

# Guidelines for the Mediterranean Grid Code

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# GUIDELINES FOR THE MEDITERRANEAN GRID CODE

## Building the Mediterranean Grid Code<sup>1</sup>

Grid codes are the technical and commercial requirements issued by the national authorities for all the grid users (production and consumption units as well as distribution companies with all their users) to connect them to the HV transmission networks and operate as per the standards.

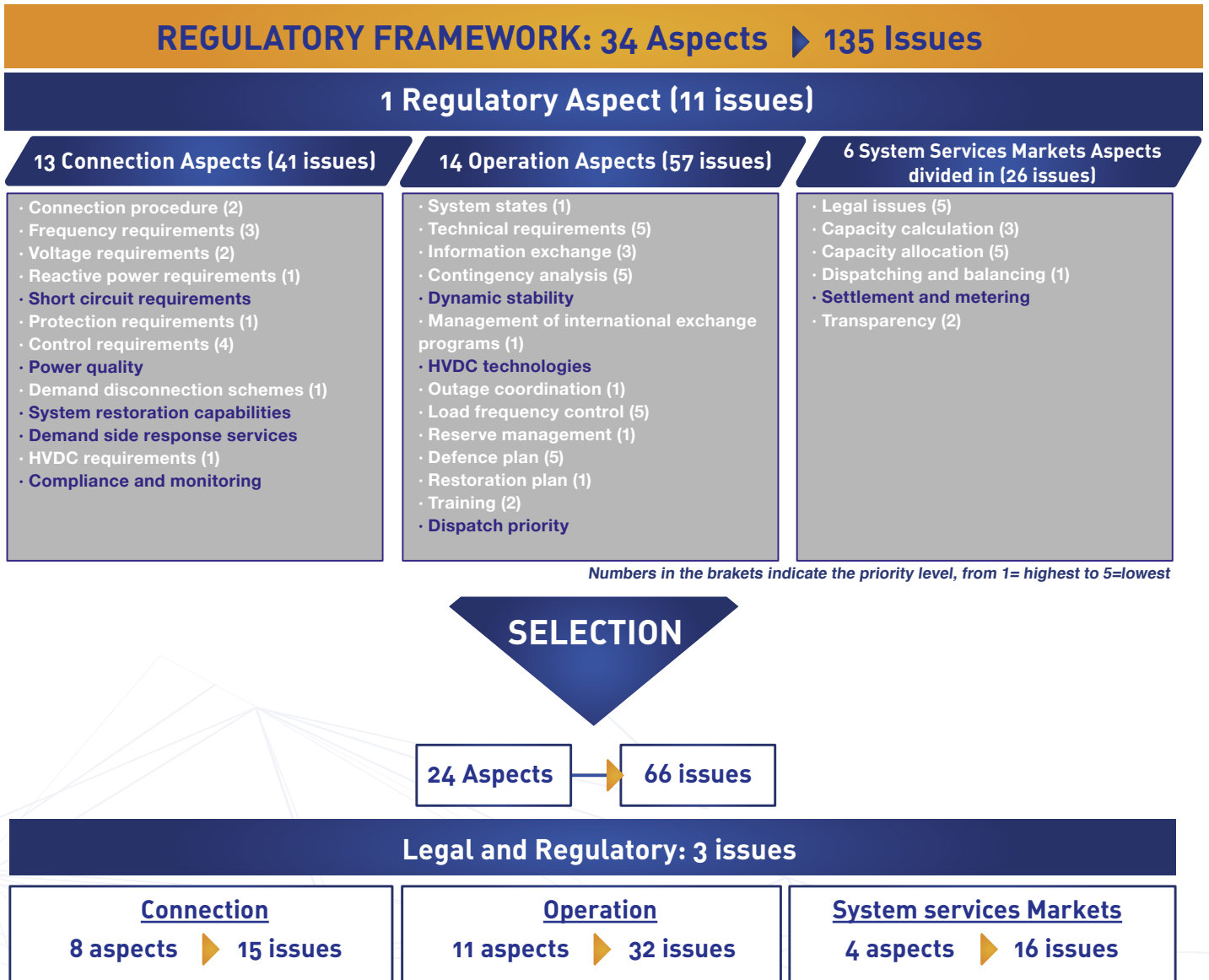
Med-TSO has developed in the two Mediterranean Projects, MP1 and MP2, a shared set of technical rules and procedures that constitute the building blocks for the elaboration of the Mediterranean Grid Codes Guidelines.

Med-TSO analysed the regulatory framework (“where we are”) in the different national power systems around the Mediterranean region and then identified, prioritized and selected the potential issues to be harmonized from a regulatory point of view, proposing a tentative roadmap (“which way we want to go”) that estimates the necessary time to implementation and entry into force.

Med-TSO focused on 4 broad thematic domains (Legal & Regulatory, Connection, Operation and System Services Markets), covering more in detail 3 technical areas:

- ◆ **Connection of users to the grid**
- ◆ **Operation of the interconnected power systems**
- ◆ **Sharing of system services**

A further classification included the identification of 34 aspects, encompassing a set of concrete technical issues (135 in total) to be potentially harmonized. Among these issues, a sub-set of items was selected, composed of 24 aspects and 66 issues, constituting the proposal for a *Common Target Regulatory Framework (CTRF)*.



**1 - Issues considered for Harmonization.**

The overall objective of CTFR is to build a shared understanding among all Med-TSO Members about what has to be considered worthy of being harmonized in a common regulatory framework, by developing a set of basic rules supporting a better interoperability of the Mediterranean power systems, facilitating electricity exchanges, infrastructure development and institutional cooperation.

Of course, the regulatory framework proposed by Med-TSO has been developed on a voluntary approach and, therefore, it is not binding, as it does not have a legal basis. Nevertheless, it shows the interest of the Members to operate proactively in that direction.

The potential binding application of the referred proposal should be subject, where relevant, to the transposition into national laws by the relevant national competent regulatory authorities. Alternatively, the proposal could be considered as “Guidelines of Good Practice” (GGP) that could be applied on a voluntary basis by Med-TSO Members.

## Proposal of a common process for the connection procedure, with main harmonization functions and responsibilities of TSOs<sup>2</sup>

The increasing amount of Renewable Energy Sources (in particular wind and solar), already existing or expected to be developed in the near future all around the Mediterranean region, can have a significant impact on the operation of the grid not only in relevant countries but also in the neighbouring interconnected power systems. In this perspective, therefore, a high level of harmonization should be required for connecting new facilities, in particular production units, with particular attention for those aspects having high impact on power system frequency and voltage control.

The Grid Code “Requirements for connection(GC RC)” defines the minimum performance capabilities, in terms of cross border implications, for all the classes of new grid connections, in order to contribute to the overall objective of increasing the security of electricity supply in the Mediterranean region. These requirements have a cross-border impact but need to be tailored country-by-country to manage and make best use of local system characteristics (network, load, generation portfolio and adopted technologies).

GC RC contains a non-exhaustive list of requirements for connecting users to the grid: all the other necessary information or parameters should be further specified at national level, possibly requiring an update and/or an amendment of the respective technical regulations (e.g. existing national grid codes). An adequate transition period from the entry into force of GC RC until its full application should allow for such a national implementation procedure, also considering the non-binding nature of this set of rules and the voluntary application in the Mediterranean area.

Med-TSO identified 7 issues to be included in the GC RC proposal, presented in the table below, developing some guidelines and a model of Grid Code that could be used at national level.

Requirements for connection of generation and demand facilities		
Requirement	Type	Scope
Frequency/time range limits for users to withstand without damage	Frequency requirements	Frequency stability
Rate of change of frequency withstand capability	Frequency requirements	Frequency stability
Limited frequency sensitive modes - over and under frequency schemes	Frequency requirements	Frequency stability
Voltage/time range limits for users to withstand without damage	Voltage requirements	Voltage stability
Fault ride through capability	Voltage requirements	Robustness of Generating Units
Limits of reactive power contributor	Reactive power requirements	Voltage stability
Observability and controllability requirements (including magnitudes to be provided in real time)	Control requirements	General system management

## 2 - Requirements for connection of generation and demand facilities

This analysis was then further developed<sup>3</sup> by detailing four main issues regarding different aspects to be considered within the connection procedure.

Two basic approaches for generation expansion are explained in the analysis: top-down and bottom-up, including also a “mixed” approach that could be used in the region. The studies and analysis to be performed by the TSOs and the criteria used to evaluate spare capacity in the transmission grid were identified. Finally, economic aspects were included, with considerations on how to deal with the cost of the transmission grid developments necessary for connecting the generation facilities.

The proposal covers the requirements for connecting generation facilities to the grid of the interconnected power system and applies to new facilities to be connected both at the transmission and distribution level. Requirements are relevant to: frequency stability; limited frequency sensitive modes(over and under frequency schemes); voltage/time range limits for users to withstand without damage(fault-ride through capability); reactive power requirements; user observability and controllability.

### Proposal of a common process for the Operation of the interconnected systems<sup>4</sup>

The expected high penetration of RES in the Mediterranean region will have a strong impact on the operation of the system. The main objective of the Grid Code for System Operation (GC SO) is to define common technical rules to be adopted by the TSOs in this domain, to guarantee the necessary coordination to ensure the interoperability of the interconnected power system while keeping its safe, secure, efficient and effective operation. Based on the results of the surveys conducted by Med-TSO, 12 issues were selected to be included in the proposal of GC SO, as presented in the table below.

Requirements for connection of generation and demand facilities		
Requirement	Type	Scope
Classification of System States	System States	System Operation
Frequency ranges in the different system states	Frequency requirements	
Voltage for unlimited operation	Voltage requirements	
Reactive power management measures	Reactive power requirements	
System protection coordination criteria	Protection requirements	
List of structural data to exchange between TSOs	Information exchange	
List of scheduled data to exchange between TSOs	Information exchange	
List of real time data to exchange between TSOs	Information exchange	
Contingency analysis	Contingencies	Operational Planning
Operational security limits	Contingencies	
List of joint remedial actions	Contingencies	
Outage coordination	Outage coordination	

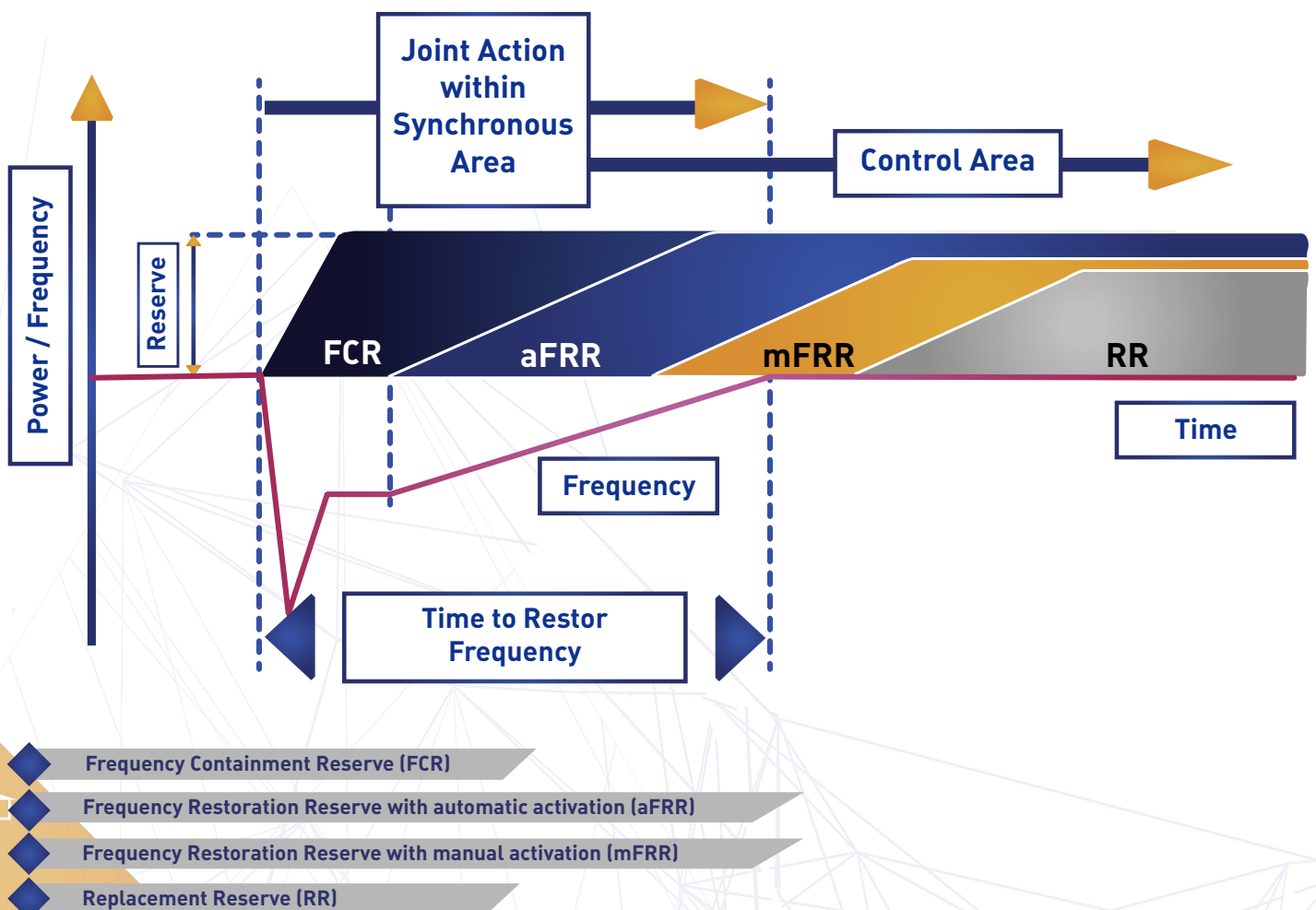
### 3 Grid Code on System Operation (GC SO)

A proposal of guidelines for those issues to be commonly adopted in the Mediterranean area is further described and clarified in the related report, together with some models for their implementation at national level.

GC SO establishes the main principles and requirements about frequency quality parameters, operational security, outages coordination and data exchange rules between TSOs.

In particular, Med-TSO developed a proposal of common rules for the following topics:

- ◆ **Legal issues:** identification of all the participants (i.e. TSO, market participants, balance responsible parties, balancing service providers) and definition of roles, registration and obligations are extensively described.
- ◆ **Capacity calculation:** coordinated capacity calculation of the transmission capacity at the borders are to be developed, to ensure that capacity calculation is reliable, and that optimal capacity is made available to the market at regional level. To this aim, capacity calculation regions should be established. Until the establishment of these regions, capacity calculations should be done bilaterally between bordering TSOs.
- ◆ **Capacity allocation:** Transmission System Operators should offer firm cross-border capacity on a regular basis for all the energy transactions, by defining a number of regular points in time for its allocation. The available cross-border capacity should be split in different timeframes and allocated through different auctions for each time horizon.
- ◆ **Load frequency control & definition of reserves:** frequency stability in a power system reflects the equilibrium between production and consumption. Since consumption fluctuates by nature, it is necessary to adjust constantly the level of production to maintain the frequency at a stable reference value (50 Hz in the Mediterranean region). Most of the components of the system are optimized and specified to operate in a given frequency range. Outside this tolerance range, even serious equipment malfunctions may occur (especially on regulating devices) and, if the imbalance is too big, generation groups disconnect from the grid, possibly causing the collapse of all or part of the electrical system. TSOs need to procure resources (i.e. power reserve) from the generation units, in order to control the stability of the power system at different timeframes and with different characteristics, as depicted in fig. 4.



#### 4 Frequency Control fields

The practical adoption of all of these rules and standards, their possible update, publishing and implementation by the relevant Authorities remains a priority in the short term.

Due to the peculiarities of the region, characterized by a large integrated area in the European bank of the Mediterranean governed by a set of common rules and by a variety of situations in the southern and eastern banks, it will be necessary to elaborate tailor-made solutions at a sub-regional level, proceeding with pragmatism and spirit of cooperation. In this sense, Med-TSO considered more appropriate to elaborate guidelines instead of binding codes where there is not a common legislative framework.

The defined proposals are only a first attempt to intervene on the matter for the global regulatory harmonisation in the Mediterranean region, for guaranteeing the security of power supply, while accomplishing the ambitious objectives of increasing energy sustainability and markets integration.

Further work is necessary, to coordinate with other perspectives, advance in the implementation details of priority rules and enlarge the harmonisation perimeter to other issues beyond the priority level, while articulate potential intermediate stages where partial harmonization might be achieved. These developments and the practical implementation of the new rules are in many cases beyond the duties and possibilities of TSOs, as they may require the engagement of Regulators and of institutional stakeholders, both at national and regional level. In order to tackle the related challenges and develop a framework of harmonized rules, Med-TSO promotes the cooperation with the main stakeholders active in the Mediterranean region (such as MedReg, UfM, PAM, AUE, COMELEC) in order to achieve concrete results. A road map for implementing the rules is already defined and will be further developed, putting in place an appropriate monitoring process for verifying its adoption in Med-TSO countries and a strong program of stakeholders engagement.



Med-TSO is the Association of the Mediterranean Transmission System Operators (TSOs) for electricity, operating the High Voltage Transmission Networks of 19 Mediterranean Countries. It was established on 19 April 2012 in Rome as a technical platform that, using multilateral cooperation as a strategy of regional development, could facilitate the integration of the Mediterranean Power Systems and foster Security and Socio – economic Development in the Region.

Med-TSO members share the primary objective of promoting the creation of a Mediterranean energy market, ensuring its optimal functioning through the definition of common methodologies, rules and practices for optimizing the operation of the existing infrastructures and facilitating the development of new ones.

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