



South Asia Regional Energy Partnership (SAREP)

Presentation

on

Cross Border Electricity Trade, Regional Energy Cooperation and Emerging Regional Perspective for South Asia

Session 2: Country Updates on “Coordination of Policies, Legal and Regulatory Frameworks for Cross Border Electricity Trade”

11th Meeting of SAREP Task Force-I on “Coordination of Policies, Legal and Regulatory Frameworks for Cross Border Electricity Trade”
Maitland State Room, 11.00-13.15 Hrs., 9th October 2023, Mount Lavinia Hotel, Colombo, Sri Lanka

Presented by
Rajiv Ratna Panda, Power Market Specialist, SAREP



Content

01 Cross Border Electricity Trade (CBET), Regional Energy Cooperation (REC), Emerging Perspective for South Asia

01.1 Macroeconomic Growth & Level of Economic Integration

01.2 Overview of South Asia Regional Power Sector

01.3 Evolution of Energy Integration & CBET- Political, Policy, Regulatory Initiatives

01.4 Is it working ? Impact of Political, Policy, Regulatory Initiatives on CBET & Its Future Outlook

01.5 Emerging Regional Perspective in South Asia-Opportunity for Deepening CBET and REC

01.5.1 Impacting Clean Energy Transformation vision through CBET

01.5.2 Gradually Transitioning from Bilateral to Trilateral CBET in SA

01.5.3 Market Instruments, Regional Energy Market

01.5.4 One Sun One World One Grid (OSOWOG)

02 Power Sector Structure and Market Development in South Asian Countries

03 Way Forward-Enablers for CBET and REC

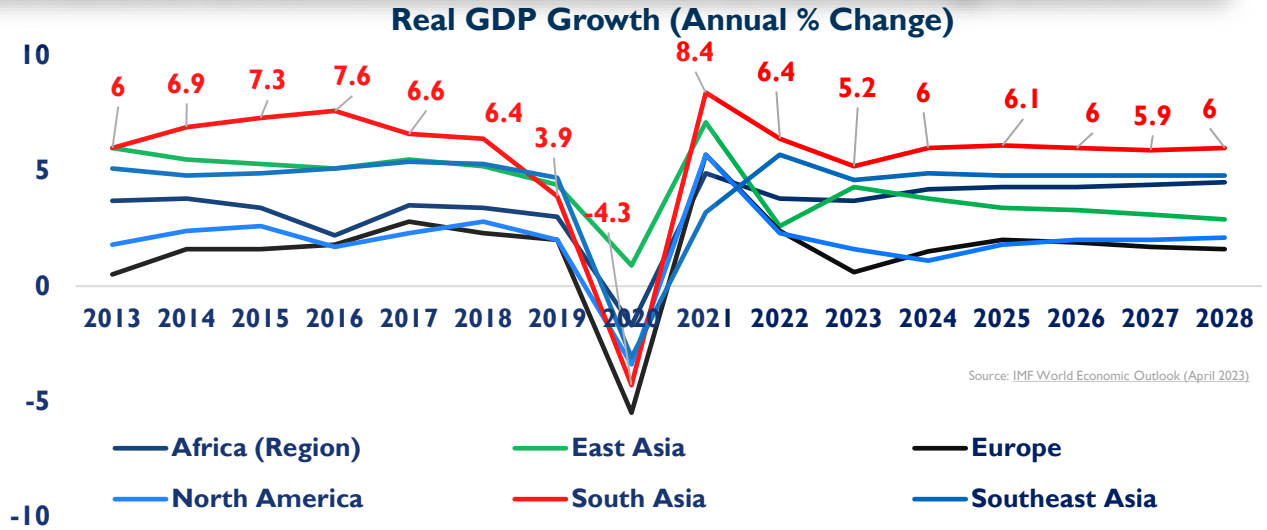
01.1

Macroeconomic Growth & Level of Economic Integration in South Asia

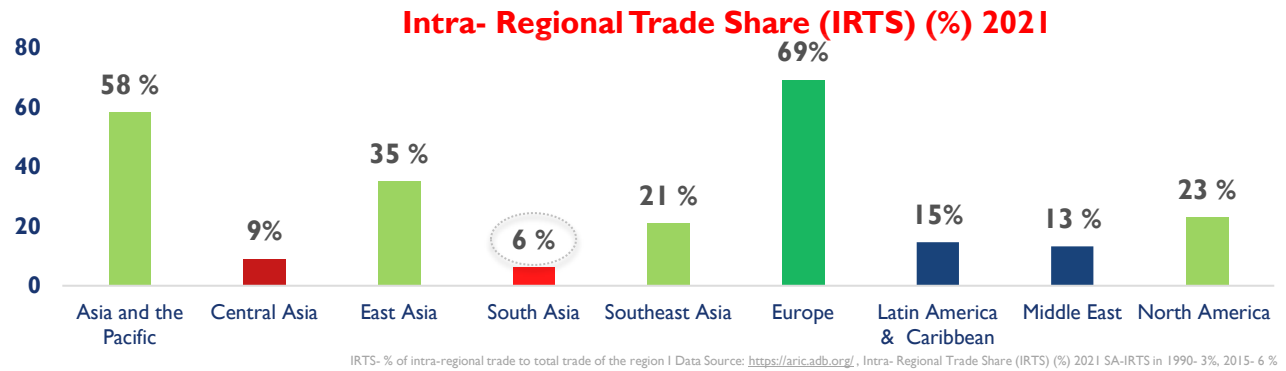


01.1 South Asia (SA): Macro-Economic Growth and Integration

- ➔ Decade of High Growth
- ➔ Resilient economy
- ➔ High growth prospects despite economic headwinds
- ➔ Fastest growing region



- ### Intra-Regional Trade
- ➔ Continue to be the Least Integrated Region
 - ➔ Only 6% IRTS





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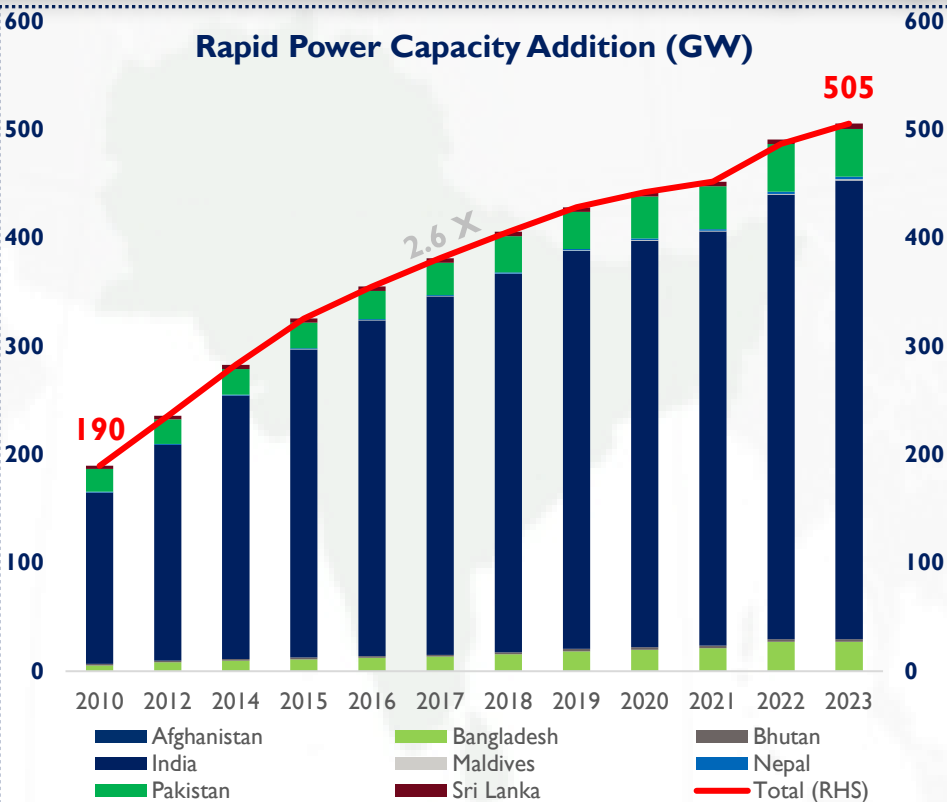


01.2

Overview of South Asia Regional Power Sector

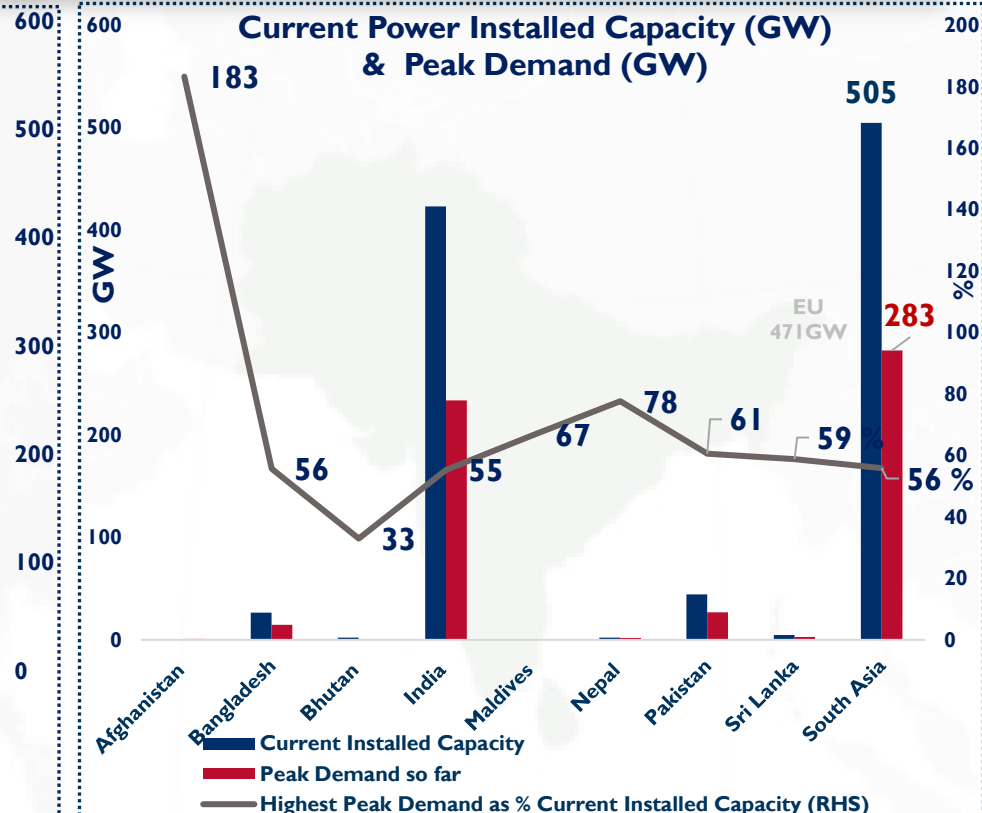


Rapid Power Capacity Addition (GW)



Source : Compiled by Author from Various Sources- BPDB, NEPRA, CEA, PUCSL, CEB, MOEA, BEA, SAED

Current Power Installed Capacity (GW) & Peak Demand (GW)

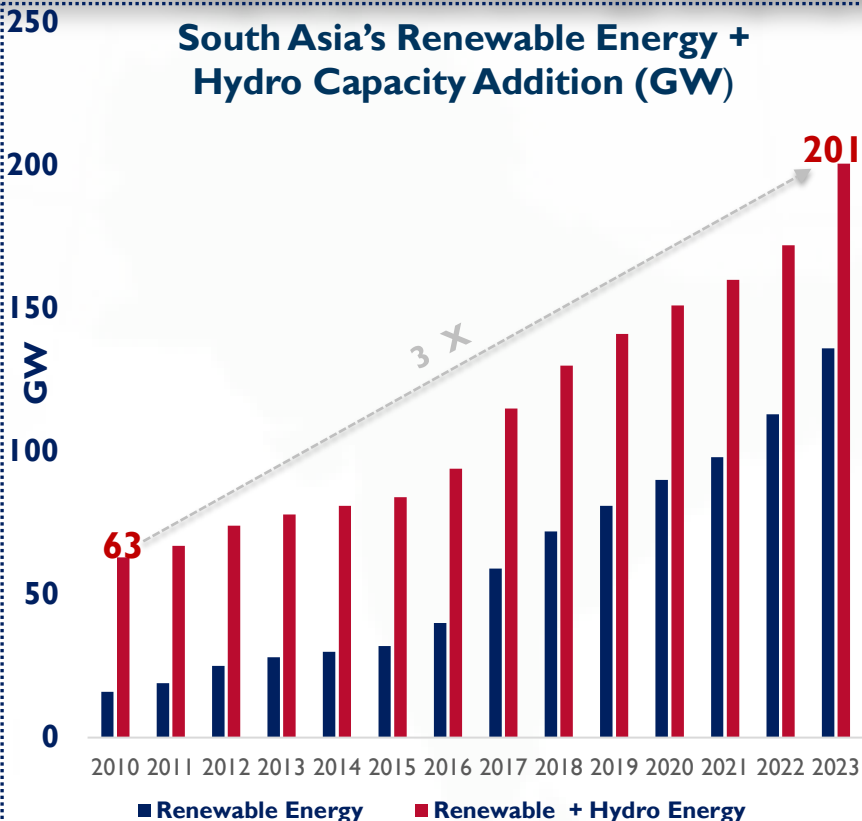


Source: CEM Presentation, Power Cell, BPSMP, APSMP, EPS, WECS, NEPRA, CEB, NEPRA, Daily Report (PSP) on June 9, 2023, Author's Estimation, EU (ENTSOE for the year 2021-471 GW)

Significant Capacity Addition | 84% India | 283 GW of Peak Demand | Still Low Electricity Consumption (~1105 KWh/Capita) | World ~3105 KWh

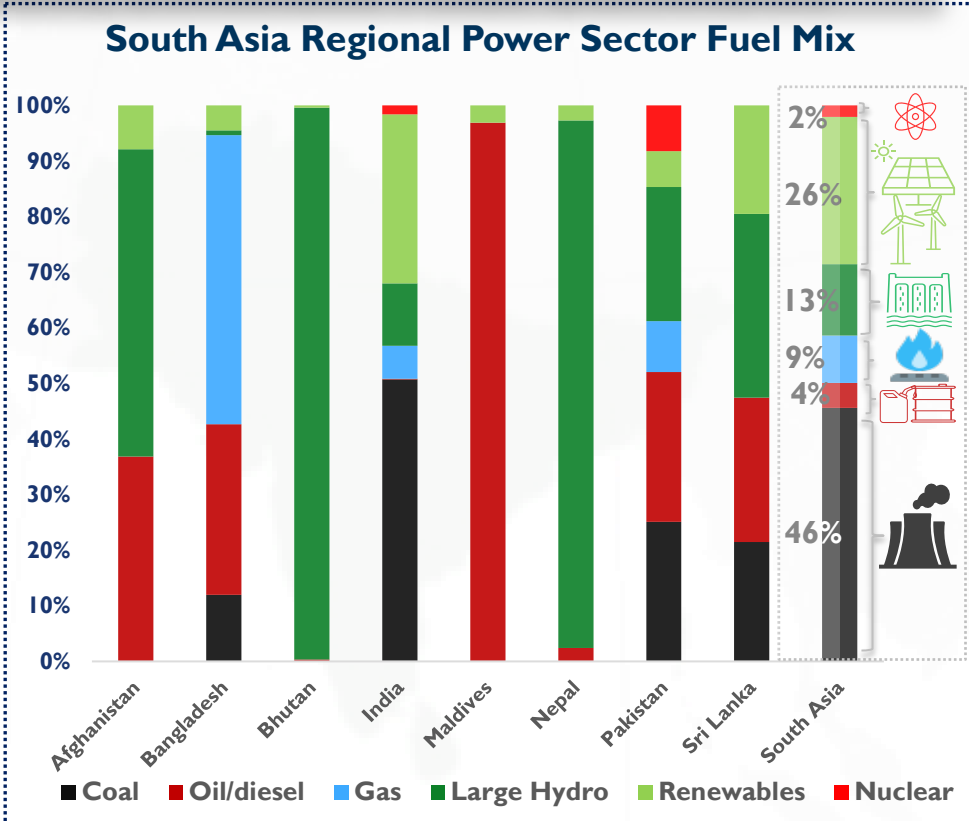
Rapid Clean Energy Deployment, Continued Fossil Dominance

South Asia's Renewable Energy + Hydro Capacity Addition (GW)



Source : Compiled by Author from Various Sources- BPDB, NEPRA, CEA, PLCSL, CEB, MOEA, REA, SAED

South Asia Regional Power Sector Fuel Mix



Source : Compiled by Author from Various Sources- BPDB, NEPRA, CEA, PLCSL, CEB, MOEA, REA, SAED

Tripled Renewable Energy (RE) Electricity Capacity Addition | ~201 GW RE | 59 % Fossil Capacity | 39 % RE Capacity | Fossil Domination



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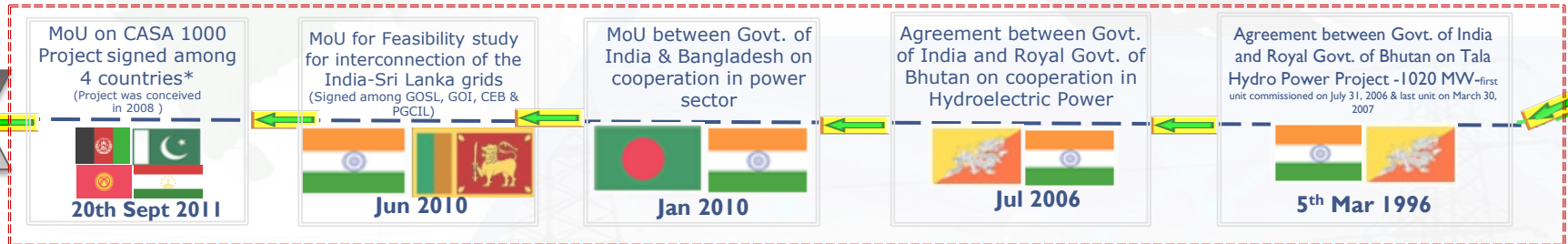
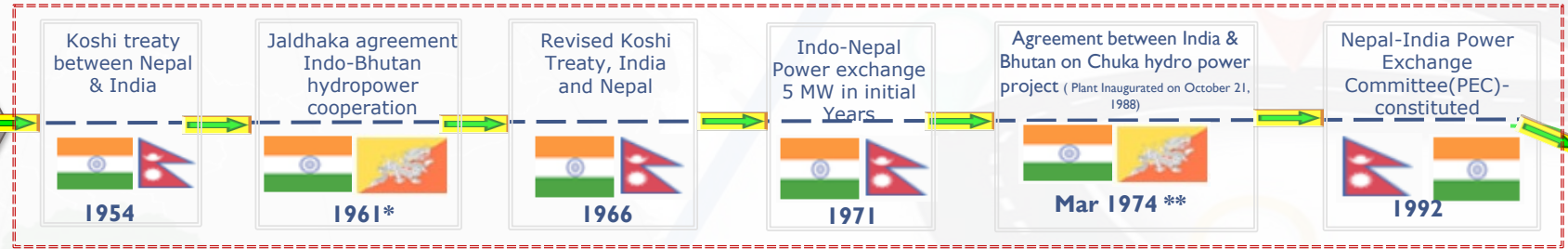
01.3

Evolution of Regional Energy Cooperation & Cross Border Electricity Trade **(Political, Policy, Regulatory Initiative)**



Evolution of Regional Energy Cooperation, Cross Border Electricity Trade

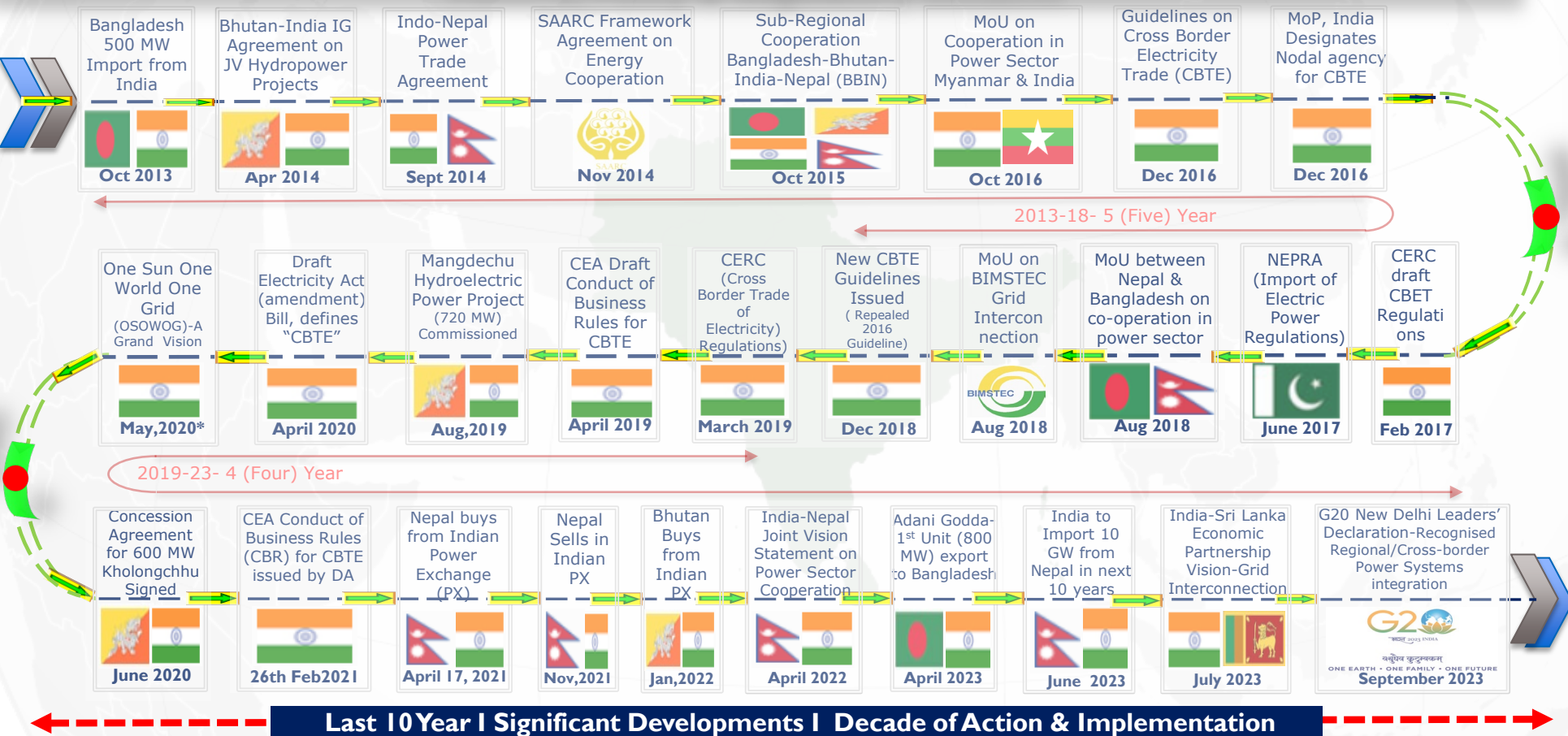
Political, Policy & Regulatory Initiative



More than Half a Century Journey (55 Years)

Evolution of Regional Energy Cooperation, Cross Border Electricity Trade

Political, Policy & Regulatory Initiative





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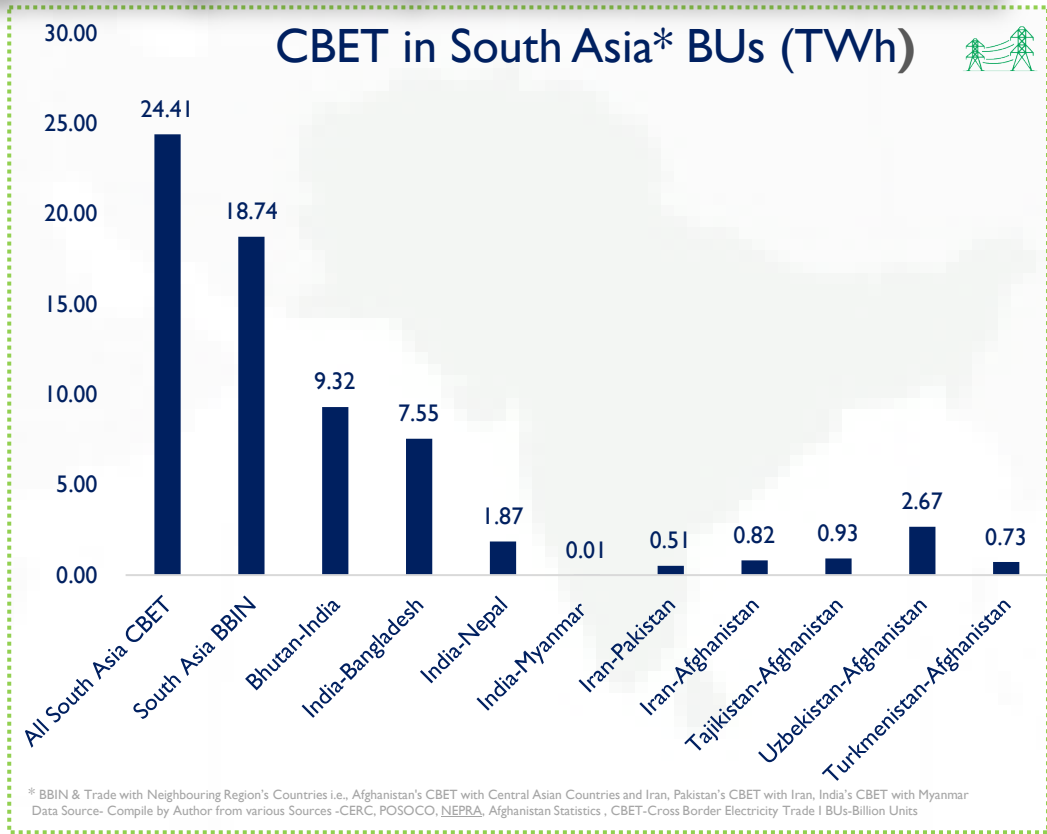
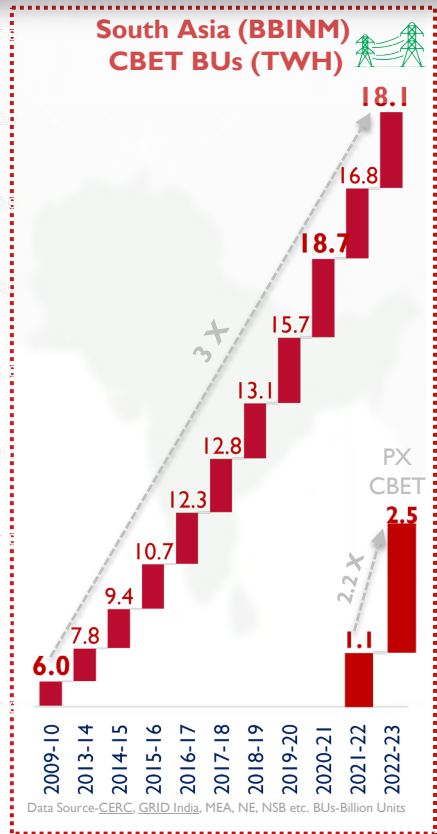
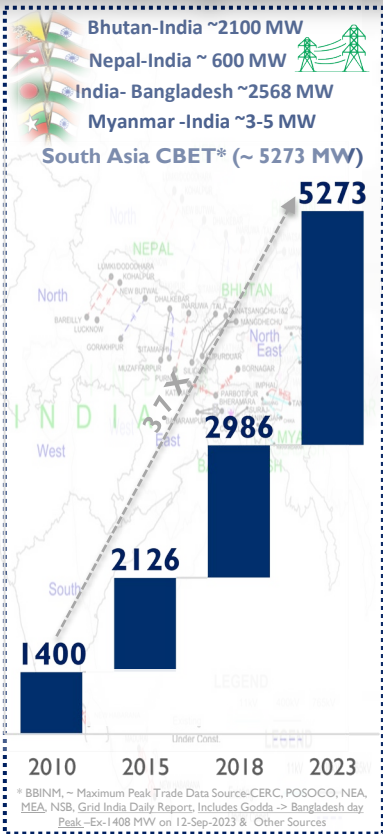
01.4

Impact of Political, Policy, Regulatory Initiatives

on

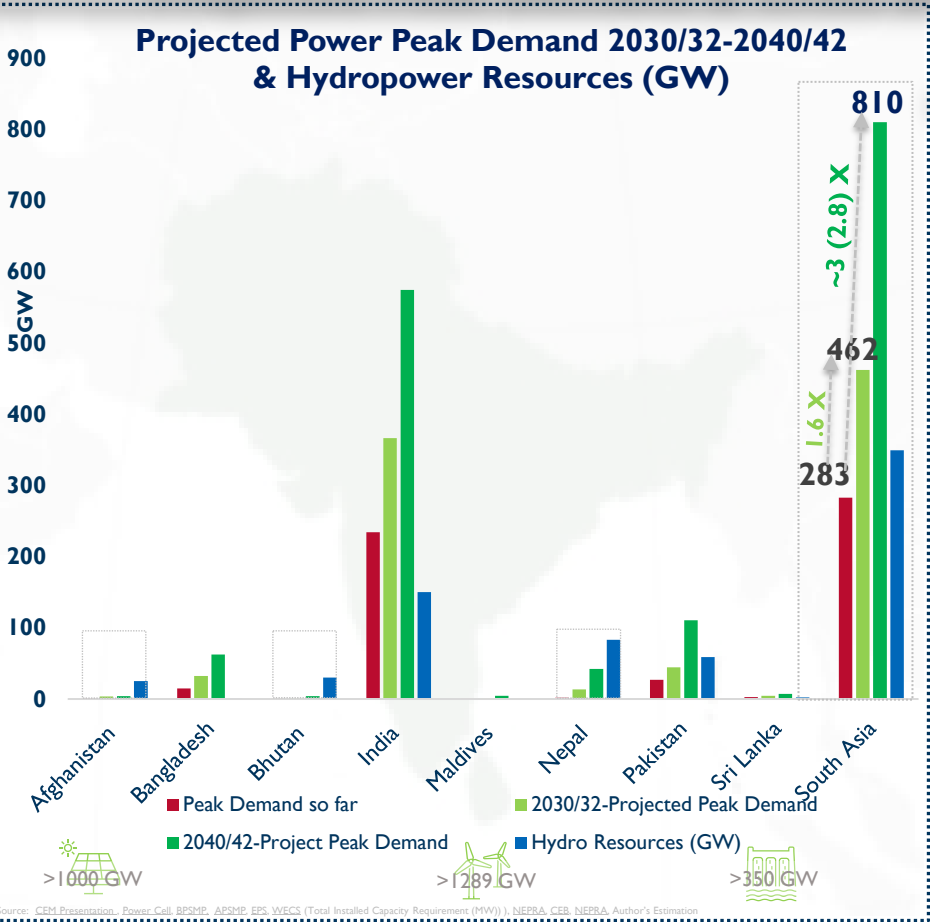
CBET & Its Future Outlook in South Asia

01.4 Impact of Political, Policy & Regulatory Initiative on CBET

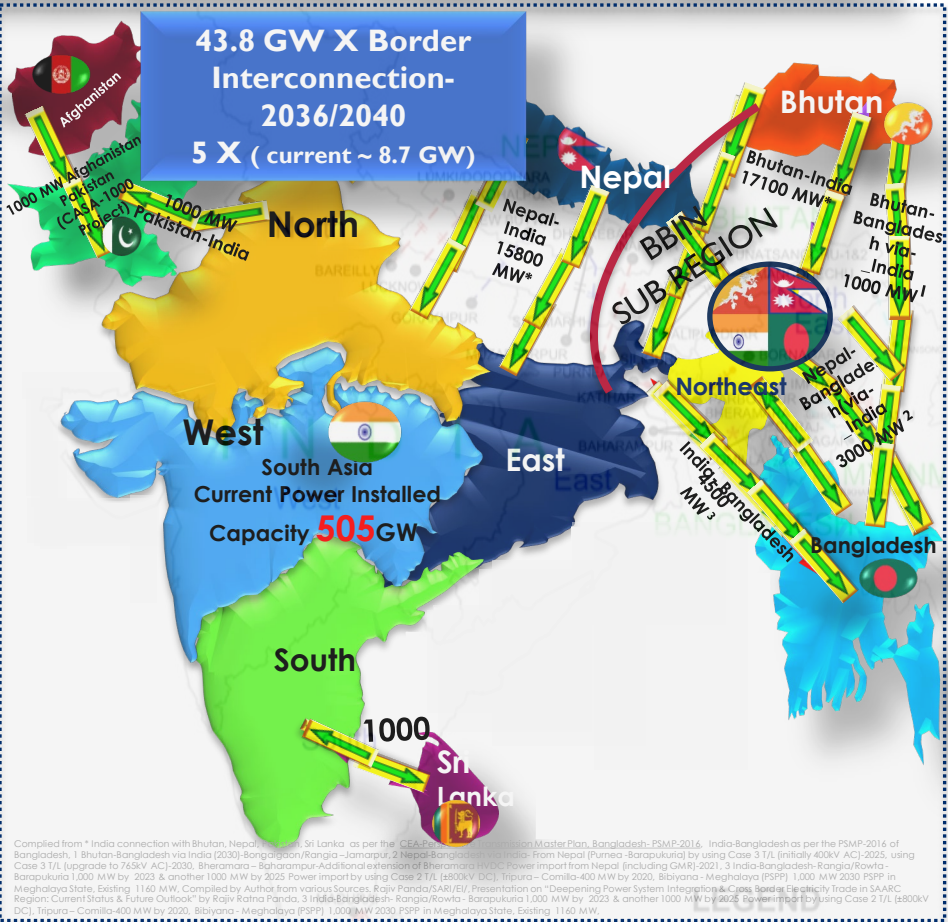


CBET Tripled | Potential Remains Large | EU (ENTSOe)-427 TWh | Prospects for Inter-Regional Integration | CBET through PX- 4.3 BU*

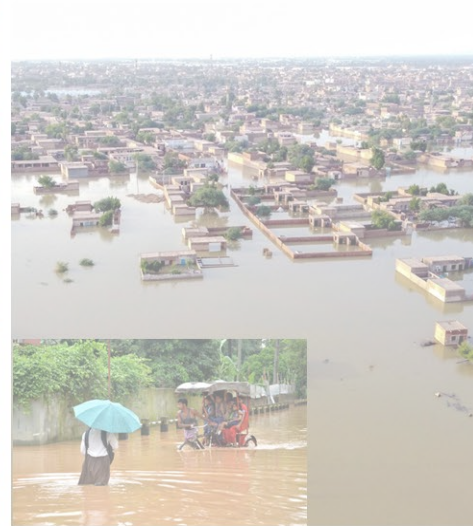
01.4 Projected Peak Demand & Cross Border Electricity Trade Future Outlook



Source: CEM Presentation - Power Cell, BPSMP, AFSMP, EPS, WECS (Total Installed Capacity Requirement (MW)), NEPRA, CEB, NEPRA, Author's Estimation



Recent Announcement are Encouraging- Prime Minister Shri Narendra Modi during the visit of Prime Minister of Nepal June 01, 2023, said, India to Import 10,000 MW of Power from Nepal in Next 10 Years



01.5 Emerging Regional Perspective

Opportunity for Deepening Cross Border Electricity Trade and REC in South Asia

Emerging Perspective 1



**Impacting Clean
Energy
Transformation vision
through CBET**

01.5.1

Emerging Perspective 2



**Gradually
Transitioning
from Bilateral to
Trilateral CBET
in SA**

01.5.2

Emerging Perspective 3



**Relying on Market
Instruments, Regional
Energy Market
Development**

01.5.3

Emerging Perspective 4



**One Sun One World
One Grid
(OSOWOG)**

01.5.4

Net Zero & RE Goals/Ambitions

❖ World's 1st Carbon Neutral Country-Bhutan

❖ Net Zero

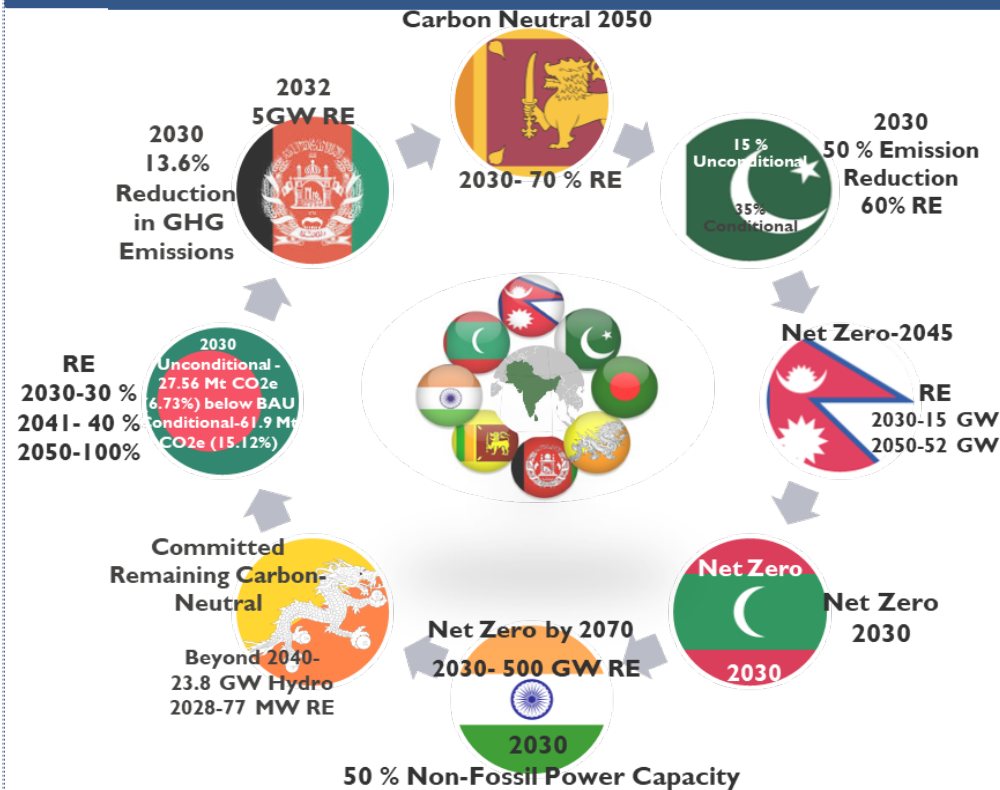
- ❖ 2030-Maldives
- ❖ 2045-Nepal
- ❖ 2050-Sri Lanka (Carbon Neutral)
- ❖ 2070-India

❖ Renewable Energy by 2030

- ❖ 500 GW-India
- ❖ 35 GW-Pakistan
- ❖ 16 GW-Bangladesh
- ❖ 15 GW-Nepal
- ❖ 9.3 GW-Bhutan
- ❖ 8.7 GW-Sri Lanka

584 GW RE by 2030

Climate-Induced Energy Sector Transformation



01.5.1 Emerging Perspective I: Transformational Action across Energy Value Chain in South Asia



Rapid De-carbonising Power Sector



Cleaner and Efficient Public Transport



Renewable Energy



Electric Vehicle & Charging Infrastructure



Modernising power grid, smart grid, smart utility



Green Hydrogen Economy and Energy Storage



Cross Border Hydro Power Projects & Cross Border Power Transmission

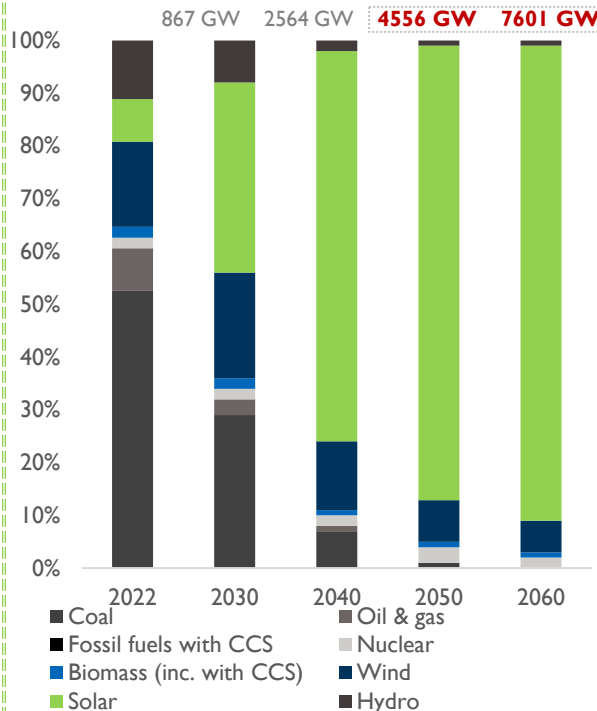


Natural Gas, LNG and Region Gas Grid

South Asia Power & Energy System is Undergoing Transformation : Electrifying and Greening the Way of Life

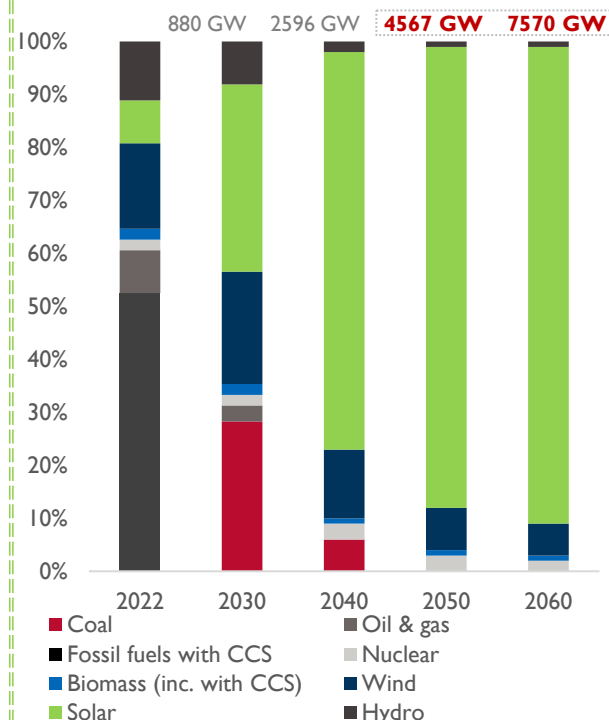
01.5.1 Emerging Perspective I: Long Term Implication of Net Zero Goals- Understanding the Scale

India-Projected Power Capacity (GW) mix in 2070 Net Zero (balanced policy mix) scenario



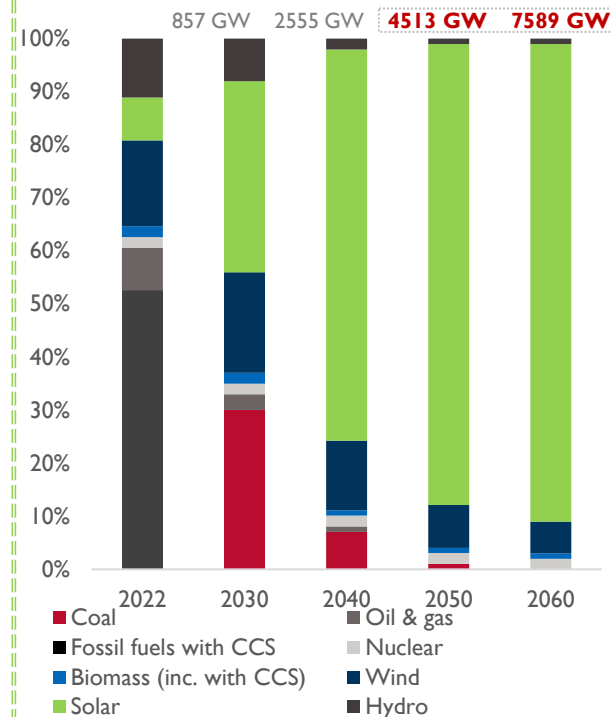
Source: Getting India to Net Zero - A Report Of The High-level Policy Commission On Getting Asia To Net Zero, ASPI

India-Projected Power Capacity (GW) mix in 2070 Net Zero (regulation focus) scenario



Source: Getting India to Net Zero - A Report Of The High-level Policy Commission On Getting Asia To Net Zero, ASPI

India-Projected Power Capacity (GW) mix in 2070 Net Zero (Market-Based Focus) scenario



Source: Getting India to Net Zero - A Report Of The High-level Policy Commission On Getting Asia To Net Zero, ASPI



India will need around \$10.1 Trillion in Cumulative Economy-wide Investment from now to meet its 2070 target | 7601 GW by 2060

Emerging Perspective 1



Impacting Clean Energy Transformation vision through CBET

01.5.1

Emerging Perspective 2



Gradually Transitioning from Bilateral to Trilateral CBET in SA

01.5.2

Emerging Perspective 3



Relying on Market Instruments, Regional Energy Market Development

01.5.3

Emerging Perspective 4



One Sun One World One Grid (OSOWOG)

01.5.4

Gradually Transitioning from Bilateral to Trilateral CBET in SA

\$2 billion , 1125 MW
Dorjilung Project

Proposed Trilateral
Project



Bangladesh will import 500 MW of electricity from 900 MW Upper Karnali (GMR) in Nepal @ 7.72 cents/unit for 25 years##

(Price Negotiation is Concluded, Discussion on transmission and other aspects is under consideration)

Bangladesh Master Plan# envisaged to import from Bhutan (1 GW) & Nepal (3 GW) through India

Power System Master plan 2016 (Final)- <https://powerdivision.gov.bd/site/page/68eb324d-c0b-483e-b047-13eb81da6820/Power-System-Master-Plan-2016>
<https://kathmandupost.com/money/2020/02/09/bangladesh-issues-letter-of-intent-to-purchase-500-mw-from-upper-karnali-hydro-project>

Enabling Frameworks



Guidelines for the Import / Export (Cross Border)-2018 of Electricity
Clause 3.1, Clause 8.6

Source: Ministry of Power, India



Central Electricity Regulatory Commission (Cross-border Trade of Electricity) Regulations, 2019
Clause 3. (2) , Clause 12. (6)

Source: CERC, India



Procedure for approval and facilitating Import/Export (Cross Border) of Electricity by the DA Authority-February, 2021
Clause 8. , Annex-V

Source: CEA, India



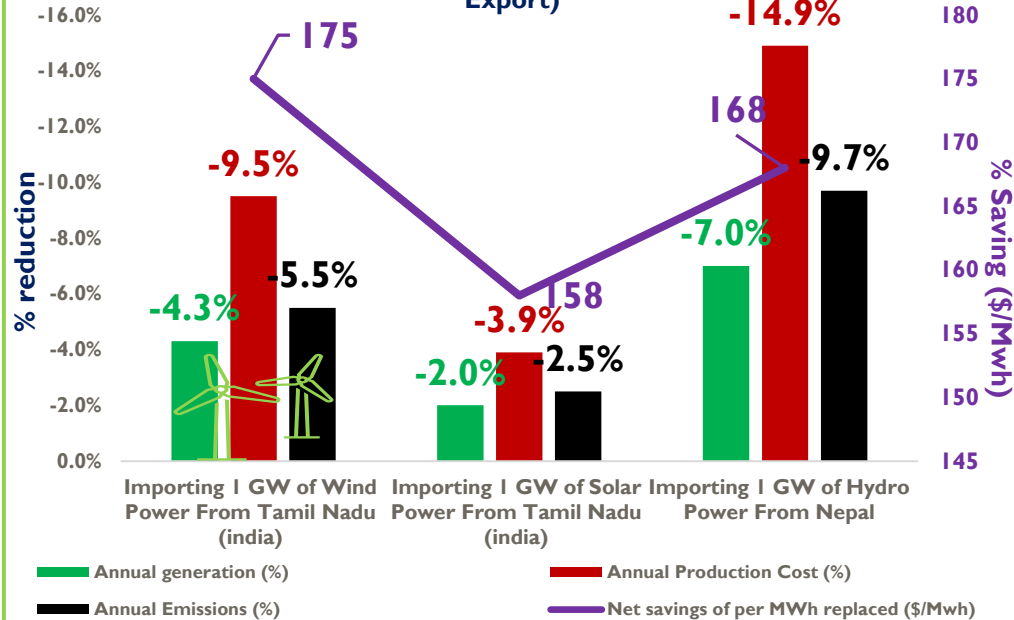
Source: Economic times

Nepal has sought approval from Indian authorities to export 40 MW of electricity to Bangladesh through India's existing transmission infrastructure, Trilateral Agreement is at advance stage

01.5.2 Emerging Perspective 2: Trilateral Cross Border Electricity Trade from Renewable Energy Zones



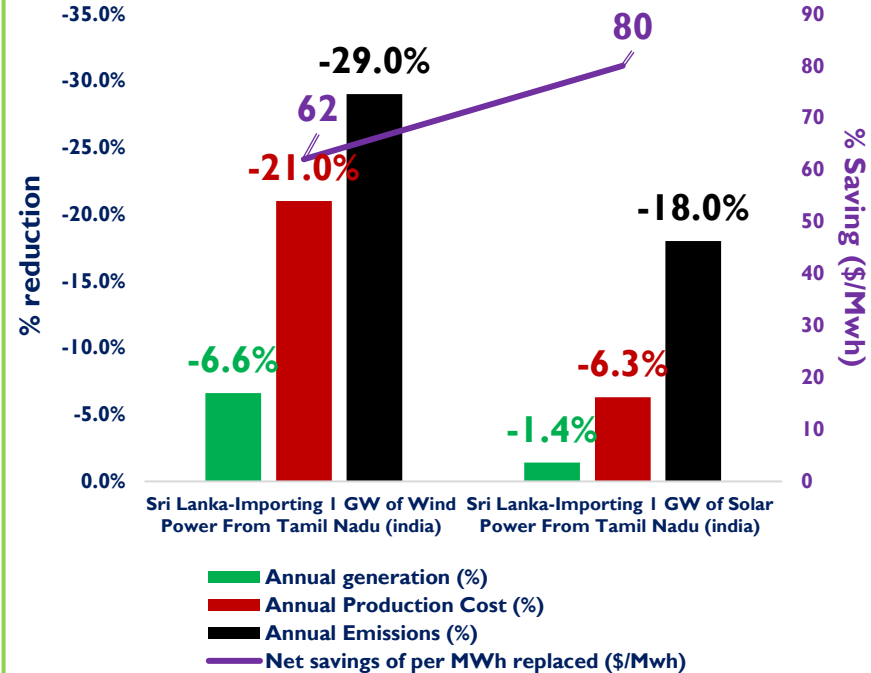
Bangladesh Importing from Renewable Energy Zones (Tamil Nadu State (Solar & wind export), India & Nepal (Hydro Power Export))



Source: **NREL** NREL Report on "Cross-Border Electricity Trading and Renewable Energy Zones"
<https://www.nrel.gov/docs/fy20osti/76919.pdf> <https://www.nrel.gov/docs/fy20osti/77029.pdf>
 1 GW of solar capacity in Tamil Nadu generates less energy than 1 GW of Nepal hydropower or 1 GW of Tamil Nadu wind power. Also, because solar's sunrise to-sunset profile is less correlated with Bangladesh load, the savings per unit of energy was also less—\$158 per MWh replaced.



Sri Lanka Importing from Renewable Energy Zones (Tamil Nadu State (Solar and wind export), India)



South Asia : GW scale RE based Trilateral CBET offers cost saving, clean energy transition:-leads to enhance energy affordability & sustainability

Emerging Perspective 1



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01.5.1

Emerging Perspective 2



**Gradually
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Emerging Perspective 3



**Relying on Market
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01.5.3

Emerging Perspective 4



**One Sun One World
One Grid
(OSOWOG)**


01.5.4


01.5.3 Emerging Perspective 3: Relying on Market Instruments, Regional Energy Market Development

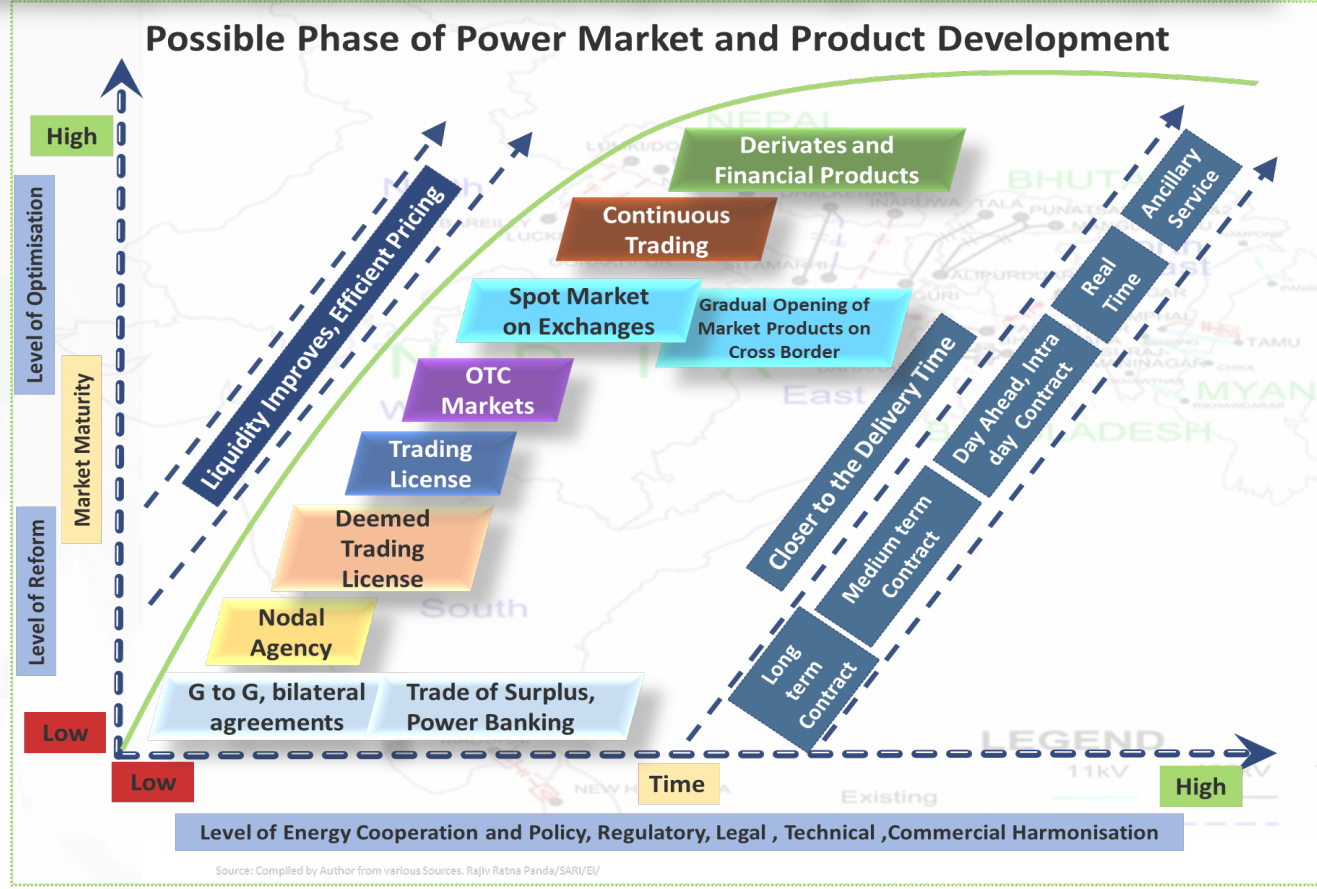
 Trend is to Rely on Competition & Market Instruments under Policy & Regulatory Oversight

 Tapping Demand Diversity-Daily, Weekly, Monthly, Seasonal

 Power Exchange-Competitive price discovery, Auction Platforms

 Portfolio of Product, Electricity (DAM, RT), Green (G-DAM, G-TAM), REC, ESCRTs

 Emergence of Carbon Market, Resurgence of Carbon Credits



Increase in Commercial/Market CBET since 2010 | Integrated Regional Power Market will facilitate optimal allocation of cost & and benefit of clean energy transition.

Emerging Perspective 1



**Impacting Clean
Energy
Transformation vision
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01.5.1

Emerging Perspective 2



**Gradually
Transitioning
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Emerging Perspective 3



**Relying on Market
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Development**

01.5.3

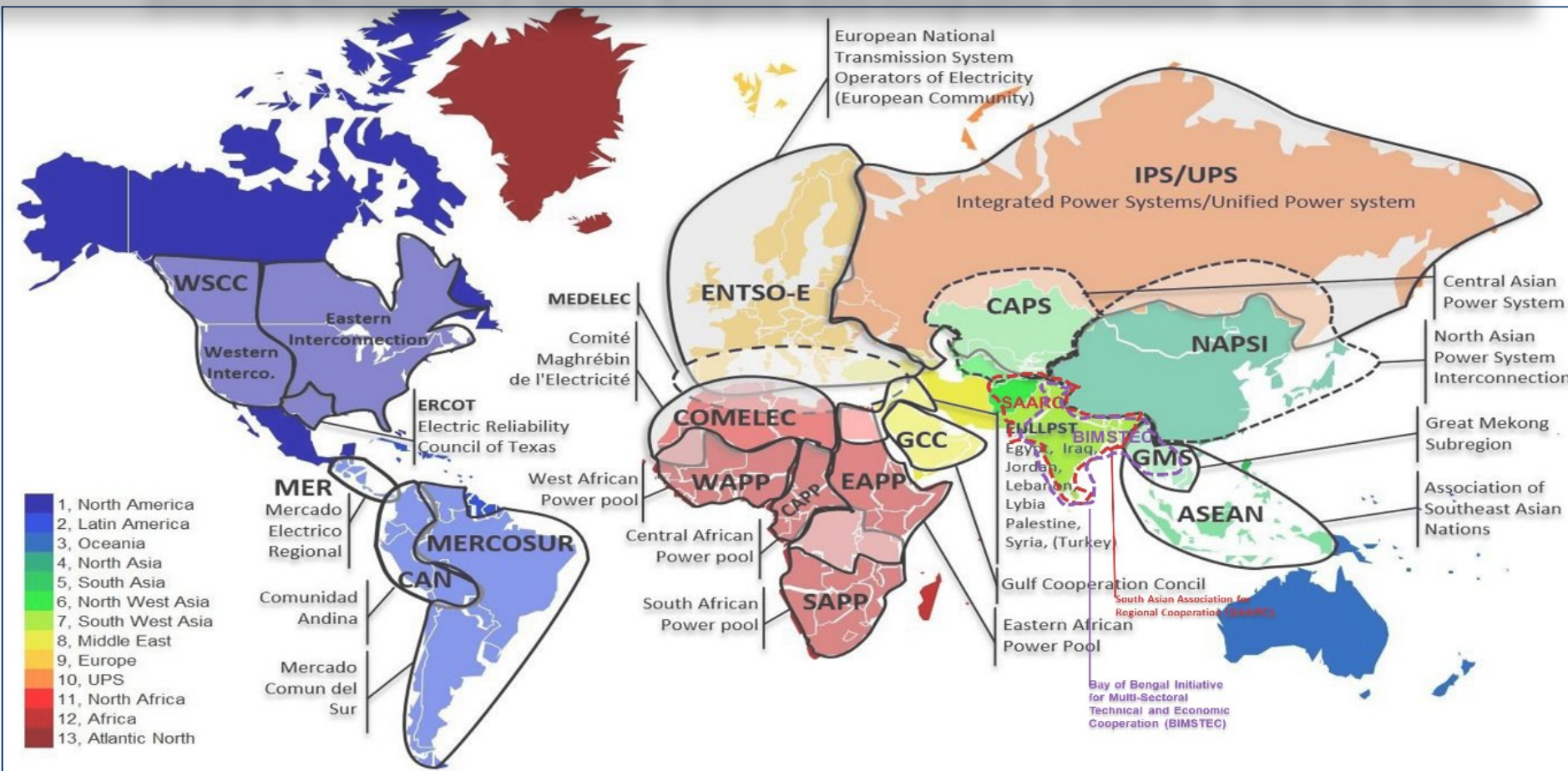
Emerging Perspective 4



**One Sun One World
One Grid
(OSOWOG)**

01.5.4

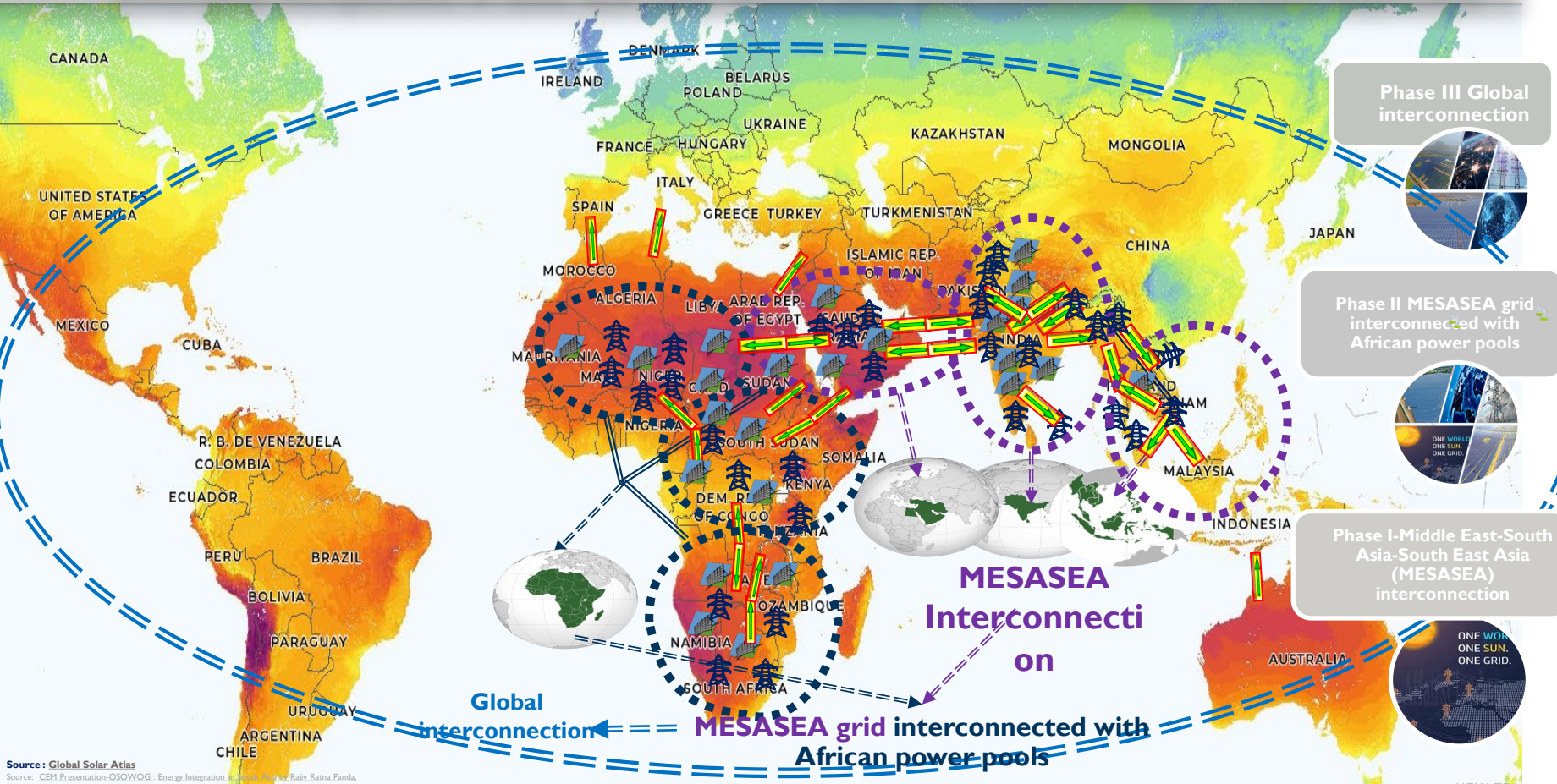
01.5.4 Emerging Perspective 4: Various Regional Grid Integration Initiatives across the Globe



Source : Power system development and Economics, Global electricity network Feasibility study, Reference: 775, September 2019, CIGRE report on "Global electricity network-Feasibility study", and further modification on the image by adding SAARC and BIMSTEC Region

01.5.4 Emerging Perspective 4: One Sun One World One Grid (OSOWOG)-3 Phase Approach

*Artistic representation only. Map not to scale, do not represent any identified location/point of interconnection or direction of power flows, purpose is simply to illustrate graphically for easier understanding of OSOWOG & its 3 phase approach in graphical manner



Source : Global Solar Atlas
 Source: CEM Presentation-OSOWOG : Energy Integration in South Asia by Rajiv Rama Panda.

Building Regional, Sub-Regional, Continental and Global Consensus on Interconnections will be the key



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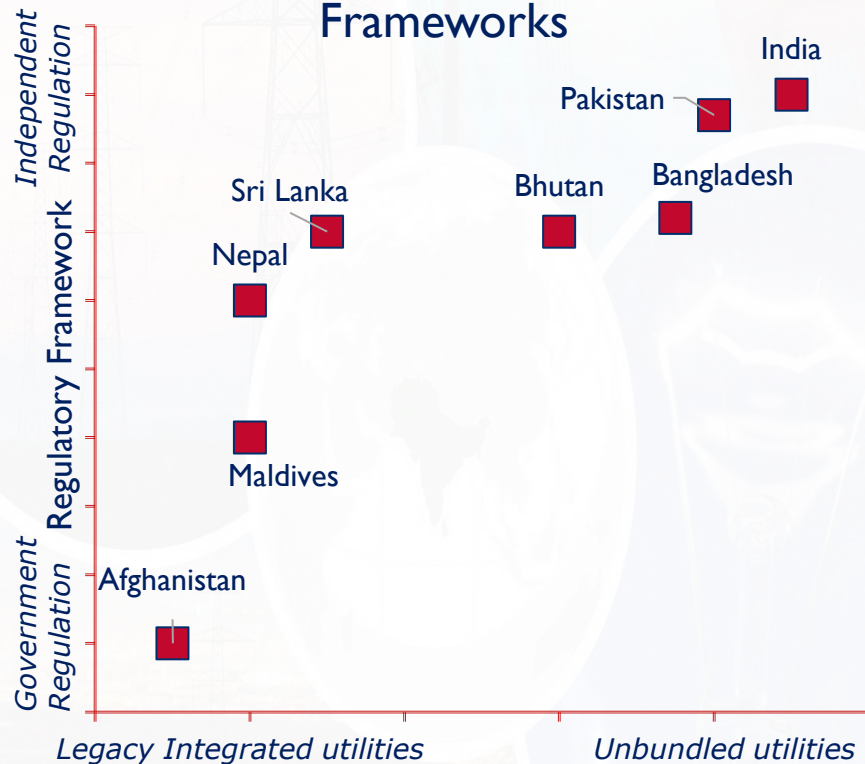
02

Power Sector Evolution, Market Development & Integration in South Asia



Power Sector Evolution, Market Development in South Asia

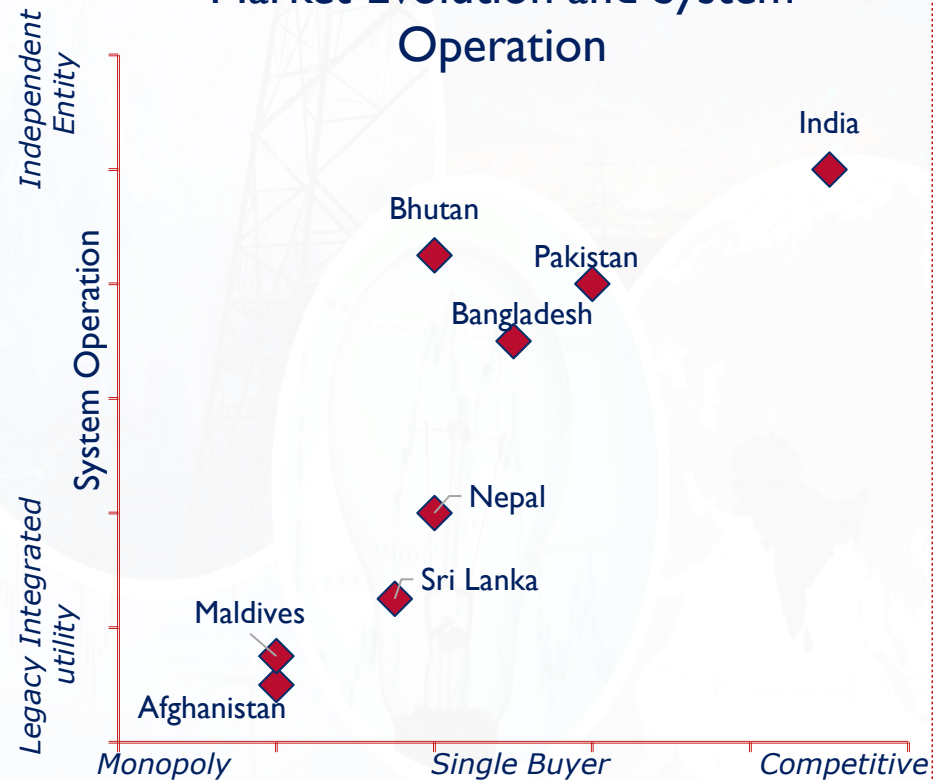
Power Sector and Regulatory Frameworks



Power Sector Framework








* Includes subjective interpretations

Market Evolution and System Operation



Electricity Market Evolution

* Includes subjective interpretations

Desirable Requirement for CBET	Afghanistan 	Bangladesh 	Bhutan 	India 	Nepal 	Pakistan 	Sri Lanka 
Regulations, legislations and policies directly related to Regional Energy Cooperation/Exchange and Cross Border Electricity Trade							
Law (incl. export/import licensing)	✗	✗	✓	✗	✓	✗	✗
Policy	✗	✗	✓	✓	⌚	✗	✗
Regulation	✗	✗	✗	✓	✗	✓	✗
Regulations indirectly related to Regional Energy Cooperation/Exchange and Cross Border Electricity Trade							
Open Access & Connectivity	✗	⌚	⌚	✓	⌚	✓	✗
Trading License (including import/export license)	⌚	✗	✗	✓	⌚	✓	✗
Grid Code	✗	✓	✓	✓	✓	✓	✓
Transmission Pricing	✗	✓	⌚	✓	✗	✓	⌚
Deviation Settlement	✗	✗	✗	✓	✗	✓	✗
Appellate Electricity Dispute Settlement Body	✗	✗	✗	✓	✗	✗	✗
			✓	Available	⌚	Partially Available	✗ Not Available

Develop Complementary Policy & Regulatory Framework and Need to Coordinate/Harmonise Policies & Regulation for Advancing CBET



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03

Way Forward

Enablers for Facilitating Energy Integration & CBET



Political & Policy



- Regional Long-Term Vision
- Political Consensus
- Intergovernmental agreement(s)
- Implementation & Review Mechanism
- Fostering Power Market Policy Reform
- Mainstreaming Clean Energy Transition in CBET dialogues as a solution

Regulatory



- Permissibility to use intermediary transmission network under open access
- Rules for identification of transmission capabilities & congestion
- Rules for measurement of imbalance and settlements
- A Robust Electricity Market Monitoring and Surveillance System
- Appropriate Regional Power Market Design

Technical and Commercial



- Harmonisation of grid codes & standards
- Transmission pricing & transit mechanism/charge
- Co-ordinated Regional Transmission Grid Planning- Regional Transmission Master Plan
- Common Cost sharing principles of cross-border transmission

Institutional



- Institutional arrangements
- Regional Coordination Forums are desirable
- Regional Dispute Settlement Mechanism

Thank You






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The data, information and assumptions (hereinafter ‘data-set’) used in this document are in good faith and from the source to the best of SAREP (the program) knowledge. The program does not represent or warrant that any data-set used will be error-free or provide specific results. The results and the findings are delivered on “as-is” and “as-available” data-set. All data-set provided are subject to change without notice and vary the outcomes, recommendations, and results. The program disclaims any responsibility for the accuracy or correctness of the data-set. The burden of fitness of the data-set lies completely with the user. In using the data-set data source, timelines, the users and the readers of the report further agree to indemnify, defend, and hold harmless the program and the entities involved for all liability of any nature.

Country	Power Trading and Market Structure	Single Buyer	IPPs	Separate Regulatory Body	Transmission System Operation (as a part of Transmission Agency)	Independent Transmission System Operator	Competitive Power Market Power/Gas Exchange Platform	Cross Border Electricity Trade Through Power market
Afghanistan 	Single Buyer (SB)-DABS, VIU-DABS							
Bangladesh 	Single Buyer (SB)-BPDB, Multiple Seller ^Partial Unbundling of Transmission							
Bhutan 	Single Buyer without Generation Assets (SBWGA)-BPC, ^^Un-bundled transmission							
India 	Multiple Buyer & Seller Competitive Power Market Platform. Power Exchange (PXs) Completely Un-bundled transmission							
Maldives 	Single Buyer (SB), VIU-FENAKA							
Nepal 	Single Buyer (SB)-NEA, Multiple Seller VIU-NEA							
Pakistan 	Single Buyer without Generation Assets- CPPA-G (Market Operator)^, Multiple Seller						^^	
Sri Lanka 	Single Buyer (SB)-CEB, Multiple Seller							

^Bangladesh- PGCB (subsidiary of BPDB which undertakes generation and distribution) owns & operates the transmission grid, ^^Pakistan –Pakistan is working to move from current single buyer to competitive market- Competitive Trading Bilateral Contracts Market (CTBCM)