South Asia Regional Initiative for Energy Integration

Key Findings & Highlights

Report on “Prospects for Sustainable Energy Infrastructure Development and Role of Cross Border Energy Trade in South Asia: Challenges, Opportunities and Way Forward”

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SAFIR Regulatory Newsletter (SRN)

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Agenda

01 Overview of South Asia (SA)
02 Climate & Sustainability Challenges
03 SA Power Sector Capacity Fuel Mix & Carbon Emissions
04 Sustainable Energy Infrastructure (SEI) - Concept
05 Growth of Renewable Energy
06 Potential Benefits of Regional SEI & CBET in SA
07 Key Planned SEI-CBET Infrastructure & Investment Opportunities
08 Key Success Factors - International Experience
09 Way Forward Regional SEI & CBET
10 SAFIR Regulatory Newsletter
Overview of South Asia

- Home to 1.79 billion people
  24% of World Population

- GDP -3.3 Trillion US$
  5th Largest Economy in the World

Pre-Covid Era
- One of the fastest growing economy
  (average growth rate ~6%) in the World
- Expected to Bounce Back (~8%)

- Intra-regional Trade Share (%)-5.6%
  Europe -68.9 %, ASEAN-23.3%

- Per Capita Electricity Consumption -1015
  World Average - 3300

- ~ 3700 MW BBIN Cross Border Power Trade
  Deepening Regional Energy Cooperation

Climate and Sustainability Challenges of South Asia

South Asia (SA) is highly vulnerable to adverse impact of climate change

CRI Ranks - **Three** SA countries, Bangladesh (7), Pakistan (8), Nepal (10) among the 10 most affected from 2000-2019 (Average)

Five SA Countries Bangladesh (7), Pakistan (8), Nepal (10), India (20), Sri Lanka (23) within the initial 30 rankings out of 180

Increase in climate related incidents puts added pressure on the **Need for more Sustainable & Resilient Infrastructure**

Data in shaded background indicates higher number of climate related incidents. Source: German watch Global Climate Risk Index

Fossil CO\textsubscript{2} Emissions in South Asia

Fossil CO\textsubscript{2} Emission on increasing trend
Though in per capita terms (1.63) substantially lower than Global average (4.93)

Between 2010 & 2019, Emissions have increased at a CAGR of 4.1%

CO\textsubscript{2} Emission varies widely among SA countries
(2019 Mt CO\textsubscript{2}/yr: India- 2,597 , Pakistan - 224, Bangladesh- 110 )
Power sector accounts for **44%** of total Fossil CO\(_2\) Emissions

**Power Installed Capacity Mix**

- ~49% Coal
- ~21% RE
- ~14% Large Hydro

**De-Carbonisation** of power sector & building **Sustainable Energy Infrastructure** is crucial for the Region.

**Recognizing Climate Concerns, SA Countries have submitted Intended Nationally Determined Contributions (INDC)**

*Presentation on Key Findings and Highlights of the Conference Paper on “Prospects for Sustainable Energy Infrastructure Development and Role of CBET in South Asia: Challenges, Opportunities and way forward” & SAFIR Regulatory Newsletter by Mr. Rajiv Ratna Panda, Associate Director/SARI/EI/IRADE/15th March, 2021*
Sustainable energy infrastructure could be of different forms: sustainable energy generation resources, transmission systems for sustainable energy, energy use that reduces overall emissions / improve energy access, more efficient market mechanisms etc. When such sustainable energy infrastructure is utilized in the regional context, through cross border cooperation or other means, they may be referred to as regional sustainable energy infrastructure.

Sustainability of an infrastructure is to be viewed from environmental, social and economic aspects.

- **Environmental sustainability**
  - Clean energy power plants and plants supporting emission reduction
  - Transmission lines supporting clean energy / emission reduction

- **Social sustainability**
  - Energy storage supported by clean energy (including pumped storage hydro, battery etc.)

- **Economic sustainability**
  - Market mechanisms that improve efficiency of power markets
  - New sustainable technology such as hydrogen based energy
Growth of Renewable Energy - Enhancing Sustainability

**SA Countries Prioritised**
Expansion of Renewable Energy (RE)
E.g. India-175 GW by 2022, 450 GW by 2030

**FY15-FY20, Total installed capacity grew at a CAGR of 6.3%**
RE Capacity Grew at a CAGR of 19.7%

**Sustainable RE Grid Integration Crucial for Region’s Sustainability**

**One Sun One World One Grid**

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Growth of Power Installed Capacity & Renewable Energy in South Asia

- **Total capacity**
- **RE**
- **RE, incl. large hydro**

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<th>YEAR</th>
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<th>RE</th>
<th>RE, incl. large hydro</th>
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91 GW of RE capacity in India
Potential Benefits of Regional Energy Infrastructure Development & CBET in SA

- Access to Competitive Power
- Export Revenues
- Economic Extension of grid
- Regional Cost Optimisation
- Economic growth

- Larger grid, better grid
- Intra-seasonal differences
- Peak Time/Time zone differences
- Better Hydro - Thermal Mix
- Regional Balancing

- Regional Hydro Power Development
- RE/Clean Energy Development
- Reduced CO2 Emission
- RE based CBET
- Improved Energy & Environmental Security

- Competitive Energy Market
- Fair & Transparent Price Discovery
- Choice - Different Products
- Consumer Benefits & Social Welfare

- New Investment Avenues
- Enhanced feasibility due to larger market
- Return on Investment
- Innovative Financing Mechanism
Key Planned Regional Sustainable Energy Infrastructure

- 900 MW Arun-III and 900 MW Upper Karnali HPPs in Nepal
- India – Bhutan IG MoU for 10,000 MW
- 1125 MW Dorjilung HPP in Bhutan, Proposed Trilateral Project - Potential export to Bangladesh
- New transmission lines between India – Nepal (400 KV New Butwal-Gorakhpur, Arun-III and Upper Karnali evacuation lines), India – Bhutan (Punatsangchu HEP – Alipurduar 400 KV, Alipurduar – Siliguri 400 KV and Kishanganj – Darbhanga 400 KV) and India – Sri Lanka (HVDC)
- 765 KV Bornagar (India North East) – Parbotipur (Bangladesh) – Katihar (India East)
- 10X Envisaged, 43.8 GW Cross Border Grid Interconnection (CBGI)-2040, Current CBGI Capacity ~ 4 GW
- 130 KM India – Bangladesh Friendship Pipeline Project
- India-Nepal: LPG pipeline, natural gas pipeline from Gorakhpur to Sunwal
- The Turkmenistan-Afghanistan-Pakistan-India natural gas pipeline (TAPI)
South Asia: Sustainable Energy Infrastructure Investment Opportunities

- De-carbonising Power Generation
- Cleaner and Efficient Public Transport
- Renewable Energy
- Electric Vehicle & Charging Infrastructure
- Natural gas, LNG and Region Gas Grid
- Modernising power grid, smart grid, smart utility
- Cross Border Hydro Power Projects and Cross Border Power Transmission
International Experience - Regional Sustainable Energy Infrastructure in Regional Power Pools / Power Markets: Key Success Factors

- Regional power projects
- Regional electricity interconnections
- Regional RE integration & CBET
- Regional fuel pipelines
- Regional electricity markets

Central American interconnections

- Denmark – Norway – Sweden
- Blue Stream
- SAPP

European Internal market

- Spain – Morocco and France
- GCC interconnection
- Itaipu dam (Brazil, Paraguay)
- Nam Theun 2 (Laos)
- Tala HPP (Bhutan)
- Central America

Regional RE integration & CBET

- PCI Projects Connecting Europe Facility
- Myanmar – Thailand gas pipeline
- EU internal market

Regional electricity interconnections

- Central American interconnection
- Spain – Morocco
- GCC

Regional fuel pipelines

- Blue Stream
- SAPP

Regional electricity markets

- Central American interconnection
- GCC interconnection
- Itaipu dam (Brazil, Paraguay)
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Development Financing Institutions

- Project viability through grants & low interest loans, PCI, Connecting Europe Facility instruments

Need for inter-governmental agreements & Effective Implementation

- Joint Ownership: Ensuring support on Project Development, comfort on buying and selling side
- Cost Sharing: Common understanding/mechanism/principle on cost sharing for the project

Note: The depiction on the map is only indicative
Summary & Way Forward for Regional Sustainable Energy Infrastructure (SEI) & Cross Border Energy Trade (CBET)

- Address gaps in regulatory policies
- Long term regulatory and policy certainty
- Regional level SEI feasibility studies
- Regional SEI Investment outlook
- Innovative financing options for the regional project as well as source of funding
- Regional Power Market Development & Operationalization
- Build More Power Transmission Connectivity

Inter-Governmental

- Take forward/implement SAARC Framework agreement & BIMSTEC MoU on Grid Interconnection
- Making Energy Cooperation Comprehensive (energy efficiency, smart grid, fuel cell, clean coal technologies, energy storage, hydrogen electric mobility, RE Grid Integration)
- Regional Institutional Mechanism/Funds for mobilizing Investment, Financing, & Investment Promotion etc.
- Investment Protection & Dispute Resolution Frameworks

Policy Makers, Regulators & Investment Community

Regional discussion, preferable under the auspices of regional institution

Regional coordination institutions such as regional forum of regulators, transmission utilities, system operators

Development of Regional Transmission Master Plan

Institutional
SAFIR Regulatory Newsletter-Highlights

Aims to Enhance Regulatory Knowledge Sharing
To be circulated in SA Countries in electronic format (Quarterly)

Regulatory updates & Developments in the Region

Key Regulatory Events in South Asia

From the Regulator’s Desk

Cross Border Transactions in the BBIN Regional Grid
Thank You

It always seems impossible until it's done.

Nelson Mandela

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Existing Regional Sustainable Energy CBET Infrastructure

- Chukkha, Kurichhu, Tala and Mangdhechu HPPs in Bhutan
- 27 MW Jaldhaka HPP in India – Bhutan border
- 120 MW Tanakpur barrage in India – Nepal border
- 400 KV lines between Bhutan – India, India – Nepal and India – Bangladesh.
- Multiple lines at 230 KV and below, including those between Iran – Pakistan, Iran – Afghanistan and Central Asia – Afghanistan.
- The 69 km petroleum product pipeline between Motihari in India and Amlekhgunj in Nepal
- 91 GW of RE capacity in India; 2.1 GW in Pakistan; 636 MW in Sri Lanka etc.
- Other countries also scaling up gradually.

Regional energy generation infrastructure

Regional electricity transmission infrastructure

Regional oil and gas pipelines

Regional sustainable energy infrastructure within the countries