USAID FROM THE AMERICAN PEOPLE

SARI/EI

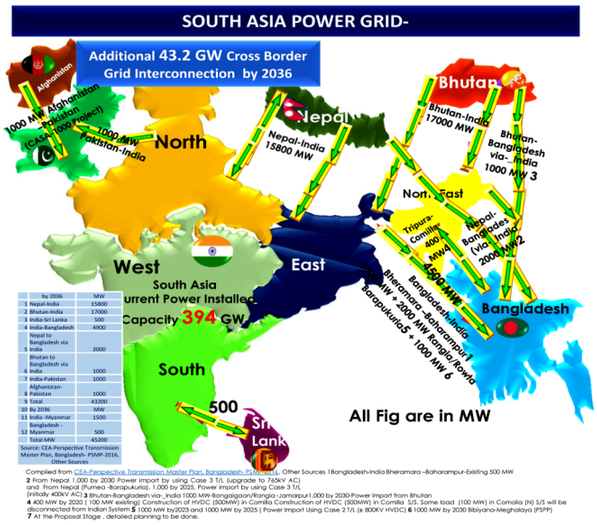
15 IRADe Integrated Research and Action for Development

Harmonization of Grid Codes, Operating Procedures and Standards to Facilitate/Promote Cross-Border Electricity Trade in the South Asia Region

Policy Brief

1. Back Ground and what is Grid Codes?

Cross Border Electricity Trade (CBET) in South Asia is gaining momentum with more and more number of cross border power projects and transmission interconnections being planned (fig-1) and proposed



	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	MW
11	India-Myanmar - Bangladesh - Myanmar	1500 500
12	Total MW	45200

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

Compiled from CEA-Perspective Transmission Master Plan, Bangladesh- PSMP-2016, Other Sources 1 Bangladesh-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 -Baraputia). 1,000 by 2025, Power import by using Case 3 T/L (Initially 400kV AC) 3 Bhutan-Bangladesh via- India 1000 MW-Bongaigaon/Rangia -Jamanpur1,000 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 Comolla (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.

Figure 1 Additional Cross Border Power Transmission System Interconnections by 2036

which will enable greater Integration of Power Systems of South Asian Countries (SACs). The SACs envisages a manifold increase in the quantum of CBET by the end of next decade. The policy environment is becoming increasingly more and more conducive for CBET as eight member states of SAARC countries signed SAARC Framework Agreement of Energy (Electricity) Cooperation. Further, the historic Power Trade Agreement (PTA) signed between India and Nepal, opens up whole range of new possibility for trade electricity between Nepal-India, and also gives an access to Nepal Power Developers to Indian Power Market. India-Bangladesh and India-Bhutan are taking steps to increase quantum of CBET in manifold. With these increased Cross Border Electricity Trade, power system in South Asia will be more regionally integrated power system.

Grid Codes: Grid code is a technical document containing rules, procedures, guidelines, criteria and responsibilities to be complied by the users, owners and operators of the transmission system of a country. Grid codes are approved by a regulatory body in exercise of powers conferred to it under the relevant electricity act/legislation. Grid codes provide basic design criteria and operational rules and responsibilities to be followed by the generating stations, transmission utilities, distribution utilities and traders. There are many rules and criteria in every grid code dealing with generation, transmission, distribution, protection, metering, maintenance, buying and selling of power, ancillary services, etc.

2. Why Harmonization of Grid Codes, Operating Procedures and Standards needed in South Asia?

Electric Power System is a large, complex system involving many entities executing their respective activities and responsibilities. With the multi-stakeholder perspective like the generation, transmission and distribution licensees, system

operators, traders and other participants in system, the stakeholders should function in proper co-ordination with each other; follow the regulations, standards and procedures for the safe, secure and reliable operation of the grid. Many common specifications appear in grid codes of various in SA countries. Different sections of the grid code will be of varying significance to the generation, transmission and distribution utilities. Some of the rules may be for promoting competitive environment for generators whereas some may be critical for the operation/maintenance of generating plant. Therefore it is essential that while interconnecting two transmission systems and deepening CBET, the respective grid codes have to be compared and reviewed to understand the underlying principles of individual systems and then harmonize the relevant rules to suit cross-border interconnection and trading and for safe, secure and reliable integration planning, operation of the South Asia Regional Power Grid. Transmission System Operators (TSOs) of all the member countries of a planned regional grid interconnection should establish a common framework for preparation and implementation of operating guidelines and procedures, maintenance schedules, exchange of data, dispute settlement, power exchanges, electricity market mechanisms etc. Therefore, harmonization of the grid codes is an important step towards streamlining cross-border power trade.

Operating an integrated electricity grid in South Asia is essentially a coordination issue. Harmonization means adjustment of differences and inconsistencies among measurements, methods, procedures, schedules, specifications, or systems to make them uniform or mutually compatible. 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, the two sides have to worry less about each other as the fault on one side is not passed on to the other. Nevertheless, the tripping of High Voltage Direct Current (HVDC) terminal would itself constitute a disturbance in terms of loss of load or loss of supply. To simple get an idea (fig-2), based on the Gap Analysis, study notes that there are different voltage and frequency limits among SA countries.

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	

Figure 2 South Asia Power System- Technical Info-Gap Analysis

3. Current approach for Grid Code Harmonization for CBET in SACs

Current approach in Grid Code among SA countries from the perspective of CBET is adhoc in nature which is evident from the fact that do not have any clear provision, regulatory and operational framework for a harmonized grid code framework for Cross Border Power Trade. This adhoc approach sometimes creates uncertainty among the various grid users, market players and in reducing sub-optimal utilization of be benefits of CBET. SARI/EI approach believes that, there is a need to have Harmonization of Grid Codes, Operating Procedures and Standards to Facilitate/Promote Cross-Border Electricity Trade in the South Asia Region. To address the above, SARI/EI has conducted a study on the above subject and have recommended a Framework grid code guidelines. The Framework Grid Code Guidelines (FGCG) is the outcome of the two years of

rigorous study through the detailed and comprehensive Review and Analysis of Grid Codes of South Asian Countries, Gap Analysis, Review and Analysis of Grid Codes, Technical standard.

4. Recommended Framework Grid Code Guidelines:

The main purpose (Fig. 3) of the FGCG: a) Establish a clear technical framework and grid code and related regulatory environment vis-à-vis a coordinated/harmonized cross-border Grid Codes for smooth, reliable, secure cross-border Elect trading; Provide roadmap for action and decision making for Relevant Authorities/Regulators in respective Country through Framework Grid Code Guidelines; c) Provides consistency across technical parameters, grid codes, standards, operating procedures in CBET transactions and gives certainty to grid users and other stakeholders.

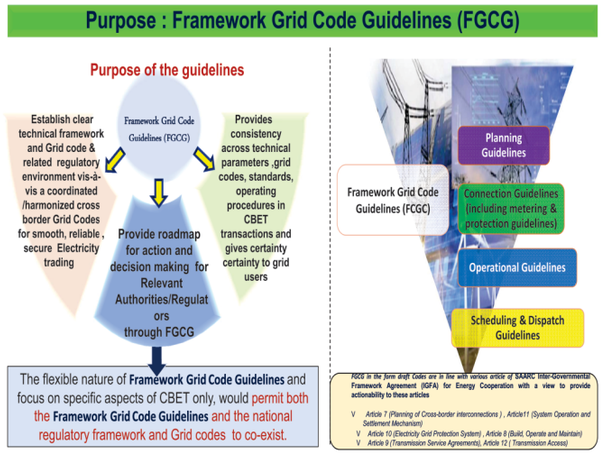


Figure 3 Purpose of FGCG

A brief summary of the Framework Grid Code Guidelines is given below in the fig-4

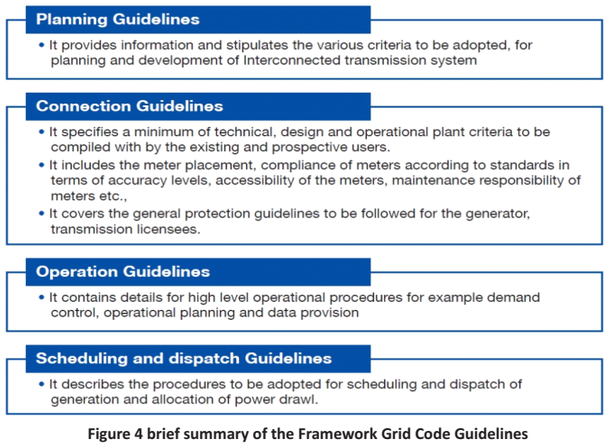


Figure 4 brief summary of the Framework Grid Code Guidelines

The overall approach for Grid Code Harmonization /Coordination in South Asia is given in the fig-5. It is envisaged that the FGCG 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 FGCG and draft codes focuses only on the specific aspects of CBET that would permit both the FGCG and draft codes and the national electricity grid code framework to coexist for a reasonable period of time. Gradually, a legal effect shall be provided to these guidelines through a structured framework. Keeping in view of the international experiences fig-6 and considering the technical complexity involved with

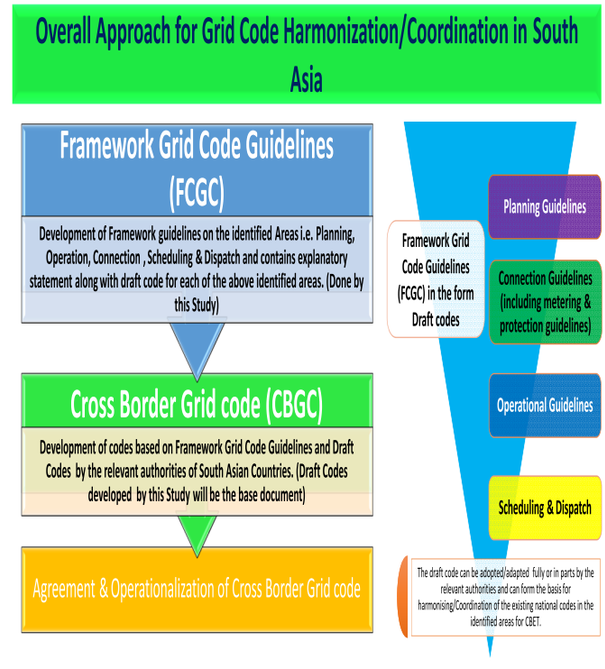


Figure 5 Overall Approach for Grid Code Harmonization /Coordination in South Asia

respect to grid code harmonization and integrated planning and operation of a regional power system in South Asia, it is important to create a Regional Technical Institutions/Body such as South Asia forum of transmission system utilities of SACs or South Asian Forum of Transmission Utility (SAFTU), which shall be mandated for coordinated, reliable and secure operation of the interconnected transmission network as well as for coordinated system planning and integrated system/network development and grid code harmonization. South Asia Forum of Transmission Utility (SAFTU) will be an independent, regional as well as technical and will

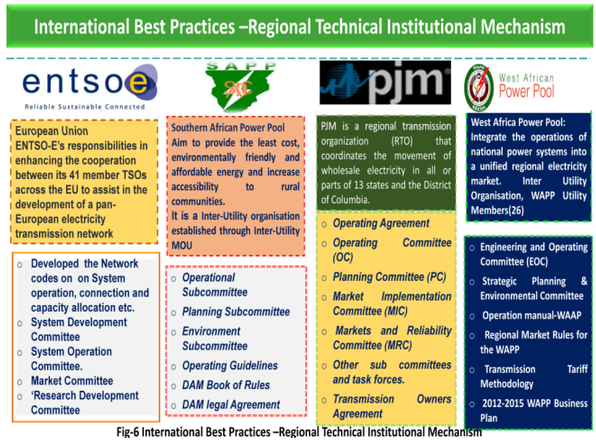


Fig-6 International Best Practices –Regional Technical Institutional Mechanism

provide technical support and inputs to the South Asia Forum of Energy/Electricity Regulators (SAFER) (or any other Regional Regulatory Institutional Mechanism in South Asia) on matter related to grid code guidelines, harmonization of grid codes, development of standards, integrated planning and operation of a regional power system etc. The proposed function of SAFTU is described in the fig-7.

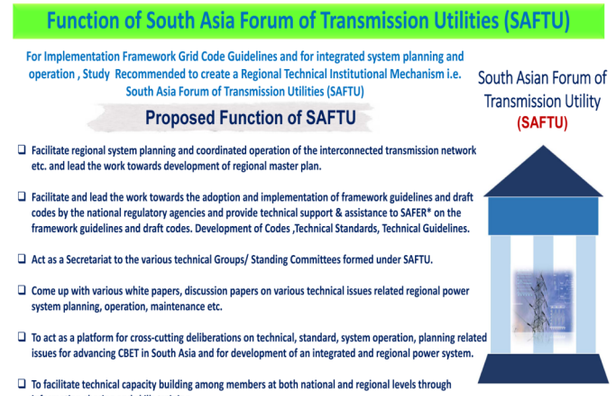


Fig-7 Proposed Function of South Asia Forum of Transmission Utilities (SAFTU)

Prepared by V. K. Kharbanda & Rajiv Ratna Panda

Mentor & Guide : Dr K Parikh & Dr Jyoti Parikh