



Publishing date: 20/07/2011

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# **Framework Guidelines On Electricity Grid Connections**

**FG-2011-E-001**

**20 July 2011**

This Document contains the Framework Guidelines on Electricity Grid Connections, which the Agency for the Cooperation of Energy Regulators (ACER) has developed pursuant to Article 6 of Regulation (EC) No 713/2009 and on the basis of a request from the European Commission.

## Related Documents

### CEER/ERGEG documents

- “Pilot Framework Guidelines on Electricity Grid Connections”, 7 December 2010, Ref: E10-ENM-18-04.  
[http://www.energy-regulators.eu/portal/page/portal/EER\\_HOME/EER\\_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Pilot\\_Framework\\_Guideline\\_Electricity\\_Grid\\_Connection/CD/E10-ENM-18-04\\_EGC-FG\\_7-Dec-2010.pdf](http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Pilot_Framework_Guideline_Electricity_Grid_Connection/CD/E10-ENM-18-04_EGC-FG_7-Dec-2010.pdf)
- “ERGEG Public Consultation on the Draft Pilot Framework Guidelines on Electricity Grid Connection – Evaluation of Responses,” 7 December 2010, Ref: E10-ENM-18-04a,  
[http://www.energy-regulators.eu/portal/page/portal/EER\\_HOME/EER\\_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Pilot\\_Framework\\_Guideline\\_Electricity\\_Grid\\_Connection/CD/E10-ENM-18-04a\\_EGC-FG\\_EoR\\_7-Dec-2010.pdf](http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Pilot_Framework_Guideline_Electricity_Grid_Connection/CD/E10-ENM-18-04a_EGC-FG_EoR_7-Dec-2010.pdf)
- “Pilot Framework Guideline on Electricity Grid Connection - Initial Impact Assessment”, 12 July 2010, Ref: E09-ENM-18-03, [http://www.energy-regulators.eu/portal/page/portal/EER\\_HOME/EER\\_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Pilot\\_Framework\\_Guideline\\_Electricity\\_Grid\\_Connection/CD/E09-ENM-18-03\\_FG-GridConnect-IIA\\_12-July-10.pdf](http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/Pilot_Framework_Guideline_Electricity_Grid_Connection/CD/E09-ENM-18-03_FG-GridConnect-IIA_12-July-10.pdf)
- “ERGEG Guidelines of Good Practice on Electricity Grid Connection and Access“, ERGEG, 10 December 2009, Ref. E09-ENM-16-04, [http://www.energy-regulators.eu/portal/page/portal/EER\\_HOME/EER\\_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/GGP%20Electricity%20Grid%20connection%20%20Access/CD/E09-ENM-16-04\\_GGP-GridConnection\\_10-Dec-09.pdf](http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_CONSULT/CLOSED%20PUBLIC%20CONSULTATIONS/ELECTRICITY/GGP%20Electricity%20Grid%20connection%20%20Access/CD/E09-ENM-16-04_GGP-GridConnection_10-Dec-09.pdf)
- “Implementing the 3rd Package: next steps”, CEER/ERGEG, 18 June 2009, Ref. C09-GA-52-06a, [http://www.energy-regulators.eu/portal/page/portal/EER\\_HOME/EER\\_PUBLICATIONS/CEER\\_ERGEG\\_PAPERS/Cross-Sectoral/2009/C09-GA-52-06a\\_Implementing\\_3rdpackage\\_18-Jun-09.pdf](http://www.energy-regulators.eu/portal/page/portal/EER_HOME/EER_PUBLICATIONS/CEER_ERGEG_PAPERS/Cross-Sectoral/2009/C09-GA-52-06a_Implementing_3rdpackage_18-Jun-09.pdf)

## External Documents

- Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0055:0093:EN:PDF>
- Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0001:0014:EN:PDF>
- Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003. <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:211:0015:0035:EN:PDF>

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## **1 General Provisions**

### **1.1 Scope**

These Framework Guidelines aim at setting out clear and objective principles for the development of network codes pursuant to Article 6(2) of Regulation (EC) No 714/2009 (the “Electricity Regulation”)<sup>1</sup>.

The network code(s) developed according to these Framework Guidelines will be applied by electricity *system operators* and *significant grid users*, taking into account possible public service obligations and without prejudice to the regulatory regime for cross-border issues pursuant to Article 38 of Directive 2009/72/EC and of the responsibilities and powers of regulatory authorities established according to Article 37(6) of Directive 2009/72/EC.

The network code(s) developed according to these Framework Guidelines will be evaluated by ACER, taking into account their degree of compliance with these Guidelines and the fulfilment of the following objectives: maintaining security of supply, supporting the completion and functioning of the internal market in electricity and cross-border trade, including delivering benefits to the customers and facilitating the EU's targets for penetration of renewable generation.

### **1.2 Application**

The network code(s) developed according to these Framework Guidelines shall apply to grid connections for all types of *significant grid users* already, or to be, connected to the transmission or distribution network.

Any *grid user* not deemed to be a *significant grid user* shall not fall under the requirements of the network code(s).

The network code(s) developed according to these Framework Guidelines take precedence over the relevant national codes and international standards and regulations. Where there are proven benefits, and if compatible with the provisions in the European network code(s), national codes, standards and regulations which are more detailed or more stringent than the respective European network code(s) should retain their applicability.

The European Network of Transmission System Operators for Electricity (hereafter referred to as ENTSO-E) shall ensure coherence and compatibility of the grid connection network code(s) with provisions contained in the Framework Guidelines on System Operation.

### **1.3 Definitions**

For the purpose of these Framework Guidelines, the definitions contained in Article 2 of EU Directive 2009/72/EC and in Article 2 of the Electricity Regulation apply.

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<sup>1</sup> Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003.

Within that context, the terms 'network' or 'grid' refer to both transmission and distribution. Moreover, the following definitions apply:

- **Ancillary Services** – services necessary to support transmission of electric power between generation and load, maintaining a satisfactory level of operational security and with a satisfactory quality of supply. The main elements of ancillary services include active and reactive power reserves for balancing power and voltage control. Active power reserves include automatically and manually activated reserves and are used to achieve instantaneous physical balance between generation and demand. Further elements of ancillary services may include black start, inertial response, trip to houseload, spinning reserve and islanding capability. In the liberalised market, many ancillary services are contracted by Transmission System Operators from selected *grid users* that qualify for providing these services.
- **Compliance Monitoring** – the process for verifying that the (technical) capabilities of *significant grid users* are maintained.
- **Compliance Testing** – the process of verification that *significant grid users'* installations comply with the specifications and requirements provided for grid connection, for example before starting operation of new installations. The verification should include, *inter alia*, the revision of documentation, the verification of the requested capabilities of the new facility by practical tests and simulation studies and the revision of actual measurements during trial operation.
- **Grid Users** – all users connected to the transmission or distribution grids.
- **New Grid Users** – *grid users* not considered as *pre-existing grid users*.
- **Pre-existing Grid Users** – *grid users* connected to the transmission or distribution grids before the entry into force of the first release of the network code(s) developed according to these Framework Guidelines.
- **System Operators** – the Transmission System Operator (TSO) and the Distribution System Operator (DSO), in their roles and responsibilities to implement and enforce the relevant grid connection code(s).
- **Significant Grid Users** – *pre-existing grid users* and *new grid users* which are deemed significant on the basis of their impact on the cross border system performance via influence on the control area's security of supply, including provision of *ancillary services*.

DSOs are treated as *grid users* where they have to comply with the TSO's requirements in the network code(s). They are treated as *system operators* where they implement network code(s) provisions with respect to *significant grid users* connected to the distribution system. Unless stated otherwise, reference to DSO implies DSO as *grid user*.

Due to the close interrelationship between a number of issues related to grid connection and system operation, the following criteria have been applied in deciding whether a specific issue is dealt with in these Framework Guidelines or in the Framework Guidelines on System Operation:

- Issues involving the active participation by *grid users* are addressed in these Framework Guidelines.
- Issues affecting only *system operators*, with no role for *grid users*, are addressed in the Framework Guidelines on System Operation.
- Issues which are relevant both to grid connections and system operation, are as a minimum mentioned in both Framework Guidelines and, where necessary, also specified in more detail. Some redundancy might emerge from this approach, but priority has been given to avoiding the omission of important aspects.



## 2 Minimum standards and requirements for connections

### 2.1 Standards and requirements applicable to all *significant grid users*

The network code(s) developed according to these Framework Guidelines shall define appropriate minimum standards and requirements applicable to all *significant grid users*.

The minimum standards and requirements shall be defined for each type of *significant grid user* and shall take into account the voltage level at the *grid user's* connection point. The network code(s) shall specify the criteria and methodology for the definition of *significant grid users*. These shall be based on a predefined set of parameters which measure the degree of their impact on cross-border system performance via influence on control area's security of supply, including provision of *ancillary services* ("significance test"). This process, undertaken by each individual TSO and reviewed by the respective National Regulatory Authority (NRA), shall require coordination with the adjacent TSOs and relevant DSOs.

The applicability of the standards and requirements to *pre-existing significant grid users* shall be decided on a national basis by the NRA, based on a proposal from the relevant TSO, after a public consultation. The TSO proposal shall be made on the basis of a sound and transparent quantitative cost-benefit analysis that shall demonstrate the socio-economic benefit, in particular of retroactive application of the minimum standards and requirements. Where it is not demonstrated that the socio-economic benefits outweigh the costs of requiring compliance, *pre-existing* (and, in exceptional cases, new) *significant grid users* can be granted derogations. The format and methodology or principles of the cost-benefit analysis shall be prescribed by the network code(s).

The "significance test" and cost-benefit analysis shall be performed by the TSO (*grid users* shall provide the relevant data and offer their assistance if necessary).

The network code(s) shall provide for regular re-assessment (including public consultation) of the "significance test" and cost-benefit analysis to cope with evolving system requirements (e.g. penetration of renewable energy sources, smart grids, distributed generation, household demand response, etc.).

The network code(s) shall define the physical connection point between the *significant grid user's* equipment and the network to which they apply. Furthermore, the network code(s) shall define the requirements on *significant grid users* in relation to the relevant system parameters contributing to secure system operation, including:

- Frequency and voltage parameters;
- Requirements for reactive power;
- Load-frequency control related issues;
- Short-circuit current;
- Requirements for protection devices and settings;
- Fault-ride-through capability; and
- Provision of *ancillary services*.

For avoidance of doubt, the network code(s) shall also contain all the necessary provisions applicable to *significant grid users* that are connected to distribution networks, but that also affect the transmission network, because, for example, they feed energy up to the

transmission grid or, given their operation mode and fuel type, they significantly influence the need for reserve capacity.

The network code(s) shall set out how the TSO defines the technical requirements related to frequency and active power control and to voltage and reactive power management. Technical rules set at the synchronous system level for operational security shall be in line with these requirements. Those rules shall be aligned as far as technically possible and economically beneficial throughout the EU, irrespective of synchronous area borders.

Where the minimum standards and requirements, introduced by the network code(s), deviate significantly from the current standards and requirements, there should be a cost-benefit analysis performed by ENTSO-E that justifies this deviation and demonstrates additional benefits from requiring the higher standard.

#### 2.1.1 Connection of/to distribution networks

The network code(s) shall set out necessary minimum standards and requirements to be followed by DSOs when connecting *significant grid users* to the distribution network.

For DSOs that are defined as *significant grid users*, the network code(s) shall set out minimum standards and requirements for their equipment installed at the connection point between the transmission and distribution system networks.

Regarding *significant grid users* connected to the distribution network, any requirements on *system operators* for adaptation of existing arrangements (as defined in section 2.3, including in respect of distribution network codes and connection agreements) and for ensuring that distribution-connected *significant grid users* meet the requirements set out in the network code(s) shall be the responsibility of the DSO.

The network code(s) shall specify a requirement on DSOs to execute (manually or automatically, depending on the purpose) the instructions regarding distribution-connected *significant grid users* given by the TSO. The TSO and the DSO shall agree how these instructions are delivered in practice. This applies also for those DSOs connected to another DSO network.

#### 2.1.2 Connection regime for specific *significant grid users*

Where additional requirements beyond those defined in the minimum standards and requirements are mandated for a particular class, technology, size or location of *significant grid user*, the network code(s) shall set out and justify these additional requirements.

Where justified by technical conditions, the network code(s) shall foresee special provisions concerning protection device setting for the large intermittent generation (e.g. wind, photovoltaics etc.).

Where specific electrical or geographical conditions require, additional national provisions could be defined, beyond the provisions in the relevant EU network code(s). ENTSO-E shall strive, in cooperation with the national TSO(s), to ensure compatibility of such national provisions with the EU-wide network code(s).

The network code(s) shall set out the necessary requirements for protection and fault-ride-through capability with particular focus on distributed generation because of its increasing importance and contribution to meeting demand. These requirements shall aim at avoiding e.g. a large disturbance in the transmission network resulting in mass tripping of distributed generation units.

The network code(s) shall set out necessary minimum standards and requirements to be followed when connecting a consumption unit to the grid, to enable demand response and/or participation of consumption units in other grid services, on a contractually-agreed basis. The responsibility for the compliance of the features and performance of the equipment with the requirements set by the TSO or DSO shall be with the consumption unit.

### 2.1.3 Special requirements on *significant grid users* for critical grid situations

The network code(s) shall define:

- situations in general (e.g. which kinds of network faults, which electrical distance)
- and
- the detail of possible deviations of significant parameters (e.g. voltage, frequency) that generation units must withstand, while remaining connected to the grid. Different definitions may apply to different types of generation units.

The network code(s) shall define minimum conditions for (re)connection to the grid in disturbed/critical operating state.

The network code(s) shall set out how generation units must be able to execute their control activities in normal and in alert (disturbed) operating states. Specific parameters for operation outside these operating states will be agreed bilaterally between generation units and *system operators*.

Coordination requirements and procedures for reconnection after tripping shall be defined transparently in the network code(s) for the different parties involved. The network code(s) shall elaborate their different roles and responsibilities.

In particular for the following services the network code(s) shall set out the minimum requirements for those generators providing them on a contractually-agreed basis:

- House load operation including the minimum duration of house load operation;
- Black start; and
- Island operation.

## 2.2 Derogations

The network code(s) developed according to these Framework Guidelines shall describe the process and criteria for applying for derogation. This process is applicable to *pre-existing* (and in exceptional cases new) *significant grid users*.

The derogation process shall be transparent, non-discriminatory, non-biased, well documented and based on the cost-benefit analysis performed by the TSO.

The network code(s) may provide that derogation from all or some of the minimum standards and requirements may be granted to classes of *pre-existing* (and, in exceptional cases, new) *significant grid users*, non-discriminatorily, without the cost-benefit analysis being performed, if the TSO submits to the NRA a reasoned request and the exemption from the cost-benefit analysis is authorised by the NRA.

During the derogation application process the *significant grid user* shall be deemed as compliant.

The relevant NRA shall decide whether to grant a derogation or not, and whether to waive the requirement for the cost-benefit analysis, based on the TSO's proposal.

Each NRA shall maintain a register in which derogations are recorded, together with the reasons for their granting, the consequences and whether the requirement for the cost-benefit analysis has been waived. This information shall be communicated to ACER. ACER shall monitor the granting of derogations and may request the relevant NRA to revoke any derogation granted without due justification.

### **2.3 Adaptation of existing arrangements to the network code(s)**

*System operators* and relevant *significant grid users* shall amend all relevant clauses in contracts and/or relevant clauses in general terms and conditions relating to the connection of the *significant grid user* to the electricity grid, in accordance with the terms of the network code(s). The relevant clauses shall be amended within a fixed time limit after entry into force of the network code(s), defined in the network code(s), but not exceeding three years. This requirement shall apply regardless of whether the relevant contracts or general terms and conditions provide for such an amendment. The detailed technical provisions for the transition from the national to the EU network code(s) shall be further elaborated in the respective code(s).

The network code(s) shall provide for a transition period within which the relevant *significant grid users* have to apply the new standards and requirements. The transition period shall be consulted upon among relevant stakeholders. The network code(s) shall specify the principles behind setting the transition periods for *significant grid users*. The *system operator* shall be responsible for evaluating the applicability of these principles to *significant grid users* and determining an appropriate transition period. The *system operator* shall take into account *significant grid users*' class and any underlying obstacles for efficient undertaking of the equipment modification/refitting. In general, the transition period should not exceed two years. Different transition periods for compliance can be set for *new grid users* and for *pre-existing grid users* and also for different minimum standards and requirements.

### **2.4 Compliance testing, compliance monitoring and enforcement**

The network code(s) shall define clear and transparent criteria and methods for *compliance monitoring*, including the requirements for *compliance testing*.

In particular, the network code(s) shall introduce an obligation for *system operators* regularly to assess the compliance of generation units with the standards and requirements defined for the connecting installation, including electrical safety.

*New grid users* defined as *significant* must provide evidence of compliance with specifications and requirements before the responsible *system operator* allows for connection. The *system operator* must define transparently the exact contents of the *compliance testing* within the provisions of network code(s).

The network code(s) shall foresee the possibility of repeated *compliance testing* by the *system operator* even after the *significant grid user* is connected to the grid.

The network code(s) shall specify which data from the actual operation of connected installations should be used to verify compliance with the applicable minimum standards and requirements.

The network code(s) shall provide for regular monitoring of the alignment of EU and national codes and provide for corrective measures if any discrepancies are detected.

The network code(s) shall always require the *system operators* to optimise between the highest overall efficiency and lowest total cost for all involved stakeholders. In that respect, NRAs shall ensure, that, whatever the cost-sharing scheme is, the cost split follows the principles of non-discrimination, maximum transparency and assignment to the real originator of the costs. Nothing in the network code(s) shall prevent commercial arrangements being used for the provision of *ancillary services*.

### **3 Promoting (real-time and other) exchange of information between parties and improved coordination**

#### **3.1 General information**

The network code(s) shall set out the procedures and requirements to coordinate and ensure information sharing between:

- TSO and TSO;
- TSO and DSO; and
- *System operator* and *significant grid user*.

These procedures and requirements shall be defined with the agreement of all affected parties.

The network code(s) shall define a harmonised standard according to which information shall be provided for grid connection at the connection point by TSO and DSO. Similarly, the network code(s) shall define what information and technical data the *significant grid user* has to provide to the TSO or DSO to which it is connected and how this data is to be provided to ensure the operational security of the system.

The network code(s) shall contain provisions committing TSOs and DSOs to publish and transparently communicate the detailed procedure for the initiation of new connection, including, inter alia, required documents, timing, methodologies, responsibilities, etc. This information shall also address the relevant grid access issues, which will be dealt with in more detail in the future Framework Guidelines for grid access.

Information exchange between TSOs and DSOs about the commissioning of *significant grid users* shall be framed on EU basis, through the coordination of the definition of *significant grid users*<sup>2</sup> in the “significance test”.

#### **3.2 Real-time information sharing<sup>3</sup>**

Information exchange provisions contained in network code(s) shall include sufficiently detailed specifications for an efficient coordinated system with access to real-time information.

The network code(s) shall set the requirement for every *significant grid user* to be able and obliged to provide the necessary real-time operational information to the DSO and TSO that their connection has significant impact upon.

The network code(s) shall set the requirement for every *significant grid user* to be able to receive and to execute the instructions sent by the TSO and/or DSO, on a contractual basis or in critical operating state.

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<sup>2</sup> As indicated in Section 2.1.

<sup>3</sup> Real-time information sharing refers to information which is also the subject of the Fundamental Electricity Data Transparency comitology guidelines. The purpose here is different, i.e. the information is primarily used by the *system operators* and not by market participants. The network code(s) shall take account of information already required as part of the comitology guidelines, and only set out requirements for data information that go over and above this. Moreover, real-time information is also relevant for Framework Guidelines on System Operation and will also be dealt with there.

### **3.3 Specific provisions for information and communication between TSOs and DSOs**

The network code(s) shall define the requirements for the interface between TSOs and DSOs, such as:

- voltage parameters; and
- reactive power flow;

taking into account the situation with regard to *significant grid users* connected to the distribution network.

The network code(s) shall set out that the TSOs of a synchronous area shall exchange, among themselves and with the DSOs, all necessary information and data relating to *significant grid users* in the distribution network. The necessary information shall be clearly and transparently defined and agreed with the DSOs.



Publishing date: 20/07/2011

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