



**Greater Mekong Subregion
WGPG ON PERFORMANCE STANDARDS
& REGIONAL GRID CODE**

RPTCC-24 Meeting

Nay Pyi Daw – Myanmar, 19-20 June 2018

By Michel CAUBET

- 1. INTRODUCTION**
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- 3. COMMENTS ON GMS OPERATIONAL NETWORK CODES**
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COLLECTED COMMENTS ON TRANSMISSION POLICIES...

POLICIES	CAMBODIA	CHINA	LAOS	MYANMAR	THAILAND	VIETNAM
LFCR Report	✓ (0)	✓ (0)	✓ (0)	✓ (0)	✓ (0)	✓ (1)
Policy #1	✓ (3)	✓ (5)	✓ (0)	✓ (0)	✓ (5)	✓ (2)
Policy #2	✓ (3)	✓ (2)	✓ (2)	✓ (0)	✓ (14)	✓ (6)
Policy #3	✓ (1)	✓ (0)	✓ (0)	✓ (0)	✓ (13)	✓ (4)
Policy #4	✓ (0)	✓ (0)	✓ (0)	✓ (0)	✓ (2)	✓ (2)
Metering Arrangements	✓ (0)	✓ (6)	✓ (0)	✓ (0)	✓ (17)	✓ (1)

Policy #1 – Scheduling & Accounting

Policy #2 – Coordinated Planning

Policy #3 – Communication Infrastructure

Policy #4 – Data Exchanges – Rules to Handle the Data – Code of Conduct

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	Cambodia	2.3 Standard S7. Electronic Data Exchange. For Electronic Data Exchange for scheduling between Control Areas, Control Blocks and the COORDINATION CENTRE electronic highway must be used.	Is it a must for member country to use Electronic Highway for Electronic Data Exchange?	Yes
2.	Cambodia	2.3 Standard S8. Electronic Data Exchange Format. The Electronic Data Exchange Format for scheduling has to be agreed among the operators.	Is it Electronic Data Exchange Format attached in Appendix?	No. It is just an example. The format shall be decided in common with the GMS Members and RPCC for guidance.
3.	Cambodia	4.2 Definitions D7. Accounting Data. Accounting Data is the result of an agreement between two TSOs on relevant accounting data and is derived from validated metered data.	In case TSOs are private company, is it possible to share accounting data among them?	Yes as far as all have signed the Code of Conduct. But, the TSO shall be independent from other actors of the Power System, especially Generators.
4.	PR of China	2.0 Scheduling Exchange Program	The pyramid architecture should be re-designed according to the latest cross-border project planning. The exchange program among GMS-TSOs should be re-designed at the same time.	Yes. It has been done.
5.	PR of China	2.0 Scheduling Exchange Program	GCT is 17:15 Considering the exchange results are the basis of generation planning of TSO, this procedure should be finished before 11:30 a.m. in CSG. We suggest GCT could be advanced to 11:30 a.m.	Yes. Considered.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
6.	PR of China	2.0 Scheduling Exchange Program	According to the actual situation of GMS countries, a simple mode of CAX could be given, such as exchange scheduling based upon annual or monthly power purchase agreement and TSO performing exchange according to the scheduling and the real system operation circumstance. When the simple mode is executed smoothly, we can upgrade the scheduling exchange mode to market based mode.	Yes. Considered.
7.	PR of China	3.0/S4 Physical Exchange	In order to have the sum of telemetered physical power exchange data balanced, the transmission loss must be taken into consideration.	Yes. Considered.
8.	PR of China	4.0 Accounting and Settlement of Unintentional Deviations	The accounting process of unintentional deviation is executed weekly. We suggest this could be changed to monthly accounting.	It is recommended to keep it weekly. On month is too long to compensate the deviations.
9.	Thailand	2.3/S12. Standards – Availability	Time may change from “00:00” to “00:01”.	00:00 is considered at beginning of the day. 00:01 is acceptable.
10.	Thailand	2.3 Standards	One or two Co-Ordination Centers have to be defined	RPTCC has opted for one Coordination Centre. Except if RPTCC decides otherwise, we leave it as it is.
11.	Thailand	2.3 Figure 2 – Timetable 1 Day-ahead deadline for GMS scheduling process	Process Time should end at 16.00	Ok. Considered.
12.	Thailand	4.2 Definitions	Definition of Virtual tie-line should be stated	Included in the Glossary of Terms.
13.	Thailand	4.3/S4./S4.2.2. Accounting Process – Timing of the weekly accounting process	Timetable 2a is not defined	There is no Table 2a. Corrected.
14.	Myanmar	No comment		

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
15.	Vietnam	General	<p>The policy should be reviewed and commented by WGRI. It quitey relates to the Market Rule/Code.</p> <p>We propose that Policy 1 cover the general content of Scheduling and accounting, detailed contents should be covered in MR/Code, because in general Grid code only covers the technical areas.</p>	It is agreed that the principles shall be shared with WGRI.
16.	Vietnam	Scheduling Exchange Program 2.1 Introduction	<p>“ ...as it is usually applied in the Synchronous Area by the TSOs of the various Control Areas / Blocks”.</p> <p>What does it mean? As we understand that TSO is transmission system operator who owns and operates the transmission network. However, in Vietnam, System Operator is National Load Dispatch Centre (SO) is separated from Transmission Corporate.</p> <p>We are not sure the model in other country,</p> <p>We propose using System Operator in GMS Grid Code and Policies.</p>	<p>Considered. Both terms shall be applicable. We shall understand ISO in the GMS countries which have adopted the ISO model instead of TSO.</p> <p>The requirements expressed for TSO are valid for ISO.</p>

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	Cambodia	2.4 Standards	S1.2. Short-term planning. In case of any changes, the agreed schedule has to be- reviewed in the course of the year	Correction considered
2.	Cambodia	4.2 Requirements	R1. Infrastructure. For exchanging the DACF load-flow data sets and the results of the network security analysis, TSOs use the infrastructure described in “Policy on Communication- Infrastructure”	Correction considered
3.	Cambodia	4.2 Definitions	D7. Accounting Data. Accounting Data is the result of an agreement between two TSOs on relevant accounting data and is derived from validated metered data. In case TSOs are private company, is it possible to share accounting data among them?	Yes as far as all have signed the Code of Conduct. But, the TSO shall be independent from other actors of the Power System, especially Generators.
4.	PR of China	3.0 Capacity Assessment	We suggest capacity assessment should be executed monthly	It is recommended to keep it as it is. Month is too long.
5.	PR of China	4.0/S7 Day-ahead Congestion Forecast	We suggest the time point of TSOs uploading their load-flow data can be advanced to 2 p.m., because most staff in charge of load-flow data will be off duty after 5:30 p.m. For the same reason, the time point of TSOs uploading their results of overloaded elements should be advanced to 4:30 p.m. scheduling exchange mode to market based mode.	Accepted.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
6.	Lao PDR	2.2 Criteria	C2. GMS planning deadlines. Outage scheduling is an interactive process aiming at an operational and economic optimum for each TSO while respecting the SECURITY LIMITS and the N-1 CRITERION. This interactive process starts in the second half of the preceding year and finishes in the week preceding actual operation. (Could you please explain the meaning of process starts in the second half of the preceding year and finishes in the week preceding actual operation) Iterative or interactive ?	Not found. Iterative is the proper term used in C2.
7.	Lao PDR	Appendix A – Capacity Assessment (Guidelines for NTC Calculation)	Please define more clearly in glossary of terms BCE and ΔE The reference base case should be discussed, more. “Winter”/”Summer”? Rainy/Dry? Rainy Peak/Rainy off Peak and Dry Peak/Dry off peak? Etc. The method of generator selection to calculate NTC should be defined and discussed.	Will be done in the GMS Network Code – Market (CACM). The Base Case Scenario shall be defined in common in coordination with RPCC. Appendix A is just an example of what can be done. The number of BCE Scenario shall be determined. To be discussed while developing the GMS Network Code – Market (CACM).
8.	Thailand	2.4 / S1./S1.1 2.4 / S1./S1.2 2.0 4.2 4.3/S4	S1.1. Mid Long-term planning. S1.2. Short-term planning. ...but at the latest until Thursday Friday before the week concerned. Outage Scheduling should cover gas supply outage S4. Frequency of DACF... Each TSO shall supply to the EH-ftp server daily data sets of its area for at least the reference times 3:30 4:00 a.m., 2:00 p.m. and 10.30 8:00 p.m (TST).	Accepted.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
9.	Thailand	4.3/S5 4.4/G2 5.5/G1.7 Appendix A/1 Appendix B / Snapshot data sets Appendix B / Reference data sets	S5. Data processing.... on the EH ftp-server before 6 2 p.m., where it is accessible to all other participating TSOs G2. Results... TSOs should exchange the results of the overloaded elements latest at 9:00 a.m. p.m. of the day before Preventive load-shedding. Load Shedding will be activated at the load area in case of emergency BCE= Best Base Case Exchange 3:30 4:00 a.m., 2:00 p.m. and 10.30 8:00 p.m CET (TST). Change "Long Term" to "Medium Term"	Accepted.
10.	Thailand	2.4/ S1./S1.1. Mid-term planning. 4.3 /S4 Frequency of DACF 4.3 /S5 Data processing Appendix A/2. Reference Base Case Preparation	Extend from next year to next five years as it will be consistent with our present five-year-planning routine Change the 8.30 pm to 7.30 pm because the evening peak almost always occurs at 7.30 pm Change the 2.00 pm to 6.00 pm because short-term planning takes time to run and is always finishes after 4.00 pm Replace Winter with Rainy because, during the rainy seasons, a lot of hydropower is purchased from Laos whereas the demand is high during summer	Not necessary. We are talking here about outage planning, therefore 2 years is enough (current year plus one year). Done. Done. Done.
11.	Myanmar	No comment		
12.	Vietnam	4.3/S5	C1. Operation security. Each TSO has to ensure that despite... Same comment on Policy # 1.	Considered. Both terms shall be applicable. We shall understand ISO in the GMS countries which have adopted the ISO model instead of TSO. The requirements expressed for TSO are valid for ISO.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
13.	Vietnam	2.3 Requirements	R1. Relevant elements. The set of power system elements (e.g. Tie-lines, internal lines, phase shifters, transformers, major power plants) which influence two or more TSOs while being out of operation has to be agreed among involved TSOs.	Considered.
14.	Vietnam	2.3 Requirements	R2. Exchange of information. TSOs collect and share information about planned outages of the relevant elements (see above paragraph 2.3 – R1) within regional groups. It's not clear what is information should be shared or provided by both sides?	No comment. Clarification was provided during the meeting.
15.	Vietnam	2.3 Standards	S1. Coordination of planned outages. TSOs plan the outages in two planning horizons: Mid-Term Planning and Short-Term Planning... In Vietnam, we have yearly, monthly and weekly planning. It's easy to updated and exchange the revised and updated planning. We suggest that we use the timeframe of Year, Month and Week instead of Mid and short term. It means that add monthly planning.	Can be accepted if necessary. Vietnam can keep monthly planning as it is stricter. It may not be imposed to other GMS countries.
16.	Vietnam	4.0 Day-Ahead Congestion Forecast	Day-ahead Congestion Forecast We suggest that supplement the week ahead congestion forecast to be consistent with the short term planning.	Very important aspect, much more than week ahead, will condition the market.
17.	Vietnam	4.3 Standards	S1. Quality of the DACF process. The Sub Group presents the results to the Working Group "Operations and Security" with the proposals of improvements... What does it mean. Could you clarify who is member of WG to check the quality of DSCF?	It is a specific Task Force to be created under RPCC coordination

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	Cambodia	No comment		
2.	PR of China	No comment		
3.	Thailand	3.0 Real-Time Data Exchange 3.2/R1 3.2/R1./Trans Netw. 3.2/R1./Gen. Unit 3.2/R1./System 3.2/R1./System 3.2/R1./System 3.3/Page 12	<ul style="list-style-type: none"> ▪ Data exchange should not be limited to real-time data exchange. ▪ Non-Real-time Data exchange may be added for scheduling and accounting. ▪ State Estimator should be mentioned in the first paragraph. ▪ Add bus bar status ▪ Governor Droop (On/Off) ▪ Spinning Reserve ▪ Primary Reserve ▪ ACE ▪ For measurements: a periodic data transfer or a spontaneous data transfer in case of a value variation greater than a defined boundary (i.e. every 6 second). 	<p>The EH is meant for data exchange which helps the TSOs in monitoring and coordinating system operation. It is highly recommended not to use the exchanged data through EH for real-time control applications.</p>

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
4.	Thailand	<p>4.5/P5 Data storage capacity and clean-up</p> <p>6.1/Additional Paragraph</p> <p>7.1/The first Paragraph</p>	<ul style="list-style-type: none"> ▪ Data storage capacity and clean-up. The system will be designed to have data storage of at least 3 months for 6 second interval data and 2 year for 1 min interval data. <p><u>Comments.</u></p> <ul style="list-style-type: none"> ▪ Data can be selected and moved from real-time server to IT server. Then, data storage can be extended to 2 year (With longer interval, may be 1 min instead of 6 seconds). ▪ NOC may be considered as a data centre for GMS. ▪ NOC will provide web-based information of all GMS power interconnection points ▪ It is important that in addition to the data exchange infrastructure using EH for dedicated application, communication over other media is also available. Other data exchange infrastructure may exist besides the EH network. Mobile application such as WhatsApp may be used for notification. 	Acceptable.
5.	Myanmar	No comment		
6.	Vietnam	Title	<p>3. POLICY ON COMMUNICATION INFRASTRUCTURE</p> <p>In order to support real time dispatching and operation, the System operator should have the hot line communication, SCADA system to control and solve the issues happen in real-time. It's minimum requirements for real time operation. Hence, we suggest, it should be mentioned in detail.</p>	This is for exchange of data and information – Different and shall not be mixed with the SCADA system for operation.
7.	Vietnam	2.1 Introduction	A meshed private communication network between TSOs provides the necessary infrastructure The same comment mentioned in Policy #1	<p>Considered. Both terms shall be applicable. We shall understand ISO in the GMS countries which have adopted the ISO model instead of TSO.</p> <p>The requirements expressed for TSO are valid for ISO.</p>

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
8.	Vietnam	2.1 Introduction	This part of the policy will describe the necessary framework for the implementation, operation, extension and maintenance of the communication network of GMS Transmission System Operators (Electronic Highways – EH). What does it mean? Who decide to set up it?	Explanation provided in the meeting.
9.	Vietnam	2.5 Procedures	P1. Network management. The network management is implemented by the Network Operation Center (NOC). Pls clarify the role, responsibility and establishment of NOC?	Don in P3 below... same section.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	Cambodia	No comment		
2.	PR of China	No comment		
3.	Thailand	C3./C3.2 Common Information 4./ 5th line from the bottom	<ul style="list-style-type: none"> ▪ Common information. The data set, resulting from the merging of the shared individual information and all derived data. The data is used only by TSO and GMS. ▪ The Network Power Frequency Characteristic of a given Control Area / Block ... Therefore, the insensitivity range of controllers should be as small as possible, and in any case should not exceed $\pm 10mHz$ $\pm 20mHz$. Where dead bands exist in specific controllers, these must be offset within the Control Area / Block concerned. To make it consistent with (Page 9)insensitivity of turbine controller (20 mHz); 	Accepted.
4.	Vietnam	Title	<p>4. Policy on Data Exchange, Rules to handle the Data – Code of Conduct</p> <p>It should be stipulated the detailed minimum list of data should exchange by both sides. The further data will be agreed by bilateral agreement.</p>	<p>This is a Policy defining the principles, not listing the data to be exchanged.</p> <p>The requirements will be developed in the GMS Network Codes.</p>
5.	Vietnam	Introduction	<p>“...the involved parties have to follow for the provision and usage of these data (code of conduct) between TSOs or TSO and other parties”.</p> <p>The same comment mentioned in Policy # 1.</p>	<p>Considered. Both terms shall be applicable. We shall understand ISO in the GMS countries which have adopted the ISO model instead of TSO.</p> <p>The requirements expressed for TSO are valid for ISO.</p>

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
6.	ADB Consultant	S1.7. Publication	<ul style="list-style-type: none"> ▪ S1.7.1. Data to be published. The RPTCC Steering Committee defines (e.g. based on the proposal of an established Working Group) the information ▪ S1.7.3. Role of GMS. The RPCC Administration Secretariat is responsible for the supervision of publication and circulation of documents... The list of documents for external publication is kept by the RPCC Administration Secretariat. All other publications are approved by the RPTCC Steering Committee or the Bureau. The RPTCC Steering Committee decides whether the statistics of an associate member should be incorporated into GMS reports. To this aim, an associate member undertakes the prompt submission of any requested data to the RPCC Administration Secretariat. 	Accepted.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
			<p>Suggest to add:</p> <ul style="list-style-type: none"> ▪ 8.3.10 Authorized Personnel or Agents Each TSO party shall nominate the authorized metering personnel or agents to undertake the installation and maintenance of their own metering system or for any technical consultation on each other metering system such as metering irregularities. ▪ Data Exchange between TSOs and NOC should be mentioned in the document ▪ Financial Settlement shall be done by NOC through metering data. ▪ Meter calibration could be carried out both in laboratory and on-site. ▪ The calibration laboratory should be accredited for ISO/IEC17025 standard. ▪ The metering data management should be depending on each country according to PPA between the parties. ▪ Energy Meters: <ul style="list-style-type: none"> ▪ Measurement: 4 quadrants measurement (active/reactive and Import/export) ▪ Accuracy class: should be 0.2s for active energy and 0.5 for reactive energy. ▪ Calculating and recording profile resolution: should be power average over every 15 minute time interval. ▪ Clocks (meter time synchronization): should be synchronized by using local GPS time source and remote synchronization from data center software. ▪ Communication (remote meter reading): should be the new technology communication other than modems and telephone n/w, such as TCP/IP n/w (LAN/WAN), etc. ▪ Current Transformers: <ul style="list-style-type: none"> ▪ Secondary rating: should be 1A or 5A which suitable for energy meter. ▪ Accuracy class: should be class 0.2s (IEC STD) or 0.3 (ANSI STD), and not limit to any MVA capacity. ▪ Voltage Transformers: 	<p>Yes</p> <p>Yes</p> <p>Yes</p> <p>To be checked</p> <p>Yes</p> <p>Yes</p> <p>As proposed by ADB Consultant</p>

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
			<ul style="list-style-type: none"> ▪ Secondary rating: should not limit to only $100/\sqrt{3}V$, depending on designed criteria for each system but should be suitable for energy meter. ▪ Accuracy class: should be class 0.2 (comply with IEC STD) or 0.3 (comply with ANSI STD), and not limit to any MVA capacity 	
15.	Vietnam	General	<p>Current Transformers & Voltage Transformers</p> <p>In Vietnam, metering regulation for class is applied according to voltage level, not for capacity. Because the capacity will change year after year, even month after month.</p>	Additional information was given in the meeting about change in the regulation: Capacity will be considered.

User type	Accuracy class:	
	Active energy meter	Reactive energy meter
Interconnection (neighbouring TSO)	0.2C + 0.2C (*)	2 + 2 (*)
Generation	0.2C + 0.2C (*)	2 + 2 (*)
Utilities and suppliers	0.2C	2
Direct consumer (demand > 10 GWh /p.a.) Eligible customer	0.2C	2
Direct consumer (demand < 10 GWh /p.a.)	0.5C	3
Generation auxiliaries	0.5C	3

(*) Main meter and control meter

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	Vietnam	General comment	It should have the regulation about the role, contribution of each TSO in frequency control reserve, how to determine the reserve of each TSO, as in the ENTSO-E regulation.	Provided in the LFCR Network Code.

COLLECTED COMMENTS ON GMS NETWORK CODES...

Network Codes	CAMBODIA	CHINA	LAOS	MYANMAR	THAILAND	VIETNAM
General Comments	-	✓ (0)	-	-	✓ (0)	✓ (4)
Operational Security Code	-	✓ (10)	-	-	✓ (4)	✓ (6)
Operational Planning & Scheduling Code	-	✓ (7)	-	-	✓ (7)	✓ (2)

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	Vietnam	General comment	The development of RE is orientation and direction of each GMS country, hence the GMS Grid Code should take into account the technical requirements for RE, particularly wind and solar energy	RE specificity are taken into consideration in the GMS Grid Codes.
2.	Vietnam	General comment	In GMS Grid Code, it mentioned about the technical requirements, so what is relation and harmonization between technical performance and technical requirements?	Technical performance requirements are considered for the establishment of process and procedures.
3.	Vietnam	General comment	In GMS Grid Code and Operation Rules, it mentioned about the role and responsibility of Country Regulator; however, each country also identifies the role of Regulator depends on the legal framework of each country. Hence, would you pls clarify the power and role of country regulator in GMS Grid Code?	The role and duty of the NRAs are to review and approve the process and procedures established by the GMS Network Codes. Then, when approved, to facilitate their implementation at national level by making the national grid codes compliant with the regional requirements.
4.	Vietnam	General comment	The result of survey is very important. It's basic to finalize GMS Grid Code as well as Transmission Regulation. Hence, the Consultant should take into account the survey to update and revise these documents?	Could you be more specific and indicate where the results of the survey have not been considered?

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	PR of China	2.1 c) iv Emergency State	We suggest the time period should be shorter than real-time Contingency Analysis period. We suggest 15 minutes is adopted here so the system operator could take emergency control measure more quickly	30 minutes is reasonable to declare Emergency situation. GMS Members have to decide, but China can adopt a stricter approach (15 minutes).
2.	PR of China	Table 2.1 – Voltages ranges for reference voltages defined by TSOs	Considering the transmission distance in GMS scenario may be very long, and the higher transmission voltage level will be good to reduce transmission loss, we consider the voltage range for 230kV above can be changed into 0.9-1.1p.u.	This request needs to review the Performance Standards! +5% introduced in 2016 and confirmed in 2017...
3.	PR of China	2.4 (2) Short-circuit current management	In section 2.4 (2), could you explain why the deviation is allowed during switching sequences	Here, it refers to Section 2.1, paragraph (5) of this Network Code [OS], and then about the Voltage ranges according to Section 2.3 of the Code.
4.	PR of China	2.6 (5) Contingency analysis and handling	We suggest the detailed content of the contingency list could be defined more clearly.	Each TSO shall differentiate between Ordinary, Exceptional and Out-of-Range Contingencies, taking into account their probability of occurrence. It is reasonably detailed.
5.	PR of China	Security Analysis	We suggest that some more clear definition on security analysis could be proposed. For example, the reference value for low frequency oscillation damping ratio, the definition of voltage stability/instability and the margin between the calculation transmission limitation and the operational transmission capacity.	These parameters vary with the development of the power system. It is therefore difficult to specify these parameters and consider them in the Code. Nevertheless, these parameters shall be determined in coordination with RPCC and considered by the operators.
6.	PR of China	2.8 (8) Dynamic stability management	We suggest the analysis should be updated every year, because the load increasing rate is very high in GMS countries.	Acceptable

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
7.	PR of China	3.2 (1) Structural and forecast data exchange between TSOs	The demands of data exchange between TSOs are proposed. What is the original basis of these demands, basing on IEC standards or only ENTSO-E standards?	ENTSO-E requirement.
8.	PR of China	3.2 (3) b) Structural and forecast data exchange between TSOs	How to verify the validity of the equivalent model of the transmission system?	By simulation on past situations.
9.	PR of China	3.2 (4) Structural and forecast data exchange between TSOs	We suggest that in calculation related to HVDC system, electro-magnet transient calculation should be added to confirm the commutation process?	This section is dedicated to data exchange for analysis. What type of additional data do you need?
10.	PR of China	General	We suggest the same simulation and calculation tool/software is necessary in RPCC data environment.	Fully agreed, necessary.
11.	Thailand	2/2.1/(1)/(d)/i. System States	Loss of more than 50% of load in the TSO Responsibility Area.	Emergency State can be declared in case of partial loss of load in the TSO Responsibility Area. WGPG to decide.
12.	Thailand	2/2.1/(2) System States	In order to determine the System State, each TSO shall at least every 30-15 minutes perform Contingency Analysis in real-time.	For automatic run, 30 minutes is acceptable. WGPG to decide.
13.	Thailand	2/2.1/(3) System States	Please add PMU data.	Done.
14.	Vietnam	General	The definition (N-2) criterion and Provisions for interconnection with (N-2) criterion transmission system should be clarified and added.	Done.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
15.	Vietnam	2.2 Frequency control management	Add clear boundary of LFC Area (Load – Frequency Control area): By country’s boundary or another criteria.	The definition of LFC Area is given in the Glossary of Terms: Load-Frequency Control Area (LFC Area) is a part of a Synchronous Area or an entire Synchronous Area, physically demarcated by points of measurement of Interconnectors to other LFC Areas, operated by one or more TSOs fulfilling the obligations of a LFC Area. In general, LFC Area corresponds to a TSO responsibility Area, but in some countries you can have several TSOs...
16.	Vietnam	2.7 (1) Protection	Each TSO shall install the necessary protection and backup protection equipment within its Transmission System in order to efficiently and effectively protect Transmission System elements and to coordinate with the protection of the equipment of Significant Grid Users, from effects of Faults in the Transmission System. Add: At the connection point, the related TSOs must cooperate to define the protection schemes for connecting elements.	Done.
17.	Vietnam	2.7 Protection	Every year, at the connection point, related TSOs will provide the total impedance of each side. TSOs must cooperate with each other to define the exchanged information from WAMs system of each TSO.	Done.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
18.	Vietnam	2.8 2.8 Dynamic stability management	Each TSO shall monitor the dynamic state of the Transmission System in terms of Voltage, Frequency and Rotor Angle Stability by off-line studies, wide area measurements, or other approaches according to paragraph (5) of Section 2.8 of this Network Code [OPS] including the exchange of relevant data with other TSOs if necessary, in order to be able to take the necessary Remedial Actions when the Transmission System Operational Security is at a risk. Please specify the level of data (equivalent network, completed network...?) to be exchanged.	All necessary data to ensure DSA of high quality.
19.	Vietnam	4.2.2.a Responsibility of the TSOs and DSOs	Clarify more detail: number of tripped elements of transmission system per year.	Each TSO shall contribute to the annual reporting. Therefore, each TSO shall submit number of incidents, causes, tripped elements, etc...

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
1.	PR of China	2.3 (2) Year-ahead Individual Grid Models	We suggest at least 4 different scenarios should be established: maximum and minimum load in rain season, maximum and minimum load in dry season.	Agreed, but not necessary to mention it in the Code. Shall be part of the agreement signed between TSOs and RPCC.
2.	PR of China	2.4 Year-ahead Common Grid Models	We suggest a more detailed description of provisions dealing with the Common Grid Models could be added.	This is the GMS Network Code. Shall be more detailed in the agreement signed between TSOs and RPCC.
3.	PR of China	3.4 Methodologies for Coordinating Operational Security Analysis	We suggest the more detailed description about how to carry out coordinating Operational Security Analysis could be added. For example, how to determine the observation area, contingency influence thresholds and external grid elements.	This is the GMS Network Code. Shall be more detailed in the agreement signed between TSOs and RPCC. TSOs shall establish a methodology standardized at least per Synchronous Area, for Operational Security Analysis...
4.	PR of China	3.5 (2) and 4.3 (2) Agreements for Coordinating Operational Security	Could you give us some example guidance or template of the agreement in section 3.5 (2) and the procedure in section 4.3 (2)? We suggest this guidance or template can be included in Appendix.	Example cannot be included in the Network Code. A separate document can be established with example and attached to the multi-party agreements that need to be signed.
5.	PR of China	4.4 (2) Methodology for assessing relevance of assets for the Outage Coordination Process	How to establish this list of Relevant Power Generation Modules and Relevant Demand Facilities?	This shall be done in agreement and coordination with the other concerned TSOs.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
6.	PR of China	General	When there are elements outages, especially forced outages, the generation scheduling and the power supply plan may be affected. How to carry out this scheduling and plan updating coordination process? Is there any terms in the OPS code concerning about this process?	This shall be covered by the Balancing and Interchanging Code – Market Code.
7.	PR of China	General	The structure and real time data of power grid which is deemed as exchanging and sharing data in this OPS code and the Operational Security Code may belong to confidentiality in much national legislation. If some governments will not issue this information for exchanging and sharing, what will we do then?	Sharing data is one of the major bases of regional power market. If not, it cannot be functional.
8.	Thailand	1./1.4/(5) Regulatory Approvals	National Regulator Authorities (NRAs) are mentioned in the Grid Code. Are they obligated by Grid Code?	NRAs have to review, approve and facilitate the implementation of the GMS Network Codes requirements at the national level. They have also to approve revision and update of nation Grid Codes in compliance with the GMS Network Codes.
9.	Thailand	2. Data for Operational Security Analysis in Operational Planning	Monthly Grid model should be added.	Agreed.
10.	Thailand	2./2.1/(2) Individual and Common Grid Model General Provisions	CACM should be defined at the first time.	Done.
11.	Thailand	3./3.1/(1)/d) D-1, Intraday and Close to Real-Time Operational Security Analysis	How often Operational Security Analysis in the intraday period should be mentioned?	In the Operational Security Code [OS], Section 2./2.1 (2), it is mentioned that, to determine the System State, each TSO shall at least every 30 minutes perform Contingency Analysis in real-time. Every 30 minutes.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
12.	Thailand	3./3.3/(5) D-1, Intraday and Close to Real-Time Operational Security Analysis	Difference between intraday and close to real-time should be defined.	Intraday market provides market participants with the opportunity to trade in energy in time intervals at least as short as the imbalance settlement period. Intraday is aligned on the periodicity of market gate opening and closure for re-declarations. Time interval varies between 1 hour and 15 minutes (under study in Europe). Close to real-time is between two gates.
13.	Thailand	4./4.1 Definition of Outage Coordination Regions	Outage coordinating regions should be defined. Is it the same as Control Block?	Yes, it is. In Europe, Regional Security Coordinators are companies owned by their clients, the TSOs. They perform services for the TSOs, such as providing a regional model of the grid or perform advanced calculations to tell TSOs which remedial actions are the most cost-efficient, without being constrained to national borders. Currently, there are three existing RSCs in continental Europe. Their offices are based respectively in Munich (TSC), Belgrade (SCC) and Brussels (Coreso).
14.	Thailand	4./4.3 (1) Methodology for assessing relevance of assets for the Outage Coordination Process	Gas Supply Maintenance Plan should be added in Outage Coordination. Special Devices such as HVDC and SVC that have an impact to transmission system should be emphasized.	This Section defines the methodology which shall be established. The methodology shall consider these elements.

#	Country	Reference section in the document	Country Comment	Consultants review and Recommendation
15.	Vietnam	3.1 Operational Security Analysis in operational planning	<p>Each TSO shall perform coordinated Operational Security Analyses at least at the following time horizons:</p> <ul style="list-style-type: none"> a) Year-Ahead; b) Week-Ahead, when applicable according to Section 2.6 of this Network Code [OPS]; c) D-1; and d) Intraday. <p>To be added: monthly horizon.</p>	Agreed.
16.	Vietnam	4.9 Treatment of Relevant Assets located in a Distribution Network or in a Closed Distribution Network	<ul style="list-style-type: none"> (1) For the Relevant Assets that are located in a Distribution Network, the Outage Coordinating TSO shall coordinate the outage planning with the Connecting DSO. (2) For the Relevant Assets that are located in a Closed Distribution Network, the Outage Coordinating TSO shall coordinate the outage planning with the Connecting CDSO. <p>To be added:</p> <ul style="list-style-type: none"> (3) DSO shall be responsible for submitting their outage plans to TSO. If such plans affect TSO's operation modes, the TSO has the right to refuse such plans and must make a written notice to the DSO. 	Done

Secure and Efficient Load-Frequency Control allows to maintain high **Frequency Quality**

→ A **common task for all TSOs** of the Synchronous Area and

→ A **necessary Precondition for Security** of Energy Supply

Secure Load-Frequency Control requires close **Coordination and Cooperation**

Efficient System Operation requires close **Collaboration** between all **Stakeholders**.

The **Network Code on Operational Security [OS]** provides the global **Operational Security Framework**

The **Network Code on Load-Frequency Control & Reserves [LFCR]** ensures **Operational Security**

Secure and efficient Load-Frequency Control can be made possible, if there is in place:

- **Harmonised System Frequency Quality Targets**
- **Harmonised Control Processes and Operational Procedures**
- **Harmonised Minimum Technical Requirements** for the organization of **Reserve provision by TSOs**
- **Harmonised Minimum Technical Requirements for Reserve Providing Units and Groups;** and
- **Harmonised Procedures** related to **Cross-border Exchange, Sharing and Activation of Active Power Reserves** within one and between different **Synchronous Areas** improving the overall efficiency of operation.

OPERATIONAL AGREEMENTS AND NRA APPROVAL

The **crucial parameters** and **methodologies** of **Load-Frequency Control** are explicitly defined in the **NC LFCR**. These parameters include:

- Main parameters defining the System Frequency Quality and Targets for TSOs;
- Load-Frequency Control processes and their implementation;
- Cross-border Load-Frequency Control processes;
- Dimensioning Rules;
- Minimum Technical Requirements for Reserve Providing Units and Reserve Providing Groups;
- Limits for Exchange and Sharing of Reserves; and
- Transparency requirements.

Some of the **Values** and **Operational Procedures** need to be defined within **Operational Agreements** mainly on the level of the Synchronous Area and LFC Blocks.

For example, for:

- Appointment of the Synchronous Area Monitor and LFC Block Monitor;
- Appointment of roles related to coordination of operational procedures;
- Agreements of organisational roles for cross-border Load-Frequency Control processes, Exchange and Sharing such as assignment of responsibilities for notifications, monitoring, detailed technical implementation in the digital control systems;
- Detailed processes for information exchange between TSOs, etc.

Some Values and Procedures, having impact on Stakeholders, cannot be defined within the scope of the NC LFCR due to the following reasons:

- The definition of values requires flexibility in presence of a living grid and significant challenges to Operational Security in general and System Frequency stability in particular;
- While the technical description of the Load-Frequency Control processes, which affect the stakeholders, is provided by the Code, the implementation of cooperation between TSOs has to be based on more detailed agreements (and case by case approval by NRAs);
- A value cannot be fully harmonised at the GMS Synchronous Area level due to fundamentally different physical boundary conditions and/or national regulation.

Examples:

- Additional Requirements for FCR Providing Units or FCR Providing Groups, which must be defined by the Reserve Connecting TSO in order to ensure monitoring and Operational Security (or by a TSO appointed by the Reserve Connecting TSO in case of the Exchange of Reserves);
- Implementation of a Cross-border Load-Frequency Control process between different LFC Blocks;
- Implementation of Exchange or Sharing of Reserves between different LFC Blocks;
- Change in responsibility structure.

All methodologies or values which:

- are not defined in the NC LFCR, but must be defined in an Operational Agreement; and
- have impact on stakeholders, especially in case of System Frequency quality or conditions for the amount, provision and activation of FCR, FRR and RR;

shall be approved by the responsible NRAs.

TRANSPARENCY REQUIREMENTS

The NC LFCR defines wide-ranging requirements for transparency. In particular, all technical requirements for:

- Reserve Providing Units and Reserve Providing Groups
- Dimensioning Rules; and
- actual Reserve Capacities,

The Synchronous Area Operational Agreement will also be made publically available on the RPCC transparency platform.

STRUCTURE OF THE LOAD-FREQUENCY CONTROL & RESERVE NETWORK CODE [LFCR]:

1. General Provisions:

- Subject and Scope
- Definitions
- Regulatory Aspects
- Regulatory Approval
- Regulatory Notification
- Recovery of Costs
- Confidentiality Obligations
- Agreements with TSOs not bound under the Grid Code
- TSO Cooperation

2. Operational Agreements:

- Synchronous Area Operational Agreement
- LFC Block Operational Agreement
- LFC Area Operational Agreement
- Monitoring Area Operational Agreement
- Imbalance Netting Agreement
- Cross-Border FRR Activation Agreement
- Cross-Border RR Activation Agreement
- Sharing Agreement
- Exchange Agreement

3. Frequency Quality:

- Frequency Quality Target Parameters
- FRCE Target Parameters
- Criteria Application Process and Frequency Quality Evaluation Criteria
- Data Collection and Delivery Process
- Synchronous Area Monitor
- LFC Block Monitor
- Information on Load and Generation Behaviour
- Ramping Period for the Synchronous Area
- Ramping Restriction for Active Power Output on Synchronous Area Level
- Ramping Restriction for Active Power Output on LFC Block Level
- Mitigation

4. Load-Frequency Control Structure:

- Basic Structure
- Process Activation Structure
- Process Responsibility Structure
- Frequency Containment Process (FCP)
- Frequency Restoration Process (FRP)
- Reserve Replacement Process (RRP)
- Imbalance Netting Process
- Cross-Border FRR Activation Process
- Cross-Border RR Activation Process
- General Requirements for Cross-Border Control Processes
- TSO Notification
- Infrastructure

5. Operation of Load-Frequency-Control
 - System States related to the System Frequency
6. Frequency Containment Reserves (FCR) (or Primary Reserves)
 - FCR Dimensioning
 - FCR Technical Minimum Requirements
 - FCR Provision
7. Frequency Restoration Reserves (FRR) (or Secondary Reserves)
 - FRR Dimensioning
 - FRR Technical Minimum Requirements
8. Replacement Reserves (RR) (or Tertiary Reserves)
 - RR Dimensioning
 - RR Technical Minimum Requirements

9. Exchange and Sharing of Reserves

- Exchange and Sharing of Reserves within a Synchronous Area
- Exchange and Sharing of Reserves between Synchronous Areas
- Cross-Border Activation Process for FRR / RR

10. Time Control Process

- Time Control Process

11. Co-Operation with DSOs

- Reserve Providing Units connected to the DSO Grid

12. Transparency of Information

- General Transparency Requirements
- Information on Operational Agreements
- Information on Frequency Quality
- Annual Report on Load-Frequency Control
- Information on the Load-Frequency Control Structure
- Information on FCR
- Information on FRR
- Information on RR
- Information on Sharing and Exchange

13. Final Provisions

- Amendments of Contracts and General Terms and Conditions
- Entry into Force

STRUCTURE OF THE EMERGENCY & RESTORATION NETWORK CODE [ER]:

1. General Provisions:

- Subject Matter and Scope
- Definitions
- Regulatory Aspects
- Regulatory Approvals
- Recovery of costs
- Consultation and Coordination
- Confidentiality obligations
- Agreement with TSOs not bound by this Network Code

2. System Defence Plan:

- General Principles
- Measures of the System Defence Plan

3. Restoration Plan

- General Principles
- Re-Energization
- Frequency Management
- Resynchronisation

4. Market Interactions

- Procedure for suspension of market activities
- Rules and conditions for suspension and restoration of market activities
- Procedure for restoration of market activities
- Communication procedure
- Settlement principles

5. Information Exchange and Communication, Tools and Facilities

- Information Exchange
- Communication systems
- Tools and facilities

6. Compliance and Review

- Compliance Testing of TSO, DSO and Significant Grid User Capabilities
- Compliance Testing and Review of System Defence Plans and Restoration Plans

7. Implementation

- Monitoring
- Stakeholder involvement

8. Final Provisions

- Amendments of contracts and general terms and conditions

**THANK YOU VERY MUCH FOR
YOUR ATTENTION**