Requirements for RES in the future European Grid Codes drafted by ENTSO-E

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REQUIREMENTS FOR RES

IN THE FUTURE EUROPEAN GRID CODES DRAFTED BY ENTSO-E

1. Why Grid Codes and Who is ENTSO-E?
2. Challenges ahead relevant to RES requirements
3. Technical requirements for RES connection to the grid
4. Connection procedures and compliance monitoring

WHY GRID CODES AND WHO IS ENTSO-E?

Grid codes or equivalent are required by DIRECTIVE 2009/72/EC at least at national level

- The regulatory authorities where Member States have so provided or Member States shall ensure that technical safety criteria are defined and that
- technical rules establishing the minimum technical design and operational requirements for the connection to the system of generating installations, distribution systems, directly connected consumers' equipment, interconnector circuits and direct lines are developed and made public.
- Those technical rules shall ensure the interoperability of systems and shall be objective and non-discriminatory.

REGULATION (EC) No 714/2009 on conditions for access to the network for cross-border exchanges in electricity

Moreover, the EU Commission requests ENTSO-E to develop network codes covering the following areas, taking into account, if appropriate, regional specificities:

- (a)network security and reliability rules including rules for technical transmission reserve capacity for operational network security;
- (b)network connection rules;
- (c) third-party access rules;
- (d) data exchange and settlement rules;
- (e) interoperability rules;
- (f) operational procedures in an emergency;
- (g) capacity-allocation and congestion-management rules;
- (h) rules for trading related to technical and operational provision of network access services and system balancing;
- (i) transparency rules;
- (j) balancing rules including network-related reserve power rules;
- (k)rules regarding harmonised transmission tariff structures including locational signals and inter-transmission system operator compensation rules;
- (l)energy efficiency regarding electricity networks.

Grid codes or equivalent : main features

They are publicly available sets of rules for developing and operating network following principles of transparency and non-discrimination

- They apply to TSOs and DSOs (planning and operating rules…)
- They apply to grid users and service providers (connection of generators, consumers, interconnectors; exchanges of information…)
- They define common processes (metering, ancillary services)
- Requirements are brought together in a single code or can be split in various regulations or various levels of regulation (case of France)
- Public consultation is largely used for establishing and updating network codes.

Who is ENTSO-E ?

ENTSO-E, the European Network of Transmission System Operators: 41 electricity transmission system operators (TSOs) from 34 countries across Europe.

ENTSO-E was established and given legal mandates by the EU's Third Legislative Package for the Internal Energy Market in 2009, which aims at further liberalising the gas and electricity markets in the EU.

ENTSO-E promotes closer cooperation across Europe's TSOs to support the implementation of EU energy policy and achieve Europe's energy & climate policy objectives, which are changing the very nature of the power system

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Reliable Sustainable Connected

Who is ENTSO-E ?

The main objectives of ENTSO-E centre on the integration of renewable energy sources (RES) such as wind and solar power into the power system, and the completion of the internal energy market (IEM), which is central to meeting the European Union's energy policy objectives of affordability, sustainability and security of supply.

The drafting of network codes is one of the main contributions of ENTSO-E to the achievement of these objectives.

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The Draft European Network Codes

Connection codes

- Requirements for generators
- Demand connection
- HVDC Connections and DC-connected Power Park Modules

Operational Security

- Operational Security
- Operational Planning and Scheduling
- Load Frequency Control & Reserves
- Emergency and restoration

Market network codes or regulations

- Capacity calculation & Congestion management
- Forward Capacity Allocation
- Electricity Balancing

CHALLENGES AHEAD

RELEVANT TO RES REQUIREMENTS

The European electricity system is going through a period of unprecedented change.

The generation mix is changing fundamentally, the potential for the demand side to become much more involved is vast and the market is becoming genuinely pan European. For Europe to achieve its trio of objectives of ensuring and enhancing security of supply; creating competitive markets; and facilitating the transition to a low carbon economy **there will need to be a significant change in the role of network users,** of Distribution System Operators and of Transmission System Operators.

It is becoming increasingly important that **all types of users** (i.e. generation, demand, distribution networks, and interconnections) **play an active role in providing the capabilities and services which are needed to maintain the security of the pan European transmission system.**

Increasing the controllability and the flexibility of all power system elements, including RES

Operating conditions with the highest RES injection (typically in windy / sunny conditions with moderate demand) present major system challenges, particularly where the high RES penetration extends to a total control area or even more if covering a total synchronous area.

The move towards a more RES dominated system implies a gradual diminution of the large scale generation connected at EHV level and this will be further compounded by this generation having much reduced running hours compared to today's levels particularly at times of favourable RES generation conditions

The main answer to this is to increase the controllability and the flexibility of all power system elements, including RES, to deliver a power system which can react and cope better with the volatility of RES.

Technical challenges ahead related to stable operation of the power systems

The three main new or expanded technical challenges ahead related to stable operation of the power systems are:

- **Frequency management**
- **Voltage management**
- **Fault level (system strength) management**

Frequency Stability

Frequency Stability is significantly impacted by the rapid increase of RES generation both through the variability of generation patterns (driven by wind speed and solar irradiation) and reduced system inertia as large conventional synchronous generation is replaced by non-synchronous convertor based RES generators.

To compensate new response and reserve strategies are required with more particularly RES generation having to be resilient to wider frequency ranges and provide new capabilities (fast frequency response and system inertia, frequency sensitive mode for large parks…).

Voltage stability

At transmission voltages, voltage management needs to be ensured in areas remote from main centres of RES installations during times of high RES production when conventional generation, which has traditionally provided this service, being displaced;

Voltage stability would be compromised if the increasing levels of generation connected at distribution voltages are unable to provide the necessary reactive power support. There are also economic benefits in providing voltage support at a distribution level (close to the demand) rather than from centralized sources connected to the transmission system.

Fault Ride Through (FRT)

Small levels of RES generation (geographically dispersed) are unlikely to significantly impact the secure operation of the system should they shut down simultaneously. However, as the levels of RES increase it is of increasing importance that a single system event should not result in the large scale shut down generation. RES generation needs to be resilient to system faults staying connected (and generating) during the initial voltage transients (as conventional generation does today).

Fault level (system strength) management shall be possible in context of rapid changes from high system strength during low RES production to extreme low system strength during high RES production, when synchronous generation is displaced (not operating).

Remote Control of distributed generation units

Remote Control of distributed generation units is a highly relevant requirement in the modern electrical network. In this sense, there already exists a very successful experience in Europe with the Spanish CECRE.

The control capability is foreseen to include active as well as reactive power regulation in order to support grid stability as well as online reconfiguration. Functionality like on the fly reconfiguration is foreseen to be essential for implementation of Smart Grid solutions in the near future, an added enabler for further RES integration.

TECHNICAL REQUIREMENTS

FOR RES CONNECTION TO THE GRID

(Onshore connection)

ENTSO-E Network code – Requirements for generators

The RfG code :

- sets requirements for connections to the grid for Power Generating Facilities, including Synchronous Power Generating Modules, Power Park Modules and Offshore Generation Facilities (AC connected).
- defines the operational notification procedure for connection to the grid.
- defines compliance criteria & derogation processes.

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What does RfG NC cover?

The network code sets out the technical requirements that all new electricity generators must adhere to. The requirements depend on the size of the generator – with the smallest facing only a minimum set of requirements and obligations, gradually building up as plant size increases. The requirements clearly set out the tasks and responsibilities for generation owners and network operators (TSO and DSOs).

They determine procedures to ensure non-discriminatory treatment of generators across Europe and are based on realistic future generation/demand scenarios based on the development of large volumes of renewable energy sources (RES) in Europe.

What does RfG NC cover?

The Network Code on Requirements for Generators (NC RfG) identifies four classes of generators to which the regulation will apply (type A, B, C, D). These are categorised by size, with type A covering the smallest generating units (anything above 800W) and including technologies such as solar panels installed on the roof of a house or a small wind turbine. Requirements increase as size increases, with type D applying to the largest plants connecting to electricity transmission systems.

Type A generators have to meet the most basic set of requirements, focused on frequency stability. The requirements increase progressively; for example, type D generators will have to meet most of the requirements met by a type A, B and C generators in addition to other specific requirements.

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What does RfG NC cover?

Two large categories of generation exist, rotating machine generation and power electronic interfaces.

For each category, specific requirements are set out (requirements for Synchronous Power Generating Modules and Power Park Modules).

In RfG NC, specific considerations for a given technology can be dealt with at the national implementation level.

Classification of Power Generating Modules

Type A	Type B	Type C	Type D
Conected below 110 kV			above 110 kV
maximum capacity threshold:			
0.8 kW or more	1 MW or more	50 MW or more	75 MW or more

General Requirements for Type A, B, C and D Power Geenrating Modules

Additional Requirements for Type B, C and D Synchronous Power Generating Modules or Power Park Modules

Will the requirements for new generators apply to existing ones?

The requirements set out in the RfG NC will apply to new generators. They will not apply to existing generators unless the relevant network operator and corresponding regulatory authority request it. For this to happen, a clear process must be followed including extensive analysis and approval by regulatory authorities.

If there is a valid case for retrofitting existing generators, the RfG NC provide a transparent process to be followed. This involves a number of steps including; a quantified cost benefit analysis, public consultation and final decision by the national regulatory authorities.

Example

- For several countries in Europe, development of the Backfitting procedure for existing photovoltaic power plants
- – "50.2Hz Problem" to minimise the risk of splitting the network in sub-networks and of blackout

  Procedure is based on
  - Public consultation
  - Cost-Benefit Analysis
  - Detailed procedure for transmission and distribution network operators and power generation facility owners
- In Germany, new Procedure is starting in May 2015 – "Backfitting of RES related to 49.5 Hz Problem"
  - 21000 Power Generating Facilities with an installed capacity of 26 GW

REQUIREMENTS RELATED TO FREQUENCY STABILITY

Frequency Ranges

[Article 8 – Applicable for Power Generating Modules Type A, B, C and D]

A Power Generating Module shall be capable of staying connected to the network and operating within the Frequency ranges and time periods as defined in the NC

Comments and examples : in continental Europe

Frequency ranges	Time period for operation
51.5 Hz ≤ f ≤ 52.5 Hz	*10 minutes*
51 Hz ≤ f < 51.5 Hz	*1 hour*
49 Hz ≤ f < 51 Hz	*Unlimited*
48.5 Hz ≤ f < 49 Hz	*1 hour*
47,5 Hz ≤ f < 48.5 Hz	*>30 minutes*

Rate of Change of Frequency Withstand Capability

[Article 8 – Applicable for Power Generating Modules Type A, B, C and D]

With regard to the rate of change of Frequency withstand capability, a Power Generating Module shall be capable of staying connected to the Network and operating at rates of change of Frequency up to a value defined by the Relevant TSO.

Comments and examples :

In Eire, ROCOF up to a value of -0.5 and +0.5 Hz/ sec

Limited Frequency Sensitive Mode (Overfrequency)

[Article 8 – Applicable for Power Generating Modules Type A, B, C and D]

With regard to the Limited Frequency Sensitive Mode - Overfrequency (LFSM-O) :

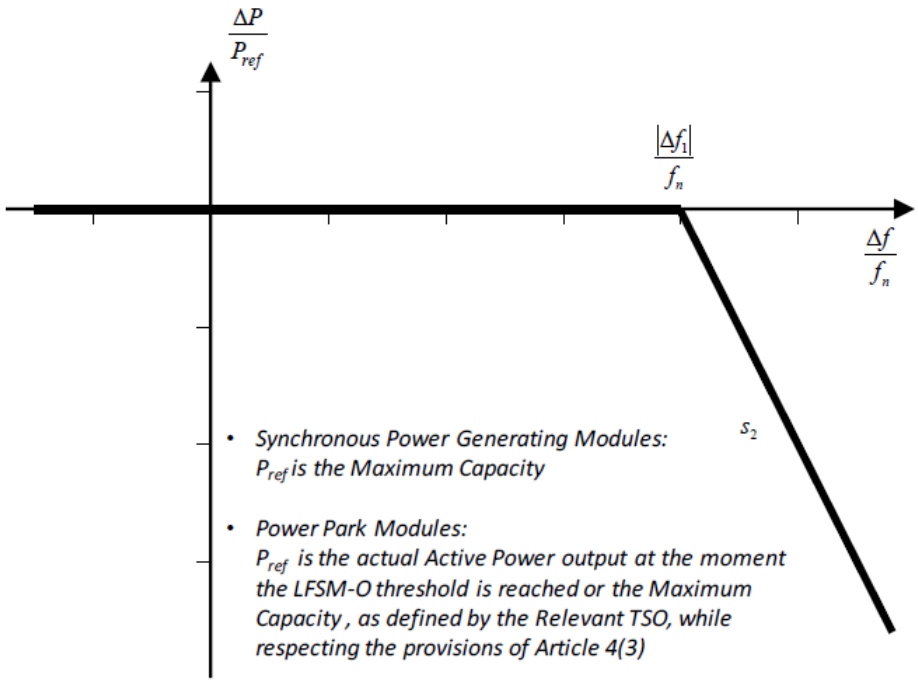


Figure 1: Source: Requirements for Grid Connection Applicable to all Generators

The Power Generating Module shall be capable of activating the provision of Active Power Frequency Response according to figure at a Frequency threshold, adjustable between and including 50.2 Hz and 50.5 Hz with a Droop in a range of 2 - 12 %.

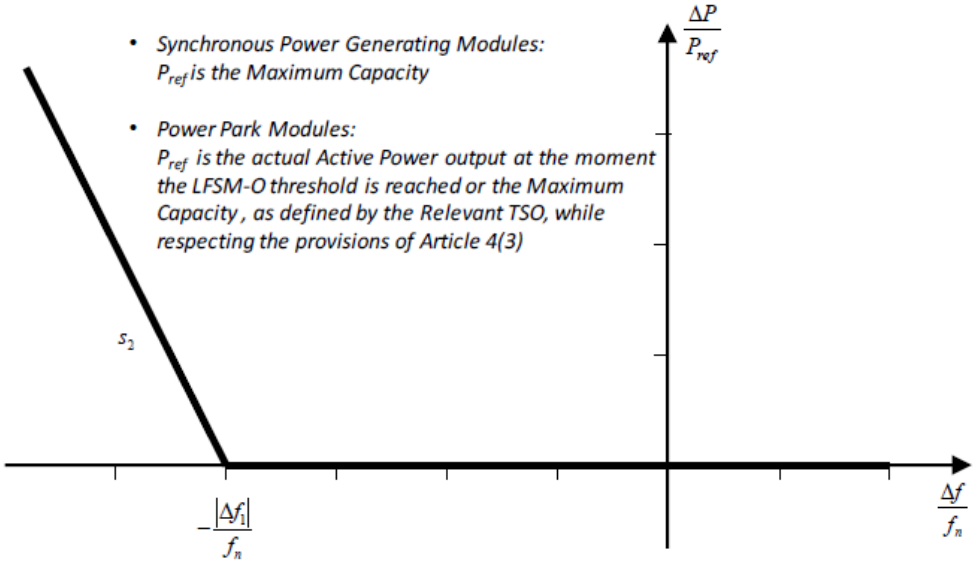
In proposals for Turkish Grid Code, the Frequency threshold is 50.2 Hz and the Droop is 4% unless stated otherwise by TEIAS.

Additional requirement in Turkey : Type A PGM shall stop to provide electric power to the network, when the Frequency is above 51.5 Hz.

Limited Frequency Sensitive Mode (Underfrequency)

[Article 10 - Applicable for Power Generating Modules Type C and D]

The Power Generating Module shall be capable of activating the provision of Active Power Frequency Response according to figure at a Frequency threshold between and including 49.8 Hz and 49.5 Hz with a Droop in a range of 2 – 12 %.

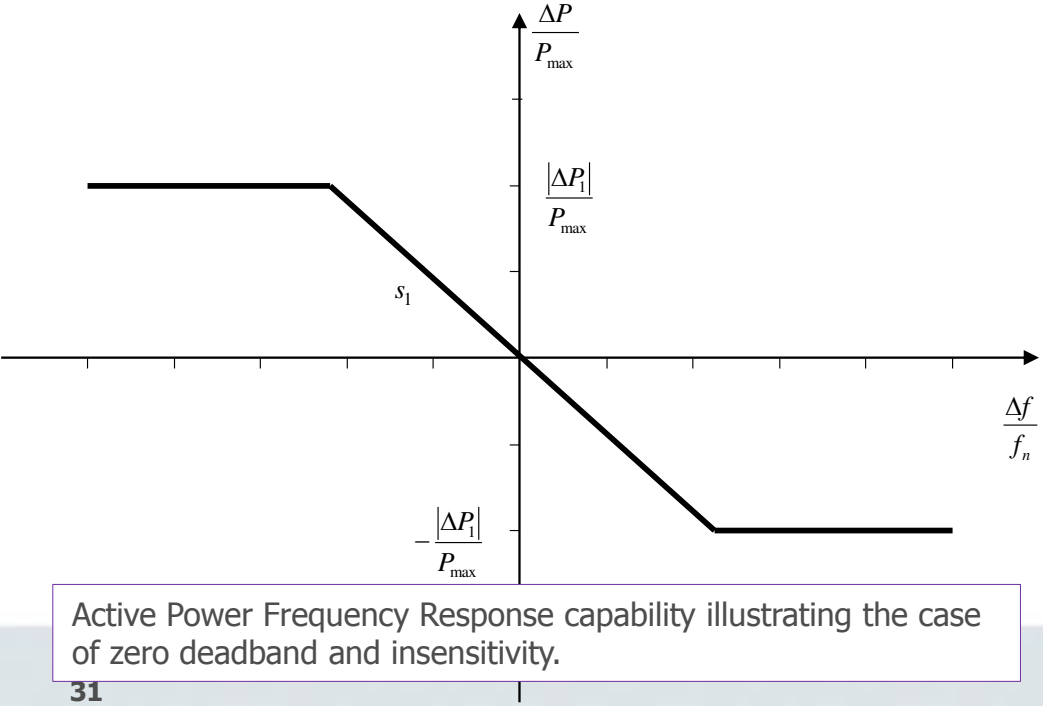


In proposals for Turkish Grid Code, the Frequency threshold is 49.8 Hz and the Droop is 4% unless stated otherwise by TEIAS.

Frequency Sensitive Mode (1/2)

[Article 10 - Applicable for Power Generating Modules Type C and D]

The Power Generating Module shall be capable of providing Active Power Frequency Response with respect to following figure and in accordance with the parameters specified by the TSO within the following ranges (see table)



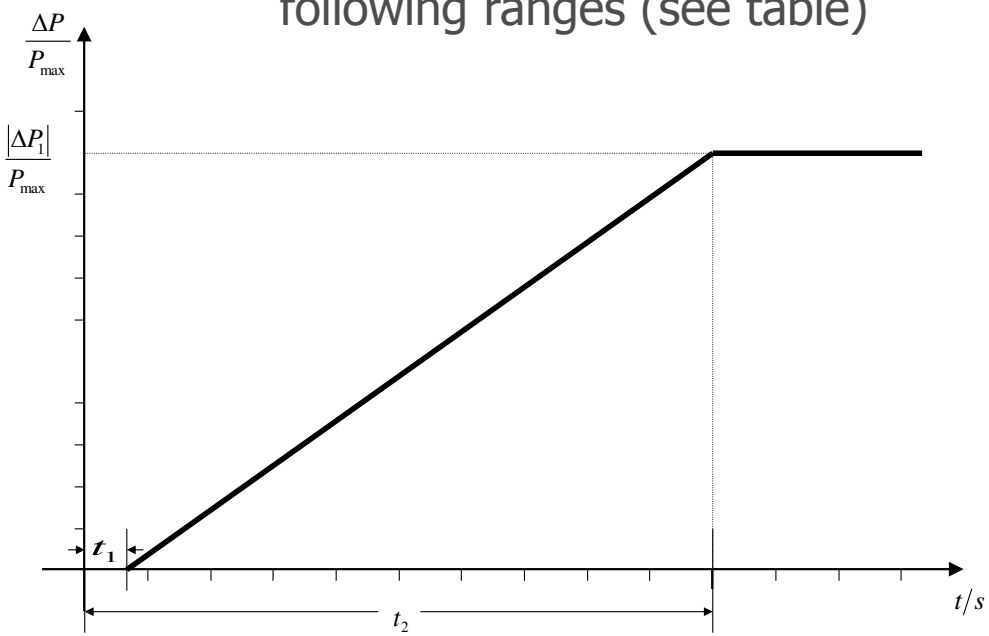
Active Power Frequency Response capability illustrating the case of zero deadband and insensitivity.

Parameters		Ranges
Active Power range related to Maximum Capacity		1.5 – 10 %
Frequency Response Insensitivity		10 – 30 mHz
		0.02 – 0.06 %
Frequency Response Deadband		0 – 500 mHz
Droop		2 – 12 %

Frequency Sensitive Mode (2/2)

[Article 10 - Applicable for Power Generating Modules Type C and D]

As a result of a frequency step change, the Power Generating Module shall be capable of activating full Active Power Frequency Response, at or above the full line according to following figure in accordance with the parameters specified by each TSO within the following ranges (see table)



Parameters	Ranges or values
Active Power range related to Maximum Capacity (Frequency response range)	**1.5 – 10 %**
Maximum admissible initial delay unless justified otherwise f**or generation technologies with Inertia**	**2 seconds**
Maximum admissible initial delay unless justified otherwise for generation technologies without Inertia	as specified by the Relevant TSO
Maximum full activation time	**30 seconds**

Synthetic Inertia to a low frequency event

[Article 16 – Applicable for Power Park Modules Type C and D]

The Relevant TSO has the right to require a Power Park Module, which is not inherently capable of supplying additional Active Power to the Network by its Inertia and which is greater than a MW size specified by the Relevant TSO, to install a feature in the control system which operates the Power Park Module so as to supply additional Active Power to the Network in order to limit the rate of change of Frequency following a sudden loss of infeed.

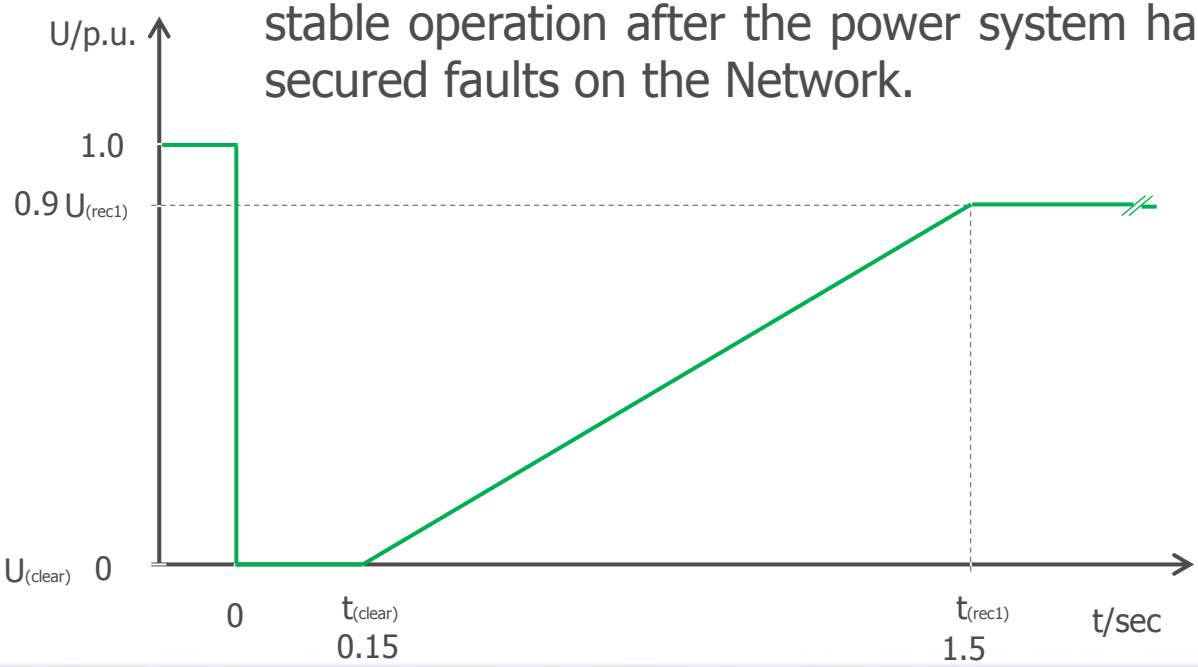
The operating principle of this control system and the associated performance parameters is defined by the Relevant TSO.

FAULT RIDE THROUGH (FRT)

Fault ride through capability

[Article 8 – Applicable for Power Generating Modules Type B, C and D]

Each TSO defines at national level a voltage-against-time-profile at the Connection Point for fault conditions which describes the conditions in which the Power Generating Module shall be capable of staying connected to the Network and continuing stable operation after the power system has been disturbed by secured faults on the Network.



proposals for Turkish Grid Code:

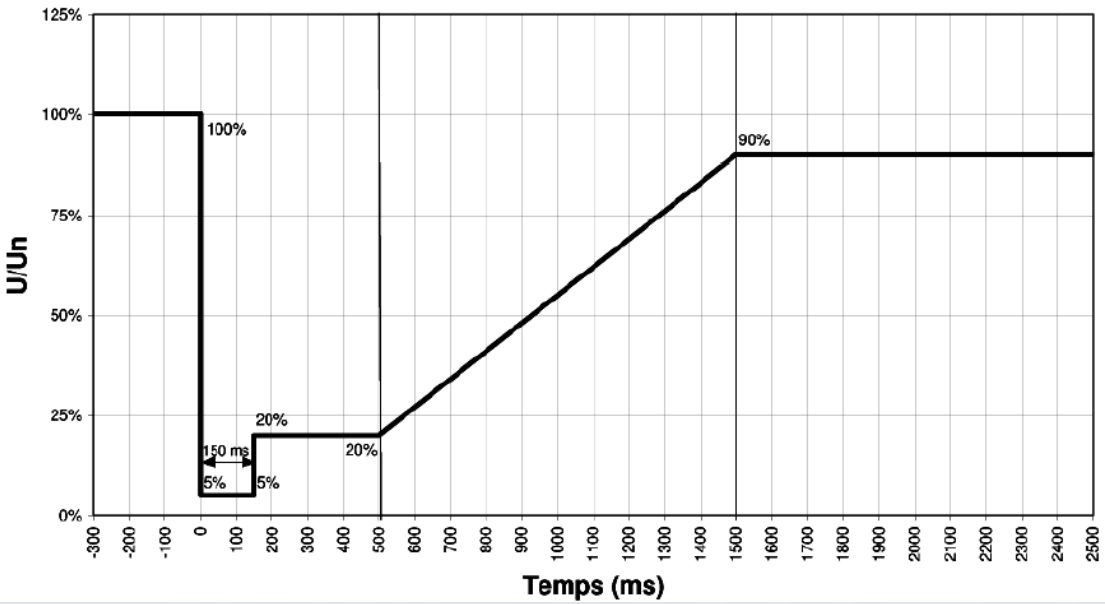
Voltage-against-time-profile (symmetrical and asymmetrical faults)

In particular cases, TEIAS can extend the time (trec1) up to 3 sec

Fault ride through capability

[Article 8 – Applicable for Power Generating Modules Type B, C and D]

Each TSO defines at national level a voltage-against-time-profile at the Connection Point for fault conditions which describes the conditions in which the Power Generating Module shall be capable of staying connected to the Network and continuing stable operation after the power system has been disturbed by secured faults on the Network.



Existing French Distribution Grid Code:

Voltage-against-time-profile for facilities connected to MV networks (>5 MW)

Fault ride through capability

[Article 15 – Applicable for Power Park Modules Type B, C and D]

The Relevant Network Operator in coordination with the Relevant TSO has the right to require fast acting additional reactive Current injection at the Connection Point to the pre-fault reactive Current injection in case of symmetrical (3-phase) faults.

The Power Park Module shall be capable of activating this additional reactive Current injection during the period of faults. The Power Park Module shall be capable of either:

- ensuring the supply of the additional reactive Current at the Connection Point (which magnitude depends on the deviation of the Voltage at the Connection point from its nominal value); or
- alternatively, measuring Voltage deviations at the terminals of the individual units of the Power Park Module and providing an additional reactive Current at the terminals of these units which magnitude depends on the deviation of the Voltage at units' terminals from its nominal value.

Fault ride through capability

[Article 16 – Applicable for Power Park Modules Type C and D]

The Relevant TSO defines whether Active Power contribution or Reactive Power contribution has priority during faults for which fault-ride-through capability is required.

If priority is given to Active Power contribution, its provision shall be established no later than 150 ms from the fault inception.

VOLTAGE STABILITY

Voltages stability

[Article 15 – Applicable for Power Park Modules Type B]

The Relevant Network Operator has the right to define the capability of a Power Park Module to provide Reactive Power.

Example (*proposals for Turkish Grid Code*):

1. The U-Q/Pmax-profile within the boundary of which the Type B Power Park Modules is capable of providing Reactive Power at its Maximum Capacity is a rectangular shape defined by the coordinates in the following table.

Q/P_{max} [pu]	Voltage at the Connection Point
x_1=0.33pu(lag) y_1=	0.95 pu
x_2=0.33pu(lag) y_2=	1.05 pu
x_3=-0.33 (lead) y_3=	1.05 pu
x_4=-0.33 (lead) y_4=	0.95 pu

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Voltages stability

[Article 15 – Applicable for Power Park Modules Type B]

The Relevant Network Operator has the right to define the capability of a Power Park Module to provide Reactive Power.

Example (*proposals for Turkish Grid Code*):

2. The P-Q/Pmax-profile at the connection point, within the boundary of which the Type B Power Park Modules is capable of providing Reactive Power below Maximum Capacity is a rectangular shape defined by the following coordinates:

Q/P_{max}	P/P_{max} at the Connection Point [pu]
x_1=0.33pu (lag)	y_1=1pu
x_2=0.33pu (lag)	y_2=0.1pu
x_3=-0.33 (lead)	y_3=0.1pu
x_4=-0.33 (lead)	y_4=1pu

Below 0.1pu Active Power, Reactive Power Capability is not required.

Voltages stability

[Article 16 – Applicable for Power Park Modules Type C and D]

The Relevant Network Operator in coordination with the Relevant TSO defines the Reactive Power provision capability requirements in the context of varying Voltage. For doing so, it defines:

- a U-Q/Pmax-profile within the boundaries of which the Power Park Module is capable of providing Reactive Power at its Maximum Capacity.
- define a P-Q/Pmax-profile within the boundaries of which the Power Park Module is capable of providing Reactive Power below Maximum Capacity.

The Power Park Module shall be capable of providing Reactive Power automatically by either Voltage Control mode, Reactive Power Control mode or Power Factor Control mode.

Voltages ranges

[Article 11 – Applicable for Power Generating Modules Type D]

A Power Generating Module shall be capable of staying connected to the network and operating within the ranges of voltage at the Connection Point (in per unit), and the time periods specified by following tables.

Voltage ranges	Time period for operation	Voltage Level
0.85 pu – 0.90 pu	60 minutes	from 66 kV to 300 kV (excluding)
0.90 pu – 1.118 pu	Unlimited	
1.118 pu – 1.15 pu	20 minutes	

Voltage ranges	Time period for operation	Voltage Level
0.85 pu – 0.90 pu	60 minutes	from 300 kV to 400 kV
0.90 pu – 1.05 pu	Unlimited	
1.05 pu – 1.0875 pu *)	60 minutes	
1.0875 pu -1.10 pu *)	60 minutes	

*) 400kV excluded

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REMOTE CONTROL OF DISTRIBUTED GENERATION UNITS

Active power controllability

The Power Generating Module shall be equipped with a logic interface (input port) in order to:

- Type A&B) cease Active Power output within less than 5 seconds following an Instruction from the Relevant Network Operator
- Type B) to be able to reduce Active Power output as instructed by the Relevant Network Operator and/or the Relevant TSO.

Could be operable remotely if requested by the Network Operator

For Type C & D, the control system shall be capable of adjusting an Active Power Setpoint as instructed by the Relevant Network Operator / TSO to the Power Generating Facility Owner.

Automatic connection

For Type A,B & C Power Generating Modules, automatic connection is allowed unless determined otherwise by the Relevant Network Operator in coordination with the Relevant TSO. Conditions are defined by the Relevant TSO (frequency ranges, within which an automatic connection is admissible, and a corresponding delay time; maximum admissible gradient of increase of Active Power output).

When starting a Type D Power Generating Module, synchronization shall be performed by the Power Generating Facility Owner after authorization by the Relevant Network Operator.

CONNECTION PROCEDURES COMPLIANCE MONITORING

OPERATIONAL NOTIFICATION PROCEDURE

Operational notification Procedure

for type A generators

for type B and C generators

for type D generators, HVDC systems, transmission connected distribution networks and demand facilities

Operational notification procedure for type A generators

The operational notification procedure for connection consists of an Installation Document.

Installation Document is obtained from the Relevant Network Operator and filled in by the Power Generating Facility Owner.

The content of the Installation Document is defined by the Relevant Network Operator, with at least :

the location at which the connection is made;
the date of the connection;
the Maximum Capacity of the installation in kW;
the type of primary energy source;
reference to Equipment Certificates used in the site installation;
for equipment used, which has not received an Equipment Certificate, information shall be provided as directed by the Relevant Network Operator; and
the contact details of the Power Generating Facility Owner and the installer and their signatures.

Permanent decommissioning shall be notified to the Relevant Network Operator in writing.

Operational notification procedure for type B and C generators

The operational notification procedure for connection comprises at least two steps:

1. The Power Generating Facility Owner send a Power Generating Module Document (PGMD) to the Relevant Network Operator.
2. The Relevant Network Operator on acceptance of a complete and adequate PGMD issues a Final Operational Notification to the Power Generating Facility Owner.

The PGMD contains information as defined by the Relevant Network Operator and the relevant TSO, including a Statement of Compliance.

Equipment certificates can be used as validated information about components of a power generating module.

Permanent decommissioning shall be notified to the Relevant Network Operator in writing.

Operational notification Procedure for type D generators

Also applies to HVDC systems, transmission connected distribution networks and demand facilities

The operational notification procedure for connection comprises at least three steps:

1. Energisation Operational Notification (EON);
2. Interim Operational Notification (ION); and
3. Final Operational Notification (FON).

Energisation Operational Notification (EON)

1. The Energisation Operational Notification (EON) is issued by the TSO after agreement with the owner of the facility on the protection and control settings relevant to the Connection Point.
2. The owner of the facility is entitled to energies its internal Network and auxiliaries for the facility by using the grid connection that is defined by the Connection Point

Interim Operational Notification (ION)

The Interim Operational Notification (ION) is issued by the TSO subject to the completion of data and study review process related to:

- itemized Statement of Compliance (can be partly based on Equipment Certificates);
- detailed technical data of the facility with relevance to the grid connection;
- simulation models required by the TSO;
- studies demonstrating expected steady-state and dynamic performance
- details of intended compliance tests

The owner of the facility is entitled to operate its facility (inject or extract power) by using the grid connection for a limited period of time (max 24 months)

Final Operational Notification (FON)

- The Final Operational Notification (FON) is issued by the TSO subject to the completion of data and study review process related to:
  - itemized Statement of Compliance
  - update of applicable technical data, simulation models and studies including use of actual measured values during testing.
  - Test results

- The owner of the facility is entitled to operate its facility (inject or extract power) by using the grid connection.

COMPLIANCE MONITORING

Compliance monitoring

- The Facility Owner shall ensure that its facility is compliant with the requirements under the Network Code. This compliance shall be maintained throughout the lifetime of the facility.
  - Planned modifications of the technical capabilities of the facility with possible impact on its compliance are notified to the Relevant Network Operator by the Facility Owner before initiating such modification.
  - Any operational incidents or failures of a facility that have impact on its compliance is notified to the Relevant Network Operator by the Facility Owner.
  - Any foreseen test schedules and procedures to verify compliance of a facility shall be notified to the Relevant Network Operator by the Power Generating Facility Owner in due time and prior to their launch and shall be approved by the Relevant Network Operator.
  - The Relevant Network Operator shall be facilitated to participate in such tests and may record the performance of the Power Generating Modules.

Example : Reactive Power Capability test for Type C Power Park Module

- The Network Code includes a detailed list of tests and simulations that shall be carried out in order to demonstrate the technical capability of the facility regarding requirements under the regulation.

The Power Park Module shall demonstrate its technical capability to provide leading and lagging Reactive Power capability according to Article 16(3) (b) and (c).

The Reactive Power Capability test shall be carried out at maximum Reactive Power, both leading and lagging, and concerning the verification of the following parameters:

- operation in excess of 60 % of Maximum Capacity for 30 min;
- operation within the range of 30 – 50 % of Maximum Capacity for 30 min; and
- operation within the range of 10 – 20 % of Maximum Capacity for 60 min.

The test is deemed passed, provided that the following criteria are cumulatively fulfilled:

- the Power Park Module has been operating no shorter than requested duration at maximum Reactive Power, both leading and lagging, in each parameter as referred to in Article 42(6) (b);
- the Power Park Module has demonstrated its capability to change to any Reactive Power target value within the agreed or decided Reactive Power range within the specified performance targets of the relevant Reactive Power control scheme; and
- no action of any protection within the operation limits defined by Reactive Power capacity diagram occurs.

Compliance monitoring

- The Relevant Network Operator regularly assesses the compliance of a facility with the requirements under the Regulation throughout the lifetime of the Power Generating Facility.
- The Relevant Network Operator has the right to request that the Facility Owner carries out compliance tests and simulations not only during the operational notification procedures but repeatedly throughout the lifetime of the Facility (according to a pre-defined plan or after any failure, modification or replacement of any equipment that may have impact on the facility's compliance).
- The Facility Owner shall be informed of the outcome of these assessments, compliance tests and simulations.
- The Relevant Network Operator shall make publicly available the procedure related to compliance monitoring including information and documents to be provided as well as requirements to be fulfilled

CONCLUSIONS

Conclusions

- It is recommended to establish a grid code with clear and transparent requirements for RES
- Requirements need to be anticipated for future operation conditions
- Requirements included in the draft European grid code RfG (Requirements for Generators) are a valuable basis for developing grid code in Arabic countries. Standardisation => lower investment costs for RES integration