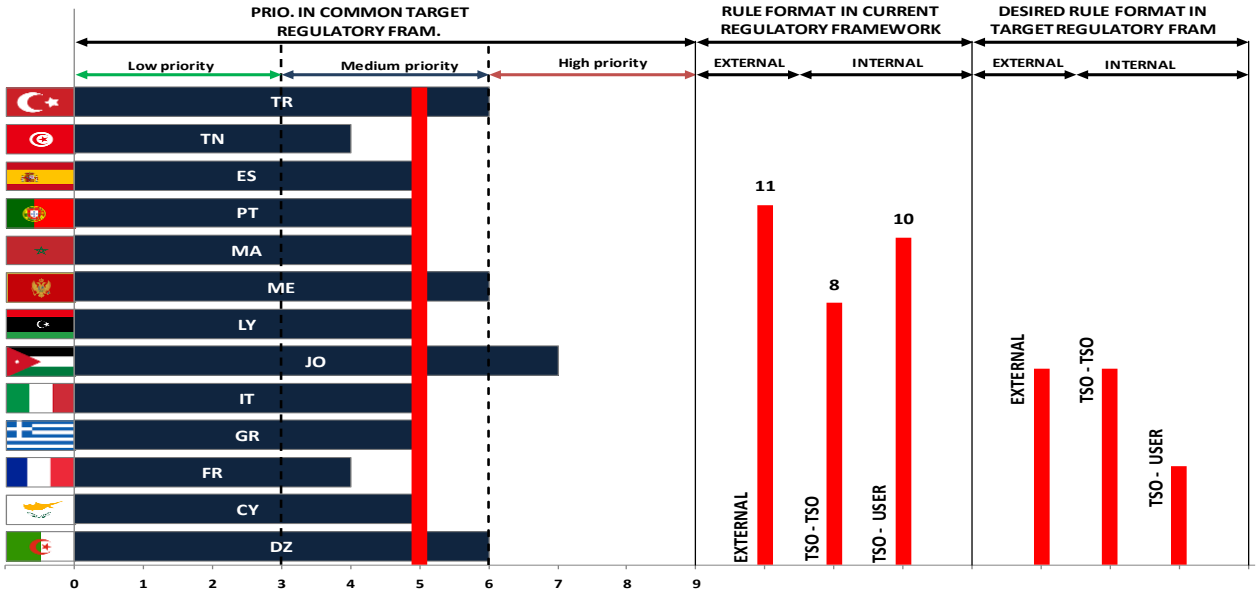
G. Is there a need for a coordinated regulation in order to make feasible and viable an international interconnection?



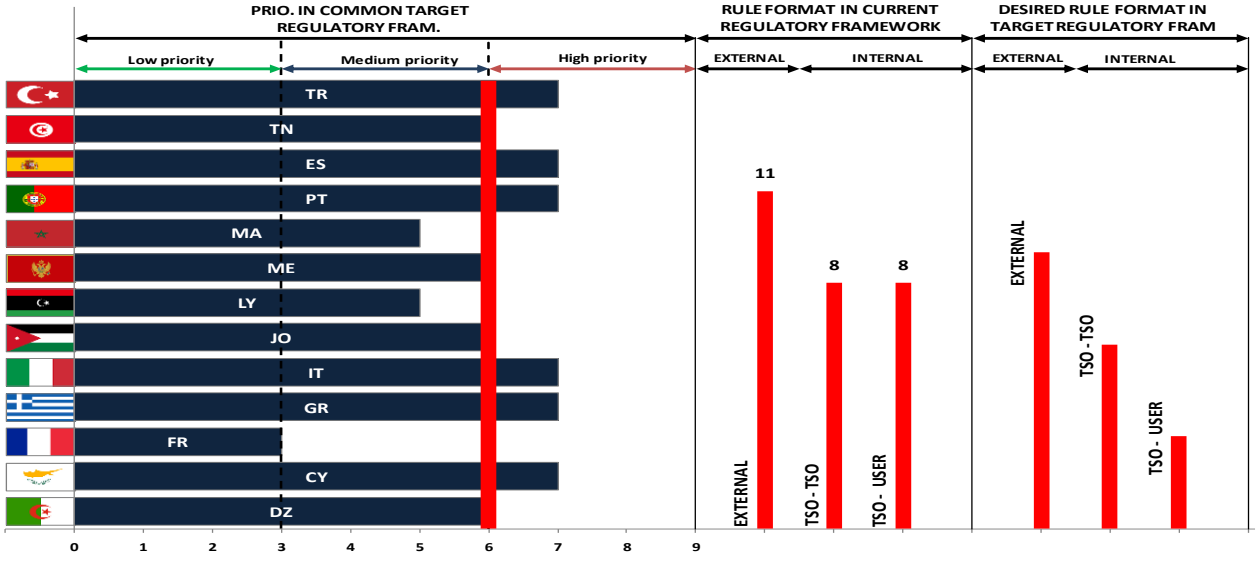
H. Should the subjects involved in international interconnections be the same in all systems?



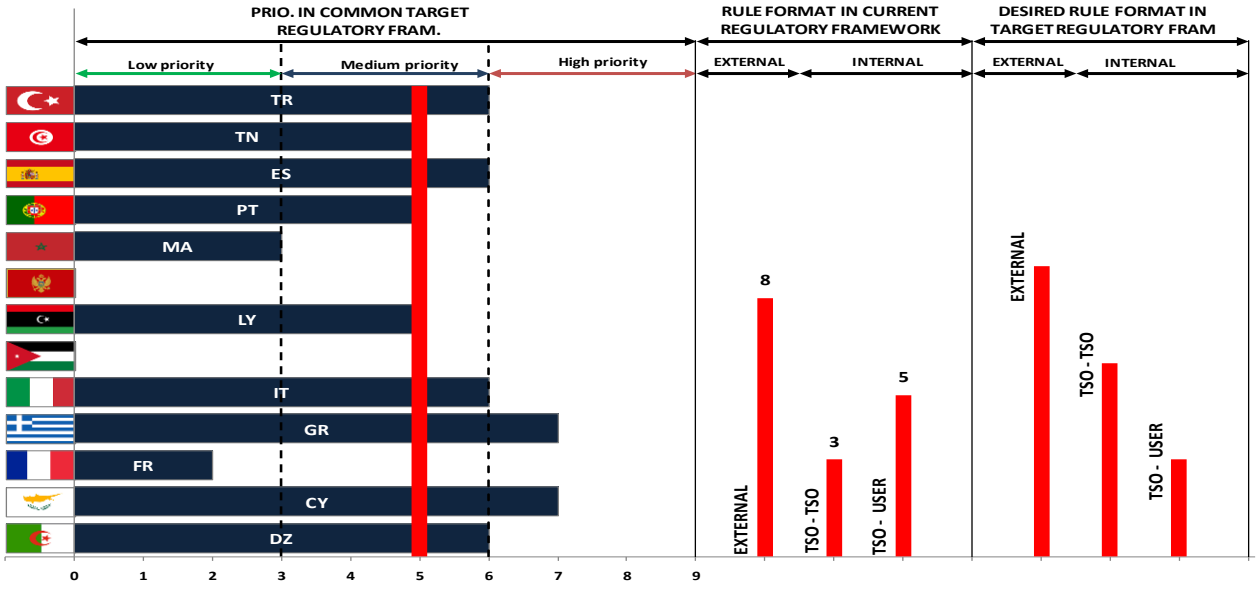
I. Should the requirements for participation in the Electricity Markets in MedTSO countries be harmonized?



J. With reference to the following activities: Production, transmission, distribution; trading on injection; trading on consumption; metering, it is important to assess whether, in the different systems, these are carried out on a free (open) market model; and whether there is a presence of a single subject (monopoly) or more subjects/counterparties."

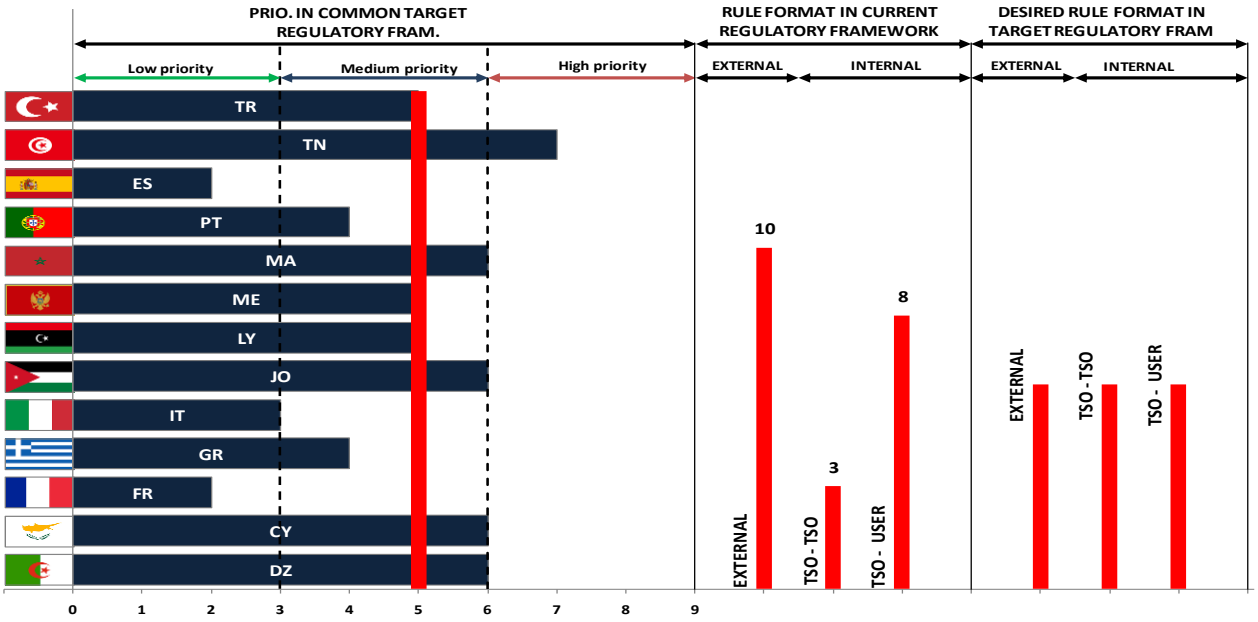


K. With reference to the following activities: Production, transmission, distribution; trading on injection; trading on consumption) it is important to assess the different typologies of authorizations and the corresponding competent authorities (Ministry, NRA, TSO, independent body.

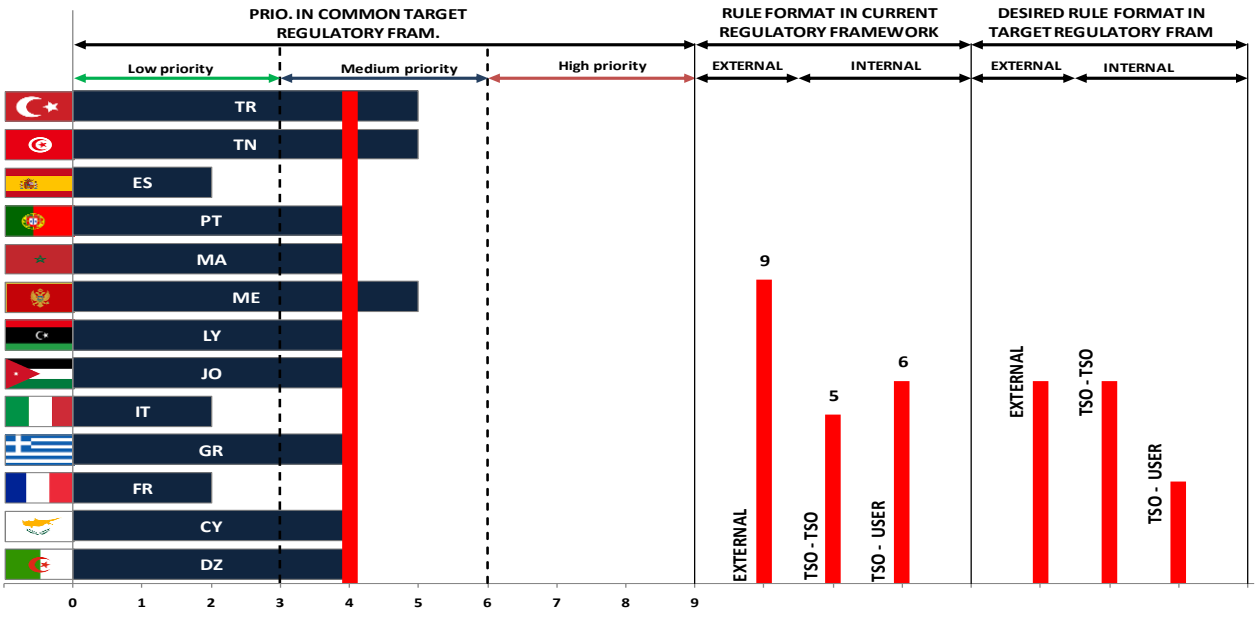


9.2 Connection

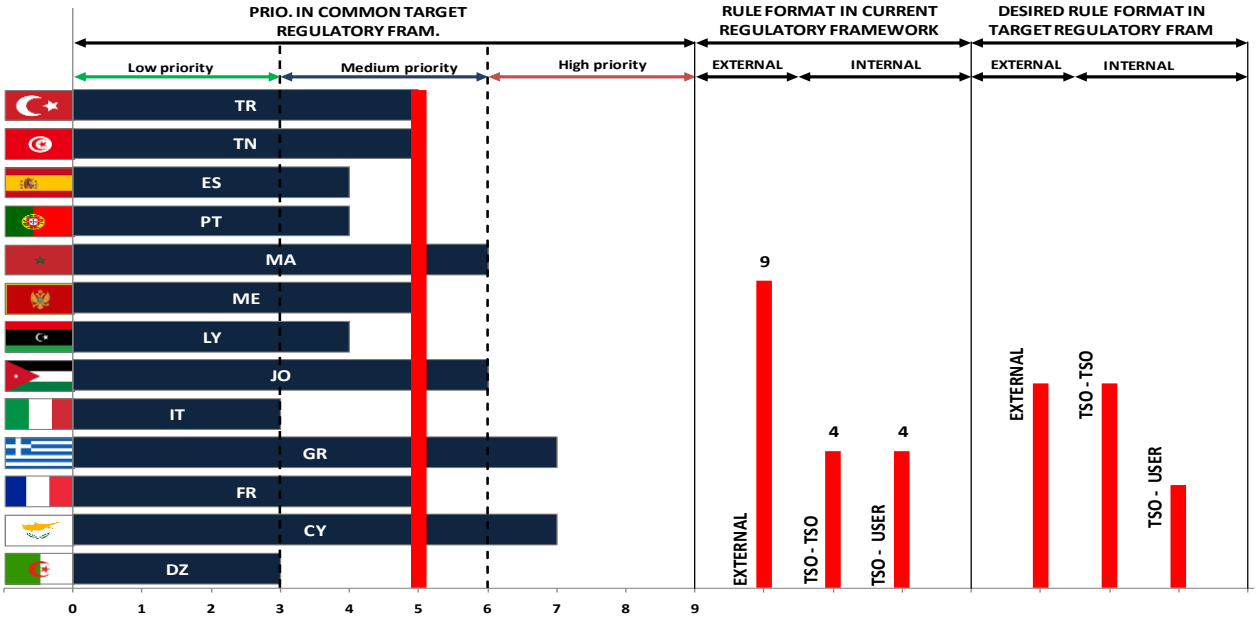
2A- Which studies are performed for Access and Connection?



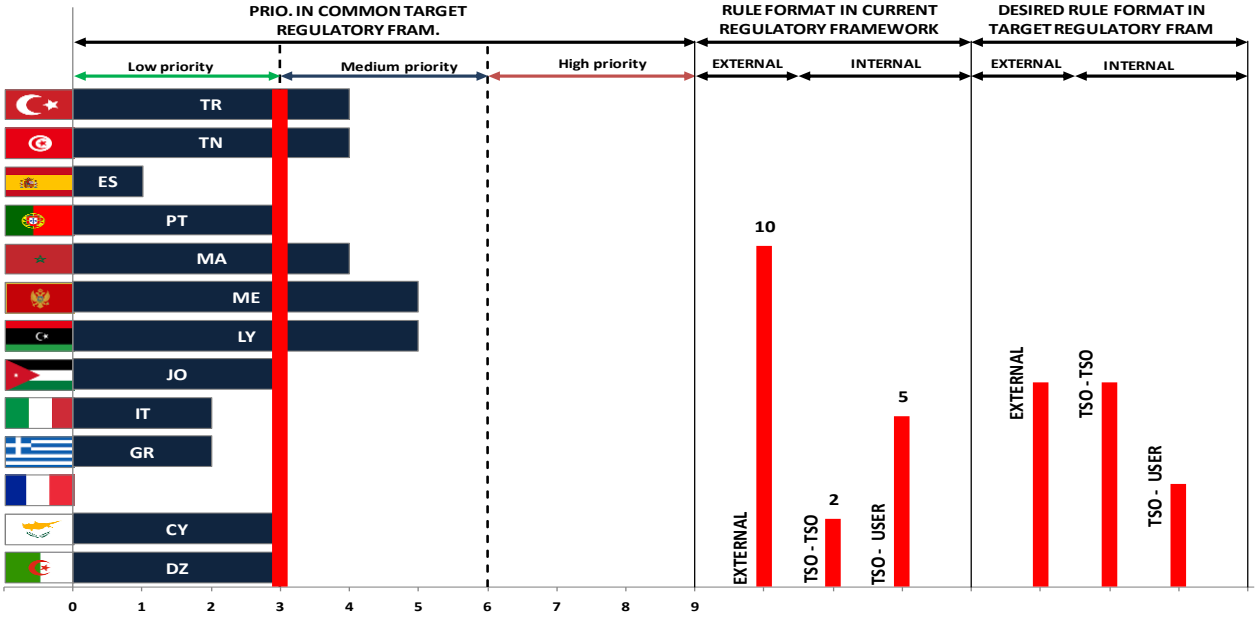
2B-Which horizons are used for access capacity calculation?



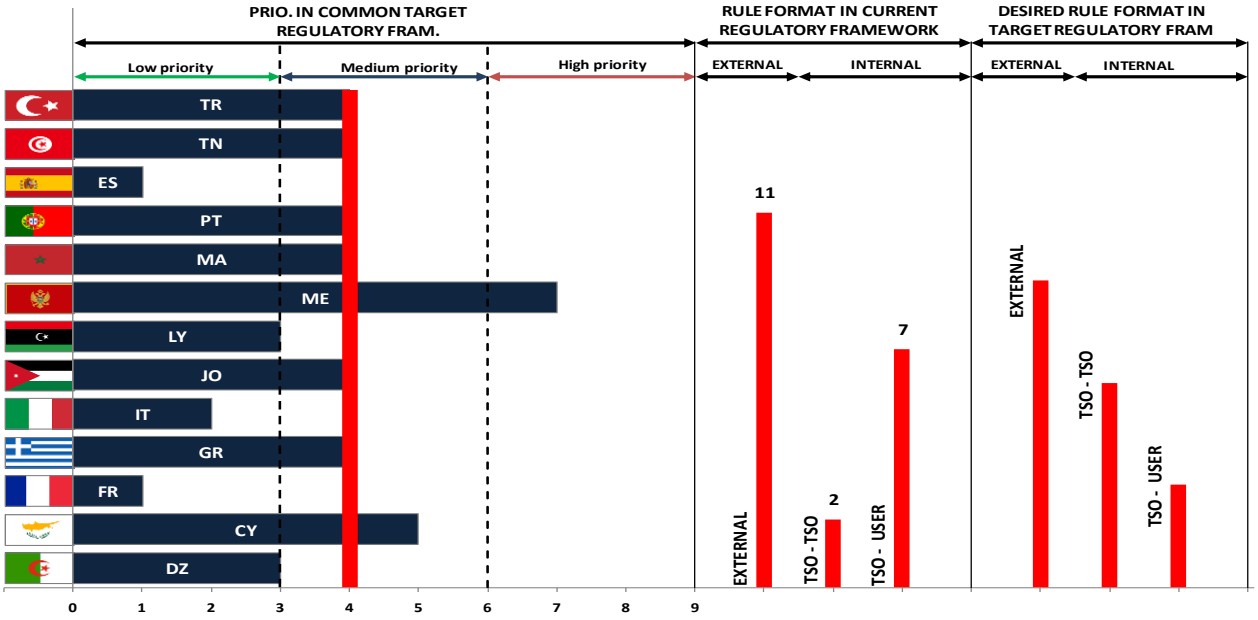
2C- Which criteria are used for access capacity calculation?



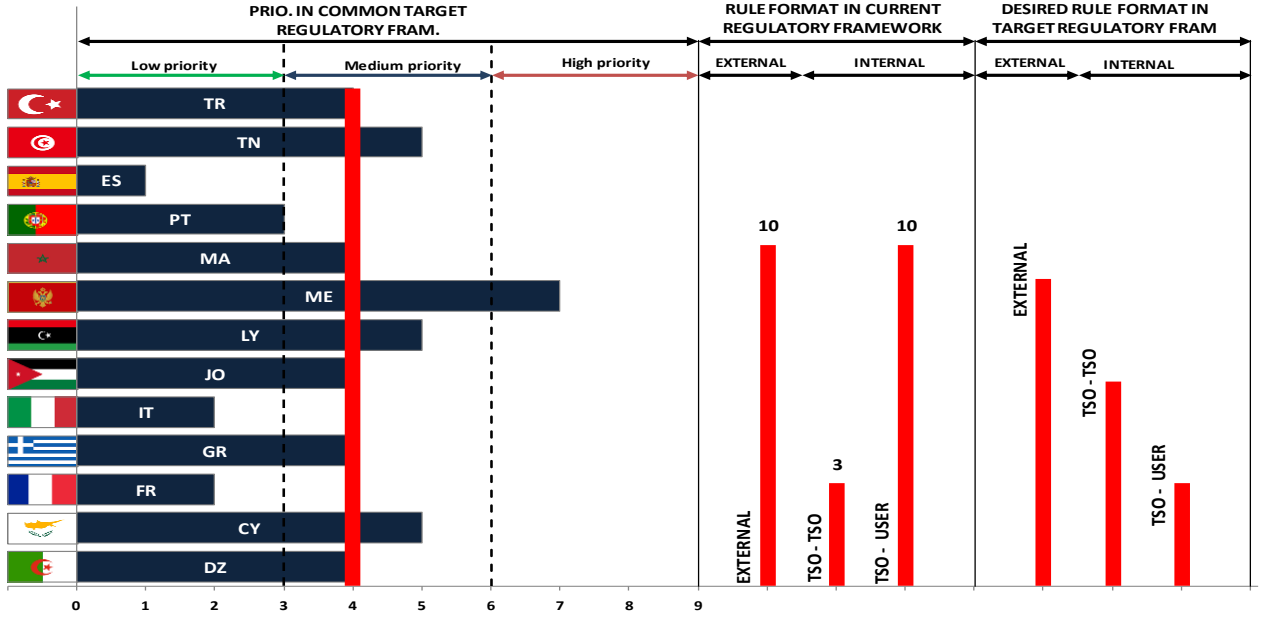
2E- Are TSOs connection studies paid by the applicants or otherwise?



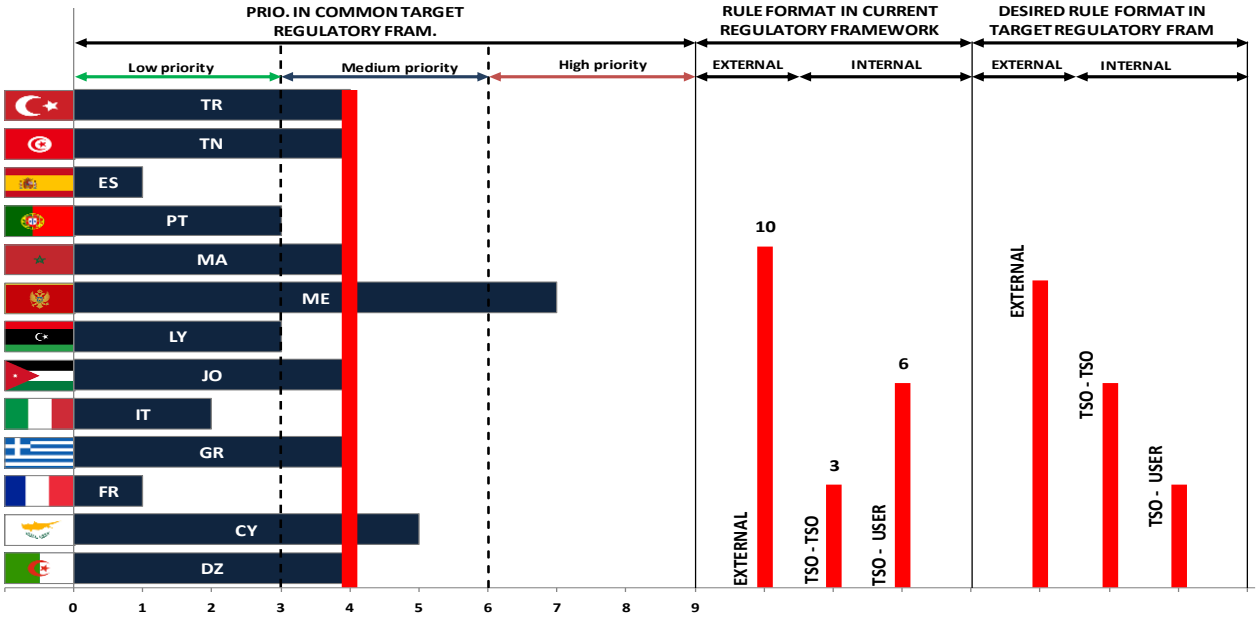
2F- Who pays for the transmission assets needed for the connection of generation?



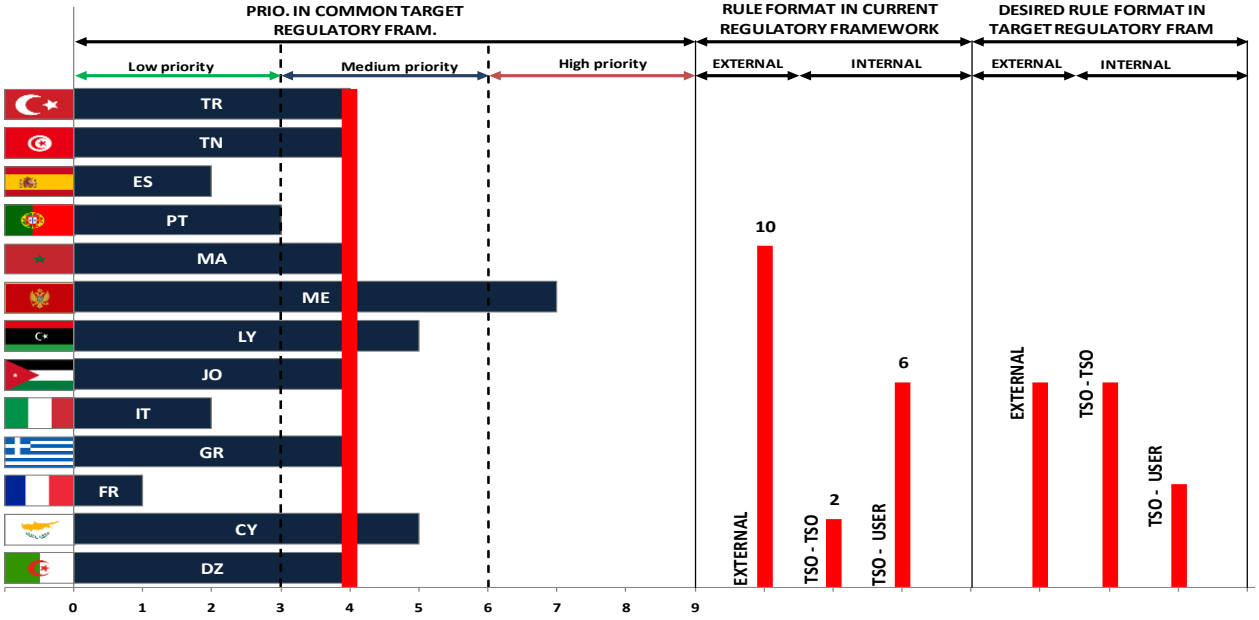
2G- Who pays for the transmission assets needed for the connection of distribution?



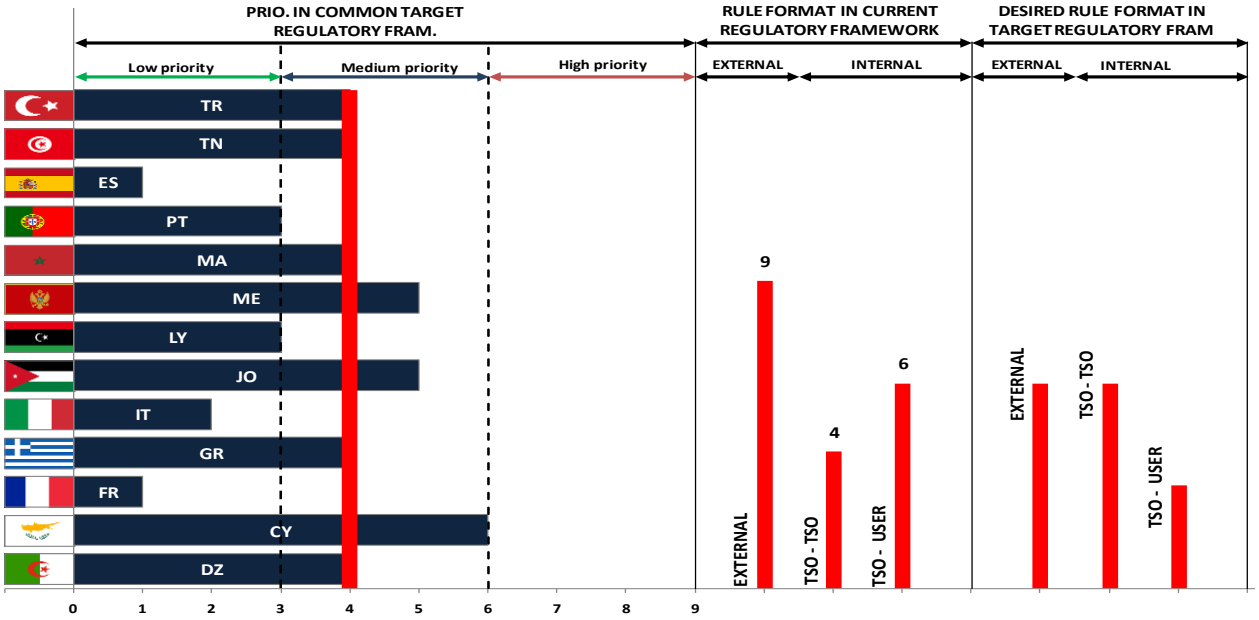
2H- Who pays for the transmission assets needed for the connection of consumption units?



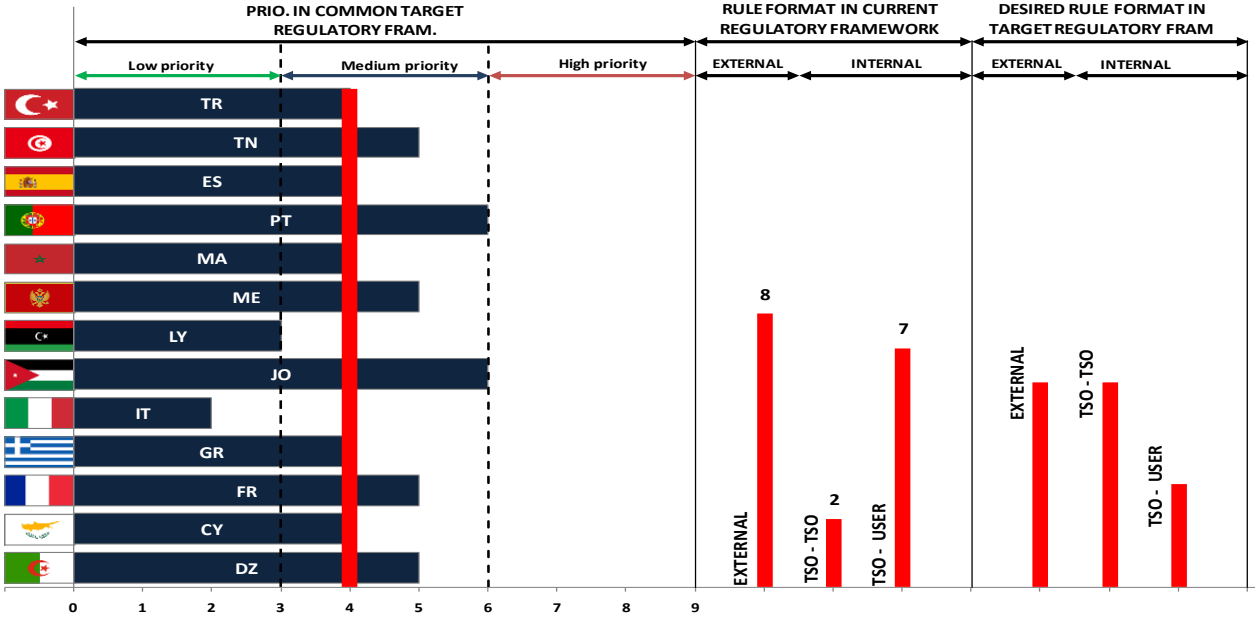
2I- Are there any limiting magnitudes required to connect to the transmission grid?



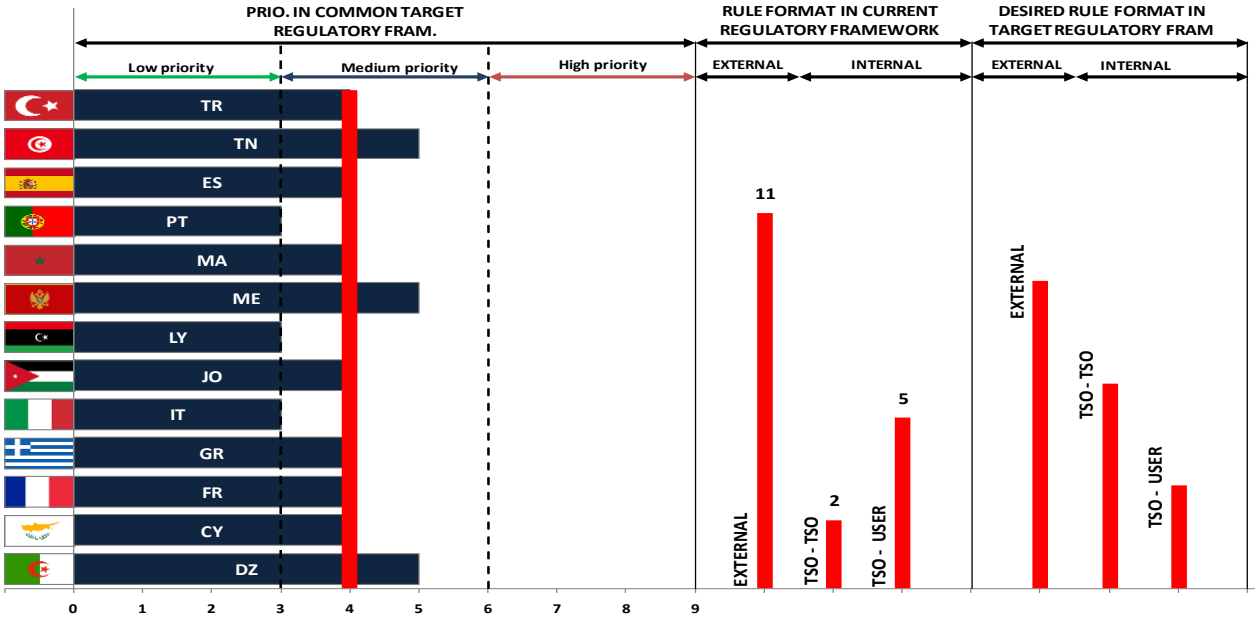
2J- Which design criteria is used for new transmission facilities needed for connection?



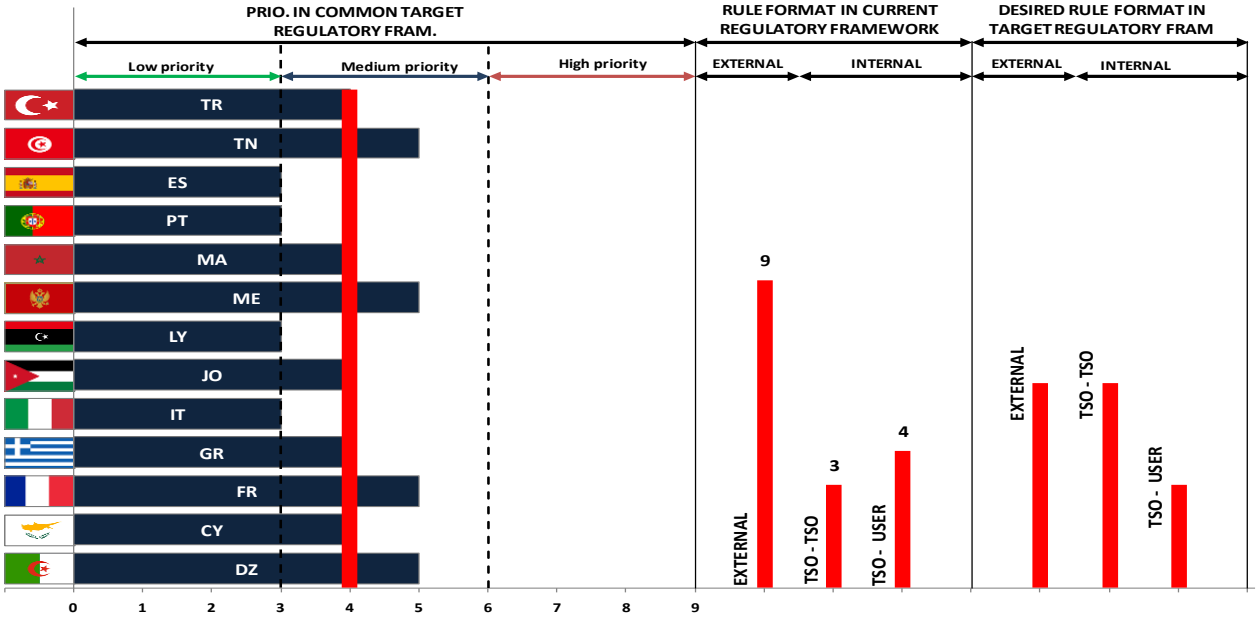
2L- Is there any obligation for users to send simulation models to network operators?



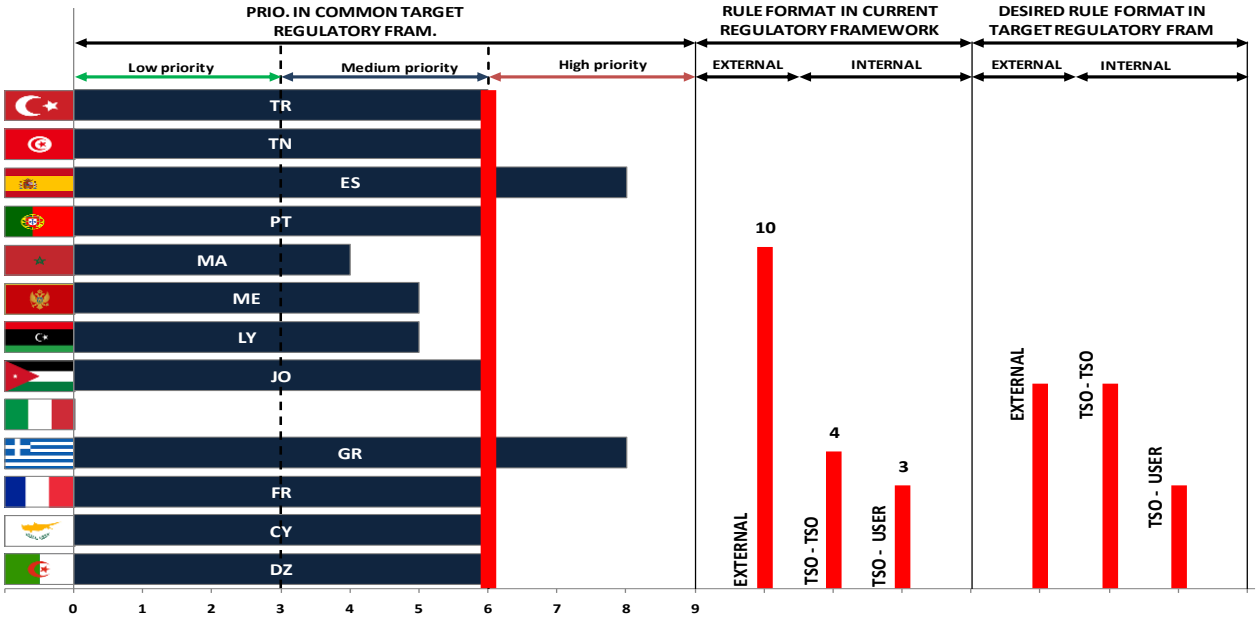
2N- Is there capacity connection priority?



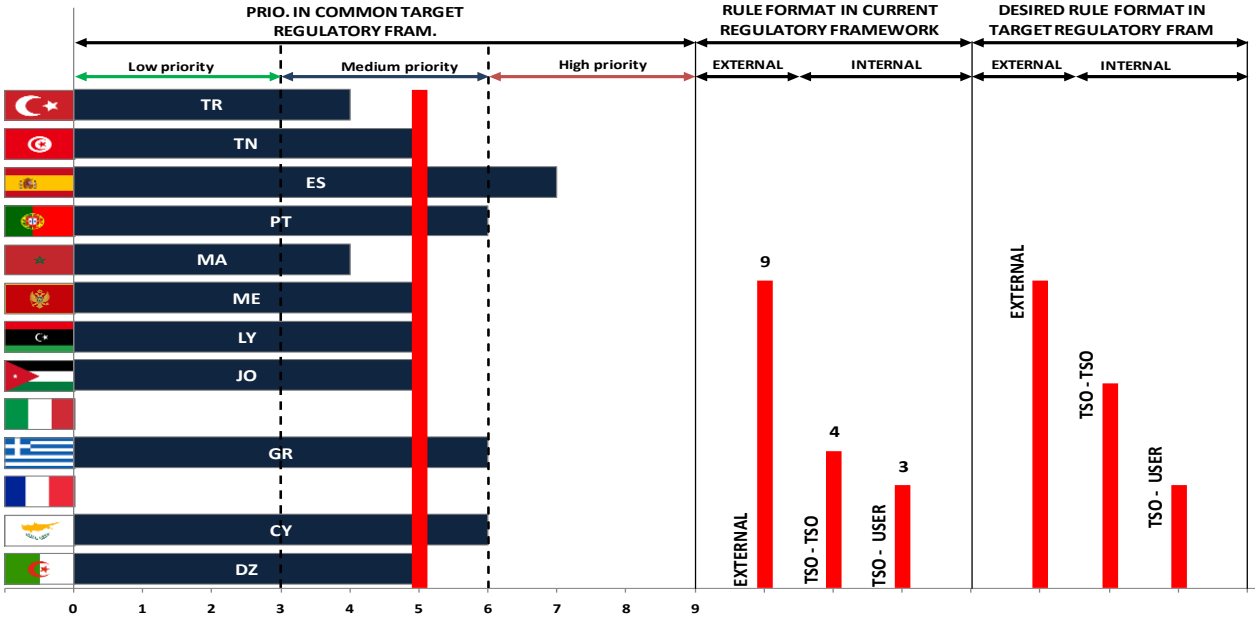
2O- Is there any binding relationship between planning and connection authorization?



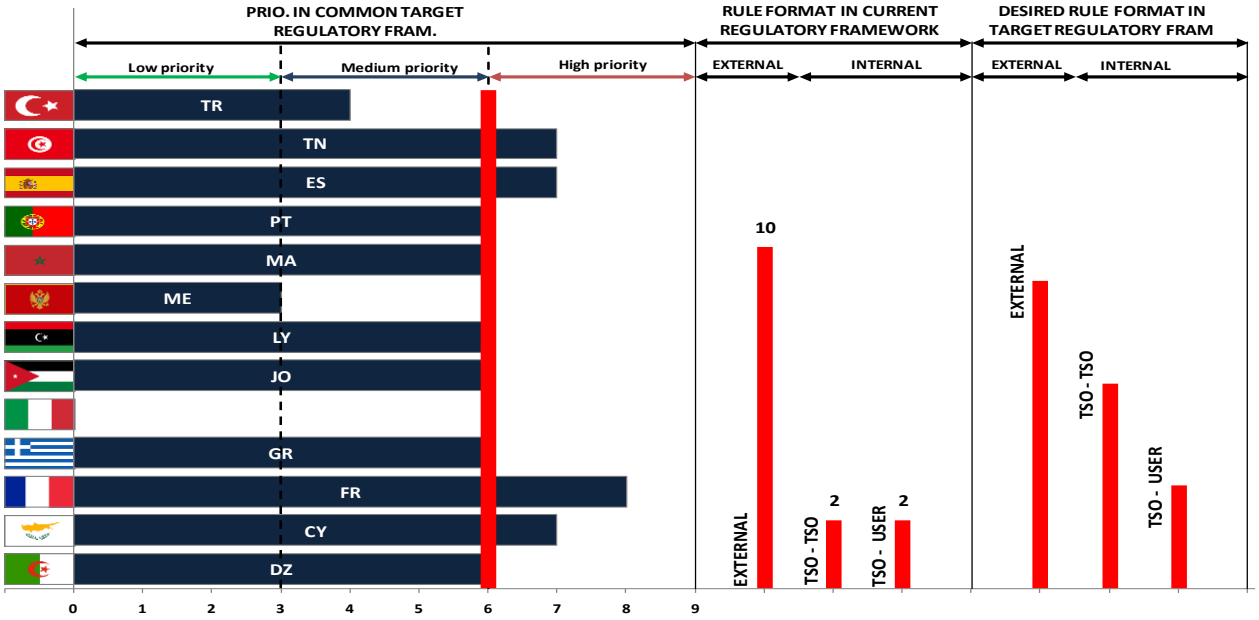
3A- What are the frequency/time range limits for users to withstand without damage?



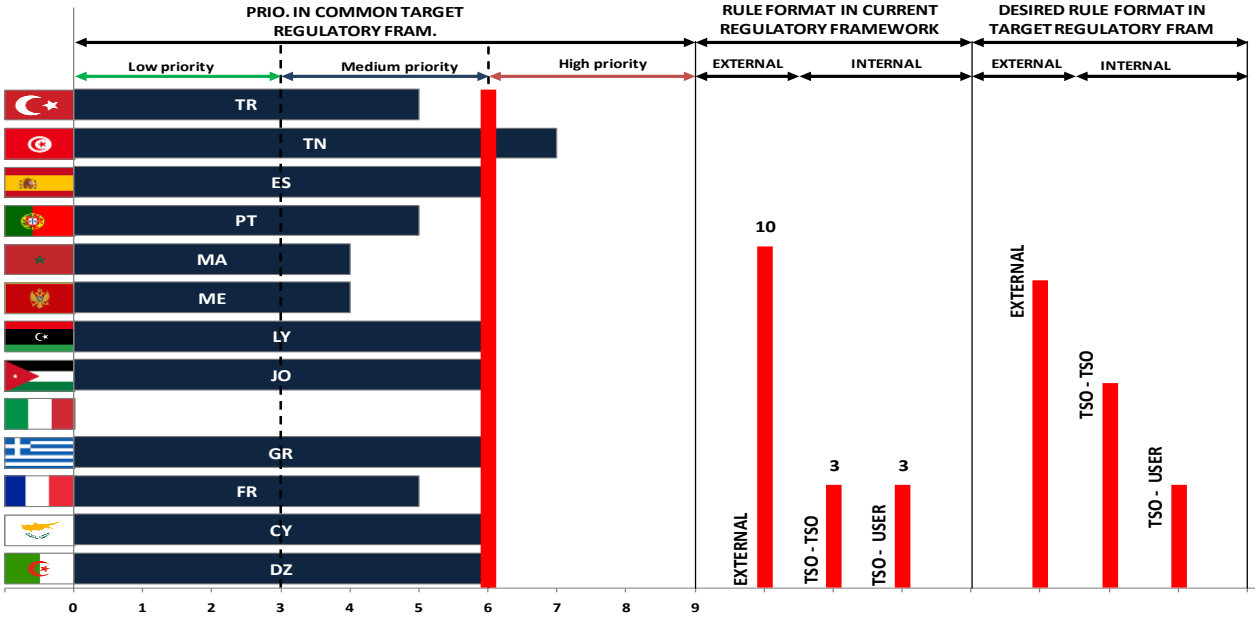
3B- What is the rate of change of frequency withstand capability?



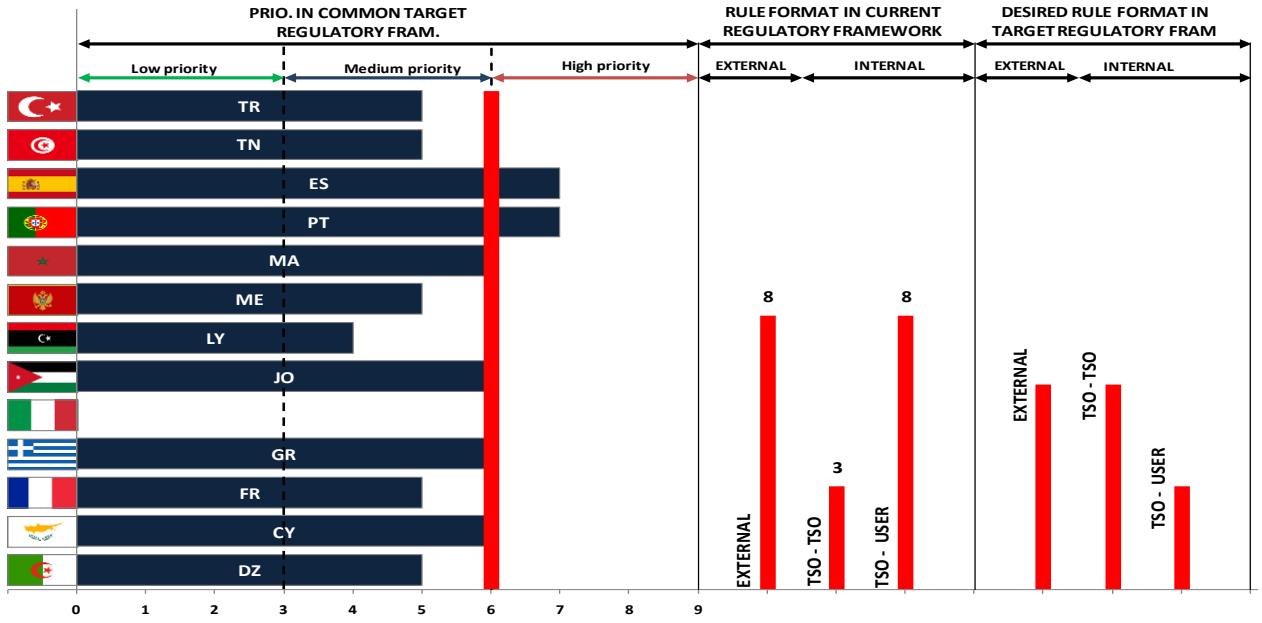
3C- Limited frequency sensitive mode – overfrequency and underfrequency schemes



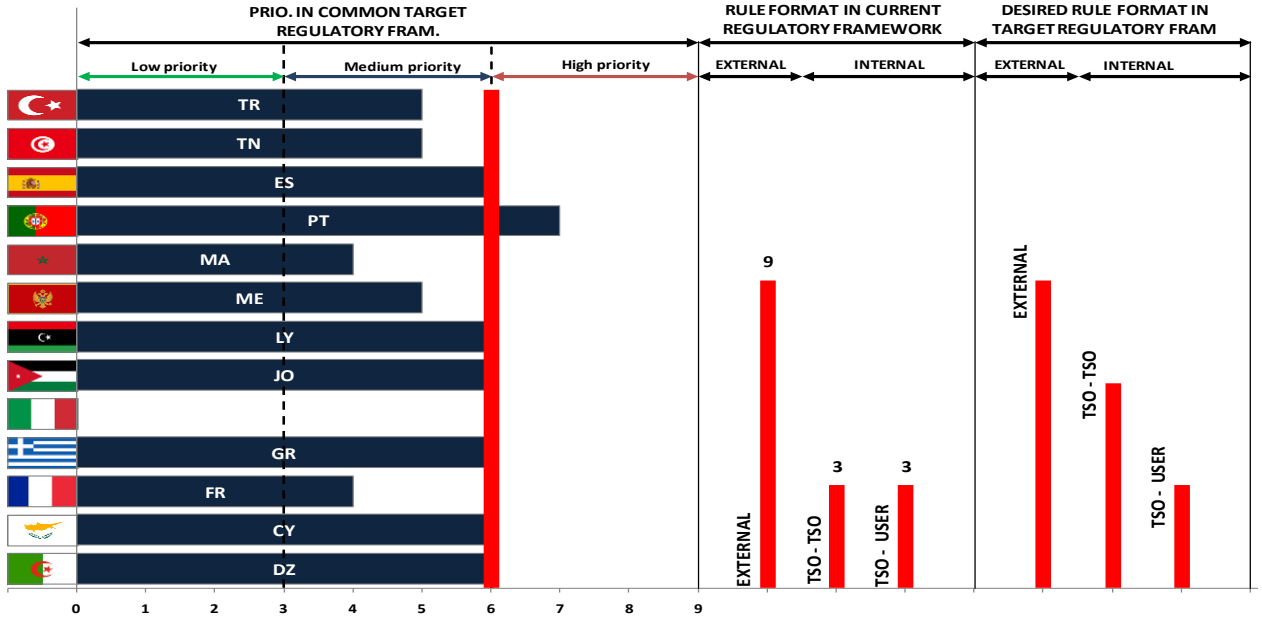
4A- What are the voltage/time range limits for users to withstand without damage?



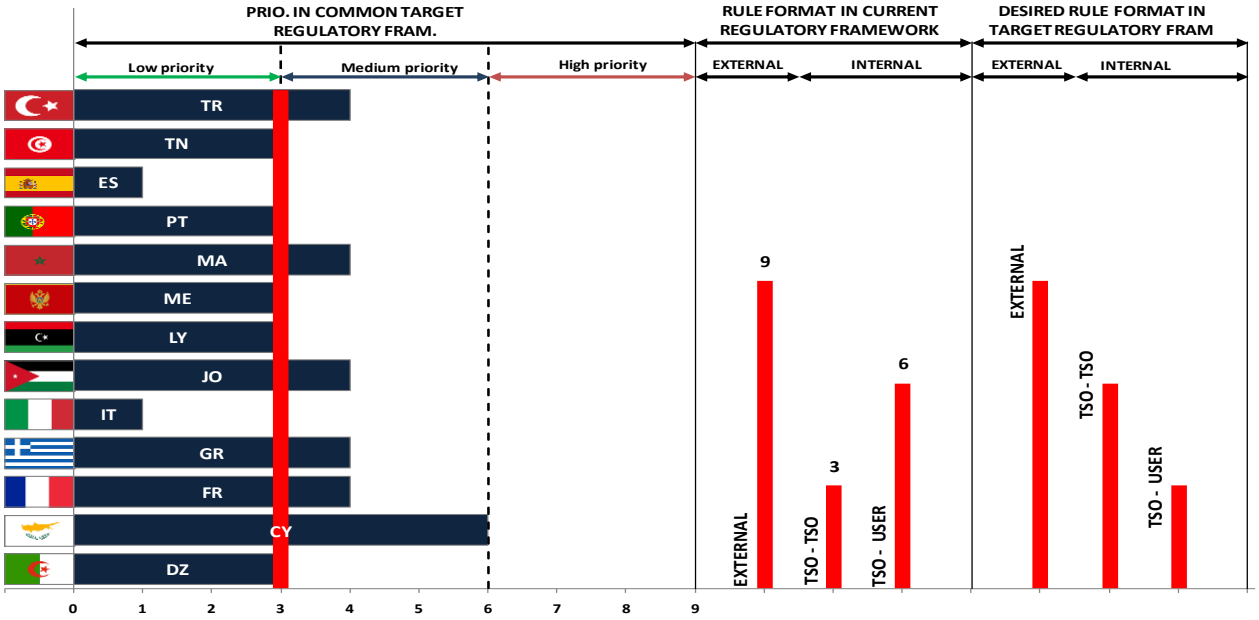
4B- What technologies have to comply with fault ride through capability requirements? Please detail and attach different profiles curves for each type.



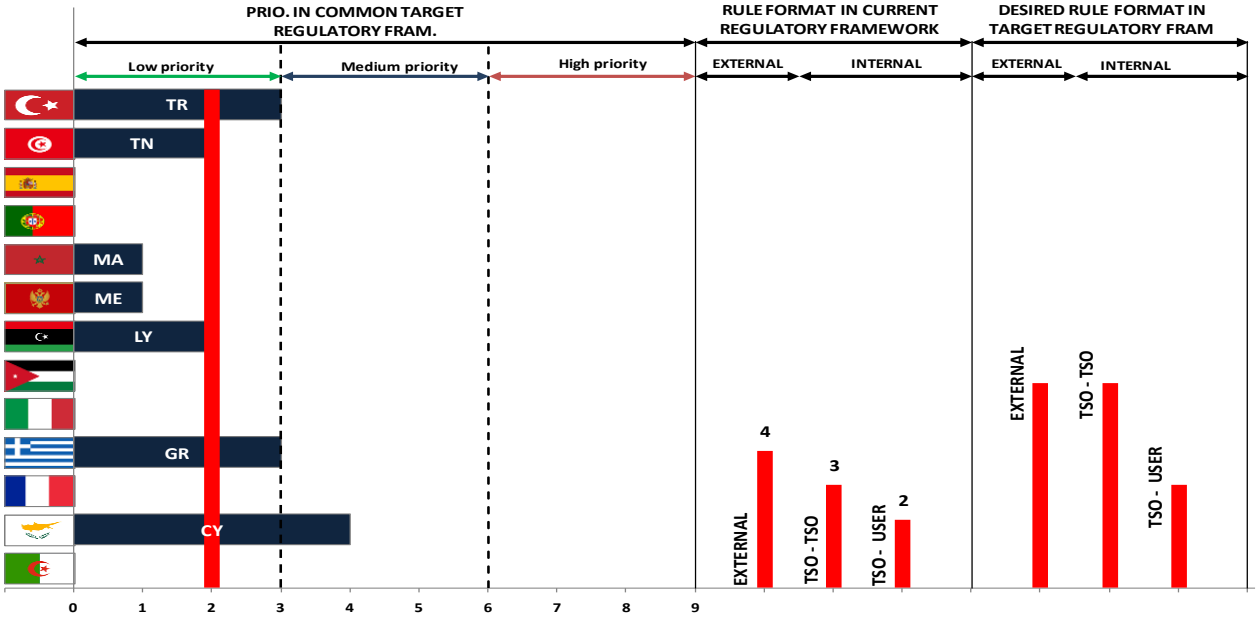
5A- Limits of reactive power contribution



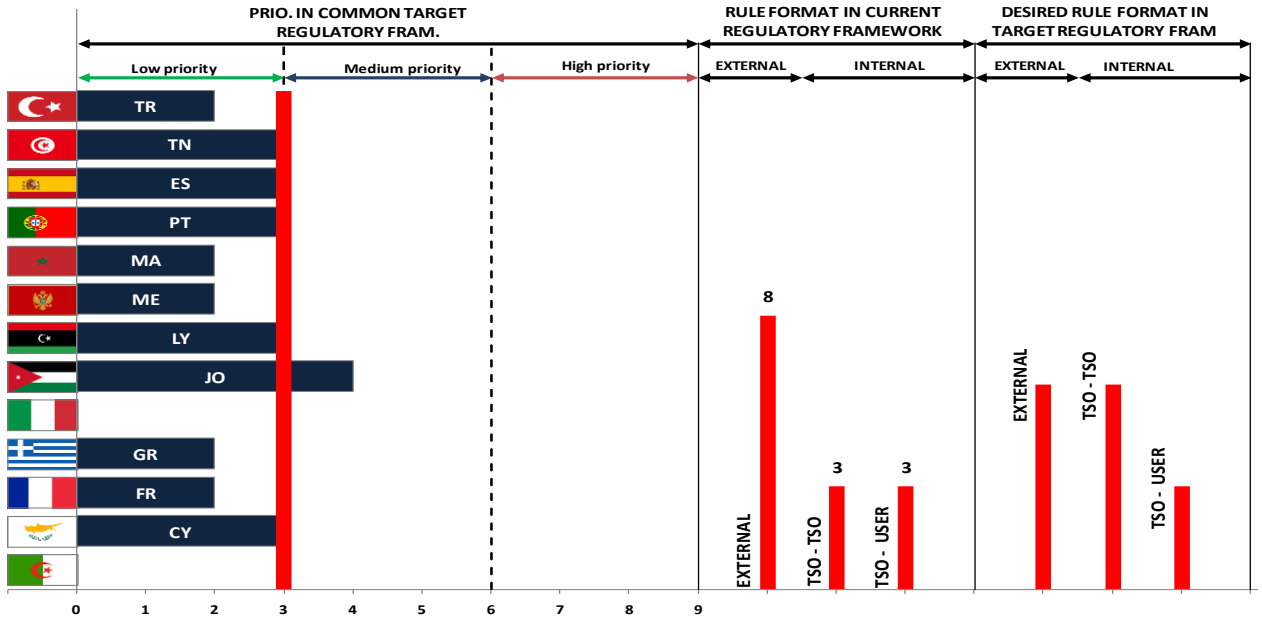
6A- Short Circuit current limits for switch equipment



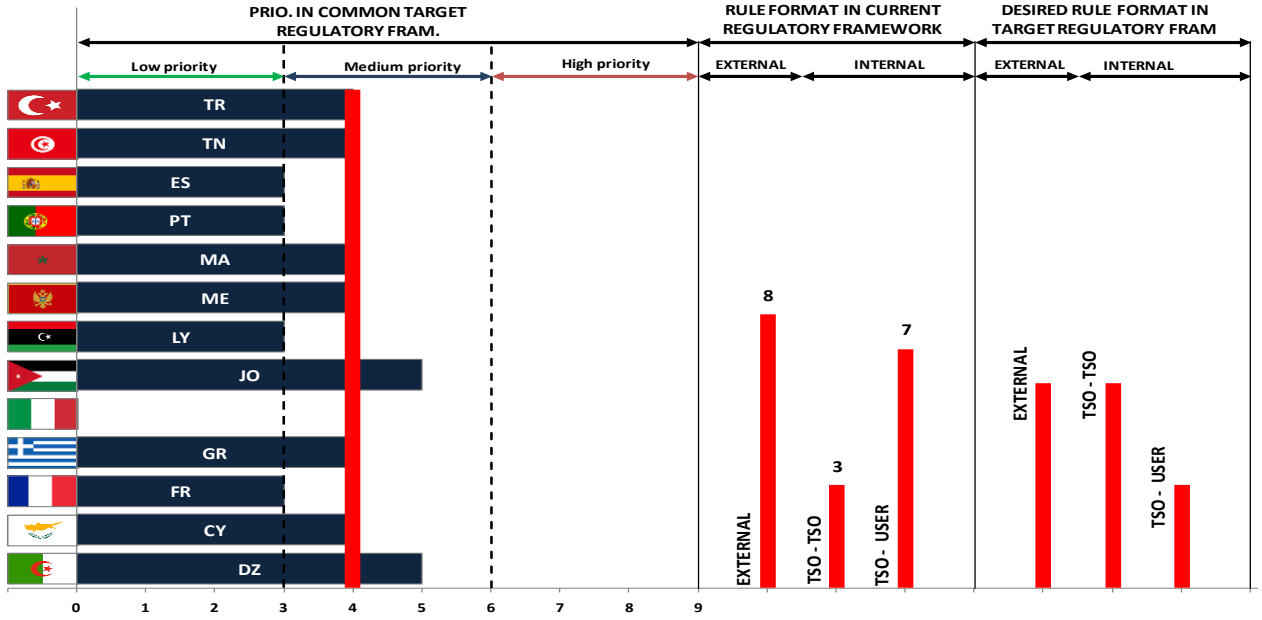
6B- Short Circuit ratio limits for thermal, CCGT, HPP



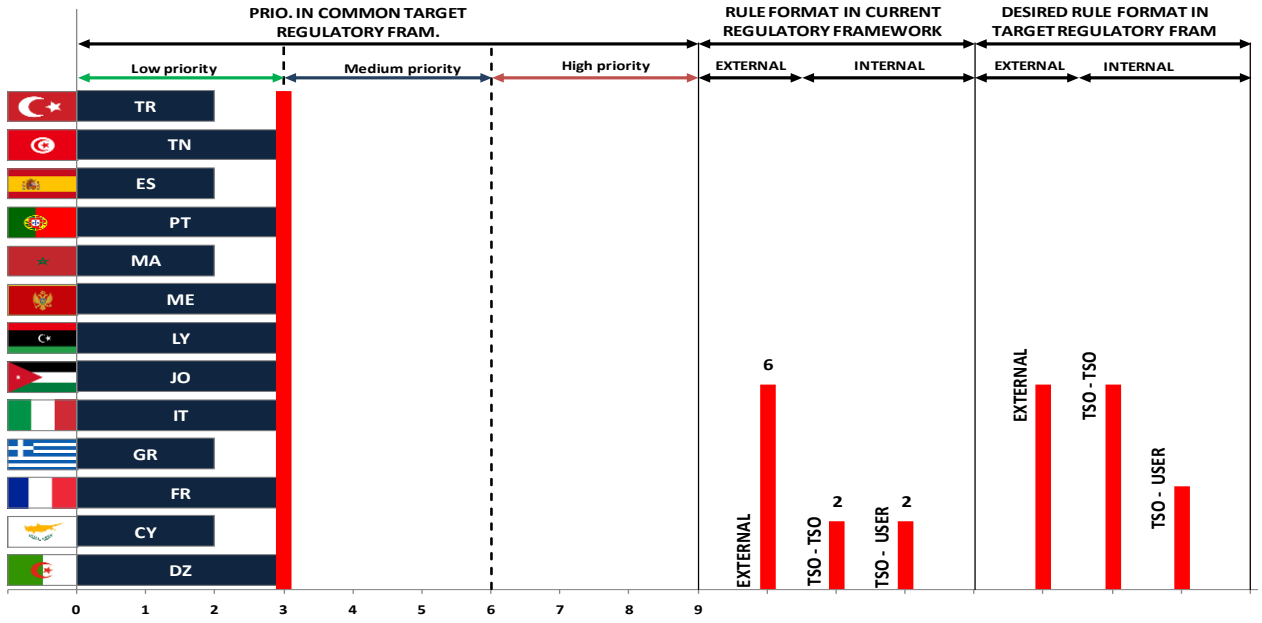
7A- Protection criteria for non-transmission facilities connected to the transmission grid are general or particular for each case?



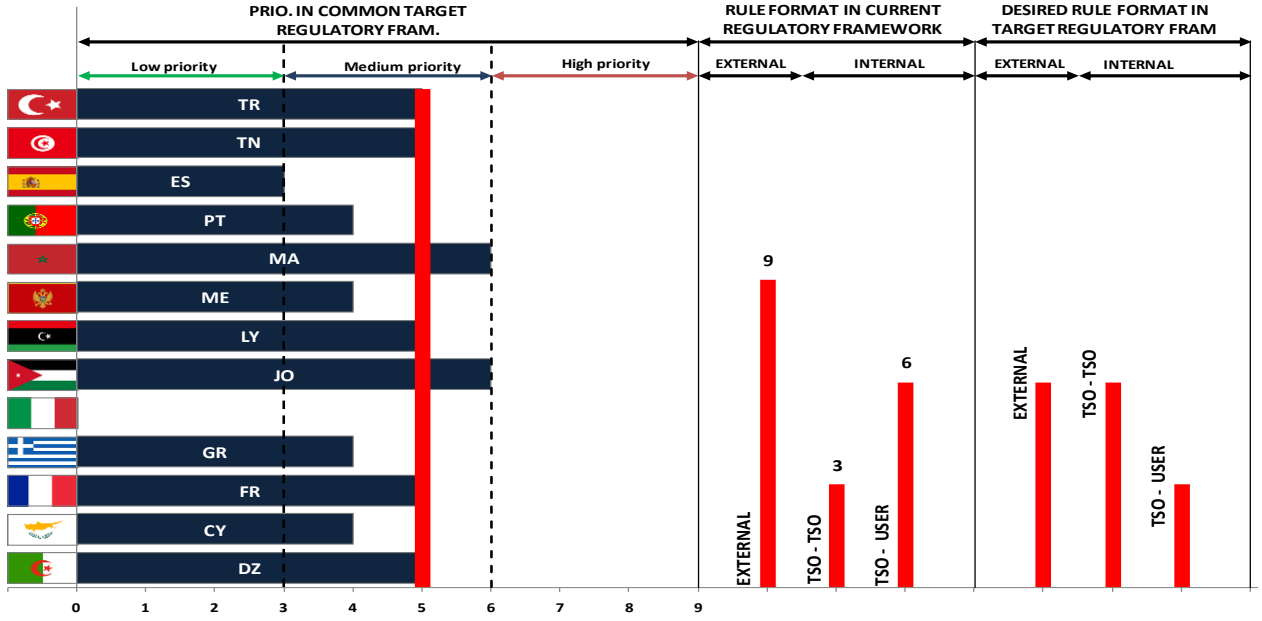
7B- Which aspects are included in the protection schemes for non-transmission facilities connected to the transmission grid? (i.e. external short-circuit, internal short-circuit, over and under frequency, over and under voltage, demand circuit protection, unit transformer protection, backup schemes)



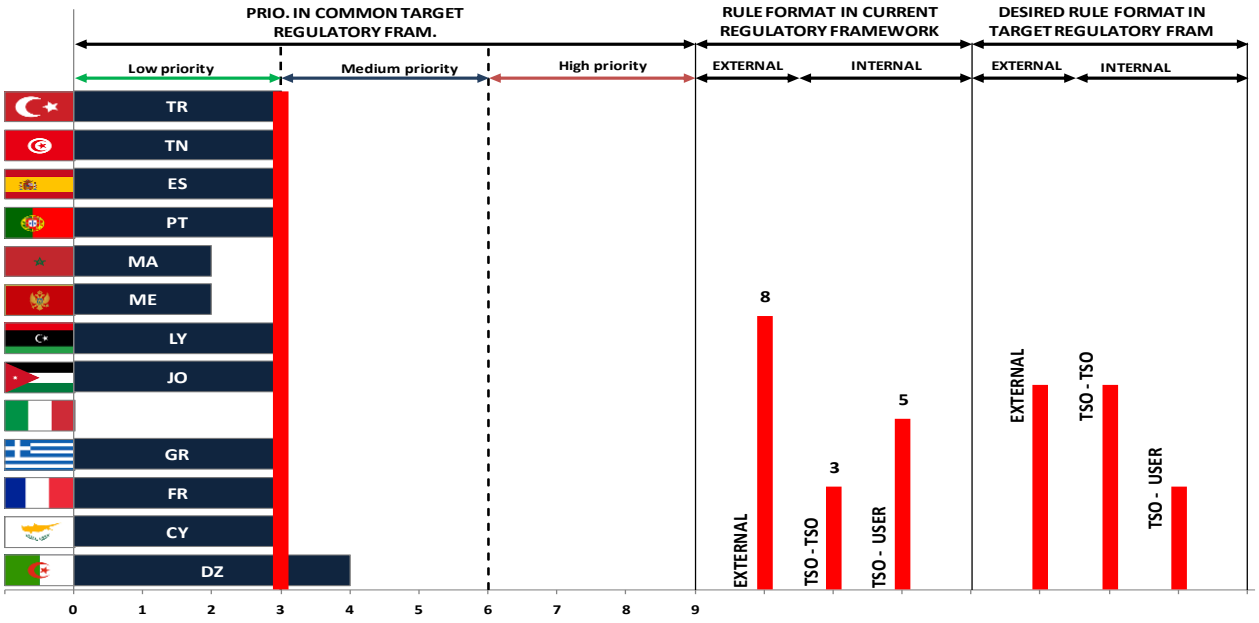
7C- Isolation levels in the transmission grid follow international standards or have specific regulation?



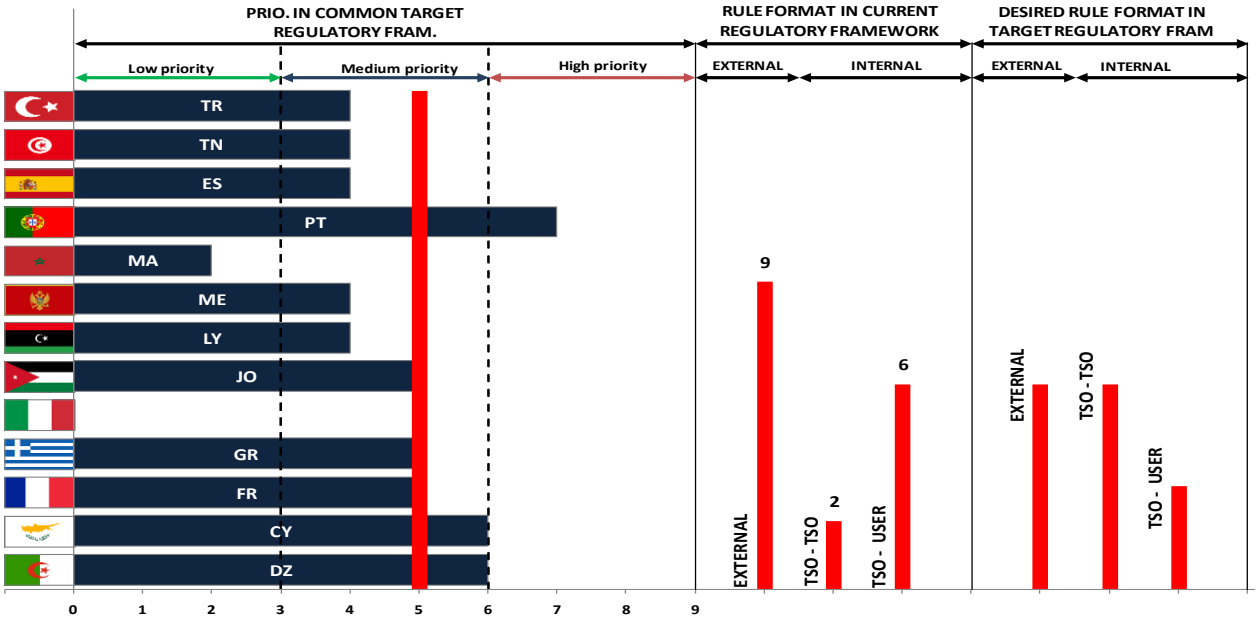
7D- Which redundancy is required for telecommunication and protection schemes?



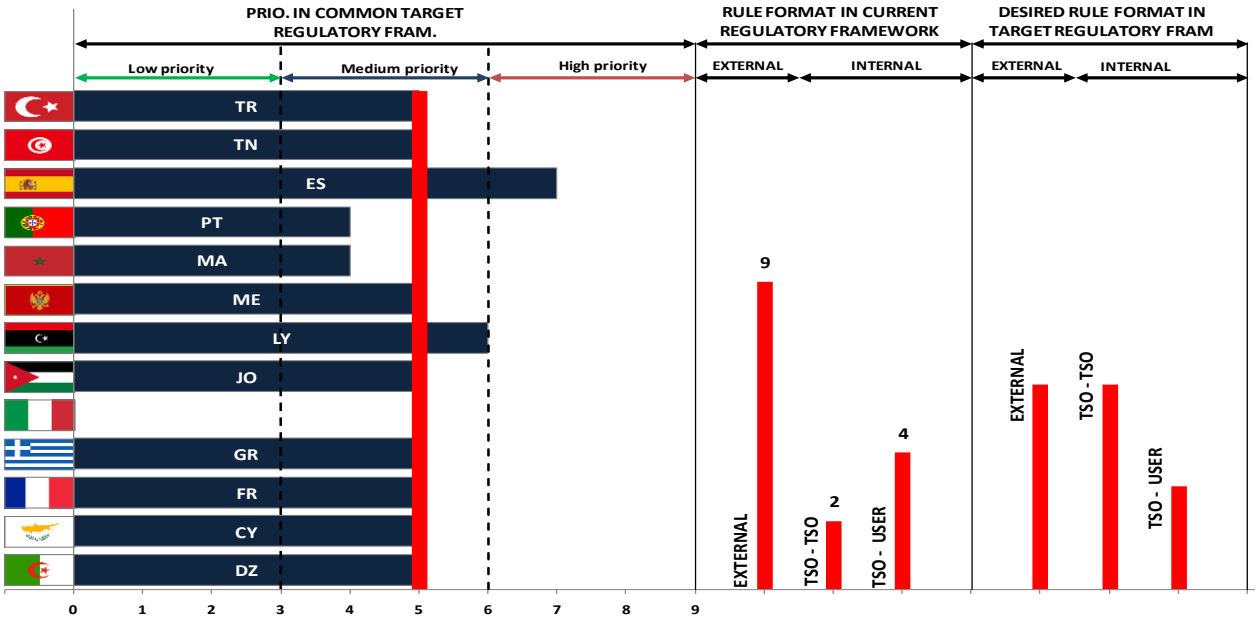
7E- Which main functions are required inside the multifunctional relays installed in the transmission grid?



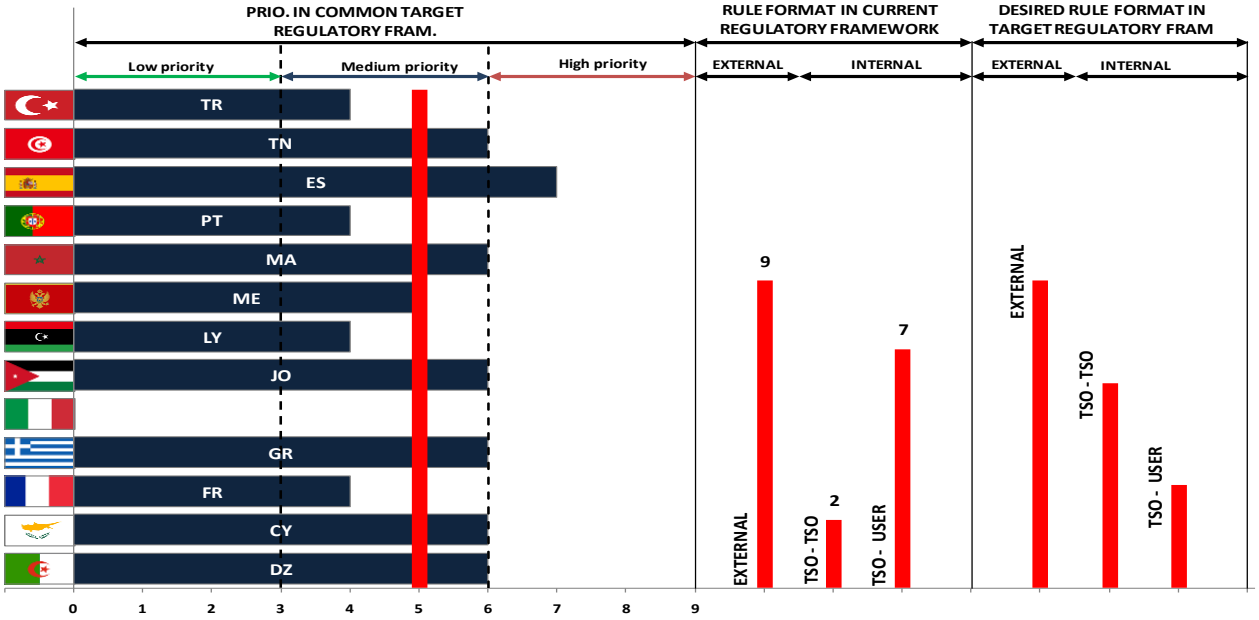
8A- Which global architecture and schemes are required for controllability and observability of non-transmission facilities connected to the transmission grid? (only direct communication user-TSO control centre; mandatory through intermediate control centres; possible through intermediate control centres; not specified)



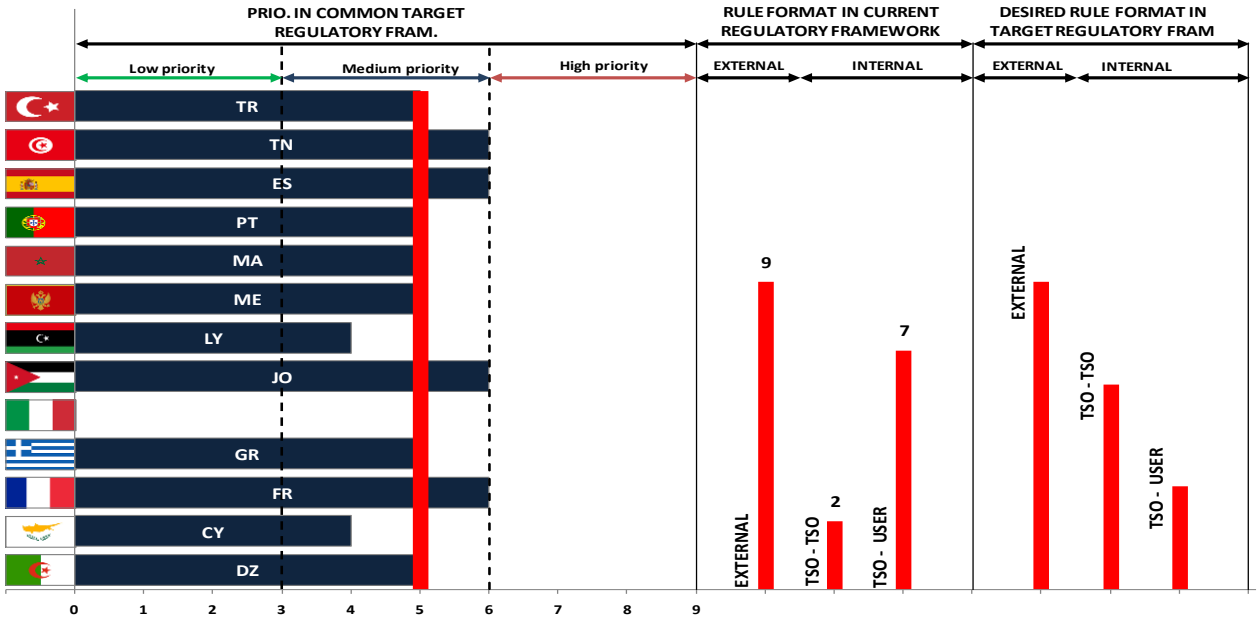
8B- Which non-transmission facilities are required to be observable by TSO control systems (real time monitoring at TSO control centre)? Specify limit in power or voltage



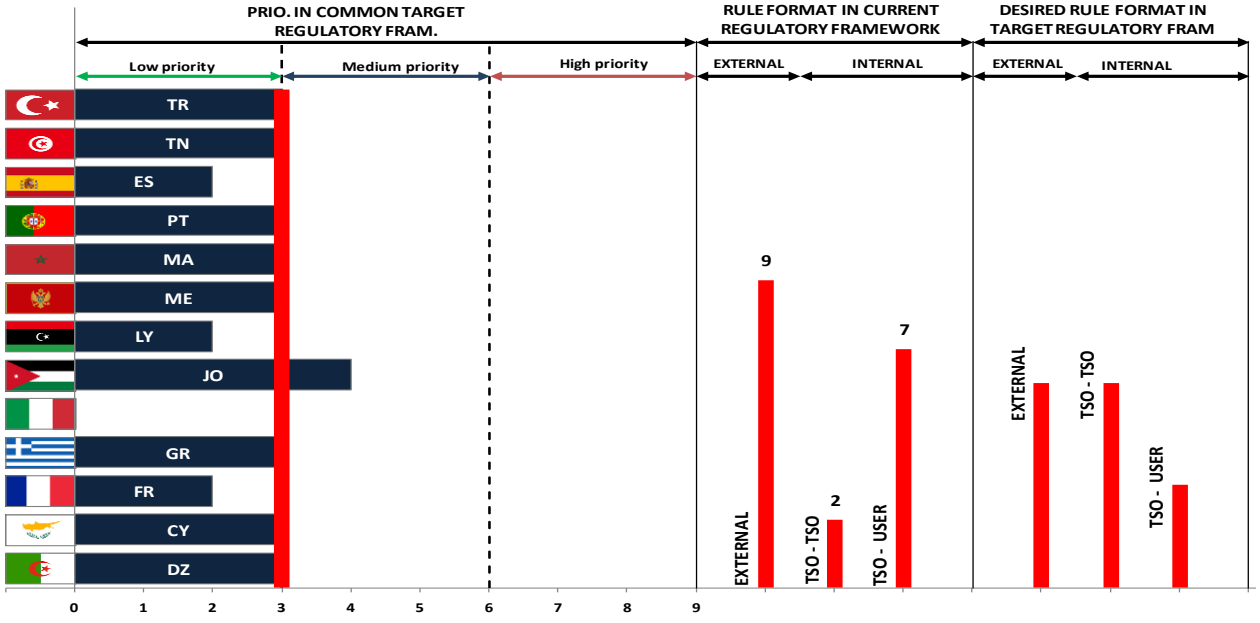
8C- Which magnitudes must be provided from non-transmission facilities to TSO control centre in real time?



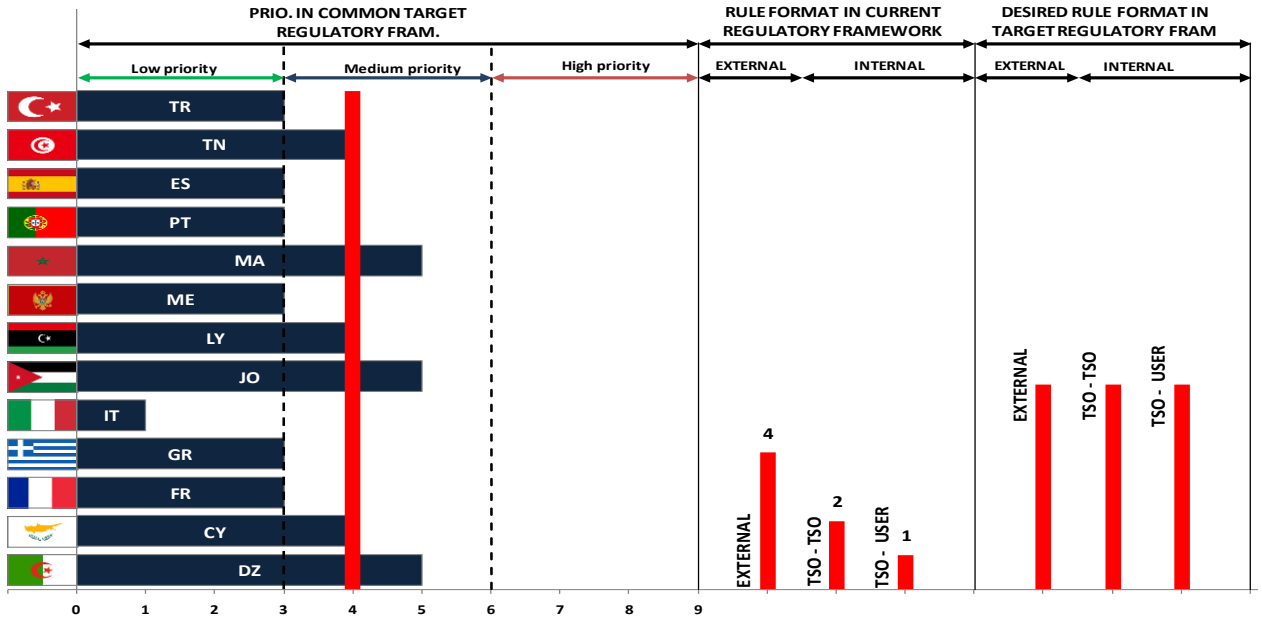
8D- Which non-transmission facilities are required to be controllable by TSO control systems? Specify limit in power or voltage



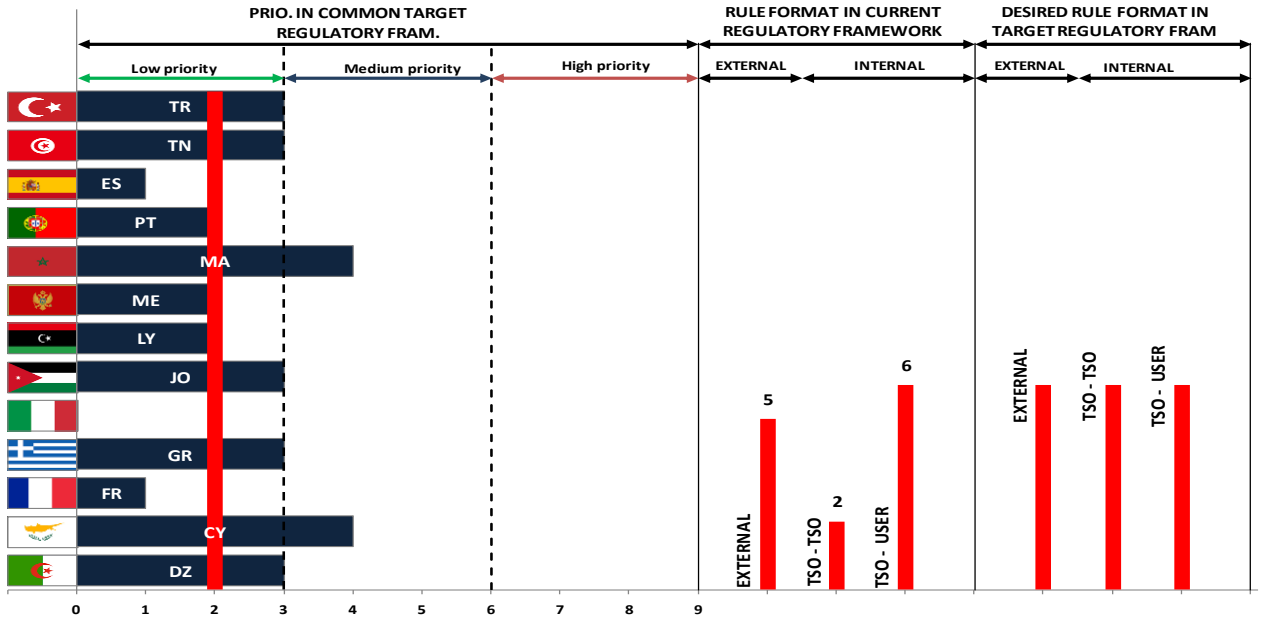
8E- Which of the following characteristics are required for the communication system?



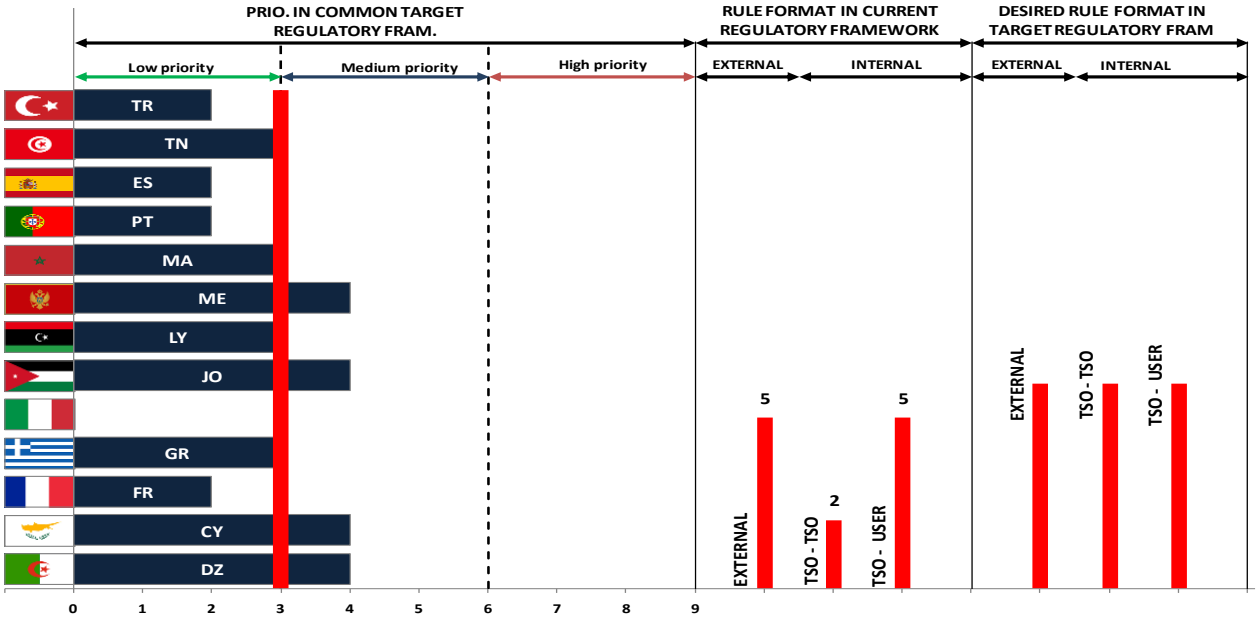
10A- Which normative standards are used as reference for power quality regulation in the transmission grid? (e.g., EN 50160, IEC 61000...)



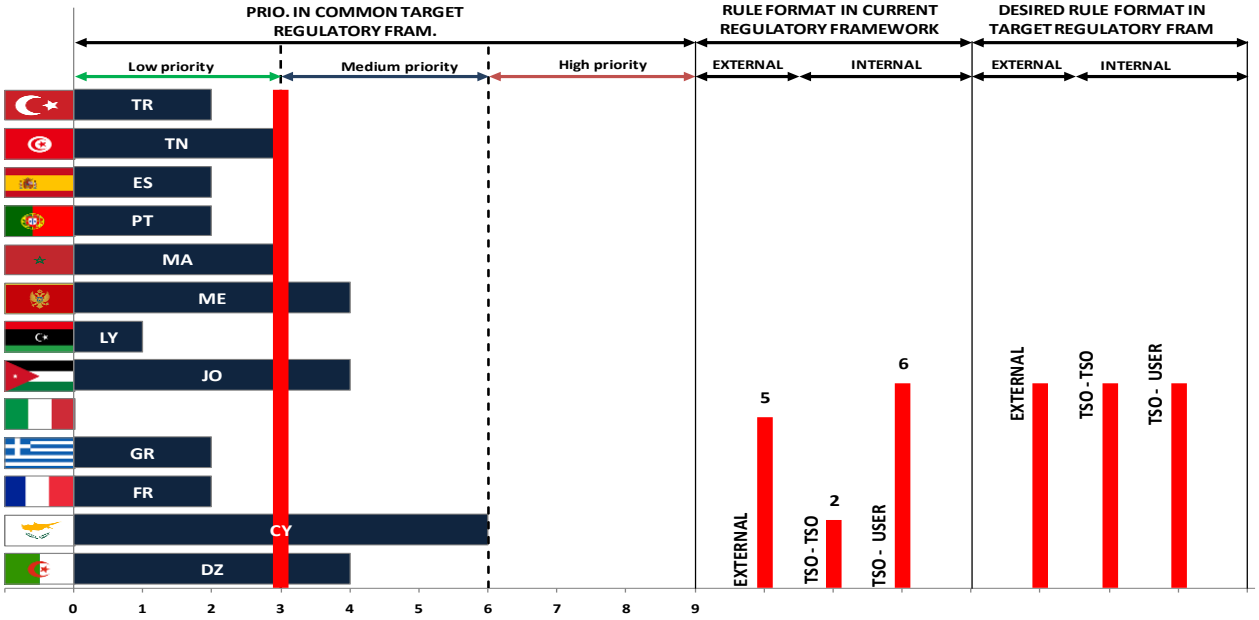
10B- VOLTAGE DIPS. What are the limit total number of voltages dips per node in your system? (separate per voltage level if needed)



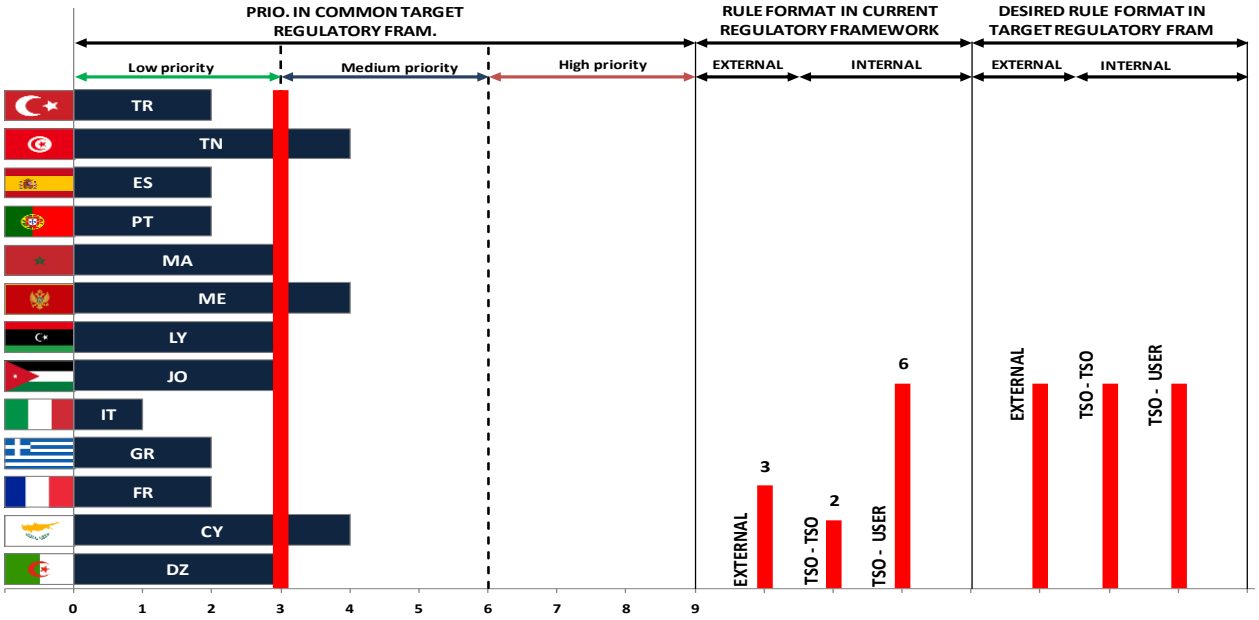
10C- HARMONIC DISTORTION. Which is the Total Harmonic Distortion (THD) factor in your system?



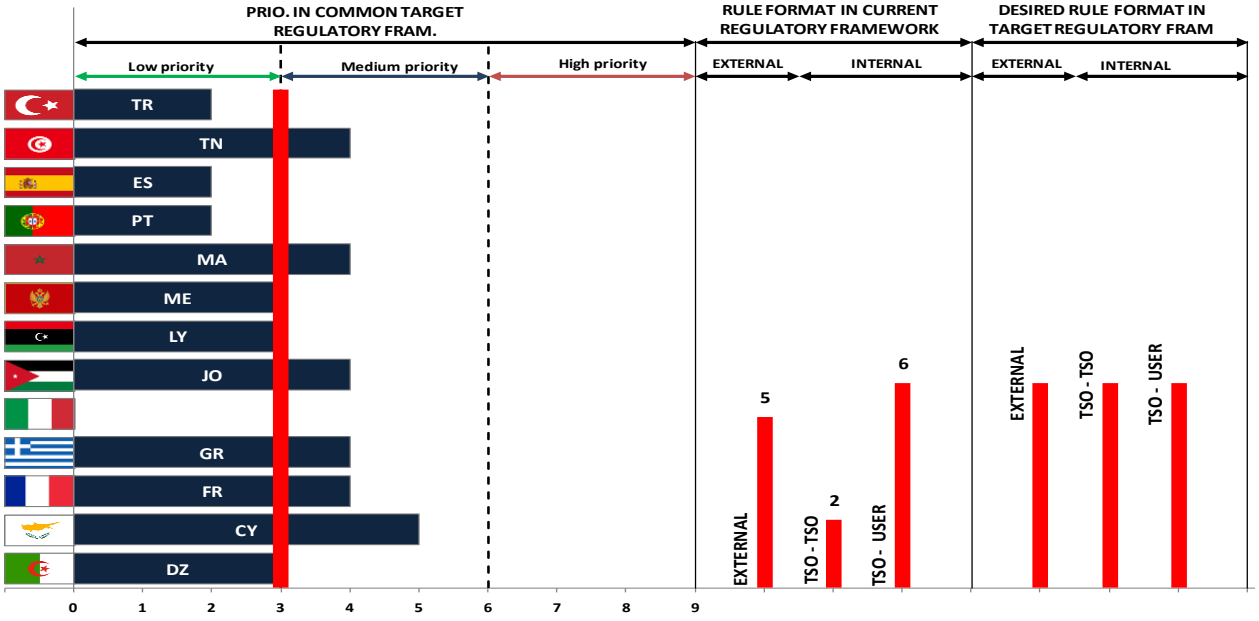
10D- FLICKER. Which are the flicker limit values in your system? Please include planning/emission limits.



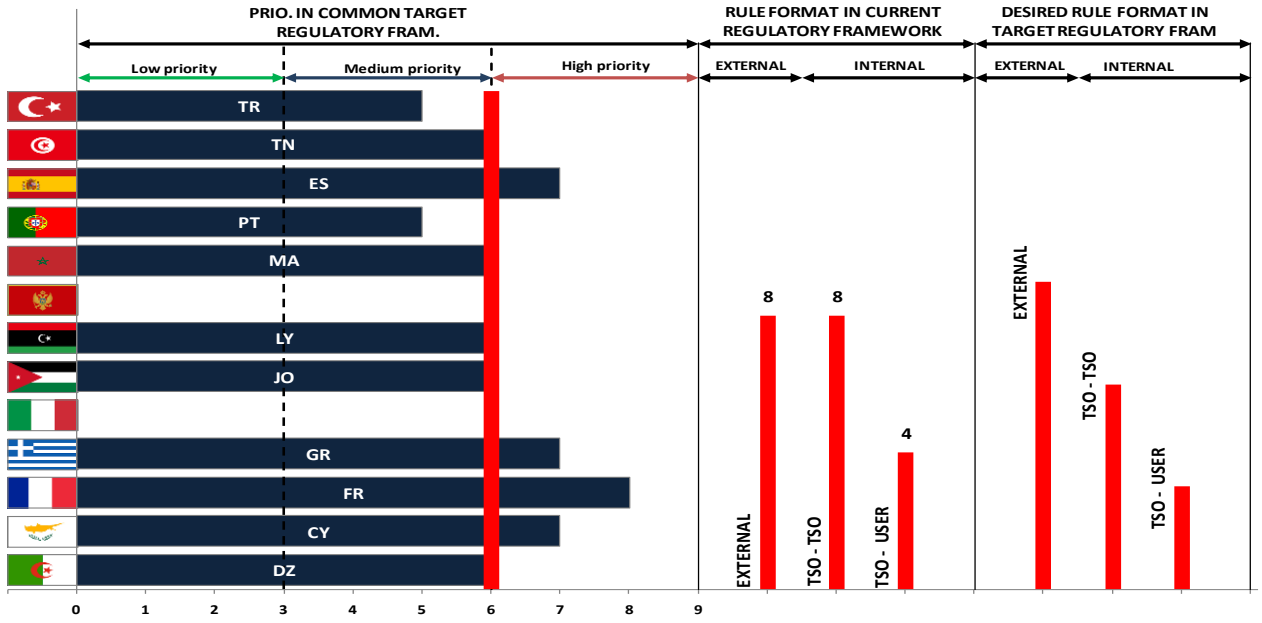
10E- UNBALANCE. Which are the reference levels for voltage unbalances in your system?



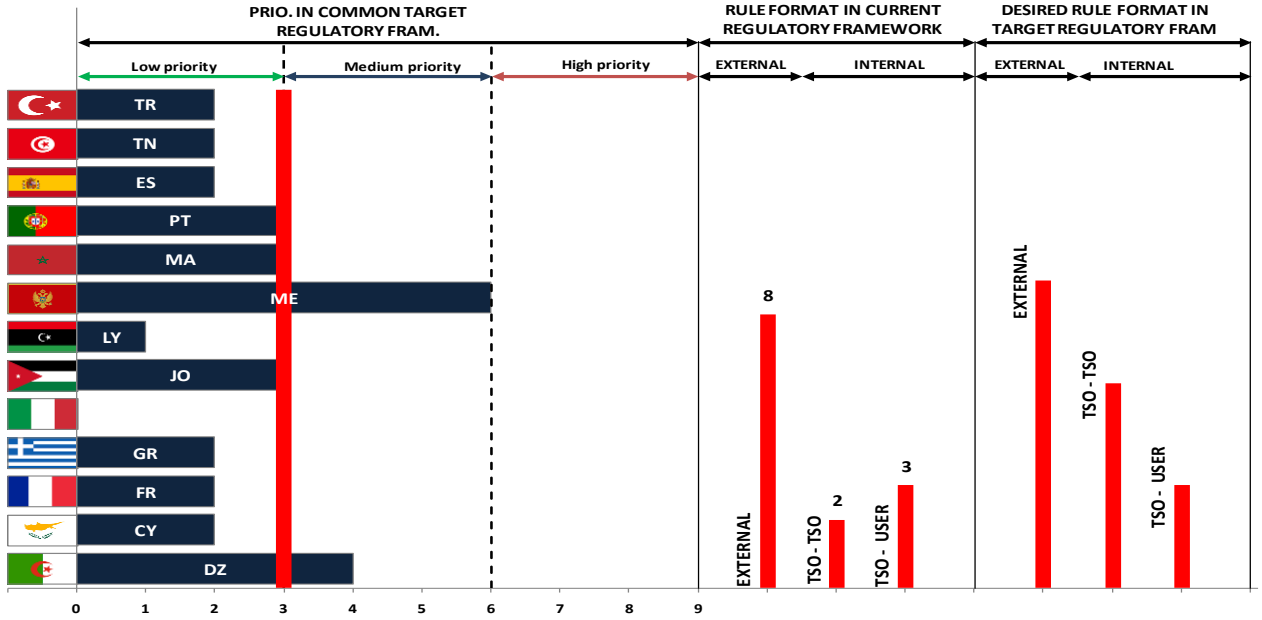
10F- OVERVOLTAGE. Which are the reference levels for transient overvoltage in your system?



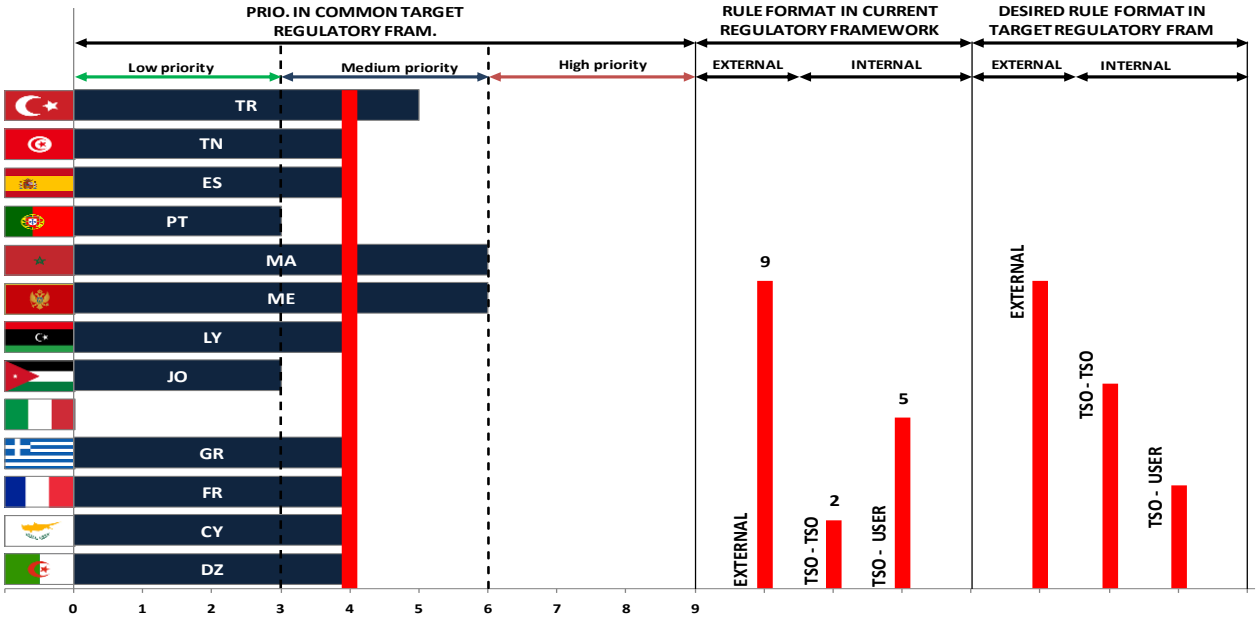
12A- Do you have demand disconnection schemes (low frequency and/or low voltage) in your system?



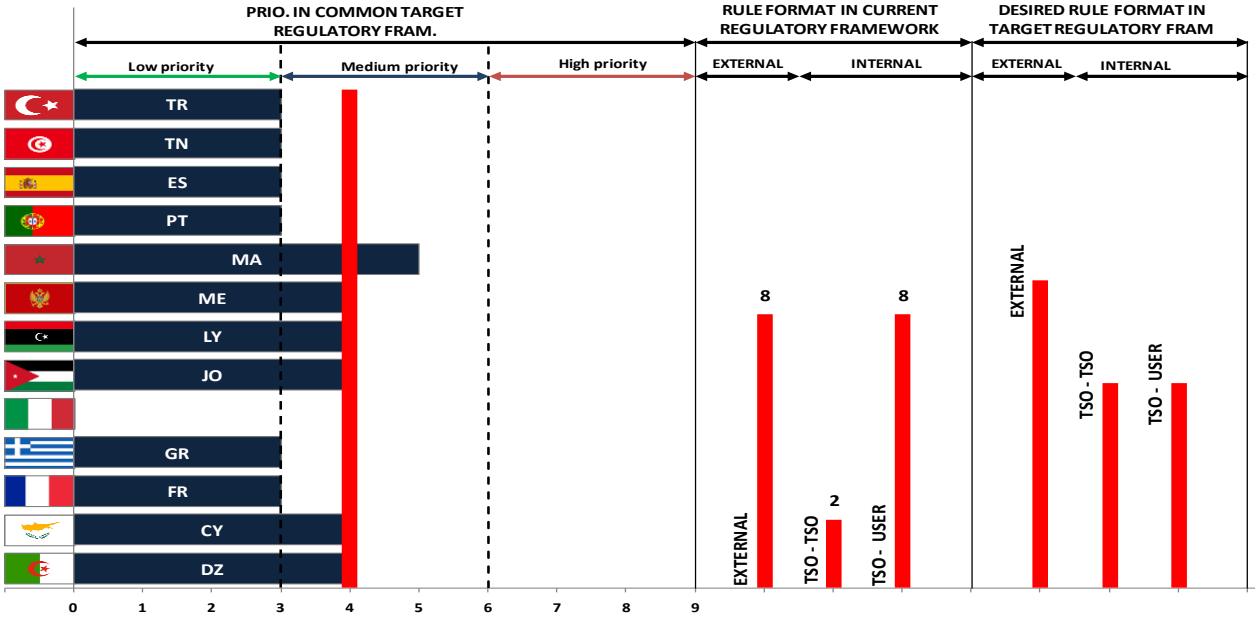
13A- Which technologies need to have Black Start Capability?



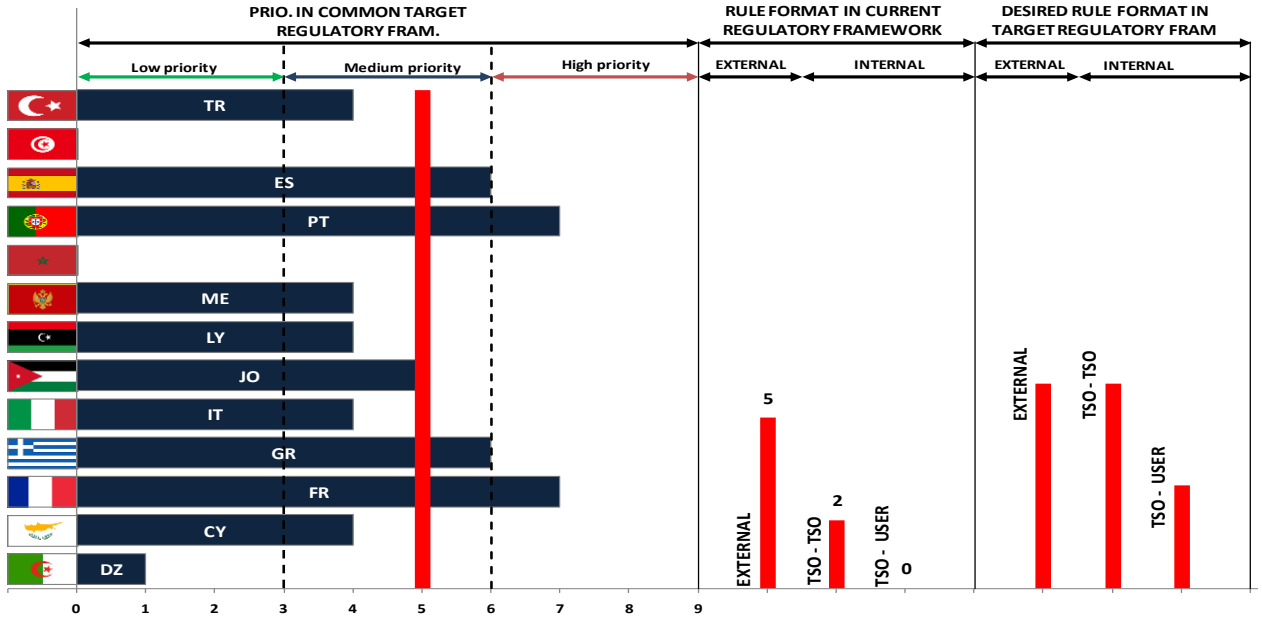
13B- Which technologies need to have Island Operation Capability?



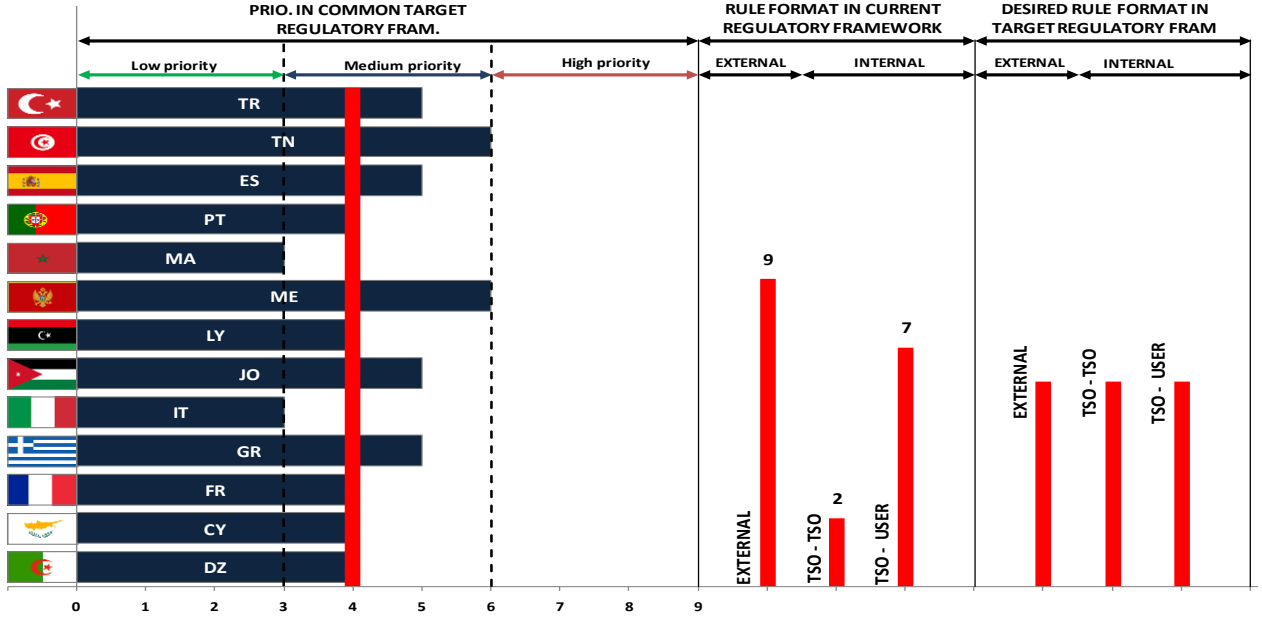
14B- Do you use demand side response services in your system? If yes, specify.



15A- Do you have HVDC specific requirements or criteria in your system? If yes, specify.

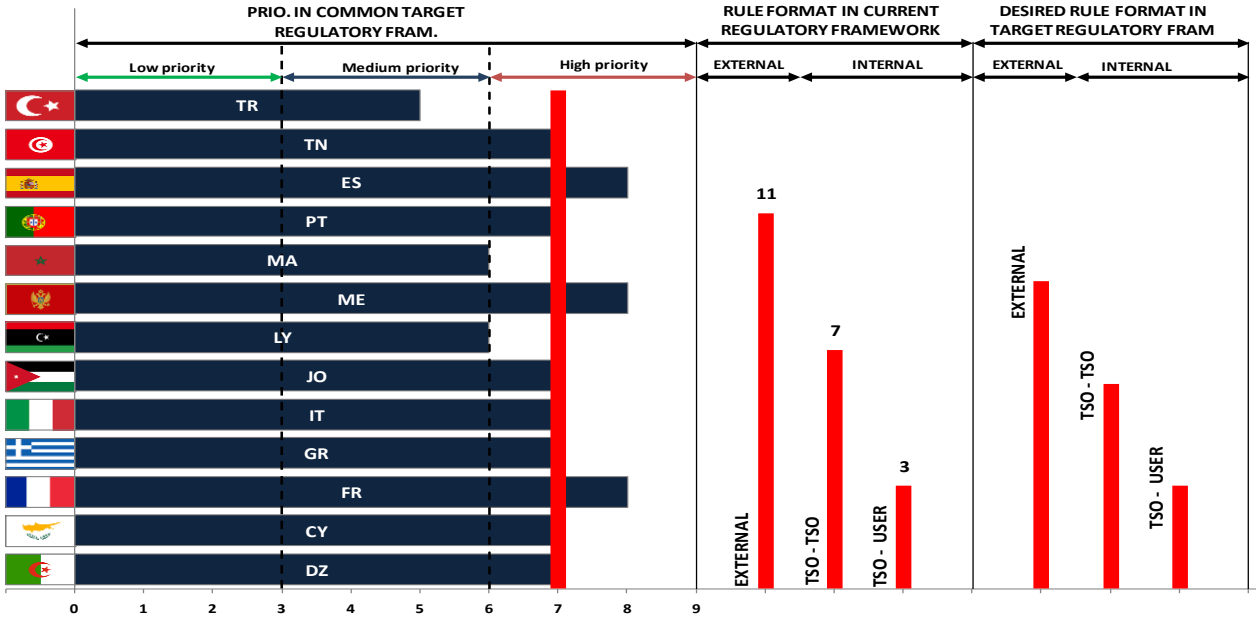


16A- What compliance scheme or schemes is used in your system?

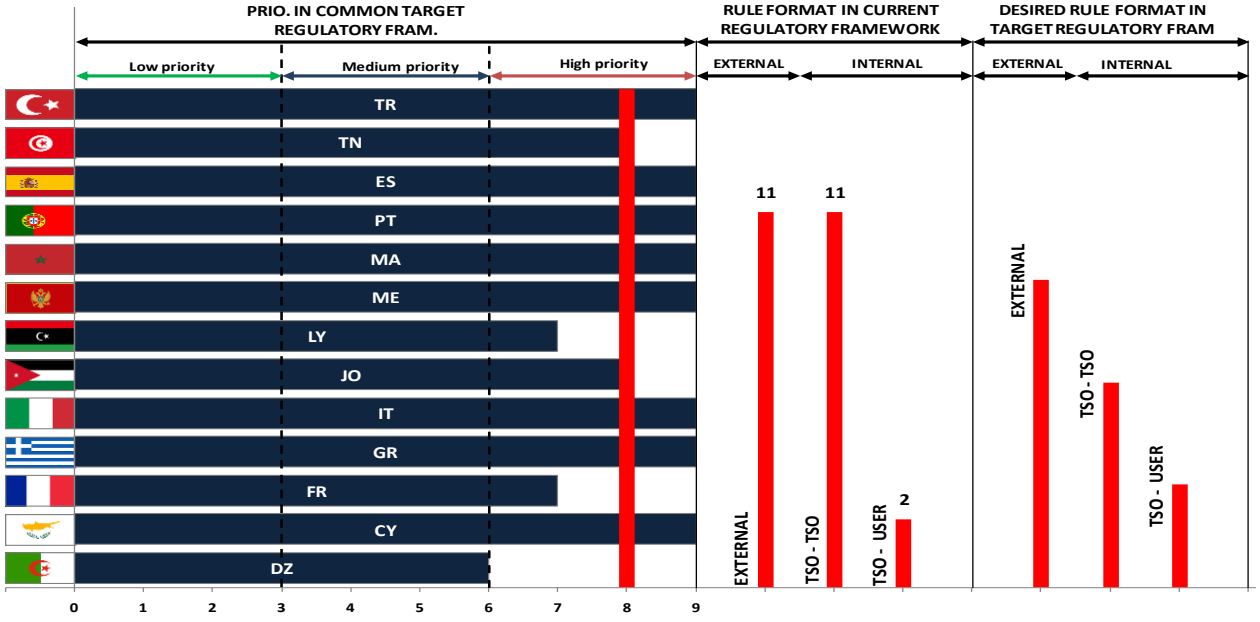


9.3 Operation

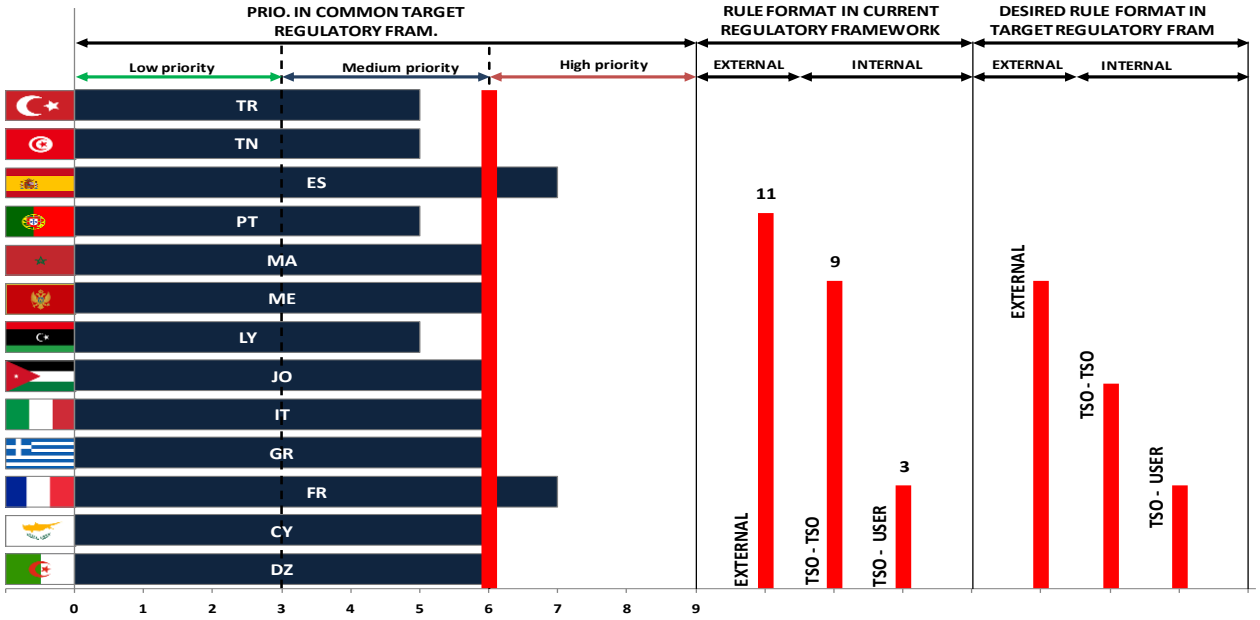
1A. Classification of system states



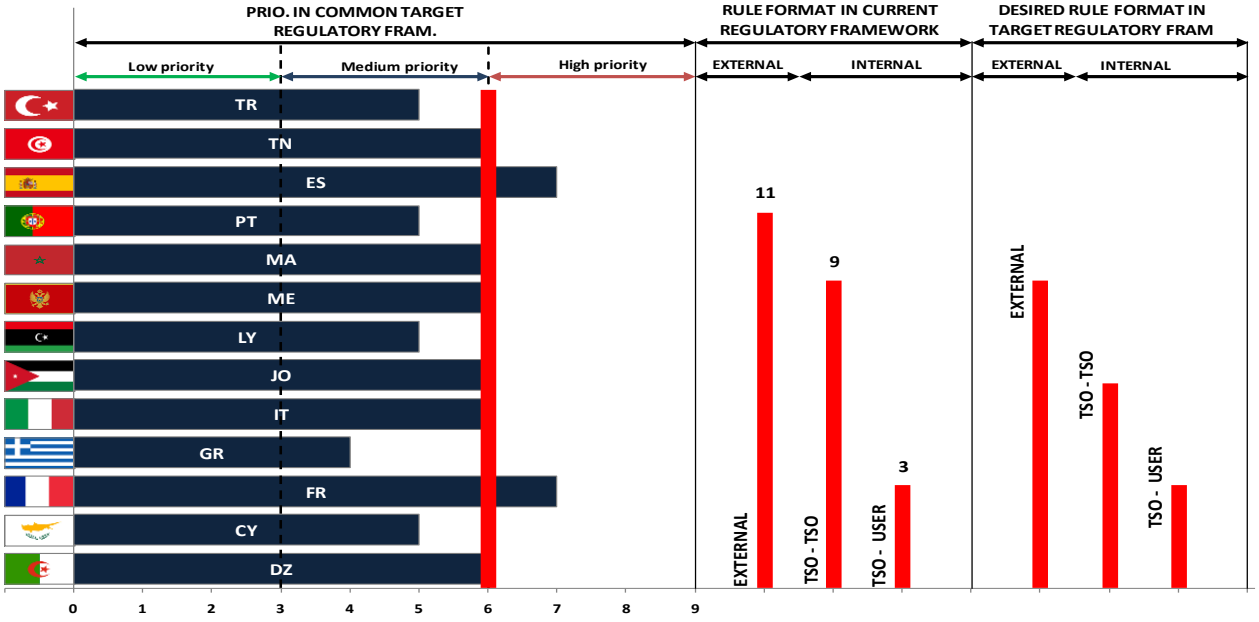
2A. Frequency ranges (quality parameters) in the different system states



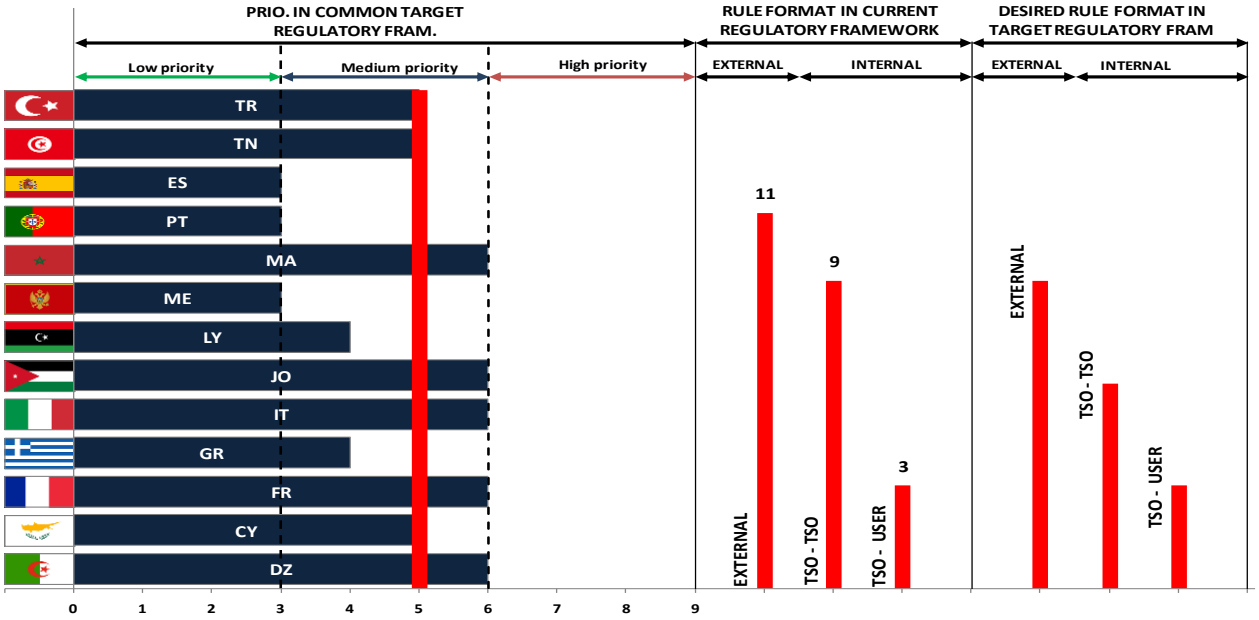
2B1 Voltage ranges (for unlimited operation) in normal conditions



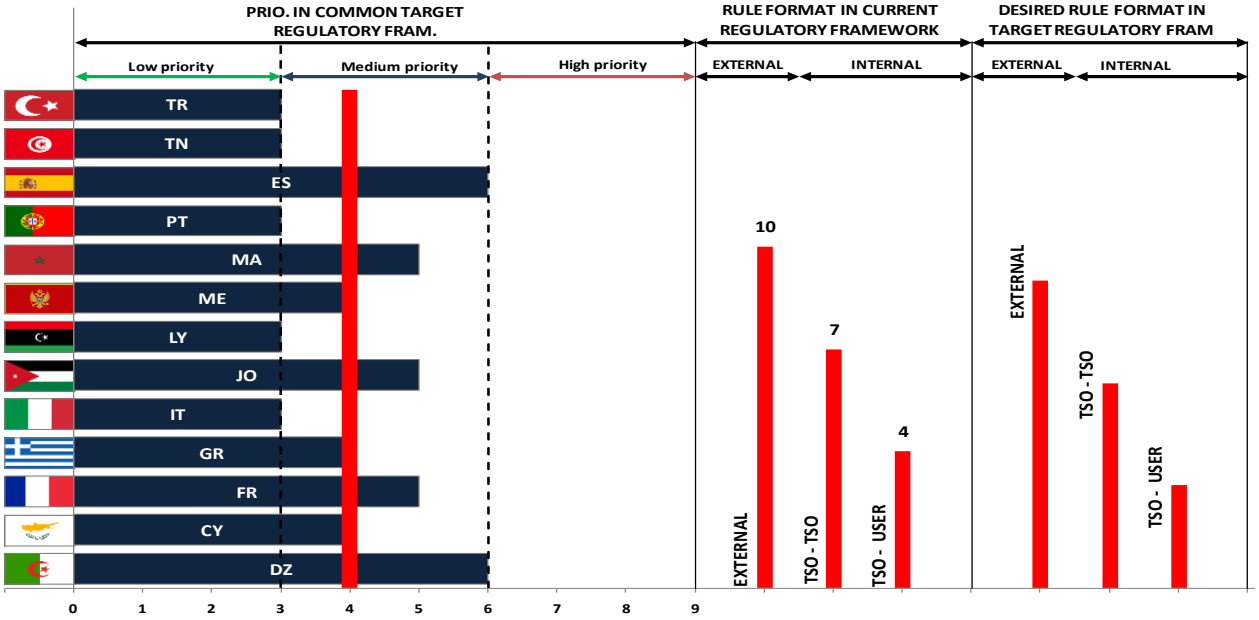
2B2. Voltage ranges (for unlimited operation) in extraordinary conditions



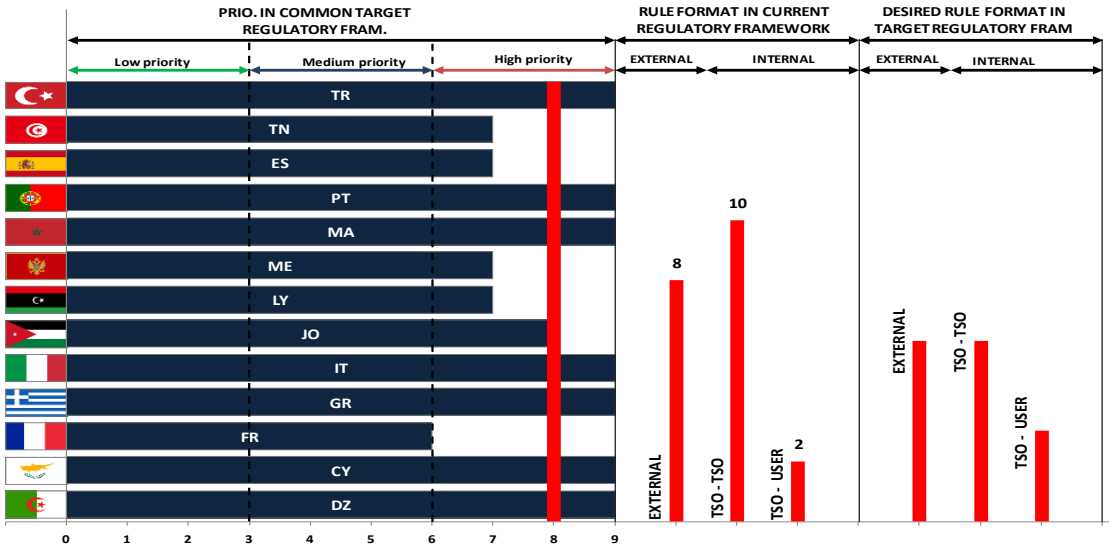
2C. Voltage ranges in international interconnections



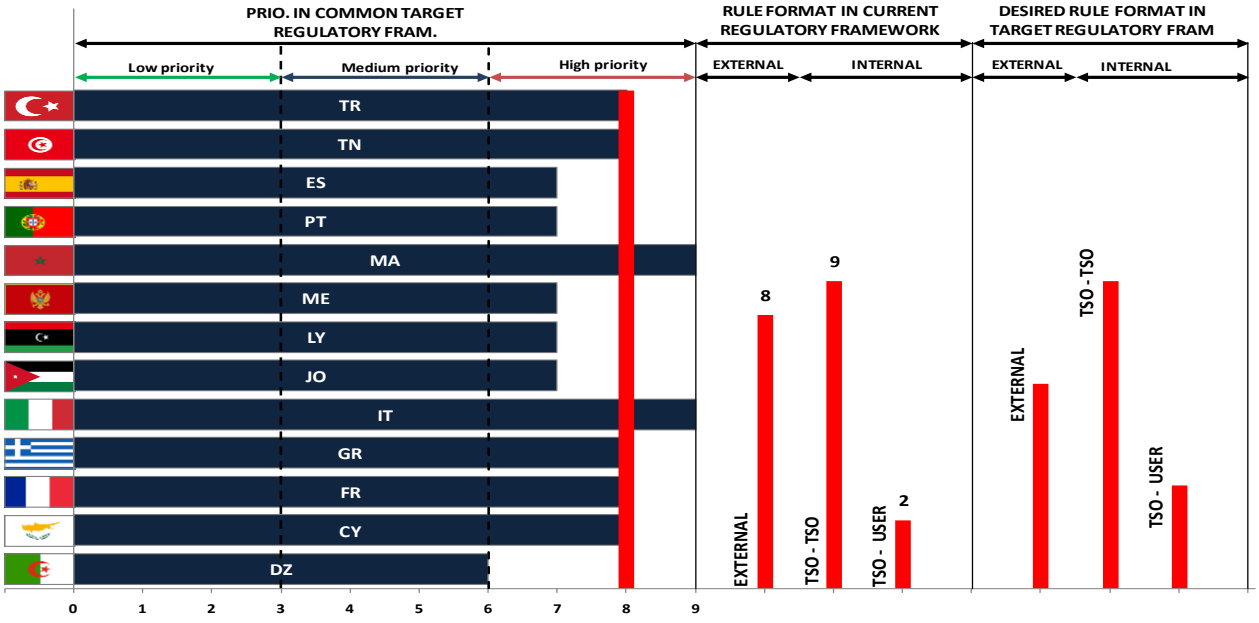
2D. Reactive power management measures



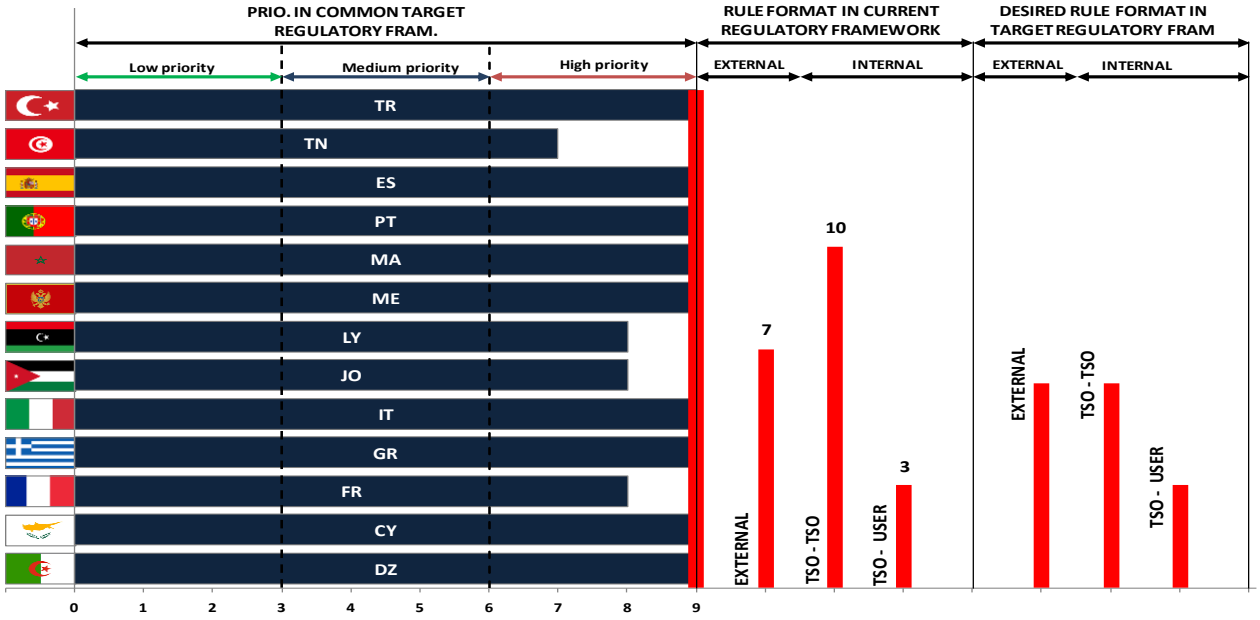
2E. Specific reactive power management measures in the international interconnections



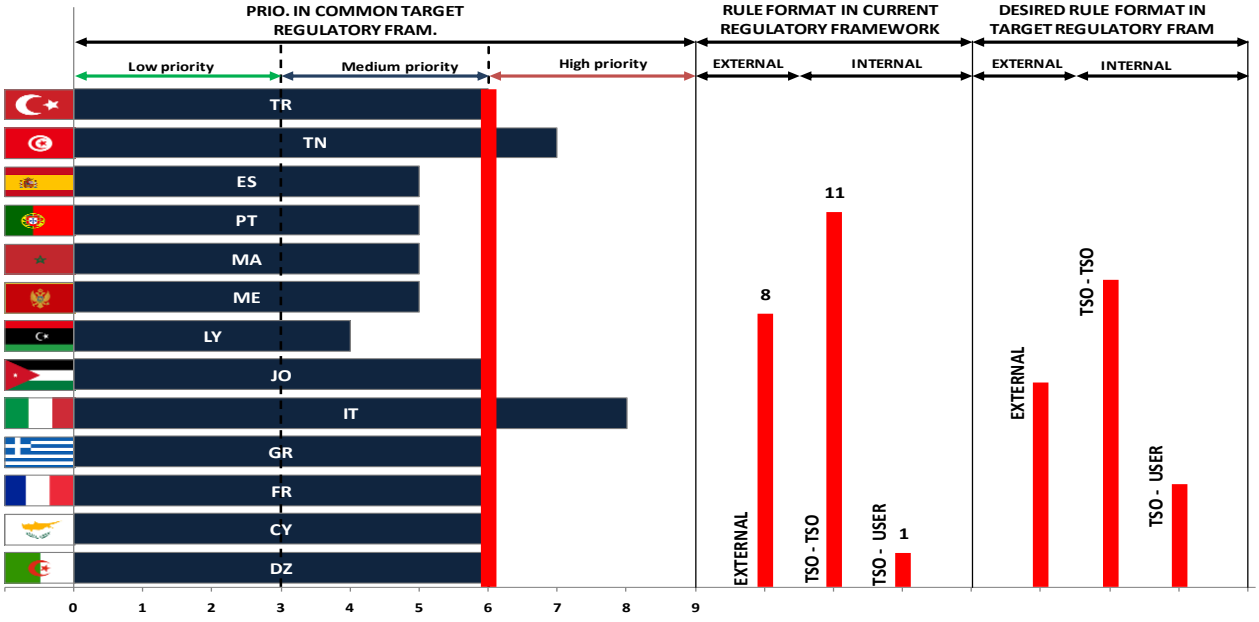
2G. System protection coordination criteria in interconnection lines



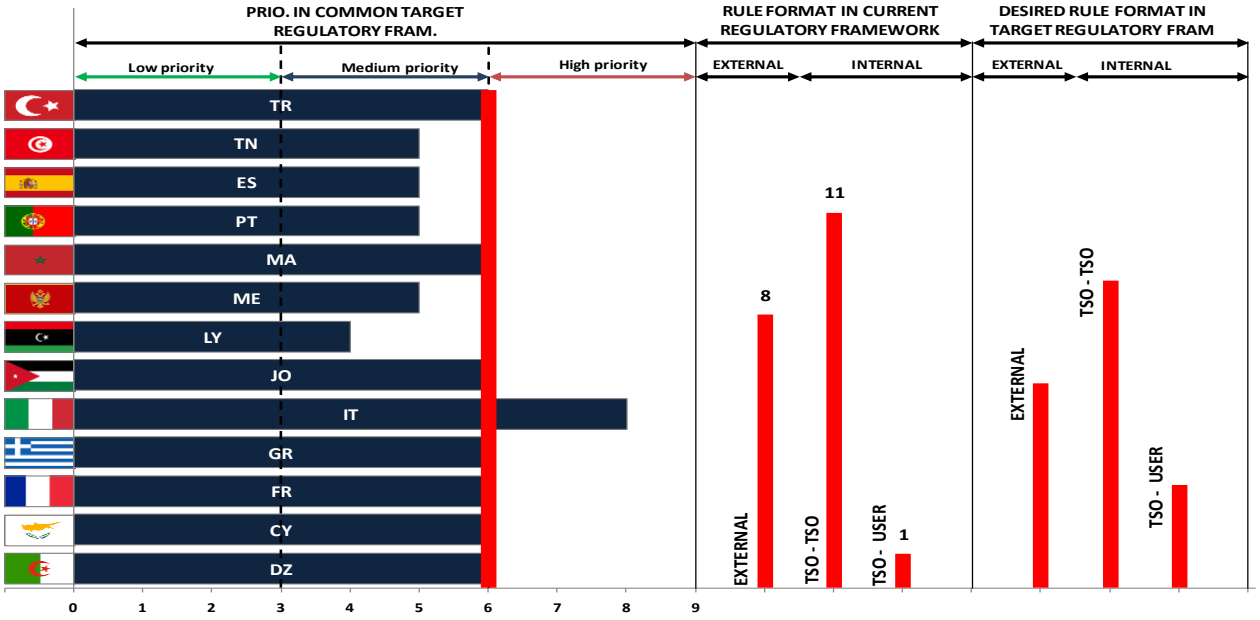
3D. List of real time data to exchange with other TSOs



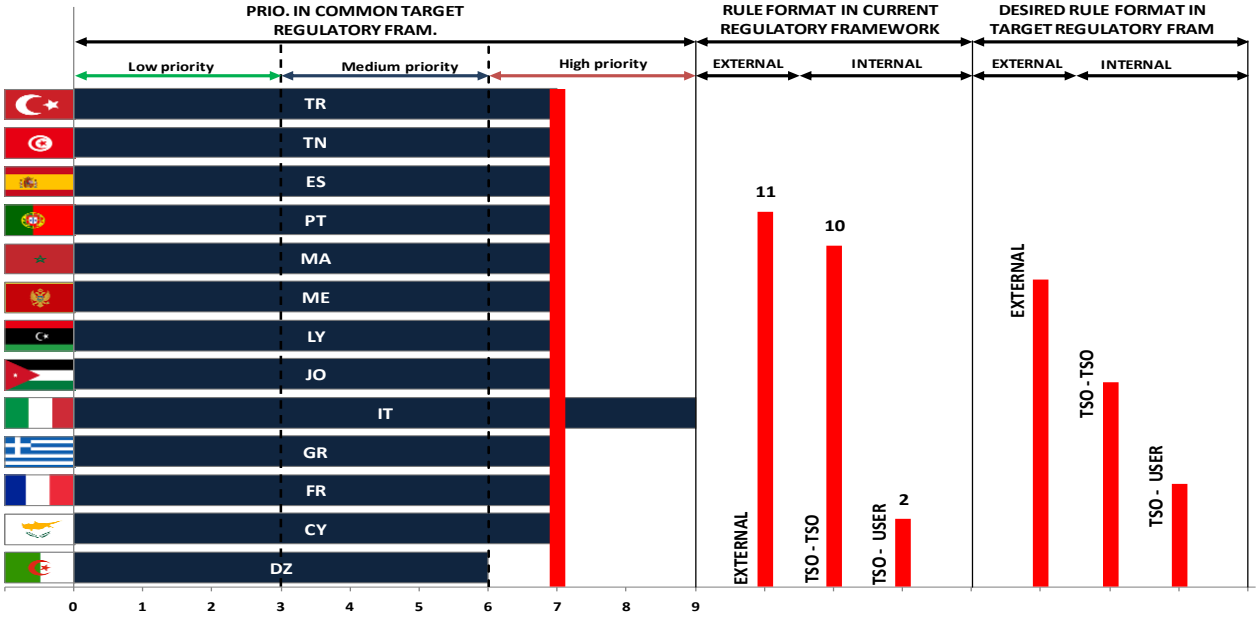
3E. List of scheduled data to exchange with other TSOs



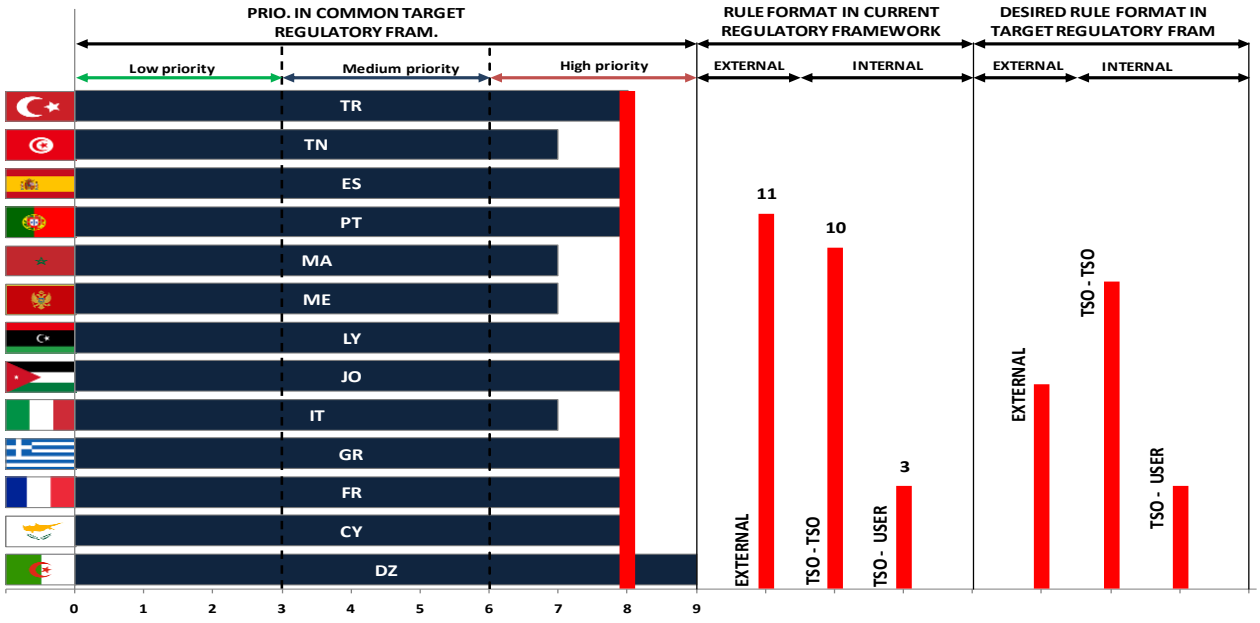
3F. List of structural data to exchange with other TSOs



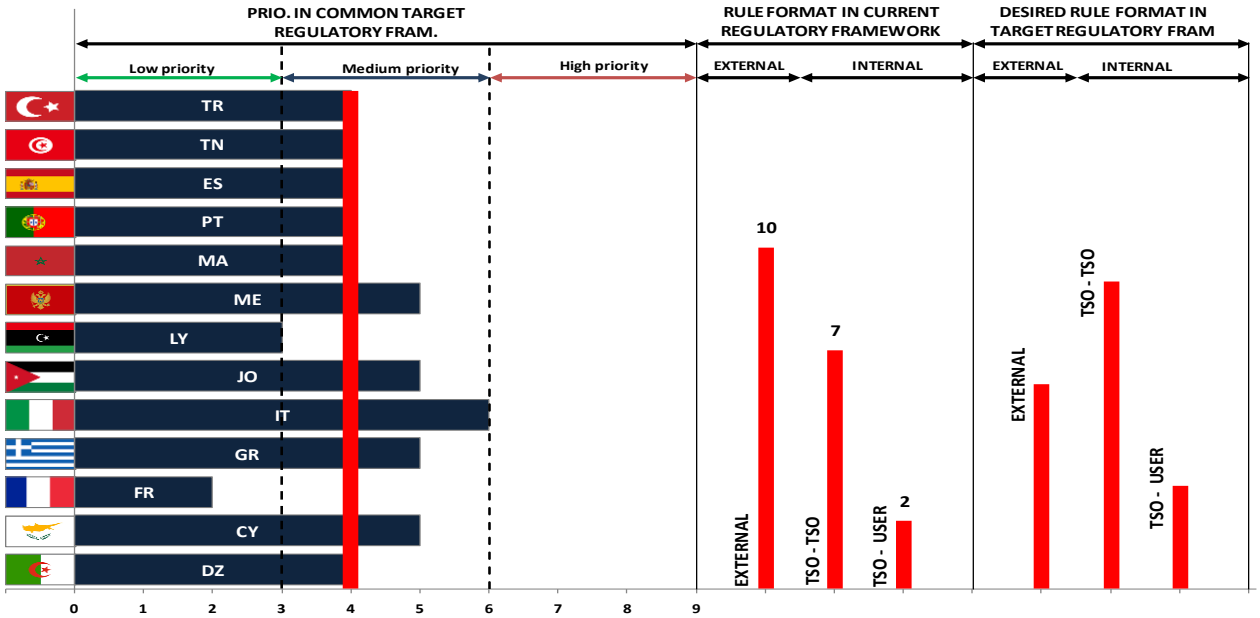
4A1. Contingencies considered



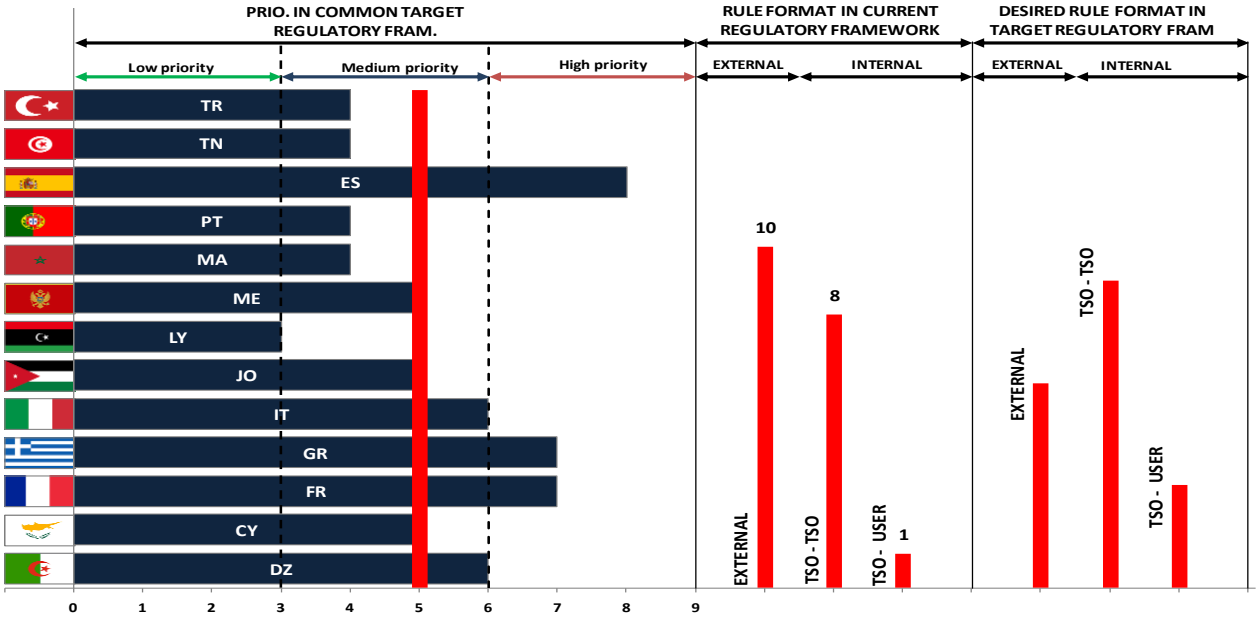
4A2. Contingency list (both internal - in national power system - and external - in neighbouring power systems -)



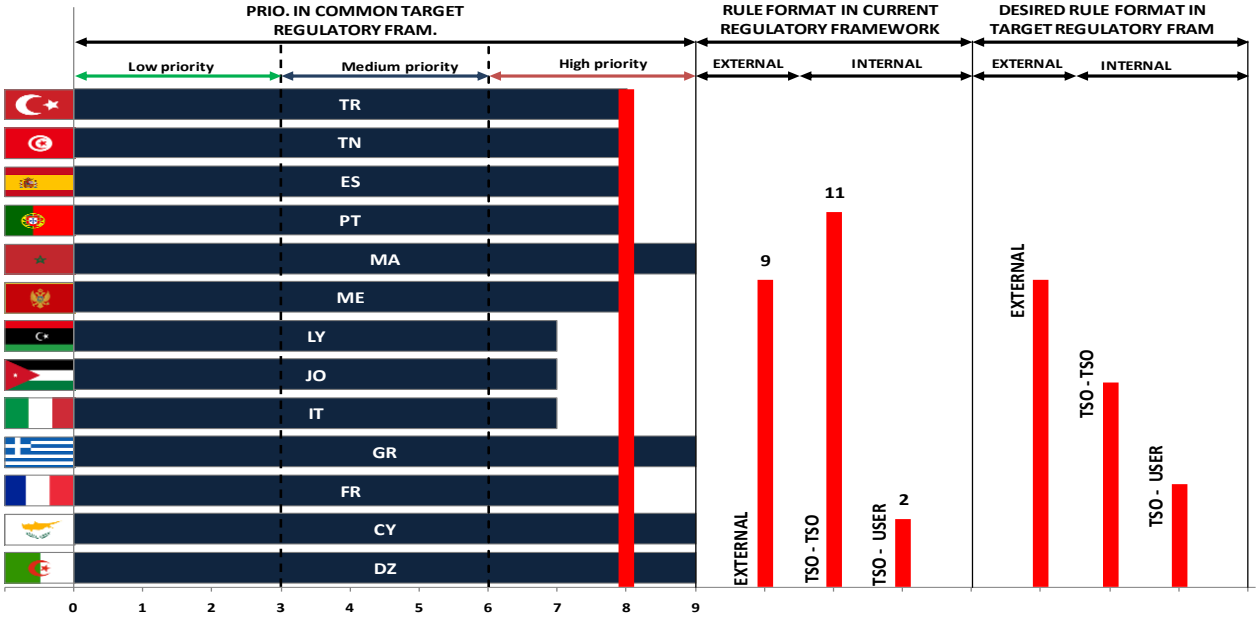
4B1. Operational security limits



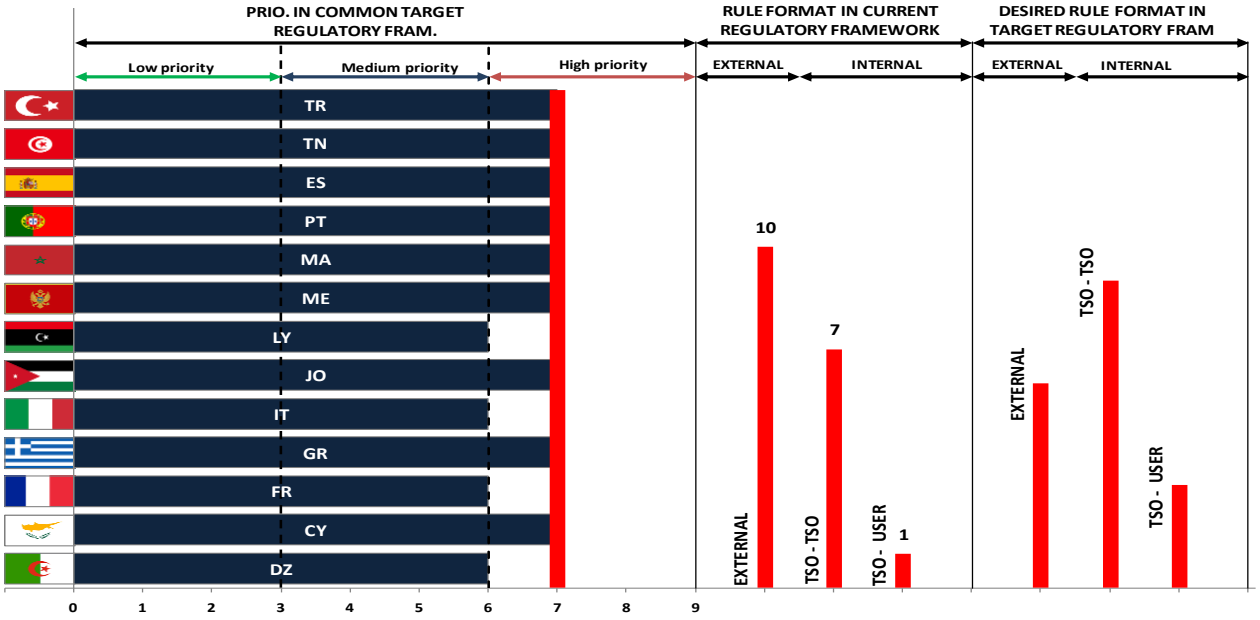
4B2. Operational security limits in the interconnection lines



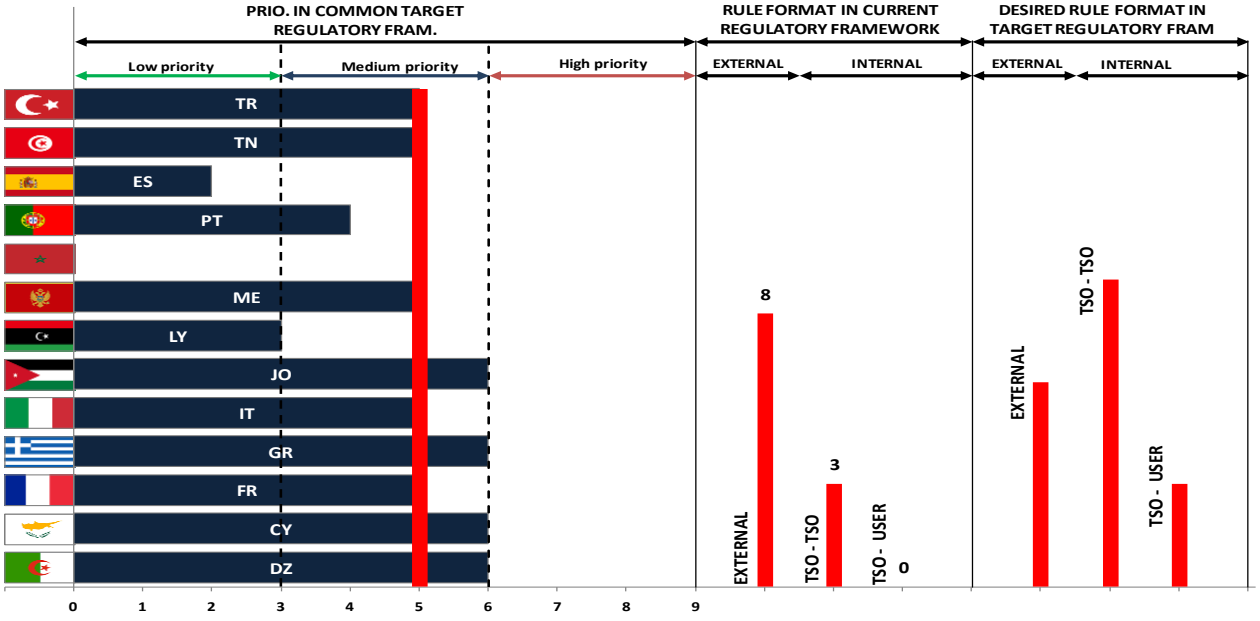
3B. List of joint remedial actions agreed between TSOs after a contingency



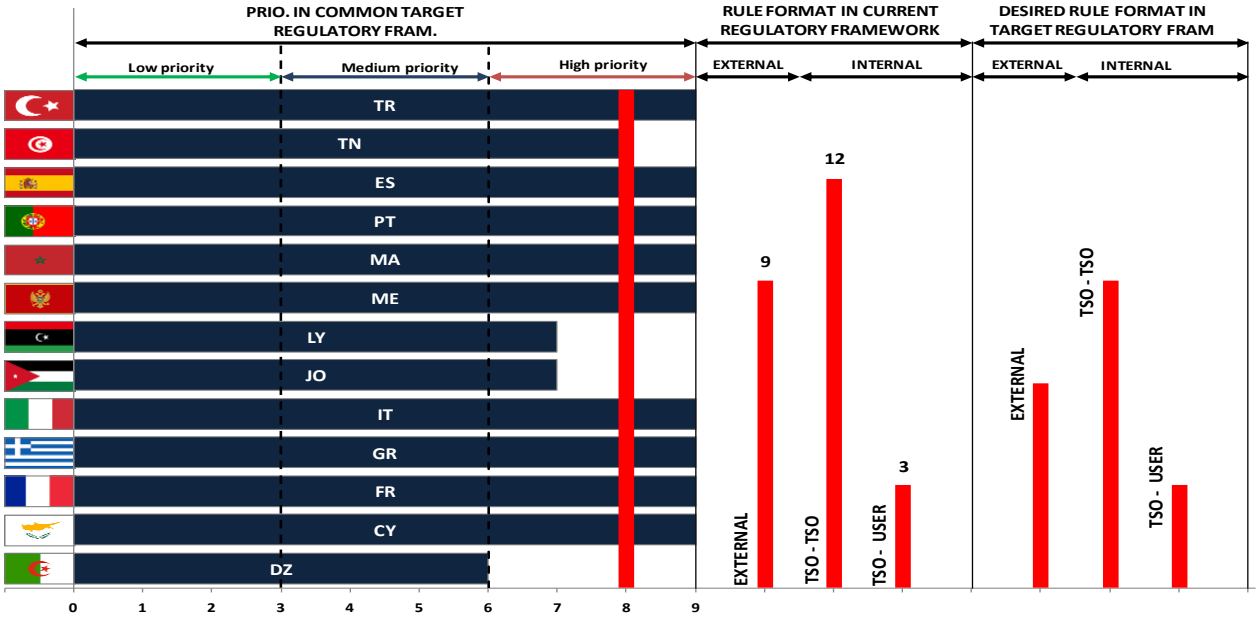
4C. Periodicity of state estimation calculations ("snapshots")



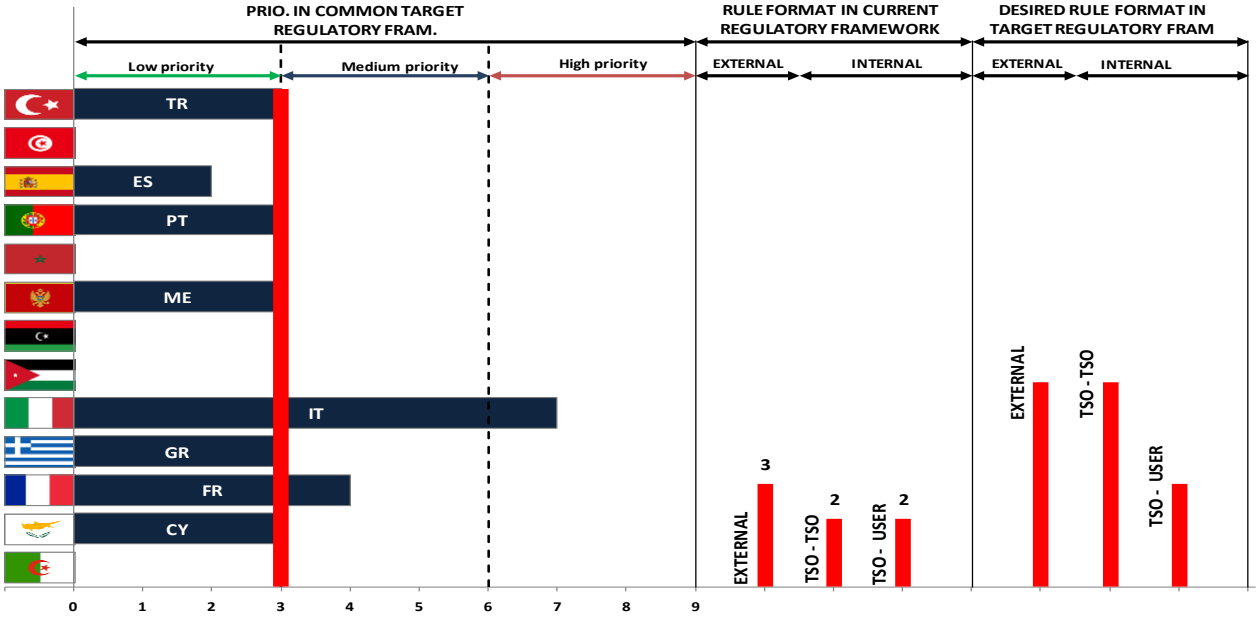
5A. Performance of dynamic stability studies



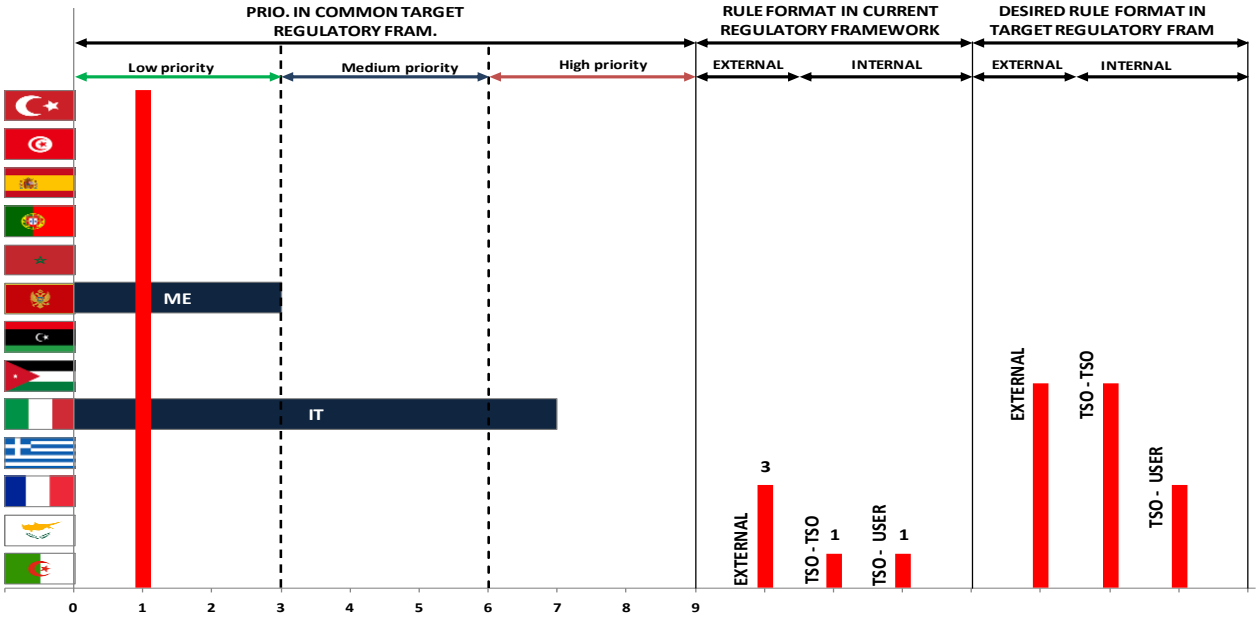
6A. Management of international exchange programs between TSOs



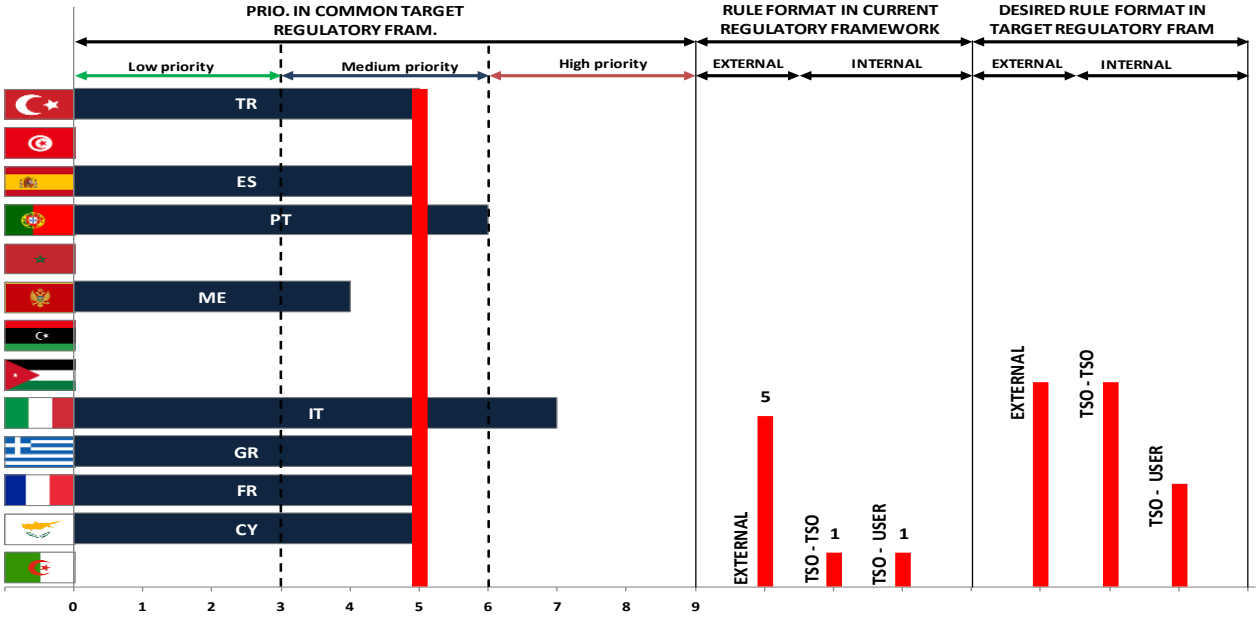
7A. Need of operational security limits for HVDC facilities



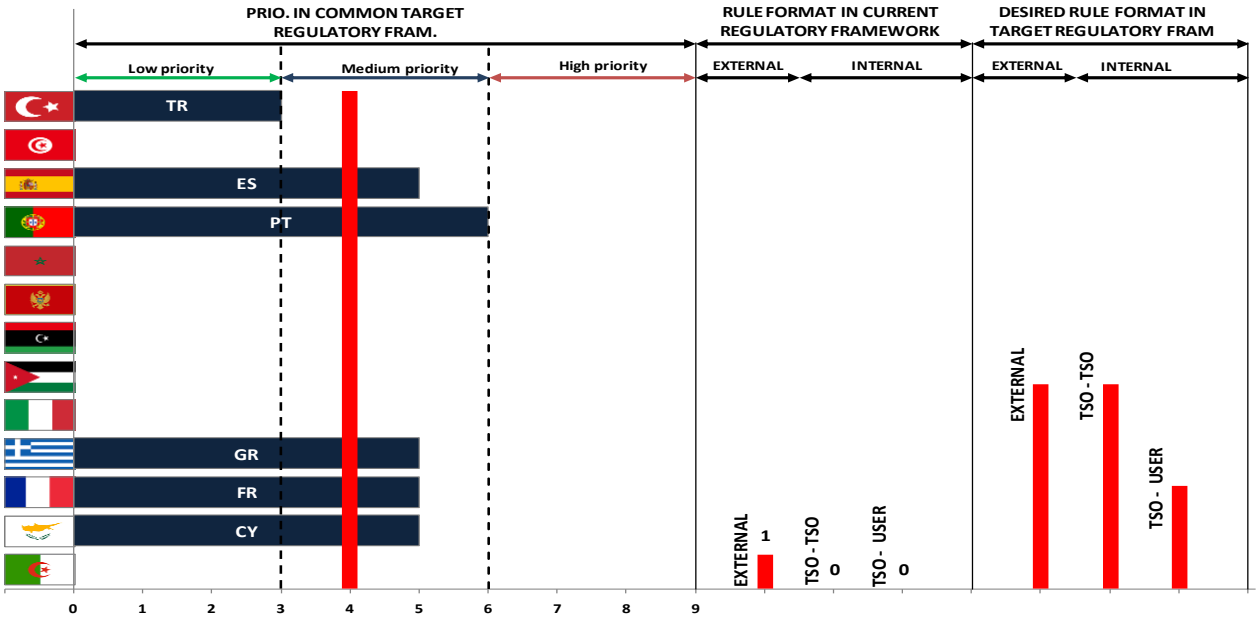
7B. HDVC technology



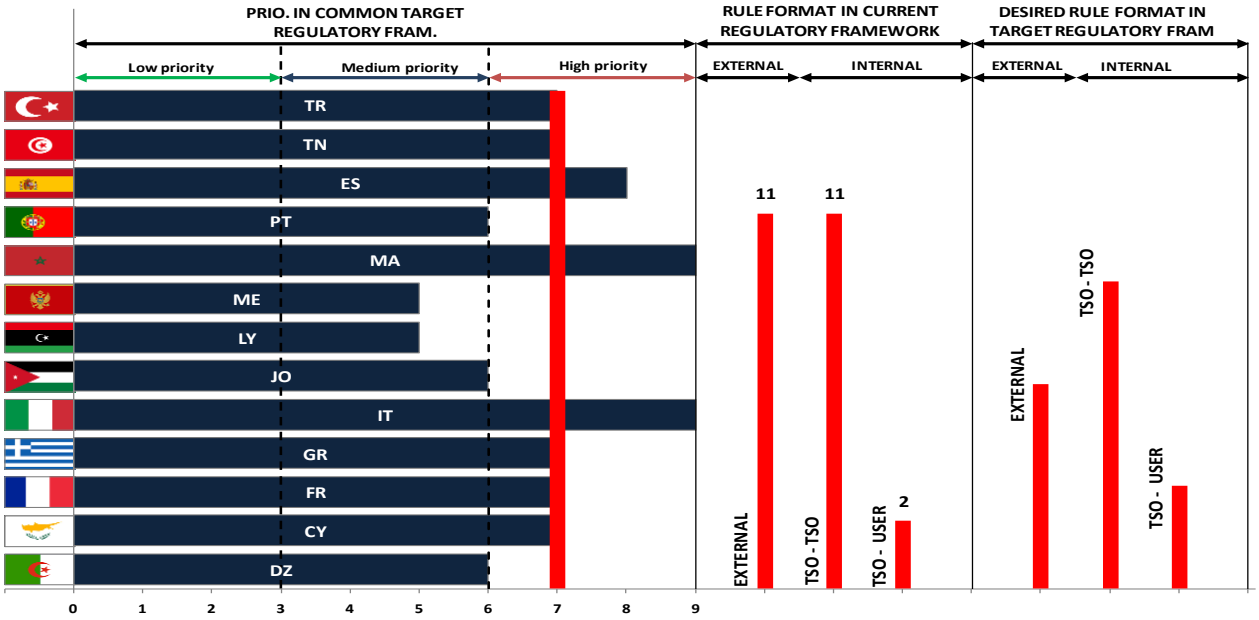
7C. Based on the experience in operation of HVDC interconnection lines, should HVDC operation practices be harmonized?



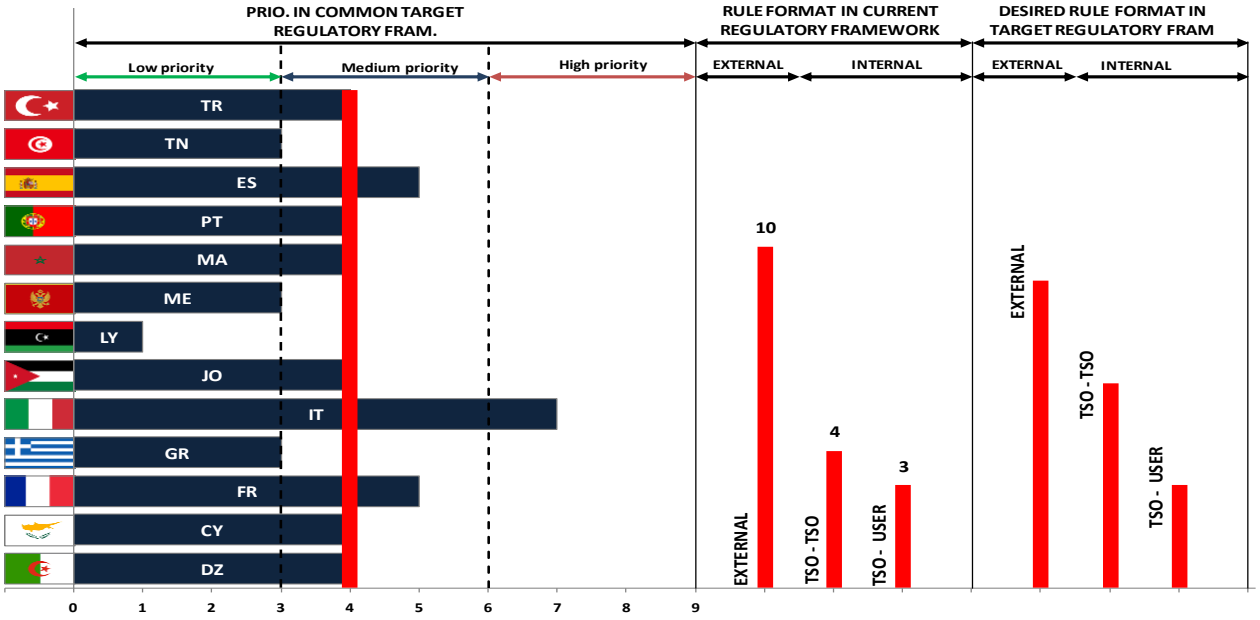
7D. Should operation practices be harmonized if HVDC interconnection lines are operated synchronously in parallel with AC interconnection lines?



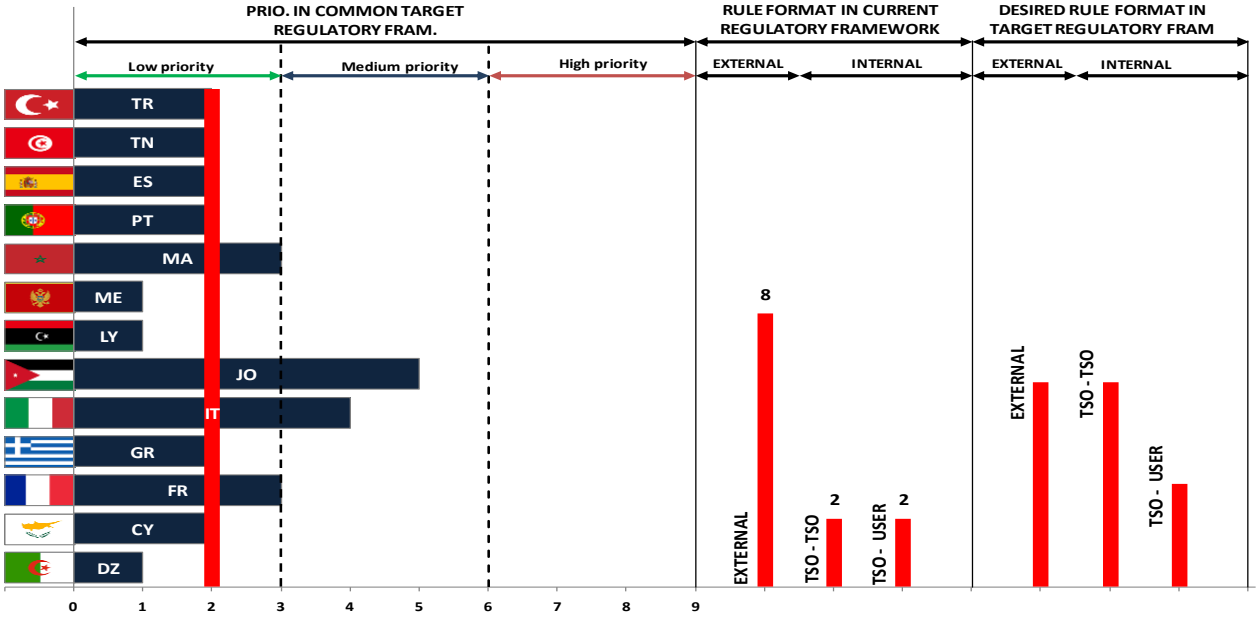
9A. Criteria and procedure for outage coordination (corrective or predictive maintenance) when affects NTC?



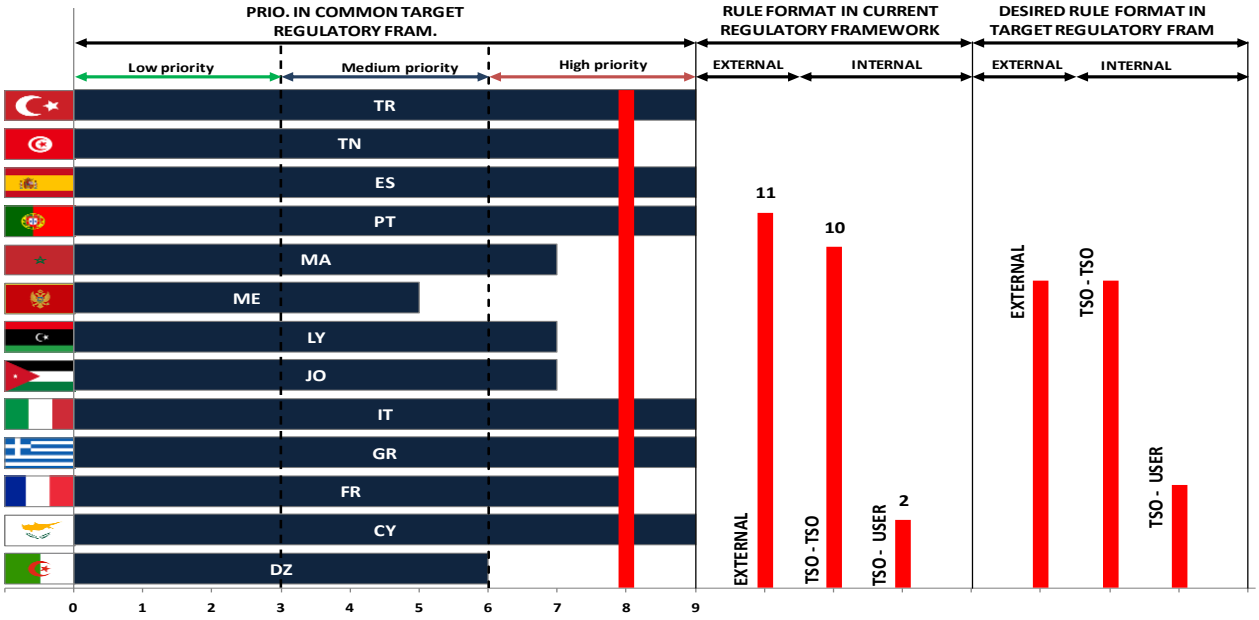
11A1. Frequency Containment Reserve (FCR). Provision of FCR



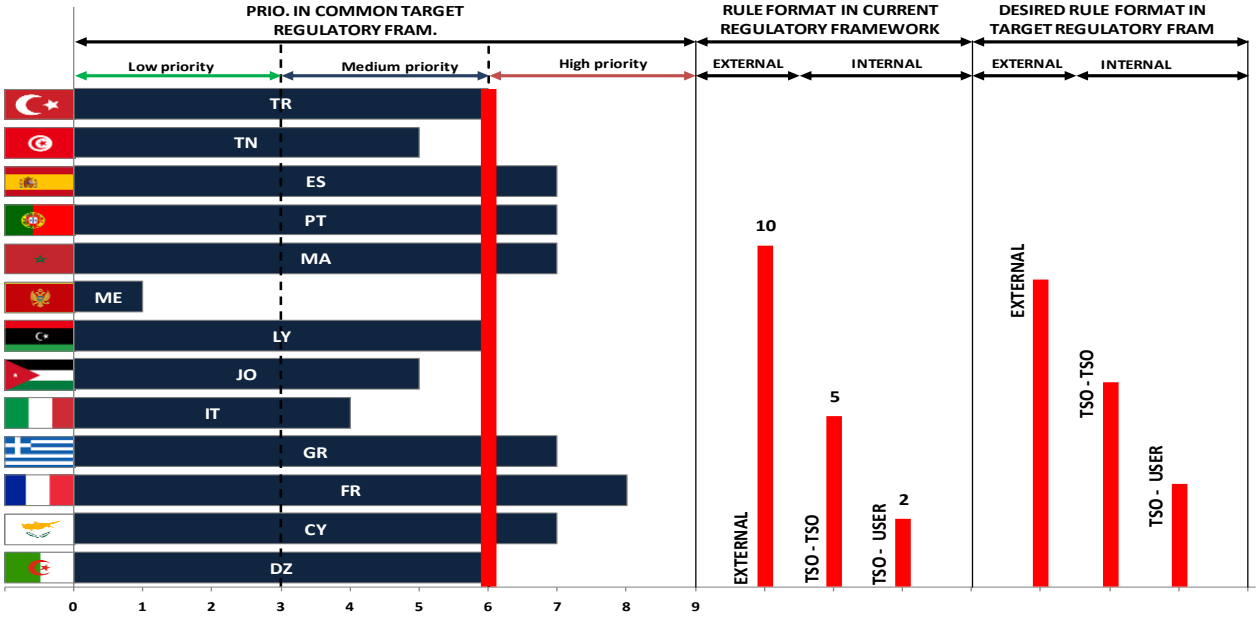
11A2. Frequency Containment Reserve (FCR). Payment of FCR



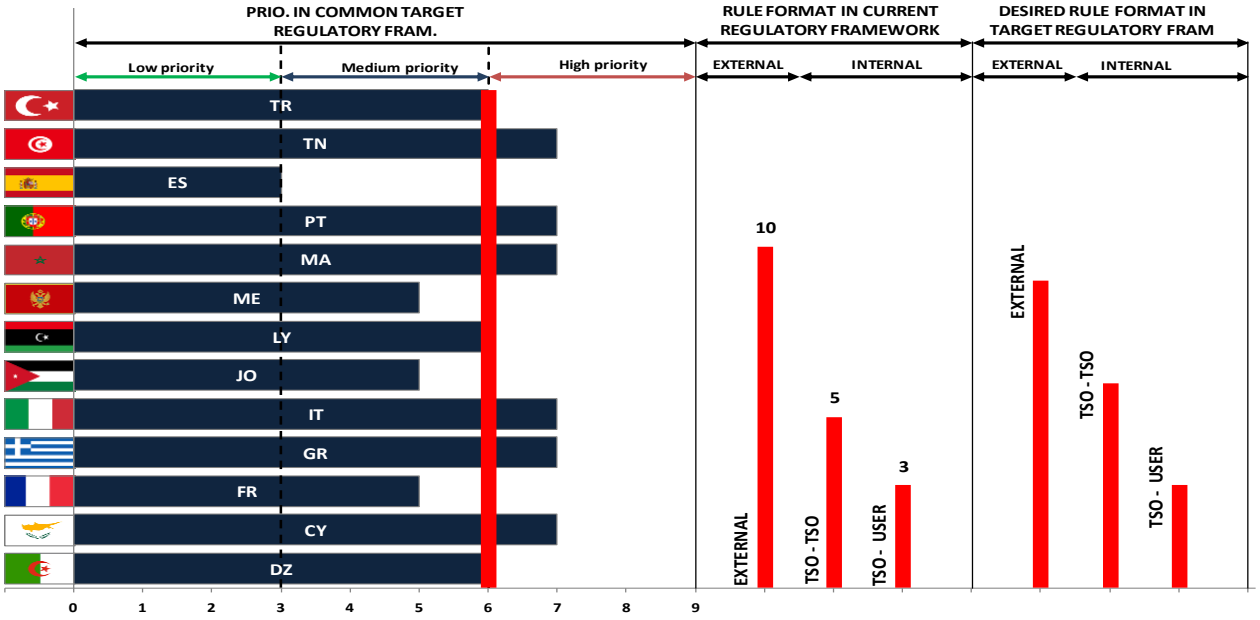
11A3. Frequency Containment Reserve (FCR) Criteria used for establishing the quantity of FCR



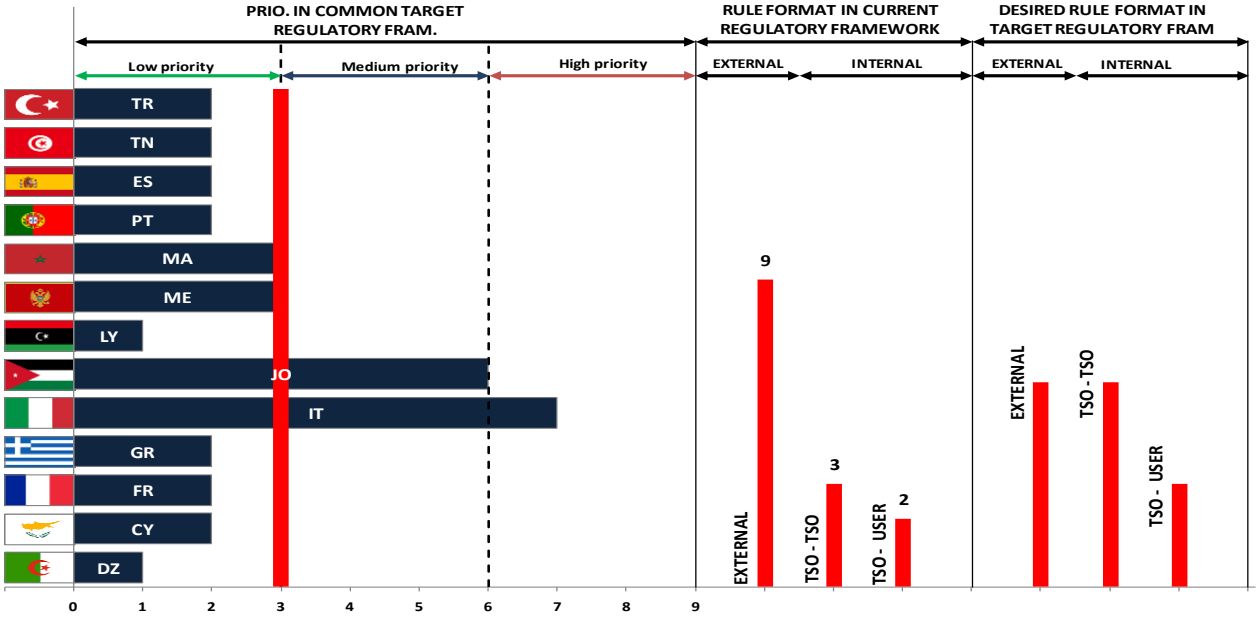
11A4. Frequency Containment Reserve (FCR) Compliance scheme and economic penalties for FCR?



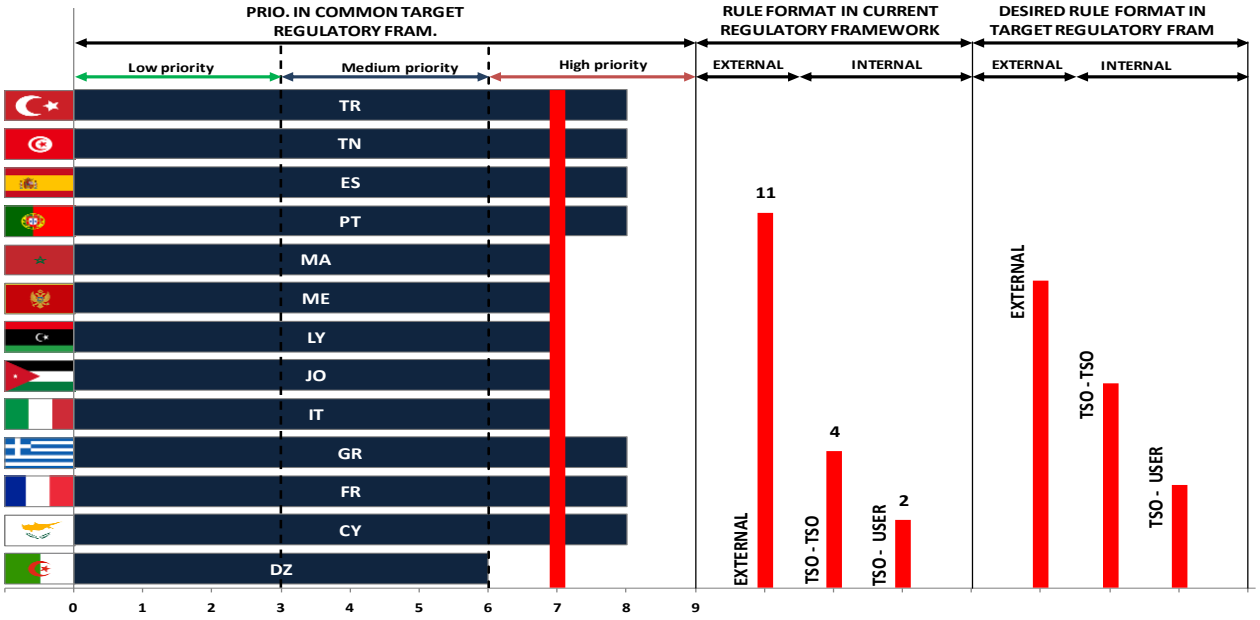
11B1. Frequency Restoration Reserve (FRR). Provision of FRR



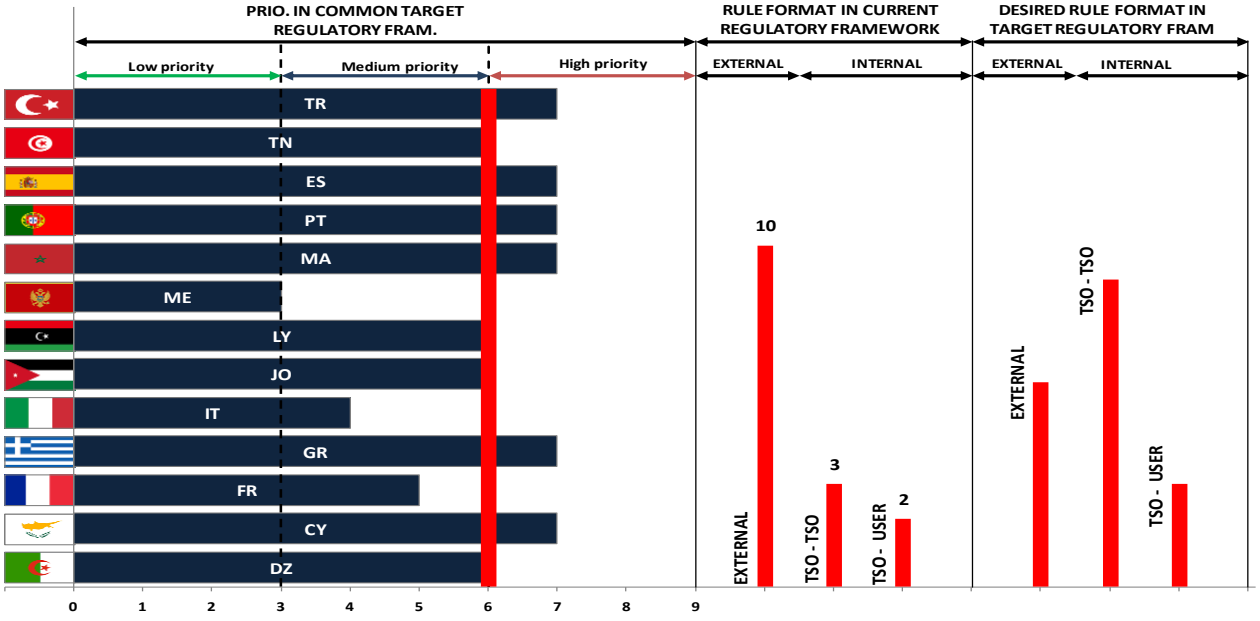
11B2. Frequency Restoration Reserve (FRR). Payment of FRR



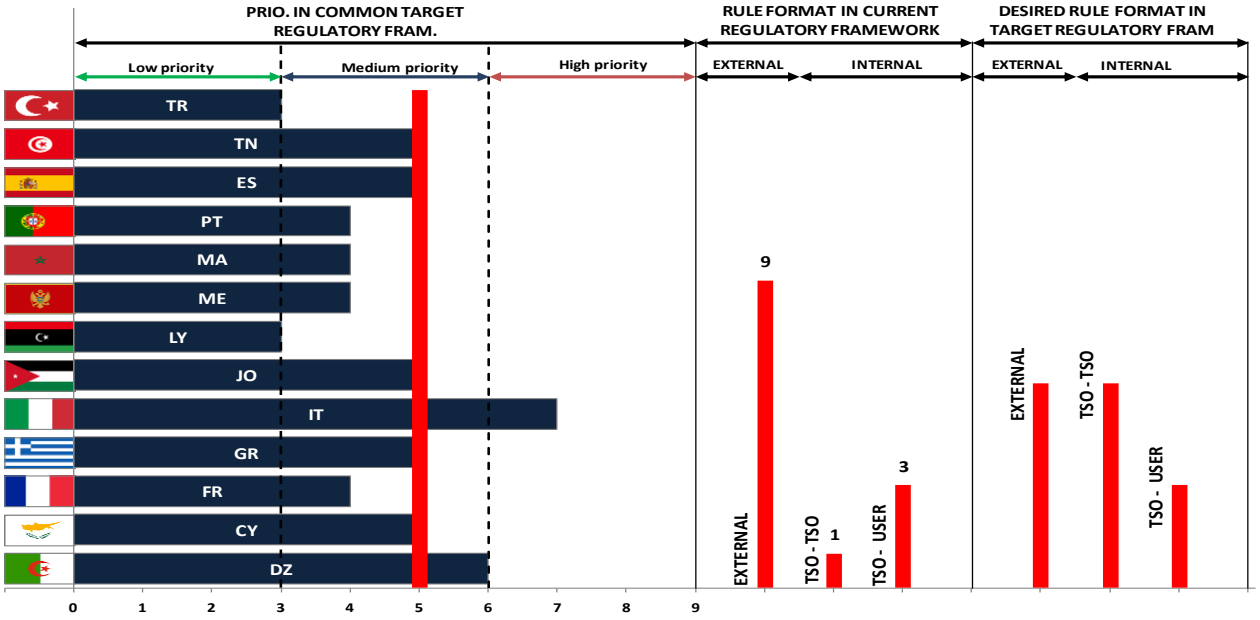
11B3. Frequency Restoration Reserve (FRR). Criteria used for establishing the quantity of FRR



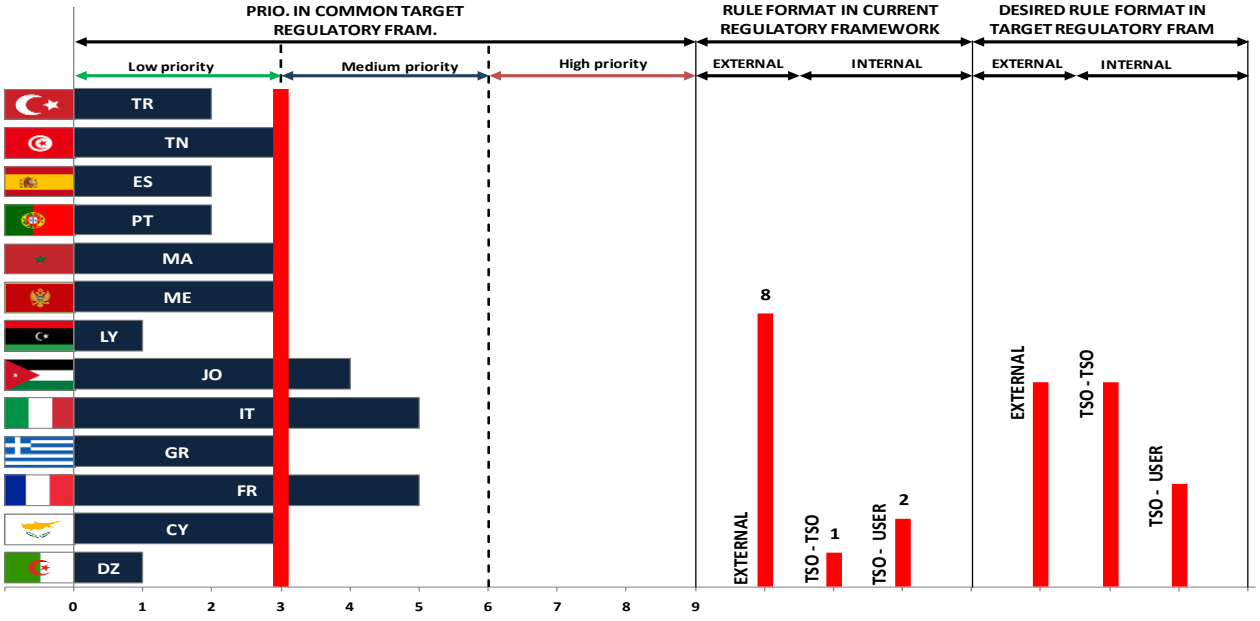
11B4. Frequency Restoration Reserve (FRR) Compliance scheme and economic penalties for FRR?



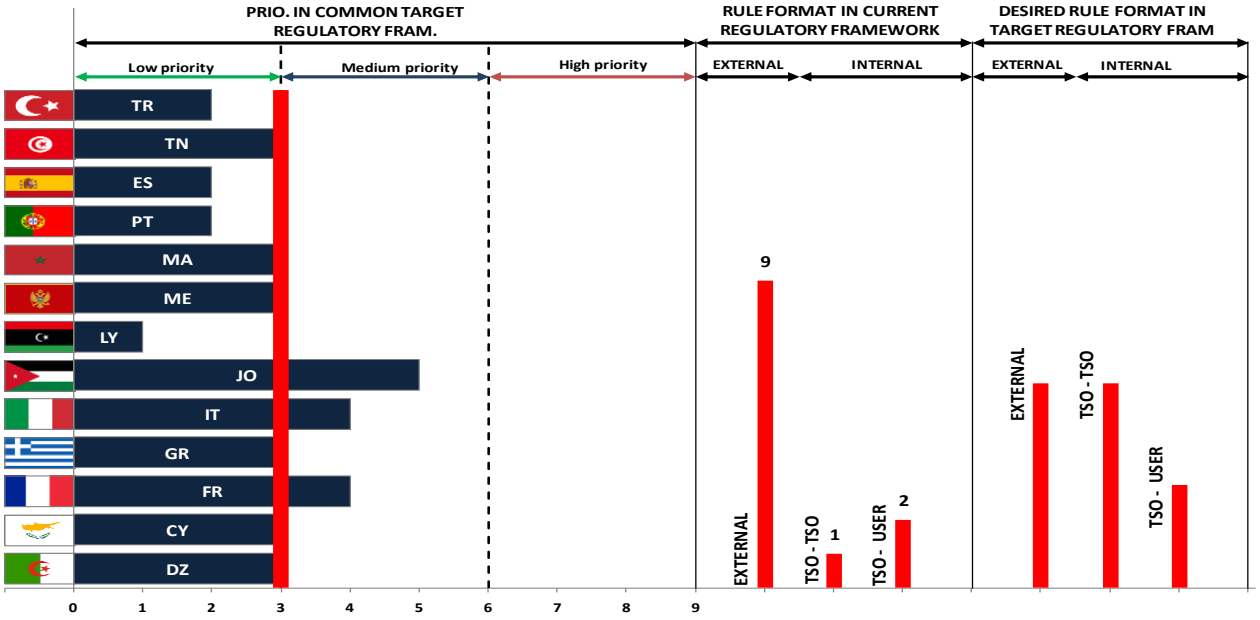
11C1. Replacement Reserve (RR). Provision of RR



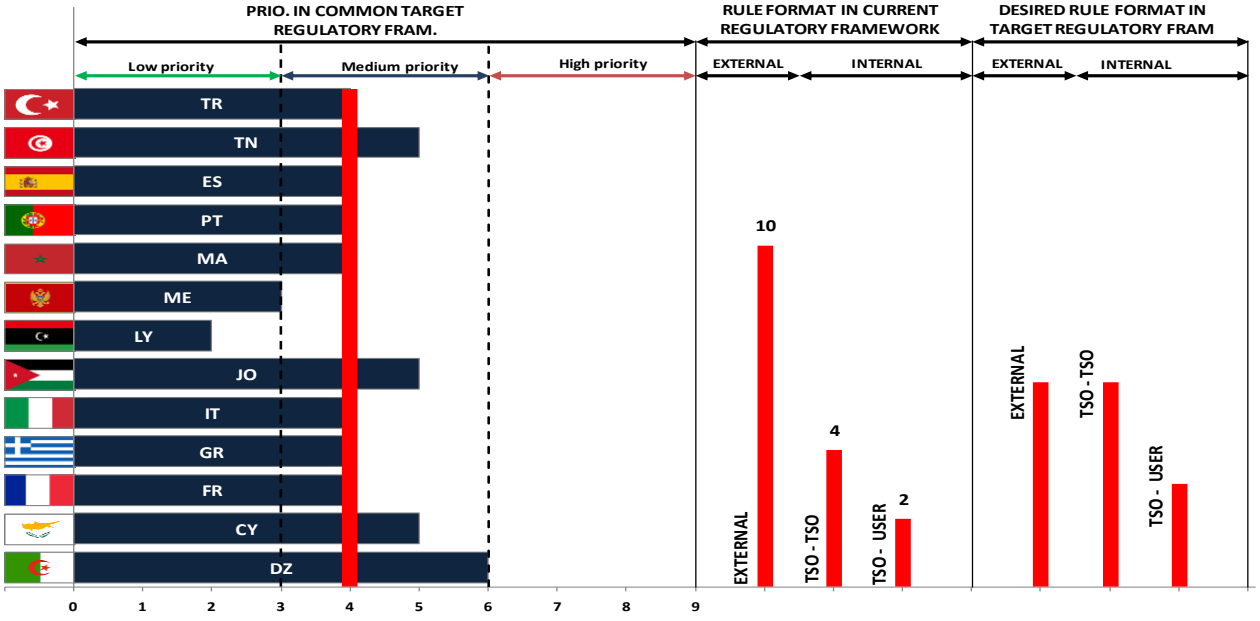
11C2. Replacement Reserve (RR). Payment of RR



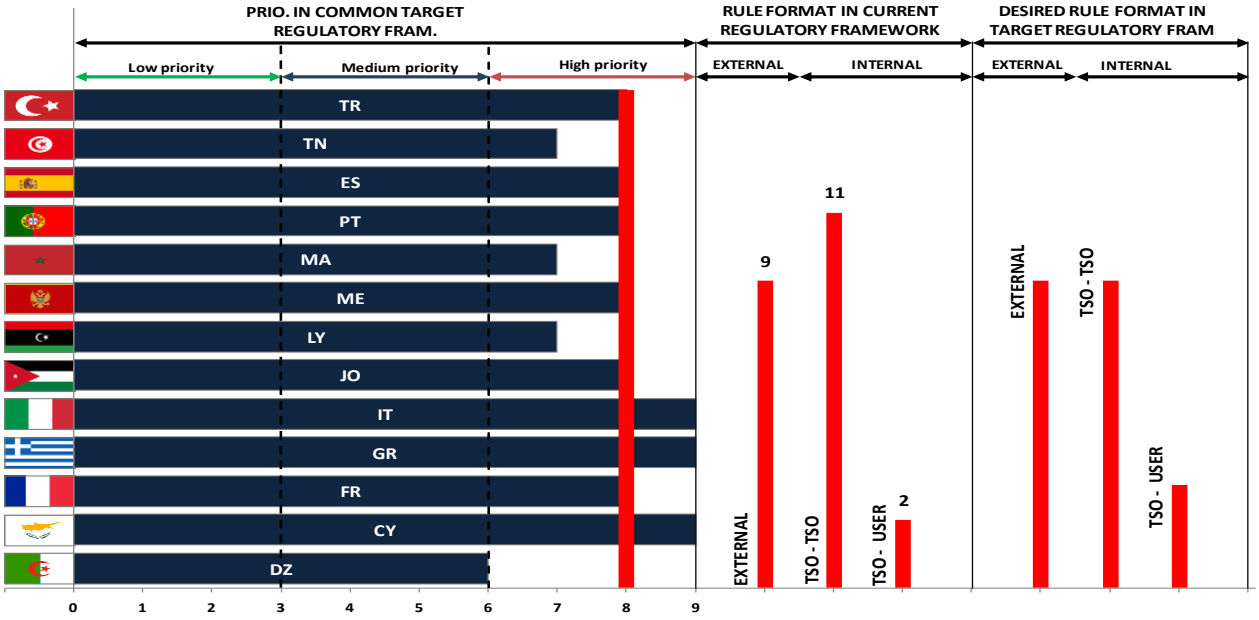
11C3. Replacement Reserve (RR). Criteria used for establishing the quantity of RR



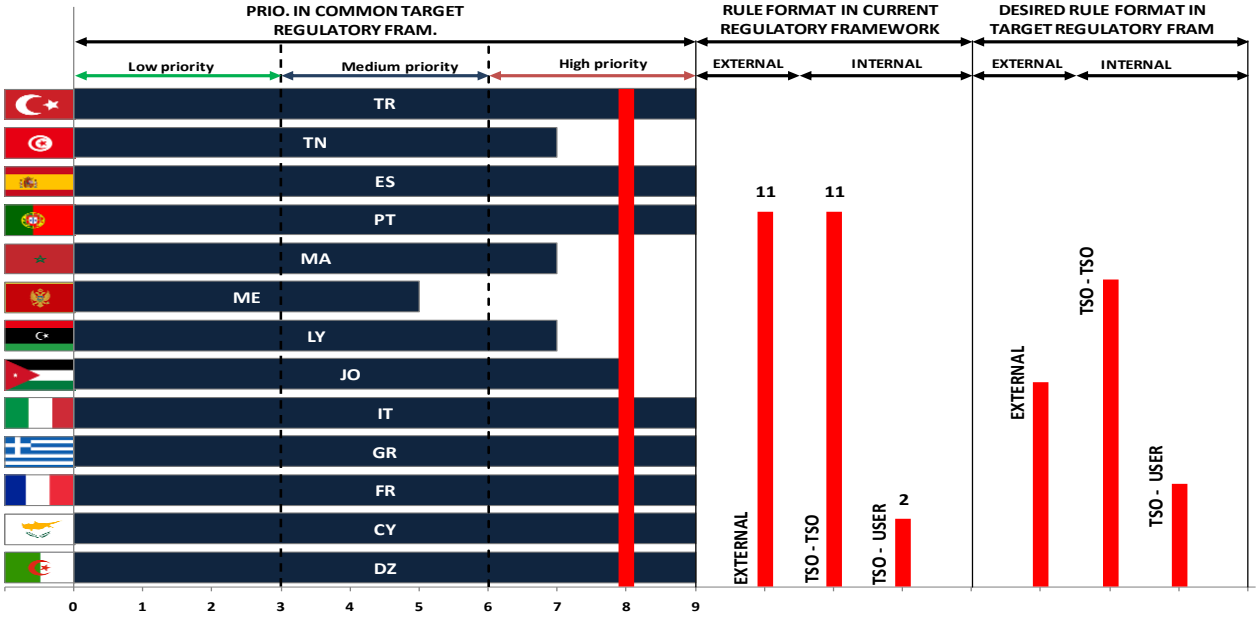
11C4. Replacement Reserve (RR) Compliance scheme and economic penalties for RR?



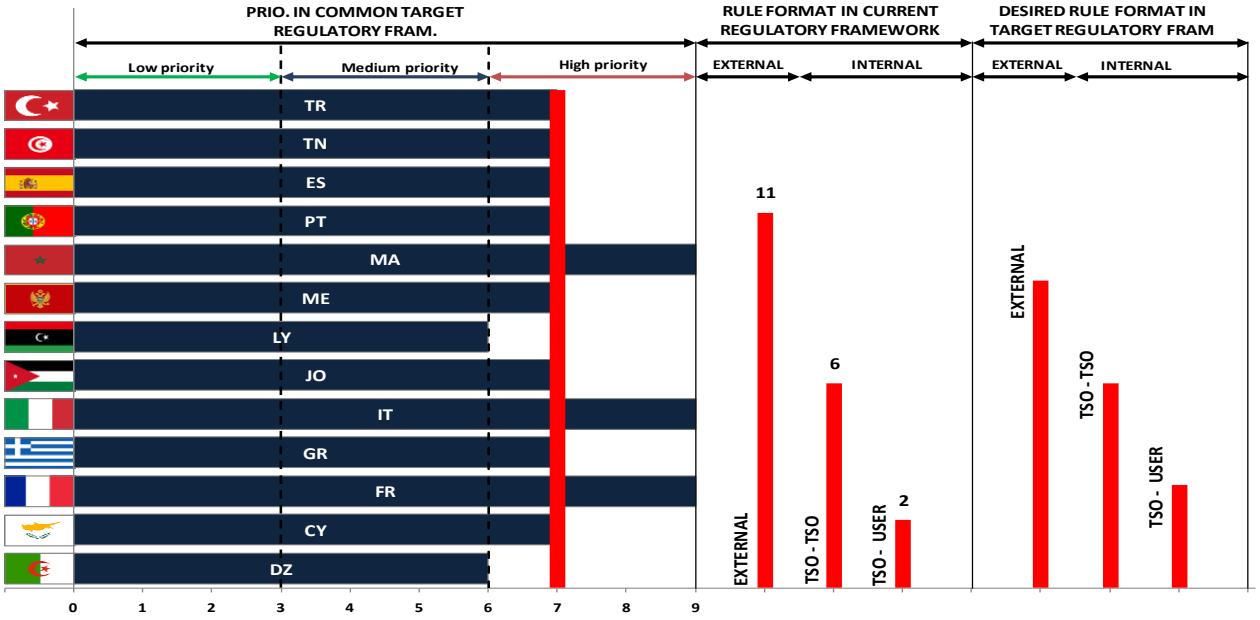
12A. Mechanisms of reserves management (exchange and sharing)



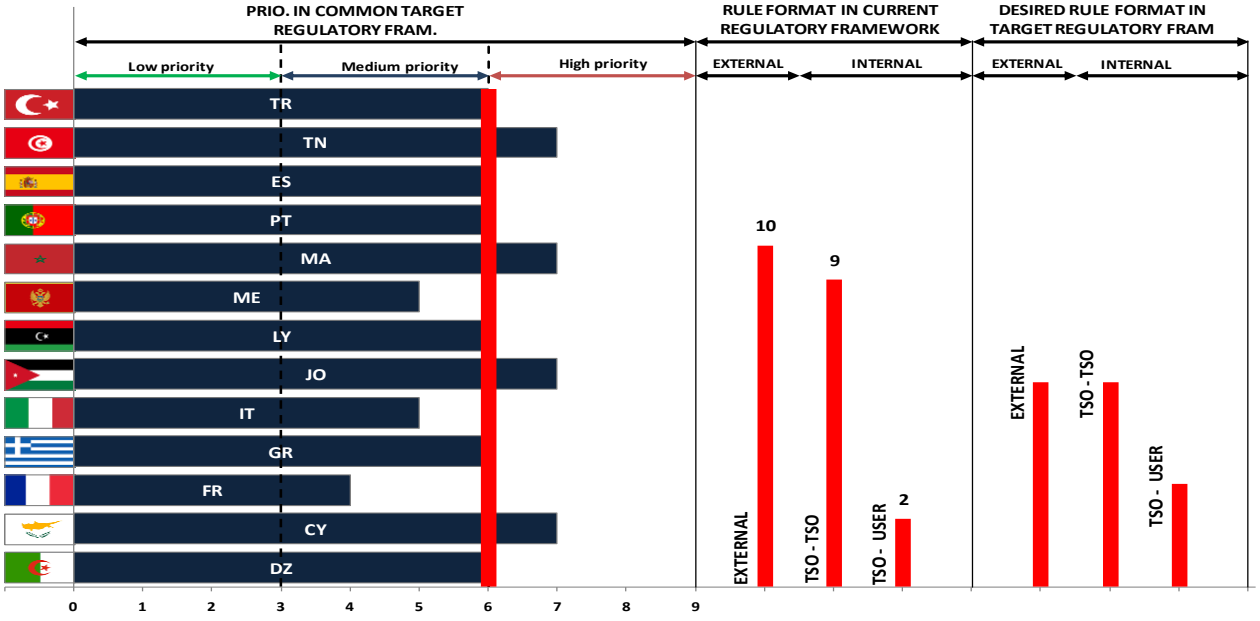
14A. Frequency deviation management procedure (Automatic Under/Over-Frequency control scheme)



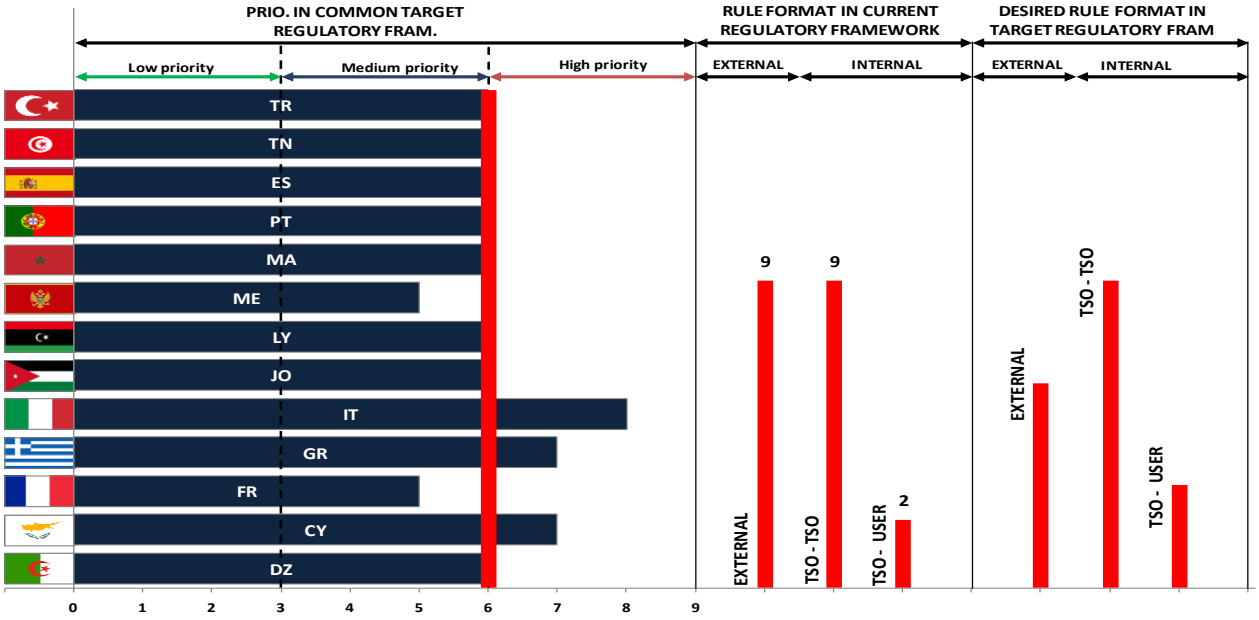
14B. Setting of demand disconnection schemes (low frequency and/or low voltage)



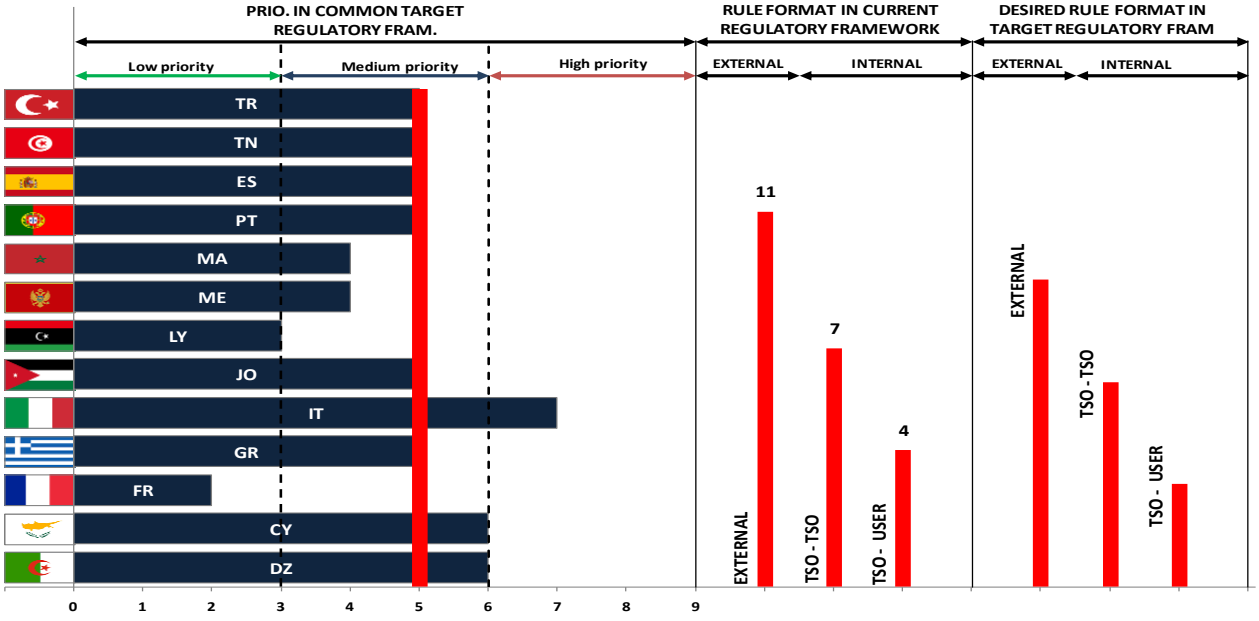
14C. Voltage deviation management procedure



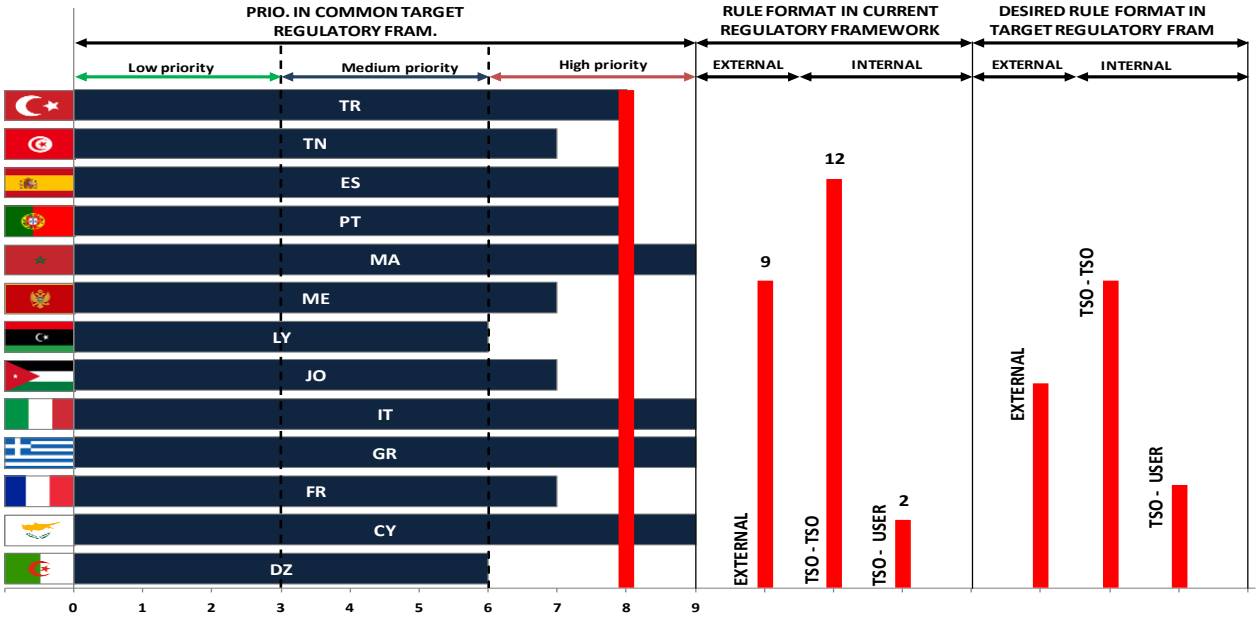
14D. Power flow management procedure



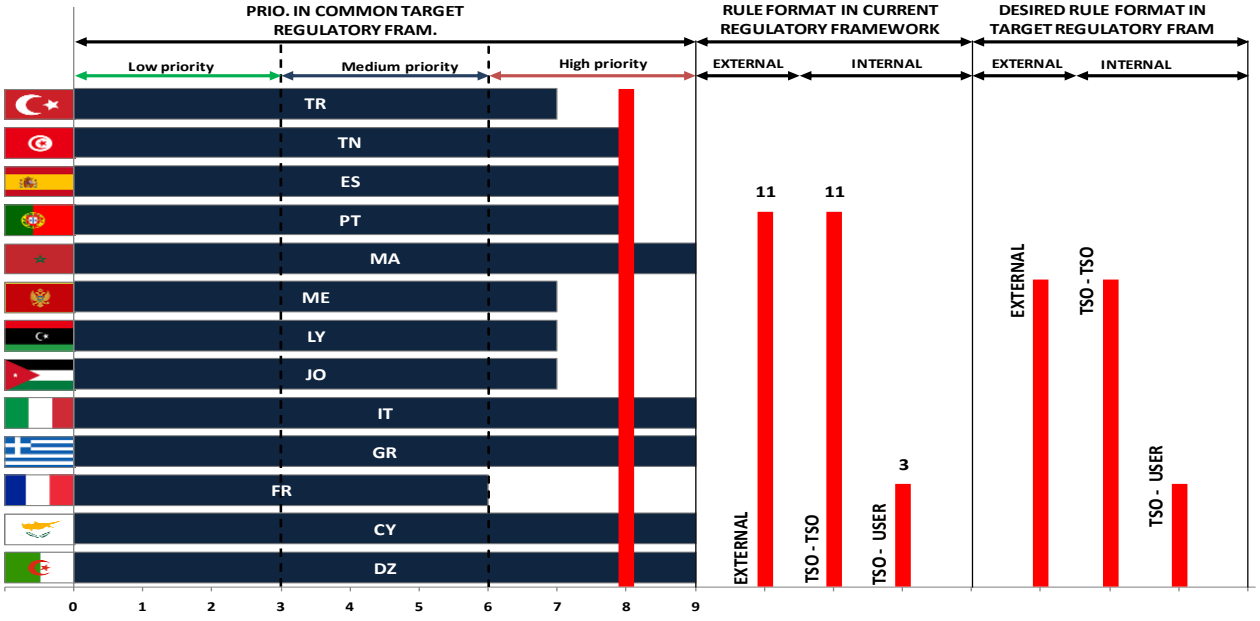
14E. Manual demand disconnection procedure



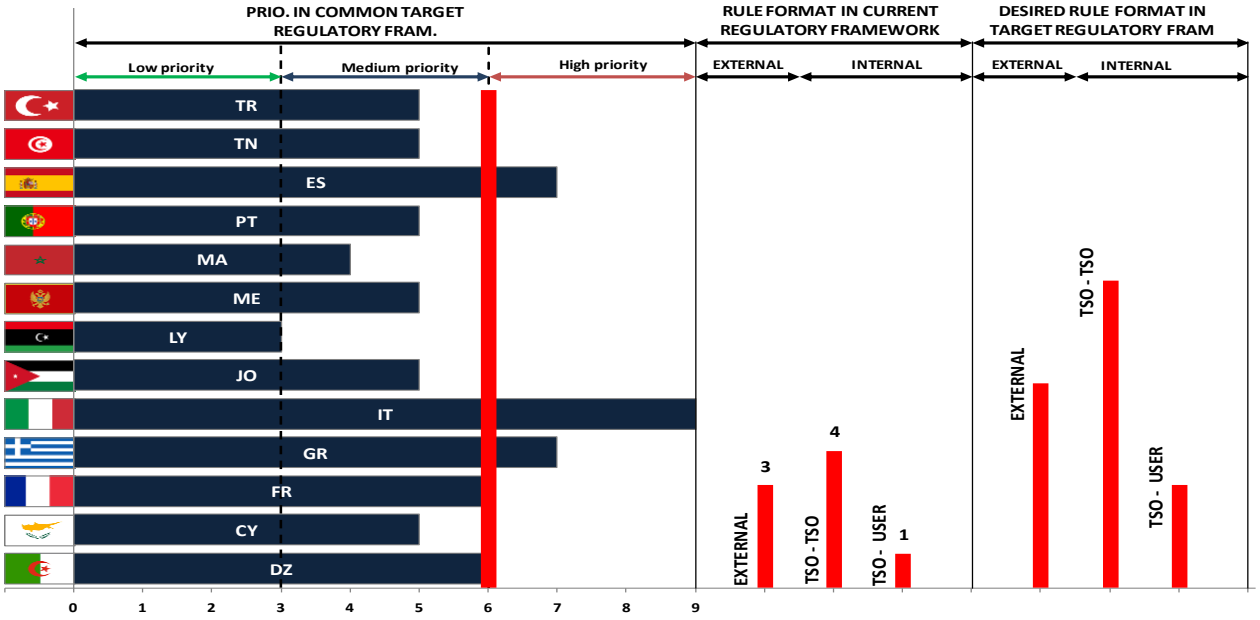
14F. Inter-TSO assistance and coordination in emergency state



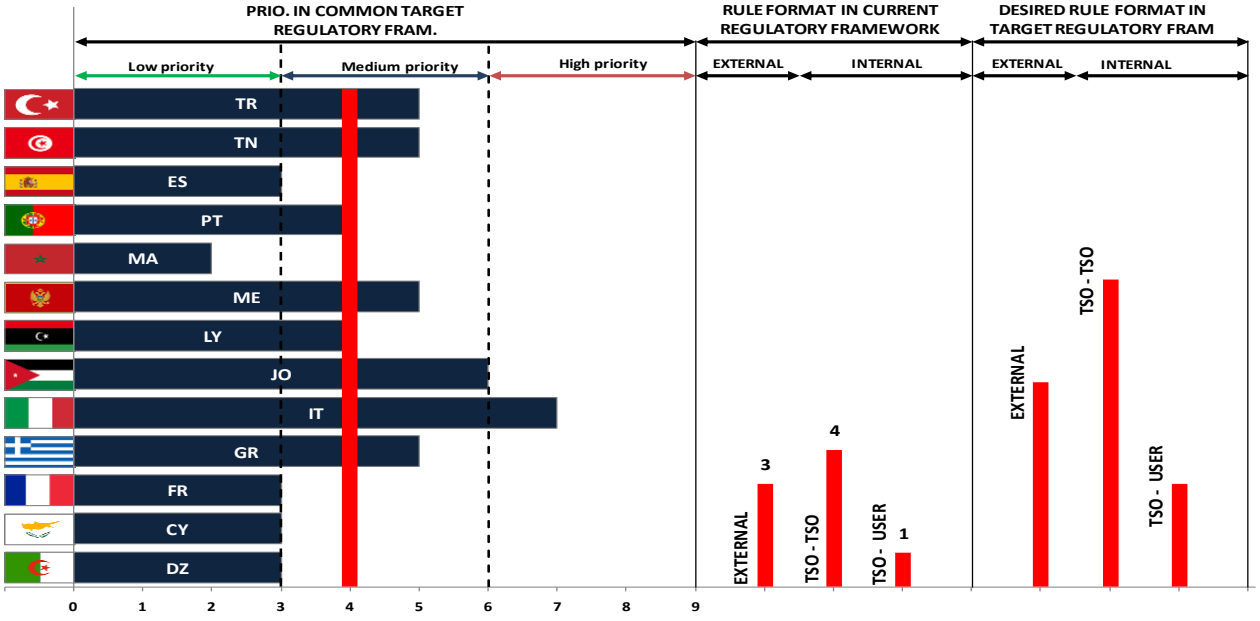
15A + 15B. Rules and types of restoration plans



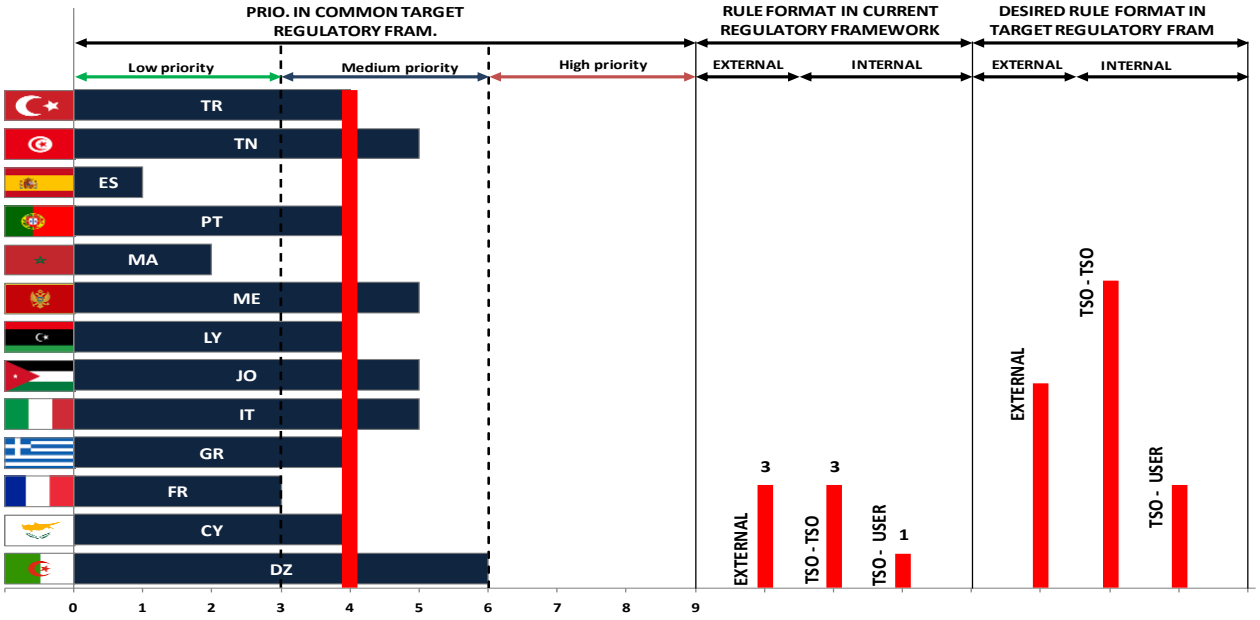
16A. Certification of the operators in charge of real time



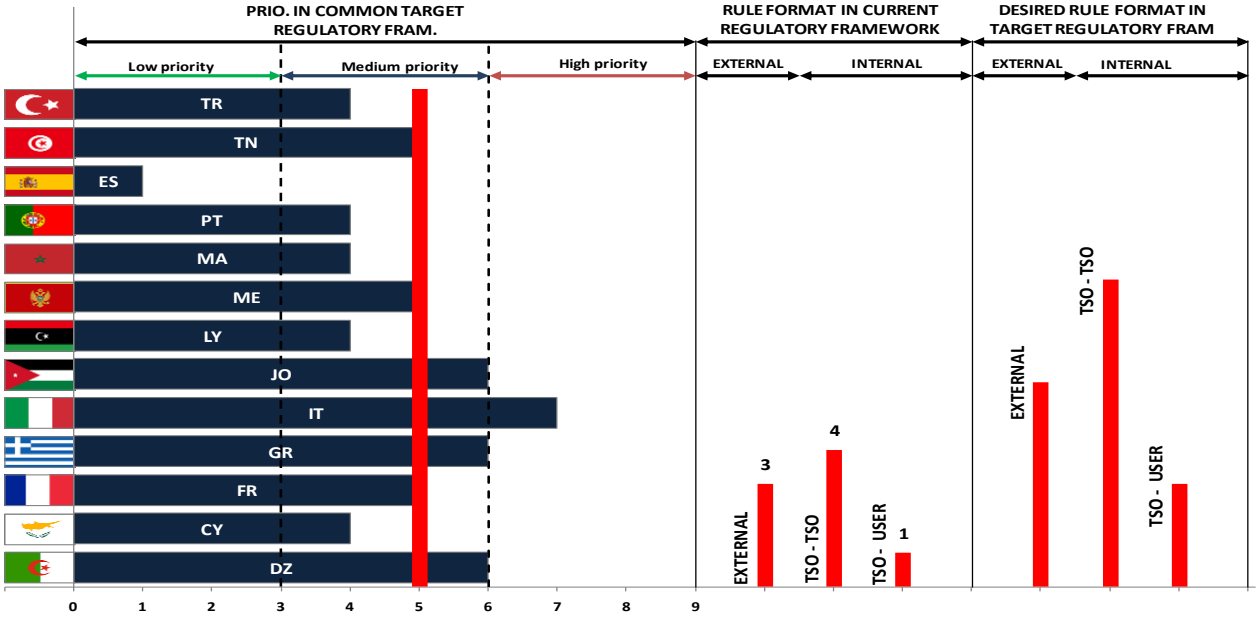
16B. Entity in charge of delivering the certification



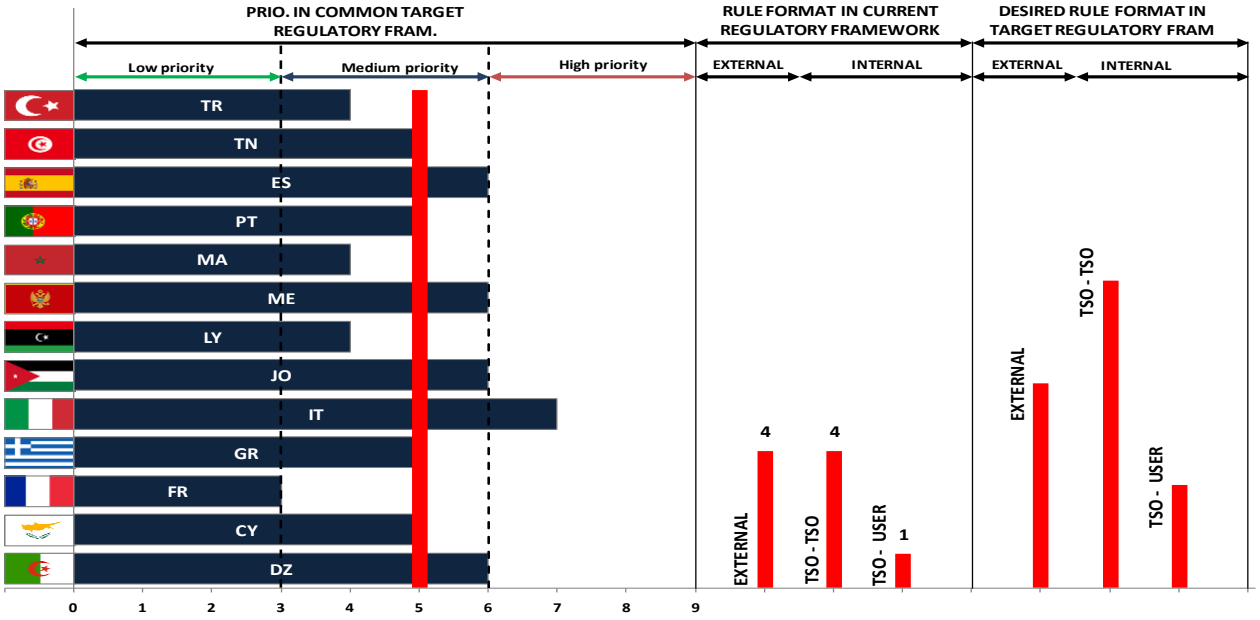
16C. Period of validity of the certification



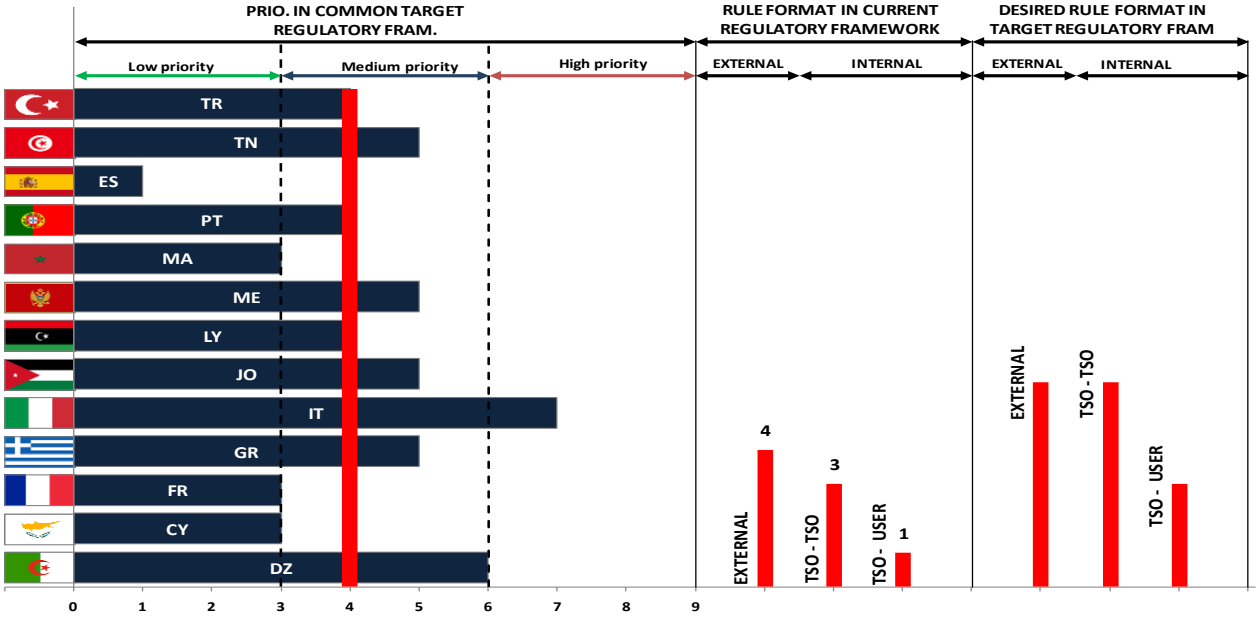
16D. Use of a simulator



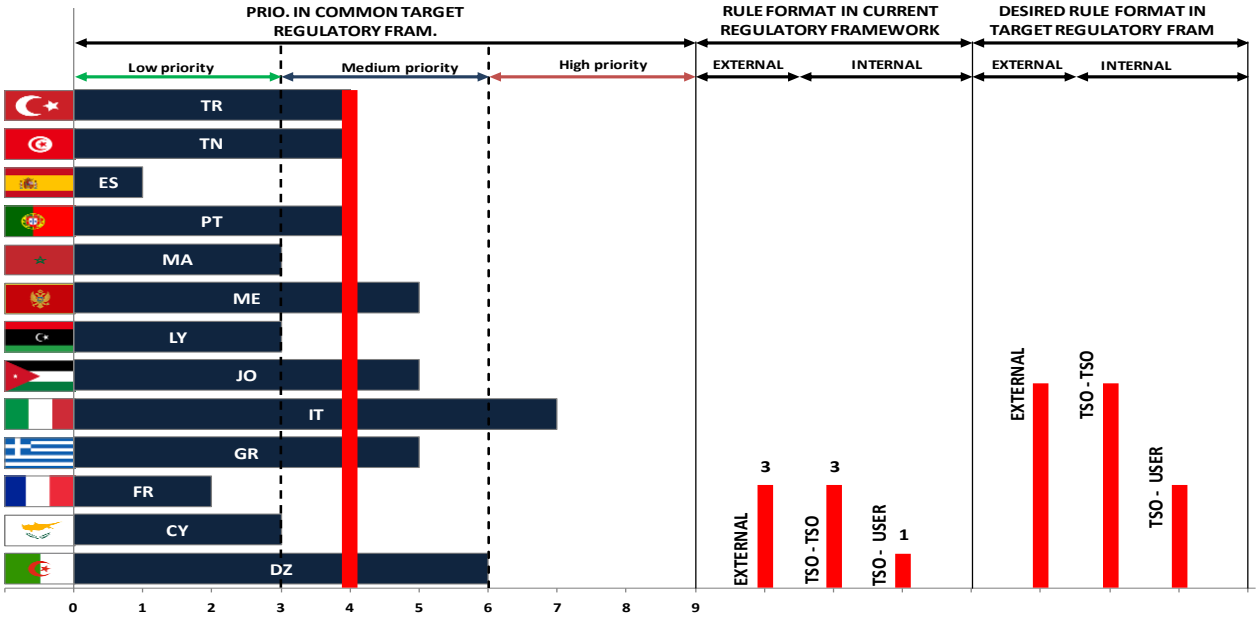
16E. Topics (including stress management) included in the training



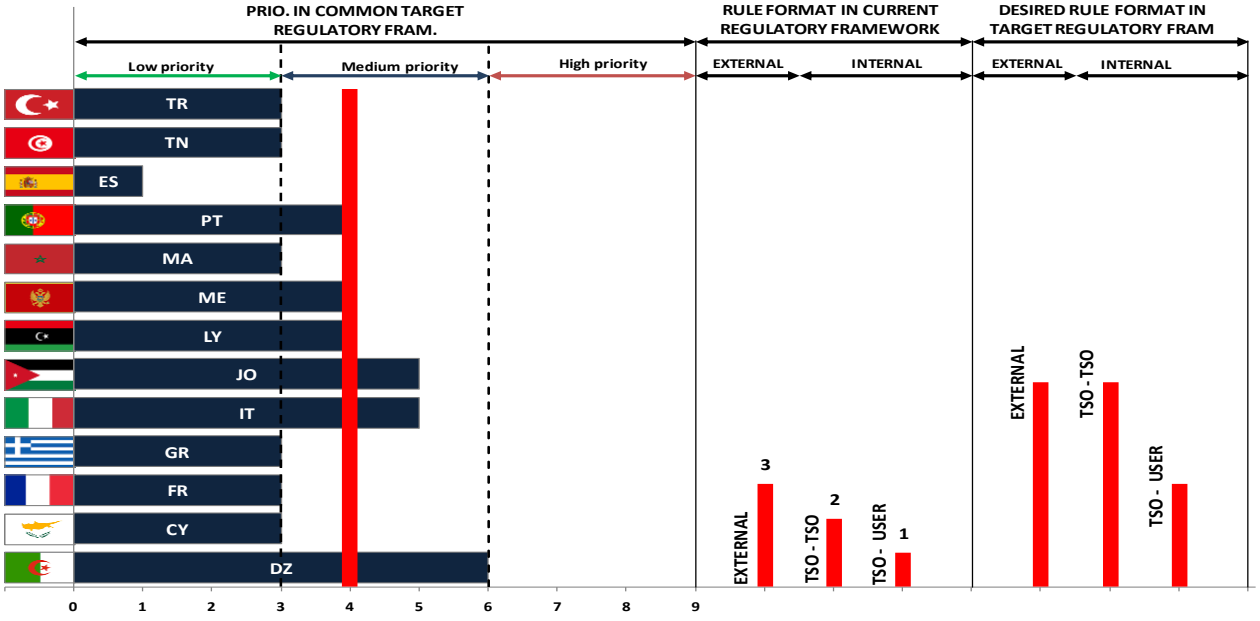
16F. Periodicity and duration of the training



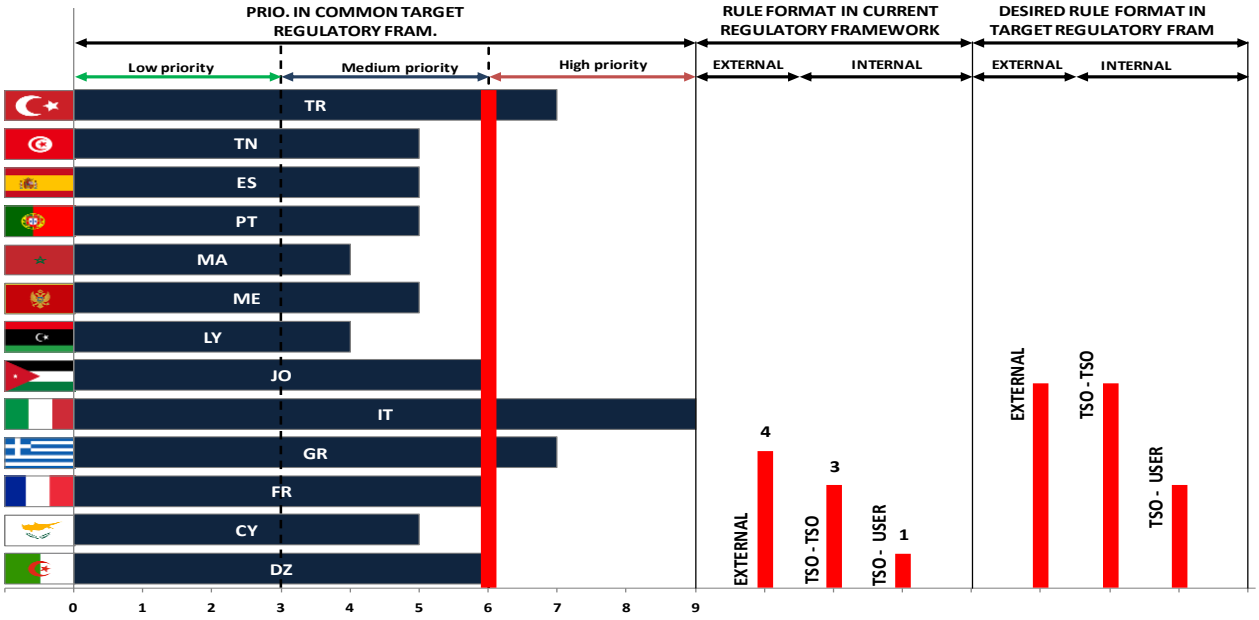
16G. Different levels of the operators and criteria of classification



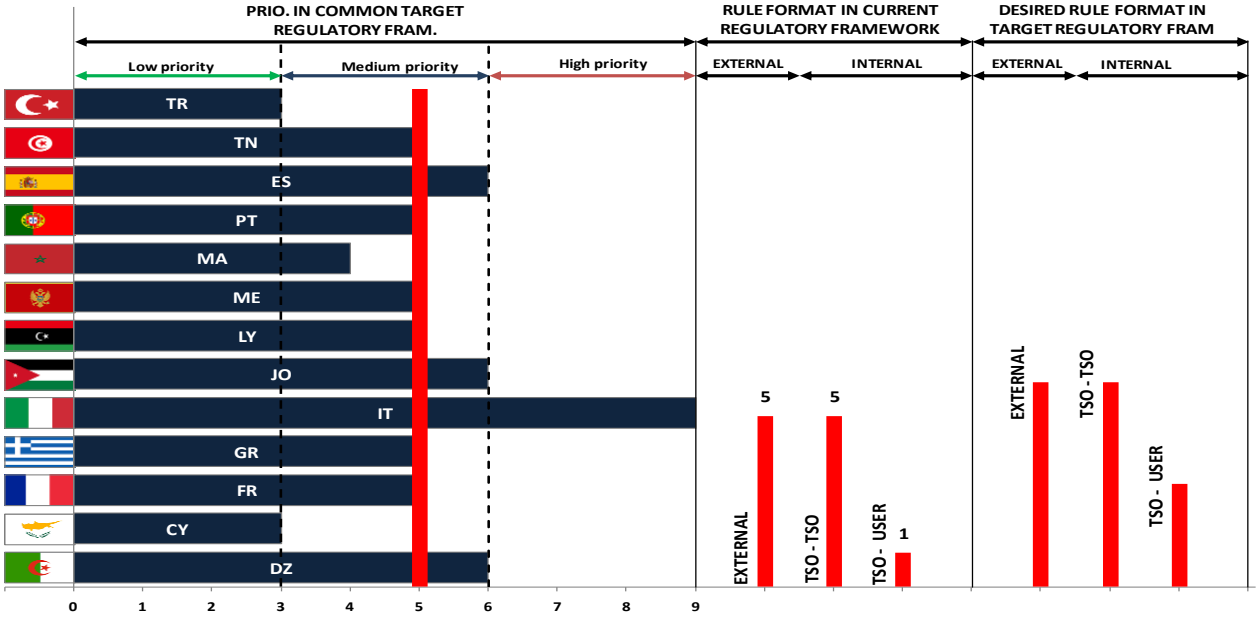
16H. Shift duration



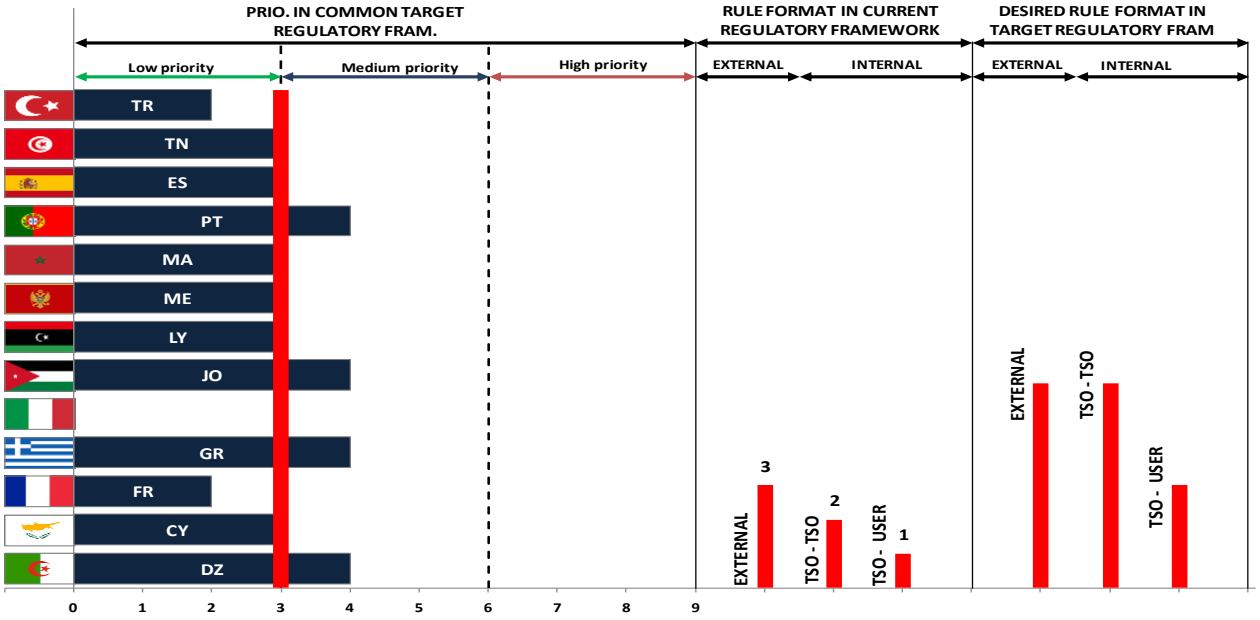
16I. Language requirements



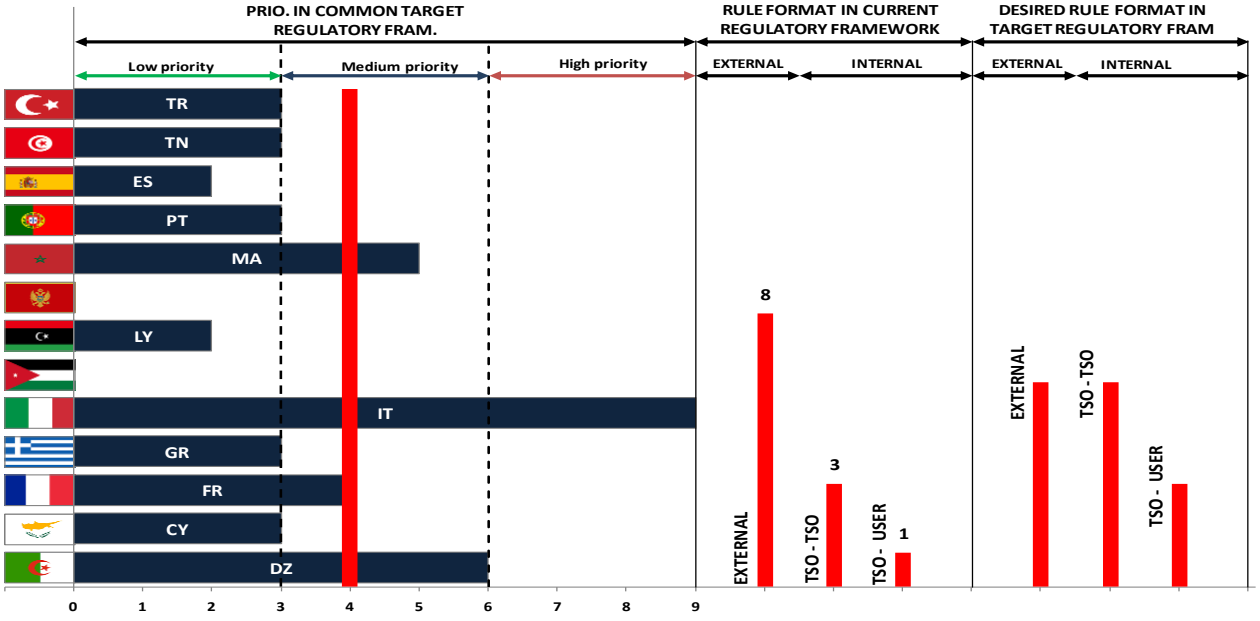
16J. InterTSO training scheme or practice



16K. Similar requirements for operators in other control centres (not operated by the TSO)

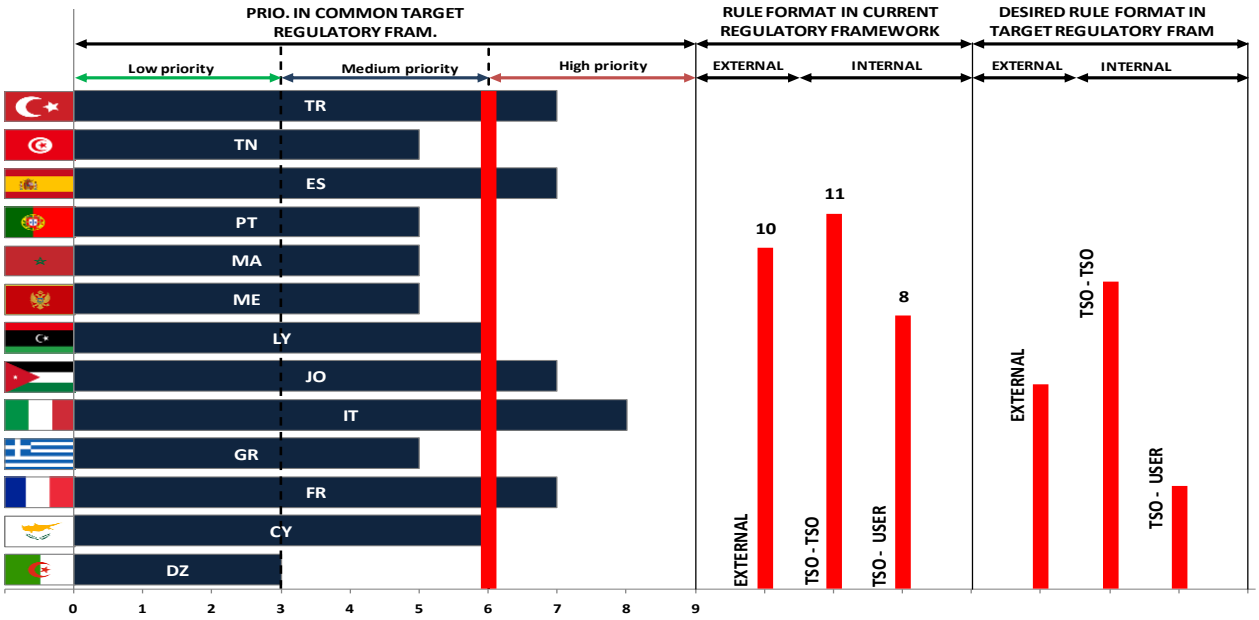


18A. Dispatch criteria (including priority)

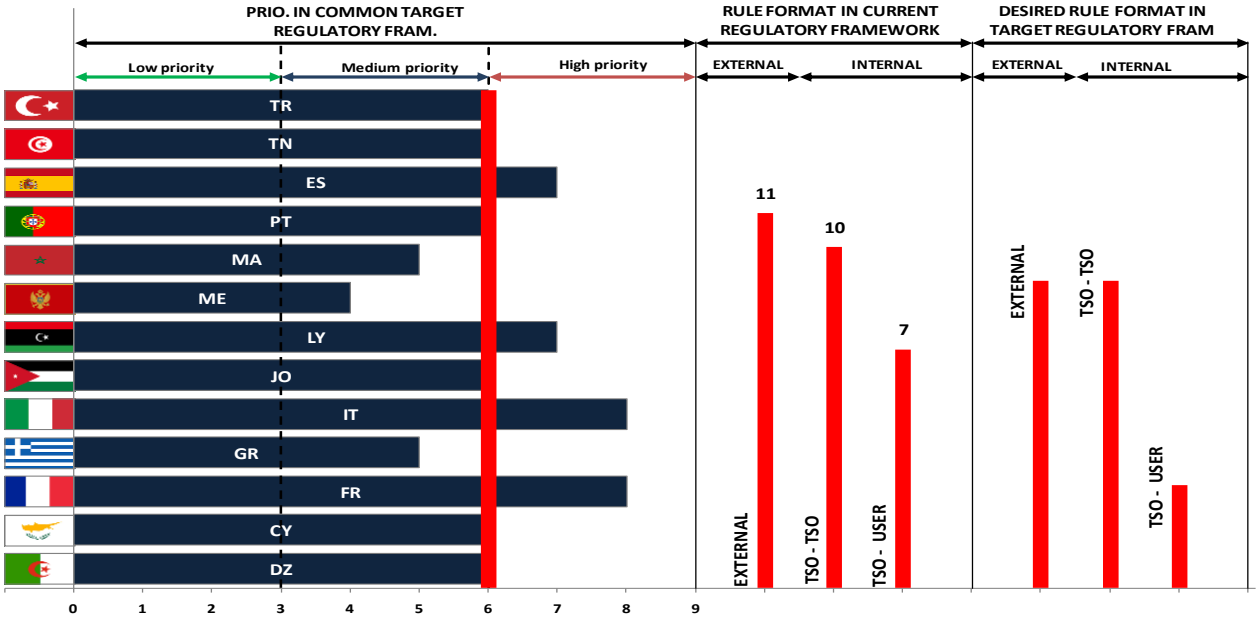


9.4 System service market

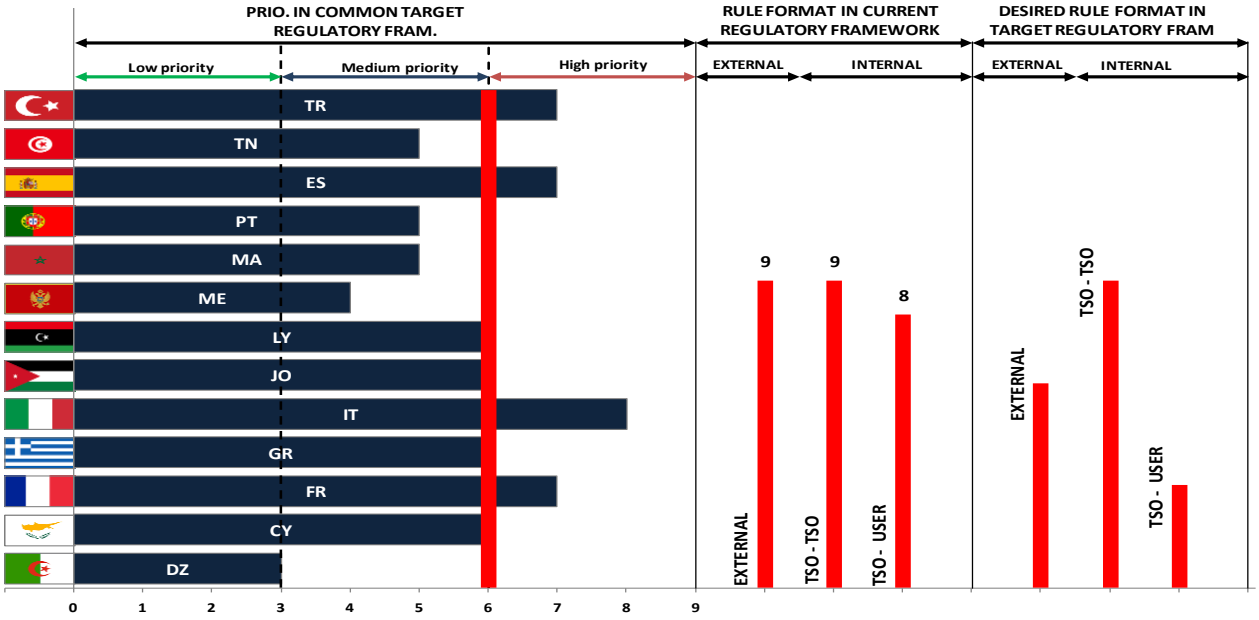
1A. What are the current requirements for participation on the cross-border electricity trade in your system?



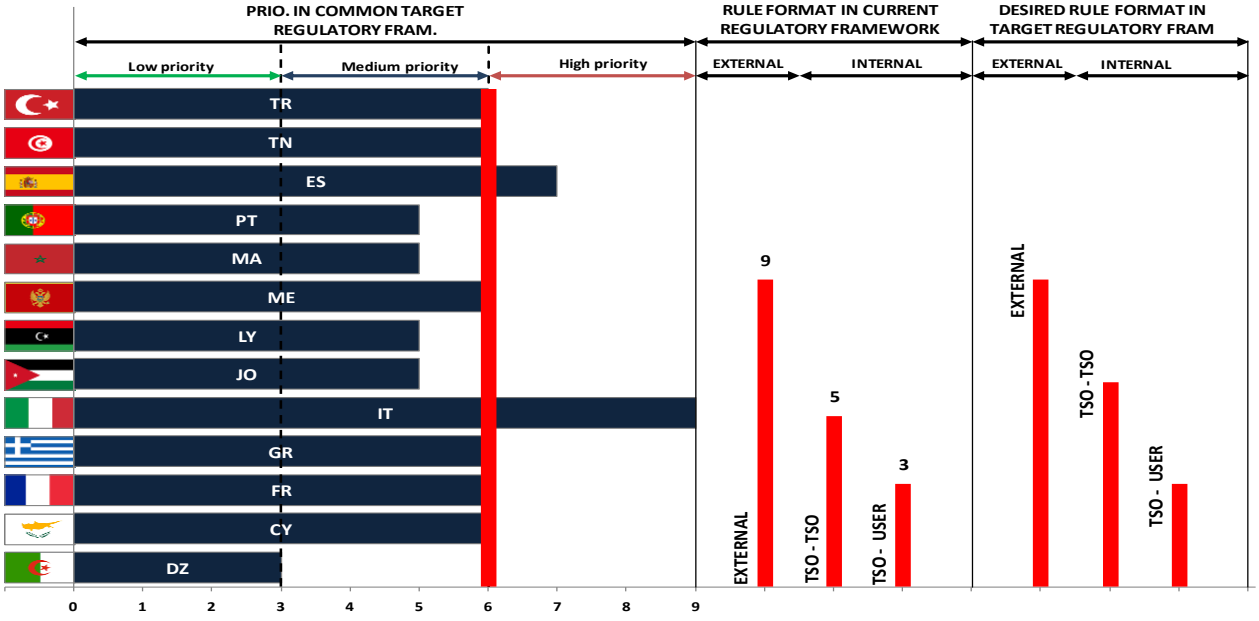
1B. What are the current rules for export/import of cross-border electricity in your system?



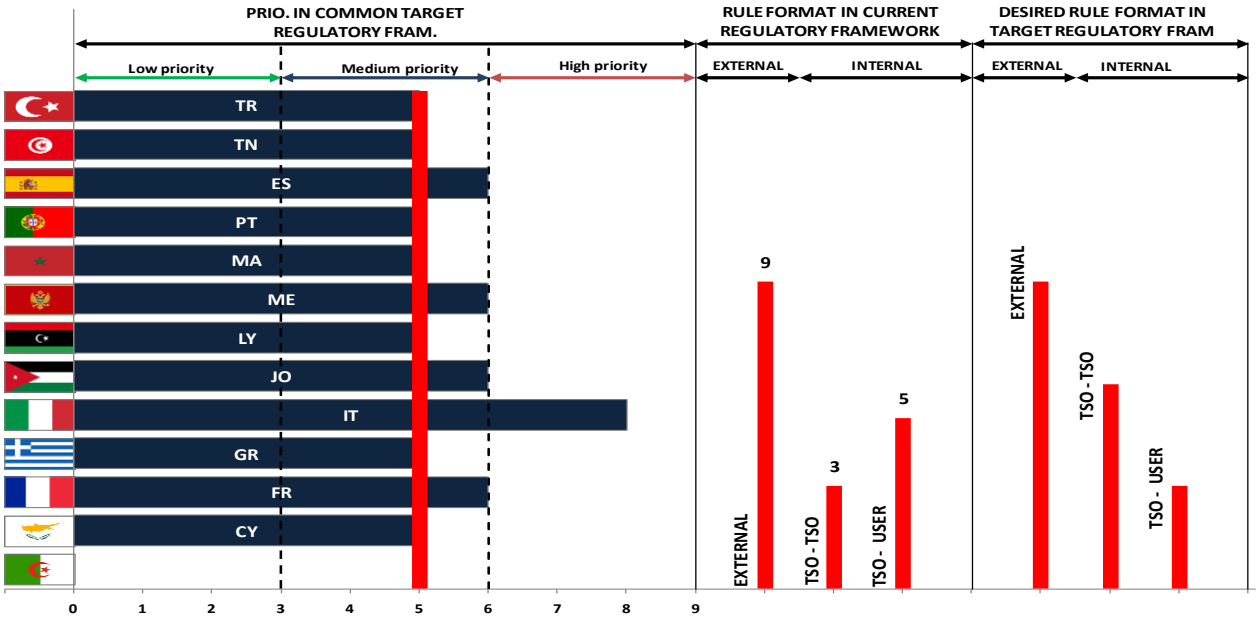
1C. What categories of operators are enabled for import/export activities?



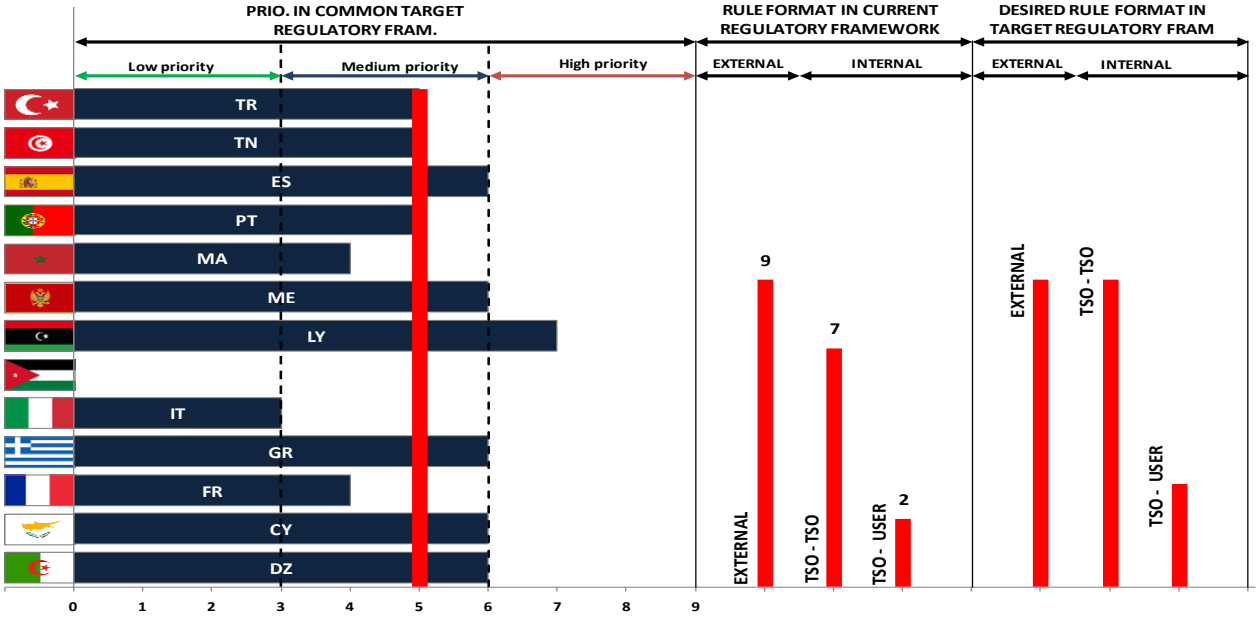
1D. Presence of a Market Operator



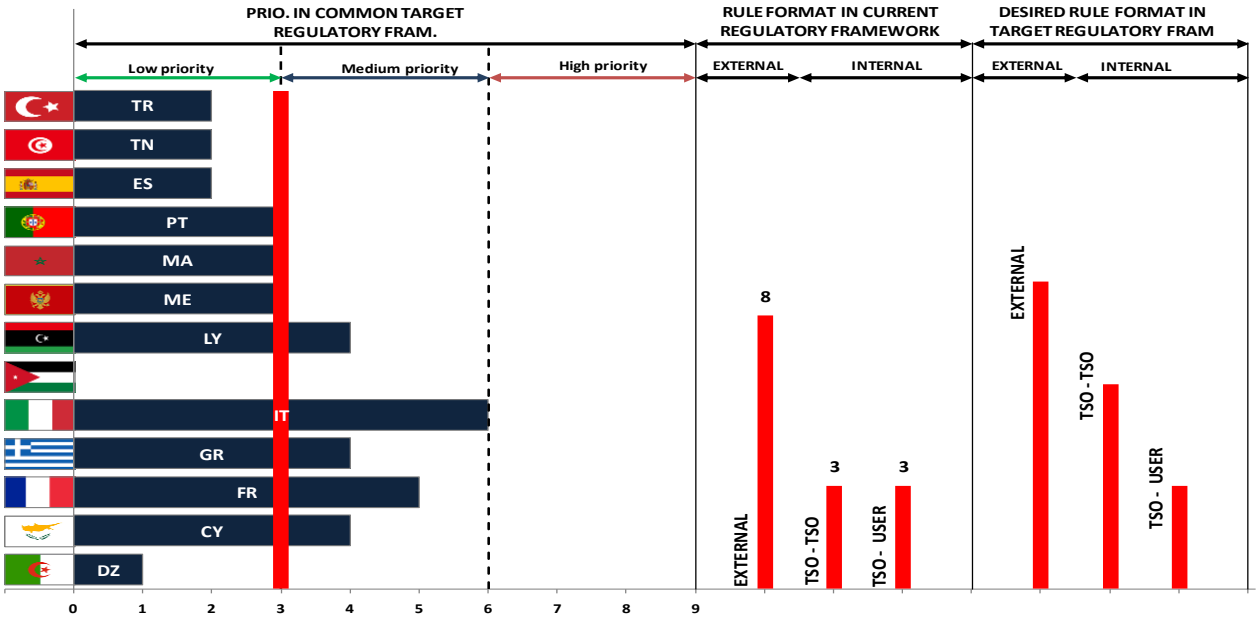
1E. Which are the requirements for stipulating and executing contracts with market players relevant for the Cross Border Trade with other relevant market players in your country?



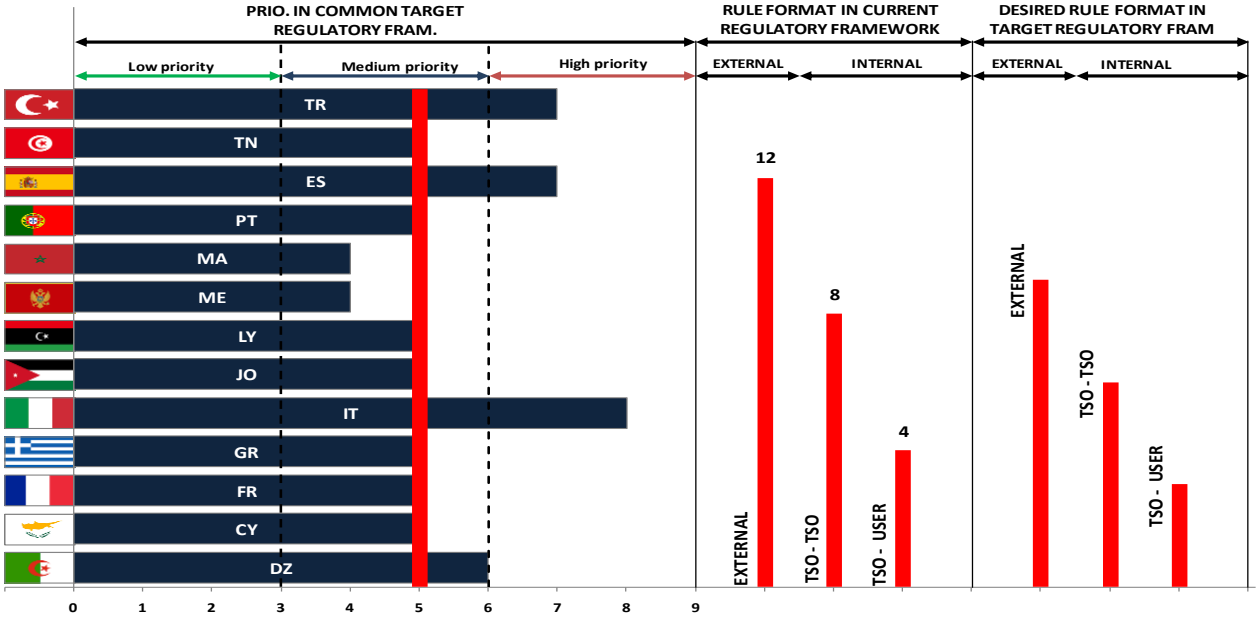
1F. Are there any international agreements on either bilateral or multilateral basis which your country has concluded with other countries concerning further development and liberalization of energy markets?



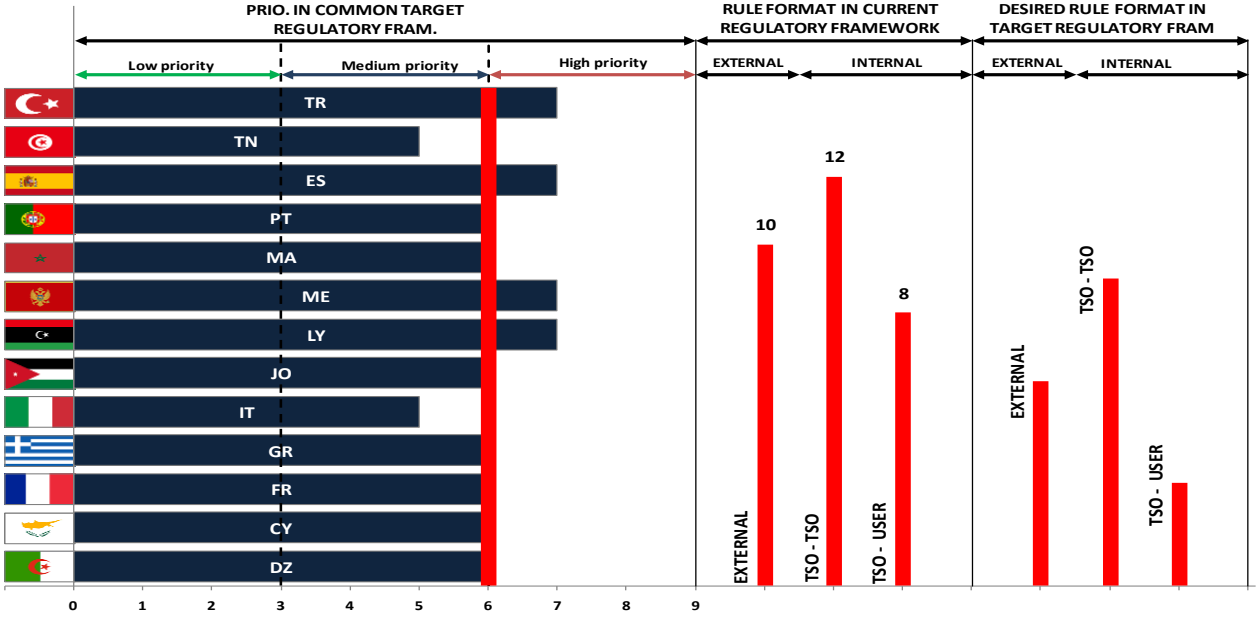
1G. Is it possible in your country to buy transmission rights already bought under the Transfer Capacity Allocation (TCA)?



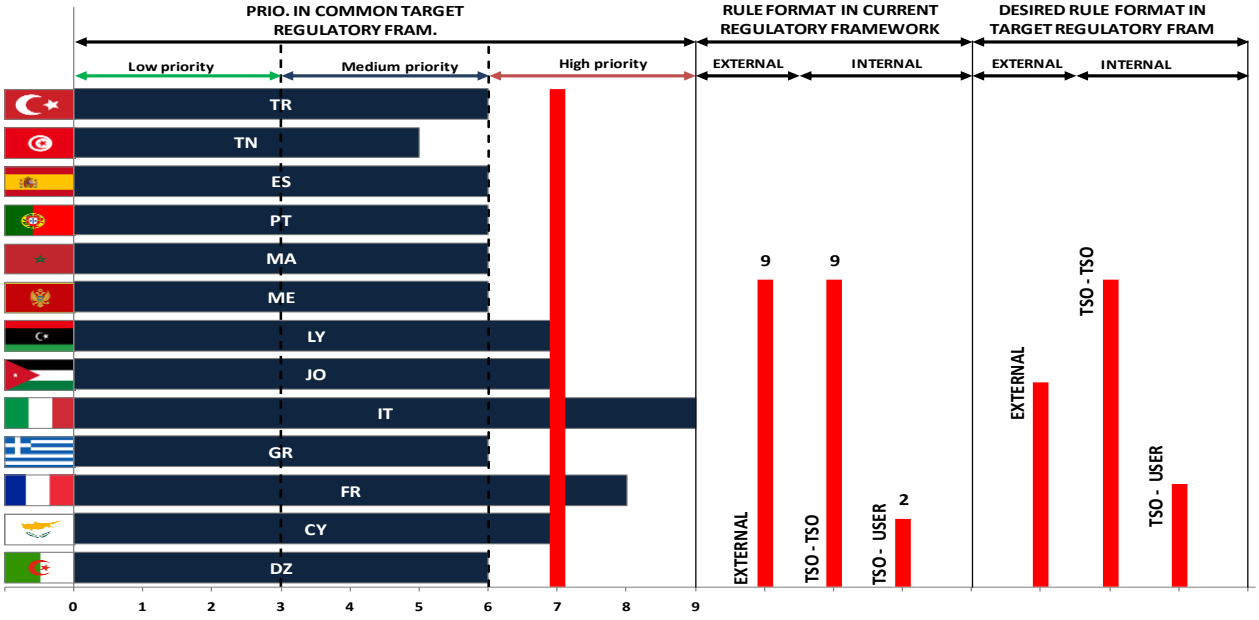
1H. How is electricity trade made in your country: between market participants or between TSO's?



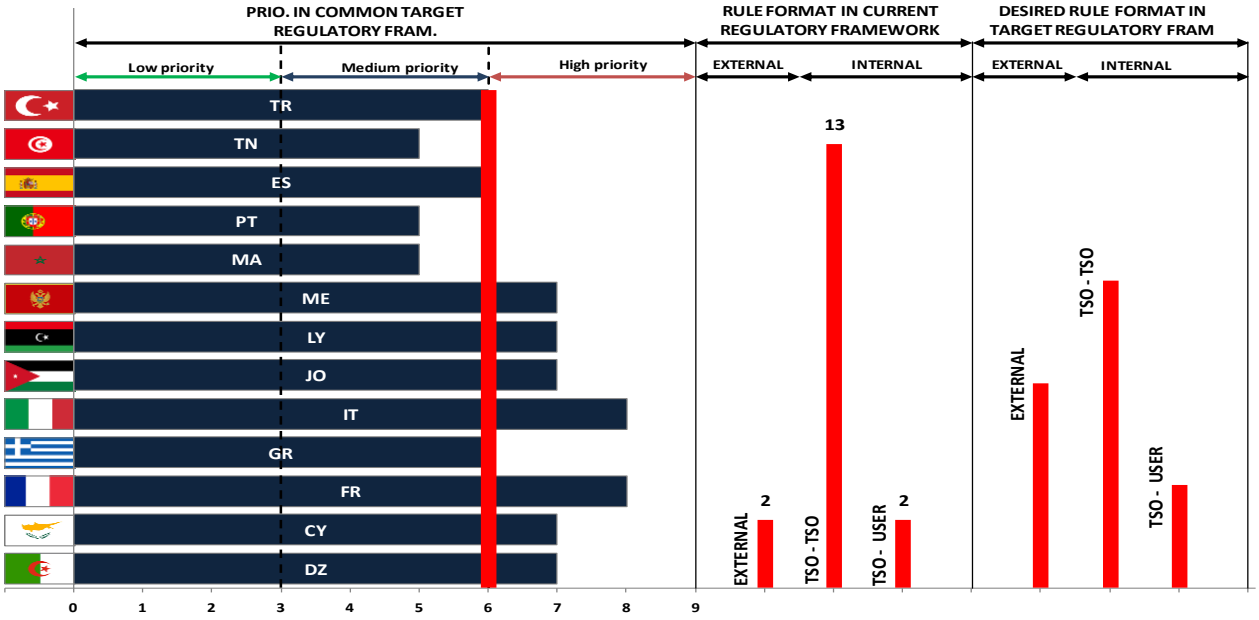
1I. Which requirements you have to satisfy for using the interconnections (e.g. demand/offer equilibrium, congestion management at national, and if possible, at international level, balancing of the exchange program in real time, coordinated dispatching)?



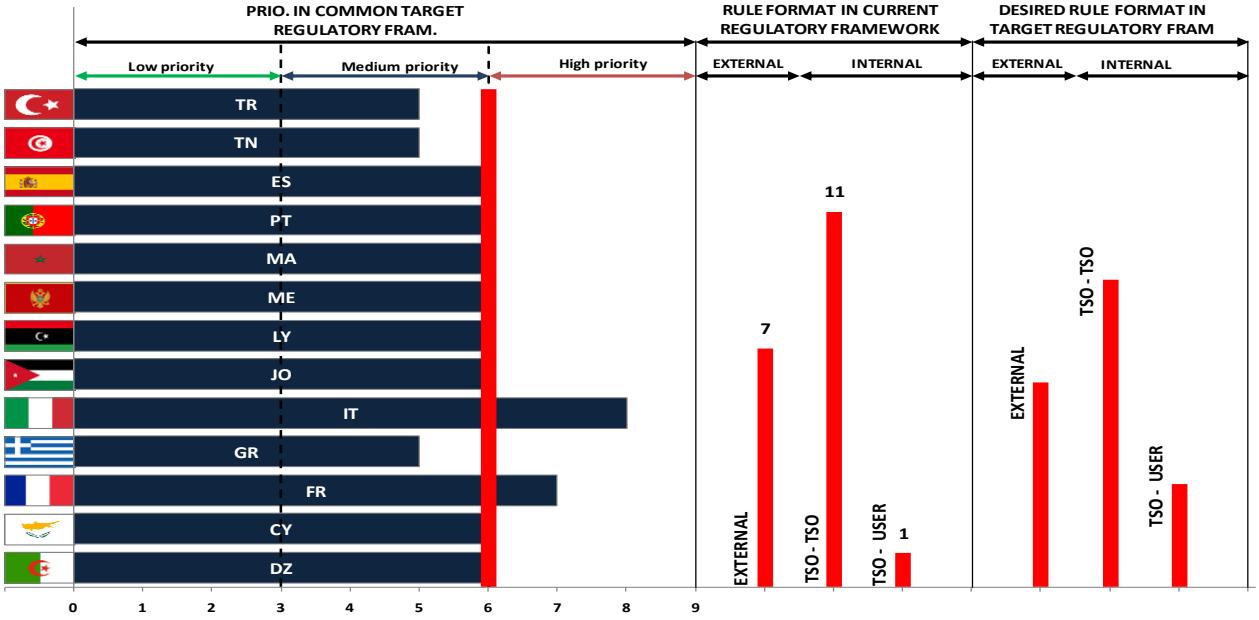
2A. Which security criteria is used for calculating the Net Transfer Capacity (NTC)? Do you apply a security criteria?



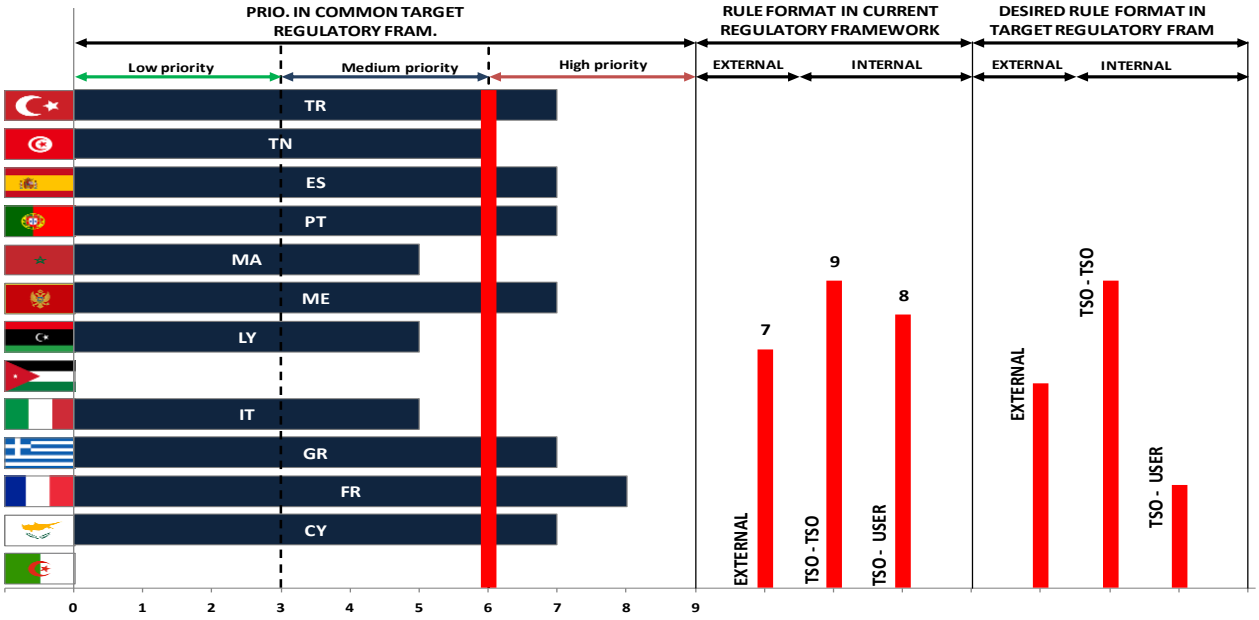
2B. What is the process for finalization of Net Transfert Capacity? Please indicate.



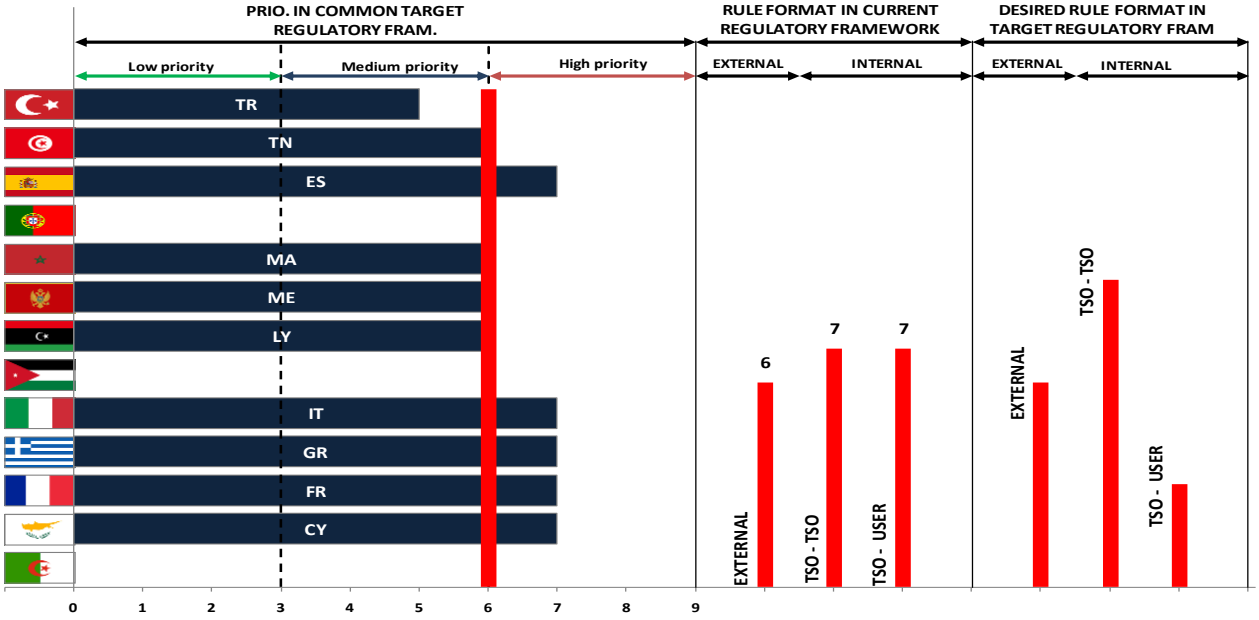
2C. Which are the time horizons used for capacity calculation? What is the process for calculating capacity in the different time horizons



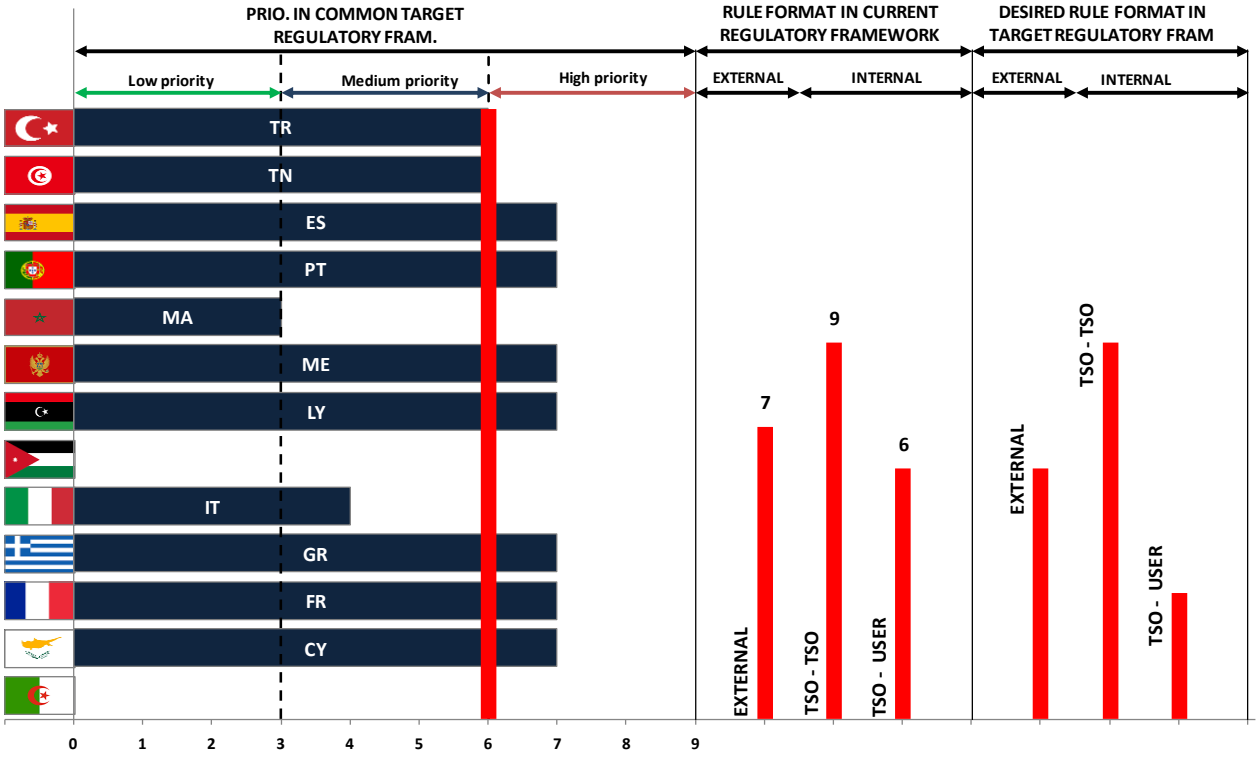
3A. Which method applies in your system for transmission capacity allocation?



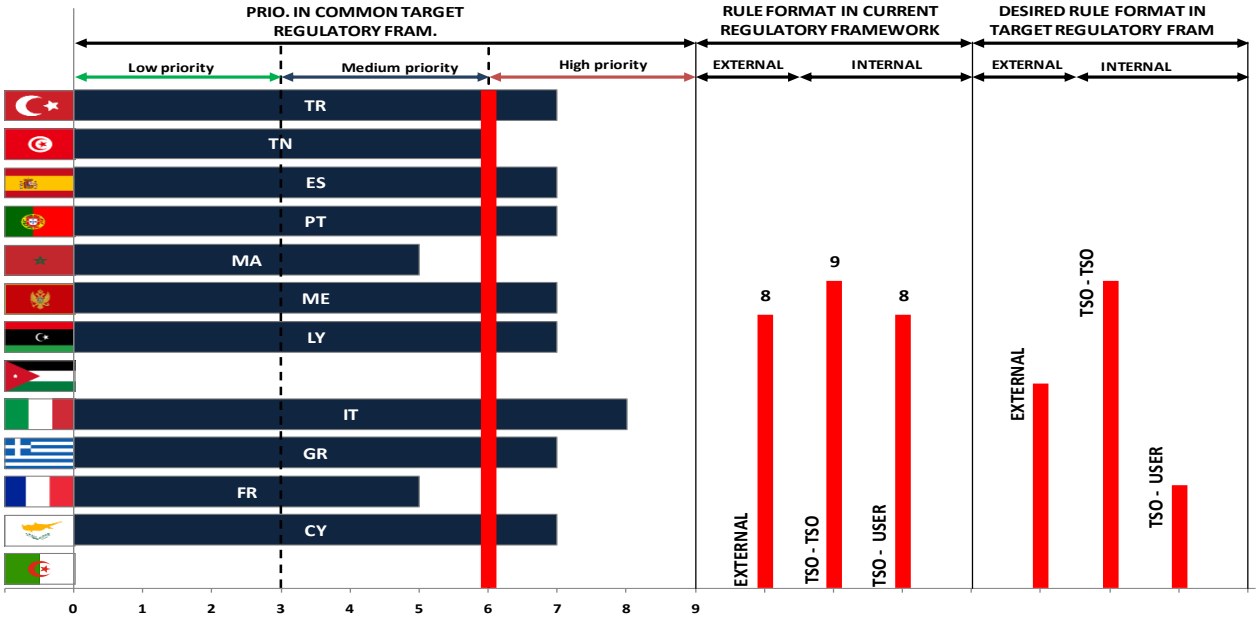
3B. Obligation to use allocated capacity?



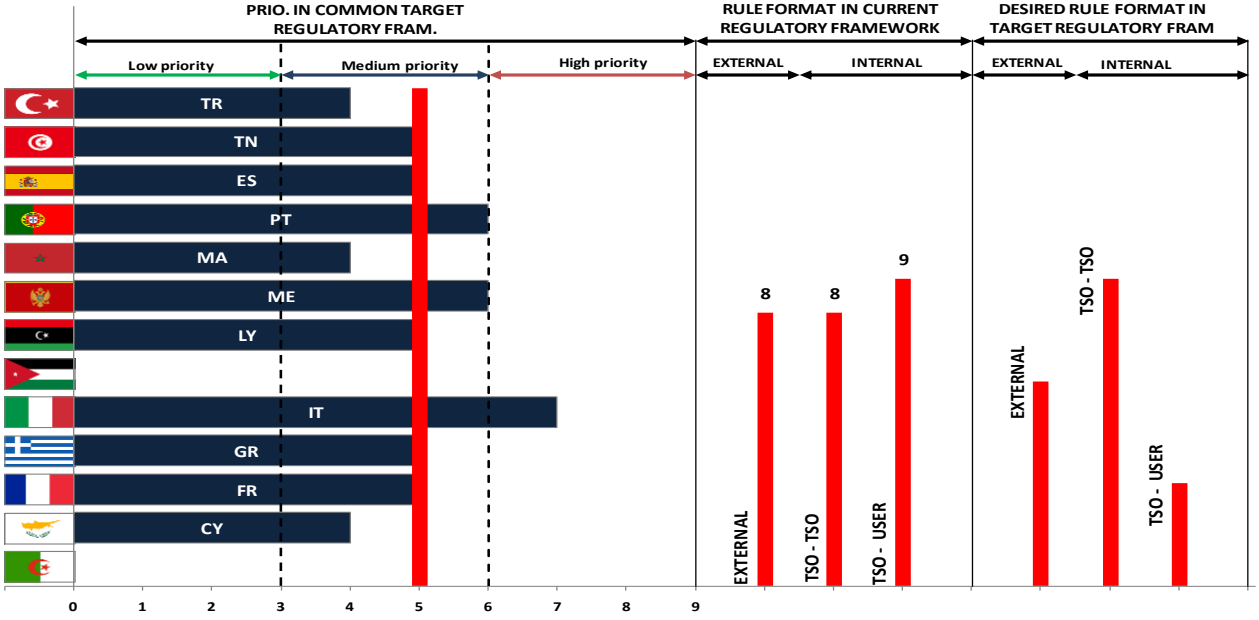
3C. Kind of capacity products



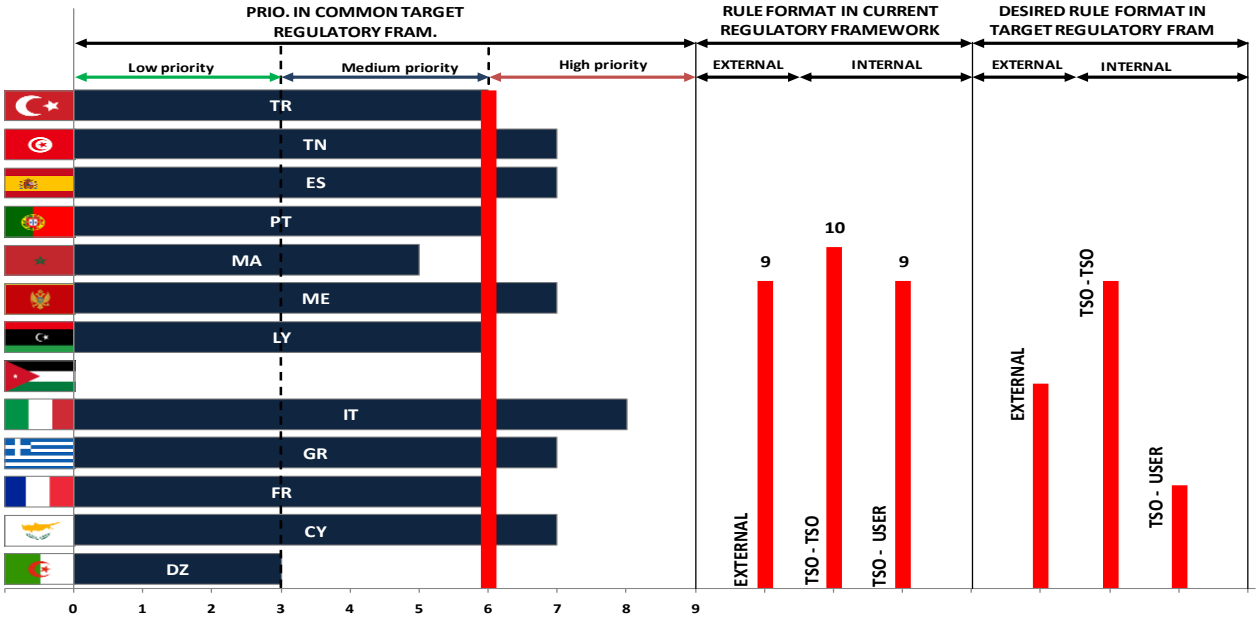
3D. What kind of procedures do you use or do you intend to use for the PTR allocation (e.g. public auction, tender procedures, ...)? How do you manage congestions in phase of PTR allocation? Which rules do you have for the management of physical and commercial use of PTR? Which related time schedule?



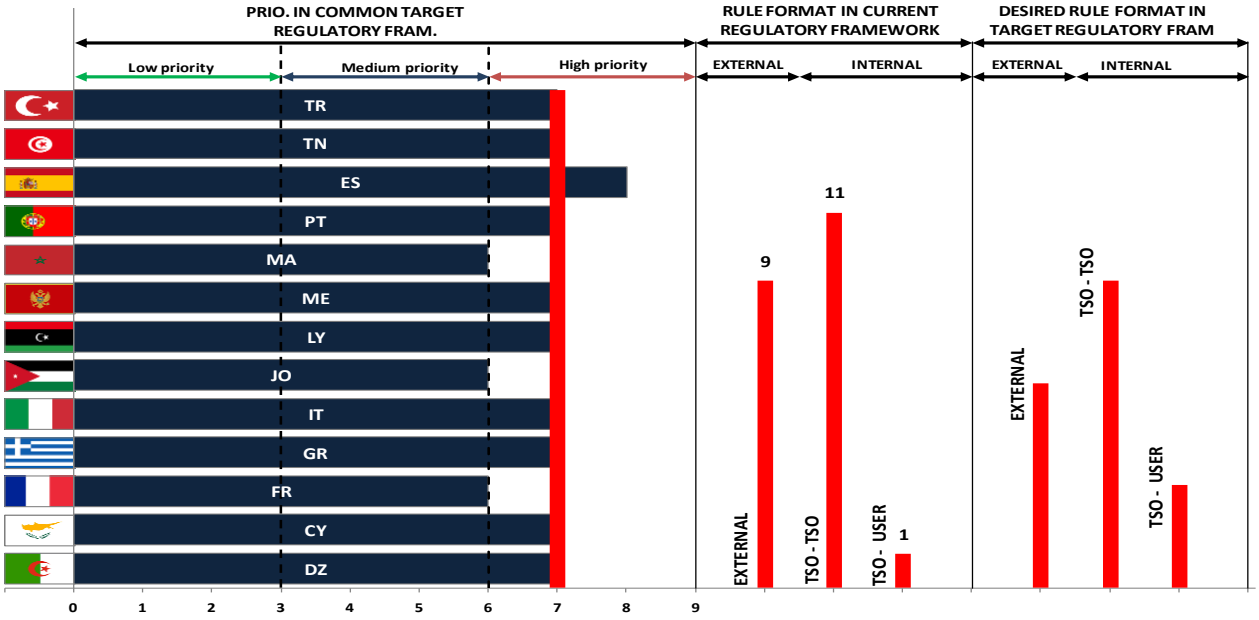
3E. Which system of liabilities, guarantees and penalties (technical and commercial) do you apply for each subject involved? Risk management: The auction rules shall contain provisions concerning risk management, possibly with an obligation for the market participants to offer collateral securities to the auction office. One possibility would be bank guarantees. a. Are there any provisions in national legislation which have to be taken into consideration? b. Does national legislation permit this tool of risk management?. c. Are there any difficulties to be expected with possible different standards for bank guarantees in your country (e.g. concerning terms of duration or the right of the beneficiary to make use of the bank guarantee?) or any other limitations which have to be taken into consideration for the purpose of introducing bank guarantees as a tool for risk management?



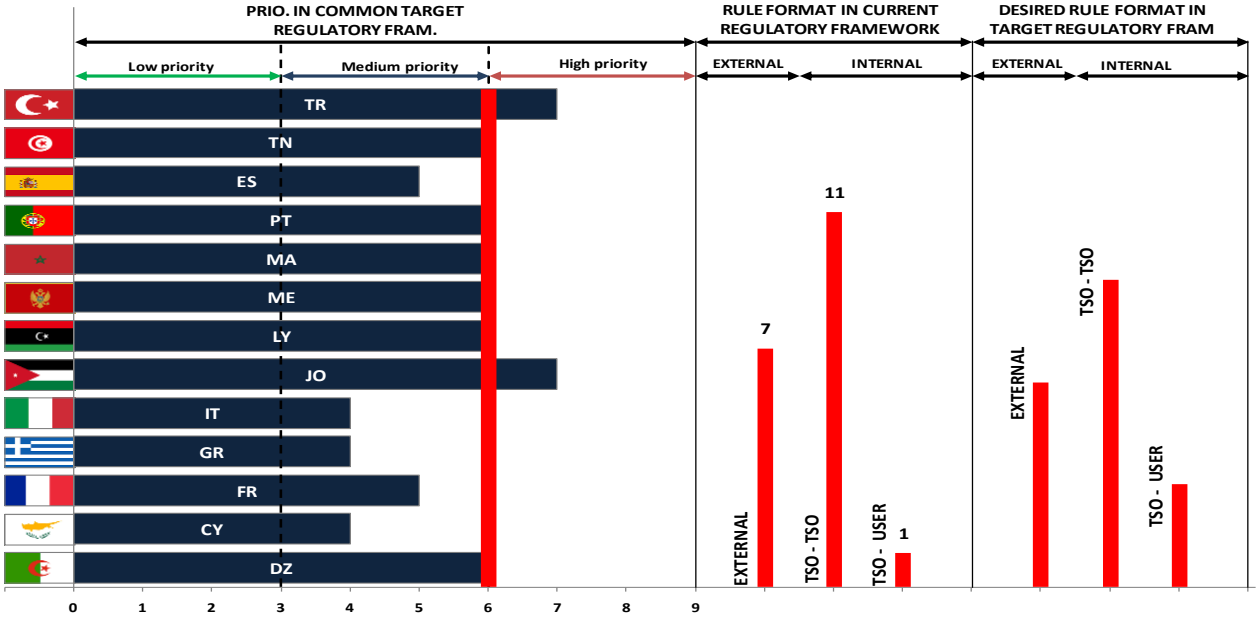
3F. Who is the subject responsible for the management procedure?



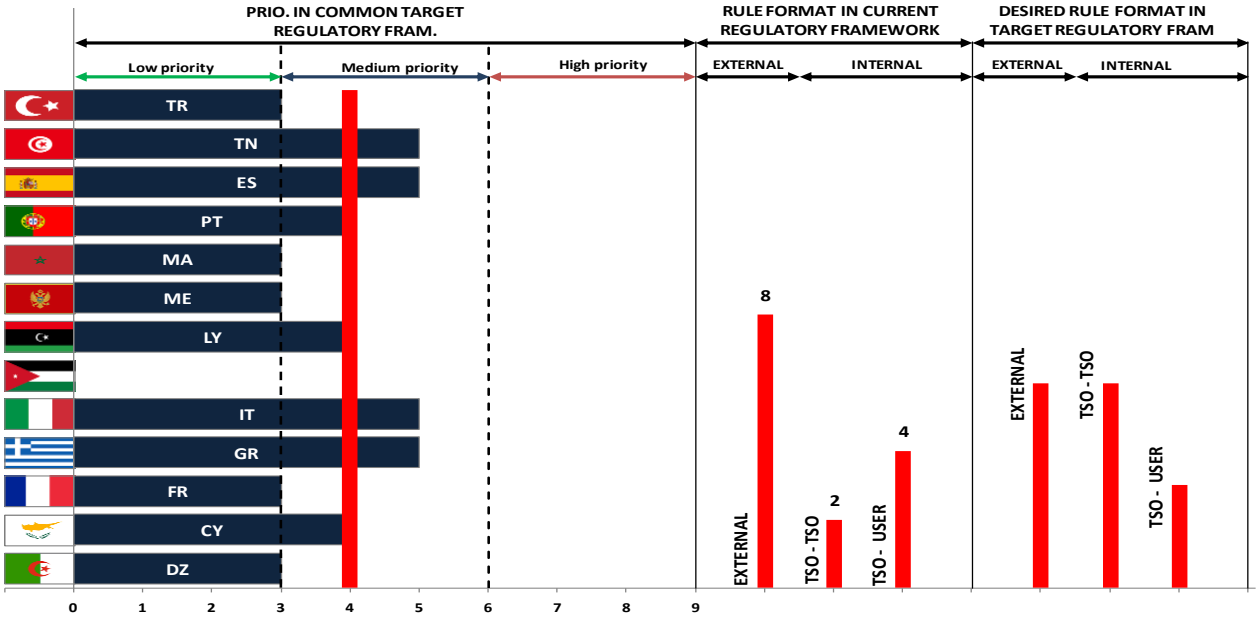
4A. Which set of actions do you apply in order to guarantee the exchange programs?



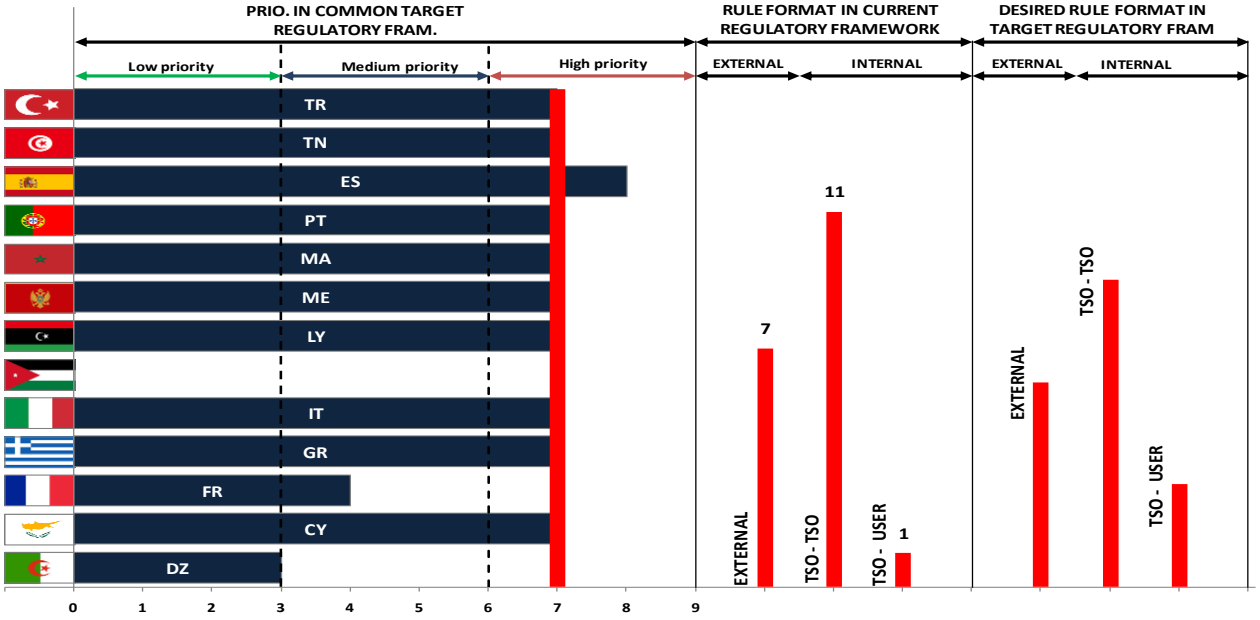
4B. How are treated unintentional deviations on international interconnections?



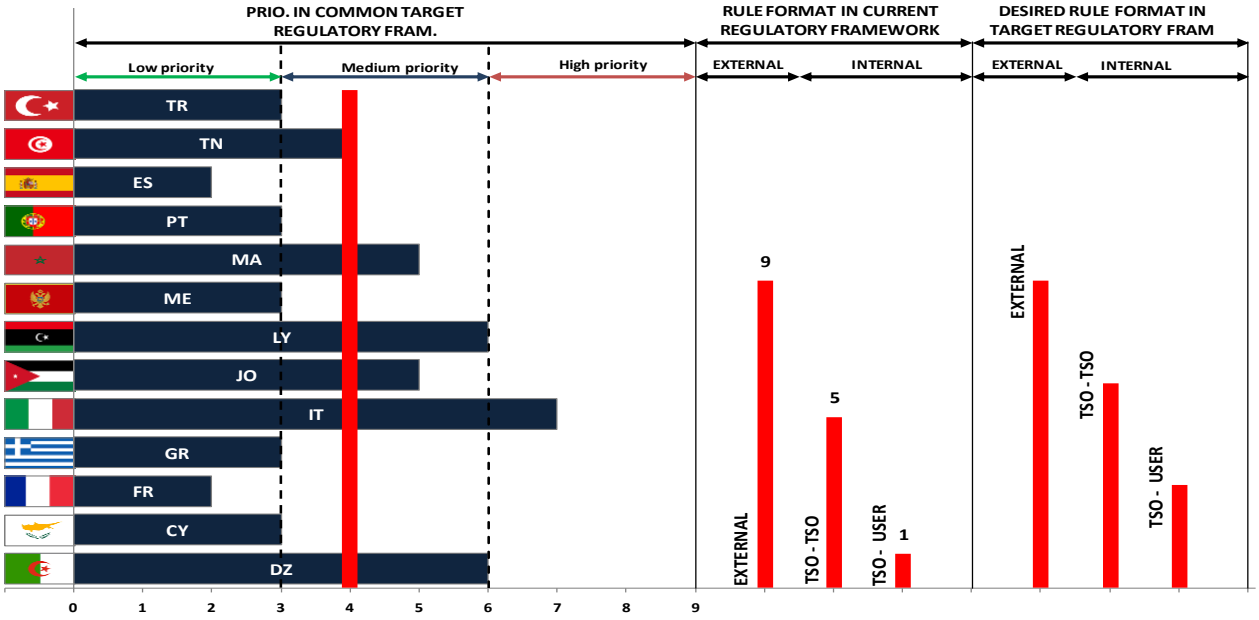
4C. Which users can provide balancing services in the international interconnections?



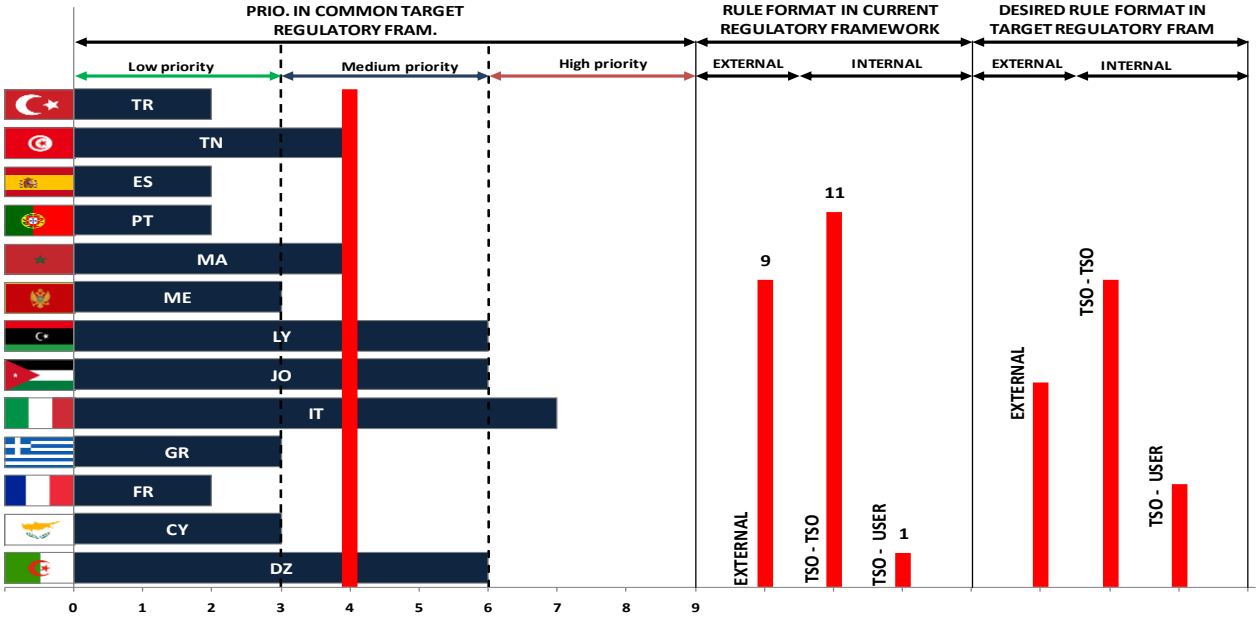
4D. Are there any international agreements on emergency situations and/or support exchanges with other countries?



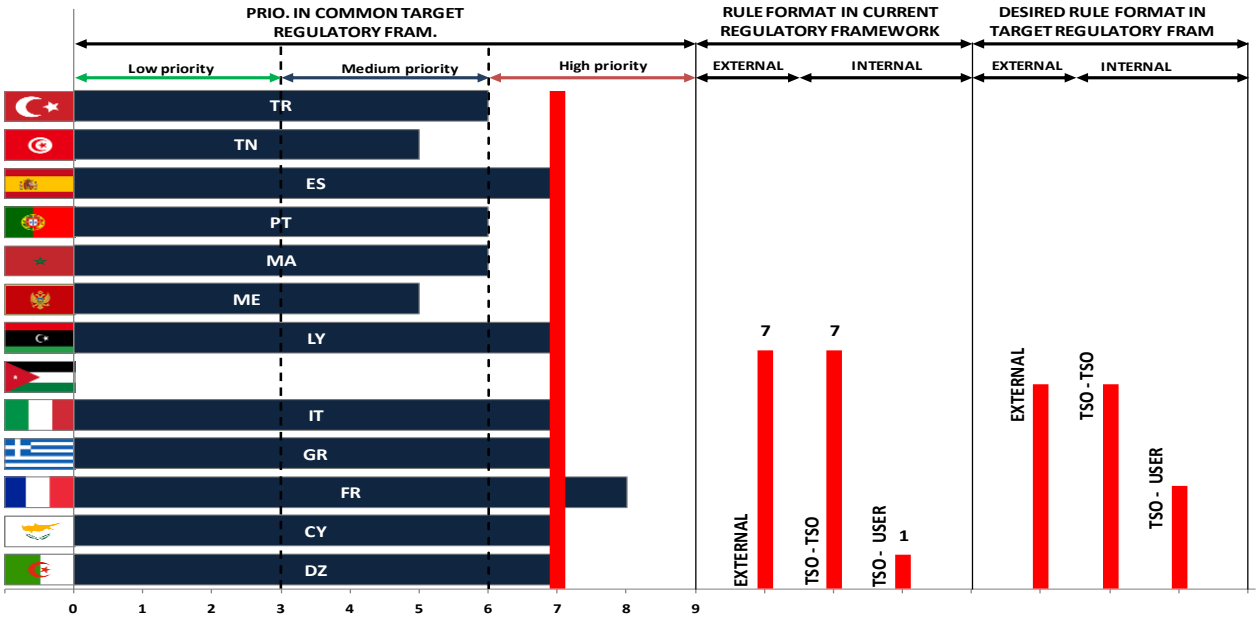
5A. Who is responsible for settlement concerning international interconnections?



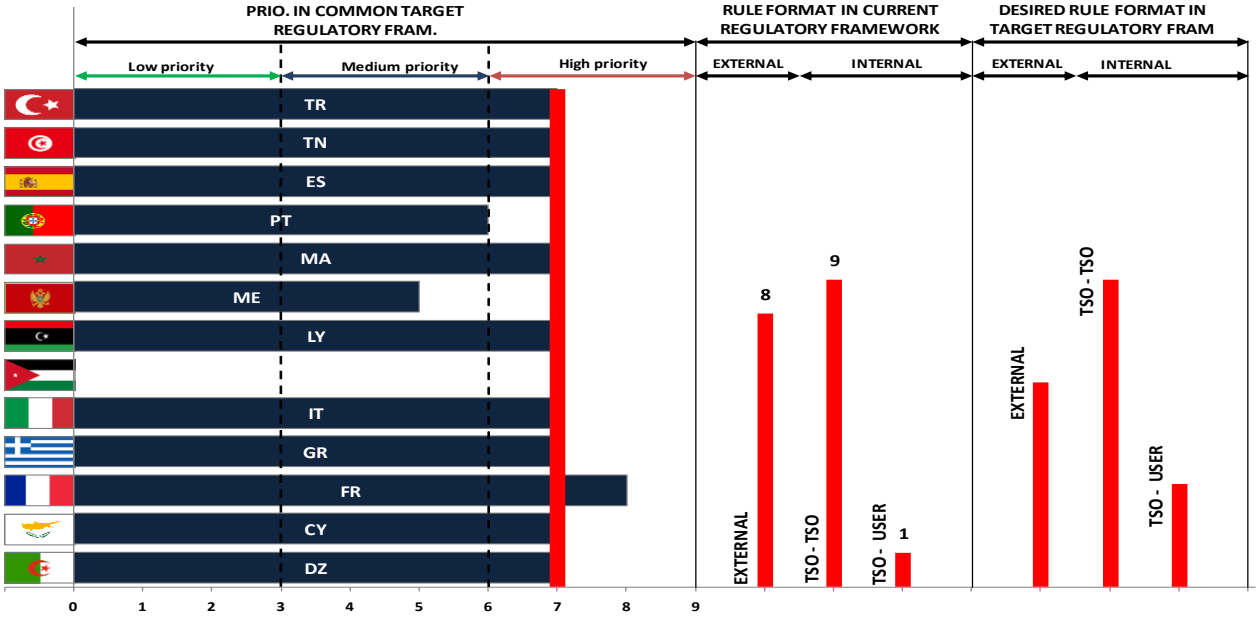
5B. Who is responsible for metering in the international interconnections?



6A. Are there any publications (public information) on the Electricity Markets data in your country? How?



6B. Are there any publications (public information) on international interconnections data in your country? How?



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