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Brief Report

On

SARI/EI Delegation to Bangladesh to meet and discuss with critical stakeholders such as National Load Dispatch Centre (NLDC),Bangladesh and Power Grid Corporation of Bangladesh (PGCB) on the SARI/EI Task Force-2 Study on "Harmonization of grid codes, operating procedures and standards to facilitate/promote Cross Border Electricity Trade in the South Asia Region"

19th April, 2016, Dhaka, Bangladesh

SARI/EI Delegation Members

Mr. Rajiv Ratna Panda, Head-Technical, SARI/EI, IRADe
Dr. K. Balaraman, Chief General Manager, PRDC
Mr. Chandra Shekhar Reddy Atla, Manager,PRDC

Background:

There has been an unprecedented growth in electricity demand in South Asian countries in the last decade. All South Asian countries are looking for alternate ways to meet this ever growing demand of electricity as this is the backbone of the economies of South Asian Countries (SAC). In order to bridge the demand, supply gap, Cross Border Electricity Trade (CBET) has emerged as viable and economical option and various steps are being taken in advancing CBET in the South Asian Region (SAR). There are already CBET between India-Bhutan, India-Nepal, India-Bangladesh. These CBET trades are bi-lateral and limited in transaction vis-a-vis the huge CBET potential that exists in the SAR. A full-fledged CBET trading requires an integrated regional electricity grid and there are various technical, operational, regulatory challenges of integrated regional electricity grid in South Asia. Operating an integrated electricity grid in South Asia is essentially a technical, operational and coordination issue and there is a need for harmonizing/coordination of the technical rules, standards, grid codes and operating procedures. Harmonization means adjustment of differences & inconsistencies among measurements, methods, procedures, schedules, specifications, or systems to make them uniform or mutually compatible.

In this context, SARI/EI under Task Force-2 have commissioned a study on "Harmonization of grid codes, operating procedures and standards facilitate/promote cross border electricity trade in the south Asia region". As a part of this study, the harmonization of grid codes for South Asian region follows a three stage approach. In the first stage, the comparison of grid code of South Asian region and gaps was identified from the perspective of facilitating CBET. In the second stage, the international grid codes pertaining to cross-border transactions are analysed, impact analysis is carried out and significant inference for SAC were drawn. In the third stage, based on the findings of stage 1 & 2 and inputs/suggestion received from TF-2 members, the draft framework guideline on integrated regional Planning, Operation, Connection, Metering, Capacity allocation & Congestion management and Scheduling & Dispatch were prepared. Draft Framework guidelines are comprehensive in nature and encapsulates: 1) Impact analysis; 2) Explanatory statement; 3) Implementation provisions; and 4) Draft code.

In the above context, it was felt during the combined meeting of SARI/EI task forces and 5th meeting of TF-2 that there is a need for SARI/EI and PRDC (Consultant) to have detailed stakeholder consultation/discussion with key stakeholders of the South Asian Countries in particular with load dispatch centers and power system planning department, regulators who are technical custodian of planning and operation of power system to better understand their operating/dispatch philosophy, relevant regulatory governance and system planning and discuss the draft framework guidelines.

In the above context, SARI/EI/IRADe Delegation comprising of Mr. Rajiv Ratna Panda, Head-Technical, SARI/EI, IRADe, Dr. K. Balaraman, Chief General Manager, PRDC and Mr. Chandra Shekhar Reddy Atla, Manager, PRDC visited Bangladesh on 19th April, 2016. The delegation held detailed discussion with critical stakeholders such as National Load Dispatch Centre (NLDC), Bangladesh and Power Grid Corporation of Bangladesh (PGCB).

Meeting and Discussion with National Load Dispatch Centre (NLDC), Bangladesh

SARI/EI/IRADe delegation held detailed discussion with the National Load Dispatch Centre (NLDC) team of Bangladesh on Draft Framework Guidelines and CBET grid codes on 19th April, 2016 at NLDC office, Dhaka, Bangladesh. Mr. Rajiv from SARI/EI/IRADe initiated the meeting and made a detailed presentation on the study on harmonization of grid codes covering a) scope of the study b) methodology and approach c) importance, context and a brief of the draft framework guidelines. The detailed presentation is attached as Annexure I. Dr. Balaraman from PRDC presented in detail the draft framework guidelines along with draft CBET grid code to the NLDC officials (Annexure I).

During the discussion, the delegation stressed that the draft framework guidelines are not intended for replacing the country grid codes, but deals with limited aspects with respect to CBET. For example all generators which are connected to country's internal transmission network has to follow respective country grid codes, however for generators which are directly connected to cross border lines, they have to follow framework guidelines and CBET grid codes which are non-binding in nature to begin with.

Various suggestions and inputs were made by National Load Dispatch Centre (NLDC) team Bangladesh. A detailed questionnaire (Annexure IV) covering system operation, scheduling & dispatch and connection was also discussed and deliberated with National Load Dispatch Centre (NLDC) team various inputs were made. The delegation requested NLDC team for their detailed responses on the questionnaire on draft guidelines and NLDC responded positively to the request of the delegation. The list of officials interacted is attached as Annexure II.

Meeting and Discussion with Power Grid Corporation of Bangladesh (PGCB)

SARI/EI/IRADe delegation held detailed discussion with the Power Grid Corporation of Bangladesh (PGCB) team on Draft Framework Guidelines on CBET grid codes on 19th April, 2016 at PGCB office. SARI/EI/IRADe delegation made a detailed presentation on the study on harmonization of grid codes covering a) scope of the study b) methodology and approach c) importance, context and a brief of the draft framework guidelines d) detail the draft framework guidelines along with draft CBET grid code,

particularly on system planning, connection and operational aspects of the draft framework and grid code guidelines. During the discussion, the delegation clarified to PGCB team that draft framework and grid code guidelines are not intended for replacing the country grid codes but are prepared form the perspective of cross border electricity trade only. However the respective country can adopt/adapt these guidelines for cross border electricity trade among South Asian countries which are non-binding in nature to begin with and also for enhancing the technical aspects in the existing Grid code from the perspective of cross border electricity trade. Various suggestions and inputs were made by Power Grid Corporation of Bangladesh (PGCB). For example Power Grid Corporation of Bangladesh mentioned that there are greater possibilities of AC interconnection with India and its importance for Bangladesh to improve the grid reliability and security for Bangladesh power system, which needs to be factored in the draft framework and grid code guidelines. A detailed questionnaire (Annexure IV) covering system planning, system operation and connection was also discussed and deliberated with PGCB team and various inputs were made by PGCB. The delegation requested PGCB team for their detailed responses on the questionnaire and PGCB team responded positively to the request of the delegation. The list of officials interacted is attached as Annexure-III.

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Annexure -II: List of officials of National Load Dispatch Centre (NLDC), Bangladesh participated in the meeting/discussion on 19th April, 2016.
1. Mr. Pranab Kumar Roy, Chief Engineer, NLDC
2. Mr. Rafiqul Islam, SE (Communications), PGCB
3. Mr. Abul Kashem, EE (SCADA), PGCB
4. Mr. Adil Chowdhary, EE (LDC), PGCB
5. Mr. Anish Reshman Khan, EE (EMD), PGCB
6. Mr. Suman Nabir, SDE, NLDC
7. Mr. Mosabbir hasan Basunia, SDE, NLDC
8. Mr. Iqbal Asam, SE, PGCB
Annexure -III: List of officials of Power Grid Corporation of Bangladesh (PGCB), Bangladesh participated in the meeting/discussion on 19th April, 2016.
1. Mr. Arun Kumar Saha, Chief Engineer, PGCB
2. Mr. Nur Mohmmad, SDE, System Planning
3. Mr. Monzur A Murshed, SDE, System Planning
4. Mr. Didarul Islam, AE, System Planning
5. Mr. Zubayer Alvi, AE, System Planning

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Annexure I

Presentation
on
SARI/EI Study on Harmonization of grid codes, operating procedures and standards to facilitate/promote cross border electricity trade in the south Asia region:

Draft Framework Guidelines

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Background

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South Asia Regional Initiative for Energy Integration (SARI/EI)

- **SARI/E is a long standing program of USAID started in the year 2000.**

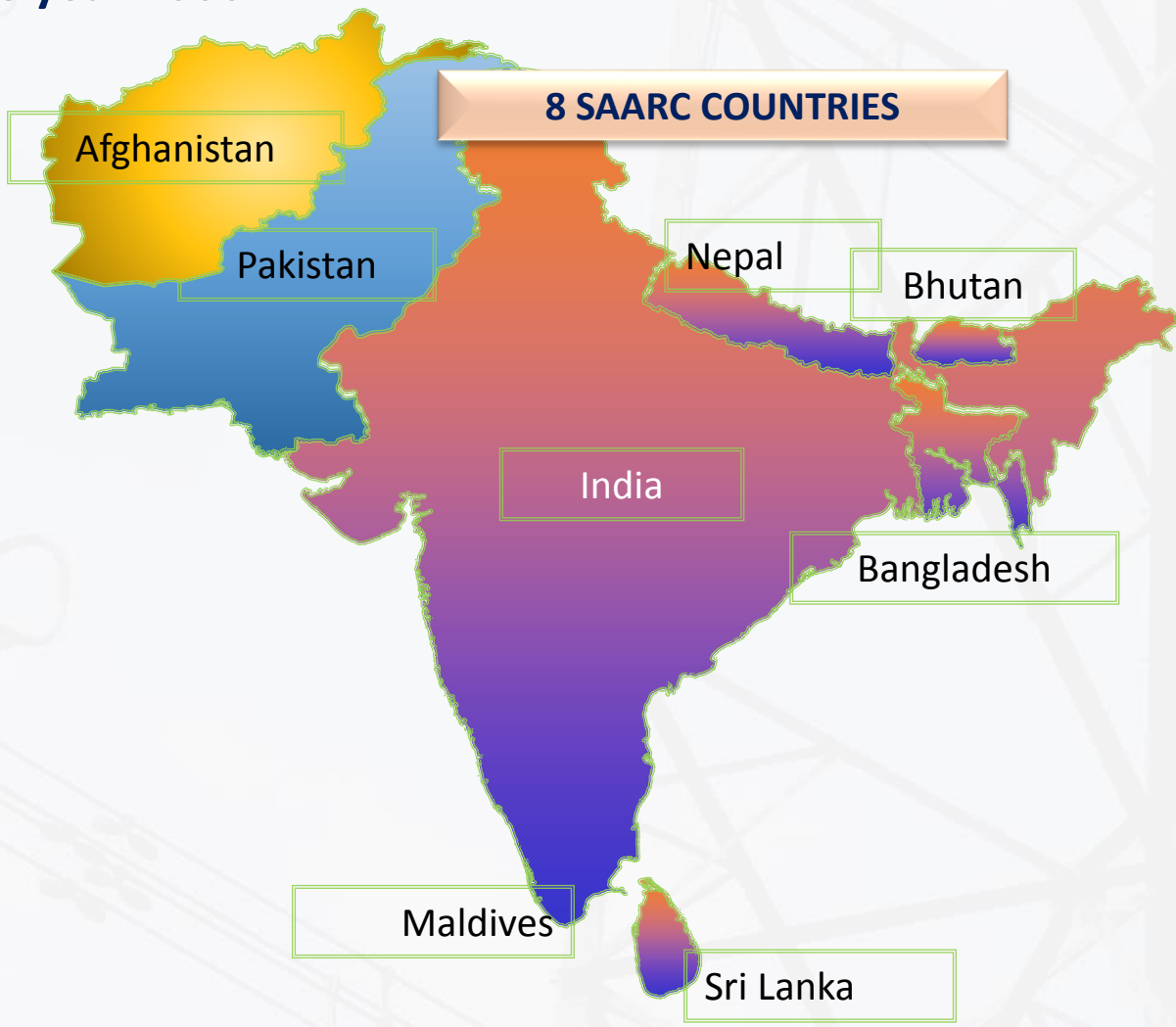
- **Program has consistently strived to address energy security in South Asia by focusing**
  1) Cross Border Energy Trade
  2) Energy Market Formation and
  3) Regional Clean Energy Development.

- **SARI/EI–Phase IV (2012-2017): Key Outcomes.**
  Three Key Development Outcomes:
  1. *Coordinate policy, legal and regulatory issues.*
  2. *Advance transmission interconnections.*
  3. *Establish South Asia Regional Electricity Markets.*

- **First Three Year of the Program is Completed.**

- **Demand Driven 'Bottom Up' Approach**

- **IRADe, a regional organization, is implementing partner**



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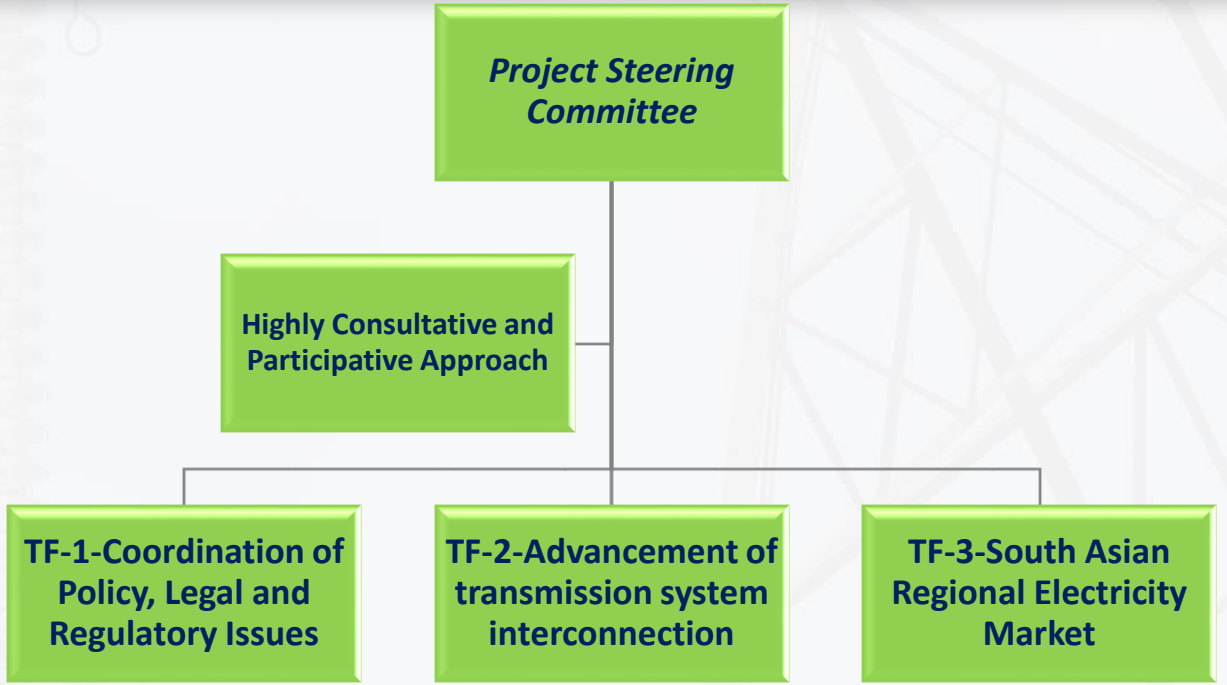
SARI/EI Framework

- **Project Steering Committee (PSC)** is the apex body of the program and provides overall strategic directions.
- PSC members consist of government nominated **Senior level officials from the country governments, SAARC, ADB, Independent Energy Experts/Diplomats.**
- Task Force Members are represented by **government nominated members from Regulatory Technical , market related institution of each SA countries.**

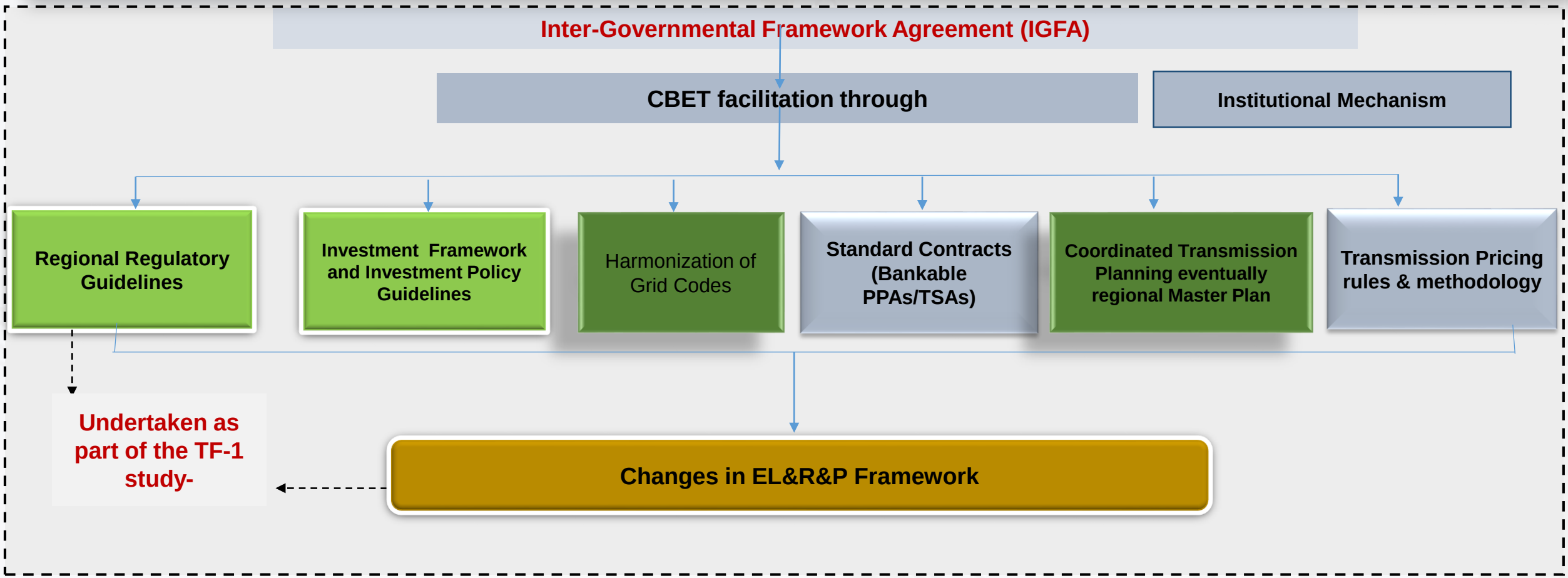


- **TF1: Coordination of Policy, Legal and Regulatory issues**

- **TF-2: Advancement of transmission system interconnection**

- **TF 3: South Asian Regional Electricity Market**

Overall Framework for development of CBET in South Asia



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Demand Driven Studies /Exercises to Achieve the Deliverables of Task Forces as Defined in the Terms of Reference of Task Forces

TF-1 :

- **Study -1: Study on Review of policies, regulations and laws, preparation regulations etc.** ***(Report has been finalized, Proposed Changes, amendments in electricity laws, regulations and policies Regional Regulatory Guidelines) - Completed***
- **Study-2: Study on Investment policies/guidelines for SA countries.** ***(study under progress-Ongoing)***

TF-2 :

- **Study 1: Study to find out the Trading Potential of South Asian Countries** ***(Draft Final Report prepared-Ongoing)***
- **Study 2: Harmonization of Grid Codes** ***(Draft Final Report Prepared-Ongoing)***

TF-3 :

- **Study 1: "Assessment and recommendation of commercial terms & conditions for Cross Border Electricity Trade (CBET) and suggesting the model Of Power Exchange in South Asian region"** ***(Draft Report Prepared – Ongoing)***
- **Study 2: Implementation of Pilot Market-Mock Exercise for SARPEX & Market rules** ***(Process initiated)***

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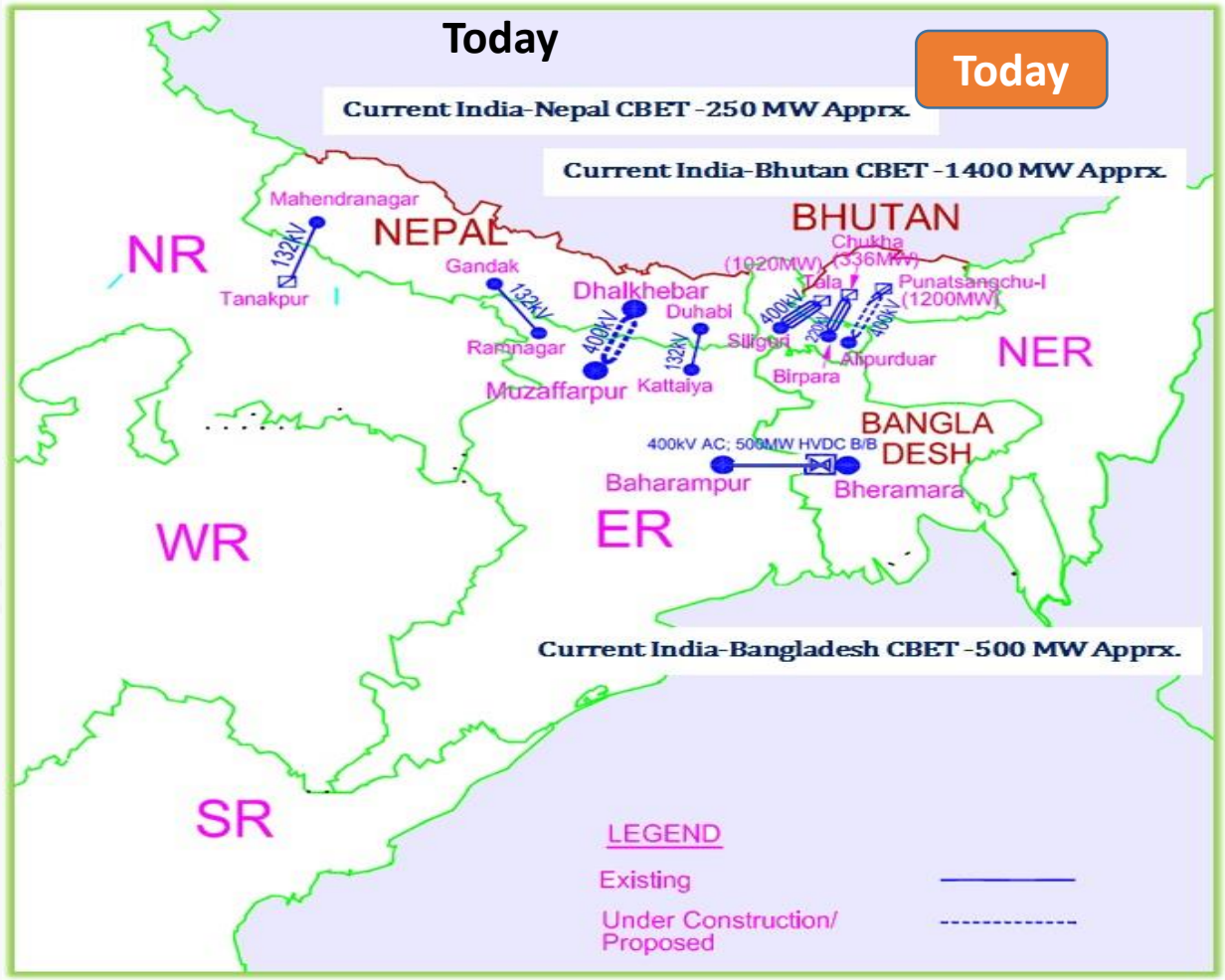
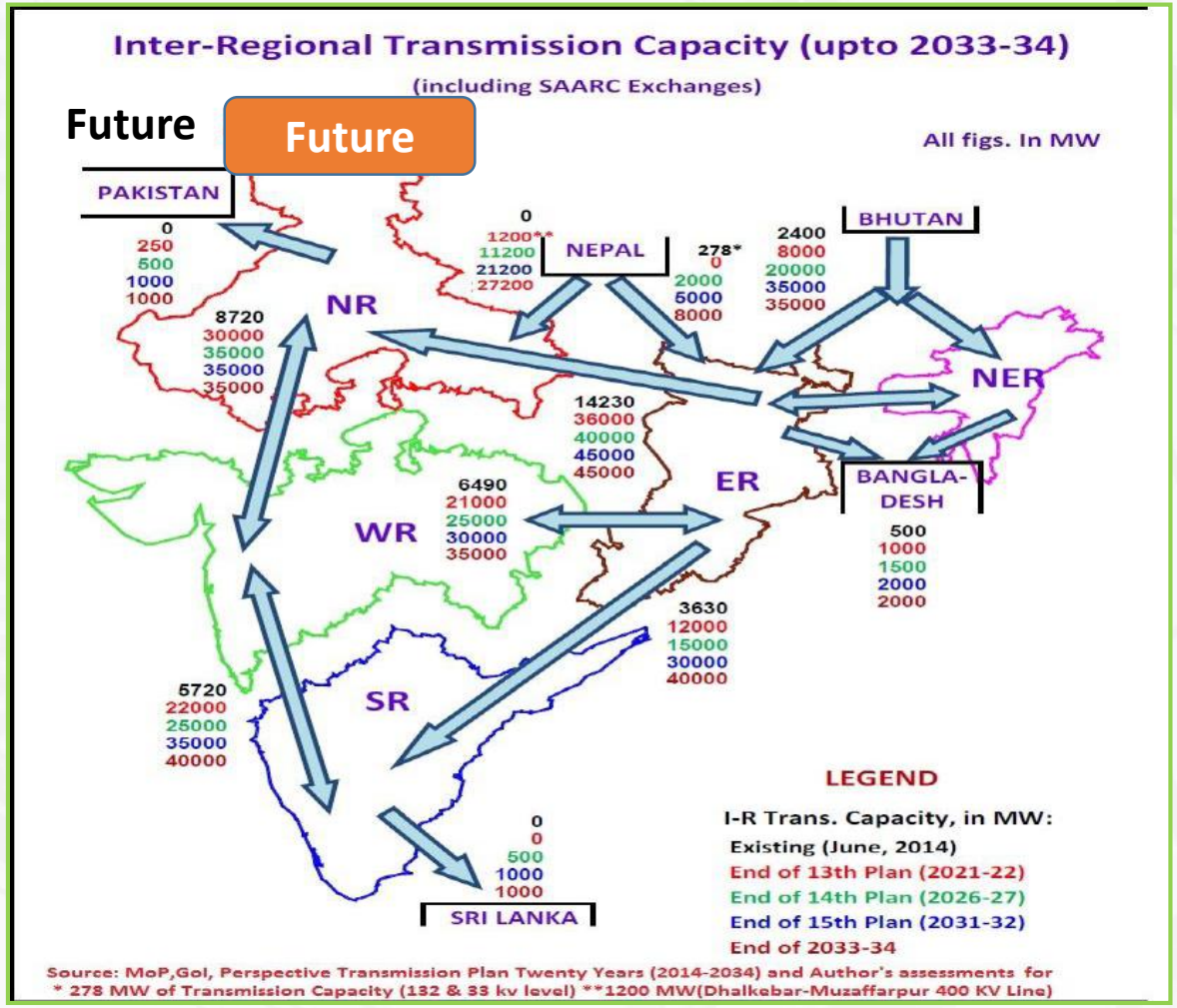
Background : What is the CBET Vision ?

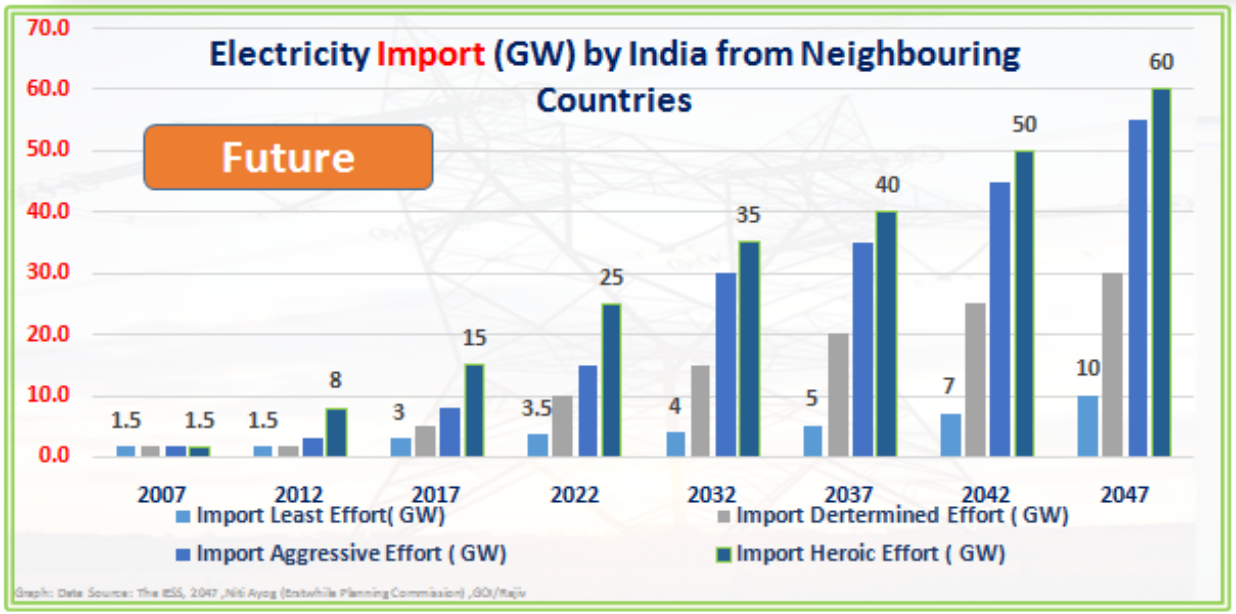


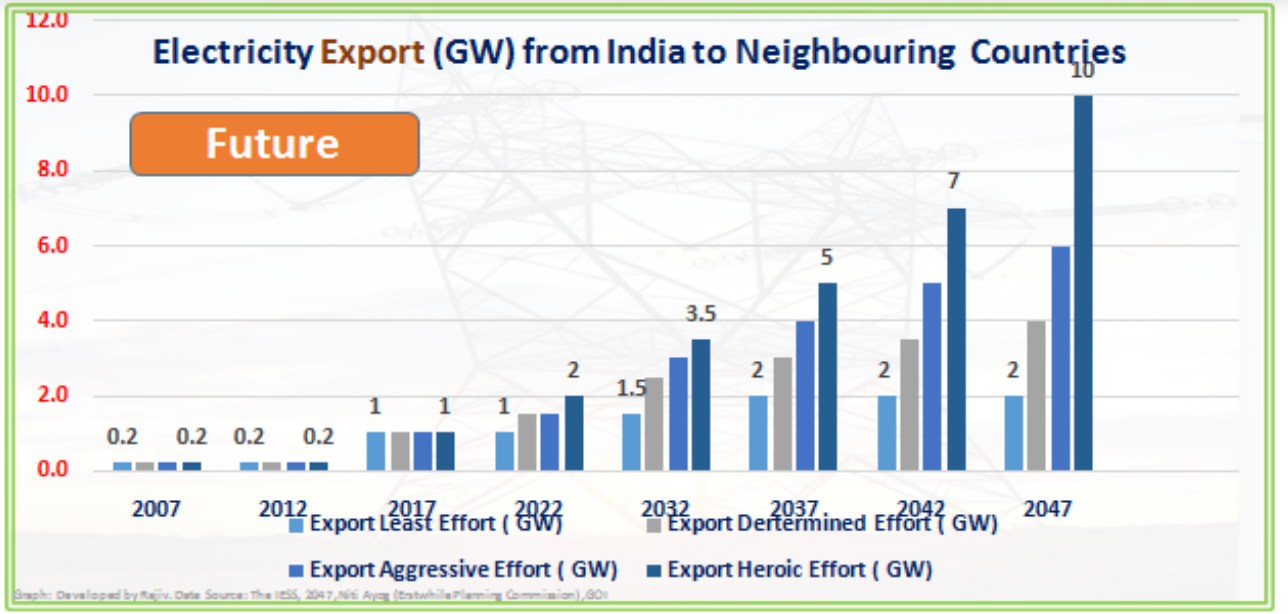


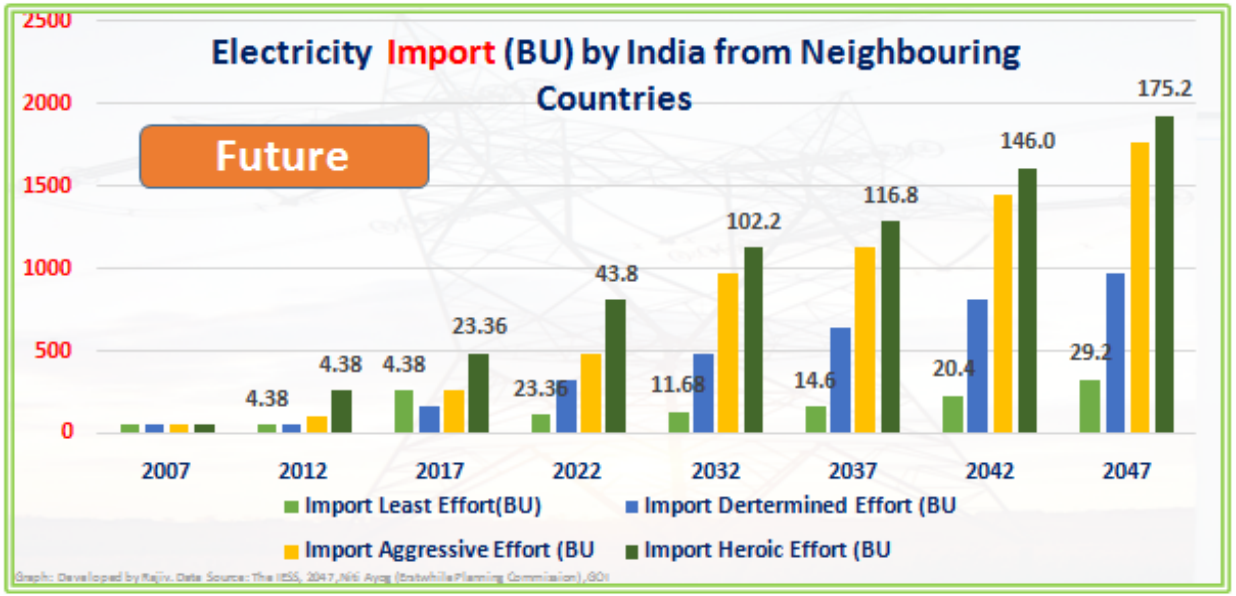
Significant Transmission System Interconnection (Both AC and DC) are being Planned and Proposed.

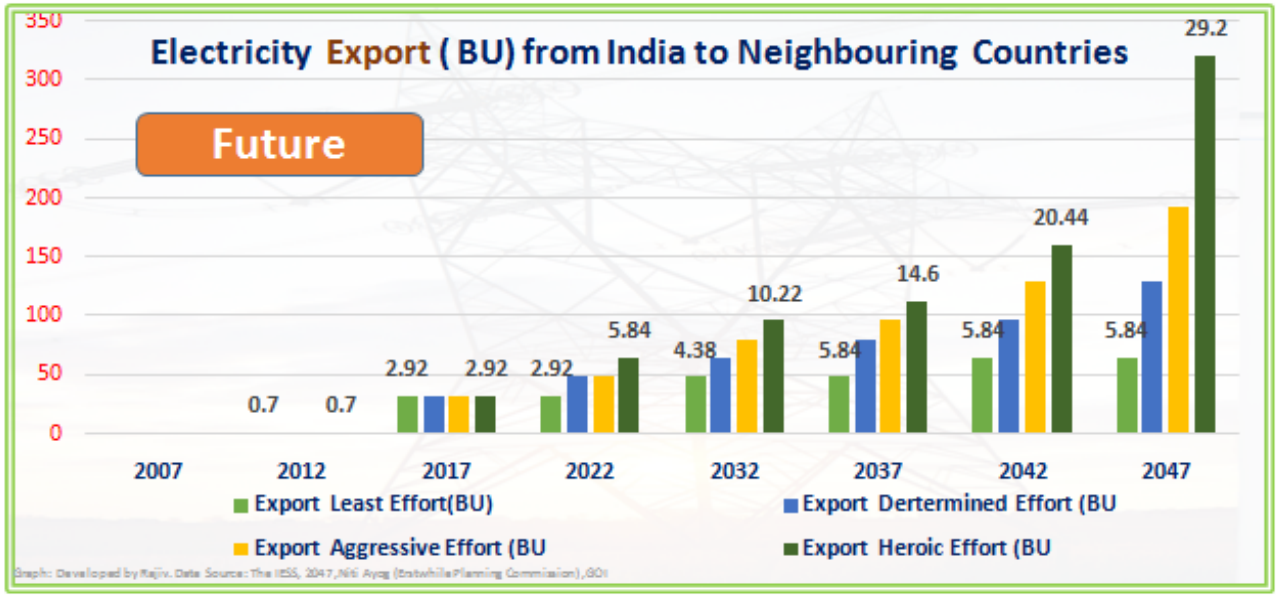
Bangladesh is in the process of Planning to Import around Apprx. 6000 MW by 2034 (PMSP 2015-JICA Presentation,4th June,2015)

India: Cross Border Electricity Trade Export and Import by India from Neighbouring Countries









Source: The IESS, 2047 ,Niti Aayog (Erstwhile Planning Commission) ,GOI

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Background : Need for Harmonization for Safe, Reliable and stable operation of the Interconnected Power system

With High Level of Cross Border Interconnection being envisaged, it is obvious that for safe, reliable and stable operation of the interconnected transmission system, the various technical aspects of grid codes, operating procedures and standards needs to be harmonized/coordinated.

Harmonization means to have procedures, schedules, specifications of systems to make them uniform or mutually compatible and manage the differences & inconsistencies among measurements, methods.

Compatibility has to be there depending on the type of interconnection.

In case of a synchronous interconnection, voltage, basic insulation strength, nominal frequency and protection scheme must match.

In case of asynchronous interconnection though may require less level of harmonization, the tripping of HVDC terminal would itself can constitute a disturbance in terms of loss of load or loss of supply at bigger level.

Scope of Work : Objectives

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Scope of Work : Objectives

Review of the Grid Codes of the respective South Asia nations covering procedures/ codes/standards such as Power system operating procedures, protection code, metering code, connection code, planning code, system security, demand estimation systems, outage planning, recovery procedures etc.

Identify relevant provisions in each of the above documents operating procedures/ Grid codes and standards that have the potential to impact “cross border electricity trade”;

Suggest possible measures with necessary changes to be made in each of the above of the respective SA countries to facilitate/promote optimal and economic “cross border electricity trade only” in the South Asia region.

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SARI/EI Task Force-2 Study on Harmonization of grid codes, operating procedures and standards to facilitate/promote cross border electricity trade in the south Asia region: Status Update

SARI/EI Task Force-2 is currently carrying out the Study on Harmonization of grid codes, operating procedures and standards to facilitate/promote cross border electricity trade in the South Asia Region.

M/s PRDC,Bangalore is conducting the study.

Methodology and approach has been finalized by Members.

Preliminary Review and Comparison of the Grid Codes and Gap Analysis has been conducted. The same was presented during the Combined Meeting of Task forces and 5th Meeting of TF-2.

Overall approach for harmonization of Grid Codes was discussed and finalized.

International best practices (European, NERC-North American Electric Reliability Corporation,SAPP) and Impact Analysis of Grid Codes & Operating Procedures has been analysed and reviewed.

Comprehensive framework guidelines along with Draft Codes are prepared

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Study Methodology

Phase I
1. Project Inception

- 1.1 Project Kick-off
- 1.2 Work Plan Preparation
- 1.3 Preliminary Data Mapping, Comparison of South Asian Grid Codes and Gap Analysis
- 1.4 Inception Report generation
- 1.5 TF/IRADe Meeting

Phase II
2. Project Interim Analysis

- 2.1 Project related Data Collection
- 2.2 Power Transmission Standards Review
- 2.3 Standards Gap Analysis
- 2.4 Organizational Structure Review
- 2.5 TF Meeting

Phase III
3. Impact Assessment & Regional Grid Code Creation (Now Framework Guidelines will be prepared as suggested by members)

- 3.1 Review of international grid codes on cross border trading
- 3.2 Impact Analysis of Grid Codes & Operating Procedures with respect to the International Review.
- 3.3 Draft Interim Report
- 3.4 Comments from TF members
- 3.5 Recommendation for CBET supportive Framework Guidelines
- 3.6 Draft Final Report

Phase IV
4. TF Workshop & Final Report Submission

- 4.1 Final TF Workshop
- 4.2 Final Report Submission
- 4.3 Identification of Training Requirements to ensure proper implementation of Framework Guidelines

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Overall Approach for Grid Code Harmonization/Coordination in South Asia

Framework Guidelines

Development of Framework guidelines on the identified Areas (contains explanatory statement along with draft code for each identified areas)

Cross Border Grid code

Development of codes based on Framework guidelines by the relevant authorities

Agreement & Operationalization of code

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Development of Framework Guidelines

The Framework Guidelines will be comprehensive in nature and shall contain

Impact analysis	Explanatory statement	Draft code	Implementation Provisions

The proposed framework shall not be intended to replace the existing national grid codes for non-cross border issues but to harmonise/Coordinate the critical issues concerning cross border trade.

Identified Areas for Framework Guidelines

Framework Guidelines

- **Planning Guidelines**
- **Connection Guidelines (including metering & protection guidelines)**
- **Operational Guidelines**
- **Scheduling & Dispatch**

The draft code can be adopted fully or in parts by the relevant authorities and can form the basis for harmonising/Coordination of the existing national codes in the identified areas for CBT.

Draft Guidelines

Planning Guidelines

- It provides various guidelines to be adopted for planning and development of system studies

Connection Guidelines

- It specifies a minimum of technical, design and operational plant criteria to be compiled with by the existing and prospective users.
- It includes the meter placement, compliance of meters according to standards in terms of accuracy levels, accessibility of the meters, maintenance responsibility of meters etc.,
- It covers the general protection guidelines to be followed for the generator, transmission licensees.

Operation Guidelines

- It contains details for high level operational procedures for example demand control, operational planning and data provision

Schedule and despatch Guidelines

- It describes the procedures to be adopted for Scheduling and despatch of generation and allocation of power drawl

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Planning Guidelines

Planning Guidelines: Planning Philosophy

Master Plan with a planning horizon of 10 years has been suggested as the basis for planning the interconnected network among member countries and reviewed every alternative year.

As the cross-border interconnection is expected to cater for the long term requirements of member countries, sufficient forecasting of demand and generation planning shall be carried out.

From practical considerations the load variations over the year shall be considered as under:

- Annual Peak Load
- Seasonal variation in Peak Loads for Winter, Summer and Monsoon
- Seasonal Light Load or Off-peak load (for Light Load scenario, motor load of pumped storage plants shall be considered)

The load-generation scenarios shall be worked out so as to reflect in a pragmatic manner due to typical daily and seasonal variations in load demand and generation availability which impact the cross border power flow along with the impact of RE i.e., wind & solar.

Planning Guidelines: Transmission Planning Criterion

Nominal Frequency	50 Hz
Steady State Operational Frequency Limits	+ 0.05 Hz to - 0.1 Hz
Instantaneous Frequency Limits	± 0.8 Hz

The temporary over voltage (peak phase voltage) limits due to sudden load rejection shall be:

- 1.4 p.u. for a 765 kV system
- 1.5 p.u. for a 400 kV & 500 kV system

The switching over voltage (peak phase voltage) limits shall be:

- 1.9 p.u. for a 765 kV system
- 2.5 p.u. for a 400 kV & 500 kV system

Short circuit ratio (SCR) at the converter terminals of HVDC installations shall be greater than 3.

Planned maximum sub-transient short circuit fault levels shall not be greater than 80% of equipment ratings.

Line to earth voltage during single line to earth faults should not rise above 80% of the rated line to line voltage.

Planning Guidelines: Transmission Reliability Criteria

Criteria for system with no contingency (‘N-0’)	For the planning purpose all the equipment's shall remain within their normal thermal loadings and voltage ratings.
	The angular separation between adjacent buses shall not exceed 30 degree
	Voltage step resulting from capacitor/reactor switching shall not exceed 3.0%.
Criteria for system with single contingency (‘N-1’)	All the equipment's in the transmission system shall remain within their normal thermal and voltage ratings after a disturbance involving loss of any one of the following elements , but without load shedding / rescheduling of generation:
	The angular separation between adjacent buses under (‘N-1’) conditions shall be permitted up to 30 degree
	The system shall be capable of withstanding the loss of most severe single system infeed without loss of stability.

- Outage of a 400 kV single circuit
- Outage of a 400 kV single circuit with fixed series capacitor
- Outage of an Inter-Connecting Transformer
- Outage of a 765 kV single circuit
- Outage of one pole of HVDC bi-pole

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Connection Guidelines

Connection Guidelines: Technical Requirements

The Agreement shall be mandatory between the applicant and the national transmission utility of the member country at the synchronous connection point.

To comply with the connection code(s), the user shall be capable to meet the minimum standard requirement at the inter connection point which is defined by:

- Reactive power requirements
- Frequency and voltage parameters
- Short-circuit fault levels
- Metering system
- Protection devices
- Simulation Models
- Data and Communication Facilities & Event Recording Instruments including real time data gathering with time stamping
- Cyber Security
- Schedule of cross border assets of member country grid

Reactive Power Requirements

- Respective country's power authority need to ensure that reactive power requirements are kept at bare minimum (within lead/lag 0.97 power factor and operated within the grid code voltage level) at connection point.
- In case of HVDC link or asynchronous link, the voltage is to be maintained within the limits by the respective transmission agencies to prevent mal-operation of the HVDC links.

Connection Guidelines: Connection Guidelines

Frequency

- User shall be capable of staying connected to the network and operating within the Frequency ranges and time periods which is specified by the system operator or automatically disconnect at specified frequencies if required by the operator.
- Recommended frequency band of operation shall be within 49.9 Hz to 50.05 Hz to maintain security of the total interconnected system. However all the connecting equipments shall withstand the frequency profile as in Table below.

Frequency	Time period for operation
47.5– 48.5 Hz	90 minutes
48.5– 49.0 Hz	To be defined by each system operator, but not less than the period for 90 minutes
49.0 – 51.0 Hz	Unlimited
51.0 – 51.5 Hz	30 minutes

Voltage

- At the point of Interconnection, acceptable range of operating voltages shall be ±5% for 400 kV and above transmission voltage levels but all the connected equipment shall withstand the voltage variation of ±10%.

Short-Circuit Fault Levels

- The coordination forum or the planning committee shall provide minimum and maximum short circuit level of the interconnecting substation of cross-border link for various possible scenarios

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Connection Guidelines: Protection Requirements

Protection schemes relevant for the power generating module and the network shall be coordinated and agreed between the relevant network operator and the power generating facility owners.

Protection scheme for Generation Facilities		
External and internal short circuit	Inter-area oscillations	Rate of change of frequency
Over-/under-excitation	Inrush current	Neutral voltage displacement
Stator and rotor overload	Asynchronous operation (pole slip)	Inverse power
Asymmetric load (-ve phase sequence)	Power generating module line protection	Over fluxing (U/f)
Over-/under-voltage at the connection point	Protection against inadmissible shaft torsions (for example, sub-synchronous resonance)	Backup schemes against protection and switchgear malfunction
Over-/under-voltage at the alternator terminals	Unit transformer protection	

Protection Scheme Devices Of Demand Facilities Shall Cover -

- External and internal short circuit;
- Over- and under-voltage at the connection point;
- Over- and under-frequency;
- Demand circuit protection;
- Unit transformer protection; and
- Backup schemes against protection and switchgear malfunction.

Fault Recorders at Generator And Transmission facilities shall -

- Exist at all transmission lines, autotransformers or phase-shifters connected to busses; shunt capacitors, shunt reactors, Individual generator line interconnections, Dynamic VAR devices and HVDC terminals
- Record duration shall be a minimum of one (1) second
- Have a minimum recording rate of 16 samples per cycle

Connection Guidelines: Metering Requirements

Bi-directional meters shall be installed at the connection point between the transmission connected grid of the participating countries, between the transmission grid & the generator and between the transmission connected grid & the distributor who are part of cross country power flow

- Minimum standard of accuracy of meters shall comply with the latest IEC standards - **Main and Check Meters:** The minimum standard of accuracy of Meters shall be 0.1%
- For the voltage and current transformers, accuracy shall be 0.2% and the secondary burden shall be maintained between 25% and 100% of rated values.
- **The metering shall record :** Bus voltage; Frequency; Active Power, Energy; Reactive Power; Current; Any other facilities as agreed in the connection agreement.

It is recommended that Energy Accounting and Audit functions shall be carried out by coordinating forum or the planning committee (as per planning guidelines) or separate agency as required.

All Main energy meters for interconnection shall be owned by Government designated Transmission Licensee in whose premises the meter is located and the check meters shall be owned by the other member country Licensee.

Location of Meters

Stages	Main Meter	Check Meter	Standby Meter
Generating station not directly connected to the Transmission system	On all outgoing feeders	On all outgoing feeders	H.V side of the Generator Transformers H.V side of all station auxiliary Transformers
Transmission connected	At both ends of the Interconnected Transmission line. Meters at both ends shall be considered as main meters for respective licensees.	-	There shall be no separate standby meter. Meter installed at other end of the line in case of two different licensees shall work as standby meter.

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Operational Guidelines

Operational Guidelines: System Security Aspects

The list of important grid elements that impacts the CBET shall be prepared and published in advance.

No important element of the interconnected grid shall be deliberately opened or removed from service at any time, except

- Under an emergency, and conditions in which such isolation would prevent a total grid collapse and/or would enable early restoration of power supply
- For safety of human life
- When serious damage to costly equipment is imminent then isolate the equipment by suitable disconnection without endangering security of the system
- Such isolation is to be specifically instructed after mutual agreement of the System Operators of the two countries through specific messages exchanged to this effect.

Any prolonged outage of power system elements, which is causing or likely to cause danger to the grid or sub-optimal operation of the grid, the same shall be regularly monitored by the respective regional heads and be reported

The exchange of information shall happen over a common platform and include sufficient information on who is responsible for exchange of what data, containing how much detail, at what frequency and in what format along with the need for time stamping.

Operators shall exchange the protection set-points of the lines, reliability entities of relay or equipment failures, revised fault analysis study, letters of agreement on settings, notifications of changes, or other equivalent evidence that will be used to confirm that there was coordination of new protective systems or changes in the transmission systems.

Operational Guidelines: System Security Aspects

All thermal and hydro generating units shall follow their respective Grid codes and shall have AVRs & Governors in operation with tuned PSS for effective damping of oscillations.

Adequate operating reserves (Primary/Secondary/Tertiary) shall be made available. The cross border links shall facilitate in the primary reserve process. However, it is desirable that the adequate control is established to restore the power flow to the scheduled level within a block period.

System Security Limits			
	Normal	Alert	Emergency
Voltage (400, 500 & 765 kV)	± 5%	± 5%	± 10%
Frequency – for synchronously interconnected system	Nominal: 50Hz Steady state limits: +0.05Hz to -0.1Hz Instantaneous limits: ± 0.8Hz	Exceeds steady state limits for upto 10 mins	Exceeds steady state limits for >10 mins up to 20 mins
Equipment loading	Within Limits	Within Limits	Exceeds limits of short term overload

Special protection system (SPS) to prevent cascading with the outagesWind and solar generation shall be treated as a must-run station, unless instructed otherwise by respective operators on consideration of grid security.

The protection strategy and concepts shall be reviewed every five years.

Protective relay settings shall not limit transmission loadability nor interfere with system operators' ability to take remedial action to protect system reliability and shall be set to reliably detect all fault conditions and protect the electrical network from these faults.

Operational Guidelines: Demand Estimation for Operational purposes

The existing demand estimation procedure as per the grid code of the respective member country can continue for daily/ weekly/ monthly/ yearly basis for current year for load - generation balance planning. The present guidelines is for information purpose only

Each region shall carry out its own demand estimation from the historical data and weather forecast data from time to time. All necessary data and information shall be provided by relevant entities as required for demand estimate. The monthly estimated demand shall be shared with the operation planning authorities.

Based on the demand estimation for operational purposes on a daily/weekly/monthly basis, mechanisms and facilities shall be created at the earliest to facilitate on-line estimation of cross border power flow for each 15 minutes block.

Operational Guidelines: Congestion Management

Commercial principles for congestion management need to be developed in order to facilitate cross border transactions. Transmission agencies shall be responsible to continuously monitor and adopt curative measures, when necessary.

- For long term commitments, re-dispatch and counter flow measures may be followed.
- For medium and short term commitments, load curtailment shall be the last resort.
- The respective member country utilities shall also implement automatic demand management like rotational load shedding, demand response.

The frequency thresholds of 49.5 Hz can be defined for automatic shedding of loads and is recommended and the loads should be classified in four groups,

- loads for scheduled power cuts / load shedding,
- loads for unscheduled load shedding,
- loads to be shed through under frequency relays & df/dt relays
- loads to be shed under any Special Protection Scheme.

All manual load shedding shall be coordinated between operators and demand facilities which shall be maintained by the respective country authorities without affecting the grid security

Operation- Outage Planning

The procedure for preparation of outage schedules for the elements of the interconnected grid shall be formed by grouping responsibility areas.

Outage planning assets are classified as relevant assets and critical assets. The outage coordination planning takes all relevant assets into account.

The planning shall be split into three time horizons, the long term (a year ahead), the medium term (monthly reassessment) and the short term planning (week ahead).

The coordinated availability plan shall have the following details for each relevant element:

- Availability Status, which may be one of the following three states:
  - **Available**: the Relevant Asset is capable of and ready for providing service, whether or not it is actually in operation.
  - **Unavailable**: the Relevant Asset is not capable of or ready for providing service;
  - **Testing**: the capability of the Relevant Asset for providing service is being tested. This status may be used only during time periods between first connection and final commissioning or immediately after maintenance.
- Reason for unavailability
- Conditions that need to be fulfilled before making asset unavailable
- Restoration time

Operation- Recovery Procedure

Recovery procedures are defined

- Each operator has to evaluate the number of units capable of black start and islanded operation to contribute to the restoration.
- Operators have to know the status of the component of their power system after a blackout.
- During re-energization, the relevant region's load frequency secondary control is switched to frequency control mode while the other load frequency secondary controllers remain in frozen control state.
- The consumption and production are balanced by the resynchronization leader with the aim of returning near to 50 Hz, with a maximum tolerance of $\pm$ 200 mHz under the coordination of the area's regional head.

Operation- Coordination Between System Operators

Each operator shall provide the following information for the purposes of system defence plan procedures and restoration plan procedures:

- To neighboring operators
- To the regional head
- To Transmission connected distribution systems

Reporting procedures in respect of all events in the system to all users and all verbal notifications may be backed up with appropriate written reports.

To facilitate smooth operation, different coordination forums are formed which is given below and this groups shall recommended to meet once every calendar quarter

- Operation and Protection Coordination Group
- The Commercial Coordination Group

In addition to the above coordination forums, the transmission system owners of the respective countries may coordinate with each other for various aspects pertaining to the O&M of the transmission assets in their respective jurisdiction.

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Scheduling & Dispatch Guidelines

Scheduling & Forecasting Guidelines: Objective & Applicability

Objective:

- Ensuring operational security;
- Ensuring optimal use of the transmission infrastructure;
- Ensuring and enhancing the transparency and reliability of information;
- Contributing to the efficient long-term development of the electricity transmission system by accurate forecasting;
- The procedures to be adopted for scheduling of the net injection / drawals of concerned entities on a day-ahead basis with the modality of the flow of information between the regional entities

Applicability

- This Guideline are applicable for all member countries which are involved in cross border grids.

Scheduling & Dispatch Guidelines: Introduction

Computation of the Available Transfer Capability (ATC) is suggested. System operator shall consider the technical limit imposed by the system components, the thermal line limits, bus voltage limits and stability limit.

Each time block shall be for a duration of 15 minutes and a common time of Indian Standard Time (IST) can be adopted for uniformity.

Transmission Losses will be apportioned between two countries based on a mutually agreed methodology.

- Transmission System Losses would be borne in kind by the utilities as per the quantum declared for the respective area of jurisdiction in the interim.

The (firm) power traded would normally be treated as a 'must-run' and thus would not be subject to revision / curtailment except under conditions which pose a threat to the System Security of either of the participating countries.

Control on its generation and / or load to maintain its interchange schedule with other member countries whenever required and contribute to frequency regulation of the synchronously operating system.

Take the responsibility of coordinating the scheduling of a generating station, within the country area, real-time monitoring of the station's operation in its availability declaration, or in any other way revision of availability declaration and injection schedule, switching instructions, metering and energy accounting, outage planning, etc.

Scheduling & Dispatch Guidelines: General Guidelines

The system operators shall publish a general scheme for calculation of the Total Transfer Capability (TTC) and Available Transfer Capability (ATC) based on the electrical and physical realities of the network.

In case of congestion, agreed commercial mechanism is to be followed.

The Available Transfer Capability (ATC) shall consider Capacity calculation timeframes (Long term, Short term, Intraday), Capacity calculation regions, Common grid model methodology

The methodologies for the capacity calculation, which shall include methodology for determining the reliability margin; operational security limits, contingencies relevant to capacity calculation and allocation constraints that may be applied

Scheduling & Dispatch Guidelines: Demarcation of Responsibilities

Operated as power pools with their own scheduling and dispatch process, in which the respective system operators shall have the total responsibility for

- Scheduling/dispatching of their own generation.
- Regulating the demand of its control area.
- Scheduling their drawal.
- Regulating the net drawal of their control area.

The member country entities shall ensure

- there is no over drawl when frequency is 49.5 Hz or below.
- When frequency is higher than 50.2 Hz, the actual net injection shall not exceed the scheduled dispatch for that time block.

The generating stations and sellers shall be responsible for their power generation/power injection as per daily schedules

The coordinating member may direct the system operator to increase/decrease their drawal/ generation in case of contingencies e.g. overloading of lines/transformers, abnormal voltages, threat to system security. Such directions shall immediately be acted upon.

The coordinating forum shall be responsible for computation of actual net injection/drawal of on the cross border link, 15 minute-wise, based on the above meter readings.

Scheduling & Dispatch Guidelines: Timeline

Time	Activity
0800 hrs	Member country Load Dispatch Centres shall compile their foreseen MW and MWh generation capabilities for the next day and submit the cross-border power transfer, i.e., from 0000 hrs to 2400 hrs of the following day to the coordinator heads.
1500 hrs	Member country Load Dispatch Centres shall compile their foreseen load pattern for the next day and submit revised cross-border power transfer to the coordinator heads.
1800 hrs	All coordinator heads together or a scheduling authority decides the best dispatch and drawal schedule for cross border interconnection and each coordinator head conveys the net dispatch schedule and the net drawal schedule through cross border interconnection to each member country load dispatch centres under its control.
2200 hrs	Any modifications in load or generation shall be brought to the notice of the coordinator head by the member country dispatch centre.

Each time block shall be for a duration of 15 minutes and a common time of Indian Standard Time (IST) can be adopted for uniformity.

The priority of scheduling of power over the cross border link would be long-term contracts, medium term contracts and short term bilateral contracts (up to 3 months) in that order.

Scheduling & Dispatch Guidelines: Deviation Settlement

Special energy meters at all interconnections between the countries for recording the actual net import / export MWh and MVArh on a 15-minute basis . Deviation from schedule on the Cross Border Link will be calculated for each 15 minute time interval.

Energy accounting is on weekly basis.

Transmission charges for wheeling of power up to the international interconnection for the international trade would be borne by both the buyer and the seller as per the prevailing methodology in the respective country.

Transmission charges for the international interconnection would be payable by the market participants as per the charges mutually agreed between the participating member countries.

Operation charges, taxes, levies and other statutory duties / levies would be payable to the system operators by the participants as per the prevailing laws of the land.

A suitable payment security mechanism for transmission charges, system operation charges and charges of imbalance would be put in place by the participating member countries.

The member states shall put into place through mutual agreement a mechanism for dispute resolution.

Scheduling & Dispatch Guidelines: Charges for Losses

Transmission system operators shall be compensated for energy losses based on an estimate of what losses would have been incurred in the absence of transits of electricity.

An agency shall be established comprising of representatives of all participating countries for the long term, a fund shall be established to compensate energy losses incurred. The fund may be referred to as Cross Border System Operator Compensation (CBSOC) Fund.

All contributions and payments shall be made as per the agreements in place and the agency shall be made responsible for relating to the CBSOC Fund as follows

- To establish the arrangements for the collection and disbursement of all payments
- To determine the timing of payments.
- To publish report annually on the implementation of the mechanism(normally on 15 minutes time block) and the management of the fund.
- To carry out the loss calculation and shall publish this calculation and its method in an appropriate format.

The amount of losses incurred on a transmission system shall be established by calculating the difference between

- The amount of losses actually incurred on the transmission system during the relevant period.
- The estimated amount of losses on the transmission system which would have been incurred on the system during the relevant period if no transits of electricity had occurred.

Implementation Provisions

Implementation Provisions: Philosophy

It is envisaged that the framework guidelines and draft codes would be agreed between the regulatory entities of SAC, initially; these will be non-binding in nature and may not have a formal legal status. The following approach is proposed in order to ensure this transition:

The framework guidelines and draft codes are adopted by the SAFER and may be recommended to the national regulators in South Asian countries for adoption as a non-binding framework, guiding grid code harmonization/coordination for Cross-Border Electricity Trade.

For adoption of the framework guidelines and draft codes by each of regulatory agencies in the member countries in the South Asian region for the purpose of cross-border energy trading in their grid code, National electricity regulators may need to identify specific changes that are required in the national grid codes. The proposed guidelines may be adopted in Toto or in parts as appropriate.

Existing National electricity Grid Code Regulations may be updated based on the framework guidelines and draft codes are modified to ensure full consistency.

Additional studies/reviews undertaken in due course can contribute in defining the national grid code regulations in a more detailed form, eventually leading to the updating of guidelines and codes.

Framework guidelines and draft codes are updated and adopted for governing cross-border trade transactions (binding nature). The legal effect could gradually be increased by adoption through the national country governments/regulatory authorities through the national grid code regulations.

Implementation Provisions: Philosophy

The above steps will require consensus building and hence, will need to be facilitated through a strong institutional sponsor. SARI/EI Task Force-1 has recommended a to establish South Asian Forum of Electricity Regulators (SAFER) to manage this process in close coordination with various regional bodies, transmission utilities including the proposed regional electricity regulatory authority, the South Asia Association for Regional Cooperation (SAARC) secretariat, technical committees, forums in the area of facilitating cross border electricity trade.

Implementation Provisions: Coordination Groups

The coordination groups/ standing committees can work under the South Asian Forum of Transmission Utility (SAFTU).

Design Coordination Group

- The Design Coordination Group would prepare the Detailed Project Report on the basis of various activities like detailed survey of the routes of transmission lines, assessment of size & location of substation land, finalization of the details of design parameters of the substations and transmission lines etc for cross boarder trade.

Project Monitoring Group

- The project monitoring group would monitor different milestones of the project after completion of DPR. The detailed activities need to be monitored include tendering activities, forest and environmental clearances, acquisition of land for substation, construction of the project, commissioning of the project etc.

Operation and Maintenance Coordination Group

- The Operation and Maintenance Coordination Group needs to be constituted for smooth operation and maintenance of the interconnecting project after its commissioning. The scope would also include maintenance of associated communication facilities, coordination of protective devices, maintenance coordination etc.
  - Operation and Protection Coordination Group
  - Commercial Coordination Group

Co-ordinating Agency for Planning

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Thank You

Annexure IV

Brief Questionnaire
On

1 PLANNING GUIDELINES

2 CONNECTION GUIDELINES

3 OPERATING GUIDELINES

4 SCHEDULE & DISPATCH GUIDELINES

Brief Questionnaire

3 PLANNING GUIDELINES

3.1 Planning Philosophy

1. *Member countries may enable the transmission planning agencies of the respective Governments to prepare master plan in the interim.*
   - Can Bangladesh's transmission planning agency be given the authority to involve in the preparation of Master Plan until a planning body is set up?

2. *The planning body set up under the aegis of SAARC shall undertake the responsibility of preparing the Master Plan in the future.*
   - Is it acceptable to set up a common Planning Body consisting of all the stakeholders from member countries under the guidance of SAARC or should the planning committee be a bi-lateral or multilateral member countries on case to case basis?

3. *The Master Plan shall be formulated with the planning horizon of at least 10 years.*
   - What is the current planning horizon followed in Bangladesh?
   - What is the current planning approach/procedures?

4. *It shall be reviewed every alternative year.*
   - How frequently is the Master plan reviewed in Bangladesh presently?

5. Following are the inputs required for preparing Master Plan.
   - Can all the following information be shared?

Data	Yes or No (Remarks, if NO)
Energy trade requirements	
Existing and proposed interconnections	
Generation Capacity	
Generation forecast (Conventional and Renewable)	
Generator parameters (Capacity, Auxiliary capacity, Ramping etc)	
Generator economic variables (fuel cost, cost curves)	

Load growth of past 3 years	
Demand forecast (Annual and seasonal)	
Demand projections for future years	
Inter region and inter country fixed flows	
Planned outage schedule	
Renewable production	
Wind/solar profiles or cold/heat spell	
Reserve Mechanism	
Scheduled maintenance	
Loading of system elements	
Existing remedial schemes	
Protection Schemes	

6. *In the AC interconnection (synchronous), the reactive power flow shall be minimized and shall be operated within 0.97 lead/lag power factor at connection point and within permissible voltage variation.*
    - Is this limit acceptable? What are the PF and Voltage limits in Bangladesh for planning studies?

7. Appropriate communication system for cross border substations along with real time data for planning studies.
    - Opinion of Bangladesh on the same

8. Cross border master plan guidelines are for planning of cross border flows but not imposed on country grid code or master plan.
    - Opinion of Bangladesh on the same
    - Is it acceptable if the country grid code also aligned with the Cross border master plan guidelines to have consistency?

3.2 Transmission Planning Criteria

9. *During planning, a 20% margin shall be kept in the transformer loading limits. The emergency thermal limits for the purpose of planning shall be 100% of the rated thermal limits of the equipment. At the planning stage, a margin of about ±3% may be kept in the voltage limits.*
    - What are the existing loading limits and margin followed by planners? Is thermal limits with adequate compensation (series compensation, shunt compensation with capacitors or SVC or Statcom) acceptable?

- Is 20% margin acceptable?

10. *The permissible voltage limits during normal and emergency condition shall be ±5% and ± 10% respectively. The steady state frequency limits shall be +0.05 Hz to -0.1 Hz. The instantaneous frequency limits shall be ±0.8 Hz.*
    - Can these limits be adhered to?

11. *Reliability criteria for N-0, N-1 and N-1-1 contingency*
    - Is it acceptable for Bangladesh for reliability criteria as detailed in draft guidelines?

12. *The system shall be capable of withstanding the loss of most severe single system infeed without loss of stability.*
    - Can the Bangladesh's grid system withstand the loss of most severe infeed?

3.3 Planning Data

13. *"Network stress tests" shall be performed on each planning case and specific technical planning criteria shall be followed on the basis of long term engineering practice.*
    - Can all necessary data for accurate modeling of the system is available?

14. *To bring the system parameters back within their normal limits, remedial actions like load shedding/ re-scheduling of generation may have to be applied either manually or through automatic system protection schemes (SPS). Such measures shall generally be applied within one and a half hour after the disturbance.*
    - Would Bangladesh be willing to adopt the remedial actions suggested by the planning committee?

15. *Operators of interconnected systems are obliged to monitor the N-1 principle not only for their own grid but also for the tie lines to neighbouring grids.*
    - Will this extended responsibility area be monitored by Bangladesh's operators?

16. *All the external elements with an influence on the responsibility area higher than a certain value, called the observability influence threshold, constitute the external observability list.*
    - Is there any reservation in sharing (network and equipment data) of surrounding areas? Can the information be shared/ disclosed?

17. *Every element participating in the system power flow directly or indirectly shall be modeled, down to 400 kV (or 500 kV) and secondary side of the 400 kV (or 500kV) sub-station. In case of relevance, a suitable portion of 220 kV or 230 kV or sub-transmission systems may be considered if it impacts the cross border power flow.*
    - The modeling would require the detailed parameters of all equipments connected at this voltage level. Is it acceptable?

3.4 Data for Generation Planning

18. *Following data is required to perform the generation planning for cross border transactions (if required). Your views on the same?*

Data	Remarks
Historical hourly load data	
Load forecast	
Capacity of the interconnections	
Transmission Losses	
Monthly energy and capacity available	
Unit installed capacity, auxiliary consumption	
Fuel / Water Availability	
Unit Forced Outage and Maintenance rates	
Retirement/ rehabilitation plan of current generating units	
Committed and planned imports/exports: Capacity of the interconnections; Transmission Losses; Monthly energy and capacity available; and Fixed and variable tariff, O&M cost if any	
Committed and planned base and peak thermal & hydro data: Technical characteristics, O&M costs, firm & average monthly capacity and energy available, capital cost data, gestation periods, cash flows, construction period.	

19. *Reliability of the system*
    - LOLP of 2% (168 hours of loss of load per year is allowed) or 0.2% (17 hours of loss of load per year is allowed) is acceptable for supply quality in Bangladesh.

ADDITIONAL PLANNING GUIDELINES

20. *Reactive power compensation: It is important to find the import and export of MVAr at cross border connection points and hence to perform reactive power studies and to provide the required recommendations like connecting reactive power compensation devices.*
    - Opinion on the reactive power compensation on transmission system

Brief Questionnaire

4 CONNECTION GUIDELINES

4.1 Procedure for Connection

1. *Transmission Company, new power generating modules or demand facilities intending to seek cross-border interconnection shall submit an application to respective authority mentioned in the grid code or any other relevant regulations.*
    - Who should be the relevant authority for approving cross-border connections in Bangladesh? Is it BPDB or PGCB?
2. *The owner of the site shall fill in the required information in the installation document and submit it to the relevant system operator or the designated agency.*
    - Can system operator be entrusted with the responsibility of collecting the necessary forms from the owner of a new connection?
3. *The joint planning committee of the respective national transmission utilities shall provide clearance for new or modified arrangement of connection with the cross border links.*
    - Your views on the same?

4.2 Connection Agreement

4. *The connection agreement shall be mandatory between the applicant and the national transmission utility of the country in which the applicant is situated and also between the national transmission utilities of the member countries where cross border link is situated.*
    - Should the agreement be only with the authority of respective country or with all concerned countries?

4.3 Important Technical Requirements for Connectivity to Grid

5. *Respective country power authority need to ensure reactive power requirements is kept at bare minimum (within lead/lag 0.97 power factor and operated within the grid code voltage level) with adjacent synchronously connected member's power system so that voltage profile is within the stipulated limits.*
    - Should it be the responsibility of only the respective country's power authority to monitor the connections in the country or should all the countries getting affected have a say in it? Anyhow, the other countries have mutually agreed cross border operation guidelines, which, if complied, should be sufficient.

Considering this, can connection guidelines be under the control of only the respective country's power authority?

6. *It is recommended that all relevant information shall be exchanged between the cross border interconnected countries through communication data channels, preferably on a common platform, in accordance with the grid code:*
   - Can the necessary data be exchanged over a common platform?
7. *All member countries shall have in place, a cyber-security framework to identify the critical cyber assets and protect them so as to support reliable operation of the grid.*
   - Does a cyber-security framework exist?
   - If yes, will it work for cross-border trade? If no, can it be brought in place?
8. *The concerned national transmission utilities shall mutually decide the maintenance procedure and time and coordinate the maintenance activity to minimize outage time at initial stage. In long term the independent authority or coordination forum can be identified to monitor and permit the outage. The designated transmission agencies are only authorized to carry out the maintenance work.*
   - Is coordinated maintenance activity acceptable and feasible?
   - In future, should the coordination forum take up this responsibility or should it continue to remain in control of the national transmission utilities?

4.4 Additional Connection Guidelines

9. *At the point of Interconnection, acceptable range of operating voltages shall be ±5% for 400 kV and above transmission voltage levels but all the connected equipment shall withstand the voltage variation of ±10%. Recommended frequency band of operation of synchronised interconnection shall be within 49.9 Hz to 50.05 Hz but all the connecting equipment shall withstand the following frequency profile:*

Frequency	Time period for operation
47.5 Hz – 48.5 Hz	90 minutes
48.5 Hz – 49.0 Hz	To be defined by each system operator, but not less than the period for 90 minutes
49.0 Hz – 51.0 Hz	Unlimited
51.0 Hz – 51.5 Hz	30 minutes

   - Your views please.
10. *At the point of Interconnection, acceptable range of operating voltages shall be ±5% for 400 kV and above transmission voltage levels but all the connected equipment shall withstand the voltage variation of ±10%.*
    - Is the proposed limits is adequate?

11. *The coordination forum or the planning committee shall provide minimum and maximum short circuit level of the interconnecting substation of cross-border link for various possible scenarios*
    - Can it be by coordination forum or planning committee of respective country? Which will be fine for Bangladesh point of view?

4.5 Ownership and Location of Meters

12. *It is recommended that Energy Accounting and Audit functions shall be carried out by coordinating forum or the planning committee (as per planning guidelines) or separate agency as required.*
    - Should this forum be one of the existing committees or a separate SAARC entity?

4.6 Installation, Operation, Testing and Maintenance of Meters

13. *The accuracy of main and check meters shall be 0.1% at cross border interconnection substations. The accuracy of the CT and PT shall be 0.2% class.*
    - Is this recommendation is ok for Bangladesh?
14. *Meter reading and recording functions shall be carried out by coordinating forum or the planning committee (as per planning guidelines) or separate agency as required.*
    - Should this forum be one of the existing committees or a separate SAARC entity?
15. *During failure of a meter, the billing for the failure period of the meter shall be done as per the procedure laid down by the Appropriate Commission.*
    - The appropriate commission in this regard can be South Asia Forum of Infrastructure Regulator (SAFER) or new forum of South Asia Electricity Regulator council?
16. *Meters shall be tested and recalibrated at least once every two years as per the agreement among member countries.*
    - What is the present frequency of testing the meters?

4.7 Protection Requirements

17. *Protection schemes relevant for the power generating module and the network shall be coordinated and agreed between the relevant network operator and the power generating facility owners.*

- Your views please

18. *Simulation studies for steady, dynamic transient states for a transmission connected demand facility shall be carried out by the coordinating agency or planning committee (as per planning guidelines) and the relevant details shall be furnished by the designated transmission agencies of member countries that are connected through interconnection point.*
    - Should the studies be carried out by a coordination agency or planning committee?
19. *Fault Recorders at Generator and Transmission facilities shall be shared with member countries in specified format for post-mortem which is necessary to find the solutions for system security.*
    - Is it fine with respect to Bangladesh?
20. Protection Scheme Devices Of Demand Facilities Shall Cover –

    External and internal short circuit;

    Over- and under-voltage at the connection point;

    Over- and under-frequency;

    Demand circuit protection;

    Unit transformer protection; and

    Backup schemes against protection and switchgear malfunction.
    - What are protection schemes are available at present in Bangladesh power system? Are the above list is acceptable for Bangladesh?

4 OPERATING GUIDELINES

4.1 Operating Philosophy

21. *The operating procedures followed by the respective countries shall be retained to the extent that it would not interfere with the cross border transaction. If any provision impact cross-border trade then the regulations given in this guidelines would be applicable.*

4.2 System Security Aspects

22. *No important element of the interconnected grid shall be deliberately opened or removed from service at any time except during emergencies. The list of such important grid elements on which the above stipulations apply shall be prepared and published in advance.*

23. *Any prolonged outage of power system elements shall be reported to the other regional heads. The regional heads defined for these guidelines include the head of designated transmission company or head of the system operator of specified country or head of the regional co-ordination forum or head of coordination forum.*
    - Whether head of BPDB or PGCB be designated as region head?
24. *The operator shall classify the current operating condition of its transmission system under one of the five operating states in real time (1. Normal state, 2. Alert state, 3. Emergency, 4. Black-Out state, 5. Restoration).*
    - Does Bangladesh follow five operating states? If not, would it be able to adhere to this guideline by making necessary changes to their operating guidelines?
25. *It shall be mandated that all thermal and hydro generating units, that have the capability to impact the grid considerably, shall be equipped with tuned PSS for effective damping of oscillations. All units shall have their AVRs in operation.*
    - Would this mandate get accepted by the generating units of Bangladesh? Any Technical or operation issues at present or future?

26. *The system security limits shall be fixed as follows:*

	Normal	Alert	Emergency
Voltage (400, 500 & 765 kV)	± 5%	± 5%	± 10%
Frequency – for synchronously interconnected system	Nominal: 50Hz Steady state limits: +0.05Hz to -0.1Hz Instantaneous limits: ± 0.8Hz	Exceeds steady state limits for upto 10 mins	Exceeds steady state limits for >10 mins up to 20 mins
Equipment loading	Within Limits	Within Limits	Exceeds limits of short term overload

- Can these limits be adhered to?

27. *In the initial development process, it is recommended to plan for special protection system (SPS) to prevent cascading with the outage of cross-border links. The SPS can be planned with hard-wired control either to demand facility or generation facility to limit the unintended power flow leading to overloads or drop in frequency.*
    - What is the current protection scheme followed? Will a SPS be required and possible?
28. *The protection strategy and concepts shall be reviewed every five years. After every protection operation even if the impact is outside of its own responsibility area, each operator shall assess whether the protection system in its area worked as planned and shall undertake corrective actions if necessary.*
    - What is the current frequency of review of protection strategy? Is the expertise available to reassess the efficiency of the strategy after every protection operation?
29. *At the connection point, respective agency shall be vested to prepare and review protection schemes according to the adopted standards in line with Article 10 of SAARC Framework Agreement for Energy Cooperation (Electricity) which states that member countries shall enable joint development of coordinated network protection systems incidental to the cross-border interconnection to ensure reliability and security of the grids of the Member Countries.*
    - What is the mechanism being followed by Bangladesh for interconnection with India?

4.3 Demand Estimation for Operational Purposes

30. *The monthly estimated demand shall be shared with the operation planning authorities.*
    - Can this information be gathered/projected and shared?

4.4 Congestion Management

31. *Commercial principle for congestion management*
    - Are there any congestion relieving mechanisms procedures exist? If not any guidelines already planned to take care of congestion? Is the proposed congestion relieving is fine?

4.5 Periodic Reports

32. *Quarterly, Monthly, Weekly and Daily reports shall be prepared and made available on a platform common to all entities. The reports shall include:*

    ***Daily Report** - performance of the cross border transaction shall be prepared which shall also include the variable power generation (wind and solar) and injection in to grid*

    ***Weekly Report**- Frequency & Voltage profile of cross border substations, Major Generation and Transmission Outages, Transmission Constraints, Instances of persistent/significant non-compliance, Instances of congestion in transmission system, Instances of inordinate delays in restoration of critical transmission elements and generating units*

    ***Monthly Report**- performance of the interconnected grid pertaining to cross border transaction*

    ***Quarterly Report**- system constraints, reasons for not meeting the requirements, if any, of security standards and quality of service, along with details of various actions taken by different persons, and the persons responsible for causing the constraints*
    - Can such a report be furnished to all entities and also in public domain?

4.6 Operational Liaison

33. *Following data may need to be exchanged between cross borer system operators:*

	Description	Sharable (Yes or No)
General Structural Information	Substations' regular Topology and other relevant data by voltage level	
	Transmission lines	
	Transformers connecting the DSOs, Demand Facilities or Power Generating Facilities	

	Maximum and minimum active and reactive power of Power Generating Modules	
	Phase-shifting transformers	
	High voltage DC lines	
	Reactors, capacitors and static VAR compensators	
	Operational security limits	
	Type of regulation concerning tap changers	
	Voltage regulation range	
	Regarding HVDC lines and FACTS devices, the Dynamic models of the device and its associated regulation suitable for large disturbances	
	Topology of Transmission system >= 400 kV	
	Model or Equivalent of Transmission system <400 kV having significant impact on its transmission system	
	Protection Set-Points of the lines included as external Contingencies in neighbouring operator's Contingency Lists	
Generator specific structural data for Dynamic Stability Analysis	Electrical parameters of the alternator suitable for Dynamic Stability Analysis, including total inertia	
	Protection models	
	Step up transformer description	
	Minimum and maximum Reactive Power	
	Prime movers and excitation system models suitable for large disturbances	
Scheduled Data	The forecasted aggregate sum by primary energy source of injection and withdrawal in every node of the Transmission System for different timeframes	
Real time data between all other operators via an IT tool	Frequency	
	Frequency Restoration Control Error or an equivalent parameter	
	Measured Active Power exchanges between LFC Areas	
	Aggregated generation infeed	
	System state	
	Set-value of the FR controller	
	Power exchange via the Virtual Tie-Lines	
Real time data only between operators within its observability area	Actual substation Topology;	
	Active and Reactive Power in line bay, including transmission, distribution and lines connecting Significant Grid User	
	Active and Reactive Power in transformer bay, including transmission, distribution and Significant Grid User connecting transformers	
	Active and Reactive Power in Power Generating Facility bay	

	Regulating positions of transformers, including phase-shifting transformers	
	Measured or estimated busbar voltage	
	Reactive Power in reactor and capacitor bay or from a static VAR compensator	
	Restrictions on Active and Reactive Power supply capabilities with respect to the Observability Area	

4.7 Outage Planning

34. *An outage coordination region shall be formed by grouping responsibility areas based on the extent of interconnection, for an efficient coordination. A coordinated availability plan shall be developed among the responsibility areas forming an outage coordination region.*
    - Would Bangladesh have just one or more responsibility areas?
35. *The annual outage plan shall be reviewed on monthly basis.*
    - Does Bangladesh follow an outage plan? If so, how often is it reviewed and updated?

4.8 Recovery Procedure

36. *Detailed plans and procedures for restoration of the grid under partial/total blackout shall be developed and reviewed / updated annually.*
    - Are there any recovery plans framed in Bangladesh?
37. *List of generating stations with black start facility, inter-country ties, synchronizing points and essential loads to be restored on priority, shall be prepared*
    - Can such a list be shared on the common platform?
38. *A common entity shall be appointed as the resynchronization leader who shall be responsible for coordinating with the regional heads during the resynchronization process of two neighbouring areas.*
    - In the event of blackout, a resynchronization leader coordinated the recovery. Should this responsibility be entrusted to an existing committee or can be co-ordinated among the system operators or Can NLDC India can be designated as re-synchronizing leader being the largest grid?

4.9 Event Information

39. *Each operator shall provide the following information in due time for the purposes of System Defence Plan procedures and Restoration Plan procedures:*
    i. *To neighbouring operators:*

- *The extent and borders of the Synchronized Region or Synchronized Regions to which its Responsibility Area belongs*
- *Restrictions to operate Synchronized Region*
- *Active and Reactive Power limits at Interconnectors*
- *Other technical or organizational restrictions*

ii. *To the regional head:*

- *Restrictions to maintain Island Operation*
- *The available additional load and generation*
- *The availability of Operational Reserves*

➢ Can all these data be provided for restoration planning?

4.10 Coordination between system operators

40. *Different coordination forums shall be constituted to facilitate smooth operation of the cross-border links among the member countries.*

- ***Operation and Protection Coordination Forum**: The Operation and Protection Coordination Group would have members from the System Operators of participating Countries and protection team of respective transmission companies to look into various aspects associated with the operation of the cross border links, including any protection coordination issues.*
- ***Commercial Coordination Forum**: The Commercial Coordination Group would have members from the System Operators of the participating countries along with other stakeholders to look into all commercial aspects related to the operation of the cross-border links.*

Bangladesh's opinion on this? Are any more forums envisaged? What committees / entities / forums exist

5 SCHEDULE & DISPATCH GUIDELINES

5.1 Demarcation of Responsibilities

41. *The system operator shall have the following responsibilities:*
    i. *Have a control on its Generation & load to maintain interchange schedule and regulate frequency.*
    ii. *Monitor the operation of all generating stations in a control area w.r.t their availability declaration and injection schedule, switching instructions, metering and energy accounting, outage planning, etc.*
    iii. *Schedule & dispatch their generation, regulate their demand and schedule & regulate their power import from cross border links.*
    - Any issues in the above demarcation? If any additional points to be considered
42. *The member country entities shall ensure that their automatic demand management scheme acts to ensure that there is no over drawl when frequency is 49.5 Hz or below.*
    - Does Bangladesh have an automatic demand management scheme at present?
    - If not, can it be taken up in near future?
    - Which entity shall be responsible for demand management? Respective System Operator to co-ordinate with Distribution entities?
43. *Deviations, if any, from the schedules shall be appropriately priced. In addition, deviations, from schedules causing congestion, shall also be priced accordingly.*
    - Should these deviation prices be set based on bi-lateral agreement or should the deviation price be set by the SAARC's operation coordination group or a similar forum?
44. *The coordinating forum shall be responsible for computation of actual net injection/drawal of on the cross border link, 15 minute-wise, based on the above meter readings.*
    - The coordinating forum shall comprise of members of all SAARC nations or should a forum be formed for each bilateral member countries? Or should it be a common 3rd party entity under SAARC umbrella?

5.2 Schedule & Dispatch

45. *Till the development of secure cross border scheduling mechanism, it is recommended to follow the Indian scheduling and Dispatch timeline for the day-ahead schedule, as tabulated below:*

Time	*Activity*
0800 hrs	*Member country Load Dispatch Centres shall compile their foreseen MW and MWh generation capabilities for the next day and submit the cross-border power transfer, i.e., from 0000 hrs to 2400 hrs of the following day to the coordinator heads.*
1500 hrs	*Member country Load Dispatch Centres shall compile their foreseen load pattern for the next day and submit revised cross-border power transfer to the coordinator heads.*
1800 hrs	*All coordinator heads together or a scheduling authority decides the best dispatch and drawal schedule for cross border interconnection and each coordinator head conveys the net dispatch schedule and the net drawal schedule through cross border interconnecting to each member country load dispatch centres under its control.*
2200 hrs	*Any modifications in load or generation shall be brought to the notice of the coordinator head by the member country dispatch centre.*

- Is this acceptable? If not, alternative suggestions / modifications?

46. *Transmission Losses will be apportioned between two countries based on a mutually agreed methodology. Transmission System Losses would be borne in kind by the utilities as per the quantum declared by the concerned System Operator for the respective area of jurisdiction in the interim i.e., the injecting utility (seller) would have to inject more power to compensate the losses and the drawee utility (buyer) would draw less power to compensate for the losses.*
    - Does Bangladesh have any recommended methodology? Or is the recommended methodology of injecting more & drawing less power to cater for the losses, acceptable? Or the alternate suggested for compensating losses through separate fund would be appropriate?
47. *The power traded over the cross border links would normally be treated as a 'must run' and thus would not be subject to revision/curtailment except under conditions which pose threat to the system security of either of the participating countries.*
    - Under this condition for any failure of one generator, can Bangladesh maintain constant power through cross border links? Any alternate point of view?
48. *It is initially envisaged to begin with bilateral contracts, gain experience and gradually ramp up to allow procurement/sale of power through the Power Exchange(s) operating in India.*
    - What is Bangladesh's view on this?

5.3 Deviation Settlement

49. *The concerned utility operating the substation at either end of the cross-border interconnection shall install special energy meters on all interconnections between the countries for recording of actual net MWh interchanges and MVArh drawals on a 15-minute basis. The installation, operation and maintenance of special energy meters shall be in accordance with prevailing Regulations in the respective countries and through mutual agreement.*
    - What is Bangladesh's regulation on installation, operation and maintenance of meters?
    - Can the same regulation be extended to cross-border power trade?
50. *A mutually acceptable and suitable mechanism for settlement of the deviation from schedule (imbalance) on the Cross Border Link along with payment mechanism needs to be evolved.*
    - Is there a specific settlement deviation and payment mechanism envisaged?
51. *Transmission charges for wheeling of power up to the international interconnection for the international trade would be borne by both the buyer and the seller as per the prevailing methodology in the respective country.*
    - Is this acceptable? Or is there a better mechanism to share the wheeling charges?

5.4 General Guidelines

52. *The System Operators/Licensees shall publish a general scheme for calculation of the interconnection capacity for different timeframes based on the electrical and physical realities of the network. The values of these interconnection capacities shall be published together with the corresponding technical assumptions in open and public document and shall be submitted for the approval of respective Regulators.*
    - What is the current methodology of calculating Total Transfer Capability (TTC), Transmission Reliability Margin and Available Transfer Capability (ATC)?
    - If no methodology is presently followed, is the proposed procedure for ATC in draft guidelines fine?
    - Can this methodology be shared in the common platform?
53. *Cross-border transmission capacity calculations require Load Flow calculation using widest possible Network Model (full representation of network elements).*
    - Which entity shall be responsible to calculate the TTC? Should it be the system operator or the transmission licensee?

5.5 Congestion Management

54. *Coordinator shall regularly evaluate the congestion management methods, paying particular attention to compliance with the principles and rules by running dedicated studies.*
    - Would these studies for congestion assessment be executed by System Operator? If not, who is the responsible entity?
55. *Congestion charges shall be applied if violation of TTC limits persists for 2 time-blocks not counting the time-block in which warning notice was issued and no affirmative action is taken by the defaulting agency. Congestion charge shall be withdrawn after the power flow on the affected transmission link has come down to the ATC and remains at this level for one time block.*
    - Is this acceptable?

5.6 Charges for Losses

56. *In order to ensure cross border power trade, the guidelines shall establish an inter-transmission system operator compensation mechanism as a stable basis for the fair compensation to transmission system operators for the costs of hosting cross-border flows of electricity. Such compensation shall be based on an estimate of what losses would have been incurred in the absence of transits of electricity. In the long term, a fund shall be established to compensate transmission system operators for the energy losses incurred. The fund may be referred to as Cross Border System Operator Compensation (CBSOC) Fund.*

    An agency shall be established comprising of representatives of all participating countries and shall be made responsible for establishing arrangements for the collection and disbursement of all payments relating to the CBSOC Fund, and shall also be responsible for determining the timing of payments.

    The system operators shall contribute to the CBSOC fund in proportion to the absolute value of net flows onto and from their transmission system as a share of the sum of the absolute value of net flows onto and from all transmission systems.
    - Opinion on establishing CBSOC fund?