

MINUTES OF THE 8TH MEETING OF SAFIR JOINT WORKING GROUP (JWG) “TO STUDY, FORMULATE AND RECOMMEND FOR FACILITATING POWER TRADE DEVELOPMENT IN SOUTH ASIA”

DATE: 13TH SEPTEMBER, 2022;

03:00 PM IST ON MS TEAMS

The meeting was chaired by Mr. Nima Tshering, Chairperson of Joint Working Group and Interim CEO of Bhutan Electricity Authority. He informed the JWG that this was his first meeting after taking over as Interim CEO of BEA, Bhutan . Thereafter, he welcomed all the members to the 8th meeting (virtual) of SAFIR Joint Working Group (JWG). The list of participants is at **Appendix**. Thereafter, Deputy Chief (RA), CERC provided a brief on the agenda of the meeting.

AGENDA 1: CONFIRMATION OF MINUTES OF THE 7TH MEETING OF THE JWG

The members were apprised of the action points identified in the 7th meeting of the JWG held on 01.07.2022 and that post discussion with stakeholders, IRADe would be presenting the final Common Minimum Grid Code in the meeting. After discussion, the minutes of the 7th meeting of JWG were confirmed.

AGENDA 2: HARMONIZATION OF RULES AND COMMON MINIMUM GRID CODE

Project Director and Technical Head of SARI/EI, IRADe made a short presentation on the Common Minimum Grid Code and deliberated on the comments given by Bangladesh Energy Regulatory Commission and Nepal Electricity Regulatory Commission. He added that there were few issues which could not be resolved and hence, the same is brought to the JWG for resolution (**Annexure-I**).

Post discussions, the following decision points emerged:

- a) The Connection Code chapter need not list the Standards as the Standards are dynamic subject to change in member countries.
- b) The Planning chapter should concentrate on cross border planning, cross border contingency and cross border operation with details of contingency criteria.
- c) Detail study should be undertaken when planning the transmission system for cross border trade, especially in case of synchronous connection so as to control the power flow due to difference in frequency. For the time being, frequency band of 49.5-50.5 Hz may be accepted, but one should have the target achieve the frequency band of 49.9-50.05 Hz. Thus, the Operating Code Chapter should define the frequency at 49.5

Hz to 50.5Hz. SAREP will conduct a detailed study on the impact on transmission planning and will revert to the Joint Working Group.

- d) Reserves should be maintained by the respective countries independently so that contingencies can be taken care if cross-border electricity is carried out in synchronous transmission connection. Thus, every country should access resource adequacy and implement ancillary services for maintaining adequate reserves to tackle any contingencies during cross border trade of electricity.
- e) To maintain voltage, reactive power at both ends of the terminal should be properly maintained, so that the connecting countries involved in cross border trade of electricity should maintain the power factor injection or drawal within the range of 0.9 leading and 0.9 lagging.
- f) The Scheduling and Despatch Code chapter should discuss the Deviation Settlement Mechanism and the same should be decided in the next 6 months by SAREP.
- g) The implementation of the Common Minimum Grid Code should be done with the formation of informal body.

The JWG decided that the final draft of the Common Minimum Grid Code (**Annexure -II**) and the Statement of Reasons (**Annexure-III**) will be circulated among the members and taken up for discussion in the next ECM meeting for final adoption.

The JWG also confirmed that post the completion of the SARI program, officials of SAREP will take over the activities related to Common Minimum Grid Code and assist the JWG in this matter.

AGENDA 3: POWER MARKET DESIGN FOR FACILITATING ELECTRICITY TRADE AMONG SAFIR MEMBER COUNTRIES

Ms.Yuge Ma, World Bank made a short presentation (**Annexure IV**) before the members and apprised that they had completed the first stage of gap analysis and now have engaged with another consultant for stage two of the power market design to develop options for approach of regional power market design. She further added that their teams have designed three-part timelines

- a) Preparing draft PPT (prepared by the World Bank team members by engaging with the utilities, policy makers and regulators of the South Asian countries). The same is expected to be completed by mid-October 2022 post which the same will be shared with the JWG.
- b) The master plan of the transmission line for the region will be prepared
- c) Setting up financing facility for enabling regional trade i.e., the regional interconnection transmission network.

The representative of WB also informed that initially the study will be carried out in India, Bhutan, Bangladesh and Nepal for which World Bank will correspond with SAFIR Secretariat so as to reach out to the JWG member countries for their inputs.

Deputy Chief (RA), CERC acknowledging the initiative taken by the World Bank requested World Bank officials to write to SAFIR Secretariat with relevant documents so that the same can be shared among the Joint Working Group member countries

The meeting ended with a vote of thanks to the Chair.

APPENDIX**LIST OF PARTICIPANTS OF THE 8TH MEETING (VIRTUAL) OF SAFIR JOINT WORKING GROUP (JWG) “TO STUDY, FORMULATE AND RECOMMEND FOR FACILITATING POWER TRADE DEVELOPMENT IN SOUTH ASIA”****JULY 1ST, 2022 AT 04:00 PM IST**

Sl. No.	Name & Designation	Organisation
MEMBERS		
01	Mr. Nima Tshering, Interim Chairperson/CEO,	JWG/ BEA, Bhutan
02	Mr. Dilli Bahadur Singh, Chairman	NERC, Nepal
03	Mr. I. S. Jha, Member	CERC, India
04	Mr. Mohammad Bazlur Rahman, Member,	BERC, Bangladesh
05	Mr. Harpreet Singh Pruthi, Secretary	SAFIR/CERC, India
SPECIAL INVITEES		
06	Ms. Bhagirathi Bhattarai, Member	NERC, Nepal
07	Mr. Rameshwar Prasad Kalwar, Member	NERC, Nepal
08	Mr. Jigme Dorji	BEA, Bhutan
09	Mr. Gamini Herath, Deputy DG	PUCSL, Sri Lanka
10	Ms. Kanchana Siriwardena, Director Tariff & Economic Affairs	PUCSL, Sri Lanka
11	Mr. B M Chalith Pasindu, Asst Director	PUCSL, Sri Lanka
12	Mr. Nalin Edirisinghe, Director Licensing	PUCSL, Sri Lanka
13	Mr. Rezaul Karim, Director (Power)	BERC, Bangladesh
15	Monyl Toga	World Bank
16	Ms. Yuge Ma, Energy Specialist	World Bank
17	Mr. Salzah Salman	World Bank
18	Mr. Sam	World Bank
19	Mr. Pankaj Batra, Project Director	SARI/EI, IRADe, India
20	Dr.Ajit Chhabra	SAREP
21	Mr. Rajiv Ratna Panda	SAREP
SAFIR SECRETARIAT		
22	Ms. Rashmi Nair, Deputy Chief (Regulatory Affairs)	CERC, India
23	Mr. Sanjeev Tinjan, Asstt. Chief (Regulatory Affairs)	CERC, India
24	Ms. Sukanya Mandal, Asstt. Chief (Regulatory Affairs)	CERC, India
25	Mr. P.M. Antony, Asstt. Secretary	FOR/SAFIR, India
26	Mr. Ravindra Kadam, Sr Advisor (RE)	CERC, India
27	Mr. Saurabh, Principal Research Officer	CERC, India
28	Mr. Manvendra Pratap, Research Officer	CERC, India
29	Mr. Kushal Pal, Research Associate	SAFIR Sectt.
30	Ms Nausheen, Research Associate	CERC, India

Annexure - I

Common Minimum Grid Code - Points for discussion during 8th meeting of the JWG of SAFIR (Virtual) on 13.09.2022

Sl.No	Clause no and Title	Original clause	Observations/Comments/Suggestions	By	Decision
1.	3. General	 b) Each country will initially be represented by a single point of contact for the initiation of implementation of the Common Minimum Grid Code. c) The single point of contact will be supported by the relevant Ministry dealing with power, the Regulator of the respective country, the transmission agency of the respective country, the system operator of the respective country and the accounts settlement/market operator of the respective country. d) Later, to formalize the process of implementation, Regional coordination bodies need to be formed for South Asia, i.e. South Asia Forum at the Government level, at the Regulator level, at the operational planning body level, transmission utility level, at the system operator level and at the billing and accounts settlement/market operator level.	e) The Regional Coordination Bodies may be formed earlier for better implementation of the process	Bangladesh	It can start with an informal body.

		e) Till these are formed, the concerned Indian entity can do the coordination in lieu of the respective forums.			
2.	4. Objective and Structure of the Common Minimum Grid Code for South Asia	Suggested to also add the following as an objective : (g) Facilitation of coordination addressing social & environmental issues regarding cross border operation of the South Asian Grid			Not required in the

			51.0 – 51.5Hz 90 minutes 51.5Hz – 52 Hz 15 minutes																													
4.	6. Operating Code	Suggested to be added	All member countries of the South Asian grid may share their Primary, Secondary & Tertiary Reserve to each other as per the decisions/formula made by the South Asia Forum of Electricity Regulators.	Bangladesh	Not agreed as of now, since the quantum of each of these category of reserves are not yet identified.																											
5.	6. Operating Code	6.2 Grid Voltage All country system operators shall take all possible measures to ensure that the grid voltage always remains within the following operating range at the interconnection point. <table><tr><th colspan="3">Voltage – (kV rms)</th></tr><tr><th>Nominal</th><th>Maximum</th><th>Minimum</th></tr><tr><td>765</td><td>800</td><td>728</td></tr><tr><td>400</td><td>420</td><td>380</td></tr><tr><td>220</td><td>245</td><td>198</td></tr><tr><td>132</td><td>145</td><td>122</td></tr><tr><td>110</td><td>121</td><td>99</td></tr><tr><td>66</td><td>72</td><td>60</td></tr><tr><td>33</td><td>36</td><td>30</td></tr></table>	Voltage – (kV rms)			Nominal	Maximum	Minimum	765	800	728	400	420	380	220	245	198	132	145	122	110	121	99	66	72	60	33	36	30	This range is quite tight at initial stage for following. However NLDC's recommendations are as follow: Voltage variation on the Transmission System shall normally be ±5% for 400 kV, ±10% for 230 kV 220 kV, 132 kV, 110 kV & below bus during normal operations and ±10 % at 400 kV, ±15% for 230 kV 220 kV, 132 kV, 110 kV & below bus during emergencies	Bangladesh	The voltages are almost the same, whether specified in kV or in %. We can retain it as such.
Voltage – (kV rms)																																
Nominal	Maximum	Minimum																														
765	800	728																														
400	420	380																														
220	245	198																														
132	145	122																														
110	121	99																														
66	72	60																														
33	36	30																														
6.	7. Scheduling and Despatch Code	7.2 The system operator of each country shall regulate their generation and/or consumers' load so as to maintain their actual drawal from the South Asia grid close to the above schedule. If regional	A mechanism for Unscheduled Interchange (UI) based on mutually decided at the level of single point of contact of the South Asian countries may be	Bangladesh	The Deviation Settlement Mechanism may be discussed with all stakeholders and																											

		entities deviate from the drawal schedule, such deviations from net drawal schedule shall be priced through a pre-decided Deviation Settlement mechanism. Till the time a Deviation Settlement mechanism is mutually decided at the level of single point of contact of the South Asian countries, the Deviation Settlement mechanism as given in the Annexure I shall prevail.	formed before the operation. This point should be discussed before finalizing the code.		decided in the next 6 months by SAREP.
7.	7. Scheduling and Despatch Code	7.5 (b).....Power Exchange(s) shall furnish the interchange on the boundaries of various countries, as intimated by NLDC. Power Exchange(s) shall also furnish the information of total drawal and injection in each of the countries. Based on the information furnished by the Power Exchanges, NLDC (National Load Despatch Centre), the National System Operator of India , dealing with the subject...	NLDC (National Load Dispatch Centre), the National System Operator of the South Asia System Operator	Bangladesh	Not agreed, since the Indian power exchange comes within the jurisdiction of the Indian Regulator. As and when a separate South Asian power exchange comes up, the same can come under the jurisdiction of the South Asia Forum of System Operators, under the overall supervision of the South Asia Forum

						of Electricity Regulators.
8.	5. Connection Code	5.3(g) The relevant international standards on cyber security of power systems may be followed by all the countries.	..relevant standard of cyber security shall be changed as Prevailing international standard and list of standards applicable now shall be added as annexure...	Nepal		Accepted to not list the Standards due to constant change.



Draft

Common Minimum Grid Code for South Asia

PREAMBLE

The Common Minimum Grid Code for South Asia lays down the common minimum rules, guidelines and standards to be followed by various South Asia country participants in the system for cross border trading in electricity, while operating the power system, in the most secure, reliable, economic and efficient manner.

1. Short title, extent and commencement

(1) These Regulations may be called Common Minimum Grid Code for South Asia Regulations, 2022.

(2) These Regulations shall come into force from 1.6.2023, except for the Planning Code, which would come into effect from a future date, as decided by the South Asia Forum of Electricity Regulators.

2. Definitions

- a) South Asia Forum of Electricity Regulators (SAFER) : SAFER is an association of Electricity Regulators of South Asia, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which would provide a platform for building consensus between the South Asian Regulators, till it gets legal recognition from the south Asian Governments.
- b) South Asia Forum of Operational Planners (SAFOP) : SAFOP is an association of operational planners of the South Asian countries, for



coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which would provide a platform for building consensus between the South Asian operational planners, till it gets legal recognition from the south Asian Governments.

- c) South Asia Forum of Transmission Utilities (SAFTU) : SAFTU is an association of transmission utilities of the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which would provide a platform for building consensus between the South Asian transmission utilities, till it gets legal recognition from the south Asian Governments.
- d) South Asia Forum of System Operators (SAFSO): SAFSO is an association of system operators of the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which would provide a platform for building consensus between the South Asian system operators, till it gets legal recognition from the south Asian Governments.
- e) South Asia Forum of Billing and Accounts Settlement Agency (SAFAS): SAFAS is an association of Accounts settlement agencies of the South Asian countries, for coordination w.r.t. cross border electricity trade among the South Asian countries. This can start as an informal body, which would provide a platform for building consensus between the South Asian system accounts settlement agencies, till it gets legal recognition from the south Asian Governments.
- e) National Load Despatch Centre (NLDC): NLDC is the national system operator of India, which has jurisdiction over operationalizing the power exchange trades discovered in the power exchanges in India, including for cross border electricity trade.



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- f) Deviation Settlement mechanism (DSM): DSM is the commercial mechanism for dealing with violations of scheduled generation and scheduled power flows, w.r.t. cross border electricity trade.

3. General

- a) This Common Minimum Grid Code for South Asia is applicable to all countries of South Asia, who get connected to the South Asia grid through a **synchronous** or **a-synchronous** (i.e. HVDC) connection.
- b) Each country will initially be represented by a single point of contact for the initiation of implementation of the Common Minimum Grid Code.
- c) The single point of contact will be supported by the relevant Ministry dealing with power, the Regulator of the respective country, the transmission agency of the respective country, the system operator of the respective country and the accounts settlement/market operator of the respective country.
- d) Later, to formalize the process of implementation, Regional coordination bodies need to be formed for South Asia, i.e. South Asia Forum at the Government level, at the Regulator level, at the operational planning body level, transmission utility level, at the system operator level and at the billing and accounts settlement/market operator level.
- e) Till these are formed, the concerned Indian entity can do the coordination in lieu of the respective forums.
- f) A South Asia Power Portal would be made for information of all South Asian countries. This would be maintained by the South Asia Forum at the operational planning level.

4. Objective and Structure of the Common Minimum Grid Code for South Asia



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The objectives of the South Asia Common Minimum Grid Code are as given below

:

- (a) Facilitation of cross border trading of power, in a fair and non-discriminatory manner for all South Asian nations, while ensuring secure, reliable, economic and efficient planning and operation of the grid.
- (b) Facilitation of the coordinated optimal operation of the South Asian Grid.
- (c) Facilitation of coordinated and optimal maintenance planning of generation and transmission facilities in the South Asian grid.

The structure of the Common Minimum Grid Code for South Asia consists of the Planning Code, Connection Code, Operating Code, Scheduling and Despatch Code and Administration of the Grid Code.

5. PLANNING CODE

5.1 Objective

The objectives of Planning Code are as follows:

- a) To specify the principles, procedures and criteria which shall be used in the planning and development of the cross border transmission system.
- b) To promote co-ordination amongst the transmission utilities of the South Asian countries.

5.2 Planning Criterion General Philosophy

- (a) The planning criterion general policy for the cross border transmission system shall be as detailed below:



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i) As a general rule, the cross border transmission system shall be capable of withstanding and be secured against the following contingency outages

a. without necessitating load shedding or rescheduling of generation during Steady State Operation:

- Outage of a 132 kV D/C (Double Circuit) line or,
- Outage of a 220 kV D/C line or,
- Outage of a 400 kV S/C (Single Circuit) line or,
- Outage of single Interconnecting Transformer, or
- Outage of one pole of HVDC Bipole line, or one pole of HVDC back to back Station or
- Outage of 765 kV S/C line

b. without necessitating load shedding but could be with rescheduling of generation during steady state operation-

- Outage of a 400 kV S/C line with TCSC, or
- Outage of a 400kV D/C line, or
- Outage of both pole of HVDC Bipole line or both poles of HVDC back to back Station or
- Outage of a 765kV S/C line with series compensation.

ii) The above contingencies shall be considered assuming a pre-contingency system depletion (Planned outage) of another 220 kV D/C line or 400 kV S/C line in another corridor and not emanating from the same substation. The planning study would



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assume that all the Generating Units operate within their reactive capability curves and the network voltage profile are also maintained within voltage limits specified.

(b) The cross border transmission system shall be capable of withstanding the loss of most severe single system infeed without loss of stability.

(c) Any one of these events defined above shall not cause:

i. Loss of supply

ii. Prolonged operation (i.e. more than 10 minutes) of the system frequency below and above specified limits.

iii. Unacceptable high or low voltage iv. System instability v. Unacceptable overloading of ISTS elements.

(d) In all substations (132 kV and above), at least two transformers shall be provided.

(e) SAFOP shall carry out planning studies for Reactive Power compensation of ISTS including reactive power compensation requirement at the interconnection substations on both sides of the border .

(f) Suitable System Protection Schemes may be planned by SAFOP, either for enhancing transfer capability or to take care of contingencies beyond that indicated in a)(i) above.

5. CONNECTION CODE

5.1 Objective

The objective of the connection code is as given below:



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- a) To ensure the safe operation, integrity and reliability of the connected South Asia grid.
- c) Any new country getting connected to the South Asia grid shall neither suffer unacceptable effects due to its connectivity nor impose unacceptable effects on the South Asia grid.
- d) Any new country seeking connection to the South Asia grid is required to be aware, in advance, of the requirements for connectivity to the South Asian grid and also the standards and conditions its system has to meet for being integrated into the grid.

5.2 Procedure for Inter Country connection

A new country seeking to establish a synchronous connection to the South Asian grid, shall submit an application, on a predetermined format, to the South Asia Forum of transmission utilities (SAFTU). After the study, the SAFTU shall lay down the minimum requirements of additional transmission infrastructure/modifications in the transmission infrastructure necessary to integrate the new country into the South Asian grid.

5.3 Important Technical Requirements for Connectivity to the Grid

- a) The minimum technical requirements for connectivity to the South Asian grid are as given below..
- A. For a synchronous connection, the following technical requirements hold :**
- b) This may require the necessity of installing fault current limiters to limit the short circuit current flowing into the country due to connection with a large grid. It may also require reactive power controller in the form of Static Var Compensator/STATCOM, etc. to prevent burdening of the South Asia grid with reactive power draw/injection beyond limits, as specified by the South Asia Forum of Operational planners.



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- c) The new country would have to implement generation and/or load control mechanisms to be able to control cross border power flows, in case of contingencies.
- d) The new country would also have to abide by the Regional under frequency load shedding schemes to ensure commensurate load shedding in case of grid disturbances, to prevent falling frequency, and also abide by the Regional islanding schemes and system protection schemes, which would be decided by the South Asian Forum of Operational Planning bodies, which are involved in operation planning.
- e) It would also have to ensure installation of Data Acquisition System, disturbance recorders and sequence-of-events recorder at the interconnection points and other significant points, as specified by SAFTU, to analyse faults through post mortem, so that such instances do not recur.
- f) The new country would have to ensure robust and reliable communication between countries, through two different modes of communication, so that voice and data communication takes place instantly and seamlessly across countries. This would be mutually decided by the points of contacts of the South Asian countries. The associated communication system to facilitate data flow up to appropriate data collection point at the interface sub-station, shall also be established by the concerned country system operators as specified by the SAFTU in the Connection Agreement.
- g) The relevant international standards on cyber security of power systems may be followed by all the countries.

B. For an asynchronous (HVDC) connection, the following technical requirements hold :



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The provisions 5,3 (b), (c) & (d) will not apply.

5.4 Connection Agreement

Every connection of a country's system to the South Asian grid shall be covered by a Connection Agreement between the SAFTU and the national transmission utility of the country seeking connection. The connection agreement shall contain general and specific technical conditions, applicable to that connection, including, but not limited to, the necessary equipment to be installed, the condition of coordination between the System Operators of the South Asian countries, protection coordination, system protection schemes, communication requirements, etc.

6. OPERATING CODE:

6.1 Objective

The primary objective of integrated operation of the South Asian grid is to enhance the overall operational reliability and economy of the entire electric power network spread over the geographical area of the interconnected system. Participant countries shall cooperate with each other and adopt Good Utility Practice at all times for satisfactory and beneficial operation of the South Asian grid.

- A. For a synchronous connection, the following requirements of Operating Code hold :**



6.2 Frequency band

All country system operators shall take all possible measures to ensure that the grid frequency always remains within the 49.9 –50.05 Hz band and as revised by the South Asia Forum of Electricity Regulators.

6.3 Grid Voltage

All country system operators shall take all possible measures to ensure that the grid voltage always remains within the following operating range at the interconnection point.

Voltage – (kV rms)		
Nominal	Maximum	Minimum
765	800	728
400	420	380
220	245	198
132	145	122
110	121	99
66	72	60
33	36	30

6.4 System Security Aspects

Protection coordination would have to be done on a South Asian Regional basis to ensure that the protection schemes are sensitive and selective. Testing of protection devices would have to be done periodically. Protection coordination



would have to be done whenever a new major power system element is introduced in the synchronously connected South Asian Grid.

6.5 Operation liaison

Any tripping, whether manual or automatic, of any of the significant elements of country grid shall be precisely intimated by the concerned country system operator to the concerned System Operators, whose grid/s is/are likely to be affected, as soon as possible, say within ten minutes of the event. The reason (to the extent determined) and the likely time of restoration shall also be intimated. The concerned System Operators shall share a report of incidence in a prescribed form/ format as specified by the South Asia Forum of Electricity Regulators.

6.6 Restoration plan to be done in coordination in case of tripping

All connected countries would have to furnish the required data to the concerned country System Operators whose grid is likely to be affected, and South Asia Forum of operational planning bodies from disturbance recorders and sequence-of-events recorder within 48 hours of restoration. Restoration procedures, including black start would have to be laid out by the South Asia Forum of operational planning bodies for the South Asian Grid as a whole, to facilitate quick restoration of the system after tripping.

6.7 Periodic reports

a) A daily report covering the performance of the regional grid shall be prepared by each country's system operator, based on the format decided by the South Asia Forum of operational planning bodies, and shall be put on its website. This report shall also cover generation by renewable energy sources, including the quantum of energy injected into grid.



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b) A Monthly report covering performance of the national/integrated grid in previous week shall be prepared by the South Asia Forum of operational planning bodies. Such weekly report shall be available on the website of the South Asia Power Portal for at least 12 months.

The monthly reports shall contain the following:-

- (a) Frequency profile
- (b) Voltage profile of interconnecting sub-stations.
- (c) Major Generation and Transmission Outages
- (d) Transmission Constraints

B. For an asynchronous (HVDC) connection, the following technical requirements hold :

For HVDC connection, the provisions 6.1, 6.2, 6.3 will not apply. However, the reliability of the control and protection of the HVDC link has to be ensured, and testing would have to be done periodically.

6.8 Outage Planning

Regional outage planning shall be done by the South Asia Forum of operational planning bodies to ensure that all countries can reap the benefit of optimal utilization of generation and transmission sources, and thus reduce the requirement of each country's reserves.

7. SCHEDULING AND DISPATCH CODE

7.1 Objective

This code deals with the procedures to be adopted for scheduling of the net injection / drawals of concerned country entities on a day ahead basis with the



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modality of the flow of information between the SAFSO / country system operators / Power Exchange.

Responsibility

- 7.2 The system of each country shall be treated and operated as a notional control area. The algebraic summation of scheduled drawal by the country from all generation procurement contracts through long – term access, medium -term and short –term open access arrangements shall provide the drawal schedule of each country, and this shall be determined in advance on day-ahead basis.
- 7.3 The system operator of each country shall regulate their generation and/or consumers' load so as to maintain their actual drawal from the South Asia grid close to the above schedule. If regional entities deviate from the drawal schedule, such deviations from net drawal schedule shall be priced through a pre-decided Deviation Settlement mechanism. Till the time a Deviation Settlement mechanism is mutually decided at the level of single point of contact of the South Asian countries, the Deviation Settlement mechanism as given in the **Annexure I** shall prevail.
- 7.4 The respective country transmission system operator shall install special energy meters, as specified by the South Asia Forum of Electricity Regulators, on all inter connections between the country grids and other identified points for recording of actual net MWh interchanges and MVarh drawals. All countries shall take weekly meter readings from Monday to Sunday and transmit them to the South Asia forum of accounts settlement operator/market operator by Tuesday noon. The South Asia forum of accounts settlement operator/market operator shall be responsible for computation of actual net injection / drawal of concerned regional entities, 15 minute-wise, based on the above meter readings on a weekly basis by each Thursday noon for the seven-day period ending on the previous Sunday mid-night, in order to prepare and issue the Deviation Settlement account in accordance with



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the South Asia Deviation Settlement Mechanism, as amended from time to time. All computations carried out by South Asia forum of accounts settlement operator/market operator shall be open to all South Asia country entities for checking/verifications for a period of 15 days. In case any mistake/omission is detected, the South Asia forum of accounts settlement operator/market operator shall forthwith make a complete check and rectify the same.

7.5 Scheduling and Despatch procedure for long-term access, Medium – term and short-term open access (All timelines given in this para are India time):

a) The country system operators shall advise the South Asia Forum of System Operators by 3 PM their drawal/injection schedule for the country as a whole, which would include long-term, medium-term and short-term contracts.

b) Scheduling of collective transaction (Day ahead and Real time market on the power exchange):

National Load Despatch Centre (NLDC) shall indicate to Power Exchange(s), the list of interfaces/control areas/regional transmission systems on which unconstrained flows are required to be advised by the Power Exchange(s) to the NLDC, based on the System operator of respective country which is transacting power on Indian Power Exchange.

Power Exchange(s) shall furnish the interchange on the boundaries of various countries, as intimated by NLDC. Power Exchange(s) shall also furnish the information of total drawal and injection in each of the countries. Based on the information furnished by the Power Exchanges, NLDC (National Load Despatch Centre), the National System Operator of India, dealing with the subject, shall check for congestion. In case of international transactions, the NLDC shall ask the system operator of the respective country for internal congestion within the grid of that country relating to the transmission corridor on which power would flow across



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the border, and along with congestion on the Indian side of the transmission corridor, shall assess the congestion on the complete transmission corridor to the respective country. In case of congestion, NLDC shall inform the Exchanges about the period of congestion and the available limit for scheduling of collective transaction on respective country interfaces for Scheduling of Collective Transaction through the respective Power Exchange. The limit for scheduling of collective transaction for respective Power Exchange shall be worked out in accordance with CERC (Central Electricity Regulatory Commission, the Central Electricity Regulator of India) directives. Based on the application for scheduling of Collective Transaction submitted by the Power Exchange(s), NLDC shall send the details (Scheduling Request of Collective Transaction) to different country system operators for final checking and incorporating them in their schedules.

After getting confirmation from the country system operators, NLDC shall convey the acceptance of scheduling of collective transaction to Power Exchange(s). The country system operators shall schedule the Collective Transaction at the respective periphery of the respective countries.

The individual transactions for the country's intra-country Entities shall be scheduled by the respective country system operators. Power Exchange(s) shall send the detailed break up of each point of injection and each point of drawal within the country to the respective country system operator, after receipt of acceptance from NLDC. Power Exchange(s) shall ensure necessary coordination with country system operators for scheduling of the transactions.

Timeline for above activities will be as per detailed procedure for Scheduling of Collective Transaction issued in accordance with CERC (Open access in inter-state transmission) Regulations, 2008 and as amended from time to time.



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- b) By 6 PM each day, the South Asia System Operator shall convey the despatch schedule to each of the country system operators, in MW for different time block, for the next day, consisting of both bilateral and collective transactions.
- c) The country system operators shall inform any modifications/changes to be made in drawal/injection schedule, if any, to South Asia System Operator by 10 PM.
- d) While finalizing the drawal and despatch schedules as above, the South Asia Forum of System Operators (SAFSO) shall also check that the resulting power flows do not give rise to any transmission constraints. In case any impermissible constraints are foreseen, SAFSO shall moderate the schedules to the required extent, under intimation to the concerned country operators. Any changes in the scheduled quantum of power which are too fast or involve unacceptably large steps, may be converted into suitable ramps by the SAFSO.

8. COMPLIANCE OVERSIGHT

The respective country system operators shall report to the SAFER instances of serious or repeated violation of any of the provisions of the South Asia Grid Code. The SAFER will investigate the matter. In case of non-compliance, appropriate action will be taken by SAFER.

9. ADMINISTRATION OF THE GRID CODE

8.1 Objective

Since this is the first time that the Common Minimum Grid Code for South Asia is being formulated, there may be some changes required, based on experience. The objective of this section is to facilitate review of the Common Minimum Grid Code for South Asia.



8.2 Process of Review of Grid Code

- a) Initially, the Committee of the single points of contact for each country would be responsible for administration and modification of the Common Minimum Grid Code for South Asia. Later this would be replaced by the South Asia Forum of Electricity Regulators.
- b) The Committee may meet at regular intervals, say six months, or as needed for the purpose of administration and modification of the Common Minimum Grid Code for South Asia.



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Annexure – I : Deviation Settlement Mechanism

Charges for Deviations: (1) The charges for the Deviations for all the time-blocks shall be payable for over drawal by the buyer and under-injection by the seller and receivable for under-drawal by the buyer and over-injection by the seller and shall be worked out on the average frequency of a time-block at the rates specified in the table below

https://cercind.gov.in/2018/regulation/dsm_fourth_amendment11-22-2018.pdf

(Pages 2 to 4)

Annexure II : Note on the Jurisdiction over Grid Code by the Regulators of South Asian Countries

Bhutan



Regulator- Bhutan Electricity Authority



Main Act- ELECTRICITY ACT OF BHUTAN YEAR 2001¹
(<http://www.bea.gov.bt/wp-content/uploads/2013/12/eact01.pdf>)

Relevant Section/Clause:

Preamble

The Electricity Act enables the restructuring of the power supply industry and the possible participation of the private sector, by providing mechanisms for licensing and regulating the operations of power companies. The establishment of the Bhutan Electricity Authority as an autonomous body will ensure a transparent regulatory regime; the Authority also has the role of laying down the **standards, codes, and specifications of the Electricity Supply Industry**. By this means the Electricity Act will define the roles and responsibilities of suppliers and protect the interests of the general public.

(" 11 Functions of the Authority

11.1 Functions of the Authority are:

i) to develop regulations, **standards, codes**, principles and procedures, which include, but are not limited to the following :

a. performance standards, including minimum technical and safety requirements for construction, operation and maintenance of generation, transmission and distribution facilities;

.....

.....")

(" 89 The Authority shall, by statutory instrument, make regulations to **establish a Grid Code.** ")

¹ <http://www.bea.gov.bt/wp-content/uploads/2013/12/eact01.pdf>

Bangladesh



Regulator-Bangladesh Energy Regulatory Commission



Main Act: - Bangladesh Energy Regulatory Commission Act, 2003²
(<http://www.clcbd.org/document/download/277.html>)

Relevant Section/Clause:

(" CHAPTER – 4, Functions, Powers and Proceedings of the Commission

22. Functions of the Commission—

Subject to the provisions of this Act, functions of Commission shall be as follows:-

.....

.....

(f) to frame **codes and standards** and make enforcement of those compulsory with a view to ensuring quality of service;

.....

..... ")

("59. Power to make regulations—

(1) Commission may, for the fulfillment of the objectives of this Act, make regulation by publishing it in the official gazette.

(2) Without affecting the totality of the said power, regulations may be made, on any or all of the following heads:

.....

(e) making of **different codes and standards** ;

.....

² <http://www.clcbd.org/document/download/277.html>



")

In exercise of the powers conferred by section 59 of the Bangladesh Energy Regulatory Commission Act 2003 (Act 13 of 2003), read with sub-sections 2(e) and 2(f) thereof and for the fulfillment of the objectives of the Act, the Bangladesh Energy Regulatory Commission has made the grid code regulations:

India



Regulator-Central Regulatory Commission (CERC) and State Regulatory Commission (SERC)



Main Act- THE ELECTRICITY ACT, 2003

Relevant Section/Clause:

(" Section 79. (Functions of Central Commission): --- (1) The Central Commission shall discharge the following functions, namely:-

.....

(h) to specify Grid Code having regard to Grid Standards; ")

.....

(" Section 86. (Functions of State Commission): --- (1) The State Commission shall discharge the following functions, namely: -

.....

(h) specify State Grid Code consistent with the Grid Code specified under clause (h) of sub-section (1) of section 79; ")

.....

(" Section 178. (Powers of Central Commission to make regulations): --- (1) The Central Commission may, by notification make regulations consistent with this Act and the rules generally to carry out the provisions of this Act.

(2) In particular and without prejudice to the generality of the power contained in sub-section (1), such regulations may provide for all or any of following matters, namely:-

.....

(g) Grid Code under sub-section (2) of section 28; ")



The Indian Electricity Grid Code (IEGC) is a regulation made by the Central Commission in exercise of powers under clause (h) of subsection (1) of Section 79 read with clause (g) of sub-section (2) of Section 178 of the Act.

Nepal



Regulator-Electricity Regulation Commission



Main Act- Electricity Regulation Commission Act, 2017

<https://erc.gov.np/storage/listies/April2020/erc-act-2017-english.pdf>

Relevant Section/Clause:

(" Chapter 6, Function, duties and authority of the commission

12 To manage the technician : For the regulation with regard to generation, transmission, distribution and business of electricity the commission shall carry up the following works :

A. To form, execute and monitor the grid code and distribution code for electricity service.

.....
..... ")

Pakistan



Regulator- National Power Regulatory Authority





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Main Act-Regulation of Generation, Transmission and Distribution of Electric Power Act, 1997

<https://nepra.org.pk/Legislation/1-Act/NEPRA%20Act%201997%20as%20amended%20vide%202018%20Act.pdf>

Relevant Section/Clause:

(" 23G. **System Operator licence.**—(1) No person shall, unless licensed by the Authority under this Act, undertake functions as a system operator as may be specified by the Authority, including but not limited to.-

.....

(4) An application for licence under sub-section (3) shall be accompanied by a draft grid code governing the form and manner in which the system operator shall undertake its licensed activities. ")

(" 23H. Duties and responsibilities of a system operator.—

(1) A system operator shall, from time to time and subject to approval by the Authority, make such grid management code as may be required to enable it to carry out its functions as a system operator.

(2) A system operator shall regulate its operations, standards of practice and business conduct in accordance policies and procedures as approved by the Authority.

(3) The Authority may, if required in the public interest, direct the system operator to make such grid code or amend its existing grid code as it may specify in writing: Provided that if the system operator does not comply with the direction of the Authority within a period of thirty days without providing just cause for such non-compliance to the Authority, the grid code of the system operator shall be deemed to have been made or amended, as the case may be, and shall take effect accordingly.

.....

.....")

Grid code is prepared in "Pursuant to Section 35 of NEPRA Act and Article 16 of the NTDC licence, the National Transmission and Dispatch Company is required to ensure that there is in force at all times a Grid Code. Consequently, NTDC is required to submit a comprehensive Grid Code for approval of the Authority in accordance with the requirement of Article 16 of its licence. The Grid Code provides for the smooth and effective functioning of NTDC and other NEPRA licensees that are or will be connected to the NTDC's Bulk Transmission System³ ".

Sri Lanka

³ <https://nepra.org.pk/Legislation/6-Codes/6.2%20NTDC%20The%20Grid%20Code%20June%202005%20with%20Grid%20Code%20Addendum%20No.%20I%20&%20I/Grid%20Code%202005.pdf>



Regulator-Public Utilities Commission of Sri Lanka



**Public Utilities
Commission of Sri Lanka**

Main Act- Sri Lanka Electricity Act, No 20 of 2009 (SLEA 2009)

https://www.pucsl.gov.lk/wp-content/uploads/2017/12/electricity_act_2009.pdf

Relevant Section/Clause:

(" CHAPTER II FUNCTIONS OF THE COMMISSION

3. (1) The functions of the Commission shall be to act as the **economic, technical and safety regulator for the electricity industry** in Sri Lanka, and—

"
(c) to approve **such technical and operational codes and standards** as are required from time to time to be developed by licensees; "

.....

(" 17. Without prejudice to the generality of section 15, a transmission licence issued to a licensee shall include conditions—

.....

.....

(f) requiring **the licensee to implement and maintain such technical or operational codes** in relation to the **transmission system (including a grid code)** as the Commission considers necessary or expedient; "

.....

.....

The Grid Code of Sri Lanka has been formulated in terms of the provisions of Clause 17(f) and 3.1 (c) of the Sri Lanka Electricity Act, No 20 of 2009 (SLEA 2009)⁴, which require the licensees to implement and maintain technical or operational codes; the Public Utilities Commission of Sri Lanka (PUCSL) to approve and regulate the implementation of such codes⁵.

⁴ https://www.pucsl.gov.lk/wp-content/uploads/2017/12/electricity_act_2009.pdf

⁵ <https://www.pucsl.gov.lk/wp-content/uploads/2018/09/Grid-Code-March-2014-Final1.pdf>



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Common Minimum Grid Code for South Asia

Explanatory Memorandum

1. All countries in South Asia have their own Grid Codes, which are generally in order, for their own countries. They contain broad Chapters on Roles and Responsibilities of various concerned organizations, Planning Code, Connection Code, Operation Code including System Security aspects, Scheduling and Despatch Code, Management of Grid Code, etc.
2. Presently, the countries of South Asia, barring Bhutan, are either connected through HVDC links or through radial means. When connected in these ways, the grids of the countries effectively operate independently. In the HVDC form of connection, the grids on either side of the connection can operate at different grid frequencies, the disturbance on one side does not get carried over to the other side, etc. Taking into account the initiatives of the Government of India towards promoting cross border electricity trade, through the Ministry of Power revised Guidelines dated 18.12.2018, and further the transmission plans for cross border lines between countries of South Asia, it is expected that the grids of the countries of South Asia would eventually get connected in synchronous mode, barring Sri Lanka. CERC has issued the CERC (Cross Border Trade of Electricity) Regulations, 2019 on 8.3.2019. After discussions with Chairperson, CERC, it was thought that a Common Minimum Grid Code (CMGC) for South Asia should be formulated to facilitate cross border trade in electricity in *synchronous* mode as well as *asynchronous (HVDC)* mode of connection.
3. We are therefore proposing a Common Minimum Grid Code for South Asia, with bare minimum changes required in the country's own rules of operation, while ensuring compatibility and grid security, both for *synchronous* mode as well as *asynchronous (HVDC)* mode of connection. The idea of having a Common Minimum Grid Code for South Asia is to ensure cross border power trade can take place through safe and secure grid operation.
4. The draft Common Minimum Grid Code for South Asia was sent in mid-2019 to the SAFIR Secretariat. It was stated by the SAFIR Secretariat that we may send the CMGC for comments to all the BBINS (Bangladesh, Bhutan, India, Nepal and Sri Lanka) countries. This was sent for comments of the South Asian Governments, Regulators and utilities in March 2020. This was also discussed with these stakeholders in each country individually, across the table, through physical meetings through 2019 and till March 2020, under the



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USAID's SARI/EI (South Asia Regional Initiative in Energy Integration) program being implemented by IRADe (Integrated Research and Action for Development). This was also presented before the SAFIR Working Group (WG) on "Regulatory Cooperation to Facilitate Knowledge sharing, addressing Cross-cutting Energy/Electricity Regulatory Issues and Capacity Building in South Asia" in the second meeting of the SAFIR WG on 4th December, 2019 and before the 18th Executive Committee meeting (ECM) of SAFIR on 5th December, 2019. It was decided in the ECM that, considering that the Grid Code is a crucial document, SARI/EI/IRADe may do more detailed and comprehensive consultation with the grid code review committee of each country as well as with all stakeholders (utilities, system operators, planners, regulators and policy makers etc.) so that the process of finalization of Draft Common Minimum Grid Code can be effected. The Electricity Regulatory Commissions in Member countries would help facilitate consultation with other stakeholders in their respective countries. Subsequently, on account of the COVID 19 pandemic, and subsequent lockdowns in all the South Asian countries, comments were again sought from all the South Asian countries, and meetings proposed virtually. Subsequently, it was also decided that the Joint Working Group (JWG), constituted by the SAFIR Secretariat, with support from the World Bank, would focus on the Common Minimum Grid Code and Market design in South Asian countries. The Common Minimum Grid Code work would be supported by SARI/EI at IRADe.

5. Bhutan provided detailed comments on the Draft Common Minimum Grid Code in May 2021, followed by POSOCO, the System Operator of India, in November 2021. These have been incorporated in the CMGC. Bangladesh submitted some initial comments and stated that they would submit detailed comments subsequently. Nepal was to submit its comments. Subsequently, virtual meetings were fixed with the expert group of stakeholders, coordinated respectively by Bangladesh and Nepal on 5th and 7th July, 2022, respectively. After detailed discussions, both the regulators stated that they would submit their comments in writing. However, these were not received. The SARI/EI team at IRADe had an in-person meeting with Electricity Regulatory Commission of Nepal on 20th July 2022, as a wrap up session for the CMGC. ERC Nepal stated that they would submit their consolidated comments by 27th July, 2022. An in-person meeting for the wrap up session on CMGC with the Bangladesh Electricity Regulatory Commission (BERC) was held on the 2nd of August, 2022, where the initial comments of Bangladesh were discussed threadbare.
6. The Chapters of the draft Common Minimum Grid Code for South Asia are discussed below.
7. **Definitions** have been put in the CMGC, defining regional bodies for coordinating various actions between the South Asian countries, for example a regional body for operation



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planning, a regional body for account settlement, etc. These are required to ensure proper coordination. Up till these bodies are created, an interim arrangement can be made, for example, the Joint Technical Team of the Region, representing all the coordination functions. Ultimately, however, it requires specialized regional bodies to ensure safe and efficient operation of the South Asian grid.

8. The **Planning Code** deals with transmission planning, in accordance with demand forecast, location of demand and generation sources, considering a certain redundancy criterion, which may be different from country to country. It would be a time taking task for each country to set up transmission lines quickly, if the redundancy criteria are different across countries. Therefore, each country can continue with its planning criteria, to the extent that it does not adversely affect the other country/countries it is getting connected to. If the redundancy in a country is less than the n-1 reliability criteria, then tripping of a line within the country may cause major changes in cross border flows, if the tripping causes a major load generation imbalance. In such a case, the cross border flow fluctuations can be prevented by putting in place appropriate system protection schemes. Therefore, the Planning Code has been put in the Common Minimum Grid Code, but left for implementation at a future date, as thought fit by the electricity regulators for South Asia.
9. The **Connection Code** is to ensure that any entity which gets connected to the grid has to ensure certain standard of equipment getting connected to the grid, abide with insulation coordination and protection coordination by the transmission planning body of the country and compliance with instructions of the country's system operator or load dispatch centre. In order to operationalize cross border trading of electricity, changing the equipment throughout the country to comply with another country's standards will be time taking and expensive. Therefore, the minimum changes that need to be followed, is change in protection settings in order to ensure protection coordination, so that if a generating unit in a country trips, the country's system operator must ensure that commensurate load is also tripped before another country's load trips. The under frequency and df/dt relay settings need to be coordinated across countries. In case of frequency instability, which generators need to control, the frequency control needs to be decided upfront, through Automatic Generation Control by all the connected countries in an equitable manner. Alternatively, this can be done through load control, again in an equitable manner. This, therefore, needs to be coordinated across countries.

It is also seen that the Indian grid has got a high fault level, being a very large grid, whereas the other South Asian countries have much smaller grids and therefore low fault levels. If the smaller countries interconnect, there could be large fault currents that could flow to the smaller countries, which could damage their equipment. One way out of this is to install fault current limiters at the boundary sub-station in the smaller countries, that would limit the fault current flowing to these countries.



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The other requirement under connection code would be that the communication system across countries has to be very robust, through two independent channels and reliable, so that instant voice and data communication takes place seamlessly across countries. This is very important for communicating events that have happened and restoration during contingencies/grid events/grid disturbances. All interconnection points must have disturbance recorders and sequence of events recorders to record disturbances, for post mortem of these events/disturbances, to prevent recurrence. In fact, it is a good idea to have these disturbance recorders and sequence of events recorders at all the major generating stations and sub-stations at the higher voltage network in each country, since the tripping could originate from any generating station, line or sub-station in the country.

10. The objective of the **Operating Code** is to enhance the overall operational reliability and economy of the entire electric power network in the country and states how the power system elements connected to the grid are to be operated from the grid reliability and economy point of view, including the flow of information in normal and abnormal circumstances and the method of restoration from a grid event or grid disturbance. It also gives the frequency limits and voltage limits of operation. These limits may be different across the South Asian countries in their own country grid codes.

The frequency of operation in a synchronous grid is the same at all points in the grid and hence, common limits will have to be prescribed for all countries in the Common Minimum Grid Code for synchronous operation. All countries in this case would be jointly responsible for maintaining the frequency of the grid. Each country in this case has to maintain load generation balance at each point of time, barring contingency situations, in which case, power would flow automatically across the countries' boundaries to help prevent a blackout in the country, where there has been tripping of generation. But the situation would have to be normalized quickly in the country of disturbance. For asynchronous operation, some of these conditions are not so onerous.

The voltage is different at different points in a country's grid, depending on reactive loads, voltage drop across lines due to active and reactive power flows, etc. Each country has specified voltage limits at different voltage levels in the country's grid code. This need not be changed. However, for synchronous operation, the only voltage/reactive power drawal/injection that has to be ensured is at the interconnection point between countries. This can be done through installation of static var compensators at the interconnection point, if required.

Another thing that needs to be planned is coordinated outage planning. If all South Asian countries plan to take out their generating units and transmission lines/sub-stations for routine maintenance in a coordinated way, then all countries can reap the benefit of optimal utilization of generation and transmission sources. Restoration procedures would also have



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to be developed in a coordinated way. For this, and, in fact, for all other codes mentioned above, there have to be regional forums created with representation from all South Asian countries, that are operating in synchronism. The appropriate Regional body would also need to maintain a South Asia power portal for information of the South Asia Region.

11. The **Scheduling and Despatch Code** sets out the procedure of scheduling and dispatch along with timelines. In order to ensure power flows in a methodical way across borders for cross border electricity trade, the scheduling interval would have to be uniform across countries. That is, if India schedules in 15 minute intervals, and Bangladesh schedules on an hourly basis, then there would be a mismatch in scheduling. However, if the country Grid Code gives schedules on hourly intervals, they need not switch immediately to 15-minute scheduling. They can give the same value for 4 15-minute blocks in the inter-country schedule. However, it would always be more optimal in future for all countries to switch to 15-minute scheduling. In fact, India is proposing to switch to 5-minute scheduling in future, for even greater optimization of system operation. The interface meters would accordingly have to have the feature of 15-minute recording. All deviations of schedule would be governed by the Deviation Settlement Mechanism (DSM) approved by the SAFER (South Asia Forum of Electricity Regulators). Till such time the uniform DSM is approved, the DSM, as provided in the Annexure, shall prevail, to incentivize grid discipline.
12. The Grid Code would need to be reviewed periodically, for refining the same based on need. For that, a section on **Management of the Grid Code** has been provided.
13. As mentioned earlier, regional bodies would have to exist in future through association of system operators, association of transmission utilities, association of regulators, association of accounts settlement/market operator, association of planning bodies, and even an association at the bureaucratic and minister level for smooth functioning of cross border electricity trade.

Activity – Accelerate South Asia Power Market				
Objective	Development of Regional Wholesale Market Design Options to advance Cross Border Electricity Trade			
Context	Following a landmark update of India's cross border electricity trading guidelines in December 2018 that allowed for the first time the possibility of neighboring countries to trade on its power exchanges, and recognizing that win-win trade has been demonstrated substantially over the past decade, the July 2019 PSRT in Singapore called for a mechanism to support aligning regulatory frameworks for cross border electricity trade with a view toward developing a South Asian Electricity Market. This activity will explore feasible market options to enable a more diverse and expanded cross-border electricity trading (CBET) in South Asia. This Activity will support diagnostics, analysis, dialogue, and capacity building to inform preparation of the policy and regulatory framework for a regional wholesale spot market, which will improve the investment environment and create higher value for regional power projects.			
Working arrangement	- A subgroup of national electricity regulatory entities from BBINS have established a Joint Working Group (JWG) within the South Asia Forum of Infrastructure Regulations in December 2019 (SAFIR was established in 1999) to develop the actions needed to align the regulations (and capacity) of each country to progress to a secure and transparent sub-regional power market. - Late 2020, With the facilitation of World Bank, the JWG agreed on a work program to cover market design and alignment of interconnection requirements. - The JWG invited the World Bank to support the study of market design options - invited USAID's South Asia Regional Initiative for Energy Integration (SARI/EI / IRADe) program to support the development of a unified grid code to facilitate power system integration - World Bank to engage with countries and with the SAFIR JWG to receive feedback on the findings. Findings may also be shared at subsequent Roundtables.			
Main tasks	Scope	Main considerations	Deliverable (interim & final)	Timeline (indicative)
	1. Development of Regional Wholesale Market Design Options. This task will provide the conceptual designs of a	> Stocktaking: this task will utilize the most relevant and significant body of work/knowledge already in place national and regionally to clearly articulate the core issues currently or potentially impacting the development of	i. <u>Interim:</u> a gap-analysis on the fundamentals of regional market design: evaluate the latest developments in cross-border trade and market development at the national level to identify constraints/shortcomings and opportunities for improvement to	

	regional power market including wholesale trading (Term, DAM, G-DAM, RTM, Ancillary) for power exchange to feasibly and organically evolve towards a fully-fledged market in the future. Those concepts would build on the current practices of bilateral trade and emerging tri-lateral trade within the BBINS.	trade at a scale and transition to a market-based trade. In addition, relevant international experience (e.g. EU, South Africa Power Pool, Pan-Arab Electricity Market, and the USA) in regional market design and development will be reviewed to identify relevant practices/lessons to South Asia. Globally, the more successful schemes are the ones that pursued an adaptive approach and adjusted their course when needed, and that remained persistent in dealing with challenges both foreseen and unforeseen. The success of such schemes indicates the need to prepare a clear implementation plan, establish dependable political support early on, and establish a monitoring mechanism that can quickly bring obstacles and challenges, as they emerge, to the attention of decision makers. > Assessment: this task would consider simulated outcomes/benefits (<i>conducted via a parallel</i>)	regional electricity trade and market development. Key achievements and open issues to scale up cross-border trade and developing market design will be identified. ii. <u>Interim:</u> devise potential feasible solutions/pathways for a staged-approach of regional market design: the focus is on a specific transitional regional market design in the short- to medium-term along with high level implementation plan containing the institutional and policy decisions to be taken during this stage. The underpinnings of such market design will be evaluated, in particular: access to markets; access to customers ;allocation of cross-border interconnection capacity; network tariffs and grid access; technical; prices (transparency and subsidization); market structure and competition; balance responsibilities and balancing markets; regulatory alignment and regional market entities. iii. <u>Final:</u> a white paper on proposed South Asia Regional Electricity Market Design and Implementation Roadmap: Synthesis paper on the rationale, description, salient features, expected benefits and risks, and high level roadmap will be developed based on the outcomes of the previous interim deliverables. The paper will present relevant options and select <u>End of Sept:</u> Dough shares interim report in PPT format with WB; WB provides comments. <u>Mid Nov:</u> Mission to the region for comments on the interim market design PPT. <u>Mid Dec:</u> Draft final white paper ready for WB and JWG comments.
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	<i>analysis on the a regional transmission masterplan</i>) , the minimum changes to institutional framework (operating and market rules) required to execute trades securely and efficiently and options for optimizing the institutional framework that would allow countries to capture more benefits of leveraging the market. It is important to note that any plan to fully integrate SAR countries and increase the opportunity for economic trade among them must be flexible, allowing each country to proceed at its own pace with implementation of the necessary reforms in its national power market. It would be unfortunate if each country were to proceed down its own path to reform and develop its own market design without regard to what neighboring countries are doing > Stakeholders Consultations: successful practices in developing regional market design underlines the importance of understanding	the most feasible option along with its roadmap of specific-actions (policy, institution, infrastructure, regulatory) for each country and regionally; iv. <u>Multi-Stakeholder consultations on market designed options.</u> In coordination with the JWG, the following consultations will be conducted: - JWG: a deep dive session with memeber of the JWG to seek final feedback and prepare for following consultations <i>Country-level consultations:</i> targeting respective ministries, utilities, regulator(s) <i>Power Secretaries Roundtable:</i> with Power Secretaries in a dedicated PSRT for market design and implementation roadmap. PRVIOUS SAREM team report that the study should define what can be done in the short-term and in the medium-term, including considerations of key elements to put in place such as: (i) Decision on compliance for participants, (ii) Bidding zones and ATC calculation process agreed by system operators, (iii) Developing a preliminary view on alignment of cross border trade with ongoing	Jan 2022 Present results at PSRT15.
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		each country's regional aspirations/goals and national priorities. As regional electricity markets will play a key role in South Asia energy transition it is important that the regional market design options consider transitional approaches to best achieve regional goals and sector priorities at the national level. Hence, in addition to the direct coordination with the JWG, country level consultations will be conducted after every deliverable (interim and final). Those consultations will serve as a platform to understand country positions and policymakers' perspectives to inform the market design building blocks (institutional, legal, operational etc. or otherwise)	developments in the Indian market including Market Based Economic Dispatch (MBED) and ancillary services market arrangements (through a separately developed study), and finally (iv) Develop a high-level specification for the regional market clearing engine (MCE) through a study.	
2. Capacity Building Support in CBET.		Focus on: - Lessons learned from international experience with cross border electricity markets development (success and failures) - Regional market operations practice such	It will be tailored based on guidance and feedback from JWG and country-level dialogue.	

		as market clearing engines, market oriented economic regulation of transmission, Security Constrained Economic Dispatch ○ and other relevant topics ○ Regional market institutional framework practices		
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