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15 Integrated Research and Action for Development

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

Theme Presentation

Session-IV

"Need for Coordinated Interconnection Transmission Planning and for Technical Institutional Mechanism in South Asia for Secure Reliable Grid Interconnection"

Rajiv Ratna Panda

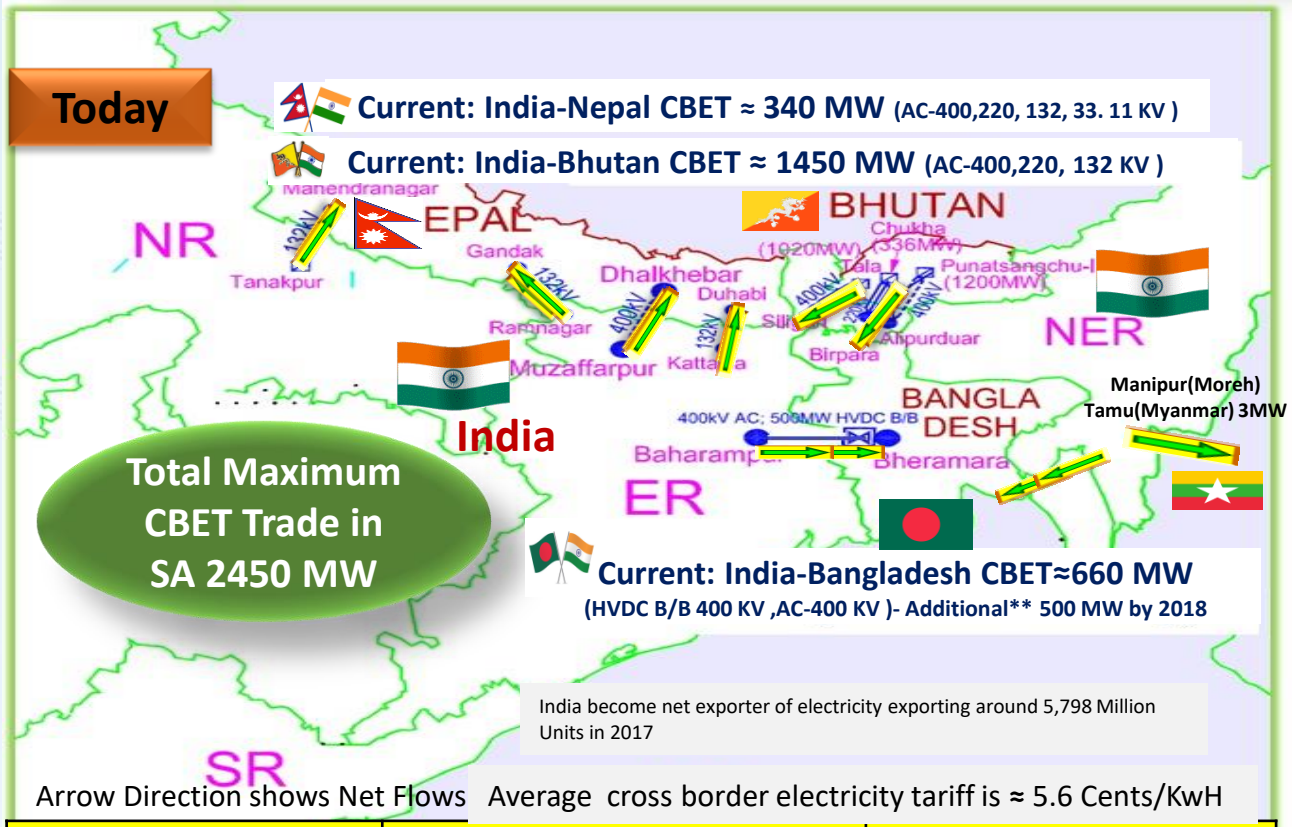
Regional Conference on Energy Cooperation & Integration in South Asia

30th-31st August'2018, Hotel Le Meridien, New Delhi

Outline

- Current and Future Cross Border Transmission Interconnections.
- Current Scenario of Coordinated system planning & operation in South Asia.
- SARI/EI Work on harmonisation of Grid codes, operating procedures & standards for Cross Border Electricity Trade.
- International Best Practices on Associations/Forums of regional technical institutional mechanism for system planning, operation.
- Some Points for Discussion.

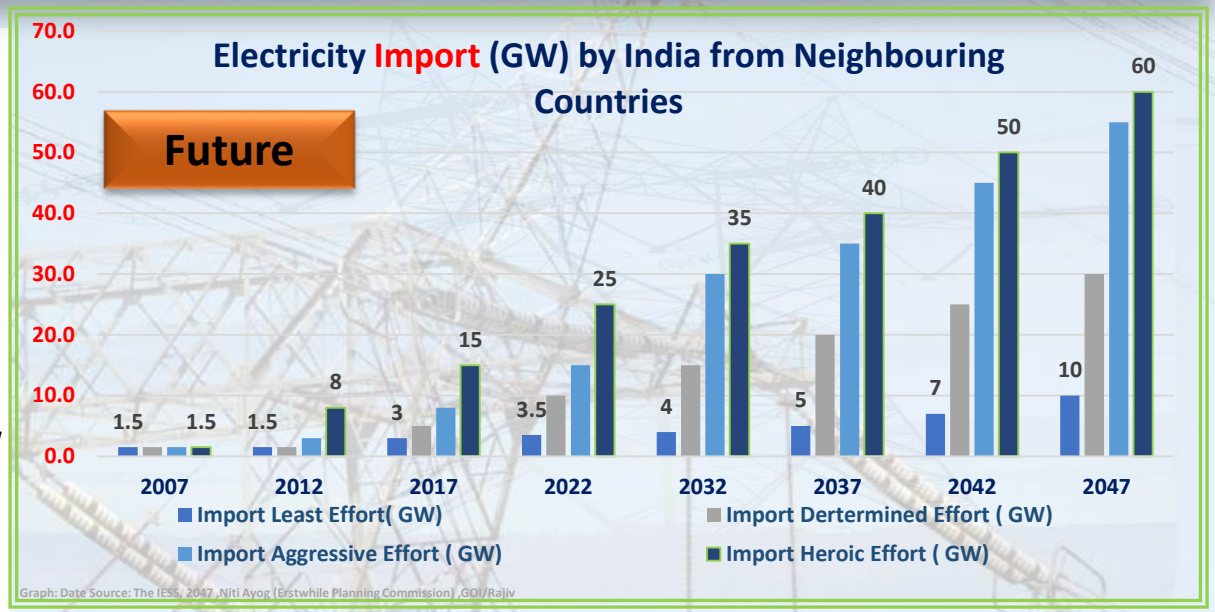
Current and Future Cross Border Transmission Interconnections

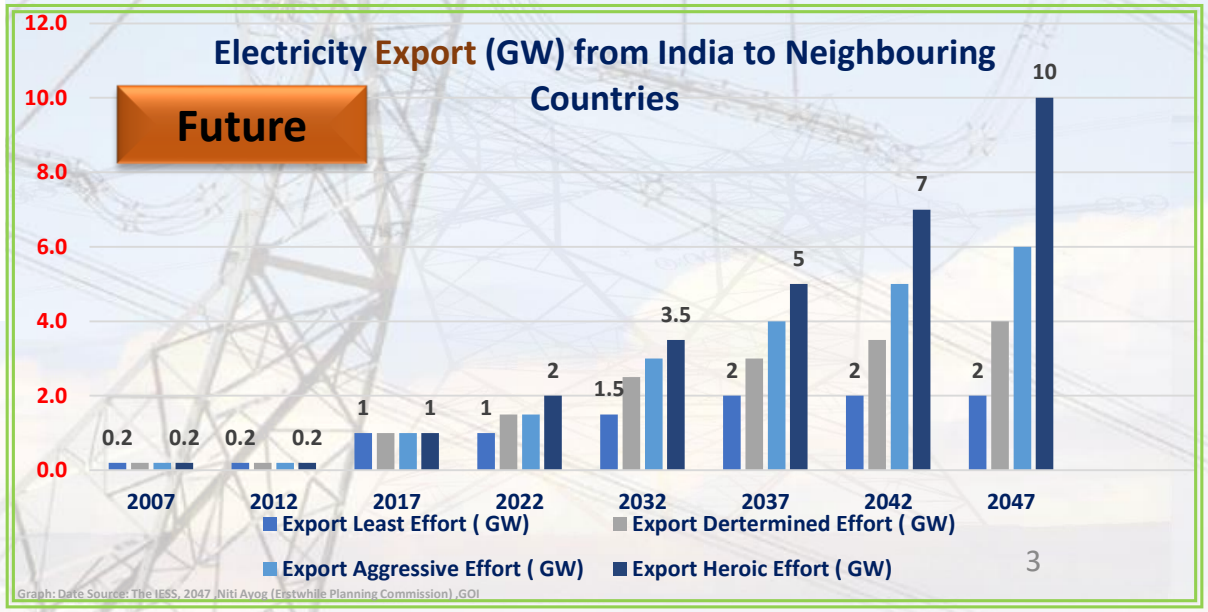


Bhutan→ India	India→ Bangladesh	India→ Nepal
• Tala: 1.80 INR/kWh for 1st year (now 1.98 INR/kWh) **(0.003 US$/KWH)** • Dagachhu: 2.40 INR/kWh for 1st year (started in 2015) **(0.04 US$/KWH)**	• NVVNL: 2.40-2.86 INR/kWh (Aug'14-May'15) **(0.04 US$/KWH)** • PTC: 4.26-5.00 INR/kWh (Dec'13-May'15) (0.071 US$/KWH) • Tripura-Bangladesh Rs 5.50 per unit **(0.091 US$/KWH)**	• Treaty/Bilateral: Current 5.40 INR/kWh **(0.09 US$/KWH)** • PTC: 4.55, 4.35, 4.30, 3.75 INR/kWh (FY11-14) • NVNL-NEA PPA (160 Mw) INR/kwh 3.60 **(0.05 US$/KWH)**

Source: Compiled from various resources, News Paper articles etc.

* Total maximum transfer capacity of lines



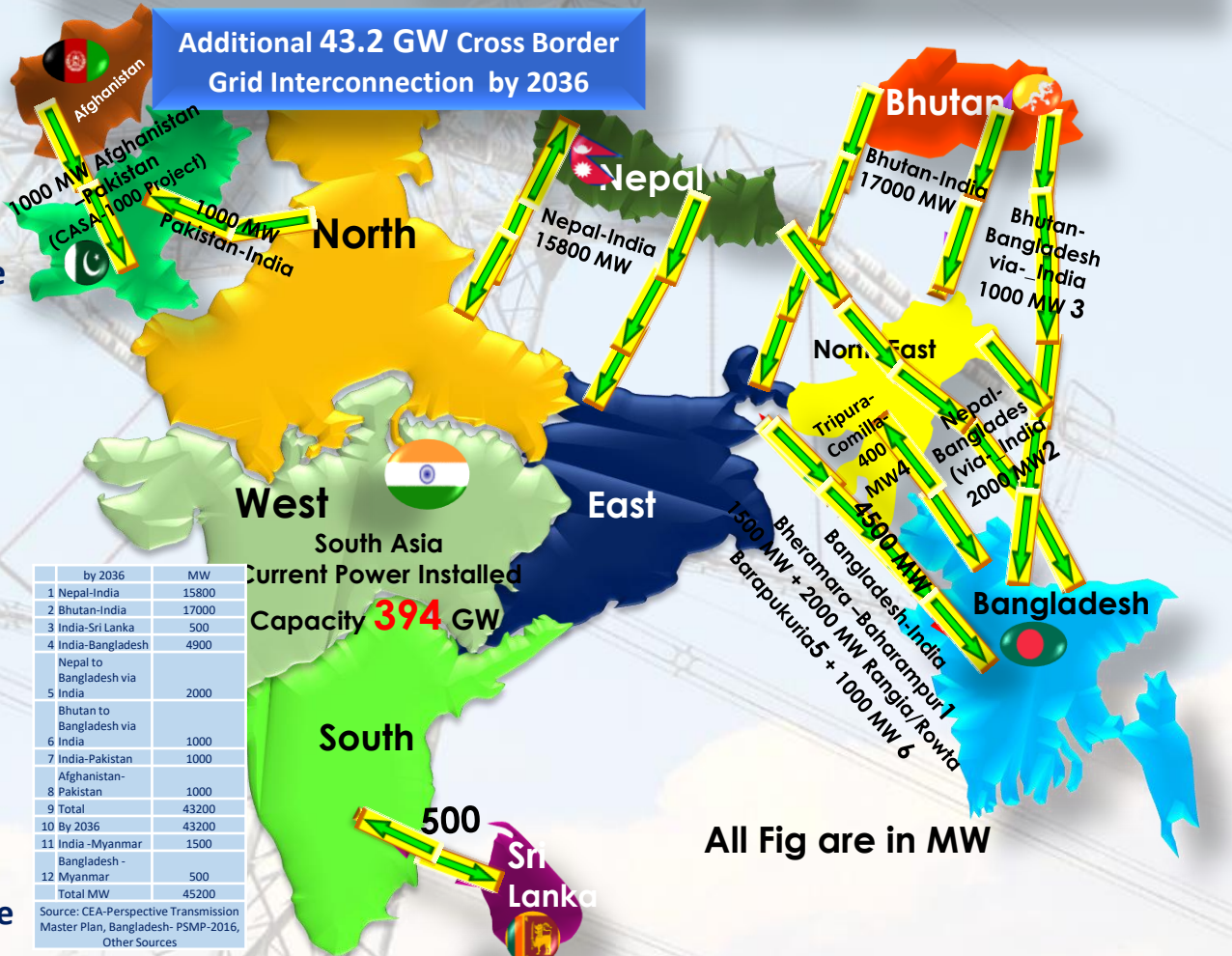


** https://www.dhakatribune.com/bangladesh/power-energy/2018/05/17/500mw-to-be-imported-from-india-in-june

Big Picture -South Asia Cross Border Transmission Capacity by the year 2036/2040

- Significant Transmission System Interconnection (Both AC and DC) are Planned and Proposed.
- 43.2 GW additional Cross Border Transmission Inter. Capacity by 2036.
- Large scale hydro power development in Bhutan and Nepal and Renewable Energy (175 GW by 2022) In India.
- Additional 500 MW capacity (India-Bangladesh) by 2018.
- India-Bhutan: - Mangdechhu -720 MW by November,2018
  - 1,200 MW Punatsangchhu-I Hydroelectric Project likely to be completed by Mar'2022 and
  - 1,020 MW Punatsangchhu-II Hydroelectric Project likely to be completed by Mar'2021
- By the end of 2018 – 2450+500+720= **3670 MW** South Asia Power trade
- By the end of 2022 – 3670+1200+1020= **5890 MW** South Asia Power trade

SOUTH ASIA POWER GRID



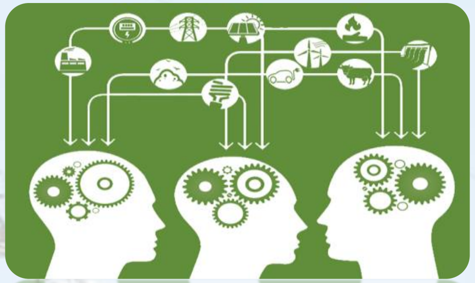
	by 2036	MW
1	Nepal-India	15800
2	Bhutan-India	17000
3	India-Sri Lanka	500
4	India-Bangladesh	4900
5	Nepal to Bangladesh via India	2000
6	Bhutan to Bangladesh via India	1000
7	India-Pakistan	1000
8	Afghanistan-Pakistan	1000
9	Total	43200
10	By 2036	43200
11	India -Myanmar	1500
12	Bangladesh - Myanmar	500
	Total MW	45200

Source: CEA-Perspective Transmission Master Plan, Bangladesh- PSMP-2016, Other Sources

Complied from CEA-Perspective Transmission Master Plan, Bangladesh- PSMP-2016, Other Sources 1Bangladesh-India Bheramara –Baharampur-Existing 500 MW
2 From Nepal 1,000 by 2030 Power import by using Case 3 T/L (upgrade to 765kV AC) and From Nepal (Purnea -Barapukuria), 1,000 by 2025, Power import by using Case 3 T/L (initially 400kV AC) **3** Bhutan-Bangladesh via-_India 1000 MW-Bongaigaon/Rangia -Jamarpur1,000 by 2030-Power import from Bhutan
4 400 MW by 2020 (100 MW existing) Construction of HVDC (500MW) in Comilla Construction of HVDC (500MW) in Comilla S/S. Some load (100 MW) in Comolia (N) S/S will be disconnected from Indian System **5** 1000 MW by2023 and 1000 MW by 2025 (Power Import Using Case 2 T/L (± 800KV HVDC) **6** 1000 MW by 2030 Bibiyana-Meghalaya (PSPP)
7 At the Proposal Stage , detailed planning to be done.

Source:- Bhutan Plant Schedules as per the http://cea.nic.in/reports/monthly/hydro/2018/bhutan-03.pdf

Importance of Coordination System Planning and Operation in South Asia



- **Power system integration in South Asia can bring potential large technical, operational, economic power system benefits in the Region.**
- **Coordinated system planning, operation is a very fundamental exercise for effective power system integration and expansion in South Asia.**

- **Ensure safe, secure and reliable South Asia power system integration and expansion.**
- **Importantly such coordinated consultative planning process also build a sense of consensus among the South Asian Countries.**
- **<u>In future, with large penetration of Renewable (wind and solar), changing energy mix, DSM, Smart Grid, Electric vehicles and storage calls for a more integrated and coordination planning for most economic & technical planning of power system</u>.**

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What are Current Institutional Mechanisms for Coordination System Planning and Operation

- Joint Steering Committee and Joint Technical Team at bilateral level among South Asia Countries which takes care for planning coordination.

- Joint Technical Team comes up with the various transmission interconnection option/feasibilities.

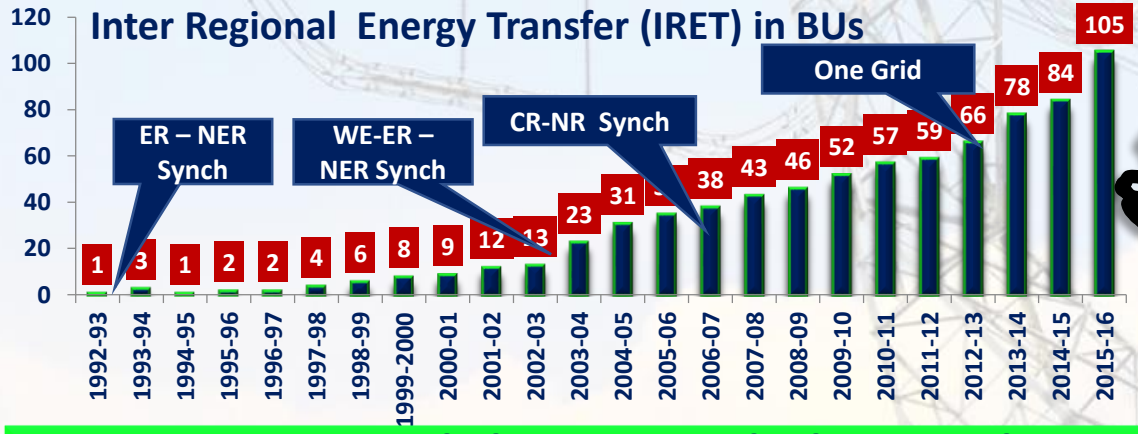
- System operation and scheduling and dispatch:- National and Regional Load Dispatch Centres coordinates among each other for cross border transactions.

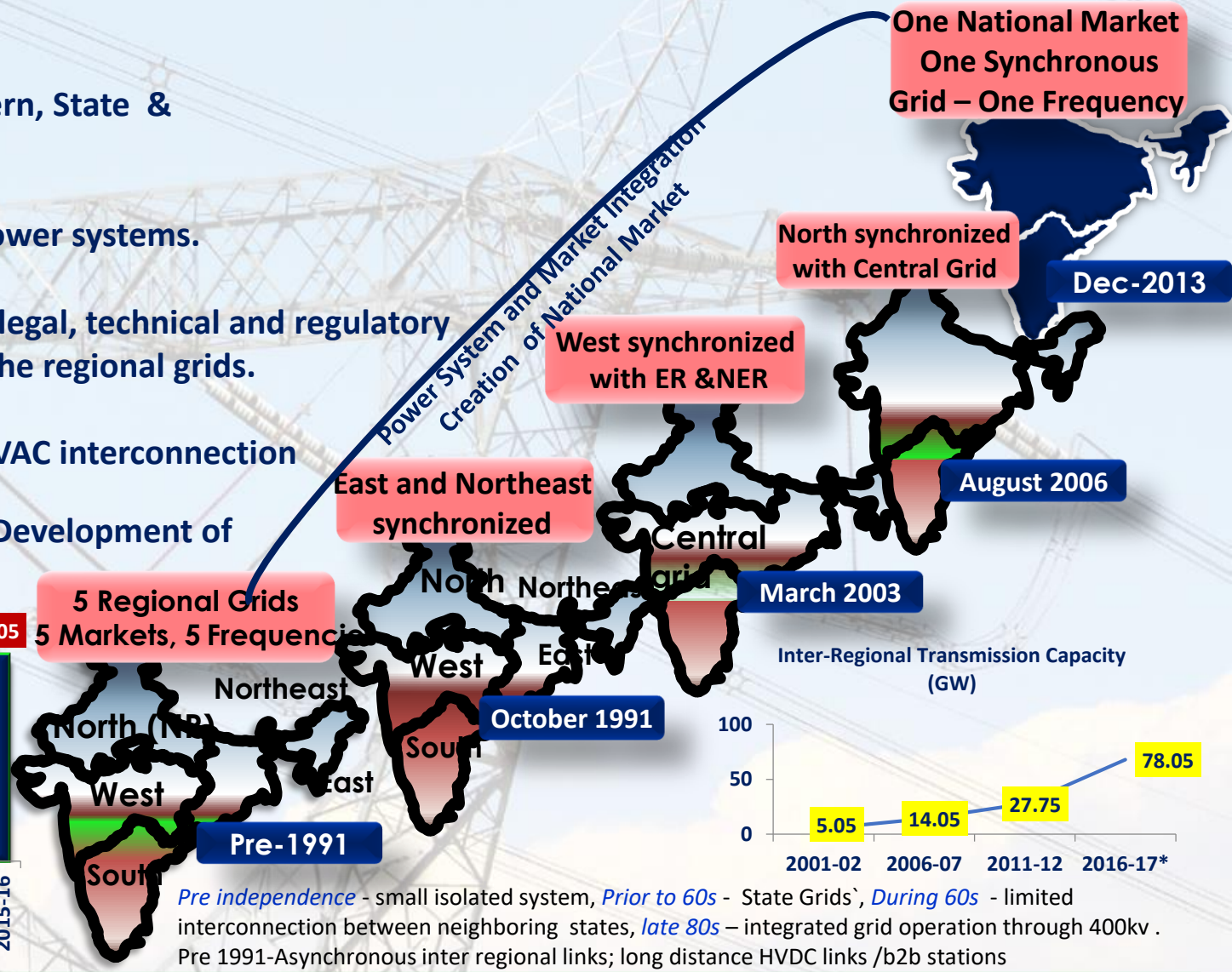
- Coordinated System operation and scheduling essential for secure and reliable South Asia grid.

Lessons from Experience inside the South Asia Region
India's Power System Integration Experience : It's Relevance in Regional Context

- Electricity in the Concurrent List.
- Both Centre and State have power to legislate and Govern, State & Centre's policy, regulation coexist (29 states).
- India had different regional grid i.e. different regional power systems.
- Considerable amount of Coordinated Harmonization at legal, technical and regulatory level happened over the years; successfully integrated the regional grids.
- Mix of HVDC (Bipolar , Back to back, Multi-terminal systems) and HVAC interconnection
- Integration of Regional Grid played the crucial role for Development of India's National Power Market.

Inter Regional Energy Transfer (IRET) in BUs





Inter-Regional Transmission Capacity (GW)

Pre independence - small isolated system, *Prior to 60s* - State Grids`, *During 60s* - limited interconnection between neighboring states, *late 80s* – integrated grid operation through 400kv . Pre 1991-Asynchronous inter regional links; long distance HVDC links /b2b stations

Systematic Regional Planning, Gradual Approach , Coordinated Harmonization- 9 BUs in 2002 to 105 BUs of IRET by 2016

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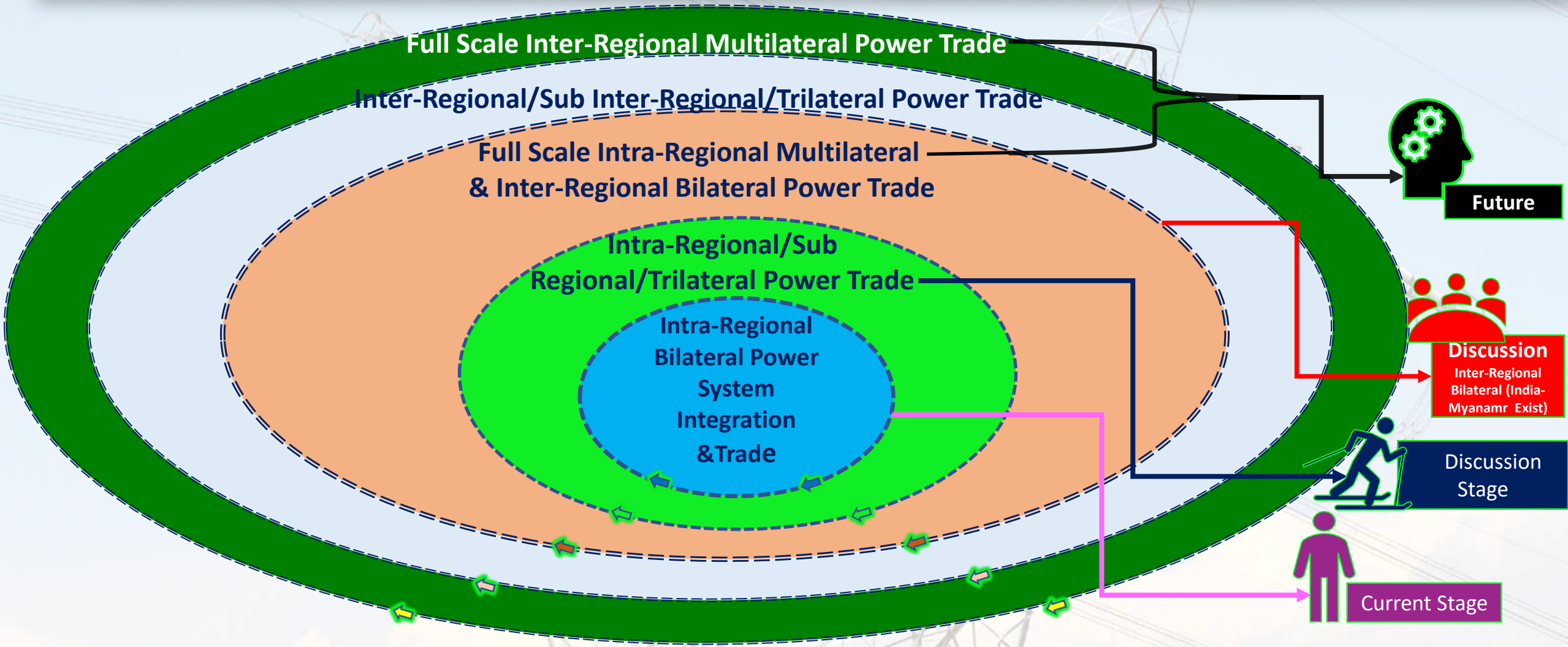
Stages/Evolutionary Nature for Power System Integration and Power Trade in South Asia



For long term sustainability of CBET and development of a regional transmission master plan needs to take in account Evolutionary Nature for Power System Integration and Power Trade in South Asia

SARI/EI Work on Harmonisation of Grid codes, operating procedures & standards for CBET

Why the Need for Harmonization of Grid Codes ?

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.

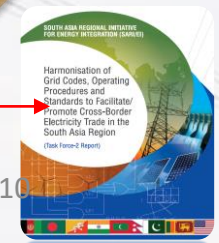
In case of asynchronous interconnection though may require less level of harmonization, the tripping of HVDC terminal would itself can constitute a disturbance in terms of loss of load or loss of supply at bigger level.

Framework Grid Code Guidelines (FGCG)

Background- ***Framework Grid Code Guidelines (Volume –III) is one of the outcome of the TF-2 study on Harmonization of grid codes, operating procedures and standards to facilitate/promote cross border electricity trade in the South Asia Region.***

Steps and Outcome of the Study

1. **Review of Existing Studies/ Literature/ Reports**
2. **Detailed Review & Analysis of Grid Codes of SAC and Gap Analysis**
   - Summary of the Gaps Identified on Planning, Connection, Operation, Scheduling & Dispatch, Metering etc.
   - Current status in member countries w.r.t to key aspects of Grid Codes i.e. Planning, Connection, Operation, Scheduling & Dispatch, Metering etc.
3. **International Regional Power Systems/Pools CBET. Review and Analysis of CBET Grid Codes, Technical Standards & Regulations.**
   - Europe-ENTSOe, North America-NERC, Southern Africa- SAAP
4. **Impact Analysis based on International Experience Review and Gap Analysis**
   - Critical Inference Drawn for South Asia based on analysis of International best practices in grid codes and impact analysis
5. **Framework Grid Code Guidelines**
6. **Implementation provision of Framework Grid Code Guidelines**
   - Recommended Institutional Mechanism for Implementation of Framework Grid Codes Guidelines SAC to promote CBET



Purpose : Framework Grid Code Guidelines (FGCG)

Purpose of the guidelines

Framework Grid Code Guidelines (FGCG)

Establish a clear technical and grid code framework for reliable , secure Electricity trading

Provides consistency across technical parameters, grid codes, standards, operating procedures

Provide roadmap for action & decision making for Relevant Authorities

The flexible nature of **Framework Grid Code Guidelines** and focus on specific aspects of CBET only, would permit both the **Framework Grid Code Guidelines** and the national regulatory framework and Grid codes to co-exist.

Framework Grid Code Guidelines (FCGC)

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

FGCG in the form draft Codes are in line with various article of SAARC Inter-Governmental Framework Agreement (IGFA) for Energy Cooperation with a view to provide actionability to these articles

- **Article 7 (Planning of Cross-border interconnections) , Article11 (System Operation and Settlement Mechanism)**
- **Article 10 (Electricity Grid Protection System) , Article 8 (Build, Operate and Maintain)**
- **Article 9 (Transmission Service Agreements), Article 12 (Transmission Access)**

Need for South Asia Technical Institutional Mechanism
International Best Practices of Technical Institutional Mechanism

entsoe
Reliable Sustainable Connected

European Union
ENTSO-E's responsibilities in enhancing the cooperation between its 41 member TSOs across the EU to assist in the development of a pan-European electricity transmission network

- Developed the Network codes on System operation, connection and capacity allocation etc.
- System Development Committee
- System Operation Committee
- Market Committee
- Research Development Committee

SAPP

Southern African Power Pool
Aim to provide the least cost, environmentally friendly and affordable energy and increase accessibility to rural communities.
It is a Inter-Utility organisation established through Inter-Utility MOU

- *Operational Subcommittee*
- *Planning Subcommittee*
- *Environment Subcommittee*
- *Operating Guidelines*
- *DAM Book of Rules*
- *DAM Legal Agreement*

pjm

PJM is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 States and the District of Columbia.

- *Operating Agreement*
- *Operating Committee (OC)*
- *Planning Committee (PC)*
- *Market Implementation Committee (MIC)*
- *Markets and Reliability Committee (MRC)*
- *Other Sub Committees and Task Forces*
- *Transmission Owners Agreement*

West African Power Pool

West Africa Power Pool: Integrate the operations of national power systems into a unified regional electricity market. Inter Utility Organisation, WAPP Utility Members (26)

- Engineering and Operating Committee (EOC)
- Strategic Planning & Environmental Committee
- Operation Manual-WAAP
- Regional Market Rules for the WAPP
- Transmission Tariff Methodology
- 2012-2015 WAPP Business Plan

System Operation in India

- Independent System Operation is important for Integration of power grids.
- Safe , Secure, Reliable Integration helps in Development of Power Market and Market Operation.
- India followed a gradual and systematic approach towards a independent system Operator.

Forum of Load Despatchers envisions being a catalyst in reliable, efficient and economic operation of the Indian bulk electric power supply system.

- Promoting technological excellence and harmonization of practices
- Promoting compliance to Reliability Standards
- Facilitating development of Ancillary Services in power system
- Promoting capacity building in Power System/Market Operation
- Developing Code of Ethics for Load Despatchers in India

before 1914: RLDC & CEA

1994 Onwards: PGCIL& RLDC

2003: Functional separation and Ring Fencing of System Operation

2009: PGCIL RLDC

2010: Financial separation POSOCO wholly owned subsidiary

2015: POSOCO Separate Independent System Operator

POSOCO

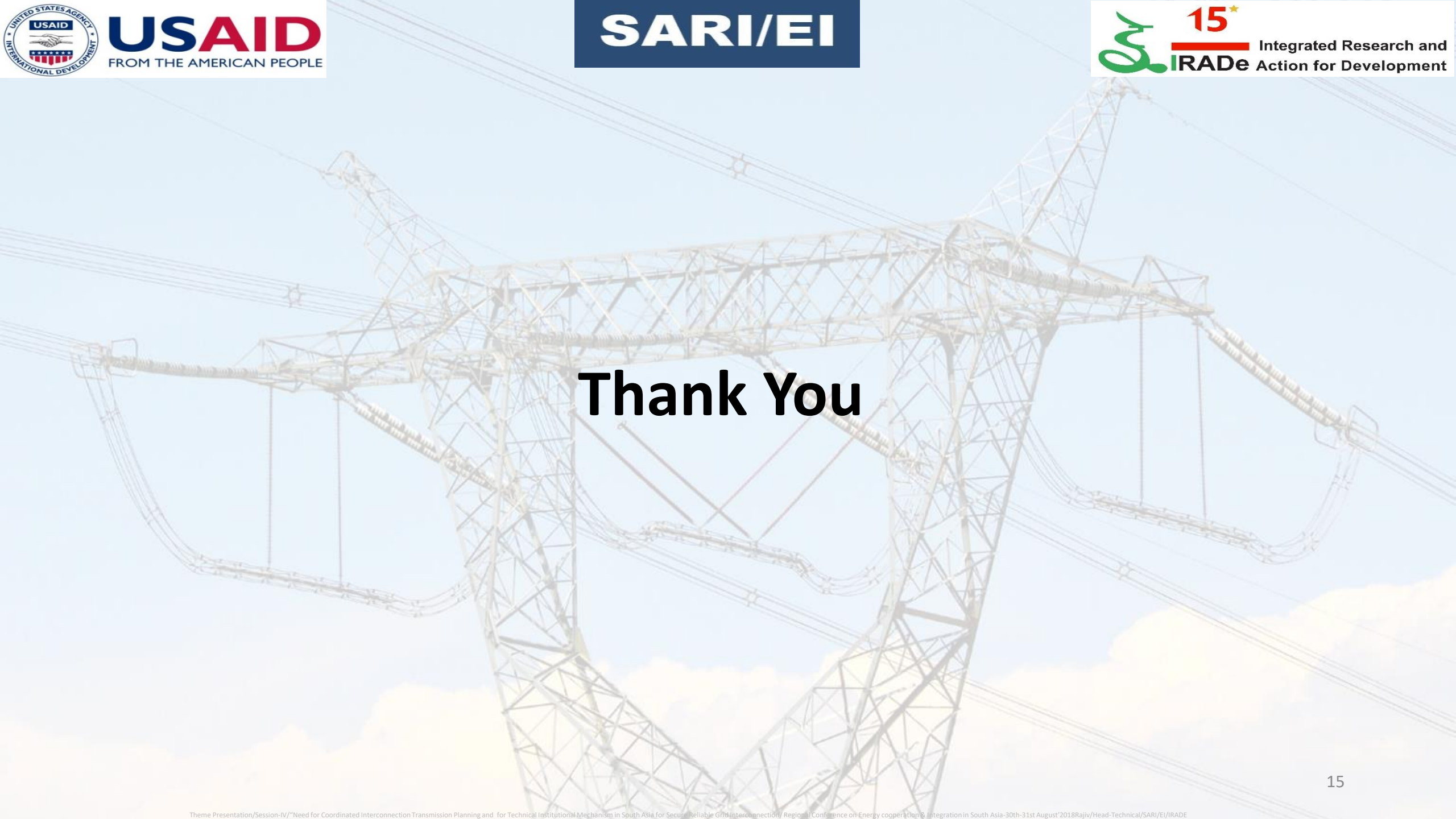
PGCIL

FORUM OF LOAD DESPATCHERS, INDIA

Forum of Load Despatchers i.e. FOLD is a forum of organisations carrying out System Control activities in India. It has been created vide reference no.: 15/8(1)/2008-FoR/CERC dated 02.01.2009 on the basis of the decision arrived at in the ninth meeting of FoR held at Bhubaneshwar on 14th & 15th November 2008.

Points for Discussions

- What are the challenges for cross border transmission planning and system operation coordination ?
- How to move towards a South Asia Transmission Master Plan ?
- Strategy and Approach Institutionalising the process- South Asia Forum of Transmission Utilities (SAFTU) and South Asia Forum of System Operators (SAFSO)
- Way forward for development grid code related technical regulatory framework for CBET ?
- How to address regional integration of Renewable of South Asian Countries through Coordinated South Asia Regional Power Grid planning and operation.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India System Operation - Hierarchy

1

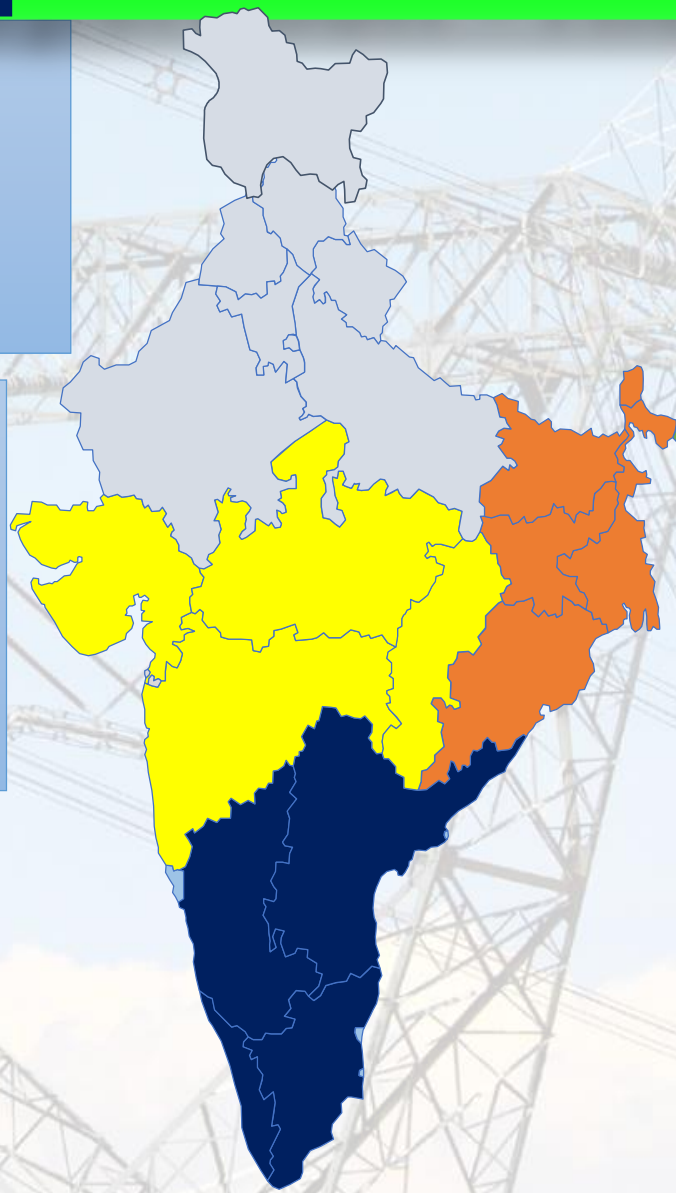
NLDC:
Apex body to ensure integrated operation of National Power System.

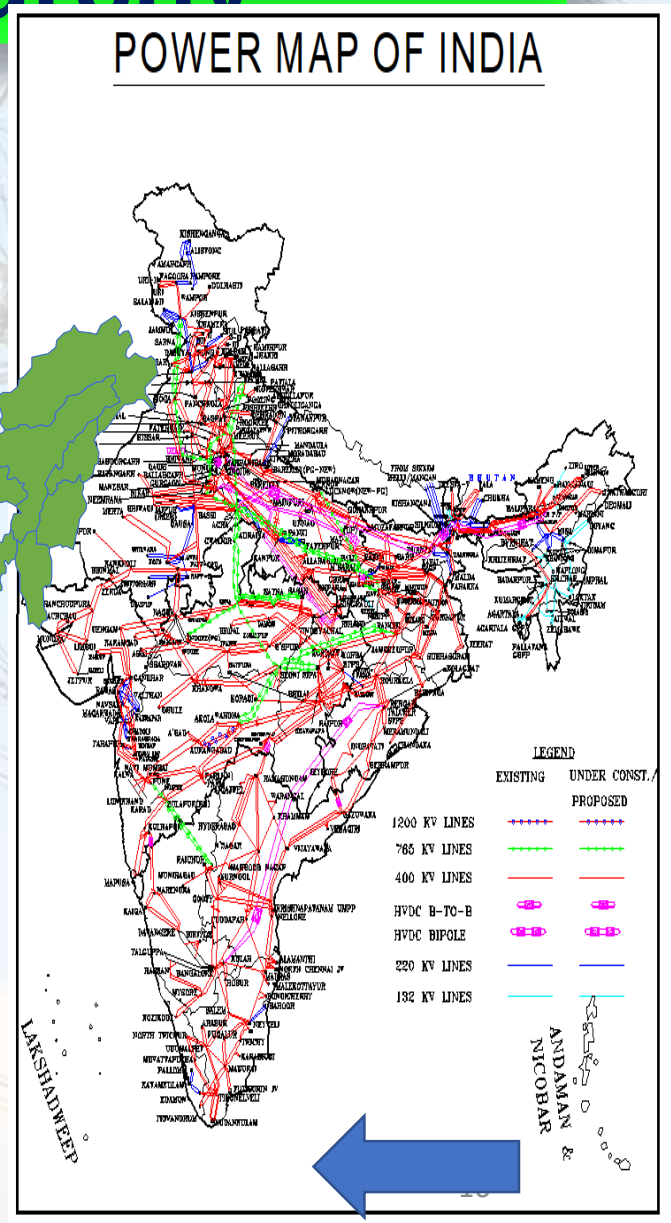
5

RLDC:
Apex body to ensure integrated operation of power System in the concerned region.

32

SLDC:
Apex body to ensure integrated operation of power System in a state.





South Asia Power System- Technical Info-Gap Analysis

	Voltage		Frequency	
	Normal	Emergency		
Bangladesh	Normal: ±5%	Emergency: ±10%	49 Hz to 51 Hz	
Bhutan	Normal: ±5%	Alert: ±10%	Normal: 49.5 Hz to 50.5 Hz	Alert: 49 Hz to 51Hz but above Normal range.
India	Normal: ±5% for 400 kV, 765 kV, ±10% for 220 kV & below.	±10% for 220 kV & below.	49.9 Hz to 50.05 Hz	
Nepal	Normal: ±5%	Emergency: ±10%	48.75 – 51.25 Hz	
Pakistan	Normal: 8% and -5% .	Emergency: ±10%	49.8 Hz to 50.2 Hz(Frequency sensitive mode)	49.5-50.5 (Tolerance Frequency band) 49.4-50.5(Load sheading threshold and contingency frequency band)
Sri Lanka	Normal: ±5% for 132 kV, ±10% for 220 kV.	Emergency: ±10%	49.5 Hz to 50.5 Hz	

Acceptable Voltage Deviations are similar but the permitted frequency deviation is different- Need to harmonize for synchronous interconnection

Except India, grid codes of all other SA nations specify the same voltage variation limits for both planning and operation stages.(For India :refer CEA's manual on transmission planning).
For (India) Planning studies +/-2% 765kV; +/-3% 400 kV; +/-5% to 7% for below 220 kV

Brief Summary of the Framework Guidelines – Planning

Planning Guidelines and Codes

1

The Planning Guidelines and Codes provides information and stipulates the various criteria to be adopted for planning and development studies. It covers codes on

- ✓ Planning Philosophy,Transmission Planning Criterion , Transmission Reliability Criteria, Planning Margins etc.
- ✓ Transmission system capability of withstanding loss of most severe single system infeed, Transient Stability Limit and Reactive Power planning.

2

The Planning Guidelines and Codes recommends :

✓Master Plan with a planning horizon of 10 years as the basis for planning. Can be for bi-lateral or multilateral.

✓Load-generation scenarios shall be worked out to reflect typical daily and seasonal variations in load demand/availability.

✓Voltage and Equipment Loading Margins. Short circuit ratio (SCR) at the converter terminals of HVDC installations shall be greater than 3.The LOLP of 0.2% or lower shall be considered in planning exercise while assessing cross border line flows.

3

The Planning Guidelines and Codes recommends –Planning Criterion:

✓Requirement of reactive power compensation (static and/or dynamic)

✓Voltage limits for planning studies (N-0 , N-1 contingencies)- ±3% voltage*. Thermal loading limits of lines & transformers- 15% margin.

4

The Planning Guidelines and Codes are in line with the overall objective of with article 7 of the SAARC framework agreement for energy cooperation (electricity) as regard to planning of cross border interconnections.

*±5 % voltage-Normal(Operational), ± 10% voltage-Emergency

The nominal frequency shall be 50 Hz. The steady state frequency limits shall be +0.05 Hz to -0.1 Hz, i.e. from 49.9 Hz to 50.05 Hz.. The instantaneous frequency limits shall be —0.8 Hz. *{The nominal frequency is that followed by all South Asian countries. The steady state frequency limits is that stated in Indian Grid Code. The instantaneous frequency limits is adopted from the European Grid Code.}*

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Brief Summary of the Framework Guidelines – Connection

Connection Guidelines and Codes

1

The Connection Guidelines and Codes specifies :

✓ A compliance of minimum of technical, design and operational plant criteria by the existing and prospective new 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 ,meter placement, compliance of meters according to standards .

2

The Connection Guidelines and Codes recommends Technical Requirement for Connectivity :

✓Reactive power *, Frequency and voltage parameters, Short-circuit fault levels, Metering system.

✓Stipulated Guidelines and code for Protection Requirement, Protection devices, Simulation Models, Data & Communication, Cyber Security. Connection Agreement .

3

The Connection Guidelines and Codes recommends :

✓Equipment Standards: Frequency limits for Equipments: 47.5 – 48.5 Hz (90 min); 48.5– 49.0 Hz (not less than the period for 90 minutes); 49.0–51.0 Hz (Unlimited); 51.0 – 51.5 Hz (30 min).

✓At interconnection point , operating voltage for 400 kV and above is : ±5% and connected equipment shall withstand the voltage variation of ±10%.

✓Bi-directional meters shall be installed at the connection point by following IEC standards. Meter accuracy shall be 0.2% and the secondary burden shall be maintained between 25% and 100% of rated values.

4

Connection Guidelines & Codes In line with article 8, 9 & 10 of the SAARC framework agreement for energy cooperation (electricity)

* reactive power flow on the link shall be within lead/lag 0.97 power factor and operated within the grid code voltage level)

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Brief Summary of the Framework Guidelines–Operation

Operation Guidelines and Codes

1

The Operation Guidelines and Codes specifies

✓All necessary aspects relevant to outage planning, operational security analysis, frequency control and handling of reserves

✓Operation code also covers operational security aspects pertaining to power system states; frequency control; voltage, reactive power, short circuit management; power flow management, contingency analysis and stability management.

✓Details for high level operational procedures, for example, demand control, operational planning and data provision.

2

The Operation Guidelines and Codes recommends :

✓No important element of the interconnected grid shall be deliberately opened or removed from service at any time, except certain emergency condition, safety of human life etc.

✓Adequate operating reserves (Primary/Secondary/Tertiary) shall be made available for CBET.

✓Stipulates Guidelines and codes for Demand Estimation for operation and Congestion Management, Outage

✓Planning, recovery procedure , Operation Liaison , exchange of information etc.

3

The Operation Guidelines and Codes recommends :

✓Frequency limits: Frequency – for synchronously interconnected system:

Nominal State: 50Hz, **Steady state limits:** +0.05Hz to -0.1Hz, Instantaneous limits: ± 0.8Hz

Alert: Exceeds steady state limits for upto 10 mins

Emergency: Exceeds steady state limits for >10 mins up to 20 mins

4

✓At interconnection, operating voltage for 400 kV and above is : Normal: ±5% , Alret: ±5% Emergency: ±10%.

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Brief Summary of the Framework Guidelines–Scheduling & Dispatch

Scheduling & Dispatch Guidelines and Codes

1

✓The Scheduling & Dispatch Guidelines and Codes specifies

✓Procedures to be adopted for Scheduling and despatch of generation and allocation of power drawl

✓Include procedure and Formula for calculation of TTC, ATC along with reliability margins and the regulations for mechanism for forward capacity allocation and congestion relieving mechanism, Deviation Settlement mechanism(Technical Part only)

2

The Scheduling & Dispatch Guidelines and Codes recommends

✓Standardized scheduling intervals.

✓Detail Guidelines for scheduling & dispatch procedures, the establishment of scheduling processes, provision of information to other country system operators, day ahead scheduling procedure, intra-day scheduling/revision procedure, sharing of information on schedules and standardized scheduling intervals for cross border trade.

✓Charges for Losses: Cross Border System Operator Compensation (CBSOC) Fund.

3

The Scheduling & Dispatch Guidelines and Codes recommends :

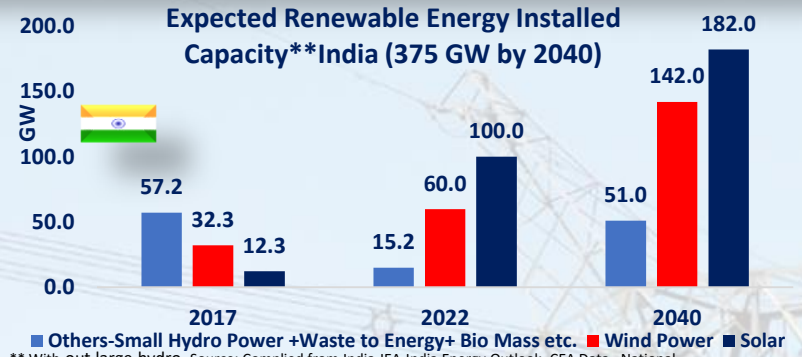
✓Each time block shall be for a duration of 15 minutes and a common time of Indian Standard Time (IST) can be adopted for uniformity.

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

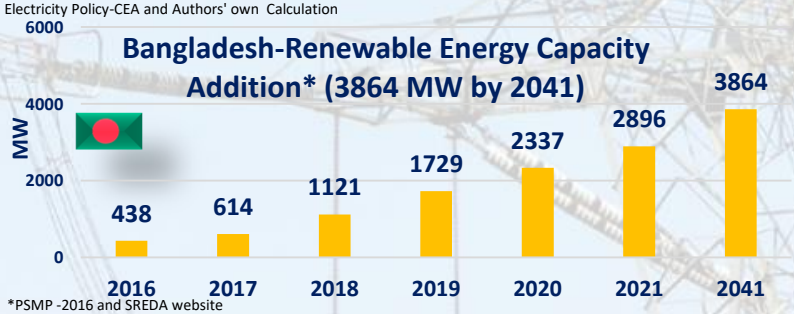
4

The Scheduling & Dispatch and Codes Guidelines and Codes enable non-discriminatory access to the respective transmission grids for purpose of cross border trade in line with article 12 of SAARC framework agreement for energy cooperation (electricity)

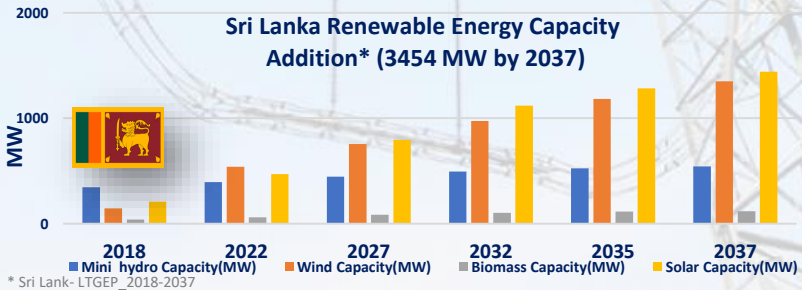
Renewable Energy Cross Border Power Trade



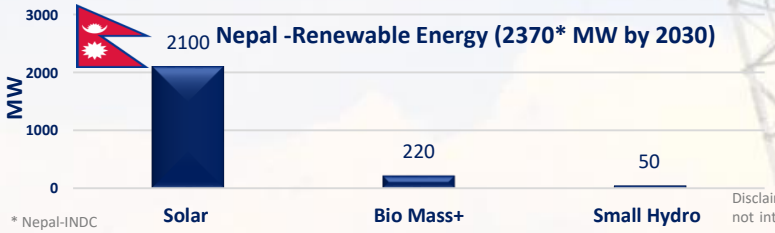
** With out large hydro Source: Complied from India-IEA-India Energy Outlook, CEA Data , National Electricity Policy-CEA and Authors' own Calculation



*PSMP -2016 and SREDA website



* Sri Lank- LTGEP_2018-2037



* Nepal-INDC

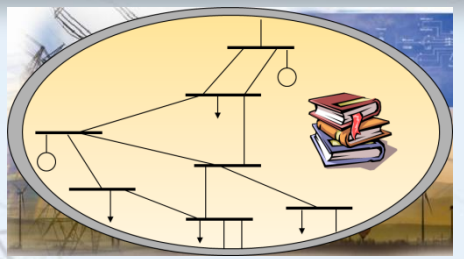
Disclaimer: By making any reference to a particular geographic area or by using the term "country" and Map in this document, IRADE/USAID does not intend to make any judgement as to the legal or other status of any area/Map. The map used is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries, and to the name of any territory, city or area.

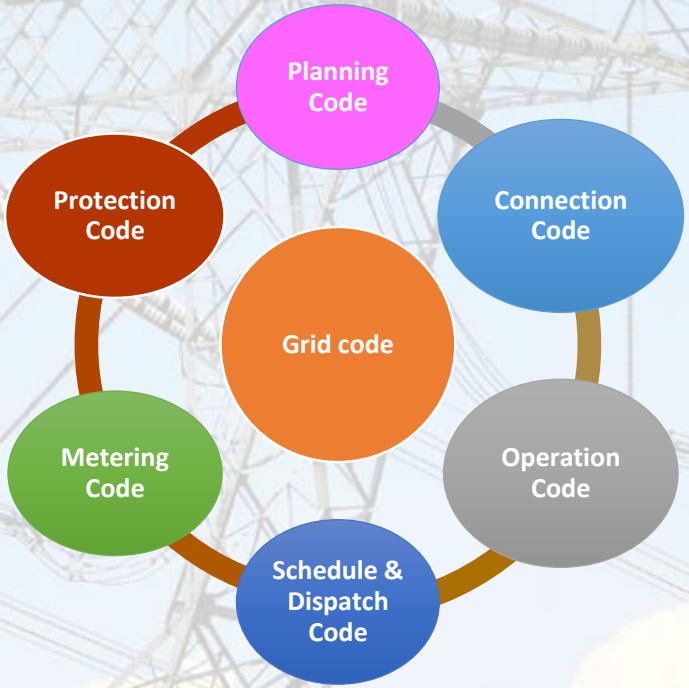
Source: ***with *275 GW generating capacity and nearly 150 GW peak demand ,** Technical Committee for "Large Scale Integration of Renewable Energy, need for balancing, Deviation Settlement Mechanism (DSM) and associated issues"

Grid Codes

A Set of rules, guidelines & standards

- To be followed by various persons and participants in the power system
- To plan, develop, maintain and operate the power system in the most secure, reliable, economic and efficient manner
- To facilitate healthy competition in the generation and supply of electricity.
- Grid codes are approved by a regulatory body or government in exercise of powers conferred to it under the relevant electricity act/legislation





GRID CODE

Rules, Guidelines
Standards

Utilities
Grid Users

Power System

Overall Approach for Grid Code Harmonization/Coordination in South Asia

Framework Grid Code Guidelines (FCGC)

Development of Framework guidelines on the identified Areas i.e. Planning, Operation, Connection , Scheduling & Dispatch and contains explanatory statement along with draft code for each of the above identified areas. (Done by this Study)

Cross Border Grid code (CBGC)

Development of codes based on Framework Grid Code Guidelines and Draft Codes by the relevant authorities of South Asian Countries. (Draft Codes developed by this Study will be the base document)

Agreement & Operationalization of Cross Border Grid code

Framework Grid Code Guidelines (FCGC) in the form Draft codes

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

The draft code can be adopted/adapted 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 CBET.

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Challenges for Harmonization of grid codes –Questions explored during the Study

How to secure the own power system while connecting with cross border regional power systems?

Can be the present Grid Code/guidelines serve the purpose for CBET? What are the Gaps

What are all the technical measures to be taken while connecting for cross border?

What are the challenges of integrating a small power system with a large power system

How the present dispatch scheduling mechanism will get effected with CBET?

How much import/export is required for future? How CBET will help the reliability of the power in country or Impact the reliability, security ?

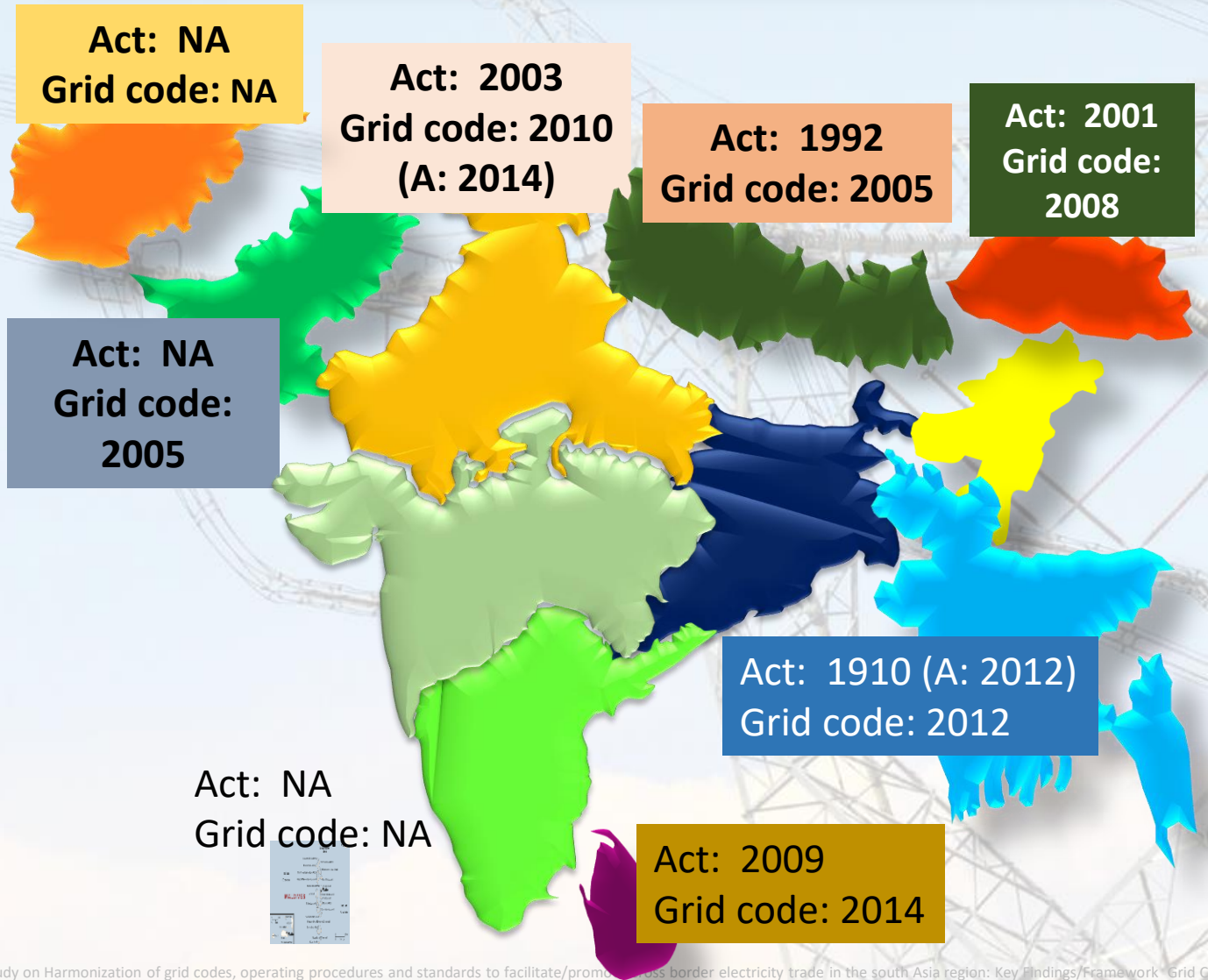
Who is responsible for what in CBET operation?

How the frame work guidelines will help for bilateral and multilateral interconnections?

Is it required to modify the existing grid codes which focusing on domestic power system

How to implement the Cross Border Grid Code?

Legal and Regulatory Framework: South Asia Grid codes



Country	Apex legal Document	Grid code document
Afghanistan	Not Available (NA)	NA
Bangladesh	Electricity Act, 1910 (AMENDMENT 2012)	Grid Code, 2012
Bhutan	Electricity Act of Bhutan, 2001	Grid Code 2008 (Reprint 2011)
India	Electricity Act, 2003	Grid code 2010 (Amendment 2014)
Maldives	NA	NA
Nepal	Electricity Act 1992	NA Grid code 2005 ,
Pakistan	NA	Grid Code, 2005
Sri Lanka	Electricity Act 2009	Grid Code, 2014