GREATER MEKONG SYSTEM REGIONAL GRID CODE

Emergency & Restoration Code (Draft)

7 of 10 Code Documents

Version 0.2

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Note: A *section titled "ANNEX: Code – History of Comments" is attached to each Code. It provides a log of every comment and subsequent consideration taken on the Code.*

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1. General Provision

1.1 Subject Matter and Scope

(1) This Network Code defines the Operational Security requirements and principles applicable for Emergency State, Blackout State and Restoration to TSOs, DSOs, Significant Grid Users, Defence Service Providers, Restoration Service Providers, Market Participants and any third party that has a role pursuant to the [GMS Network Market Code] and efficient utilisation of the power system and resources;

(2) This Network Code lays down minimum requirements on:

a) the management of Emergency, Blackout and Restoration States;

b) the coordination of the GMS system operation in Emergency, Blackout and Restoration States in a common and coherent way;

c) simulations and tests for the purpose of reliable, efficient and fast restoration from Emergency or Blackout System States; and

d) the tools and facilities needed for the purpose of reliable, efficient and fast restoration from Emergency or Blackout System States.

(3) The provisions of this Network Code shall not apply to the Transmission System or parts of the Transmission System of a Member State which is not operating synchronously with or which is temporarily disconnected from the rest of the Synchronous Area provided it is not the consequence of a Disturbance.

(4) For the Power systems operating in a Synchronous Area whose Frequency is influenced in a predominant way by systems that are not bound by the GMS legislation, provisions of this Network Code related to Frequency management shall apply only to the extent that they could be duly, physically and technically applied and implemented by the respective TSO.

(5) In Member States where more than one TSO exists, this Network Code shall apply to all TSOs within that Member State. Where a TSO does not have a function relevant to one or more obligations under this Network Code, Member States may provide that the responsibility for complying with those obligations is assigned to one or more different, specific TSO.

(6) A TSO may delegate some of its tasks under this Network Code to the Regional Power Coordination Centre (RPCC), while respecting Section 3.1, paragraph (10) [GMS Network Code on Operational Security – OS] and Section 2.1, paragraph (4) [GMS Network Code on Operational Security – OS]. The TSO shall remain solely liable and responsible under this Network Code for the tasks it delegated.

(7) For the purpose of this Network Code, the classification of Existing Power Generating Modules and Existing Demand Facilities pursuant to Section 1.1, paragraph (4) [GMS Network Code on Operational Security – OS] shall apply.

The Significant Grid Users within the scope of this Network Code shall be:

a) Existing and New Power Generating Modules of type B, C and D according to the criteria defined in Section 2.1, “Requirements for Generators – RfG” of the [GMS Network Connection Code];

b) Existing and New Transmission Connected Demand Facilities and all Existing and New Transmission Connected Closed Distribution Networks;

c) Redispatching Aggregators and Providers of Active Power Reserve according to the [GMS Network Code on LFCR]; and

d) HVDC Systems and DC-connected Power Park Modules.

(8) This Network Code shall apply to new and existing type A Power Generating Modules as well as to Demand Facilities, Closed Distribution Network and Aggregators providing Demand Side Response when they qualify as Defence Service Provider pursuant to Section 2.1.1, paragraph (8) and/or Restoration Service Provider pursuant to Section 3.1.1, paragraph (11) of this Network Code [ER].

(9) Type A and type B Power Generating Modules, Demand Facilities and Closed Distribution Networks providing Demand Side Response may fulfil the requirements they are subject to directly or indirectly (including but not restricted to through an Aggregator), according to the conditions set pursuant to Section 2.1.1, paragraph (8) and/or Section 3.1.1, paragraph (11) of this Network Code.

1.2 Definitions

(1) For the purposes of this Regulation, the definitions contained in the GMS Glossary of Terms shall apply.

(2) In addition the following definitions shall apply and have been added to the GMS Glossary of Terms:

Defence Service Provider – means a legal entity with a legal or contractual obligation to provide a service contributing to one or several measures of the System Defence Plan.

Restoration Service Provider – means a legal entity with a legal or contractual obligation to provide a service contributing to one or several measures of the Restoration Plan.

Restoration Plan – means the sum of all technical and organisational measures to be undertaken to restore the system back to Normal State.

Top-down Re-energisation Strategy – means a strategy that requires the assistance of other TSOs to re-energise (part of) the system of a TSO.

Demand – means the netted value of Active Power seen from a given point of the system, computed as (load – generation), generally expressed in kilowatts (kW) or megawatts (MW), at a given instant or averaged over any designated interval of time.

Energy Storage – means a device being used for storage of energy and that can be used to balance the system.

Bottom-up Re-energisation Strategy – means a strategy where (part of) the system of a TSO can be re-energised without the assistance from other TSOs.

Re-energisation – means reconnecting generation and load to energise (parts of) the system that have been disconnected.

Resynchronisation – means synchronising and connecting again two Synchronised Regions at the Resynchronisation Point.

Frequency Leader – means the TSO managing Frequency within a Synchronised Region or a Synchronous Area in order to restore System Frequency back to Nominal Frequency.

Synchronised Region – means a subpart of a Synchronous Area covered by interconnected TSOs with a common System Frequency not synchronised with the rest of the Synchronous Area.

Resynchronisation Leader – means the TSO in charge of Resynchronisation of two Synchronised Regions.

Resynchronisation Point – means the device used to connect two Synchronised Regions, usually a circuit breaker.

1.3 Regulatory Aspects

(1) The requirements established in this Network Code and their applications are based on the principle of proportionality, non-discrimination and transparency as well as the principle of optimization between the highest overall efficiency and lowest total cost for all involved parties.

(2) Notwithstanding the above, the application of the principle of non-discrimination and the principle of optimization between the highest overall efficiency and lowest total costs while maintaining Operational Security as the highest priority for all involved parties, shall be balanced with the aim of achieving the maximum transparency in issues of interest for the market and the assignment to the real originator of the costs.

(3) When defining terms and conditions or actions necessary to ensure Operational Security pursuant to this Network Code, a TSO shall in addition to the principles set in paragraph 1 above, take into account at least the following:

a. characteristics of the system;

b. operational conditions; and

c. overall efficiency.

(4) This Network Code relies on the capabilities required in the [GMS Network Code on Connection: Chapter 2, “Requirements for Generators (RfG)”, Chapter 3, “High Voltage Direct Current Connections (HVDC)” and Chapter 4, “Demand Connection”]. The Power Generating Facilities, Demand Facilities and HVDC links that are not a subject of the provisions in Chapters 2, 3 & 4 of the [GMS Network Code on Connection] shall continue to be bound by those technical requirements that apply to them pursuant to legislation in force in the respective GMS Member State or contractual arrangements in force. Capabilities required pursuant to Section 5.2 of this Network Code shall apply to new and existing Power Generating Facilities, Demand Facilities and HVDC Systems.

1.4 Regulatory Approvals

(1) Regulatory authorities or other competent authorities of the Member State concerned shall be responsible for approving the terms and conditions or actions referred to in paragraph 2 below.

(2) For the purpose of this Network Code, each TSO shall submit the following terms and conditions or actions to the regulatory authority or other competent authority of the Member State concerned for individual approval:

a) the terms and conditions to apply as Defence Service Providers on a contractual basis in accordance with Section 2.1.1, paragraph (8);

b) the terms and conditions to apply as Restoration Service Providers on a contractual basis in accordance with Section 3.1.1, paragraph (11);

c) the rules and conditions for suspension and restoration of market activities in accordance with Section 4.2, paragraph (1);

d) specific rules and conditions for imbalance settlement and settlement of balancing energy in accordance with Section 4.5, paragraph (1); and

e) the test plan in accordance with Section 6.1.1, paragraph (2).

(3) For the purpose of this Network Code, each TSO notify the regulatory authority or other competent authority of the Member State concerned of the following terms and conditions or actions:

a. the System Defence Plan in accordance with Section 2.1.1, paragraph (6) and Section 6.2.1, paragraph (3); and;

b. the Restoration Plan in accordance with Section 3.1.1., paragraph (7) and Section 6.2.2, paragraph (4).

(4) The notifications pursuant to paragraph 3 above are without prejudice to the possible competence under national law of a regulatory authority or other competent authorities of the Member State concerned to approve parts or the entire System Defence Plan or Restoration Plan.

1.5 Recovery of costs

(1) The costs borne by regulated Network Operators stemming from the obligations laid down in this Network Code shall be assessed by the competent regulatory authorities. Costs assessed as reasonable, efficient and proportionate shall be recovered in a timely manner through network tariffs or other appropriate mechanisms as determined by the competent regulatory authorities.

(2) If requested by the competent regulatory authorities, regulated Network Operators shall, within three months of such a request, provide information necessary to facilitate assessment of the costs incurred.

1.6 Consultation and coordination

(1) When expressly provided in this Network Code, a TSO shall consult concerned parties for the terms and conditions or actions it defines before real-time or for real-time.

The following process shall apply:

a) the TSO shall liaise with at least these parties identified under this Network Code;

b) the TSO shall explain the ambition and objective of the consultation and of the decision that it has to take;

c) the TSO shall collect from the parties any relevant information and suggestions;

d) the TSO shall duly consider the views, situations and constraints of the parties consulted;

e) the TSO shall before taking a decision, provide to the parties consulted a clear and robust justification for including or not the views, situations and constraints resulting from the consultation.

(2) When expressly provided in this Network Code, a TSO, requesting the execution of a set of actions in real-time by several parties, shall coordinate with these parties. The following real-time coordination process shall apply:

a) the TSO shall liaise at least with these parties identified under this Network Code;

b) the TSO shall explain the ambition and objective of the coordination and actions to be taken;

c) the TSO shall propose actions to be executed by each party;

d) the TSO shall collect from the concerned parties any relevant information and suggestions;

e) the TSO shall make a proposal on actions to be executed by each party, duly considering the views, situations and constraints of the concerned parties;

f) if the concerned parties do not oppose to execute the actions proposed by the TSO, each party, including the TSO, shall execute the actions in line with the proposal;

g) if one or more of the parties refuse the action proposed by the TSO, the TSO shall refer the action proposed to the relevant authority for decision. If time does not allow the referral to the relevant authority, the TSO shall initiate an equivalent action that has the least or no impact on the parties that refused to execute the action proposed. A party may only refuse the action proposed provided it justifies that this action would lead to the violation of one or more technical, legal, personal safety or security constraint(s).

(3) Each TSO shall support any TSO in Emergency, Blackout or Restoration States, upon request, provided it does not endanger the Operational Security of its Transmission System or of the interconnected Transmission Systems.

(4) Each TSO and DSO shall respect technical, legal, personal safety and security constraints.

(5) When designing its System Defence Plan pursuant to Section 2.1.1and its Restoration Plan pursuant to 3.1.1, each TSO shall assess the consistency of at least the following measures with the corresponding measures in the plans of TSOs within its Synchronous Area:

a) Inter-TSO assistance and coordination in Emergency State, pursuant to Section 2.1.4;

b) Frequency management procedures, pursuant to Section 2.2.1 and Section 3.3.1;

c) Assistance for Active Power procedure, pursuant to Section 2.2.7; and

d) Top-Down Re-energization strategy, pursuant to Section 3.2.2.

1.7 Confidentiality obligations

(1) Any confidential information received, exchanged or transmitted pursuant to this Network Code shall be subject to the conditions of professional secrecy laid down in paragraphs 2, 3 and 4 below.

(2) The obligation of professional secrecy shall apply to any person subject to the provisions of this Network Code.

(3) Without prejudice to cases covered by national law, the other provisions of this Network Code or other relevant Union legislation, confidential information received by the persons referred to in paragraph 2 above, in the course of their duties, may not be divulged to any other person or authority.

(4) Without prejudice to cases covered by national law, regulatory authorities, bodies or persons, which receive confidential information pursuant to this Network Code, may use it only for the purpose of the performance of their functions under this Network Code.

1.8 Agreement with TSOs not bound by this Network Code

(1) No later than 12 months after entering into force of this Network Code, all TSOs shall endeavour to implement a Synchronous Area Agreement within a Synchronous Area to ensure that TSOs with no legal obligation to respect this Network Code, belonging to the Synchronous Area, also cooperate to fulfil the requirements.

(2) If an agreement, according to paragraph (1) of this Section, cannot be implemented, the respective TSOs shall implement, no later than by [date – 14 months after entry into force], processes to ensure compliance with the requirements of this Network Code.

(3) If an agreement, according to paragraph (1) of this Section, cannot be implemented within 12 months after entering into force of this Network Code, the TSOs operating in a Synchronous Area whose frequency is influenced in a predominant way by Power systems that are not bound by the GMS regulations, shall nevertheless endeavour to implement a Synchronous Area agreement within their Synchronous Area to ensure that TSOs with no legal obligation to respect this Network Code, belonging to the Synchronous Area, also cooperate to fulfil the requirements.

2. System Defence Plan

2.1 General Principles

2.1.1 Design of the System Defence Plan

(1) Each TSO shall design a System Defence Plan in consultation with relevant DSOs, Significant Grid Users, neighbouring TSOs and the other TSOs in that Synchronous Area.

(2) When designing its System Defence Plan, each TSO shall take into account, at least:

a) Operational Security Limits;

b) behaviour and capabilities of load and generation;

c) specific needs of high priority Significant Grid Users listed pursuant to Section 4.2, paragraph (10) of [GMS Network Code on Operational Security – OS]; and

d) characteristics of its Network and underlying DSOs Networks.

(3) In the design of its System Defence Plan, each TSO shall respect the following principles:

a) the impact for System Users is minimal;

b) the measures are economically efficient;

c) only the necessary measures are activated; and

d) the measures do not endanger the Operational Security of its Transmission System or of the interconnected Transmission Systems.

(4) The System Defence Plan shall include at least the following technical and organisational measures specified in Section 2.2 of this Network Code:

a) System Protection Schemes including at least:

i. automatic under-Frequency control scheme;

ii. automatic over-Frequency control scheme;

iii. automatic scheme against Voltage collapse; and

iv. automatic disconnection scheme on loss of synchronization.

b) System Defence Plan procedures, including at least:

i. Frequency Deviation management procedure;

ii. Voltage deviation management procedure;

iii. power flow management procedure;

iv. assistance for Active Power procedure; and

v. manual Demand disconnection procedure.

(5) Each TSO shall define at least in its System Defence Plan procedures:

a) the conditions under which the procedure is activated, according to Section 2.1.3;

b) the relevant set of measures;

c) System Defence Plan instructions to be issued by the TSO; and

d) measures subject to real-time consultation or coordination with identified parties.

(6) Each TSO shall notify the regulatory authority or other competent authority of the Member State concerned of at least the following elements of its System Defence Plan:

a) objectives the System Defence Plan intend to achieve, including the phenomena to be managed or the situation to be solved;

b) conditions triggering the measures of the System Defence Plan;

c) general principle of each measure, explaining how each measure contributes to the objectives of the System Defence and who will implement these measures; and

d) deadlines identified pursuant to paragraph 7 below for implementation of the measures.

(7) In the design of its System Defence Plan, each TSO shall:

a) list the measures to be implemented on its installations;

b) identify DSOs that have to implement measures on their installations and list the measures to be implemented by these DSOs;

c) identify Significant Grid Users that have to implement measures on their installations, when these measures are using mandatory requirements from [GMS Network Code on Connection] or national legislation and list the measures to be implemented by these Significant Grid Users;

d) list the measures to be implemented by Defence Service Providers; and

e) identify the implementation deadlines for each listed measure.

(8) Unless the terms and conditions to act as Defence Service Providers are defined in the national legal framework, each TSO shall define the terms and conditions to apply as Defence Service Providers on a contractual basis including at least:

a) characteristics of the service to be provided;

b) the possibility of and conditions for aggregation; and

c) additional requirements and conditions.

2.1.2 Implementation of the System Defence Plan

(1) Each TSO shall implement and maintain the measures of its System Defence Plan, which are to be implemented on the Transmission System.

(2) Each TSO shall notify:

a) Transmission Connected DSOs of the measures, including the deadlines for implementation, which are to be implemented on:

i. their installations pursuant to Section 2.1.1, paragraph (7); and/or

ii. the installations of Significant Grid Users identified pursuant to Section 2.1.1, paragraph (7) connected to their Distribution Systems; and/or

iii. the installations of Defence Service Providers connected to their Distribution Systems; and/or

iv. the installations of DSOs connected to their Distribution Systems.

b) Significant Grid Users identified pursuant to Section 2.1.1, paragraph (7) and/or Defence Service Providers directly connected to its Transmission System of the measures, which are to be implemented on their installations, including the deadlines for the implementation.

When provided in national legislation, the TSO shall notify directly Significant Grid Users identified pursuant to Section 2.1.1, paragraph (7), Defence Service Providers and/or DSOs connected to Distribution Systems. It shall inform the concerned DSO of this notification.

(3) Each notified DSO shall notify the Significant Grid Users, Defence Service Providers and/or DSOs connected to its Distribution System of the measures of the System Defence Plan they have to implement on their installations, including the deadlines for implementation, unless the TSO already notified them pursuant to paragraph 2 above.

(4) Each notified DSO, Significant Grid User and Defence Service Provider shall:

a) implement the measures notified to it and confirm this implementation to the notifying Network Operator, who shall, when different from the TSO, notify the TSO; and

b) maintain the measures implemented on its installations.

2.1.3 Activation of the System Defence Plan

(1) Each TSO shall activate procedures of its System Defence Plan in coordination with DSOs and Significant Grid Users identified pursuant to Section 2.1.1, paragraph (7) and with Defence Service Providers.

(2) In addition to the automatically activated measures of the System Defence Plan, each TSO shall activate a procedure of the System Defence Plan when:

a) the system is in Emergency State due to at least one deviation from the Operational Security Limits and times according to Section 2.1, paragraph (1) of [GMS Network Code on Operational Security – OS] and no Remedial Action is available to restore the system to Normal State; or

b) according to Operational Security Analysis, the Operational Security of the Transmission System requires the activation of a measure of the System Defence Plan in addition to available Remedial Actions.

(3) Each DSO and Significant Grid User identified pursuant to Section 2.1.1, paragraph (7), as well as Defence Service Provider shall execute without undue delay the System Defence Plan instructions issued by the TSO, according to System Defence Plan procedures.

(4) Each TSO shall activate procedures of its System Defence Plan having a significant cross-border impact in coordination with the impacted TSOs.

2.1.4 Inter-TSO assistance and coordination in Emergency State

(1) Each TSO upon request from a neighbouring TSO in Emergency State shall provide through Interconnectors any possible assistance to the requesting TSO, provided it does not endanger the Operational Security of its Transmission System or of the interconnected Transmission Systems. This assistance includes, but is not limited to, a curtailment of Cross Zonal Allocated Capacities according to [GMS Network Code on Market – Section 2 on CACM] and assistance for Active Power according to Section 2.2.7 of this Network Code.

(2) When provided through DC Interconnectors, this assistance includes, but is not limited to, taking into account the technical characteristics and capability of HVDC System:

a) manual regulation actions of the transmitted Active Power to help the TSO in Emergency State to bring power flows within Operational Security Limits or Frequency of neighbouring Synchronous Area within System Frequency limits for Alert State defined in Section 5.1, paragraph (4) of [GMS Network Code on LFCR];

b) automatic control functions of the transmitted Active Power based on the signals and criteria defined pursuant to Section 3.2 of [GMS Network Code on Connection – Chapter 3 HVDC];

c) automatic Frequency control according to Chapter 3 of [GMS Network Code on Connection – Chapter 3 HVDC] in case of islanded operation; and

d) Voltage and Reactive Power control according to Section 3.4 of [GMS Network Code on Connection – Chapter 3 HVDC].

(3) Each TSO shall announce and duly prepare any manual opening of an Interconnector in coordination with neighbouring TSOs, respecting that this action will not endanger the Operational Security of the remaining interconnected Transmission System.

(4) A TSO may manually open an Interconnector without coordination, in specific conditions including the violation of limits, to prevent endangering personnel safety or damaging equipment.

2.2 Measures of the System Defence Plan

2.2.1 Frequency Deviation management procedure

(1) The Frequency Deviation management procedure of the System Defence Plan shall contain a set of measures to manage System Frequency Deviation outside System Frequency limits for Alert State defined in Section 5.1, paragraph (4) of [GMS Network Code on LFCR]. It shall be in line with the procedures set out in accordance with Section 2.2, paragraphs (2) and (3) [GMS Network Code on Operational Security – OS] and respect at least the following requirements:

a) a decrease of generation shall be smaller than the decrease of load during under-Frequency events; and

b) a decrease of generation shall be greater than the decrease of load during over-Frequency events.

(2) Each TSO shall adapt the operating mode of its load frequency control in order to prevent interfering with manual activation or deactivation of Active Power as described in paragraphs 3 and 5 below.

(3) Each TSO shall be entitled to define an Active Power set-point, which the Significant Grid User shall maintain provided it is identified for this measure pursuant to Section 2.1.1, paragraph (7) and the set-point respects its technical constraints. The Significant Grid User shall execute without undue delay the instructions given directly by the TSO or indirectly through DSOs, until further instructions are issued.

(4) Each TSO shall be entitled to disconnect Significant Grid Users and Defence Service Providers, directly or indirectly through DSOs. They shall remain disconnected until further instructions are issued.

(5) In case of an under-Frequency event and provided the rate of change of Frequency allows it, each TSO shall activate Demand Side Response from Defence Service Providers providing DSR before activation of the automatic Low Frequency Demand Disconnection scheme described in Section 2.2.2 of this Network Code below.

(6) Each TSO and DSO identified pursuant to Section 2.1.1, paragraph (7) shall manually disconnect Energy Storage acting as load connected to its network before activation of the automatic Low Frequency Demand Disconnection scheme described in Section 2.2.2 below, provided the rate of change of Frequency allows it.

2.2.2 Automatic under-Frequency control scheme

(1) The automatic under-Frequency control scheme of the System Defence Plan shall include an automatic Low Frequency Demand Disconnection scheme and the settings of Limited Frequency Sensitive Mode **–** Under frequency in the TSO LFC Area.

(2) In the design of its System Defence Plan, each TSO shall foresee activation of Limited Frequency Sensitive Mode **–** Under frequency before activation of the automatic Low Frequency Demand Disconnection scheme, provided the rate of change of Frequency allows it.

(3) Each TSO and DSO identified pursuant to Section 2.1.1, paragraph (7) shall foresee automatic disconnection of Energy Storage acting as load connected to its network before activation of the automatic Low Frequency Demand Disconnection scheme.

(4) Each TSO shall design the automatic Low Frequency Demand Disconnection scheme with the objective to shed load in real-time according to the Table 2.1 below. This scheme shall include the disconnection of Demand at different frequencies, from a starting level to a final mandatory level within an implementation range whilst respecting a minimum number and maximum size of steps. The implementation range defines the maximum admissible deviation of Demand to be disconnected from the target Demand to be disconnected at a given Frequency, calculated through linear interpolation between starting and final mandatory levels. The implementation range does not allow disconnection of less Demand than the Demand to be disconnected at the starting mandatory level.

The starting mandatory level, the final mandatory level, the implementation range, the minimum number of steps and the maximum Demand disconnection for each step shall respect the following characteristics:

PARAMETER	GMS VALUES FOR THE SYNCHRONOUS AREA
Demand disconnection starting mandatory level: Frequency	49 Hz
Demand disconnection final mandatory level: Frequency	48 Hz
Demand disconnection final mandatory level: Cumulative Demand to be disconnected	45 % of the Total Load at national level
Maximum Demand disconnection for each step	10% of the Total Load at national level, for a given step

Table 2-1 - Automatic Low Frequency Demand Disconnection Scheme Characteristics

(5) Each TSO and/or DSO shall locate its necessary Low Frequency Demand Disconnection relays taking into account at least load behaviour and dispersed generation, according to Chapter 4, “Demand Connection” of [GMS Network Code on Connection].

(6) Each TSO and/or DSO shall, when implementing the automatic Low Frequency Demand Disconnection scheme pursuant to the notification under Section 2.1.1, paragraph (2):

a) avoid to set an intentional time delay in addition to the operating time of the relays and circuit breakers;

b) minimise the disconnection of Power Generating Modules and especially those providing Inertia; and

c) limit the risk that this scheme leads to power flow deviation and Voltage deviation outside Operational Security Limits.

When a DSO cannot fulfil the requirements under (b) and (c) above, it shall notify the TSO and propose which one of these requirements shall prevail. The TSO shall define the applicable requirements.

(7) Each TSO may include in the automatic Low Frequency Demand Disconnection scheme of its System Defence Plan a Demand disconnection based on a Frequency gradient provided that:

a) it is activated only:

i. when the Frequency Deviation is higher than the Maximum Steady State Frequency Deviation and the Frequency gradient is higher than the one produced by the Reference Incident; and

ii. until the Frequency reaches the Frequency of the Demand disconnection starting mandatory level; and

b) it complies with Table 2.1.

(8) Each TSO may include in the automatic Low Frequency Demand Disconnection scheme of its System Defence Plan additional Demand disconnection steps below the Demand disconnection final mandatory level set out in Table 2.1.

(9) Each TSO shall be entitled to implement other System Protection Schemes triggered by a Frequency smaller or equal to the Frequency of the Demand disconnection final mandatory level and aiming at a faster restoration process, ensuring that such schemes do not further deteriorate Frequency.

2.2.3 Automatic Over-Frequency control scheme

(1) The automatic over-Frequency control scheme of the System Defence Plan shall lead to an automatic decrease of the total Active Power injected in each LFC Area.

(2) In consultation with the other TSOs of its Synchronous Area, each TSO shall define the following parameters of its automatic over-Frequency control scheme:

a) the Frequency thresholds for the activation; and

b) the reduction ratio of Active Power injection.

(3) Each TSO shall design its automatic over-Frequency control scheme taking into account Limited Frequency Sensitive Mode – Over frequency capabilities of Power Generating Modules in its LFC Area. In case the Limited Frequency Sensitive Mode – Over frequency is not existing or not sufficient to fulfil the requirements set out in 2 (a) and 2 (b) above, each TSO shall implement in addition a step-wise linear disconnection of generation in its LFC Area. The maximum size of steps of disconnection of Power Generating Modules and/or of HVDC System shall be defined in consultation with the other TSOs of its Synchronous Area.

2.2.4 Voltage deviation management procedure

(1) The Voltage deviation management procedure of the System Defence Plan shall contain a set of measures to manage Voltage deviation outside Operational Security Limits defined in Section 2.3, paragraph (1) and (2) of [GMS Network Code on Operational Security – OS].

(2) Each TSO shall be entitled to define a Reactive Power or Voltage range and instruct the DSOs and Significant Grid Users identified for this measure pursuant to Section 2.1.1, paragraph (7) to maintain it, according to Section 2.3 of [GMS Network Code on Operational Security – OS].

(3) Each TSO shall, upon request of neighbouring TSO in Emergency State, make available all Reactive Power capabilities that do not endanger the Operational Security of its Transmission System. During the activation of this measure, the Operational Security Limits coordinated according to Section 2.1, paragraph (8) of [GMS Network Code on Operational Security – OS] may be exceeded.

2.2.5 Automatic scheme against Voltage collapse

(1) The automatic scheme against Voltage collapse of the System Defence Plan may include one or more of the following schemes depending on the results of a TSO assessment of system security pursuant to Chapter 4, “Demand Connection” of [GMS Network Code on Connection]:

a) Low Voltage Demand Disconnection scheme according to Section 4.8 of [GMS Network Code on Connection];

b) On Load Tap Changer blocking scheme according to Section 4.8 of [GMS Network Code on Connection]; and

c) System Protection Schemes for Voltage management.

(2) Unless the assessment pursuant to paragraph 1 above demonstrates that implementation of the On Load Tap Changer blocking scheme is not necessary to prevent a Voltage collapse in the TSO Responsibility Area, the TSO shall define the conditions under which the On Load Tap Changer shall block according to Section 4.8 of [GMS Network Code on Connection], including at least:

a) method of blocking (local or remote from control room);

b) Voltage level threshold at the Connection Point;

c) Reactive Power flow direction; and

d) maximum time delay between threshold detection and blocking.

2.2.6 Power flow management procedure

(1) The power flow management procedure of the System Defence Plan shall include a set of measures to manage power flow outside Operational Security Limits defined according to Section 2.1, paragraph (5) of [GMS Network Code on Operational Security – OS]. These measures shall be used in case the measures developed according to Section 2.5, paragraph (4) of [GMS Network Code – OS] are not sufficient.

(2) Each TSO shall be entitled to define an Active Power set-point which the Significant Grid User shall maintain provided it is identified for this measure pursuant to Section 2.1.1, paragraph (7) and the set-point respects its technical constraints. The Significant Grid User shall execute without undue delay the instructions given directly by the TSO or indirectly through DSOs, until further instructions are issued.

(3) Each TSO shall be entitled to disconnect Significant Grid Users and Defence Service Providers, directly or indirectly through DSOs. They shall remain disconnected until further instructions are issued.

2.2.7 Assistance for Active Power procedure

(1) Each TSO shall be entitled to request assistance for Active Power in the following situations:

a) in case of absence of Responsibility Area Adequacy in day-ahead and intraday, as defined in Section 5.5 of [Network Code on Operational Planning and Scheduling – OPS], provided the TSO has activated all available Balancing Energy and/or taken into account all available Balancing Energy within its Coordinated Balancing Area at the moment of absence of Adequacy, according to Chapter 3, “Energy Balancing” of [GMS Network Code on Market]; or

b) in case the TSO is in Restoration State whereas some of its neighbouring TSOs are in Normal or Alert State.

(2) The TSO in the situation referred in paragraph 1 (a) above shall be entitled to request assistance for Active Power from:

a) Balancing Service Providers which, upon the TSO request, shall change its Availability Status to make available all its Active Power, provided it was not already activated through any Balancing mechanism, and while respecting its technical constraints; and

b) Any Significant Grid User connected in its LFC Area that does not have an agreement with a Balancing Service Provider, and which, upon the TSO request, shall make available all its Active Power, while respecting its technical constraints.

(3) The TSO in the situations referred in paragraph 1 (a) or (b) above shall be entitled to request assistance for Active Power from neighbouring TSOs, irrespective of their participation or not into its Coordinated Balancing Area(s).

Each requested TSO in Normal or Alert State shall:

a) make available its Unshared Bids as defined in Chapter 3, “Energy Balancing” of [GMS Network Code on Market];

b) be entitled to activate the available Balancing Energy from the Coordinated Balancing Area(s) it belongs to and that do not include the requesting TSO, in order to provide the corresponding power to the requesting TSO; and

c) be entitled to request assistance for Active Power from its Balancing Service Providers and from any Significant Grid User connected in its Responsibility Area that does not have an agreement with a Balancing Service Provider, in order to provide the corresponding power to the requesting TSO.

(4) Each TSO shall activate the Active Power requested pursuant to paragraphs 2 and 3 in accordance with Section 2.1.3 of this Network Code.

(5) When activating the Active Power requested pursuant to paragraph 3 above, the requesting and the requested TSOs shall be entitled to use:

a) available cross-zonal capacity; and

b) additional cross-zonal capacity that may be available due to real-time status of the system.

(6) Assistance for Active Power pursuant to paragraph 3 above shall be firm, unless the TSO providing the assistance enters into Emergency or Blackout State.

2.2.8 Manual Demand disconnection procedure

(1) In addition to the measures set out in Sections 2.2.1, 2.2.4 and 2.2.7, each TSO shall be entitled to define an amount of Demand to be manually disconnected, directly by the TSO or indirectly through DSOs, when necessary to prevent any propagation or worsening of an Emergency State.

(2) The TSO shall activate this measure to:

a) resolve overloads or under Voltage situations; or

b) resolve situations in which assistance for Active Power according to Section 2.2.7 has been requested but is not sufficient to keep Adequacy in its Responsibility Area in D-1 and intraday as defined in Section 5.5 of [Network Code on Operational Planning and Scheduling – OPS], leading to a risk of Frequency deterioration in the Synchronous Area.

(3) The TSO shall notify DSOs of the amount of Demand to be disconnected on their Distribution Systems. Each DSO shall disconnect the notified amount of Demand, without undue delay.

3. Restoration Plan

3.1 General Principles

3.1.1 Design of the Restoration Plan

(1) Each TSO shall design a Restoration Plan in consultation with relevant DSOs, Significant Grid Users, neighbouring TSOs and the other TSOs in that Synchronous Area, to return its system to Normal State as fast as possible.

(2) When designing its Restoration Plan, each TSO shall take into account, at least:

a) behaviour and capabilities of load and generation;

b) specific needs of high priority Significant Grid Users listed pursuant to Section 4.2, paragraph (10) [GMS Network Code on Operational Security – OS]; and

c) characteristics of its Network and underlying DSOs Networks.

(3) In the design of its Restoration Plan, each TSO shall respect the following principles:

a) the impact for System Users is minimal;

b) the measures are economically efficient;

c) only the necessary measures are activated; and

d) the measures do not endanger the Operational Security of the interconnected Transmission Systems.

(4) The Restoration Plan shall contain the necessary means to allow the TSO to execute a Bottom-up Re-energization Strategy, containing at least means for:

a) managing Voltage and Frequency Deviations due to Re-energization;

b) monitoring and managing Island Operation; and

c) resynchronising Island Operation areas.

(5) The Restoration Plan shall include at least the following technical and organisational measures specified in this Chapter:

a) Re-energization procedure;

b) Frequency management procedure; and

c) Resynchronisation procedure.

(6) Each TSO shall define at least in its Restoration Plan procedures:

a) the conditions under which the procedure is activated;

b) the relevant set of measures;

c) Restoration Plan instructions to be issued by the TSO; and

d) measures subject to real-time consultation or coordination with identified parties.

(7) Each TSO shall notify the regulatory authority or other competent authority of the Member State concerned of at least the following elements of its Restoration Plan:

a) objectives the Restoration Plan intend to achieve, including the phenomena to be managed or the situation to be solved;

b) conditions triggering the measures of the Restoration Plan;

c) general principle of each measure explaining how each measure contributes to the objectives of the Restoration Plan and who will implement these measures; and

d) deadlines identified pursuant to paragraph 8 for implementation of the measures.

(8) In the design of its Restoration Plan, each TSO shall:

a) list all measures to be implemented on its installations;

b) identify DSOs that have to implement measures on their installations and list the measures to be implemented by these DSOs;

c) identify Significant Grid Users that have to implement measures on their installations, when these measures are using mandatory requirements from [GMS Network Code on Connection, Chapter 2 (RFG), Chapter 3 (HVDC) and Chapter 4 (DC)] or national legislation and list the measures to be implemented by these Significant Grid Users;

d) list the measures to be implemented by Restoration Service Providers; and

e) identify the implementation deadlines for each listed measure.

(9) Each TSO shall identify all substations which are essential for its Restoration Plan procedures.

(10) Each TSO shall define the number of power sources in its Responsibility Area necessary to re-energize its system with Bottom-up Strategy, having the following capabilities:

a) Black Start Capability;

b) quick re-synchronisation capability (through House-load Operation); and

c) Island Operation.

(11) Unless the terms and conditions to act as Restoration Service Providers are defined in the national legal framework, each TSO shall define the terms and conditions to apply as Restoration Service Providers on a contractual basis including at least:

a) characteristics of the service to be provided;

b) target geographical distribution of power sources with Black Start and Island Operation capabilities;

c) the possibility of and conditions for aggregation; and

d) additional requirements and conditions.

3.1.2 Implementation of the Restoration Plan

(1) Each TSO shall implement and maintain the measures of its Restoration Plan that are to be implemented on the Transmission System.

(2) Each TSO shall notify:

a) Transmission Connected DSOs of the measures, including the deadlines for implementation, which are to be implemented on:

i. their installations pursuant to Section 3.1.1, paragraph (8); and/or

ii. the installations of Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) and connected to their Distribution Systems; and/or

iii. the installations of Restoration Service Providers connected to their Distribution Systems; and/or

iv. the installations of DSOs connected to their Distribution Systems.

b) Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) and/or Restoration Service Providers directly connected to its Transmission System of the measures which are to be implemented on their installations, including the deadlines for implementation.

When provided in national legislation, the TSO shall notify directly Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) and/or Restoration Service Providers and/or DSOs connected to Distribution Systems and shall inform the concerned DSO of this notification.

(3) Each notified DSO shall notify Significant Grid Users, Restoration Service Providers and/or DSOs connected to its Distribution System of the measures of the Restoration Plan which they have to implement on their installations, including the deadlines for implementation, unless the TSO has already notified them pursuant to paragraph 2 above.

(4) Each notified DSO, Significant Grid User and Restoration Service Provider shall:

a) implement the measures notified to it and confirm this implementation to the notifying Network Operator, who shall, when different from the TSO, notify the TSO; and

b) maintain the measures implemented on its installations.

3.1.3 Activation of the Restoration Plan

(1) Each TSO shall activate procedures of its Restoration Plan in coordination with DSOs and Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) and with Restoration Service Providers, when the TSO is:

a) in Emergency State, once the system is stabilised following activation of the measures of the System Defence Plan; or

b) in Blackout State.

(2) Each DSO and Significant Grid User identified pursuant to Section 3.1.1, paragraph (8), as well as Restoration Service Provider shall execute without undue delay the Restoration Plan instructions issued by the TSO, according to Restoration Plan procedures.

(3) Each TSO shall activate procedures of its Restoration Plan having a significant cross-border impact in coordination with the impacted TSOs.

3.2 Re-Energization

3.2.1 Re-energization procedure

(1) The Re-energization procedure of the Restoration Plan shall contain a set of measures based on the following strategies:

a) a Top-down Re-energization Strategy; and

b) a Bottom-up Re-energization Strategy.

(2) Each TSO shall be entitled in real-time to combine Top-down and Bottom-up Re-energization Strategies as needed.

(3) Each TSO shall inform its neighbouring TSOs on its capability to support a Top-down Re-energization Strategy.

3.2.2 Re-energization strategy

(1) When activating the Re-energization procedure, each TSO shall define a strategy to apply, taking into account:

a. the availability of power sources capable of Re-energization in its Responsibility Area;

b. the expected duration of possible Re-energization strategies;

c. the conditions of the power systems;

d. the conditions of the directly connected systems, including at least the status of Interconnectors; and

e. the high priority Significant Grid Users listed pursuant to Section 4.2, paragraph (10) of [GMS Network Code on Operational Security – OS].

(2) When applying a Top-down Re-energization Strategy, each TSO shall manage the connection of load and generation with the aim to regulate the Frequency towards the Nominal Frequency with a maximum tolerance of the Maximum Steady-State Frequency Deviation. Each TSO shall apply the conditions for connection of load and generation defined by the Frequency Leader, when appointed.

(3) When applying a Bottom-up Re-energization Strategy, each TSO shall manage the connection of load and generation with the aim to regulate the Frequency towards the target Frequency defined according to Section 3.3.1, paragraph (3) (b).

(4) During Re-energization, the TSO shall, after consultation with DSOs, define and notify the amount of Demand to be reconnected on distribution Networks. Each DSO shall reconnect the notified amount of Demand, while respecting the Block Loading and taking into account the automatic re-connection of load and generation in its Network.

(5) For the activation of a Top-down Re-energization Strategy, the TSO shall request neighbouring TSOs to support the Re-energization. The requested TSOs shall provide assistance for the Re-energization, unless it would lead their systems to Emergency or Blackout States. In this case, the requesting TSO shall use the Bottom-Up Re-energization Strategy.

3.3 Frequency Management

3.3.1 Frequency Management procedure

(1) The Frequency management procedure of the Restoration Plan shall contain a set of measures aiming at restoring System Frequency back to Nominal Frequency.

(2) Each TSO shall activate its Frequency management procedure:

a) in preparation of the Resynchronisation procedure, when a Synchronous Area is split in several Synchronised Regions;

b) in case of Frequency Deviation in the Synchronous Area; or

c) in case of Re-energization.

(3) The Frequency management procedure shall include at least:

a) appointment of Frequency Leaders;

b) definition of target Frequency in case of Bottom-up Re-energization Strategy;

c) Frequency management after Frequency Deviation; and

d) Frequency management after Synchronous Area split.

(4) The Frequency management procedure shall include the determination of the amount of load and generation to be reconnected, taking into account the available Active Power Reserves within the Synchronised Region in order to avoid major Frequency Deviations.

3.3.2 Appointment of Frequency Leaders

(1) During system Restoration, each TSO shall identify and monitor:

a) the extent and borders of the Synchronised Region or Synchronised Regions to which its Responsibility Area belongs;

b) the TSOs with which it shares a Synchronised Region or Synchronised Regions; and

c) the available Active Power Reserves in its Responsibility Area.

(2) During system Restoration, when a Synchronous Area is split in several Synchronised Regions, the TSOs of each Synchronised Region shall appoint a Frequency Leader, in accordance with paragraph 4 below.

(3) During system Restoration, when a Synchronous Area is not split but the System Frequency exceeds Frequency limits for Alert State as defined in Section 5.1, paragraph (4) of [GMS Network Code on LFCR], all TSOs of the Synchronous Area shall appoint a Frequency Leader, in accordance with paragraph 4 below.

(4) The TSO with the highest real-time estimated K-factor shall be appointed as the Frequency Leader, unless the TSOs of the Synchronised Region, or of the Synchronous Area, agree to appoint another TSO as the Frequency Leader. In that case, the TSOs of the Synchronised Region, or of the Synchronous Area, shall consider the following criteria:

a) the amount of available Active Power Reserves and especially Frequency Restoration Reserves;

b) the available capacities on Interconnectors;

c) the availability of Frequency measurements of TSOs of the Synchronised Region or of the Synchronous Area; and

d) the availability of measurements on critical elements within the Synchronised Region or the Synchronous Area.

(5) When a TSO is appointed as Frequency Leader of a Synchronised Region, it shall inform the other TSOs of the Synchronous Area of its appointment.

(6) Once appointed, a TSO shall remain Frequency Leader until:

a) another Frequency Leader is appointed for its Synchronised Region;

b) a new Frequency Leader is appointed as the result of Resynchronisation of its Synchronised Region with another Synchronised Region; or

c) the Synchronous Area has been completely resynchronised, the System Frequency is within the Standard Frequency Range and the load frequency control operated by each TSO of the Synchronous Area is back to its normal operating mode according to Section 5.1, paragraph (6) of [GMS Network Code on LFCR].

3.3.3 Frequency management after Frequency Deviation

(1) During system Restoration, when a Frequency Leader has been appointed according to Section 3.3.2, paragraph (3) above, the TSOs of the Synchronous Area, with the exception of the Frequency Leader, shall as a first measure suspend the manual activation of Frequency Restoration Reserves and Replacement Reserves.

(2) The Frequency Leader shall define, after consultation with the other TSOs of the Synchronous Area, the operating mode to be applied on the load frequency control operated by each TSO of the Synchronous Area.

(3) The Frequency Leader shall manage the manual activation of Frequency Restoration Reserves and Replacement Reserves within the Synchronous Area, aiming at regulating the Frequency of the Synchronous Area towards the Nominal Frequency while taking into consideration Operational Security Limits pursuant to Section 2.1, paragraph (5) of [GMS Network Code on Operational Security – OS]. Each TSO of the Synchronous Area shall support the Frequency Leader when requested.

3.3.4 Frequency management after Synchronous Area split

(1) During system Restoration, when a Frequency Leader has been appointed according to Section 3.3.2, paragraph (2), the TSOs of each Synchronised Region, with the exception of the Frequency Leader, shall as a first measure suspend the manual activation of Frequency Restoration Reserves and Replacement Reserves.

(2) The Frequency Leader shall define, after consultation with the other TSOs of the Synchronised Region, the operating mode to be applied on the load frequency control operated by each TSO of the Synchronised Region.

(3) The Frequency Leader shall manage the manual activation of Frequency Restoration Reserves and Replacement Reserves within the Synchronised Region, aiming at regulating the Frequency of the Synchronised Region towards the target Frequency defined by the Resynchronisation Leader, if any, pursuant to Section 4.3, paragraph (1) (a) of this Network Code while taking into consideration Operational Security Limits pursuant to Section 2.1, paragraph (5) of [GMS Network Code on Operational Security – OS]. When no Resynchronisation Leader is appointed for the Synchronised Region, the Frequency Leader shall aim at regulating the Frequency towards the Nominal Frequency. Each TSO of the Synchronised Region shall support the Frequency Leader when requested.

3.4 Resynchronisation

3.4.1 Resynchronisation procedure

(1) The Resynchronisation procedure of the Restoration Plan shall include, at least:

a) the appointment of Resynchronisation Leaders;

b) a Resynchronisation strategy; and

c) maximum limits for phase angle, Frequency and Voltage differences for connecting lines.

3.4.2 Appointment of a Resynchronisation Leader

(1) During system Restoration, when two Synchronised Regions can be resynchronised without endangering the Operational Security of the Transmission Systems, the Frequency Leaders of these Synchronised Regions shall appoint a Resynchronisation Leader in consultation with at least the TSO(s) identified as potential Resynchronisation Leader and in accordance with paragraph 2 below.

(2) For each pair of Synchronised Regions to be resynchronised, the Resynchronisation Leader shall be the TSO that:

a) has in operation at least one substation equipped with a parallel switching device on the border between the two Synchronised Regions to be resynchronised;

b) has access to Frequency measurements from both Synchronised Regions;

c) has access to Voltage measurements on the substations between which potential Resynchronisation Points are located; and

d) is able to control the Voltage of potential Resynchronisation Points.

(3) In case more than one TSO fulfils the criteria under paragraph 2 above, the TSO with the highest number of potential Resynchronisation Points between the two Synchronised Regions shall be appointed as the Resynchronisation Leader, unless the Frequency Leaders of the two Synchronised Regions agree to appoint another TSO as the Resynchronisation Leader.

(4) Each Frequency Leader shall inform TSOs from its Synchronised Region of the appointed Resynchronisation Leader.

(5) A TSO shall remain Resynchronisation Leader until:

a) another Resynchronisation Leader is appointed for the two Synchronised Regions; or

b) the two Synchronised Regions have been resynchronised, and all the steps in Section 4.3 of this Network Code have been completed.

3.4.3 Resynchronisation strategy

(1) Prior to Resynchronisation, the Resynchronisation Leader shall:

a) define, after consultation with the Frequency Leaders of the involved Synchronised Regions, while respecting maximum limits set out in Section 4.1, paragraph (1) of this Network Code:

i. target value of Frequency for Resynchronisation;

ii. maximum Frequency difference between the two Synchronised Regions;

iii. maximum Active and Reactive Power exchange; and

iv. operating mode to be applied on the load frequency control.

b) after consultation with the Frequency Leaders of the Synchronised Regions and the TSOs operating the substations used for Resynchronisation:

i. select the Resynchronisation Point, taking into account the Operational Security Limits in the Synchronised Regions;

ii. define and prepare all necessary actions for the Resynchronisation of the two Synchronised Regions at the Resynchronisation Point;

iii. define and prepare a subsequent set of actions to create additional connections between the Synchronised Regions; and

iv. assess the readiness of the Synchronised Regions for Resynchronisation, taking into account the conditions defined in accordance with paragraph 1 (a) above.

(2) Each Frequency Leader shall inform TSOs within its Synchronised Region of the planned Resynchronisation.

(3) When all conditions defined in paragraph 1 (a) above are fulfilled, the Resynchronisation Leader shall execute the Resynchronisation by activating the actions defined in paragraphs 1 (b) (ii) and (iii) above.

4. Market Interactions

4.1 Procedure for suspension of market activities

(1) When, during an Emergency State one or more conditions for suspension of market activities pursuant to Section 4.2 of this Network Code are met, or during a Blackout State, each TSO shall be entitled to temporally suspend one or more market activities pursuant to paragraph 2 below. These activities may be suspended until the conditions for restoration of market activities pursuant to Section 5.2 of this Network Code are fulfilled.

(2) The following market activities may be suspended pursuant to paragraph 1 above:

a. provision of Cross Zonal Capacity for Capacity Allocation on the corresponding Bidding Zone Borders for each market time unit where it is expected, the Transmission System shall not be restored to Normal or Alert State;

b. submission by Balancing Service Provider of Balancing Capacity and Balancing Energy bids, as described in Chapter 3, “Electricity Balancing” of [GMS Network Code on Market];

c. provision by Balance Responsible Party of a balanced Position in day ahead and the provision of change of its Position, as described in Chapter 3, “Electricity Balancing” of [GMS Network Code on Market]; and

d. provision of schedules, as described in Section 7.2, paragraphs (1) and (2) of [GMS Network Code on Operational Planning and Scheduling – OPS].

(3) In case of suspension of market activities pursuant to paragraph 1 above, upon request of the TSO, each Significant Grid User shall operate, if technically possible, at an Active Power set point defined by the TSO.

(4) In case of suspension of market activities pursuant to paragraph 1 above, each TSO shall be entitled to fully or partially suspend the operation of its processes impacted by such suspension.

(5) In case of suspension of market activities, each TSO shall duly inform the following parties in its Responsibility Area about the suspension of market activities, in accordance with communication procedure pursuant to Section 4.4:

a) Balance Responsible Parties;

b) Balancing Service Providers;

c) Nominated Electricity Market Operators;

d) Entities assigned to execute market functions according to Chapters 2 (CACM) and 3 (EB) of [GMS Network Code on Market]; and

e) Transmission Connected DSOs.

(6) In case of suspension of market activities pursuant to paragraph 1 above, each TSO shall coordinate at least with the following parties:

a) TSOs of Capacity Calculation Regions of which the TSO is a member of;

b) TSOs of Coordinated Balancing Area of which the TSO is a member of;

c) Nominated Electricity Market Operators within its Responsibility Area;

d) TSOs of a Load-Frequency Control Block of which the TSO is a member of; and

e) Coordinated Capacity Calculators of the Capacity Calculator Regions of which the TSO is a member of.

4.2 Rules and conditions for suspension and restoration of market activities

(1) Each TSO shall define, in consultation with entities referred to in Section 4.1, paragraph (5) above, the rules and conditions for suspension and restoration of market activities.

The TSO shall publish these rules and conditions following their approval by the regulatory authority or other competent authority of the Member State concerned pursuant to Section 1.4, paragraph (2) of this Network Code.

(2) The rules and conditions for suspension of market activities shall cover at least the situations where prolongation of market activities would worsen the conditions of the Transmission System being in Emergency State.

(3) The rules and conditions for restoration of market activities shall cover at least the situations where the restoration of market activities would not exacerbate, the conditions of the Transmission System being restored.

(4) When defining the rules and conditions for suspension of market activities, each TSO shall consider at least the following parameters:

a) a percentage of load disconnection in the LFC area of the TSO;

b) a percentage of generation disconnection in the LFC area of the TSO;

c) a significant part of the LFC area in de-synchronised operation with the rest of the LFC area of the TSO;

d) the reduction to zero of Cross Zonal Capacity on a Bidding Zone Border(s);

e) a percentage of affected entities, referred to in Section 4.1, paragraph (5) above, not able to execute their market activities for reason(s) out of their control; and

f) the absence of the proper functioning of tools and communication means necessary for TSOs to facilitate market activities.

When defining the rules and conditions for suspension of market activities, each TSO shall define waiting periods of time to be respected for each parameter, when appropriate, before starting the procedure for suspension of market activities.

(5) When defining the rules and conditions for restoration of market activities, each TSO shall consider at least the following parameters:

a) a percentage of remaining load disconnection in the LFC area of the TSO;

b) a percentage of remaining generation disconnection in the LFC area of the TSO;

c) a part of the LFC area remaining in de-synchronised operation with the rest of the LFC area of the TSO;

d) availability of Cross Zonal Capacity on Bidding Zone Border;

e) a significant percentage of affected entities referred to in Section 4.1, paragraph (5) being able to execute their market activities; and

f) the absence of proper functioning of tools and communication means necessary for TSOs to facilitate market activities.

(6) Each TSO shall assess in real-time the rules and conditions defined pursuant to paragraphs 4 and 5 above, on the basis of the information at its disposal.

4.3 Procedure for restoration of market activities

(1) Each TSO, in coordination with NEMOs in its Responsibility Area and neighbouring TSOs, shall launch the restoration of market activities suspended pursuant to Section 4.1, paragraph (1) of this Network Code, when:

a. the conditions for restoration of market activities pursuant to Section 4.2, paragraph (5) of this Network Code are met; and

b. the entities referred to in Section 4.1, paragraph (5) of this Network Code have been duly informed in advance in accordance with Section 4.4 below.

(2) Each TSO, in coordination with neighbouring TSOs, shall launch the restoration of TSO processes impacted by the suspension of market activities when the conditions of the paragraph 1 of this Section are fulfilled or before, if necessary, to restore market activities.

(3) Each Nominated Electricity Market Operator (NEMO), in coordination with TSOs and entities referred to in Section 4.1, paragraph (5) of this Network Code, shall launch the restoration of the relevant Day Ahead Market Coupling process and/or the relevant Intraday Market Coupling process after being informed by its TSO(s) that TSOs' processes have been restored.

(4) When provision of Cross Zonal Capacity has been suspended and subsequently restored, each concerned TSO shall update the Cross Zonal Capacities for Capacity Allocation by using the most feasible and efficient option of the following possibilities for each market time unit:

a) use the latest available Cross Zonal Capacities calculated by the Coordinated Capacity Calculator;

b) launch of the regional capacity calculation processes applicable according to Chapter 2 (CACM) of [GMS Network Code on Market]; or

c) in coordination with TSOs within the Capacity Calculation Region, determine Cross Zonal Capacities based on the actual physical network conditions.

(5) When part of the total coupled area where market activities have been suspended is back to Normal State or Alert State, the Nominated Electricity Market Operators (NEMO) of this area shall be entitled to execute a market coupling in a part of the total coupled area, in consultation with the TSOs and entities referred to in Section 4.1, paragraphs (5) and (6), of this Network Code provided the TSO has restored the capacity calculation process.

4.4 Communication procedure

(1) Each TSO shall develop and publish, in consultation with the entities referred to in Section 4.1, paragraph (5) of this Network Code, a communication procedure detailing the tasks and actions expected from each party in its different roles during the suspension and restoration of market activities. The communication procedure shall also include information to the regulatory authority or other competent authority of the Member States concerned.

(2) The procedure shall include at least the following steps :

a) notification by the TSO that market activities have been suspended according to Section 4.2 of this Network Code;

b) notification by the TSO of best estimate for the time and date for Transmission System restoration;

c) notification by the Nominated Electricity Market Operator (NEMO) of suspension of Ahead Market Coupling process and/or relevant Intraday Market Coupling process, if any;

d) notification by entities referred to in Section 4.1, paragraph (5) of this network Code, which are affected to their customers of any suspension of market activities announced by the TSO and/or NEMO;

e) updates by TSOs on the process for restoration of the Transmission System;

f) notification by the entities referred to in Section 4.1, paragraph (5) of this Network Code, which are affected, that their market tools and communication systems are operational;

g) notification by the TSO(s) that the Transmission System has been restored back to Normal State or Alert State;

h) notification by the NEMO of the best estimate for time and date when market activities will be restored; and

i) confirmation by the NEMO that market activities have been restored.

4.5 Settlement principles

(1) Each TSO shall be entitled to develop specific rules and conditions for imbalance settlement and settlement of balancing energy, which shall be applicable for imbalance settlement periods during which the market activities were suspended. In this case, the TSO shall consult the entities referred to in Section 4.1, paragraph (5) of this Network Code.

The TSO shall publish these specific rules and conditions following their approval by the regulatory authority or other competent authority of the Member State concerned pursuant to Section 1.4, paragraph (2) of this Network Code.

(2) The specific rules and conditions shall address the settlements of TSO's with Balance Responsible Parties, Balance Services Providers and TSOs from which assistance is requested pursuant to Section 2.2.7 of this Network Code.

5. Information Exchange and Communication, Tools and Facilities

5.1 Information Exchange

(1) In addition to the provisions of Sections 3.1 to 3.14 of [GMS Network Code on Operational Security – OS], each TSO shall be entitled to gather the following information when in Emergency, Blackout or Restoration States:

a) from DSOs identified pursuant to Section 3.1.1, paragraph (8) of this Network Code, necessary information about at least:

i. existing part of their Network in Island Operation;

ii. ability to synchronise parts of their Network in Island Operation; and

iii. capability to start Island Operation.

b) from Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) and Restoration Service Providers, information about at least the following conditions:

i. current status of the installation;

ii. operational limits;

iii. Full Activation Time and time to increase generation; and

iv. time critical processes.

(2) Each TSO shall provide the following information during Emergency, Blackout or Restoration States in due time and for the purposes of System Defence Plan procedures and Restoration Plan procedures, provided the information is available to the TSO:

a) to neighbouring TSOs, information about at least:

i. the extent and borders of the Synchronised Region or Synchronised Regions to which its Responsibility Area belongs;

ii. restrictions to operate Synchronised Region;

iii. Active and Reactive Power time limits at Interconnectors; and

iv. other technical or organisational restrictions.

b) to the Frequency Leader of its Synchronised Region, information about at least:

i. restrictions to maintain Island Operation;

ii. the available additional load and generation; and

iii. the availability of Operational Reserves.

c) to Transmission Connected DSOs, information about at least:

i. the System State of its Transmission System;

ii. limits of Active and Reactive Power, Block Loading, tap and circuit breaker position at the connection points;

iii. information on the current and planned status of Power Generating Modules connected to the DSO, if not available to the DSO directly; and

iv. all necessary information leading to further coordination with distribution connected parties.

d) to Defence Service Providers, information about at least:

i. the System State of its Transmission System; and

ii. scheduled measures which require participation of the Defence Service Providers.

e) to DSOs and Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) and to Restoration Service Providers, information about at least:

i. the System State of its Transmission System;

ii. ability and plans to re-energise couplings; and

iii. scheduled measures which require their participation.

(3) All TSOs shall exchange between each other information in Emergency, Blackout or Restoration State including at least:

a) known circumstances that lead to the current System State of its Transmission System; and

b) potential problems making assistance for Active Power necessary.

(4) Each TSO in Emergency, Blackout or Restoration State shall provide, in due time, information to at least the following parties about the System State of its Transmission System and, if available, additional information explaining the situation on the Transmission System:

a) Nominated Electricity Market Operators, who shall make this information available to their Market Participants, according to Section 4.4 of this Network Code; and

b) its National Regulatory Authority, or when explicitly foreseen in national law, other relevant national authorities.

(5) Each TSO shall inform each affected party about the test plan developed pursuant to Section 6.1.1, paragraphs (2) and (3) of this Network Code.

5.2 Communication systems

(1) Each DSO and Significant Grid User identified pursuant to Section 3.1.1, paragraph (8) of this Network Code, each TSO and each Restoration Service Provider shall have at least one redundant voice communication system to exchange the necessary information for Restoration Plan. At least one of these voice communication systems shall have backup power supply for at least 24 hours and shall be prioritized.

(2) Notwithstanding the previous paragraph, Significant Grid Users identified pursuant to Section 3.1.1, paragraph (8) of this Network Code, which are type B Power Generating Modules and Restoration Service Providers, which are type A or B Power Generating Modules, shall have the possibility to only have a redundant data communication system instead of voice communication system if agreed upon with the TSO.

5.3 Tools and facilities

(1) Each TSO shall make available critical tools and facilities defined in Section 2.1, paragraph (15) of [GMS Network Code on Operational Security – OS] for at least 24 hours in case of loss of primary power supply.

(2) Each DSO and Significant Grid User identified pursuant to Section 3.1.1, paragraph (8) of this network Code as well as Restoration Service Provider shall make available critical tools and facilities defined in Section 2.1, paragraph (15) of [GMS Network Code on Operational Security – OS] and used in Restoration Plan for at least 24 hours in case of loss of primary power supply.

(3) Each TSO shall have at least one geographically separate backup control room. The backup control room shall include at least the critical tools and facilities defined in Section 2.1, paragraph (15) of [GMS Network Code on Operational Security – OS]. Each TSO shall arrange a backup power supply for its backup control room for at least 24 hours in case of loss of primary power supply.

(4) Each TSO shall prepare an evacuation procedure for moving from the main control room to the backup control room, in a maximum time of three hours, including the operation of the system during the evacuation.

(5) Substations identified as essential for the Restoration Plan procedures pursuant to Section 3.1.1, paragraph (9) of this Network Code shall be operational in case of loss of primary power supply for at least 24 hours.

6. Compliance and Review

6.1 Compliance Testing of TSO, DSO and Significant Grid User Capabilities

6.1.1 General Principles

(1) Each TSO shall periodically assess the proper functioning of all equipment and capabilities contributing to the System Defence Plan and the Restoration Plan. In this objective, each TSO shall periodically verify the compliance of capabilities that are used in the System Defence Plan and in the Restoration Plan, in accordance with Section 6.1.1, paragraph (2) of this Network Code, Chapter 2 (RfG), Chapter 3 (HVDC) and Chapter 4 (DC) of [GMS Network Code on Connection].

(2) Each TSO shall define a test plan in consultation with DSOs, Significant Grid Users identified pursuant to Section 2.1.1, paragraph (7) and Section 3.1.1, paragraph (8) of this network Code, Defence Service Providers and Restoration Service Providers. The test plan shall identify the capabilities and equipment used in the System Defence Plan and in the Restoration Plan that have to be tested.

(3) The test plan shall include periodicity and conditions of the tests, following minimum requirements outlined in Sections 6.1.2, 6.1.3 and 6.1.4. The test plan shall follow the methodology described in Chapter 2 (RfG), Chapter 3 (HVDC) and Chapter 4 (DC) of [GMS Network Code on Connection] for the corresponding tested capability, except for Significant Grid Users which are not subject to Chapter 2 (RfG), Chapter 3 (HVDC) and Chapter 4 (DC) of [GMS Network Code on Connection] where they shall follow the provisions of national law.

(4) Each TSO, DSO, Significant Grid User, Defence Service Provider and Restoration Service Provider shall not endanger the Operational Security of the Transmission System and of the interconnected Transmission System during the test. The test shall be conducted in a way that minimises the impact on System Users.

(5) The test is deemed passed when it fulfils the conditions defined by the Relevant Network Operator pursuant to paragraph 3 above. As long as a test fails to fulfil these criteria, the TSO, DSO, Significant Grid User, Defence Service Provider and Restoration Service Provider shall repeat the test.

6.1.2 Compliance Testing of Power Generating Module capabilities

(1) Each Restoration Service Provider, which is a Power Generating Module delivering Black Start service, shall execute a Black Start Capability test, at least every three years, following the methodology described in Chapter 2 (RfG) of [GMS Network Code on Connection].

(2) Each Restoration Service Provider which is a Power Generating Module delivering a quick re-synchronisation service shall execute tripping to house-load test after any changes of equipment having an impact on its House-load Operation capability, or after two unsuccessful consecutive tripping in real operation, following the methodology described in Chapter 2 (RfG) of [GMS Network Code on Connection].

6.1.3 Compliance Testing of Demand Facilities providing Demand Side Response

(1) Each Defence Service Provider delivering Demand Side Response (DSR) shall execute a demand modification test, after two consecutive unsuccessful responses in real operation or at least every year, following the methodology described in Chapter 4 (DC) of [GMS Network Code on Connection].

(2) Each Defence Service Provider delivering DSR shall execute a Low Frequency Demand Disconnection (LFDD) test within a period to be defined at national level and following the methodology described in Chapter 4 (DC) of [GMS Network Code on Connection] for Transmission Connected Demand Facilities or according to a methodology similar to the requirements in Chapter 4 (DC) of [GMS Network Code on Connection] defined by the Relevant Network Operator for other Demand Facilities.

6.1.4 Compliance Testing of HVDC Facilities

(1) Each Restoration Service Provider, which is an HVDC System delivering a Black Start service, shall execute a Black Start Capability test, at least every three years, following the methodology described in Chapter 3 (HVDC) of [GMS Network Code on Connection].

6.1.5 Compliance Testing of Low Frequency Demand Disconnection (LFDD) Relays

(1) Each DSO and TSO shall execute testing on the Low Frequency Demand Disconnection relays implemented on its installations, within a period to be defined at national level and following the methodology described in in Chapter 4 (DC) of [GMS Network Code on Connection].

6.1.6 Testing of Communication Systems

(1) Each DSO and Significant Grid User identified pursuant to Section 3.1.1, paragraph (8) of this network Code, each TSO and each Restoration Service Provider shall test the communication systems, defined in Section 4.2 of this Network Code, at least every year.

(2) Each DSO and Significant Grid User identified pursuant to Section 3.1.1, paragraph (8) of this network Code, each TSO and each Restoration Service Provider shall test the backup power supply of their communication systems at least every five years.

6.1.7 Testing of Tools and Facilities

(1) Each TSO shall test the capability of main and backup power sources to supply its main and backup control rooms, in accordance with Section 4.3 of this Network Code, at least every year.

(2) Each TSO shall test the functionality of critical tools and facilities defined in Section 2.1, paragraph (15) of [GMS Network Code on Operational Security – OS], at least every three years, covering both main and backup tools and facilities. Where these tools and facilities involve DSOs or Significant Grid Users, these parties shall participate in this test.

(3) Each TSO shall test the capability of backup power sources to supply essential services of the substations identified as essential for the Restoration Plan procedures pursuant to Section 3.1.1, paragraph (9) of this Network Code, at

least every five years. When these substations are in Distribution Systems, DSOs shall execute this test.

(4) Each TSO shall test the evacuation procedure for moving from the main control room to the backup control room, according to Section 4.3, paragraph (4) of this Network Code, at least every year.

6.2 Compliance Testing and Review of System Defence Plans and Restoration Plans

6.2.1 Compliance Testing and Periodic Review of System Defence Plan

(1) Each TSO shall monitor the proper implementation of the Low Frequency Demand Disconnection on the basis of the yearly written notification on Low Frequency Demand Disconnection provided by the DSO and by the Demand Facility Owner pursuant to Chapter 4 (DC) of [GMS Network Code on Connection], and on the basis of implementation details of TSOs' installations where applicable.

(2) Each TSO shall review, at least every two (2) years, its complete System Defence Plan to assess its effectiveness. The TSO shall in this review take into account at least:

a) development and evolution of its Network since the last review or first design;

b) capabilities of new equipment installed on the Transmission and Distribution Systems since the last review or first design;

c) Significant Grid Users commissioned since the last review or first design, their capabilities and relevant offered services;

d) tests carried out and analysis of system incidents pursuant to Section 4.3, paragraph (5) of [GMS Network Code on Operational Security – OS]; and

e) operational data collected during normal operation and after Disturbance.

(3) When the TSO identifies the need to adapt the System Defence Plan, it shall amend its System Defence Plan and implement these amendments in accordance with Sections 2.1.1 and 2.1.2 of this Network Code.

6.2.2 Compliance Testing and Periodic Review of Restoration Plan

(1) Each TSO shall test measures of its Restoration Plan based on computer simulation, using data from DSOs identified pursuant to Section 3.1.1, paragraph (8) of this Network Code and Restoration Service Providers, at least every five years. The TSO shall define these simulation tests in a dedicated testing procedure covering at least:

a) energising restoration path from Restoration Service Providers with Black Start or Island Operation capabilities;

b) the supply of Power Generating Modules main auxiliaries;

c) Demand reconnection process; and

d) process for Resynchronisation of Networks in Island Operation.

(2) In addition, if deemed necessary by the TSO for the effectiveness of the Restoration Plan, each TSO shall execute operational testing of parts of

Restoration Plan, in coordination with DSOs identified pursuant to Section 3.1.1, paragraph (8) of this Network Code and Restoration Service Providers. The TSO shall define, in consultation with the DSOs and Restoration Service Providers, these operational tests in a dedicated testing procedure.

(3) Each TSO shall review its Restoration Plan to assess its effectiveness, at least every five years.

(4) When the TSO identifies the need to adapt the Restoration Plan, it shall amend its Restoration Plan and implement these amendments in accordance with Sections 3.1.1 and 3.1.2.

7. Implementation

7.1 Monitoring

(1) The RPTCC, in cooperation with the RPCC Board, shall draw up within six months after the entry into force of this Network Code, a list of the relevant information to be communicated by the RPCC Administration to the Regulatory authorities or other competent authorities of the Member State concerned. The list of relevant information may be subject to updates. The RPCC shall maintain a comprehensive, standardised format, digital data archive of the information required by the Regulatory authorities or other competent authorities of the GMS Member State.

(2) All TSOs shall submit to the RPCC Administration the data required to perform the tasks in accordance with paragraph 1 above.

(3) DSOs shall, at the joint request of the Regulatory authorities or other competent authorities of the GMS Member State concerned, submit to RPCC the information required for monitoring in accordance with paragraph 1 above, except for information already obtained by the regulatory authorities in the context of their respective implementation monitoring tasks.

7.2 Stakeholder involvement

(1) The RPCC in close cooperation with the Regulatory authorities or other competent authorities of the GMS Member State, shall organise stakeholder involvement regarding the implementation of this Network Code. This shall include regular meetings with stakeholders to identify problems and propose improvements notably related to the requirements set out in this Network Code.

8. Final Provisions

8.1 Amendments of contracts and general terms and conditions

By [date – the same as the date in Section 8.2 below], each relevant TSO, DSO and Significant Grid User shall amend all relevant clauses in contracts and relevant clauses in general terms and conditions, regardless of whether the relevant contracts or general terms and conditions contain an amendment process, in order to achieve compliance with the requirements of this Network Code.

8.2 Entry into force

This Network Code shall enter into force on xxxxx.

Section 2.1.1 “Design of the System Defence Plan” and Section 3.1.1 “Design of the Restoration Plan” of this Network Code shall apply [from the entry into force of this Network Code].

Section 2.1.2 “Implementation of the System Defence Plan”, and Section 3.1.2 “Implementation of the restoration plan” of this Network Code shall apply [1 year after the entry into force of this Network Code].

Section 2.2.2 “Automatic under-Frequency control scheme”, Section 4.2 “Communication Systems” and Section 4.3 “Tools and Facilities” of this Network Code shall apply [5 years after the entry into force of this Network Code].

Other Sections shall apply [2 years after the entry into force of this Network Code].

This Network Code shall be binding in its entirety and directly applicable in all Member States.

Done at xxxxxxxxx,

ANNEX: Emergency & Restoration Code – History of Comments

#	Country	Reference section in the document	Country Comment	Consultants Review and Recommendation	Country Acceptance
1.	PR of China	Section 2.1.1 (4)	Propose to add a function related to disconnection after losing synchronous state.	Added.	
2.	PR of China	Section 2.2.2 (4)	Automatic under-frequency control: GMS Values for the synchronous area. China suggests that the values are not fixed in all cases. These values may be changed when there are great changes to the power grid scale or composition.	It is important that all systems within the same synchronous area act at the same time to preserve from spreading the incident with possible global black-out caused by incoordination. But, the load-shedding steps can be different from one country to the other. What is important is that the frequency drop shall be contained within the same limits. The frequency stages shall be identical or very close.	
3.	PR of China	Section 2.2.2 (6) (a)	"Avoid setting an intentional time delay in addition to the operating time of the relays and circuit breakers". Automatic Low Frequency Demand Disconnection with time delay is used as a backup measure to correct frequency deviation for a rather long period. So we suggest this rule is not compulsory.	Not agreed. Could jeopardize and disturb the good functioning of the Emergency Plan.	
4.	PR of China	Section 3.3.2 (4)	3.3.2 Appointment of Frequency Leaders: China suggest: "(4) The TSO or power plant with the highest real-time estimated K-factor shall be appointed as the Frequency Leader…"	The leader is always the TSO (System Operator) which has a global vision of the system under its responsibility and, as such, is in position to react correctly. The leadership shall be defined in the multilateral operational agreement.	

#	Country	Reference section in the document	Country Comment	Consultants Review and Recommendation	Country Acceptance
5.	PR of China	Section 6.2.1 (2)	6.2.1 Compliance Testing and Periodic Review of System Defence Plan: China suggest: "(2) Each TSO shall review, at least every 2 ~~five~~ years, its complete System Defence Plan to assess its effectiveness …" Considered the scale and the topology of power grid maybe change greatly every year in GMS countries, we suggest we should check the validity of the System Defence Plan more often.	Ok, agreed if it is feasible.	
6.	Thailand	Section 2.2 Table 2-1	Delete Rows no. 2, 5 and 6 in Table 2-1 UF scheme should be designed based on characteristic of each country's power system. Only "Starting mandatory level: Frequency", "Final mandatory level: Frequency" and "Cumulative demand to be disconnected" should be specified for GMS interconnection. "Starting mandatory level: Demand to be disconnected", "Implementation range" and "Minimum number of steps to reach the final mandatory level" should not specified in a regional standard since they require further studies by each country.	Ok, agreed if no objection form the other GMS Countries.	