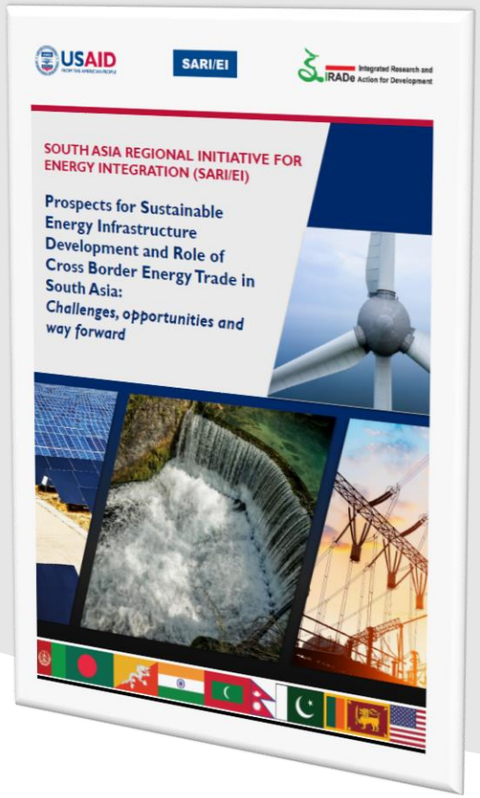
South Asia Regional Initiative for Energy Integration

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"

&

SAFIR Regulatory Newsletter (SRN)



Presented by

Mr. Rajiv Ratna Panda

Associate Director, SARI/EI/IRADe

Inaugural Session of the SAFIR-SARI/EI Conference (Virtual) on "Sustainable Energy Infrastructure Development and Role of Cross Border Energy Trade in South Asia: Challenges, Opportunities and Way Forward" 15th March 2021, New Delhi, India

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

01

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

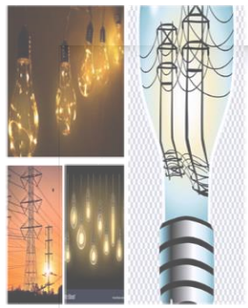
Pre-Covid Era

One of the fastest growing economy (average growth rate ~6%) in the World

Expected to Bounce Back (~8 %)

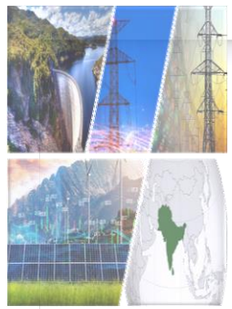
Intra-regional Trade Share (%)-5.6 %

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

02

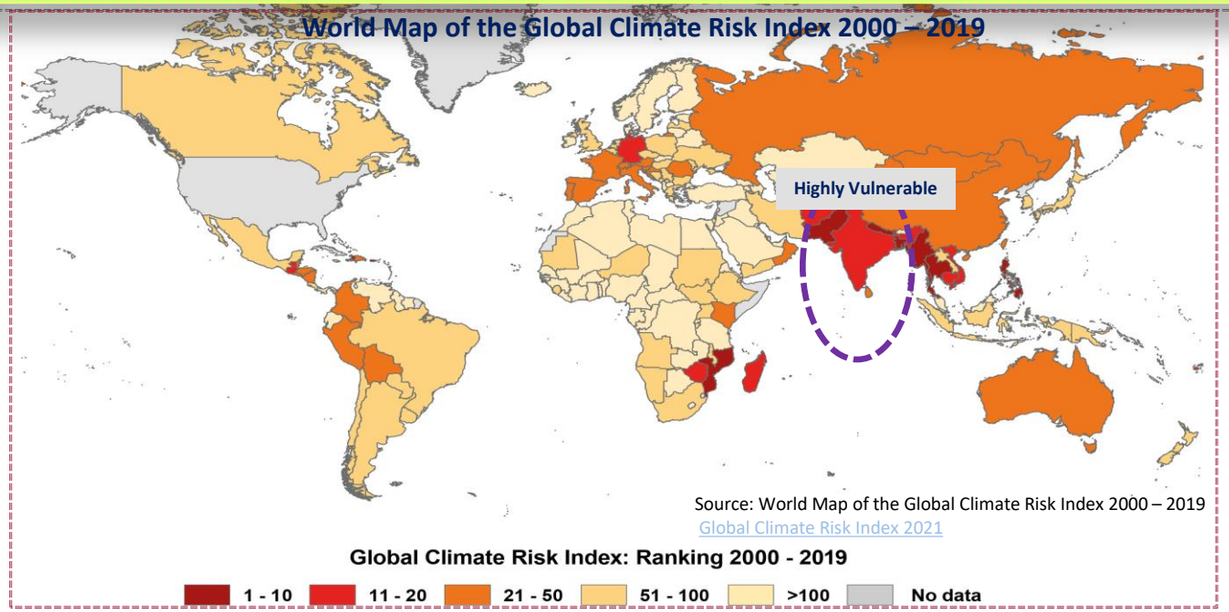
Climate and Sustainability Challenges of South Asia

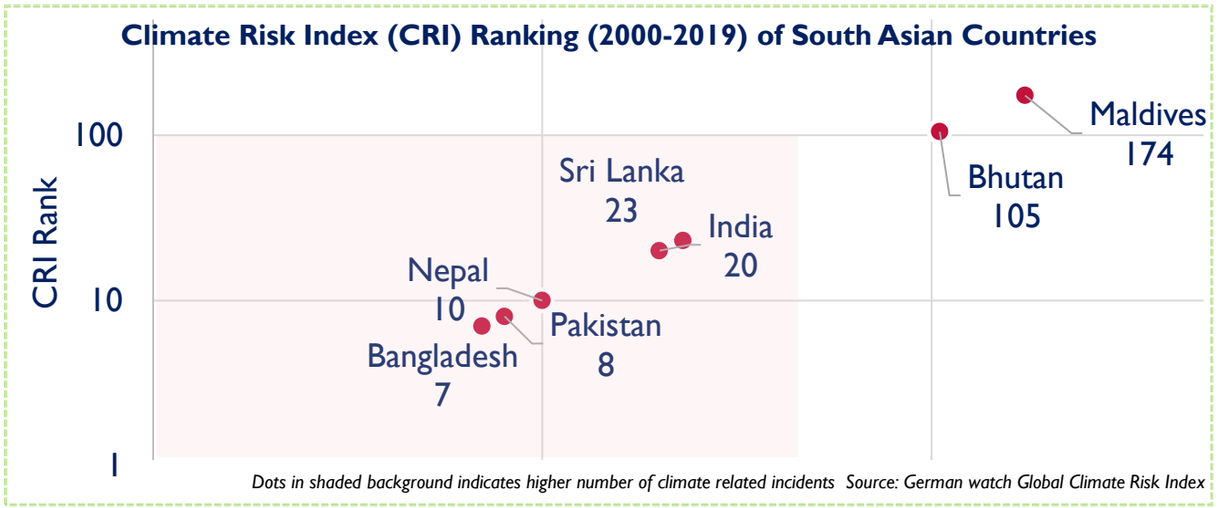
South Asia (SA) is highly vulnerable to adverse impact of climate change

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**





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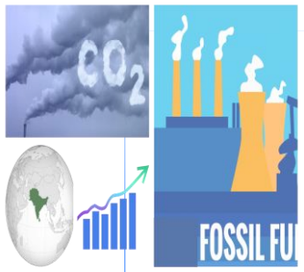
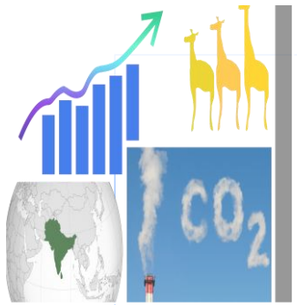
Fossil CO_2 Emissions in South Asia

Fossil CO_2 Emission on increasing trend

Though in per capita terms (1.63) substantially lower than Global average (4.93)

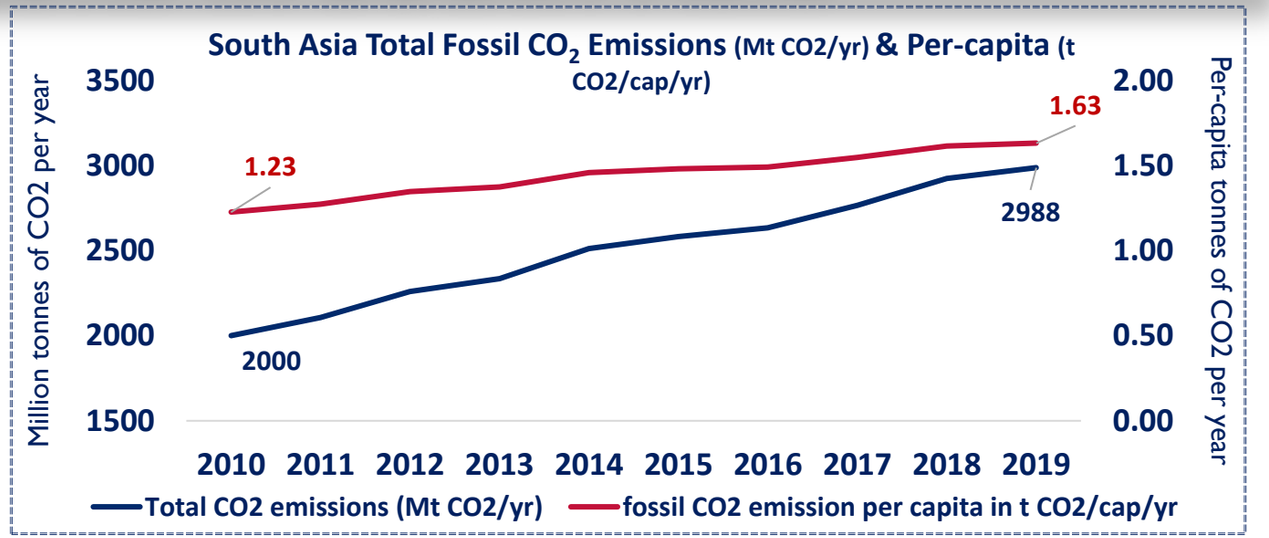


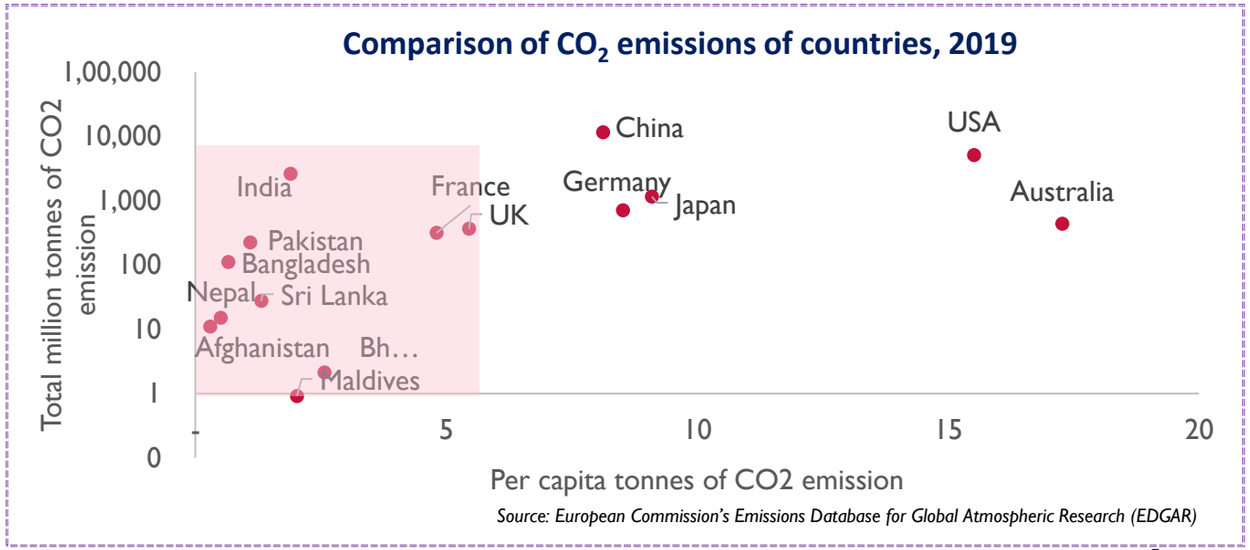
Between 2010 & 2019, Emissions have increased at a CAGR of 4.1%



CO_2 Emission varies widely among SA countries

(2019 Mt CO2/yr:-India- 2,597 , Pakistan- 224, Bangladesh- 110)





Source: European Commission's Emissions Database for Global Atmospheric Research (EDGAR)

2019 Mt CO2/yr:-Sri Lanka -28, Nepal-15, Afghanistan -11, Bhutan-2, Maldivies-1

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Integrated Research and Action for Development

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03 South Asia Power Sector Fuel Mix & Carbon Emissions

Power sector accounts for **44%** of total Fossil CO_2Emissions

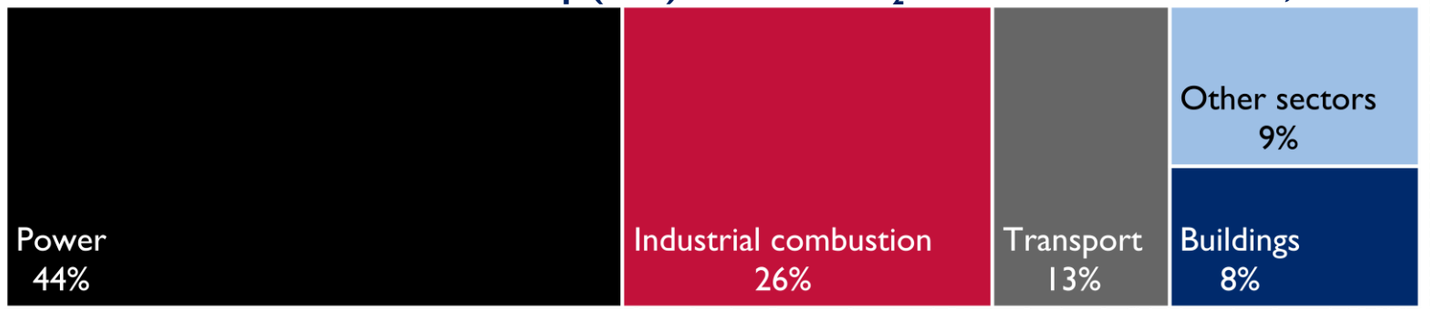
Power Installed Capacity Mix

~49% Coal, ~21% RE

~14% Large Hydro

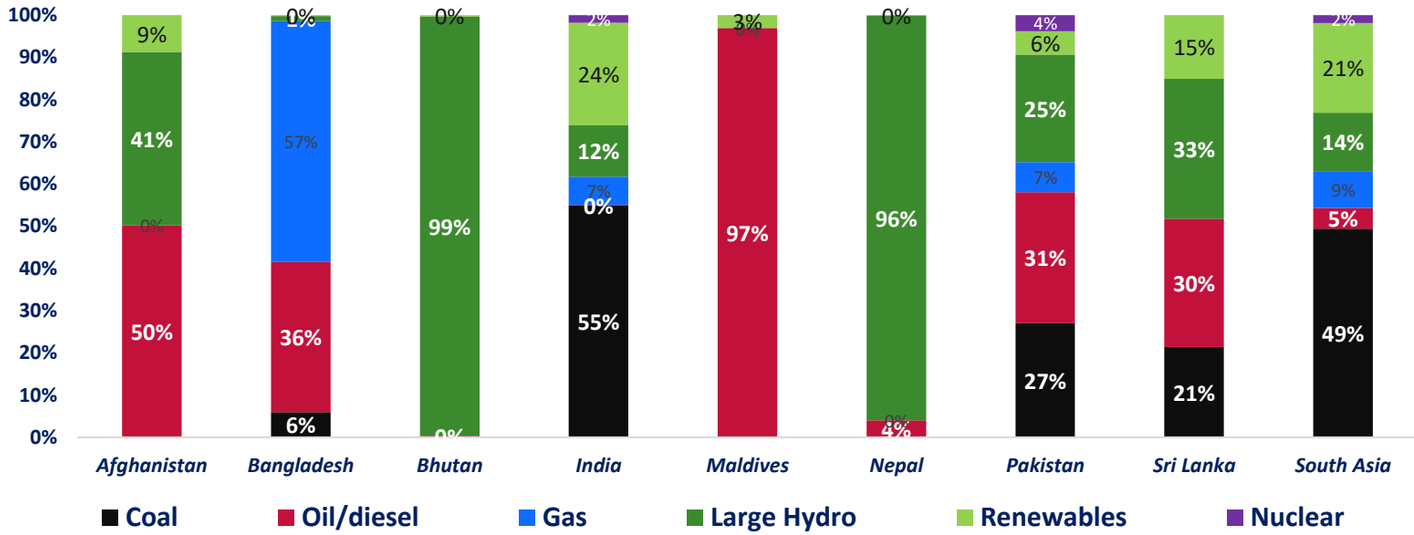
De-Carbonisation of power sector & building **Sustainable Energy Infrastructure** is crucial for the Region.

Sector wise breakup (in %) of Fossil CO_2 emissions in South Asia, 2019



Source: Based on European Commission's Emissions Database for Global Atmospheric Research (EDGAR)

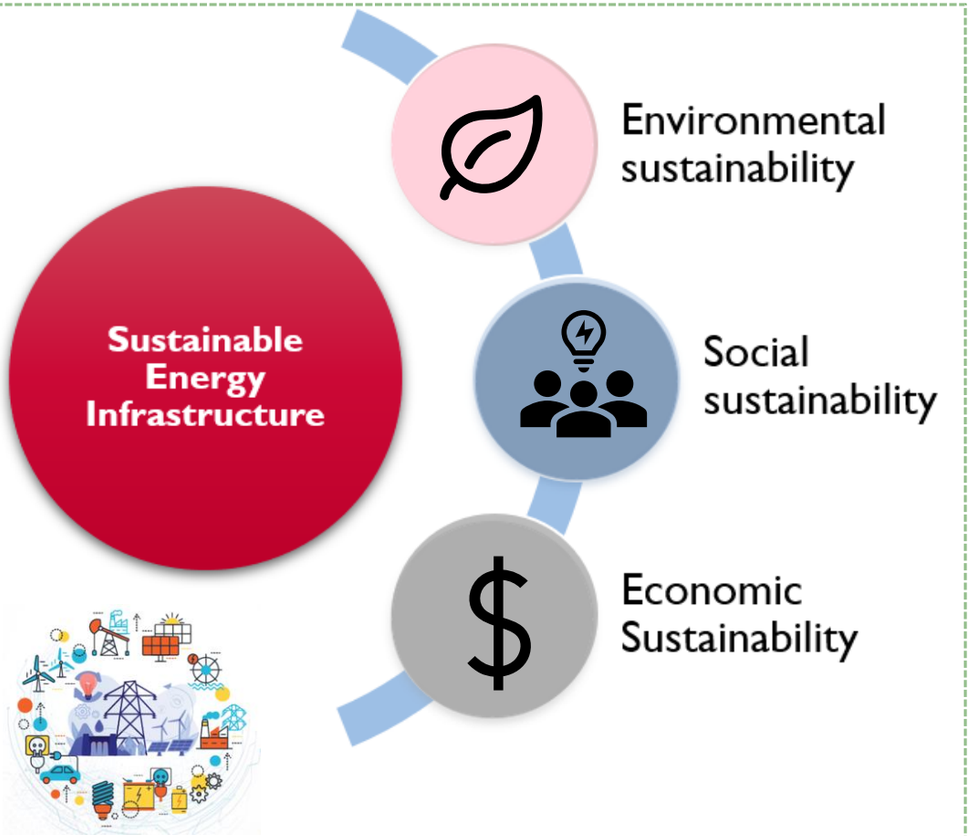
South Asia – Electricity Installed Capacity Fuel Mix



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

04

Sustainable Energy Infrastructure-Concept



Clean energy power plants and plants supporting emission reduction

Transmission lines supporting clean energy / emission reduction

Infrastructure to improve electricity access

Energy storage supported by clean energy (including pumped storage hydro, battery etc.)

Market mechanisms that improve efficiency of power markets

H

New sustainable technology such as hydrogen based energy

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

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.**

05 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

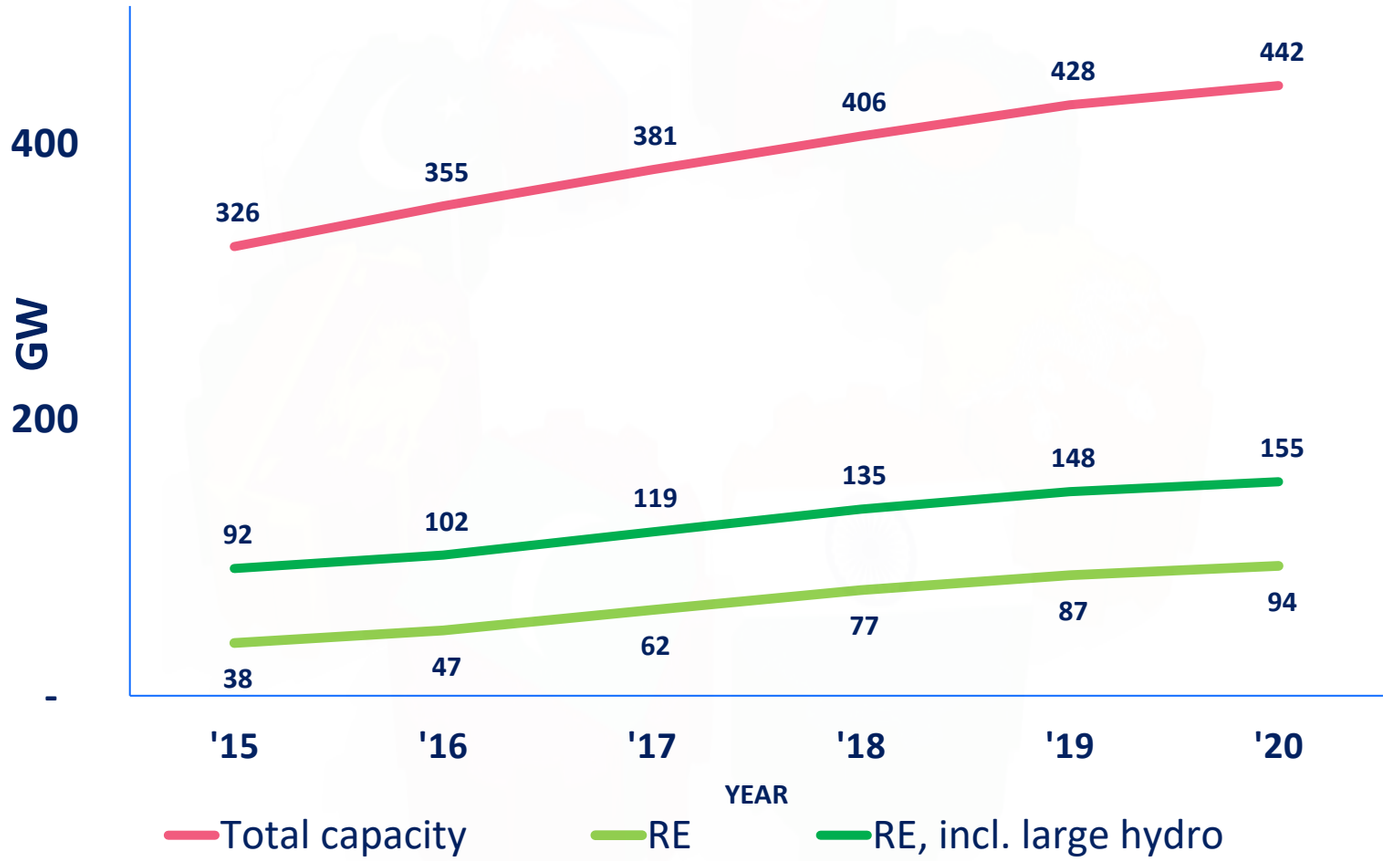
FY15 -FY20, Total installed capacity grew at a CAGR of 6.3%

RE Capacity Grew at a CAGR of 19.7%

Sustainable RE Grid Integration Crucial for Region's Sustainability

One Sun One World One Grid

Growth of Power Installed Capacity & Renewable Energy in South Asia

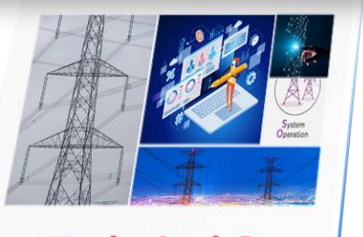


91 GW of RE capacity in India

06 Potential Benefits of Regional Energy Infrastructure Development & CBET in SA

Economic & Financial

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



Technical & Operational

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

Environmental & Social

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

Regional Energy Market

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

Mobilizing of investment

- New Investment Avenues
- Enhanced feasibility due to larger market
- Return on Investment
- Innovative Financing Mechanism

07 Key Planned Regional Sustainable Energy Infrastructure

Regional energy generation 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

Regional electricity transmission infrastructure

- 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

Regional oil and gas pipelines

- 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)

07 South Asia: Sustainable Energy Infrastructure Investment Opportunities

De-carbonising Power Generation

Cleaner and Efficient Public Transport

Renewable Energy

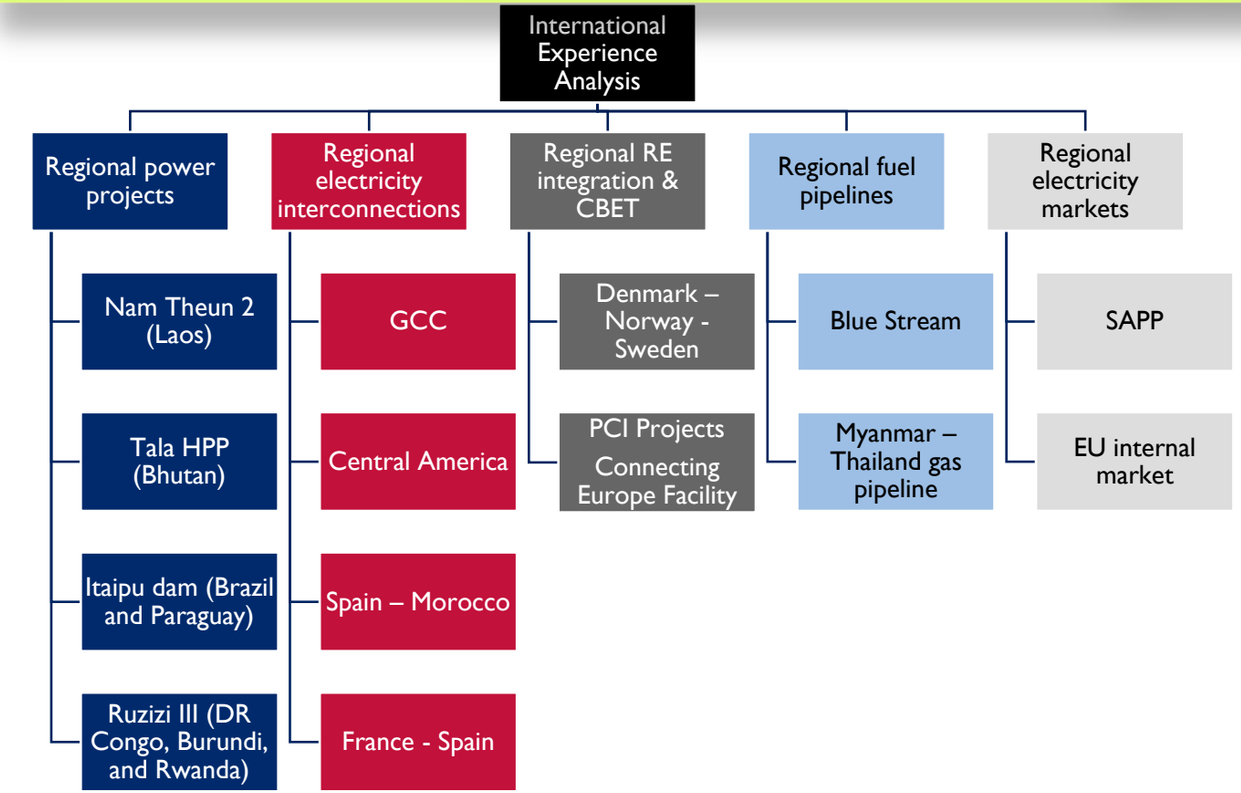
Electric Vehicle & Charging Infrastructure

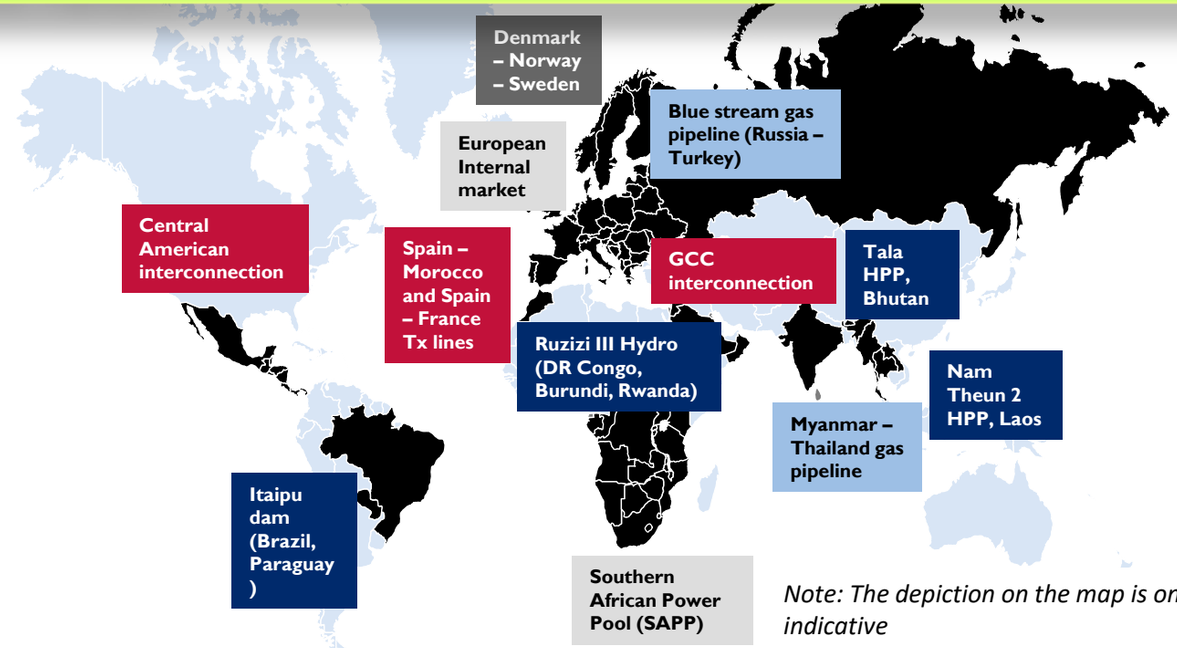
Natural gas, LNG and Region Gas Grid

Modernising power grid , smart grid, smart utility

Cross Border Hydro Power Projects and Cross Border Power Transmission

08 International Experience-Regional Sustainable Energy Infrastructure in Regional Power Pools / Power Markets : Key Success Factors





Note: The depiction on the map is only indicative

Key success factors

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

Development Financing Institutions project viability through **grants** & **low interest loans, PCI, Connecting Europe Facility instruments**

09

Summary & Way Forward for Regional Sustainable Energy Infrastructure (SEI) & Cross Border Energy Trade (CBET)

Policy Makers, Regulators & Investment Community

- 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

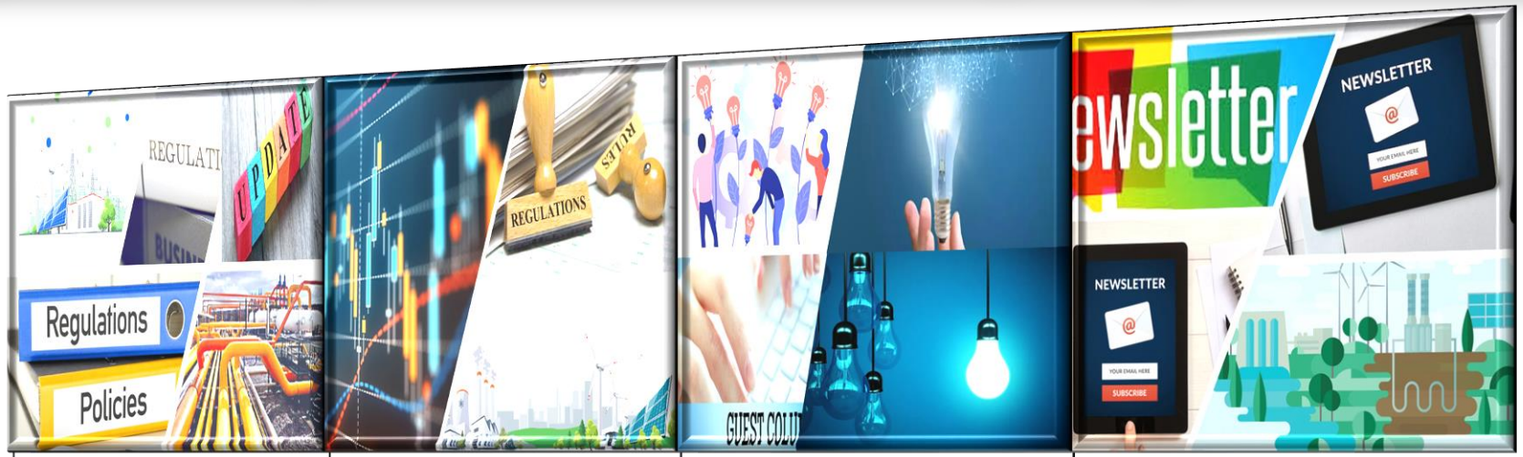
Inter-Governmental

- 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

Institutional

- 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

SAFIR Regulatory Newsletter-Highlights



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

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

Thank You

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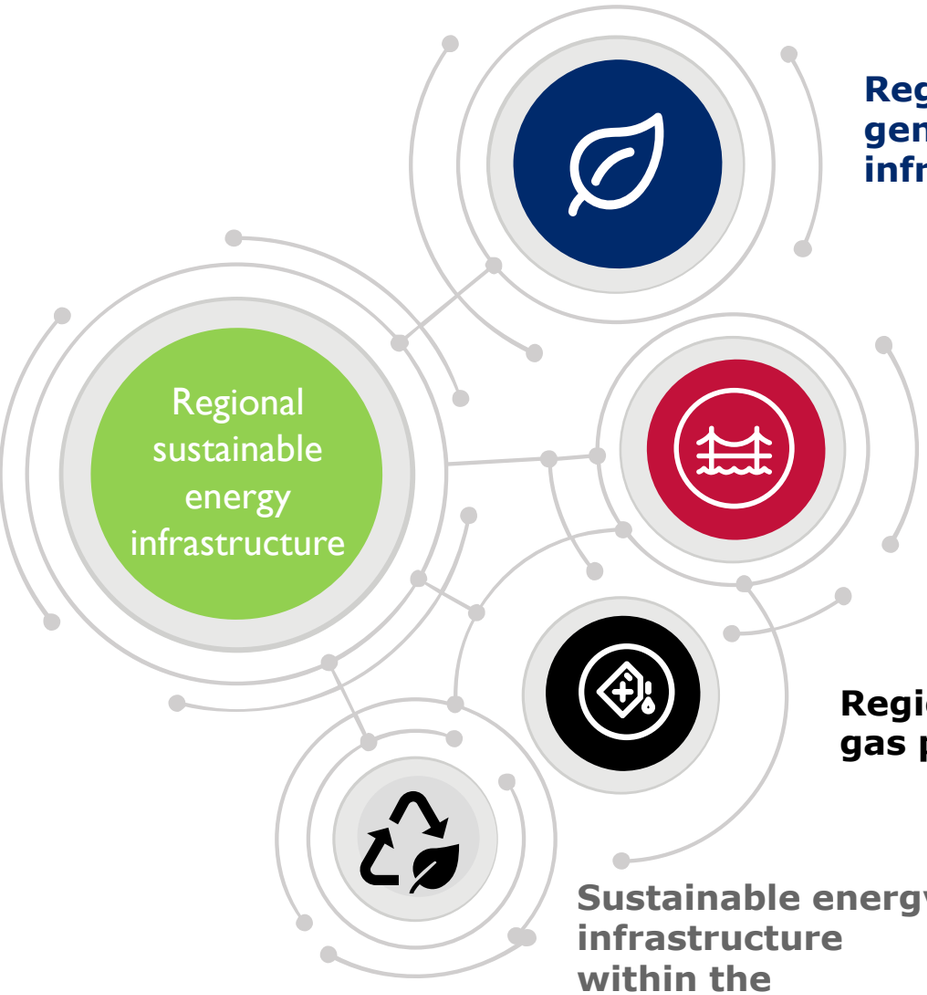
https://www.irade.org/

06 Existing Regional Sustainable Energy CBET Infrastructure



Regional energy generation 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

Regional electricity transmission infrastructure

- 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.

Regional oil and gas pipelines

- The 69 km petroleum product pipeline between Motihari in India and Amlekhgunj in Nepal

Sustainable energy infrastructure within the countries

- 91 GW of RE capacity in India; 2.1 GW in Pakistan; 636 MW in Sri Lanka etc.
- Other countries also scaling up gradually.