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**IRADe** Integrated Research and  
Action for Development

## Brief Report

On

**SARI/EI participation as Resource Person in the “SAARC Dissemination Workshop  
on the Study for Development of Potential Regional Hydro Power Plant in South Asia”**



**09<sup>th</sup> -10<sup>th</sup> May, 2016**  
**Hotel SoalteeCrowne Plaza**  
**Kathmandu, Nepal**





## Brief Report

Based on the invitation from SAARC Energy Centre of South Asia Association of Regional Cooperation, Mr. Rajiv Ratna Panda, Head-Technical, SARI/EI/IRADe participated in the SAARC Dissemination Workshop on “The Study for Development of Potential Regional Hydro Power Plant in South Asia” held on 09th -10th May, 2016 at Hotel SoalteeCrowne Plaza, Kathmandu, Nepal.

Mr. Rajiv made a detailed presentation titled “Regional Energy Cooperation: Regional Regulatory Guidelines for Promoting Cross Border Electricity Trade & Hydro Power Development in South Asia”. His presentation covered a) Brief overview of SARI/EI b) Overview of South Asian Power Sector c) Key drivers for Cross Border Electricity Trade (CBET) and Regional Exploitation of Energy Resources d) Current status of CBET and future scenario of CBET in South Asia e) Key Issues related to CBET Hydro Power Projects: investor/lender and developers perspective in South Asia f) Accelerating responsible hydropower development in South Asia: Policy Making Perspective g) Non energy benefits of Hydropower in South Asia: Policy Making Perspective h)Hydro Power for regional balancing i) Possible phase of market development in CBET in South Asia j) Key challenges and risk associated with CBET projects k) Need of regulatory framework-Regional Regulatory Guidelines (RRGs) l) Context, Preamble and Purpose of Regional Regulatory Guidelines m) Brief Summary of the RRGs n) Implementation provision of Regional Regulatory Guidelines o) International Best Practices on Regional Regulatory Institutional Mechanism and p) way forward. His detailed presentation is attached as Annexure-I.



He also presented and explained the each of the guidelines i.e. on 1) Licensing for cross border electricity trading 2) Open access to Transmission network 3) Transmission pricing regime 4) Transmission planning 5) Imbalance settlement mechanism 6) Harmonization of Codes 7) Dispute Resolution 8) Duties and tax regimes. The Workshop was inaugurated by Mr.Suman Prasad Sharma, Hon’ble Secy. Ministry of Energy, Government of Nepal. The workshop was attended by the delegates from the SAARC Member states, resources persons and Department of Electricity Development (DoED), Ministry of Energy, Government of Nepal.





# Regional Energy Cooperation: Regional Regulatory Guidelines for Promoting Cross Border Electricity Trade & Hydro Power Development in SA

**Rajiv Ratna Panda**  
**HEAD-TECHNICAL, SARI/EI/IRADe**

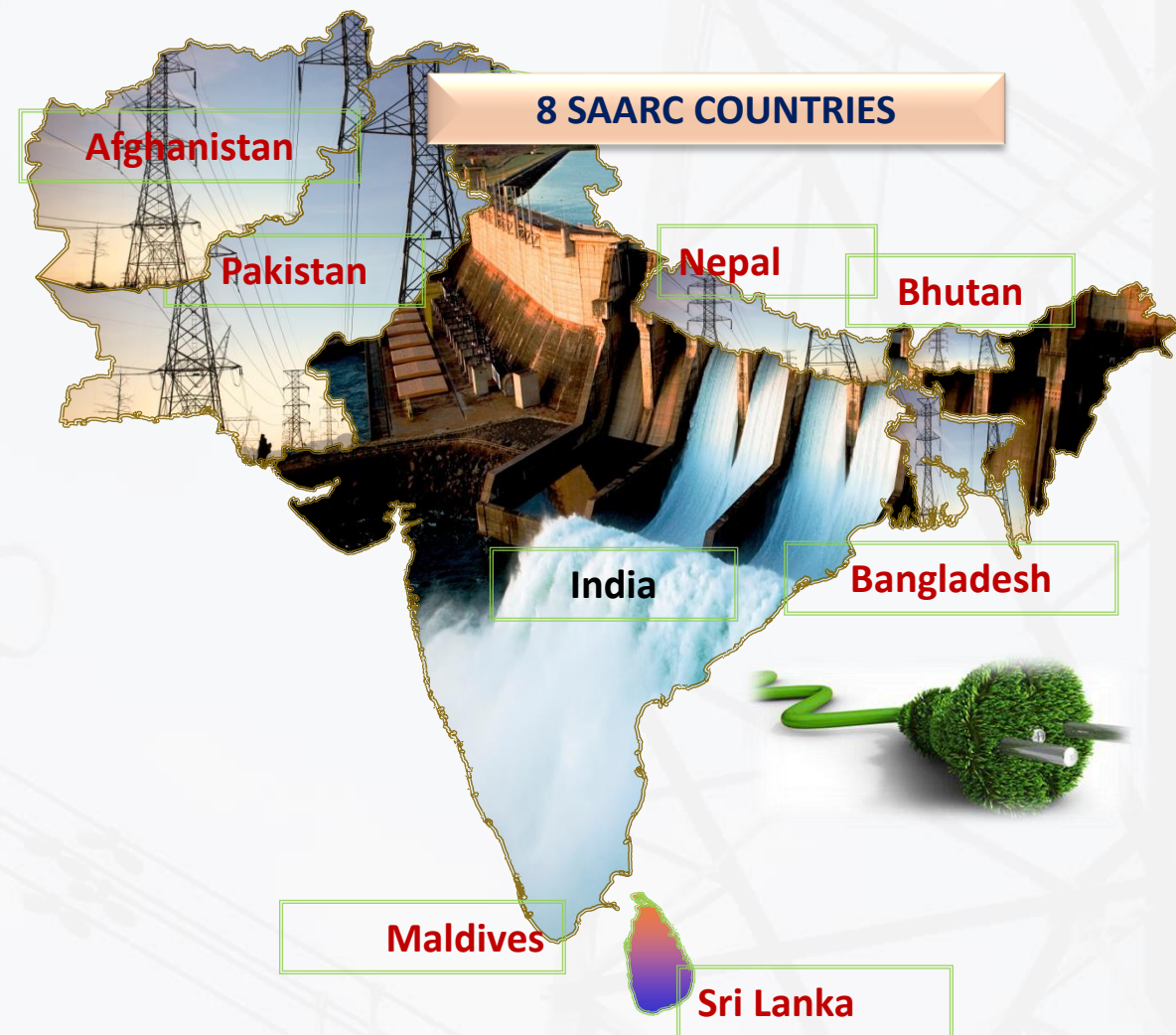
**09– 10 May 2016**

**SAARC Dissemination Workshop on  
“The Study for Development of a Potential Regional Hydro Power Plant in South Asia”  
Hotel Soaltee Crowne Plaza, Kathmandu, Nepal**



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- *Way Forward*





# *Brief Overview of SARI/EI*



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

● SARI/E is a long standing program of USAID started in the year 2000.

● Program has consistently strived to address energy security in South Asia by focusing

- 1) Cross Border Energy Trade
- 2) Energy Market Formation and
- 3) Regional Clean Energy Development.

● SARI/EI–Phase IV (2012-2017): Key Outcomes.

Three Key Development Outcomes:

1. *Coordinate policy, legal and regulatory issues.*
2. *Advance transmission interconnections.*
3. *Establish South Asia Regional Electricity Markets.*

● First Three Year of the Program is Completed.

● Demand Driven ‘Bottom Up’ Approach

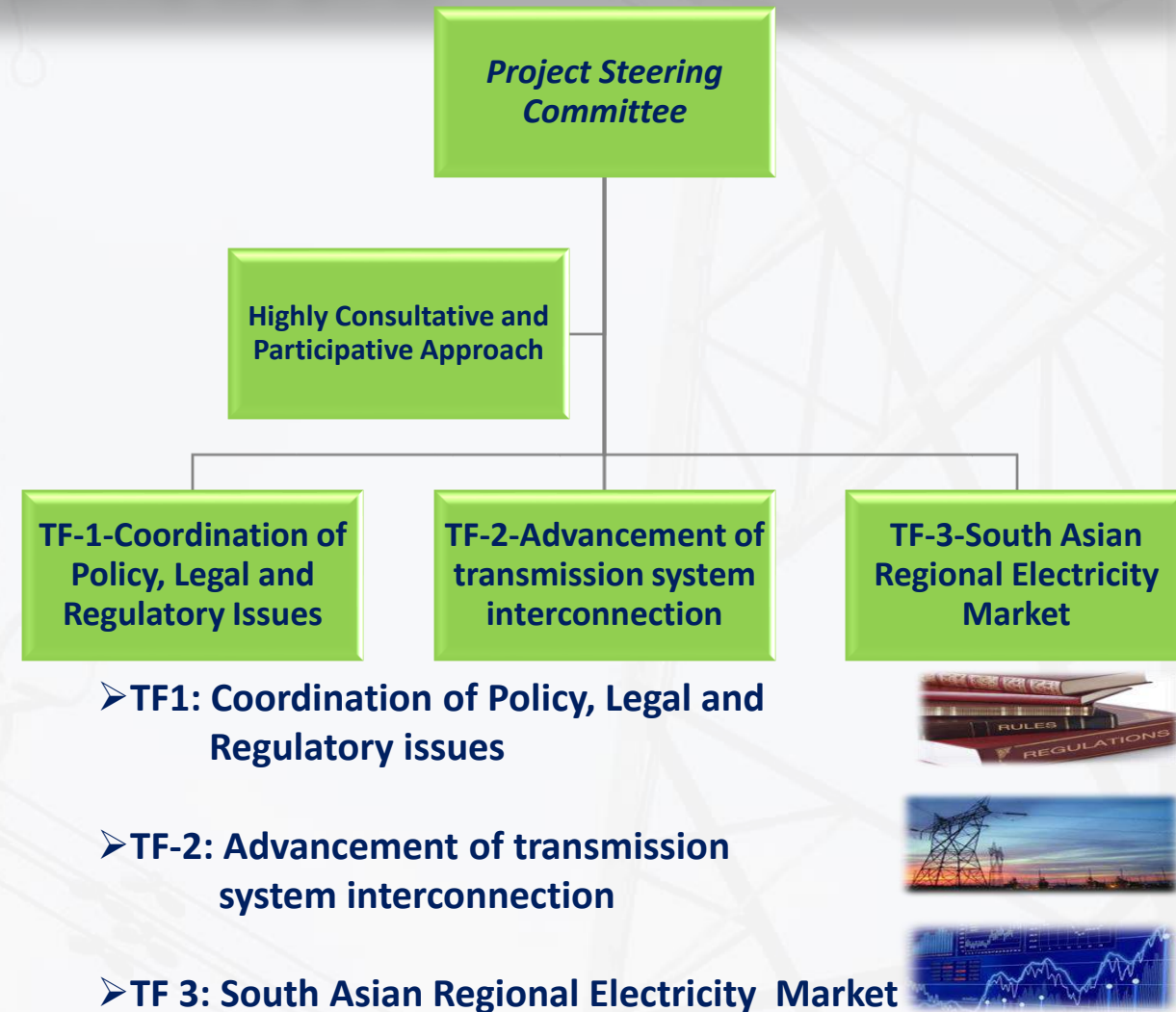
● IRADe, a regional organization, is implementing partner



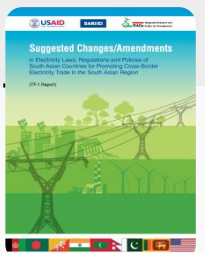
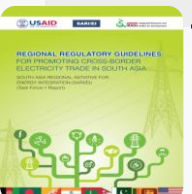
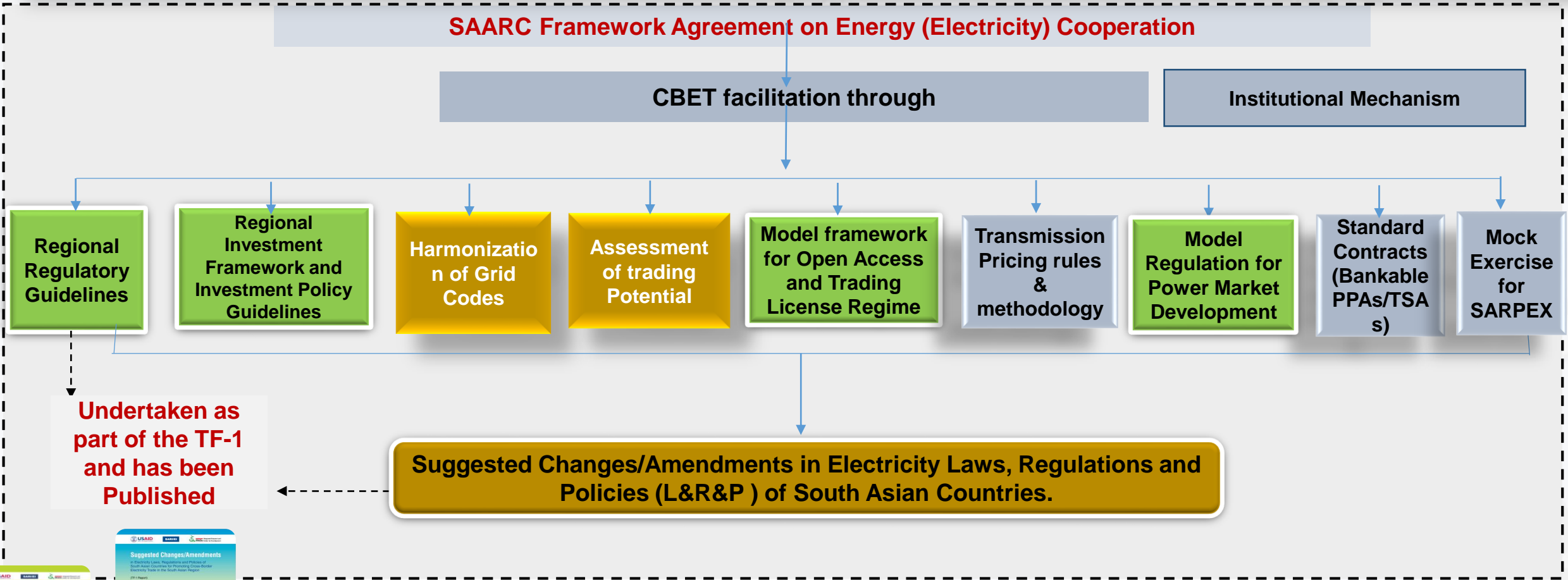


# SARI/EI Framework

- **Project Steering Committee (PSC)** is the apex body of the program and provides overall strategic directions.
- PSC members consist of government nominated **Senior level officials from the country governments, SAARC, ADB, Independent Energy Experts/Diplomats.**
- Intergovernmental Task Forces: Task Force Members are represented by **government nominated members from Regulatory Technical , market related institution of each SA countries.**



# Overall Framework for development of CBET in South Asia





## Demand Driven Studies to achieve the Deliverables of Task Forces as Defined in the Terms of Reference of Task Forces



**TF-1 :**

**Study -1:** Study on Review of policies, regulations and laws, preparation regulations etc. (*1<sup>st</sup> Report on Regional Regulatory Guidelines and 2<sup>nd</sup> Report on Suggested Changes/Amendments in Electricity Laws, Regulation and Policies - Published.*)



**TF-2 :**

**Study-2:** Study on Investment policies/guidelines for SA countries (*Study has started-Ongoing*)

**Study 1:** Study to find out the Trading Potential of South Asian Countries (*Draft Final Report prepared-Ongoing*)

**Study 2:** Harmonization of Grid Codes (*Draft final Report Prepared-Ongoing*)



**TF-3 :**

**Study 1:** "Assessment and recommendation of commercial terms & conditions for Cross Border Electricity Trade (CBET) and suggesting the model Of Power Exchange in South Asian region" (*Draft Report Prepared – Ongoing*)

**Study 2:** Implementation of Pilot Market – Mock Exercise for SARPEX (*TOR finalized*)

### *Future Activities to implement Task Force Recommendations*

- Building Consensus and Developing a White Paper on South Asian Forum of Electricity Regulators (SAFER)
- Development of Standard set of procedures, T&C for grant of trading license, open access etc.
- Regulatory Guidelines & Model Regulation for domestic power Market Development.
- Pilot Market: Mock Exercise for SARPEX. Development of Market Rules.
- Development of an appropriate regional dispute settlement mechanism for promoting CBET.
- Technical Advice to Regional Regulatory Institutional Mechanism under SAARC.
- White paper on creation of institutional mechanism on South Asia forum of Transmission and Generation planning and system operation.

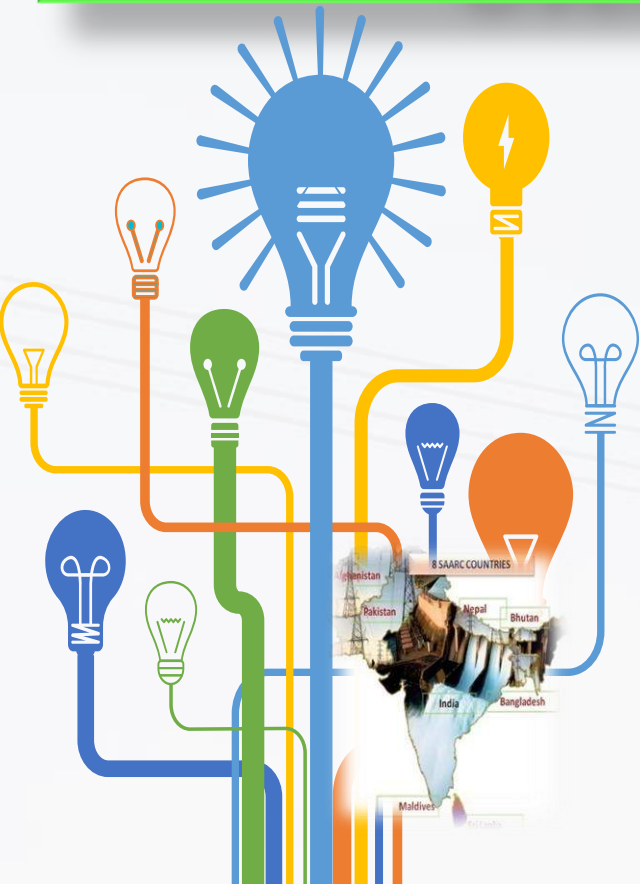


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# Overview of South Asian Power Sector





# Overview of South Asian Power Sector

**South Asian Power Sector. Total Installed capacity of around 3,42,820 MW.**

**Afghanistan:** Small Power system (1341 MW), Electricity Imports high, Hydro Dominated.

**Bhutan:** Small Power system (1614 mw) Hydro Dominated, Surplus Hydro , Exporting to India. Leading Exporter of Hydro Electricity

**Bangladesh:** Gas Dominated, Resource Constraints, Imports Electricity from India and in future will remain as a Importing Country. One of Leading Importer of Electricity.

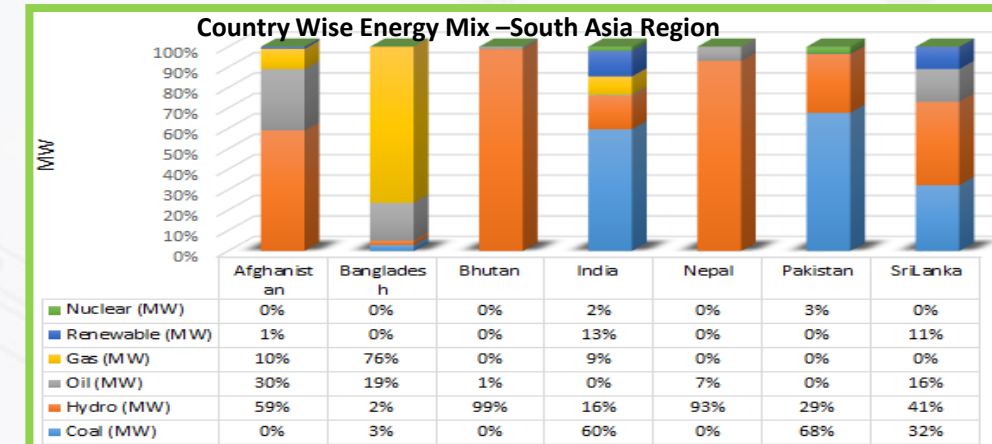
**India:** Large Power System, Coal Dominated, reducing deficits, long terms electricity demand are huge and potential large market, Leading Electricity importing and exporting nation. Large Renewable Capacity Addition.

**Nepal:** Very small power system (765 MW), Hydro based, very high deficits, Importing Electricity from India , Potential for Larger exporter for Hydro Electricity and importer of electricity in Short/Medium Term.

**Sri Lanka:** Hydro dominated but the flex mix is changing, High peak demand.

| Country      | Installed Capacity (MW) |
|--------------|-------------------------|
| Afghanistan  | 1341                    |
| Bhutan       | 1,614                   |
| Bangladesh   | 12,071                  |
| India        | 298059.97               |
| Nepal        | 765                     |
| Sri Lanka    | 4050                    |
| Pakistan     | 24,829                  |
| Maldives     | 90                      |
| <b>Total</b> | <b>3,42,820</b>         |

Source : Compiled form various sources PGCB, DGPC,CEA,Annual Report NEA, Status of Industry Report NEPRA, Task Force 1 Report IRADe Report on CBET south Asia: Challenges and investment



# Regional Resource Potential: Hydro Potential :350 GW !

- **Vast potential of hydro power:350 GW**
- **Bhutan, Nepal, Pakistan,India, 30,83, 59,150 GW respectively.**
- **Nepal and Bhutan can build exported oriented hydro plants**
- **Significant Coal deposits in India and Pakistan.**
- **Coal deposits in Bangladesh yet to be exploited.**
- **In addition to the conventional energy resources, there is huge renewable energy resources like solar and wind. .**

| Country     | Coal (million tons) | Oil (million barrels) | Natural Gas (trillion cubic feet) | Biomass (million tons) | Hydro (GW) |
|-------------|---------------------|-----------------------|-----------------------------------|------------------------|------------|
| Afghanistan | 440                 | NA                    | 15                                | 18-27                  | 25         |
| Bhutan      | 2                   | 0                     | 0                                 | 26.6                   | 30         |
| Bangladesh  | 884                 | 12                    | 8                                 | 0.08                   | 0.33       |
| India       | 90,085              | 5,700                 | 39                                | 139                    | 150        |
| Maldives    | 0                   | 0                     | 0                                 | 0.06                   | 0          |
| Nepal       | NA                  | 0                     | 0                                 | 27.04                  | 83         |
| Pakistan    | 17,550              | 324                   | 33                                | NA                     | 59         |
| Sri Lanka   | NA                  | 150                   | 0                                 | 12                     | 2          |
| Total       | 108,961             | 5,906                 | 95                                | 223                    | 349.33     |

Source: SAARC Secretariat (2010) for Bangladesh, Bhutan, India, Nepal, Sri Lanka; CWC (2005) for Indian States and WAPDA (2011) for Pakistan

| Renewables                      | Bangladesh        | India   | Nepal     | Bhutan  | Pakistan | Sri Lanka |
|---------------------------------|-------------------|---------|-----------|---------|----------|-----------|
| Solar Power (Kwh/sq. m per day) | 3.8 - 6.5         | 4 - 7   | 3.6 - 6.2 | 2.5 - 5 | 5.3      | NA        |
| Wind (MW)                       | limited potential | 151,918 | 3,000     | 4,825   | 24,000   | 25,000MW  |

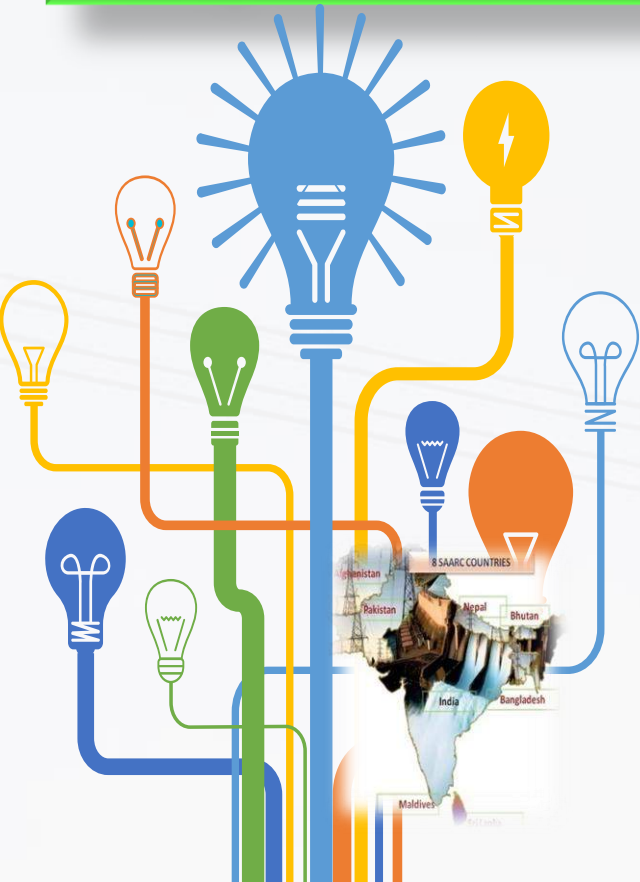


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# Key Drivers for CBET and Regional Exploitation of Energy Resources





# Key Drivers for CBET and Regional Exploitation of Energy Resources

- Low per Capita electricity consumptions
- Electricity Shortages.
- Poor access to electricity.
- Optimal utilization of energy resources.
- Fostering Economic Growth and Regional Integration
- Resource Crunch
- Opportunity to create a regional electricity market.
- Seasonal complementarities in power systems of South Asia

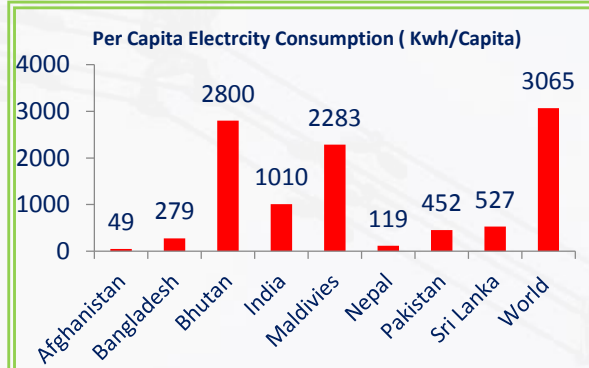
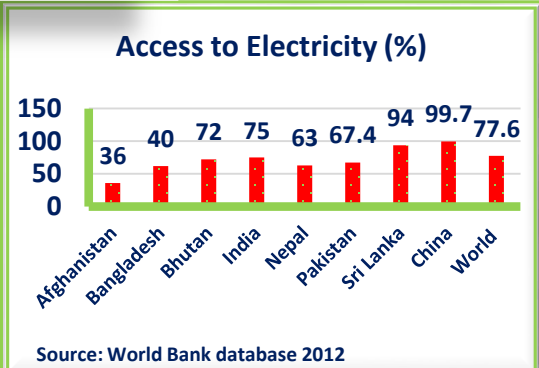
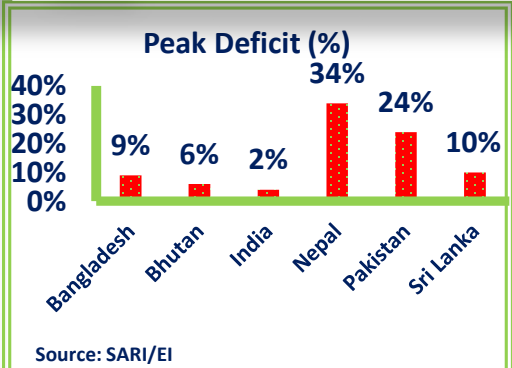
**Nepal and Bhutan**  
 Large hydropower resources;  
 Nepal experience severe power shortages  
 Economic benefits of Trade

**Sri Lanka**  
 Heavy reliance on liquid fuel  
 and plans for large coal power development

**Bangladesh** :Power shortages, Large Suppressed Demand, heavy reliance on domestic natural gas and plans for large coal power development

**Afghanistan and Pakistan**  
 Access to large hydropower resources but experience severe power shortages  
 High Demand Growth

**India**  
 High demand growth, coal power dominated, coal shortages, power deficits, significant advances in clean energy development



Seasonal complementarity in power systems in South Asia – Monthly Electricity Load Profiles across South Asian Grids

|                    | January | February | March | April | May | June | July | August | September | October | November | December |
|--------------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|
| Bangladesh         | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| India - North East | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| Bhutan             | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| India - East       | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| Nepal              | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| India - North      | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| India - West       | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| Pakistan           | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |
| India - South      | Low     | Low      | Low   | Low   | Low | Low  | Low  | Low    | Low       | Low     | Low      | Low      |

Source: World Bank-2015

# Benefits of Cross Border Electricity Trade and Regional Hydro Power Development

## Technical and Operational

- ✓ **Optimum Utilization of Energy Resources.**
- ✓ **Energy security** due to large trade possibilities
- ✓ Diversified **generation mix**
- ✓ Reduction in **Load Shedding**
- ✓ Reduction in **spinning reserves**
- ✓ Management of **peak energy deficit**
- ✓ System reliability.

## Economic and Financial

- ✓ Power availability at **competitive price**
- ✓ High **export income**
- ✓ Avoided **generation capacity** and **T&D infrastructure**
- ✓ Less exposure to **volatile international energy prices**

## Environmental Benefits:

- ✓ Reduction in **CO<sub>2</sub> emissions**
- ✓ Less Impact on Local and Global environment
- ✓ Renewable Energy Development
- ✓ Improvement in Social Indicators

## Market Dev.

- ✓ Bringing Resources to the Market.
- ✓ Market Development
- ✓ Efficient Pricing

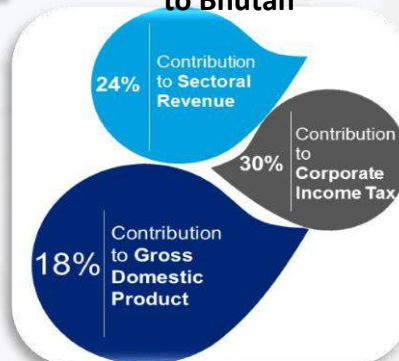
## Regional Hydro Power Dev.

- ✓ Flood Control
- ✓ Water Security
- ✓ Multi-purpose use of the resource
- ✓ Facilitates regional governance
- ✓ Strategic Development

## Regional Stability

- ✓ Regional Stability

### Hydropower Benefits to Bhutan



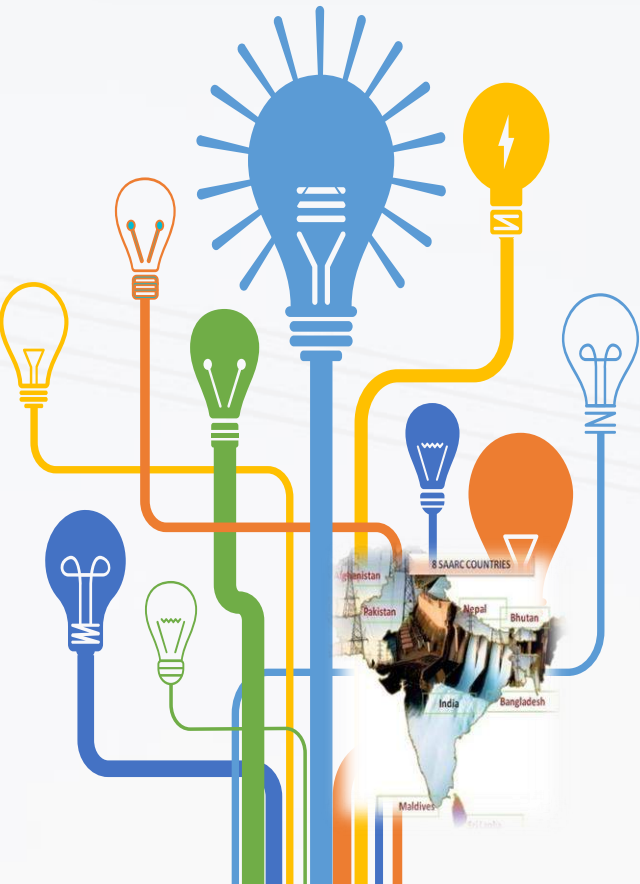


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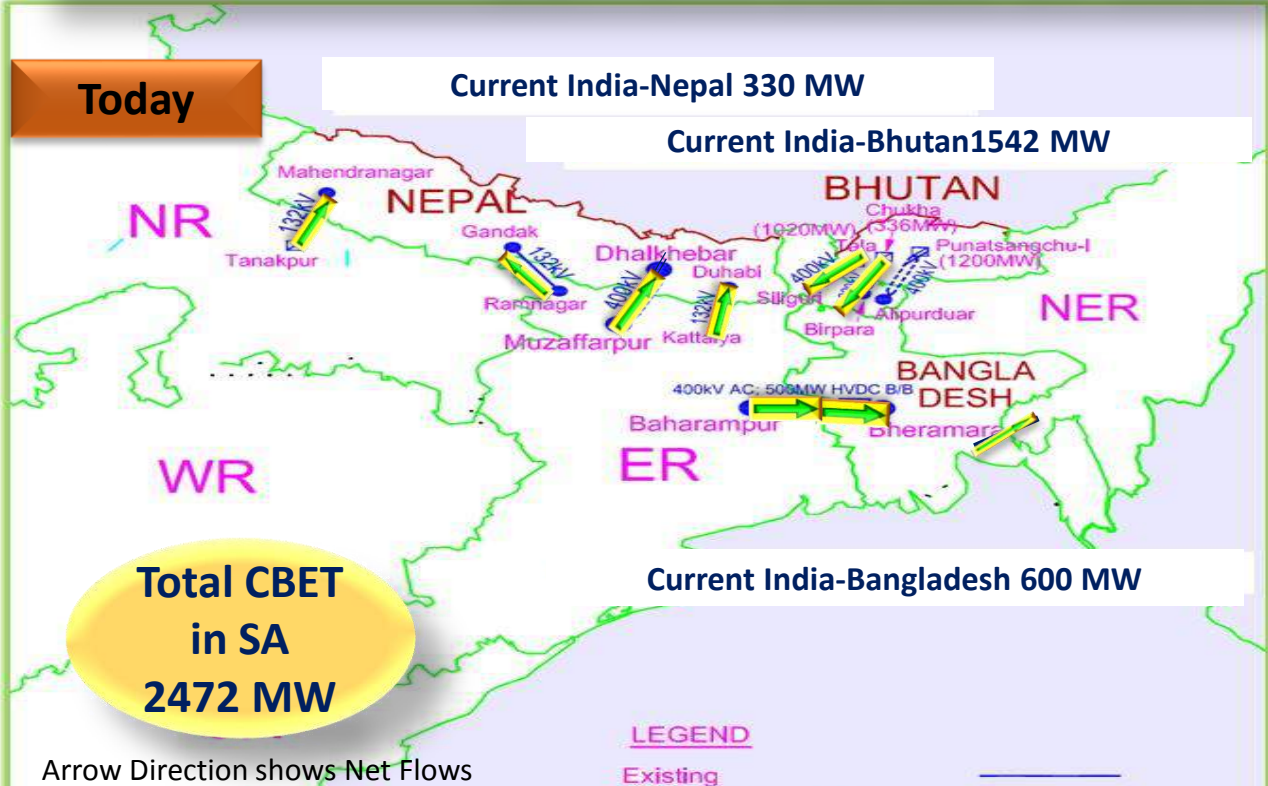


# Current Status of CBET and Trading Potential





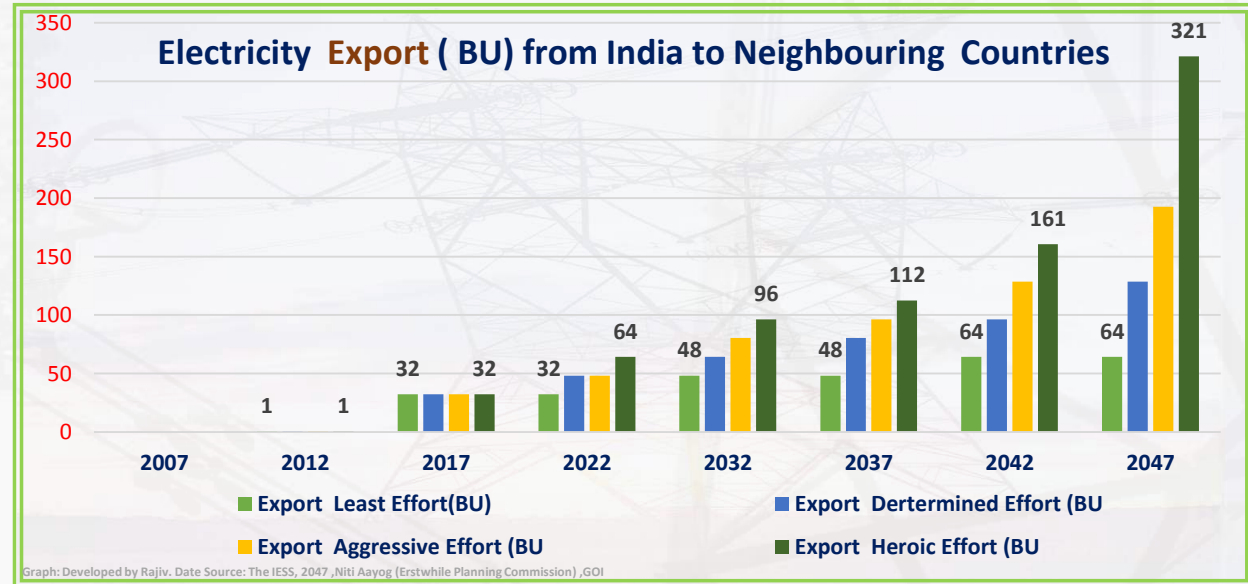
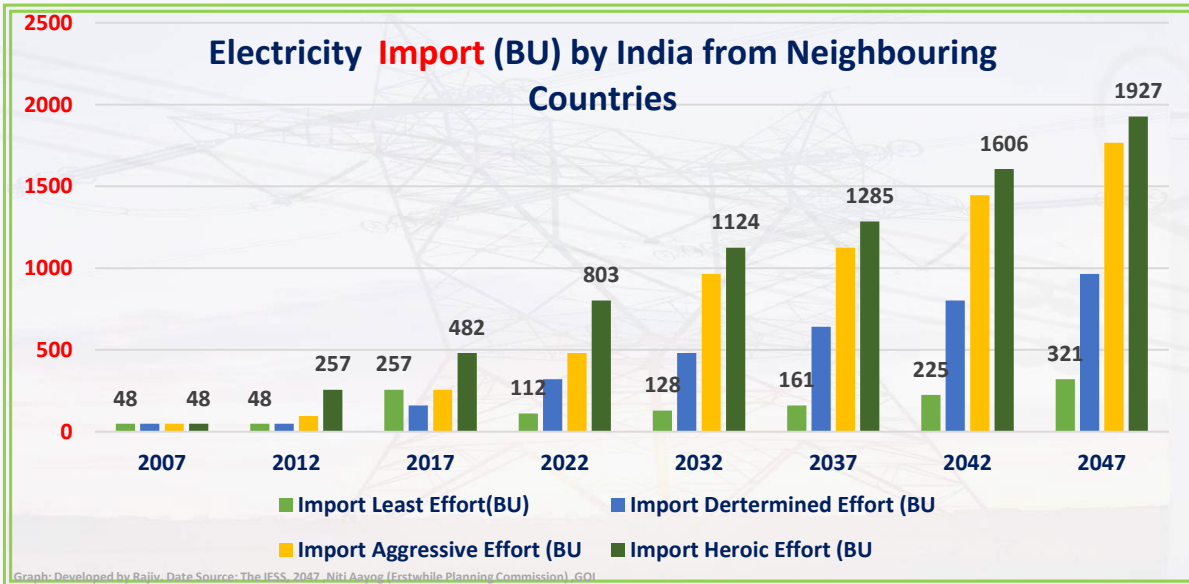
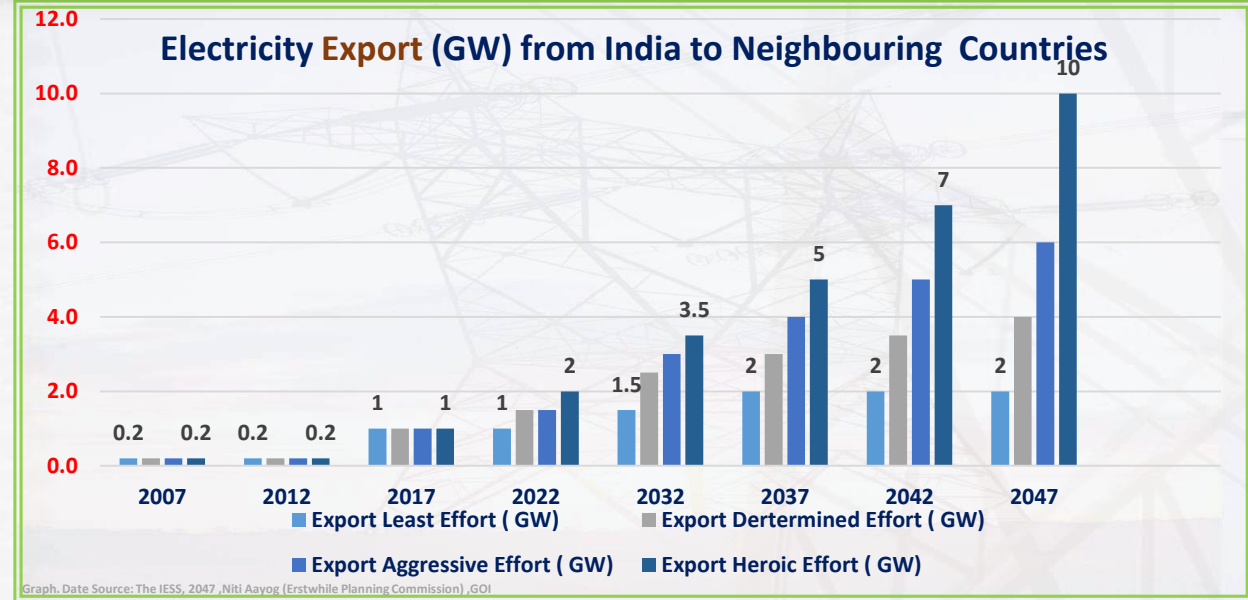
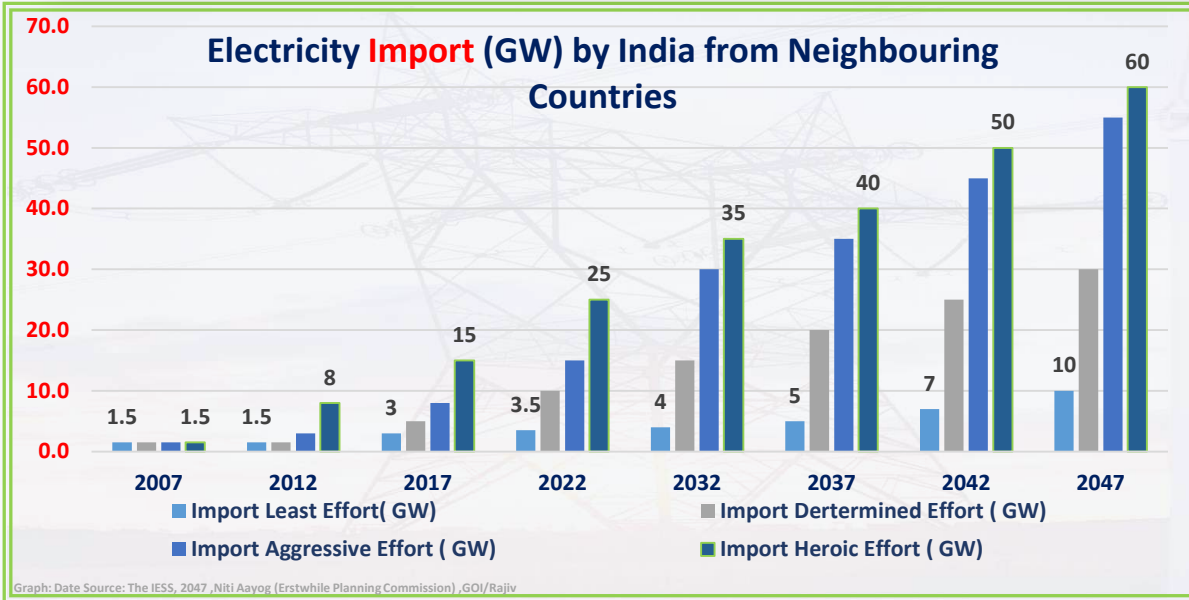
# Current Status of CBET and Trading Potential



| Year   | Annual regional Cross Border Electricity Trade potential |
|--|--|
| 2015 to 2020   | ~6 BU to ~20 BU  |
| 2025 to 2034   | ~108 BU to ~260 BU                                       |
| <p><i>Note: 1. This trading potential has been calculated by accounting India, Nepal, Bhutan, Sri Lanka, Pakistan and Bangladesh. 2. The above trading potential is based on the base case scenario.</i></p> <p><b>Source-SARI/EI Task Force 2</b></p> |  |

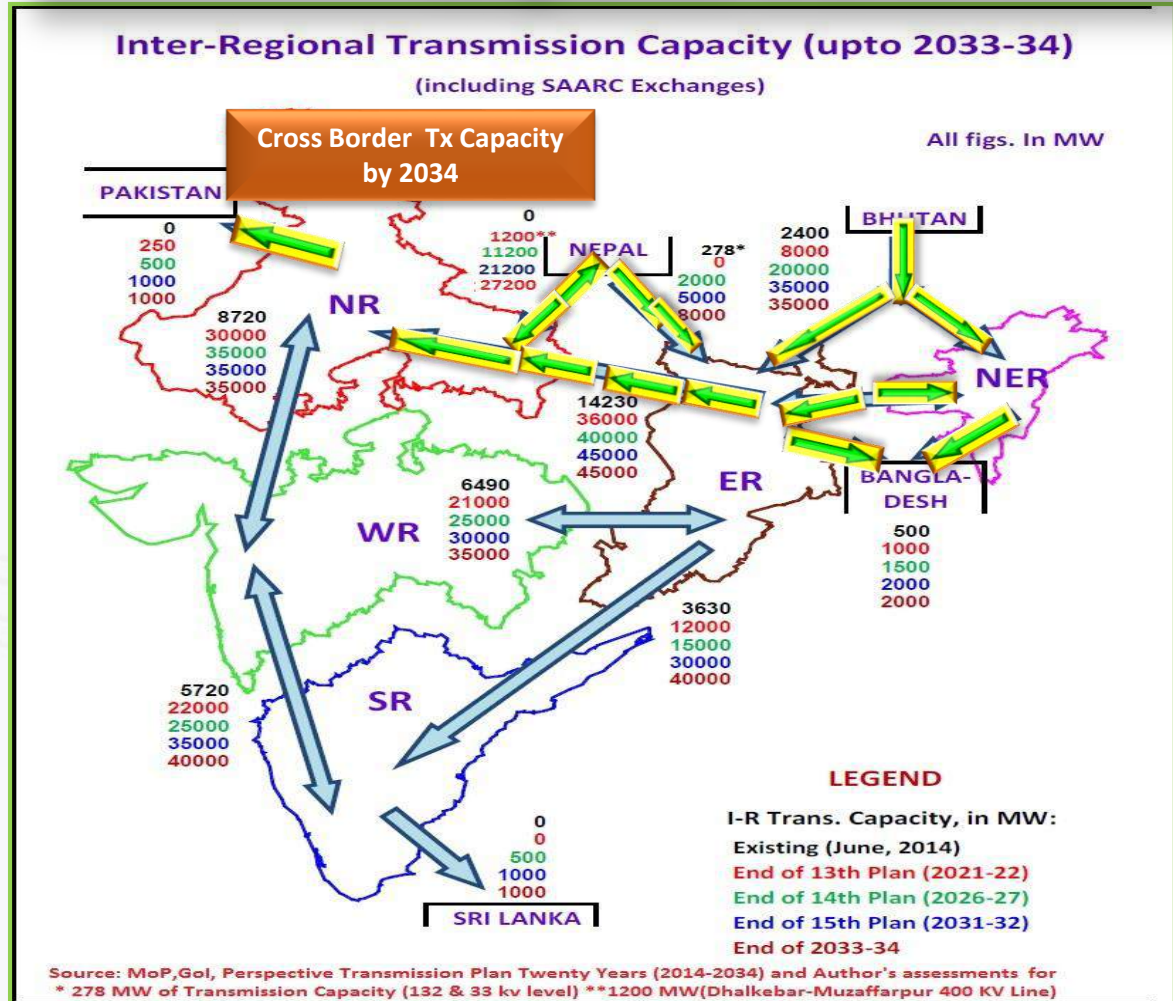
| Bhutan → India  | India → Bangladesh  | India → Nepal  |
|---|---|--|
| <ul style="list-style-type: none"> <li>Tala: 1.80 INR/kWh for 1<sup>st</sup> year (now 1.98 INR/kWh)</li> <li>Dagachhu: 2.40 INR/kWh for 1<sup>st</sup> year (started in 2015)</li> </ul> | <ul style="list-style-type: none"> <li>NVVNL: 2.40-2.86 INR/kWh (Aug'14-May'15)</li> <li>PTC: 4.26-5.00 INR/kWh (Dec'13-May'15)</li> <li>Tripura-Bangladesh Rs 5.50 per unit</li> </ul> | <ul style="list-style-type: none"> <li>Treaty/Bilateral: Current 5.40 INR/kWh</li> <li>PTC: 4.55, 4.35, 4.30, 3.75 INR/kWh (FY11-FY14)</li> <li>NVNL-NEA PPA (80 Mw) INR 3.44</li> </ul> |

# India: Cross Border Electricity Trade Export and Import by India from Neighbouring Countries

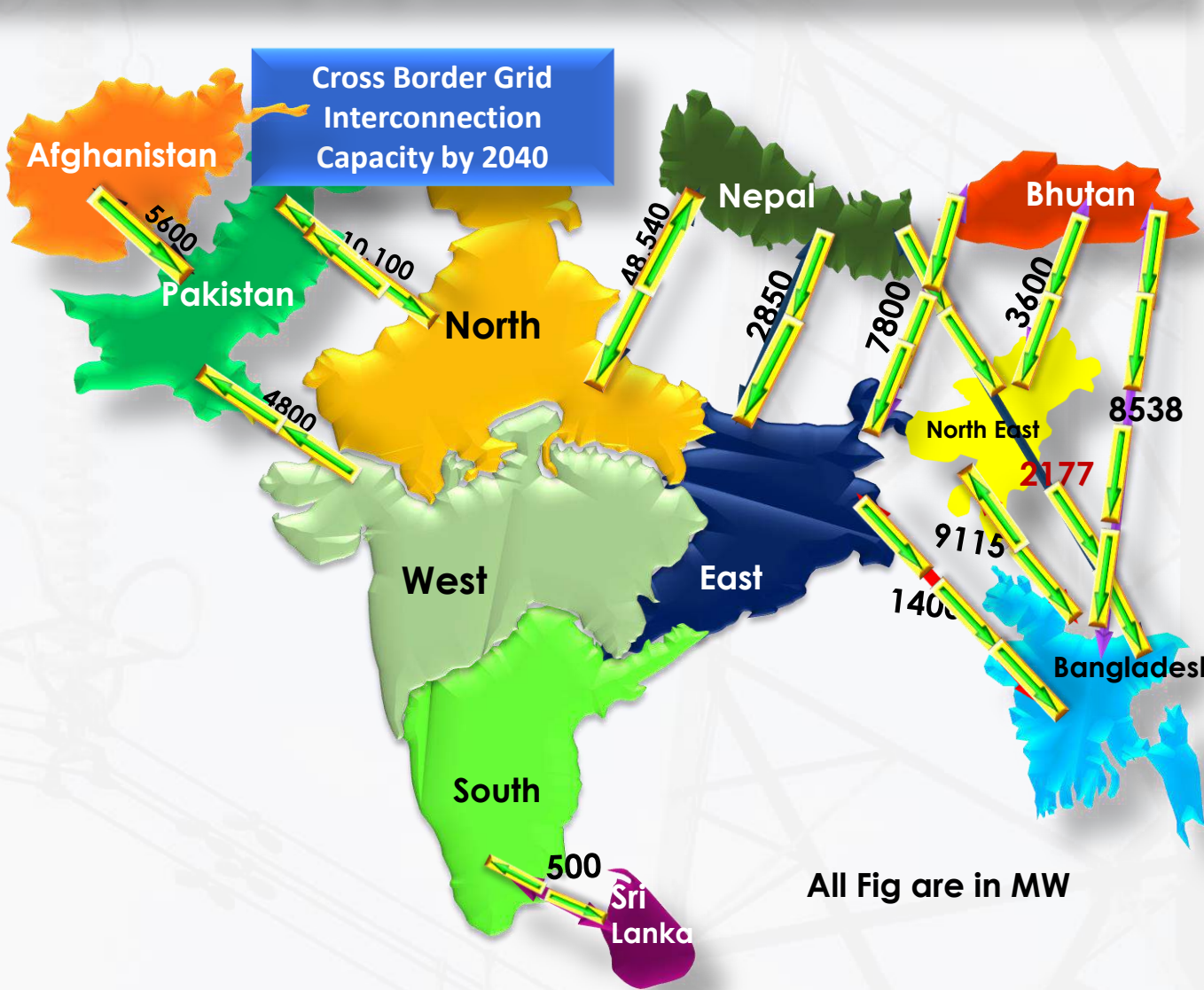




# Regional Transmission Capacity by 2033-34, 2040



[http://www.erpc.gov.in/uploads/news\\_pdf/141207381720%20Yr%20Trans%20Perspective%20Plan.pdf](http://www.erpc.gov.in/uploads/news_pdf/141207381720%20Yr%20Trans%20Perspective%20Plan.pdf)  
 Significant Transmission System Interconnection ( Both AC and DC) are being Planned and Proposed. Bangladesh is in the process of Planning to Import around Apprx. 6000 MW by 2034 (PMSP 2015-JICA Presentation, 4<sup>th</sup> June, 2015)



Source: How Much Could South Asia Benefit from Regional Electricity Cooperation and Trade, World bank





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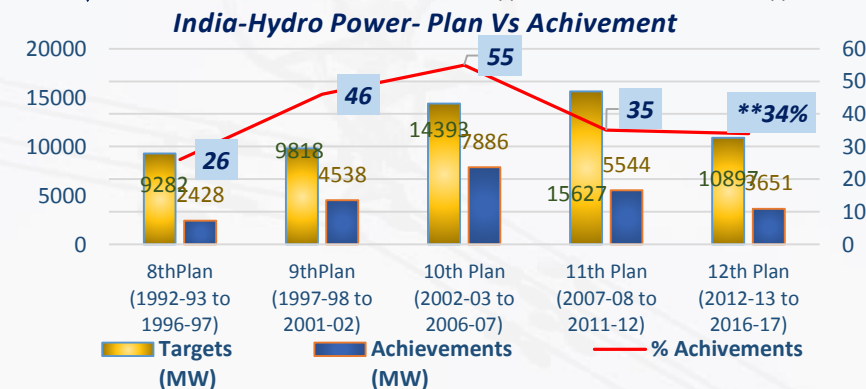
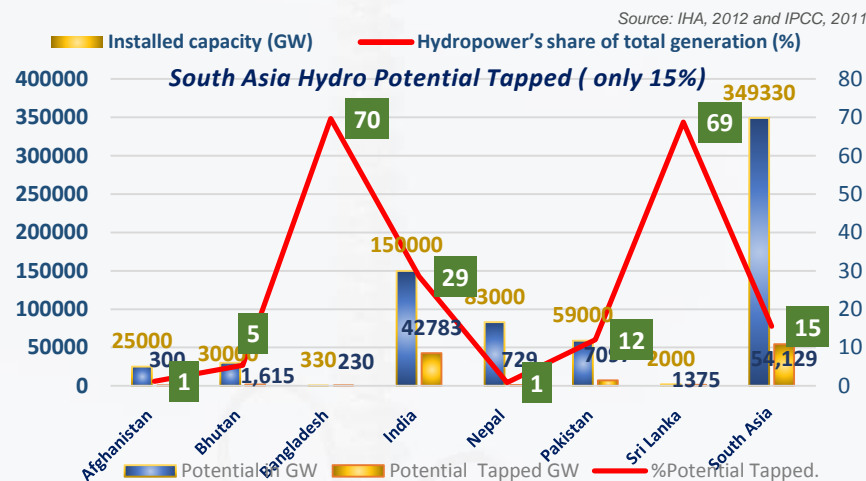
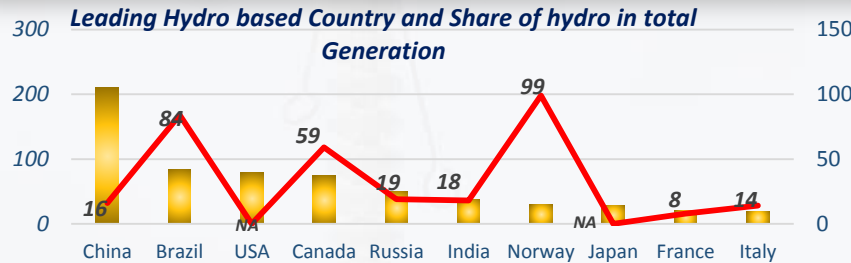


## key Issues and Challenges of Hydro Power



# Hydro Power Project : Not been easy to Crack

- Globally, around \*19% of the potential has been developed.
- However ,countries which have actively developed hydropower , has been benefiting successfully - 99% generation come from Hydro in Norway. 84% in Brazil
- South Asia, only 15% of the resources has been developed. Nepal and Bhutan have developed 1% and 5% of their potential. India 29% of their potential.
- Mismatch Plan Vs Achievement: India on an average 50 % target ahs been achieved.
- Bhutan like to achieve 50 % target i.e. 5000 MW by 2020.



- Geological uncertainties / Natural Calamities
- Land Acquisition / Environment and Forest issues
- Rehabilitation & Resettlement / Law & order problem & Local issues
- Difficult Terrain, Poor Accessibility & Limited working season
- Contractual problems / Delay in award of works.
- Poor performance of Contractor- Inadequate mobilization of man/ machinery, inadequate experience, labour disputes etc.
- Funds constraints with developer/ contractor
- Delay in supply of major equipment / Delay in arrival of foreign engineers/ technicians
- Inter-state issues (India)
- Delay in power evacuation arrangement

While there are Challenges, but continuous development is the key to success of hydropower development.



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# Key Issues related to of CBET Hydro Power Projects: Investor/Lender and developers perspective





# Key Issues related to of CBET Hydro Power Projects: Investor/Lender perspective

## Policy & Regulatory Risk

Political and Social stability, Legal , Regulatory and Country Risk  
Absence of Regional Regulatory Framework  
Overall business operating environment , Overall Tax environment



## Project & Developers Risk

✓ Risk Profile & Project Viability  
✓ Developers/Promoters Creditability

✓ Geological uncertainty , Statutory clearances  
✓ Land Acquisitions , R & R Policies  
✓ Evacuation Infra  
✓ Forward linkages :Sale of power



## Protection of Investment

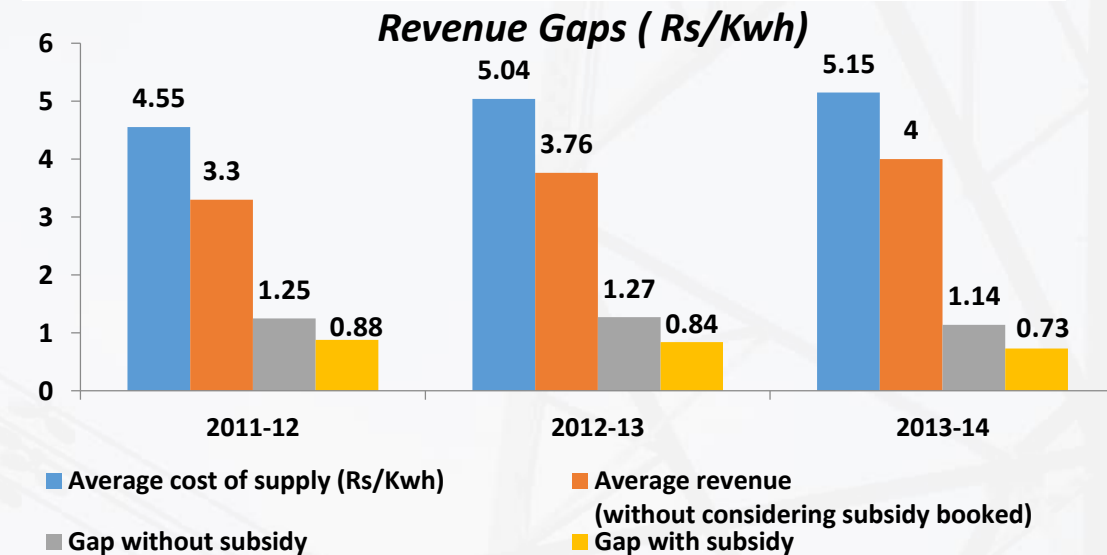
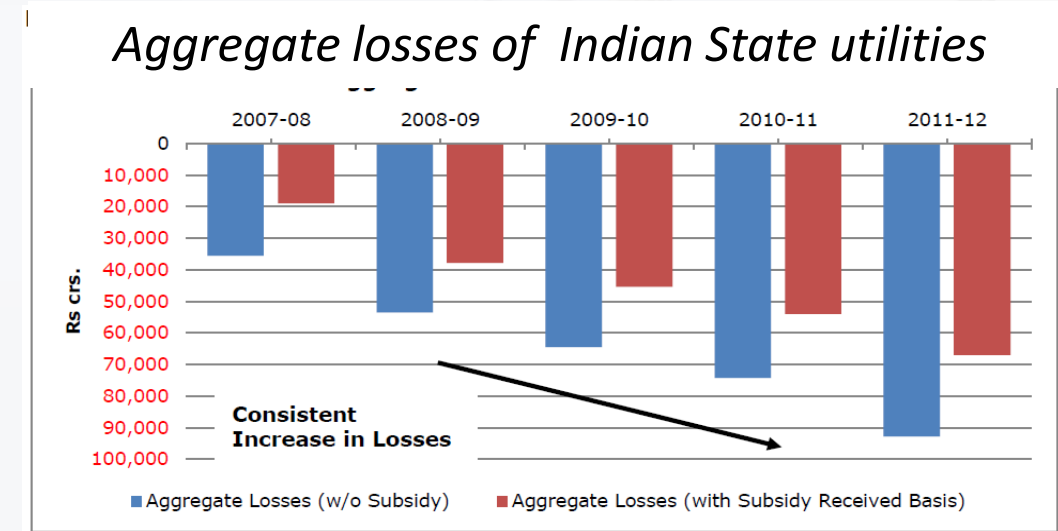
Considering large scale investment requirement and long term nature of investment , need for appropriate protection of investment

✓ Investment protection agreements  
✓ Sovereign Guarantees  
✓ Credit Guarantees  
✓ Investment Guarantee Instruments



# Key Issues related to of CBET Hydro Power Projects: Investor/Lender perspective: Commercial Viability of Power Sector

- ✓ Commercial Viability of Power Sector
- ✓ Creditworthiness of the Buyer
- ✓ Revenue gap and Financial health of Discoms.
- ✓ Balancing the Commercial and social aspects of the SA power sector.
- ✓ In long run can impact CBET



# Need for Compressive Framework for Hydropower Development in South Asia : Developers Perspective

## Incentives offered to developers

- Fiscal benefits - Tax holidays
- Concessional interest rates
- Incentives – Export incentives, Exemption of electricity duty and excise duty
- Rebates on land cost

## PPP attractiveness

- Contractual framework
- Risk-reward profile
- Royalty regimes
- Key drivers

## For investment protection

- Dispute settlement mechanism
- Contract enforcement
- Political insurance
- Regulatory framework



## Policy drivers and inhibitors

- Repatriation of profits and tax on expatriates income
- Minimum capital requirement
- Protection of foreign investment
- Outward direct investment
- Limits on foreign equity participation

## Cross border power trade

- Guidelines/ procedures/ frameworks for undertaking CBET projects
- Technical challenges - grid code
- Transmission pricing framework
- Open access rights
- Deviation settlement mechanisms
- Regional regulatory framework



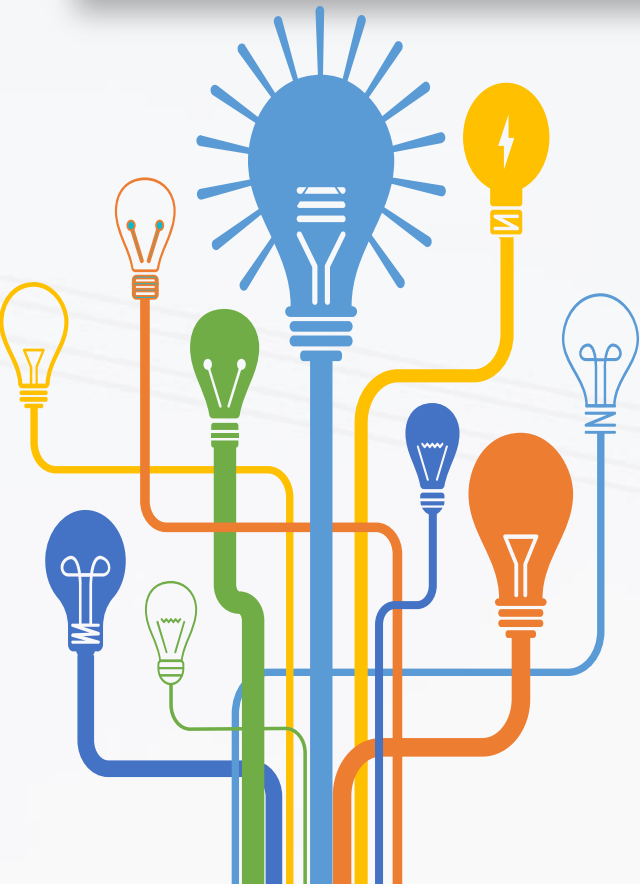


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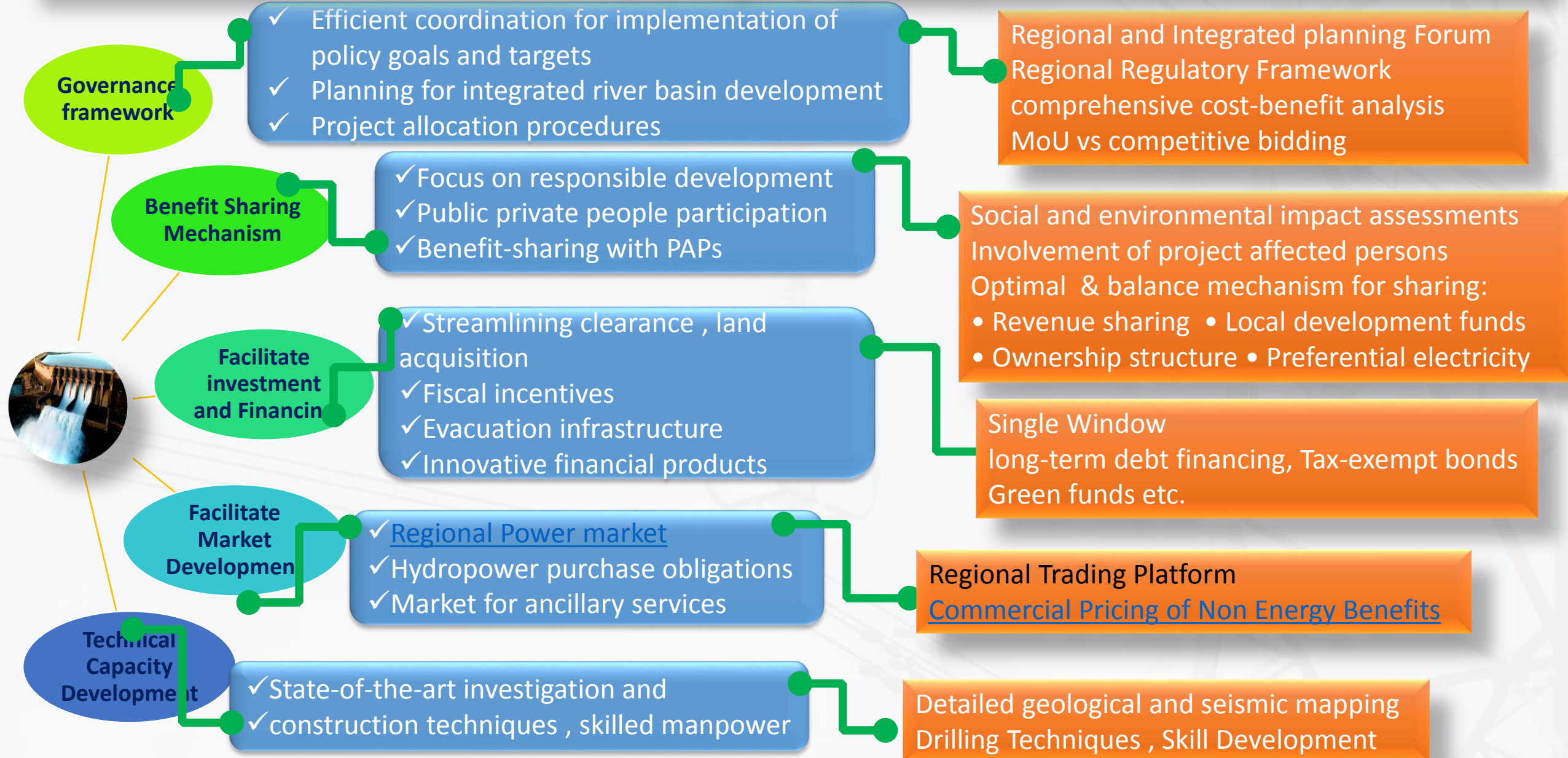
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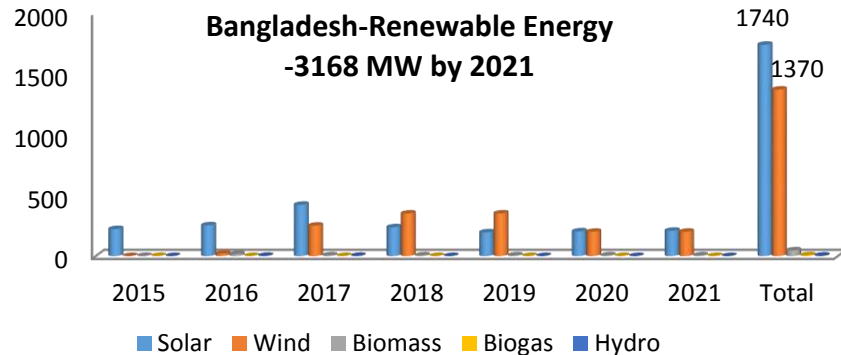
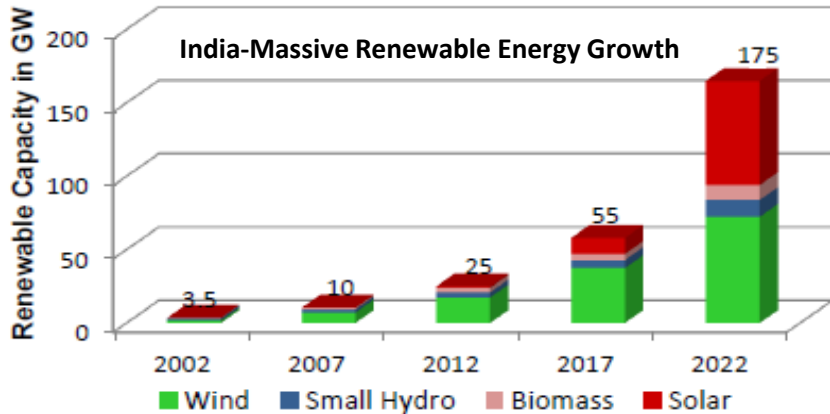
# Accelerating Responsible Hydropower Development in South Asia: Policy Making Perspective



# Accelerating Responsible Hydropower Development in South Asia: Policy Making Perspective



# Non Energy Benefits of Hydropower in South Asia: Policy Making Perspective



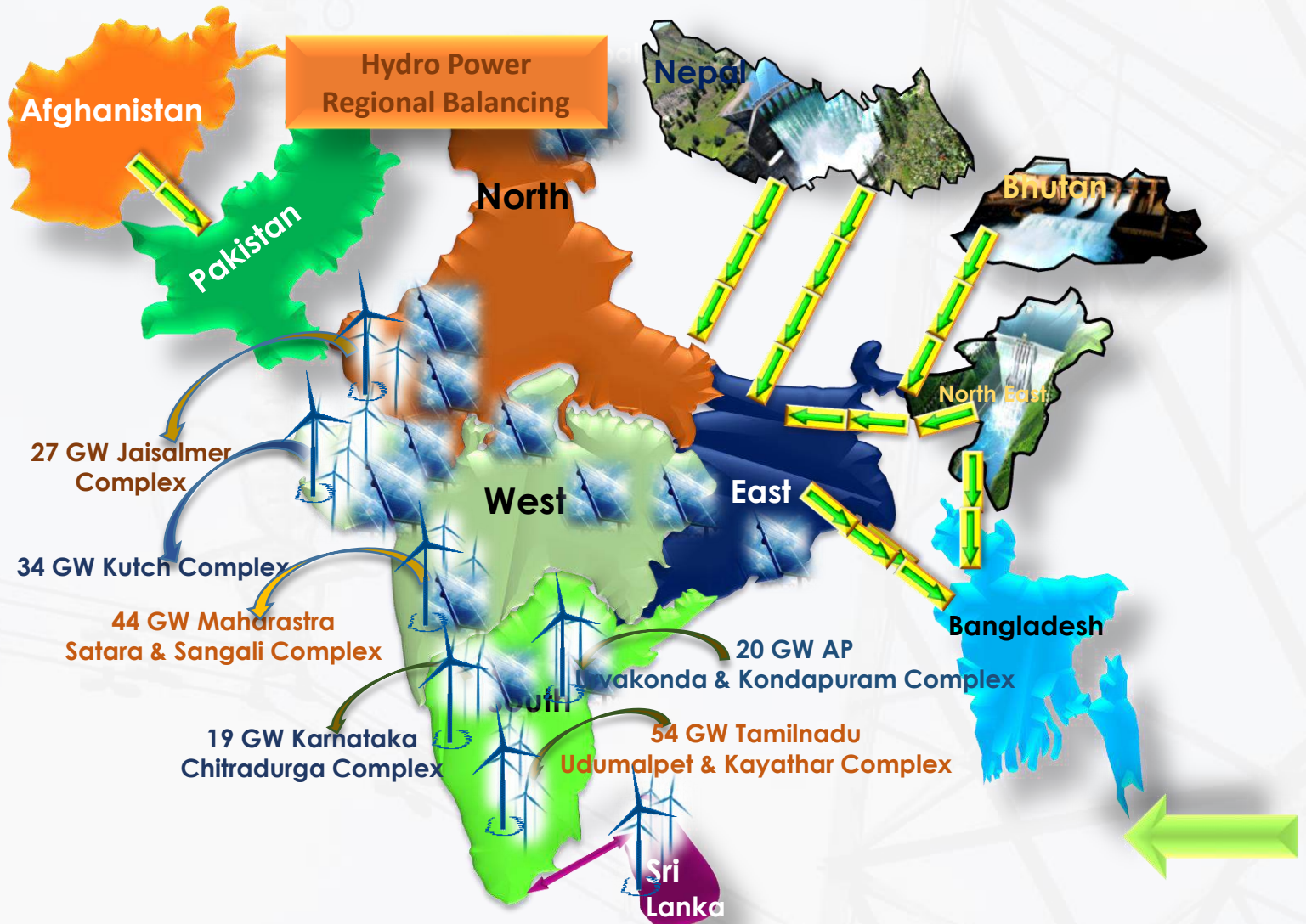
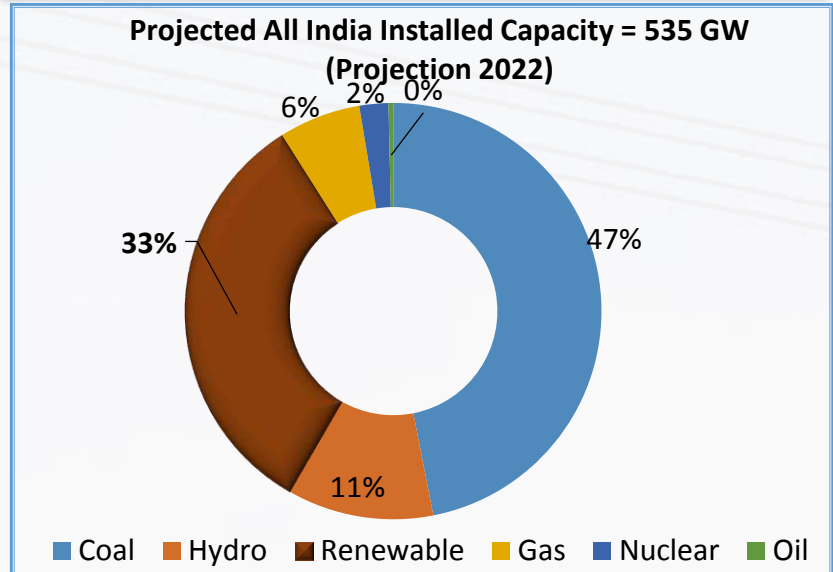
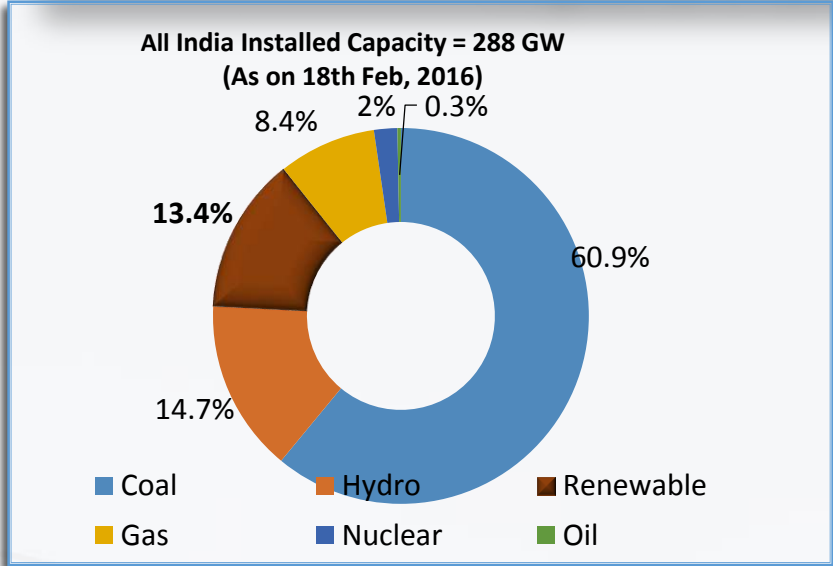
Sri Lanka to Increase the share of electricity generation from renewable energy sources from 50% in 2014 to 60% by 2020 and finally to meet the total demand from renewable/other indigenous energy resources by 2030.

- High Renewable Energy Growth in SA power system needs a flexible, fast responsive with Demand response SA power system.
- Both reservoir and pumped storage hydropower are flexible sources of electricity that can help in handle the variability of other renewable energy such as wind power and photovoltaic electricity.
- Storage hydropower (including pumped storage) represents 99% of the world's operational electricity storage.
- Hydro share in India has been declining over the years (45% in 1970 to Apprx 15% in 2015)
- In terms of National Electricity policy, spinning reserves at 5% of the Installed Generation Capacity of around 272 GW works out as 13600 MW.
- Need of \*tertiary reserve of at least 7000 MW and secondary reserves of the order of 2500 MW.
- Regional Ancillary Market- India Has started ancillary market recently.





# Hydro Power Can Provide Regional Balancing



# Possible -Phases of Market development for CBET



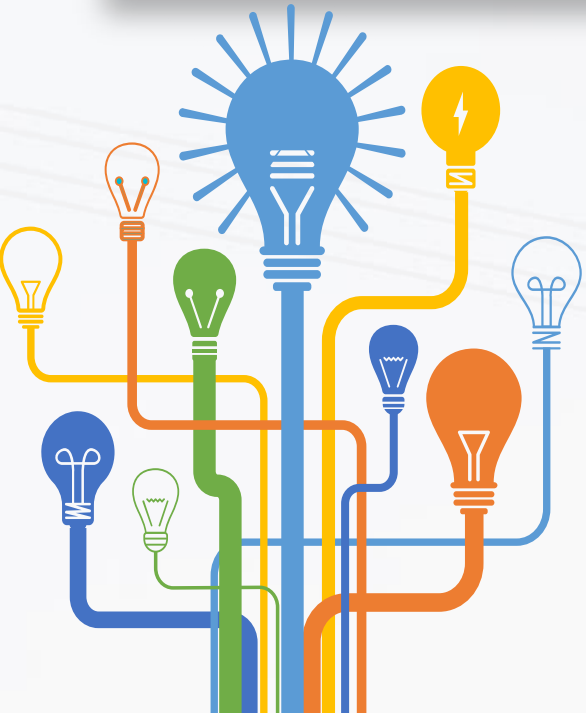


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# Regional Regulatory Guidelines for promoting Cross Border Electricity Trade in South Asia Region

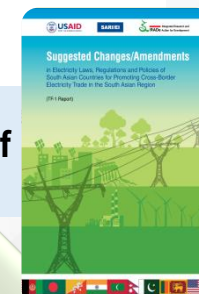
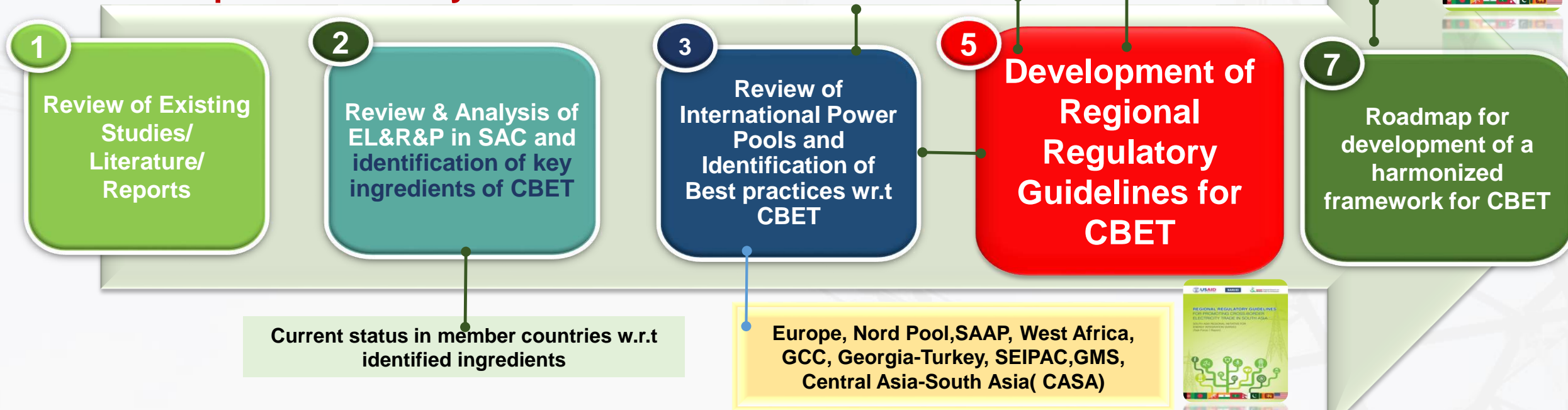




# Background and Approach of the Regional Regulatory Guidelines

**Background-** *Regional Regulatory Guidelines* is one of the outcome of the TF-1 study on Review of Electricity Laws, Policies and Regulatory framework of SAC to identify critical requirements of CBET and recommend changes/amendments therein for consideration of the SA countries.

## Steps for the Study

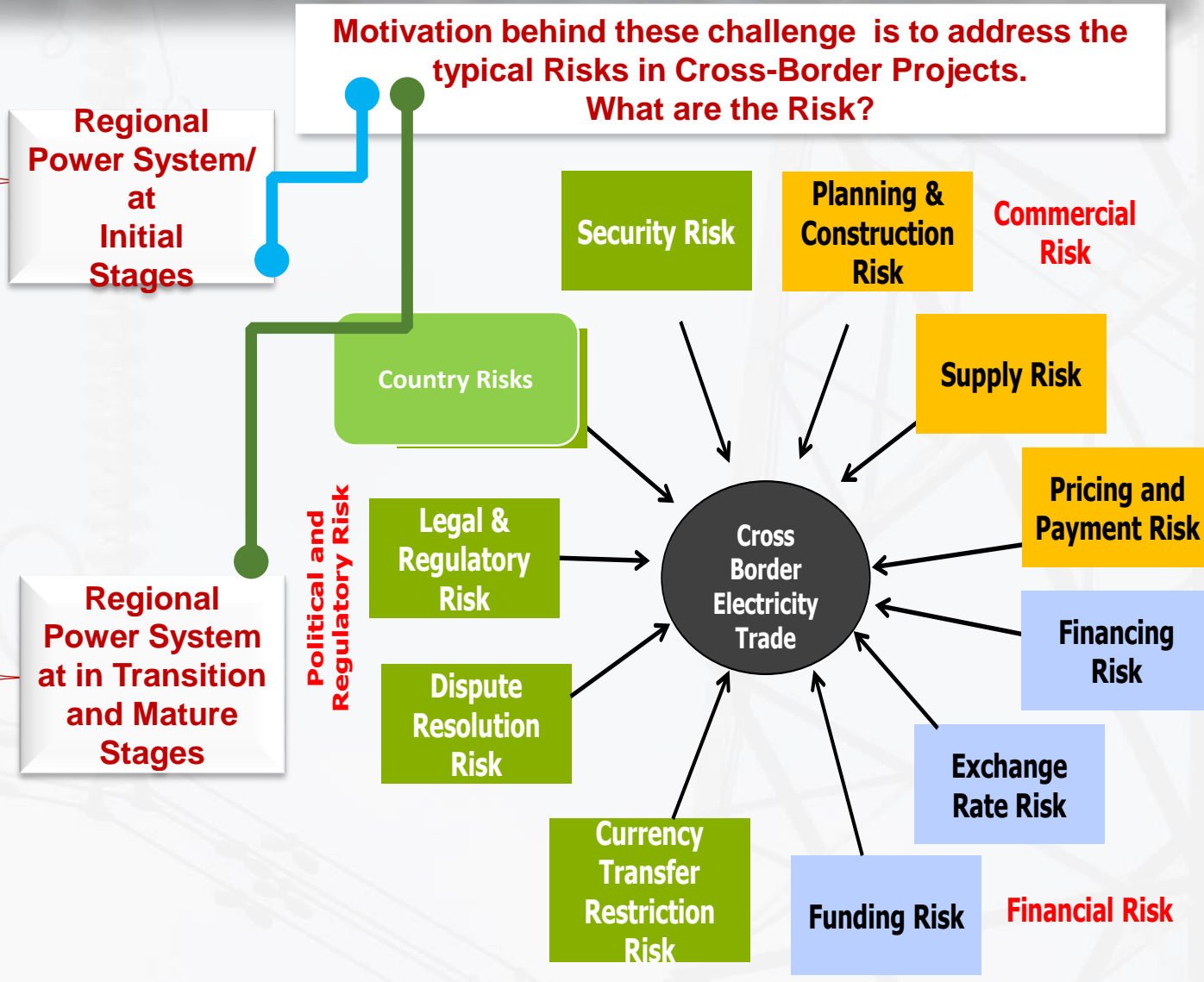


# International Review : Key Challenges and risk for CBET

## Key Challenges

1. Political Conesus : Regional Cooperation and Recognition of CBET/Trade in the National Policy, Law
2. Government Commitment & Policy Coordination
3. Financial Challenges, Investment , Financial Viability

4. Mechanism of Inter-connection
5. Market form of Trade
6. Regional Cooperation on Regulatory and Contractual Aspects
7. Open Access in Transmission
8. Transmission Charges/Pricing
9. Transmission Plan
10. Commercial Mechanisms to Settle Imbalances
11. Dispute Resolution



## Regional Regulatory Guidelines

- **Context**
- **Preamble**
- **Purpose of Guidelines**
- **Summary of Guidelines**
  - *G1: Licensing for cross border trading*
  - *G2: Open access to transmission network*
  - *G3: Transmission pricing regime*
  - *G4: Transmission planning*
  - *G5: Imbalance settlement mechanism*
  - *G6: Harmonization of Codes*
  - *G7: Dispute Resolution*
  - *G8: Duties and tax regimes*
- **Implementation of Guidelines**





# Context of Regional Regulatory Guidelines

## Context of the guidelines

- CBET in the region is largely on bilateral basis and is limited
- This is set to change with several new transmission interconnections being proposed that will enable greater integration of power systems in member countries
- Harmonization/coordination of EL&R&P framework is a critical requirement
- The agreements/guidelines needs to recognize the diversity in countries
- Be compatible with respective country's EL&P&R framework

## Existence of political will and consensus is evident from the IGFA

The **SAARC Inter-Governmental Framework Agreement (IGFA) for Energy Cooperation**, signed by Foreign Ministers of the eight member states provides a strong basis for ensuring consistency in certain identified areas of trade as follows

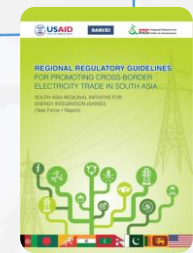
- *Article 4 (Duties & Taxes)*
- *Article 11 (System Operation and Settlement Mechanism)*
- *Article 12 (Transmission Access)*
- *Article 15 (Regulatory Mechanisms)*

It is important to provide actionability to the Articles by defining them into operating rules and common guidelines w.r.t CBET transactions

The guidelines are based on the review of the existing CBET transactions and the existing laws, policies and regulations and review of international experience of various power pools

# Preamble to the Regional Regulatory Guidelines

- ❖ These regulatory guidelines *apply to CBET among the South Asian countries.*
- ❖ These guidelines are **non-binding in nature and are aimed to provide national regulators of SAC with a consistent set of guidelines** applicable to CBET
- ❖ The **guidelines deal only with limited areas where need for such common guidelines has been felt** by the SAC and are not meant to be comprehensively dealing with all matters related to CBET. **For all other purpose, respective national regulations, rules and guidelines shall apply.**
- ❖ **Appropriate Institutional Mechanism is required for facilitating and working towards enabling the guidelines and facilitating the required changes** to be made in the national regulatory framework. Such entity shall **work in close coordination with the National Energy/Electricity Regulators and SAARC for the same.** Study has proposed a Forum i.e South Asia Forum of Electricity **SAFER for the Coordination, and facilitate the implementation of the RRGs.**
- ❖ In countries **where regulators do not exist, the responsibilities shall rest with relevant ministry and/or empowered entity .**



# Purpose of Regional Regulatory Guidelines

## Purpose of the guidelines

**Regional  
Regulatory  
Guidelines**

Establish clear  
regulatory  
environment for  
cross-border  
trading

Provides  
consistency in  
CBET transactions  
and certainty to  
stakeholders

Provide roadmap  
for action and  
decision making in  
respective  
country

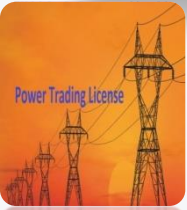
The flexible nature of the guidelines and focus on specific aspects of CBET, would **permit both the guidelines and the national regulatory framework to co-exist for a reasonable period of time.**

*Specific aspects requiring consensus through common operating principles*

- 1. Licensing for cross border trading**
- 2. Open access to Tx network**
- 3. Transmission pricing regime**
- 4. Transmission planning**
- 5. Imbalance settlement mechanism**
- 6. Harmonization of Codes**
- 7. Dispute Resolution**
- 8. Duties and tax regimes**



# Brief Summary of Regional Regulatory Guidelines



## Regional Regulatory Guidelines

### 1 Licensing for CBET: (Important Regulatory Tool for Trading)

- Recognition of Trading as a **separate licensed business activity**
- Grant of license for CBET **through a well defined process**
- **License requirements** and the underlying rules/limitations

### 2 Open access transmission system: (Competitive Market)

- **Setting of fair rules and procedures** for non-discriminatory open access
- **Modification/amendment of applicable regulations and gradually legally binding provisions**
- Defining **application process, eligibility criteria, priority order** and nodal agency for OA

### 3 Transmission Pricing: (cost reflective & efficient)

- Transmission pricing mechanism based on a **country's requirement and acceptability**
- Setting up **principles and mechanism for determination of economically efficient transmission pricing regime** and gradually adopting methods based on the concept of location specific pricing
- Adoption of **tariff framework in respective country power system through enabling regulations**

### 4

### Transmission Planning: (coordinated Regional Planning)

- **Development of a regional coordination forum of National Transmission Utilities** to coordinate between Member Countries on transmission planning aspects
- **Development of a database of information that enables coordination** and cooperation towards transmission planning
- **National Transmission Plans** to also include details of **cross border transmission lines** (specifically for CBET) & associated infrastructure
- **Sharing of the national transmission plan** at the regional level and progress towards **developing a regional level master plan**

# Brief Summary of Regional Regulatory Guidelines

## Regional Regulatory Guidelines

5

**Imbalance Settlement:** (transparent common procedure)

- Member Countries to **develop a common set of procedures for Imbalance Settlement for CBET transactions**
- This will include **preparation of scheduling, dispatch, energy accounting and settlement procedures for both AC-AC & AC-DC interconnections in the region**

6

**Harmonization of codes:** (safe and reliable regional integrated system operation)

- **Harmonization through formulation of guidelines on technical standards for interconnection of power systems** on aspects related to voltage standards, frequency tolerance, thermal limits etc.
- **Sharing of technical characteristics and system specific data among the member countries**
- **Rules on metering standards, communication technologies, Protection Schemes etc.**

7

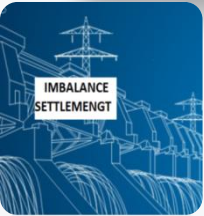
**Dispute Resolution:** (transparent and fair legal framework)

- Dispute Resolution process should primarily be in accordance with the **agreements or through amicable settlement**
- **Referring the disputes to the SAARC Arbitration Council in case the member countries are unable to resolve disputes through amicable settlement.**

8

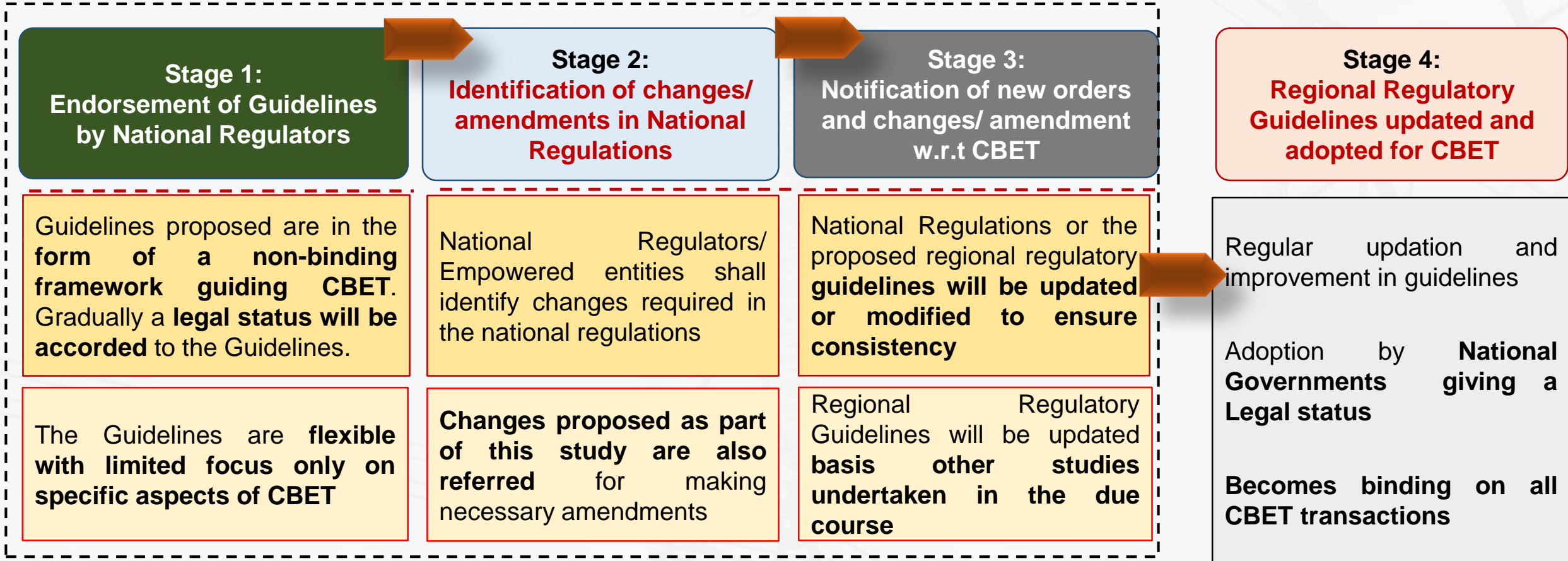
**Taxes & Duties:** (for fostering investment and removing trade barriers)

- Countries to **gradually move towards a zero tax regime**



# Implementation of Regional Regulatory Guidelines

The proposed regional regulatory guidelines shall be implemented in a phased manner



The above steps will require consensus building and hence will need to be facilitated through a strong sponsor. The study proposes South Asia Forum of Electricity Regulators (SAFER)/ any other appropriate institutional mechanism to manage this process or any other appropriate institutional mechanism .





# International Best Practices on Regional Regulatory Institutional Mechanism.



ACER in European Union

Issues non-binding opinions and recommendations to national energy regulators, transmission system operators

- Fosters cooperation among European energy regulators,
- Ensures market integration and harmonisation of regulatory frameworks.
- Formulates **Framework Guidelines** related to regulation on System operation, connection and capacity allocation etc. leads to network codes.
- Harmonization of **Transmission tariff**

**RPTCC**  
(Regional Power Trade  
Coordination Committee)

RPTCC in Greater Mekong Subregion

High level body responsible for coordinating and guiding the market development

- Specifying **basic rules and guidelines for power trading among Parties**
- Providing **recommendation for the overall policy** and day-to-day management of regional power trade;



RERA in Southern Africa ( SAAP)

Responsible for Cooperation on regulatory & contractual aspects through common set of regulatory guidelines

- **Regional Guidelines for regulating cross-border power trading.**
- **Making Compatible regulatory decisions**
- **Approving cross-border agreements in transit countries**
- **Promoting transparency in the regulation of cross-border trading**

**ECOWAS Regional Electricity Regulatory Authority (ERERA) in West Africa.**

Ensure the regulation of interstate electricity exchanges and to give appropriate support to national regulatory bodies or entities of the Member States.

- *Framework for cross Border Electricity trade.*
- **Regulatory coordination and harmonization of regulations.**
- *Various regulation and guidelines related to the system operation, transmission tariff etc.*





# Way Forward

- SA GDP Growth 6%, One of fastest growing region in the world.
- Low per capita :Need to increase for economic growth , quality of life and sustainability and stability of the region.
- Non-Energy Benefits of Hydro needs to be captured in the context of Renewable Energy Integration and Grid Balancing. Need build `Market Mechanism
- Political Consensus backed by a Regulatory framework is the key to the success of CBET in the Region.
- Harmonization/coordination of policy and regulations.
- Regional settlement mechanism for Cross Border Transaction and Dispute settlement mechanism.
- Regional Transmission master plan for CBET.
- Institutionalization of the CBET framework: Regulatory Forum for Coordination of Regulations and Forum of Transmission utilities etc.
- Investor friendly framework guidelines are important for sustainable exploitation of the energy resources and protection of investments.
- Competitive Regional Power market.
- Potential to contribute significantly to mitigate climate change and Co2 emission in the region through development of Hydro power.

# ***Brief Description of Regional Regulatory Guidelines***



## *Back ground-Trading licence in SA countries*

### **India :**

Currently electricity trading is licensed activity in India i.e. for Domestic electricity trading and is governed by CERC regulations Procedure, Terms, and Conditions for Grant of Trading License and Other Related Matters (2009).

**Bhutan :** In Bhutan-The Electricity Act of 2001 recognizes export and import of electricity as licensed activities.

The BEA issues licenses and monitors the performance of the licensees to ensure compliance with the provisions of Acts, Regulations, Standards, Codes, etc., For instance, the Bhutan Electricity Authority (BEA) has granted license to Dagachhu Hydropower Corporation Limited (or Licensee) to carry out the activities of construction, generation, supply, and export.

**Bangladesh:** The Bangladesh Electricity Regulatory Commission Act of 2003 does not mention export and import of electricity as a licensed activity.

**Other SA countries do not have any trading licenses regimes.**

**On CBET front, currently trade is happening through Nodal Agencies (traders) such as PTC, NVNL between India-Nepal and India-Bhutan.**



# Regional Regulatory Guidelines: Guideline 1-Licensing Cross-border Electricity Trade Activities, Imports And Exports

## Guideline 1: Licensing Cross-border Electricity Trade Activities, Imports And Exports

### Rationale

Since countries have different licensing rules and procedures, a **harmonized licensing framework** ensures that licensing does not restrict entry. It provides regulatory tools that helps regulators to keep an **oversight of the market**

1

Member countries shall aim to recognize CBET as a **distinct licensing activity through amendments** in existing laws or regulations or through enactment of enabling regulations

2

National regulators to **define the process of obtaining and issuing licenses** for CBET subject to their national Legal & Policy requirements

3

Provisions to include



4

The license shall impose **conditions to comply with prescribed planning and technical standards** and may also require the licensee to provide specific information as deemed necessary by the regulator/designated entity

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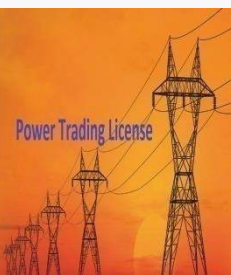
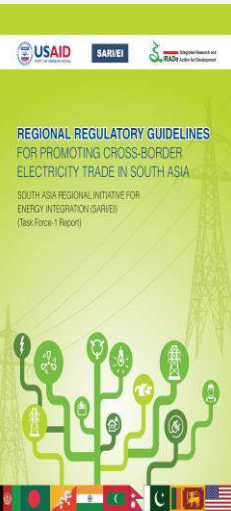
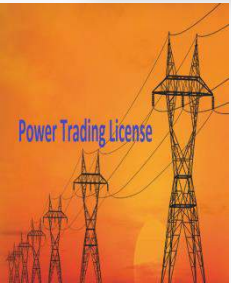
In the **absence of the regulator, grant of license shall rest with relevant Ministry/ Government body. Summary to be made public**

### **Accelerate the Implementation of SAARC Framework Agreement on Energy (Electricity) Cooperation**

Article 13-Facilitating Buying and Selling Entities Member States shall enable Buying and Selling Entities to engage in cross-border electricity trading subject to the laws and regulations of the concerned Member States.

### **Accelerate the Implementation of PTA-India-Nepal**

ARTICLE-IV-The Parties shall allow the **authorized/licensed electricity producers/ buyers/traders** of each country to engage in cross-border electricity trading, including that through Power Exchanges, and to seek cross-border transmission access as per the laws of the respective country.



# Background: Guideline- 2 of Regional Regulatory Guidelines- Non-Discriminatory Access to Transmission Network

- ✓ **Non-Discriminatory Access to Transmission Network is one of important requirement.**
- ✓ **Open Access :** Possibility for any party selling or buying electricity to use Transmission systems:
  1. Without discrimination
  2. Subject to transparently formulated system-security constraints
  3. Against payment of adequate fees.
- ✓ **In CBET, non-discriminatory access to their respective transmission systems increases opportunities for any party to sell/buy electricity at a cost-reflective fee and to take advantage of the load and time diversity and contribute to better utilization of resources.**
- ✓ **Cross-border transmission interconnections with freedom of access is a critical instrument of integration of the national electricity markets, or “market coupling (European Union).** Open access is also one of the key to free and fair electricity market and facilitates better integration of two or more power systems (Europe).
- ✓ **OA has been recognized through Protocols, Supplementary Acts (WAPP), Strategy Documents (GMS), Operational Manuals (SAPP).**
- ✓ **Open Access is also an essential element of introducing competition to electricity markets and increasing their efficiency.**

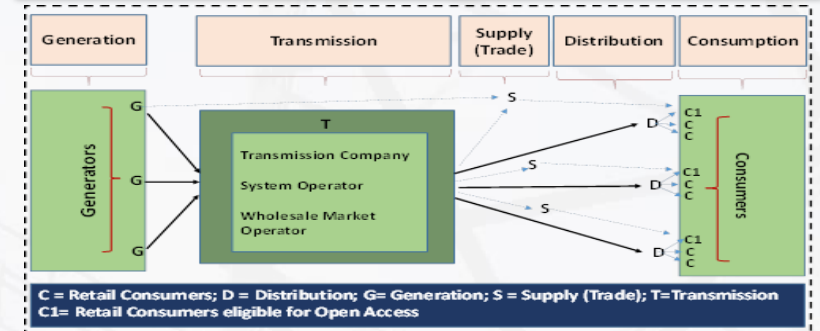


**Accelerate the Implementation of SAARC Framework Agreement on Energy (Electricity ) Cooperation**

- ✓ **Article 12 :Transmission Access**  
Member States shall, for the purpose of cross-border trade, enable non-discriminatory access to the respective transmission grids
- ✓ **Article 6 : Promoting competition**  
Member States shall encourage the process of opening up of electricity sector guided by respective national priorities with the aim of promoting competition.

**Accelerate the Implementation PTA-India-Nepal**

- ✓ **Article 2 (B) The Parties shall allow non-discriminatory access to the cross-border interconnection(s) for all authorized/licensed participants in the common electricity market**





## Back ground- Access/Open Access in SA countries

Currently, it is only in India, Bhutan, and Bangladesh that specific provisions related to Access/open access exist ,however comprehensive framework/guidelines/regulations exist only in India, whereas Afghanistan, Pakistan, Nepal, and Sri Lanka have not yet introduced specific provisions .

India through EA 2003 has mandated open access for inter- as well as intra-State transmission lines. The Regulatory Commissions (CERC and SERCs) provide a facilitative framework for non-discriminatory open access through enabling regulations.

Bangladesh- POLICY GUIDELINES FOR ENHANCEMENT OF PRIVATE PARTICIPATION IN THE POWER SECTOR, 2008 :

PGCB and all Distribution Licensees shall provide non- discriminatory open access, to their transmission and/or distribution system for use by any Generation Licensee subject to payment of transmission/distribution wheeling charges determined by BERC.

Draft Electricity (amendment) act, 2012 requires the Bangladesh Electricity Regulatory Commission (BERC) to introduce, operate, and maintain an independent, fair, and competitive market structure for the bulk trading of electricity in the country and take necessary measures to facilitate a smooth transition from the single buyer system to the open market system in consultation with the Government of Bangladesh. While the Act mandates the transmission utility, Power Grid Corporation of Bangladesh (PGCB), to provide non-discriminatory open access to its transmission system for use by any licensee or generating company on payment of the transmission charges, it also directs the **Commission to issue necessary regulations in order to ensure open non-discriminatory access by all the concerned parties to the grid system in Bangladesh.**

In Bhutan, the EA 2001 mandates the Bhutan Electricity Authority to ensure non-discriminatory access.



# Regional Regulatory Guidelines: Guideline 2- Provision of Non-discriminatory Open Access to Transmission Network

## Guideline 2: Provision of Non-discriminatory Open Access to Transmission Network

### Rationale

Open Access makes it possible to sell or buy electricity, irrespective of location of buyer/seller in the grid; subject to transparently formulated **system-security constraints without discrimination** and against **payment of adequate fees** for accessing the system.

1

Member countries shall coordinate setting of **fair rules and procedures** for non-discriminatory open access. **Notification of enabling regulations in respective SAC, by working along with the national regulators** and/or other empowered entities

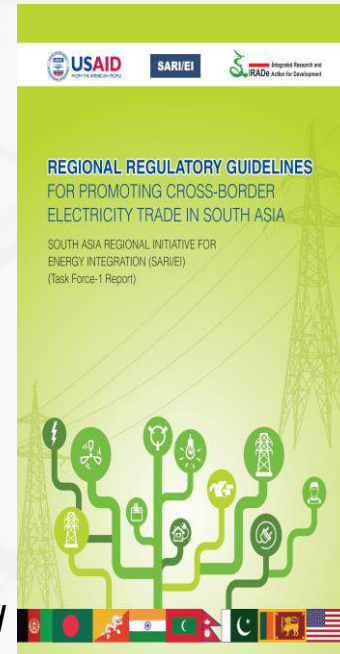
2

**Explicitly defined through amendment of regulations or enactment of separate regulations/orders** and eventually, in the **long-term legislative enablement of open access**

3

The enactment of various provisions/regulations inter alia shall include

- **Nominating nodal agency for grant open access-** Responsible for undertaking scheduling and dispatch operation as well as processing of applications filed by the applicants
- **Procedure for filing applications, application fee-** Customers shall have to apply to seek access on a format to be prescribed by nodal agency giving necessary details such as capacity required, point of injection, point of drawal, duration, type of service required, average load, peak load etc.



# Regional Regulatory Guidelines: Guideline 2- Provision of Non-discriminatory Open Access to Transmission Network

## Guideline 2: Provision of Non-discriminatory Open Access to Transmission Network

3

The enactment of various provisions/regulations inter alia shall include

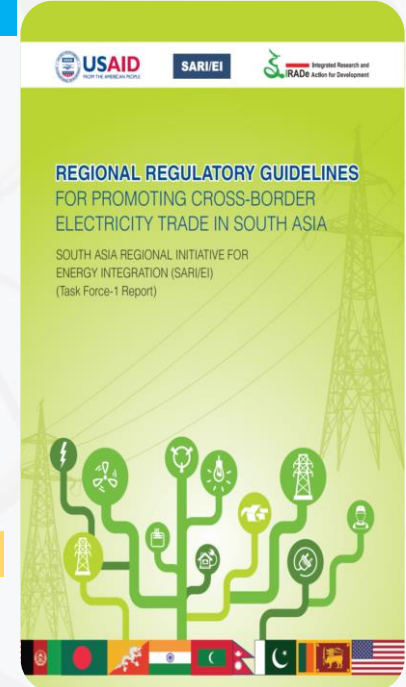
- **Processing of applications, priority order and criteria for grant of access-** The request for transmission access shall be processed by the nodal agency in a time bound manner taking into account line loading, voltage profile, system stability etc. and ensuring that the existing loads continued to be serviced with reasonable reliability. Subject to Available Transmission Capacity (ATC), the long-term customers shall have priority over short-term customers
- **Principles with regard to non-discriminatory and transparent charges for network use-** The objective in the design of the open access charges should be to recover the sunk cost of the transmission system. Further, open access customers to compensate the nodal agency for scheduling, system control and dispatch services rendered by them.

4

Enabling provisions for the system operators in respective countries to **coordinate scheduling and dispatching of cross border flows**

5

Eventually, in the **long-term legislative enablement of open access may be considered** through inclusion of **non-discriminatory open access provisions in the relevant laws.**





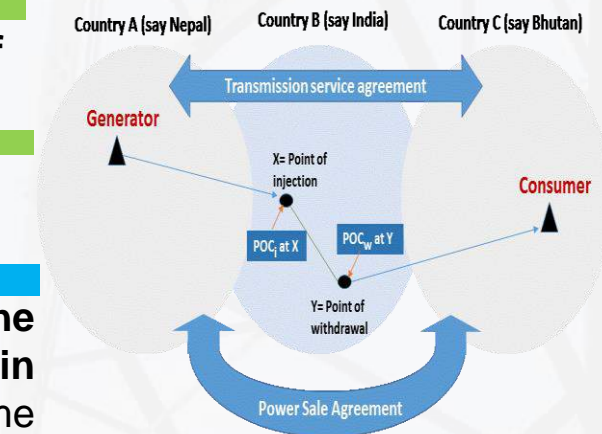
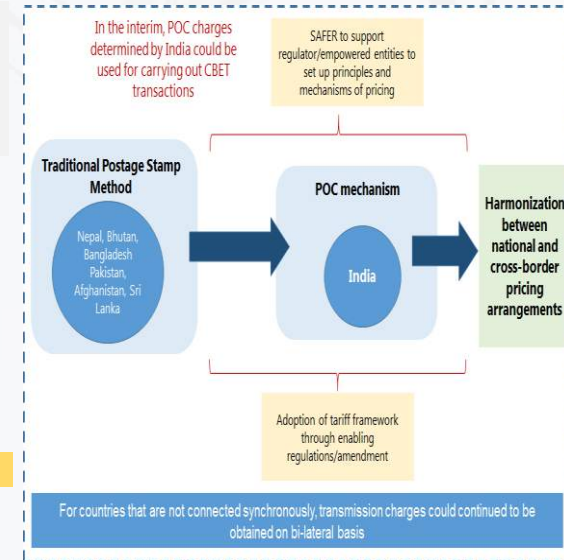
# Regional Regulatory Guidelines: Guideline 3- Transmission Pricing

## Guideline 3: Transmission Pricing

### Rationale

For CBET, it is essential to have a pricing mechanism that separates pricing of “carriage” and “content”. Pricing must be **cost-reflective, efficient, and transparent**.

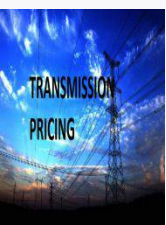
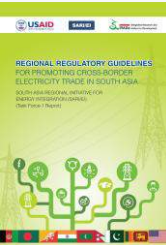
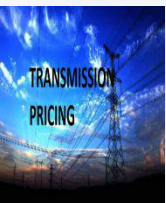
**Note:** *The preference and feasibility of a transmission pricing mechanism is entirely a country’s prerogative and depends on whether the power system in that particular country has reached the stage wherein it is ready to adopt a particular pricing mechanism.* In most of the above cases, the PoC charges prevalent in India currently can either be directly used and/or further adapted to arrive at approach for transmission pricing



POC<sub>i</sub> = Point of Connection charges for injection determined by POSOCO  
 POC<sub>w</sub> = Point of Connection charges for withdrawal determined by POSOCO

**A typical multilateral trade scenario between Nepal-India-Bhutan**

- 1 SAFER shall work along with national regulator/ empowered entities to formulate principles and mechanisms for transmission pricing that are **economically efficient and transparent**
- 2 The tariff framework shall be **sensitive to distance, direction, and related to quantum of power flow**.
- 3 The Regulators (or other empowered entities) in SAC shall gradually adopt such tariff framework in their respective system through enabling regulations.
- 4 Gradually, the member countries shall move towards a pricing framework based on the principle that transmission system users must share the total transmission cost in proportion to their respective utilization of the transmission system, while at the same time covering the revenues of the transmission licensee.
- 5 Single point charges in the form of injection charges and withdrawal charges shall be determined for each cross border interconnector/national boundary.



# Regional Regulatory Guidelines: Guideline 3- Transmission Planning

## Guideline 4: Transmission Planning

### Rationale

It is important for member countries to have their individual and **comprehensive national transmission plans with identified cross border interconnections**. Further, development of a **regional transmission plan for the region will facilitate coordinated development**

1

SAFER shall facilitate the development of a **regional coordination forum of National Transmission Utilities** for purpose of transmission planning

2

Forum shall facilitate coordination between member countries to **develop common guidelines for development and augmentation of the national transmission plans** to support existing bilateral CBET

3

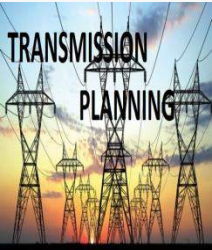
- The national transmission plans shall include and ensure the following:
  - ***Adequate coverage of transmission system for feasible CBET scenarios***
  - ***Details of planned transmission lines, interconnecting points in the regions, timelines for commissioning, sources of funding etc.***

4

Member countries shall develop database of regional transmission projects. **Transmission plans shall be shared with the regional coordination forum to facilitate coordinated development**

5

Countries shall work towards **evolving a coordinated regional level master plan** based on pre-specified guidelines, utilizing information from databases shared at the regional level



# Regional Regulatory Guidelines: Guideline 5- Provision Of Imbalance Settlement

## Guideline 5: Provision Of Imbalance Settlement

### Rationale

Imbalance Settlement refers to **financial settlement for deviations in schedules of injection/withdrawal of electricity**. It addresses the issue of mismatch between scheduled and actual delivery of power in the grid through penalty mechanism in case of default.

1

Member Countries shall develop a **common set of procedures for Imbalance Settlement of CBET transactions**

2

Common set of procedures shall be evolved by empowered entities (designated system operators or central transmission agencies), comprising **scheduling, dispatch, energy accounting and settlement procedures for both AC-AC and AC-DC interconnections in the region**

3

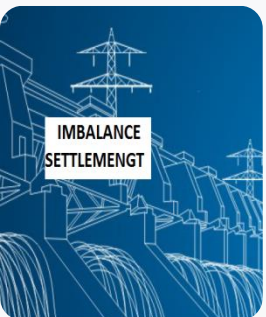
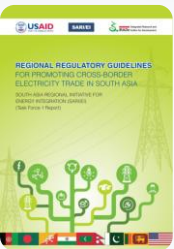
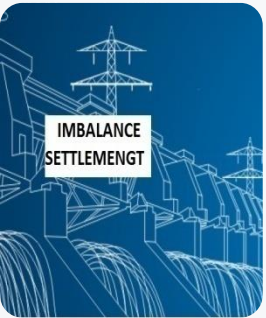
The Imbalance Settlement mechanism shall be explicitly defined by member countries through **modification/amendment of applicable regulations or through enactment of separate regulations applicable to CBET**

4

All participants **involved in CBET shall submit their schedules to their respective designated system operators** who in turn will **coordinate with their counterparts** in other countries basis the common set of procedures

5

The enactment of various provisions/regulations inter alia shall include (i) **Charges for deviation** (ii) **Limits on deviation volume and consequences of violating limits** (iii) **Accounting of Charges for Deviation** (iv) **Schedule of Payment of Charges for Deviation**





# Regional Regulatory Guidelines: Guideline 6- Harmonization Of Codes

## Guideline 6: Harmonization Of Codes

### Rationale

The **scale of harmonization of Grid codes** across countries varies depending upon the type of **interconnection and the scale of transactions** undertaken. In case of **high volumes being transferred through AC interconnection** the **risks of deviation and grid security is significant** and necessitate harmonization of standards and codes.

1

SAFER shall **coordinate and facilitate sharing/exchange of technical characteristics** and system specific data among the owners/operators of power systems in member countries

2

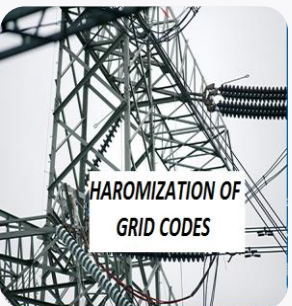
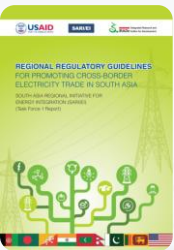
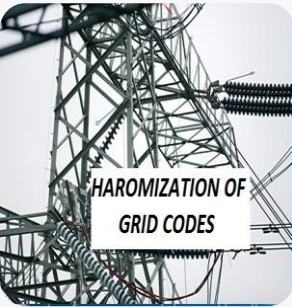
SAFER shall **facilitate harmonization through formulation of guidelines** on technical standards of interconnection. The guidelines shall be framed in **consultation with empowered technical bodies in member countries.**

3

- Harmonization to be achieved on following aspects
  - ***Voltage standards and System voltage regulation***
  - ***Frequency tolerance limits and Thermal limit constraint***

4

- Guidelines to additionally include rules on
  - ***Metering standards, communication technologies and monitoring***
  - ***Protection Schemes for congestion management and system islanding***



# Regional Regulatory Guidelines: Guideline 7- Dispute Resolution

## Guideline 7: Dispute Resolution

### Rationale

Dispute Resolution procedures provide for **settlement of disputes through conciliation and arbitration. It creates** conditions favorable for fostering greater investment by investors of one Member State in the territory of another Member State.

1

**Transparent, fair, commonly accepted legal framework** and clearly **defined dispute resolution procedures** are an absolute necessity since they govern and effect the existing and future trade relations between two countries.

2

Any dispute arising out of interpretation and /or implementation of the Agreements/contracts entered into shall be resolved amicably among the Member States.

3

If unresolved, the Member Countries may choose to refer the dispute to the SAARC Arbitration Council. **The SAARC Arbitration Rules shall govern the arbitration procedure**



# Regional Regulatory Guidelines: Guideline 8- Taxes and Duties

## Guideline 8: Taxes & Duties

### Rationale

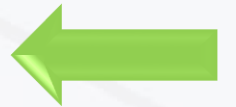
**Taxes and Duties have commercial implications** on end consumers and **uncertain tax regimes deter investor confidence**. To promote CBET in the SA region, countries **should adopt a zero tax regime**

1

Member Countries to move towards **exempting export/import duty/levies/fees/taxes, etc. for CBET.**

2

National Governments to facilitate **implementation of a zero tax regime through modification/amendment** of extant notifications/Regulations



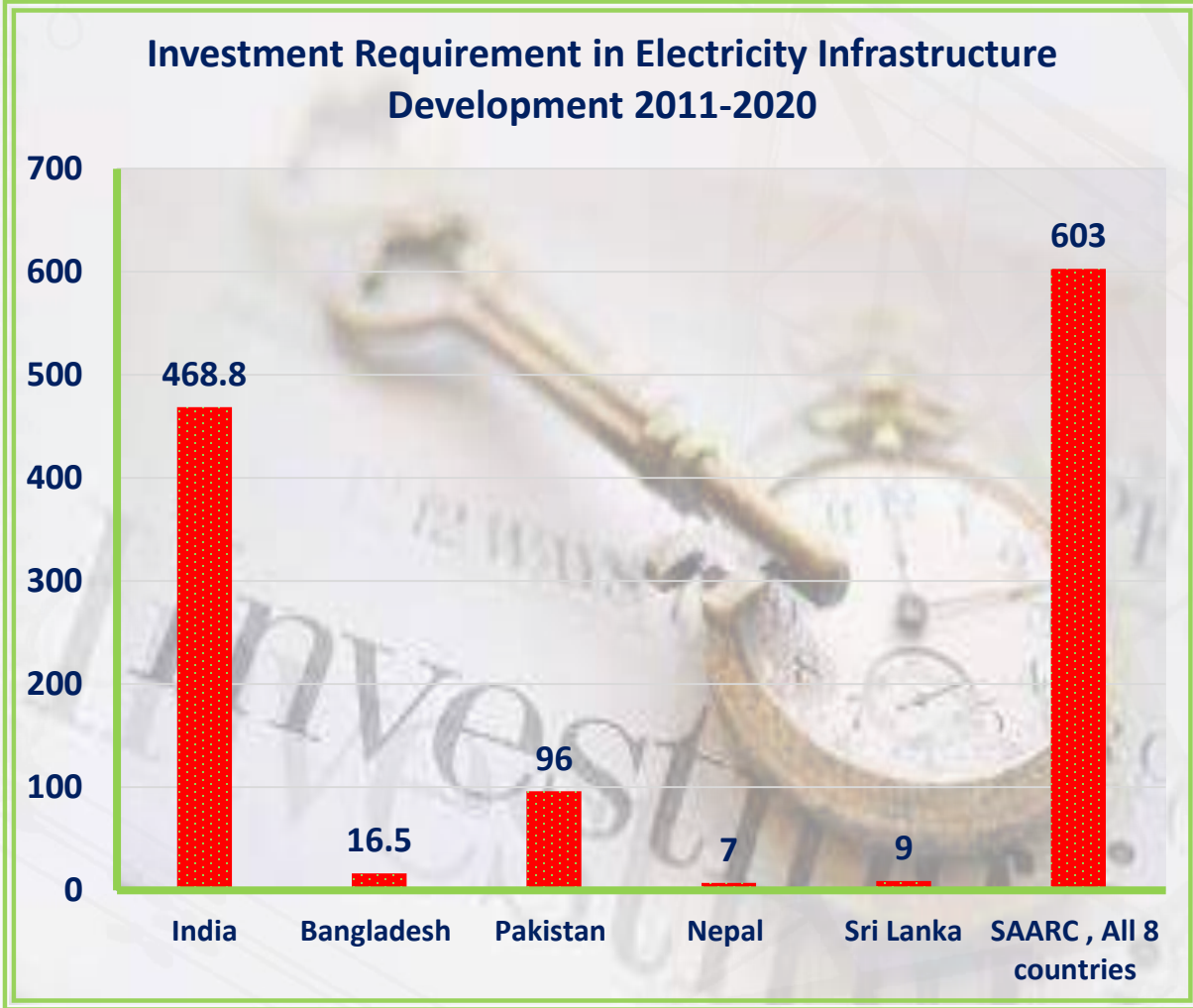




| Country     | Policy  | Regulation   | Generation  | Transmission  | System Operation                                     | Distribution  | Trading   |
|-------------|---|--|---|---|--|---|---|
| Afghanistan | Ministry of Energy and Water (MEW)  | Afghanistan Electricity Regulatory Authority (AERA) (Proposed)                                   | DABS  | DABS  | DABS   | DABS  | DABS  |
| Bangladesh  | Ministry of Power, Energy and Mineral Resources (MPEMR)   | Bangladesh Energy Regulatory Commission (BERC)   | BPDB, EGCB, APSCL, NWPGC, IPPs, SIPPs, Rental Plants  | PGCB  | PGCB   | BPDB, WZDPC, APSCL, DPDC, DESCO, REB  | BPDB  |
| Bhutan      | Ministry of Economic Affairs (MEA)  | Bhutan Electricity Authority (BEA)   | Druk Green Power Corporation (DGPC)   | Bhutan Power Corporation (BPC)  | BPC (NLDC)   | BPC   |   |
| India       | Central: Ministry of Power under the Government of India<br><br>State: Power/Energy Department under the State Government | Central: CERC<br><br>State: SERCs/<br>JERCs  | Central: NTPC, NHPC, NPCIL, UMPPs, IPPs, MPPs<br><br>State: State-owned GenCos, IPPs, CPPs                    | Central: POWERGRID (CTU), Private/JV Licensees<br><br>State: STUs, Private/JV Licensees | Central: POSOCO (NLDC & 5 RLDCs)<br><br>State: SLDCs | Central: Nil<br><br>State: State-owned Discoms, Private Licensees, Distribution Franchisees | Central: Inter-state Licensees<br><br>State: Discoms / TradeCos (Include State Holding Cos) / Intra-state Licensees |
| Maldives    | Ministry of Environment and Energy (MOEE)   | Maldives Energy Authority (MEA)  | STELCO, FENAKA  | STELCO, FENAKA  | STELCO, FENAKA                                       | STELCO, FENAKA  | -   |
| Nepal       | Ministry of Energy (MoE)  | Electricity Tariff Fixation Commission (ETFC) under Department of Electricity Development (DOED) | Nepal Electricity Authority (NEA), IPPs   | NEA   | NEA  | NEA   | NEA   |
| Pakistan    | Ministry of Water and Power (MOWP)  | National Electric Power Regulatory Authority (NEPRA)   | State-owned generating companies formed after restructuring of WAPDA (CPGCL, JPCL, LPGCL, NPGCL) & other IPPs | National Transmission & Despatch Company (NTDC)   | NTDC   | KESC & Distribution Companies formed after restructuring of WAPDA (total 10 in nos.)        | -   |
| Sri Lanka   | Ministry of Power and Energy (MOPE)   | Public Utilities Commission of Sri Lanka (PUCSL)   | Ceylon Electricity Board (CEB), IPPs  | CEB Transmission Licensees  | CEB Transmission Licensees                           | CEB Distribution Licensees<br>1-4<br>LECO   | -   |

# Investment Requirement in Electricity in South Asia 2020

- ✓ South Asia is one the fastest growing regions in the world.
- ✓ As per world bank estimates at present economic growth rate, SA countries needs to invest in the range of **USD 1.7 trillion to USD 2.5 trillion( 2011-2020)** to bring its power grids, roads, water supplies up to the stranded needed to serve the population.
- ✓ Total investment of **USD 603 billion** is required for SAARC countries for Electricity Infrastructure development.
- ✓ Bangladesh, India, Nepal , Pakistan and Sri Lanka are expected to invest around **US\$ 16.5 Billion, US\$ 468.8 Billion, US\$ 7billion, US\$ 96 Billion and US \$ 9 Billion** respectively by 2020.





## Bhutan: Some of the Key project and Investment requirements

- ✓ A total investment of US\$ 12.62 Billion is required for Developing Generation and Transmission Projects.
- ✓ This cost may go up considering the cost escalation nature of hydro projects due to various uncertainties.

| Project Name                     | Implementation Mode/Remark | Capacity | Investment Requirements (INR Cr.)   | Associated transmission cost (INR Cr.) |
|----------------------------------|----------------------------|----------|---|--|
| Punatsangchhu-I HEP              | IG*/Under construction     | 1200     | Punatsangchhu-I HEP<br>Is at Final Stage of Implementation and Dagachhu has been Commissioned |  |
| Dagachhu HEP                     | PPP-commissioned           | 126      |   |  |
| Punatsangchhu-II HEP             | IG/Under construction      | 1020     | 8160  | 434.1                                  |
| Mangdechhu HEP                   | IG/Under construction      | 720      | 5760  | 905.5                                  |
| Amochhu Reservoir HEP            | IG/DPR cleared             | 540      | 4320  | 105.1                                  |
| Chamkharchhu-I HEP               | JV/DPR under review        | 770      | 6160  | 586.95                                 |
| Kholongchhu HEP                  | JV/DPR cleared             | 600      | 4800  | 811.45                                 |
| Wangchhu HEP                     | JV/DPR under review        | 570      | 4560  | 53.8                                   |
| Sunkosh Main HEP                 | IG/DPR under review        | 2500     | 20000   |  |
| Sunkosh Barrage HEP              | IG/DPR under review        | 85       | 680   | 296.95                                 |
| Bunakha Reservoir HEP            | JV/DPR cleared             | 180      | 1440  | 104                                    |
| Nikachhu HEP                     | PPP/DPR cleared            | 210      | 1680  | 147                                    |
| Kuri-Gongri HEP                  | IG/DPR to begin soon       | 1800     | 14440   | 809.9                                  |
| Bindu Khola HEP                  | NA                         | 13       | 104   | 4.75                                   |
|                                  |                            | 10334    | 72104   | 4259.5                                 |
| <b>Total Investment Required</b> |                            |          | <b>76363.5( 12.62 US \$ billion)</b>  |  |



# Nepal: Capacity Addition Planned



- ✓ Installed Capacity : 765 MW
- ✓ Nepal is expected to have peak load of 5622 MW by 2030.
- ✓ Nepal is expected to add 4541 MW of additional capacity by 2025 (3057 MW RoR and 1484 Storage)
- ✓ There are many projects are being pursued currently which are Cross Border Power in nature

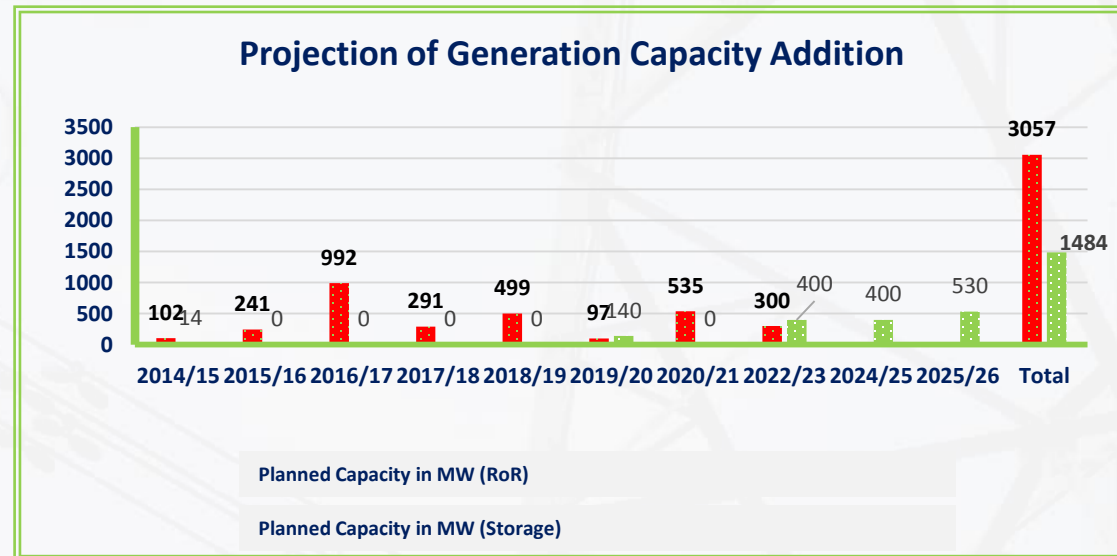
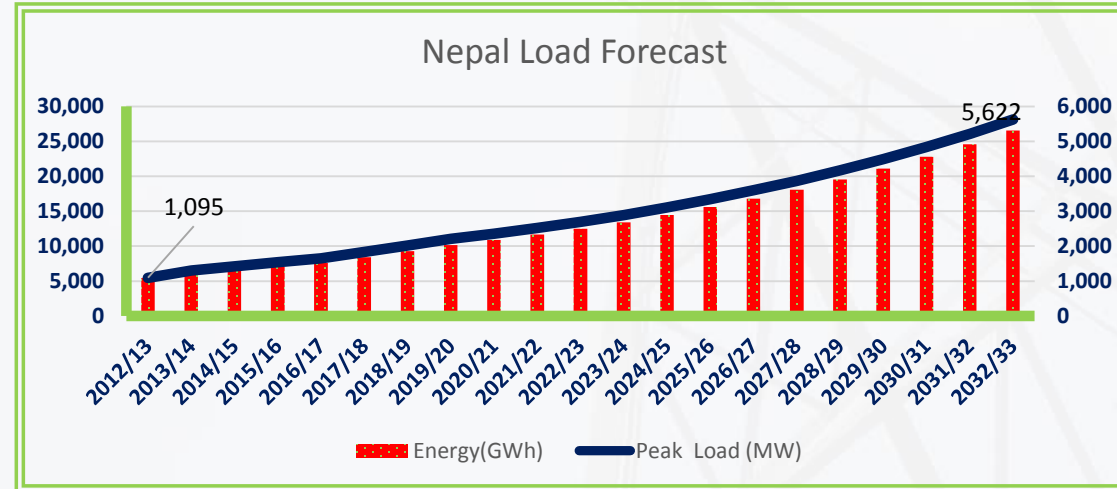
**PDA Concluded:**

1. 900 MW Upper Karnali with GMR India
2. 900 MW Arun -3 with SJVNL

**PDA in the pipelines:**

1. 600 MW Upper Marsyangdi - GMR
2. 750 MW West Seti – CWE ( Three Gorges )
3. 880 MW Tamakosi III (SN Power)

- ✓ For development of 10,000 Mw hydro power around US\$ 7.21 billion will be required.
- ✓ Investment required for transmission projected under Construction, planned and proposed is USD 1.786 Billion





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# Nepal: Some of the Key Hydro Projects and Investment Requirement



| Name of the Project   | Capacity in MW | *Estimated Project Cost |
|-----------------------|----------------|-------------------------|
| Arun-3                | 900            | \$ 944.5 million        |
| Upper Karnali Project | 300            | \$450 million           |
| Sapat Koshi           | 3300           | \$ 4950 million         |
| Karnali               | 10,800         | \$ 16200 million        |
| Naumure               | 225            | \$ 337.5 million        |
| Pancheshwar           | 5600           | \$ 8400 million         |

\* USD 1.5 Million per MW

# GLOBAL TRENDS

## Europe

- 405 MW added in 2014.
- Pumped storage remains a focus of activity, with 8,600 MW planned or under construction, including 2,500 MW expected in the Swiss Alps by 2017.
- In 2015, Norway and the UK announced agreement for the world's longest submarine high-voltage cable (730 km, 1.4 GW), allowing the UK to import Norwegian hydropower.
- In preparation for the 2015 climate



## South America

- 4,979 MW added in 2014.
- 3,312 MW commissioned in Brazil, despite severe drought affecting generation in the south.
- 875 MW commissioned in Colombia, including the 820 MW Sogamoso project, which will meet about 8% of the country's electricity demand.
- Development continuing on the lower Caroni cascade in Venezuela, with the commissioning the 'Manuel Piar' project (2,300 MW) expected in early 2016



## Africa

- 128 MW added in 2014.
- Very low deployment, despite significant untapped potential and major needs for electricity and water services.
- Ethiopia completed construction of the 1,870 MW Gilgel Gibe III in 2015, and is well into construction of the Grand Renaissance project, will bring a further 6,000 MW to the region.
- Burundi, Rwanda and Tanzania signed an agreement to build the 80 MW Rusumo Falls HP plant, with output shared equally between the 3 countries.





# GLOBAL TRENDS

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- In 2015, Norway and the UK announced agreement for the world's longest submarine high-voltage cable (730 km, 1.4 GW), allowing the UK to import Norwegian hydropower.
- In preparation for the 2015 climate summit in Paris, the EU committed to a 40% reduction in GHG emissions by 2030 compared with 1990, complemented by a 27% target for renewables.



## South and Central Asia

- 4,073 MW added in 2014.
- The policy environment is shifting in support of more hydropower in India, with the government considering market incentives and encouraging private sector investment.
- Regional interconnection projects could drive further optimisation of hydropower, with the CASA-1000 transmission project linking Pakistan, Tajikistan, Kyrgyzstan and Afghanistan.
- Russia added 1,168 MW of new capacity to the mix and completed the restoration of the 6,400 MW Sayano-Shushenskaya station.
- Turkey commissioned 1,352 MW as part of its push to rapidly exploit its hydropower potential by the year 2023.

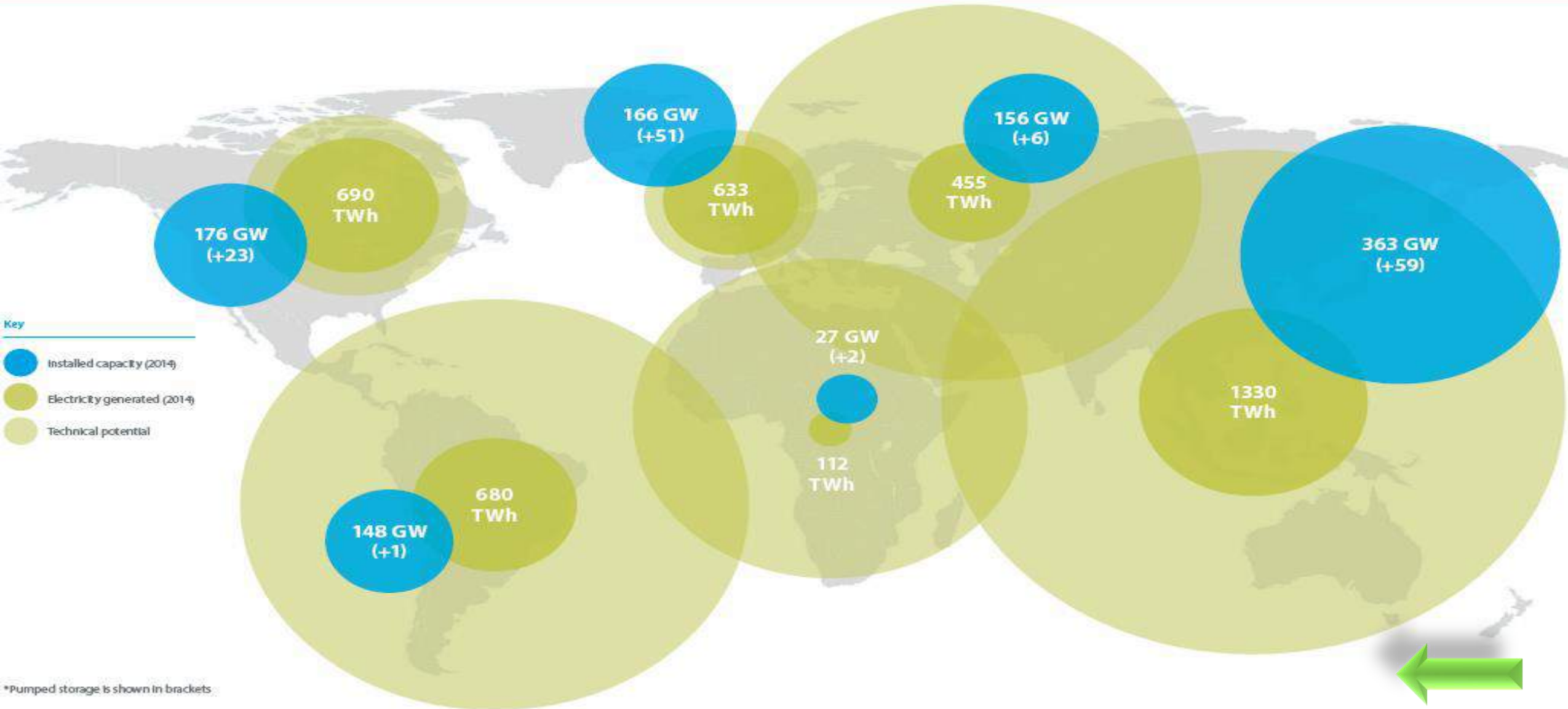


## East Asia and Pacific

- 24,724 MW added in 2014, 90% of which is in China.
- China leads global hydropower development, with 21,850 MW installed in 2014, including the final 4,620 MW of the 13,860 MW Xiluodu project – the third-largest hydropower plant in the world.
- Malaysia commissioned 836 MW in the state of Sarawak, including the final two 300 MW turbines at Bakun (2,400 MW) and the first of four 236 MW turbines at Murum (944 MW), while also announcing plans to begin construction on the 1,285 MW Baleh project in 2016.

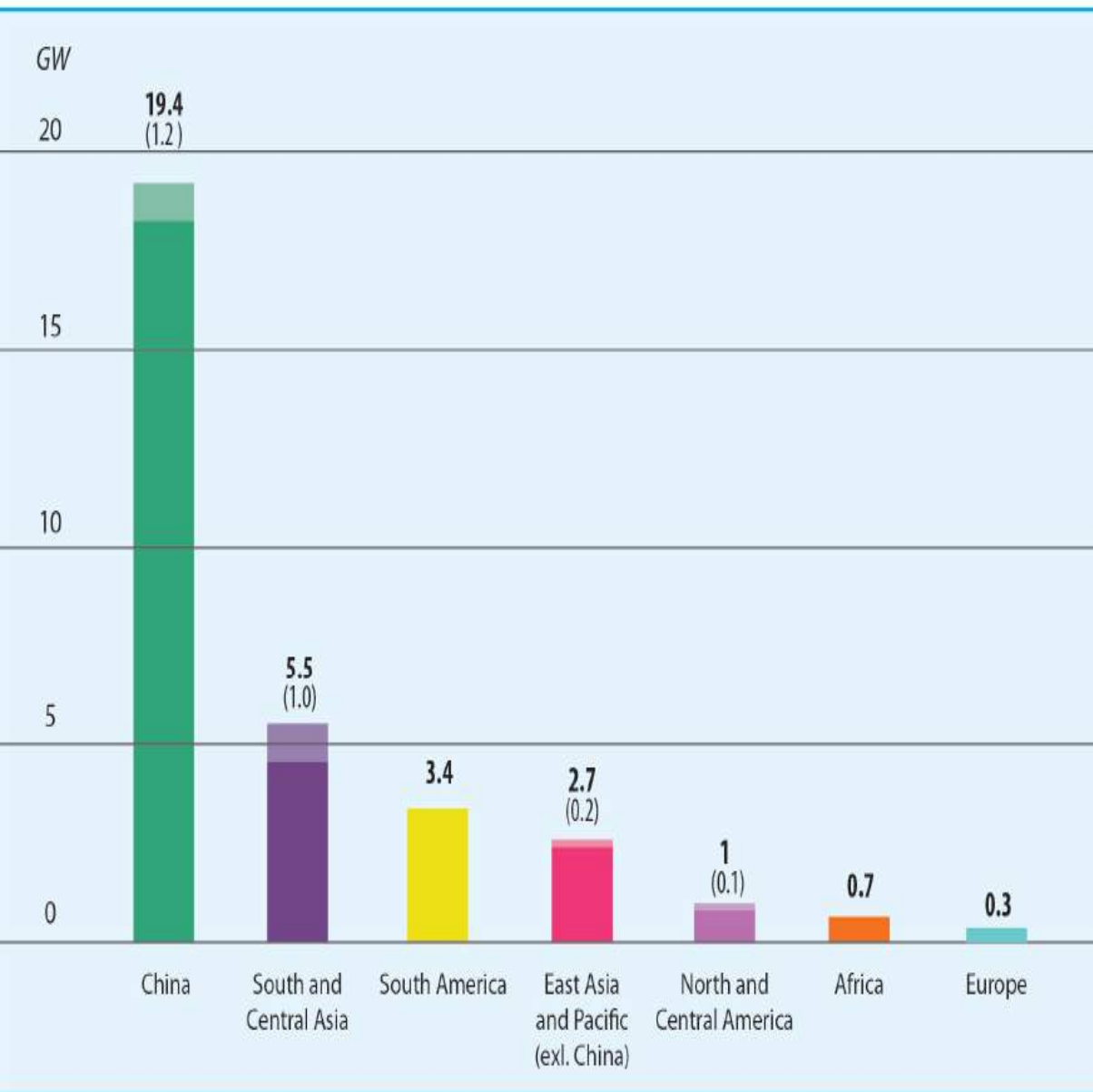


# GLOBAL HYDROPOWER TECHNICAL POTENTIAL, GENERATION AND INSTALLED CAPACITY BY REGION\*



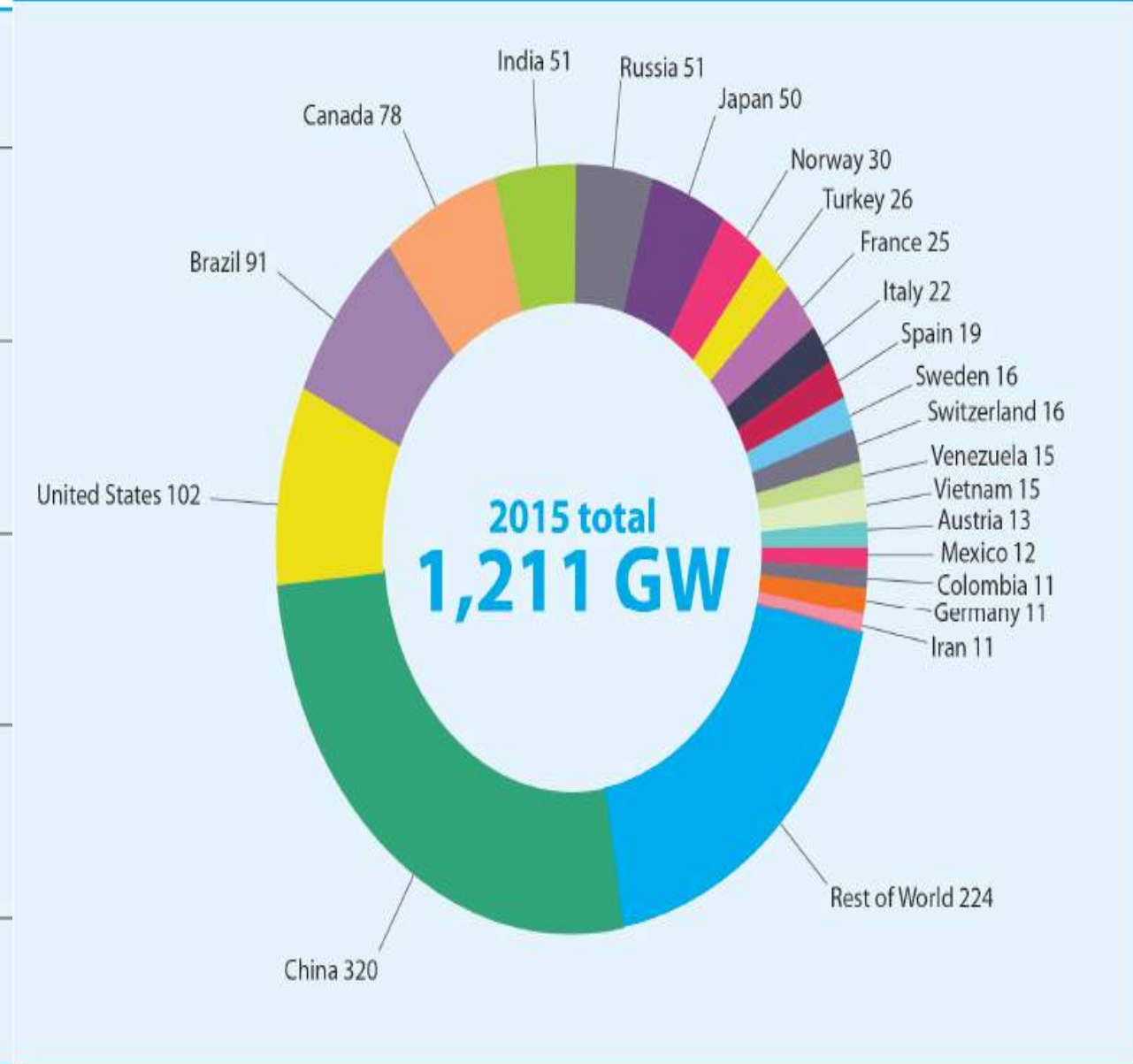
## Total capacity added in 2015 by region:

33 GW hydropower capacity (including 2.5 GW pumped storage)



## World installed hydropower capacity at the end of 2015:

1,211 GW (including 145 GW pumped storage)







- Installed capacity in GW, including pumped storage
- Estimated generation in 2015, in TWh per year
- Maximum generation (assuming potential is fully developed)

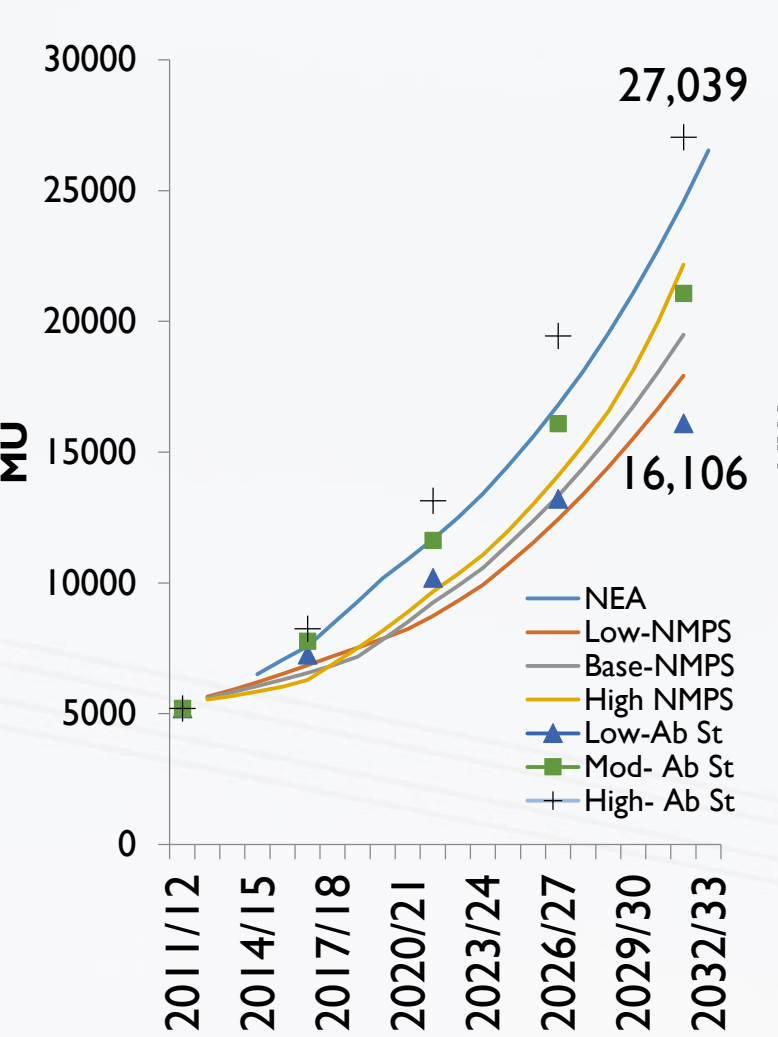
| River                | Nepal Theoretical Potential in MW                                      |  | Total (MW) |
|----------------------|--|--|------------|
|                      | Major river courses having catchments areas above 1000 km <sup>2</sup> | Small river courses having catchments areas 300-1000 km <sup>2</sup> |            |
| Sapta Koshi          | 18750  | 3600   | 22350      |
| Sapta Gandaki        | 17950  | 2700   | 20650      |
| Karnali and Mahakali | 32680  | 3500   | 36180      |
| Southern River       | 3070   | 1040   | 4110       |
| CountryTotal         | 72450  | 10840  | 83290      |

| River                | Nepal Technically Feasible Potential in MW                             |  | Total (MW) |
|----------------------|--|--|------------|
|                      | Major river courses having catchments areas above 1000 km <sup>2</sup> | Small river courses having catchments areas 300-1000 km <sup>2</sup> |            |
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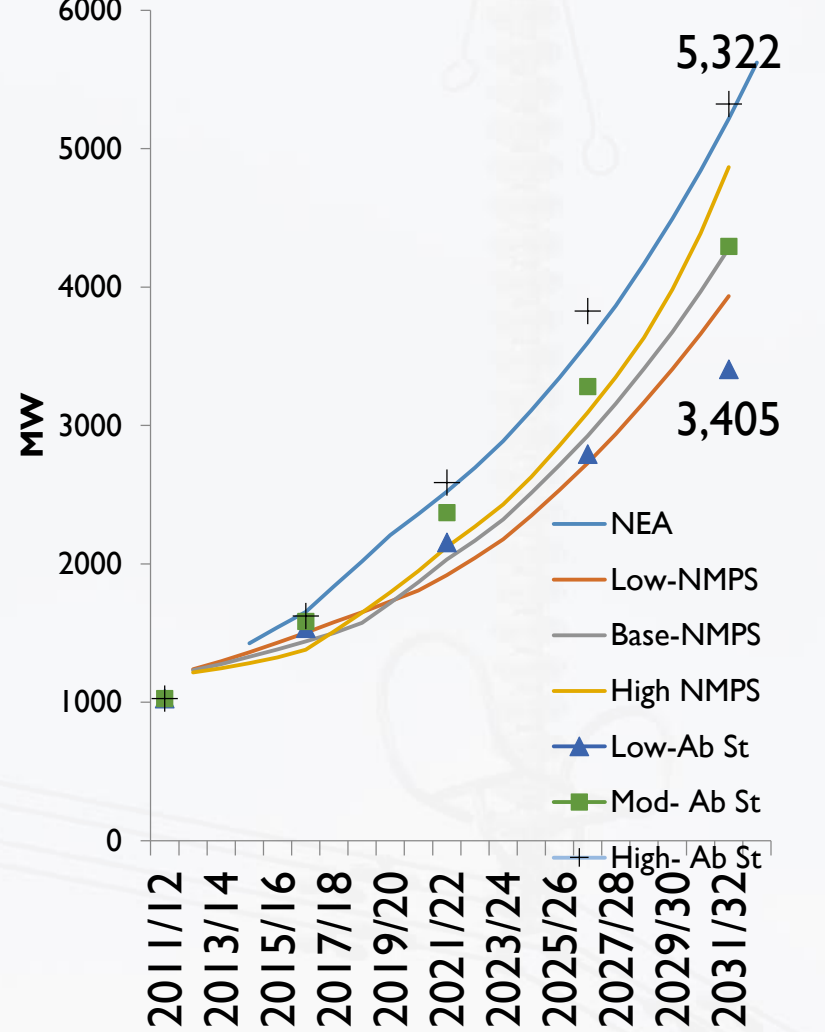
| Under Construction                |               | Planned                 |               |
|-----------------------------------|---------------|-------------------------|---------------|
| HPP                               | Capacity (MW) | HPP                     | Capacity (MW) |
| Upper Tamakosi Hydropower Project | 456           | Upper Arun HEP          | 335           |
| Tanahu Hydropower Project         | 140           | Upper Modi A HEP        | 42            |
| Chameliya HEP                     | 30            | Upper Modi HEP          | 18            |
| Kulekhani III                     | 14            | Dudh Kosi Storage HEP   | 640           |
| Upper Trisuli 3 A HEP             | 60            | Tamor Storage HEP       | 530           |
| Rahughat HEP                      | 32            | Uttar Ganga Storage HEP | 300           |
| Upper Sanjen                      | 14.6          | Tamakoshi V HEP         | 87            |
| Rasuwagadi                        | 111           | Upper Bheri HEP         | 85            |
| Madhya Bhotekoshi                 | 102           | Chainpur Seti HEP       | 140           |
| Upper Trisuli 3 B                 | 42            |                         |               |
| <b>Total</b>                      | <b>1044.1</b> | <b>Total</b>            | <b>2177.2</b> |

# Nepal Demand Projection and Generation Profile

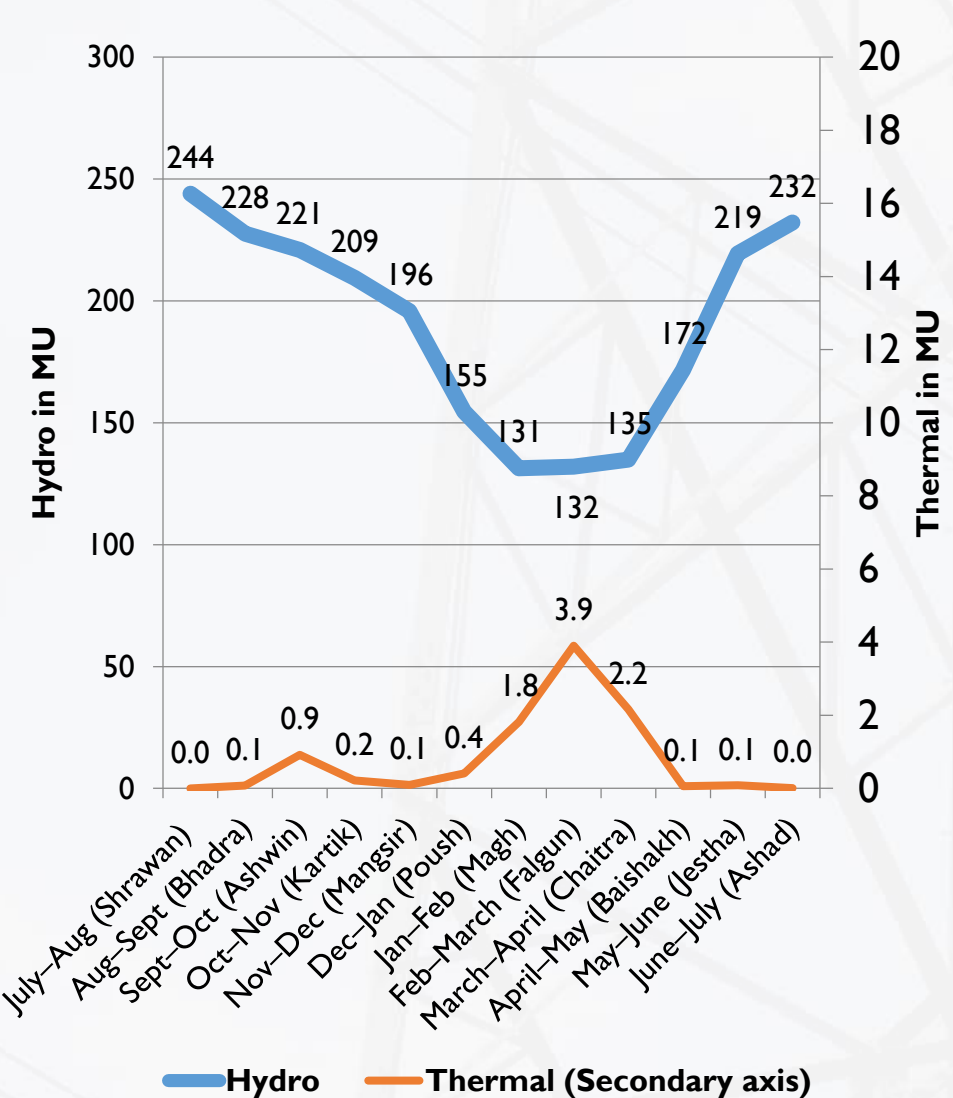
### Electricity Demand Projections (in MU)- Nepal



### Peak Demand Projections (in MW)- Nepal



### Electricity Generation Profile for 2013-14- Nepal



- **AbSt** - Nepal Hydropower Absorption Study
- **NMPS** - Nationwide Master Plan Study on Storage-type Hydroelectric Power Development in Nepal, JICA



# CASA-1000: PRESENT STATUS & FUTURE ACTIONS

- Inter-governmental Council (IGC) has been formed ,in which each country is represented by the Minister / Deputy Minister runs the affairs.
- The project was to be funded by the WB, ADB and IDB . ADB, expected to contribute 40% of project cost, has decided to pull out of this project.
- Each country has constituted a working group for deliberation on various issues with other Working Groups and make recommendations as a Joint Working Group (JWG) for approval of IGC.
- The JWG has agreed for preparations on the basis of Contractual Joint Venture and start negotiations on the standard terms and conditions of the proposed agreements in accordance with agreed commercial principles.
- The Main Agreements of the Project was signed in April 2015 namely;
  1. Master Agreement signed by all four parties of the project.
  2. Power Purchase Agreement between Pakistan and Tajikistan.
  3. Power Purchase Agreement between Pakistan and Kyrgyz Republic.

## FOUR PPAs TO BE SIGNED

1. A PPA between entities designated by the Govts. of Kyrgyz Republic and Pakistan.
2. A PPA between entities designated by the Govts. of Kyrgyz Republic and Afghanistan.
3. A PPA between entities designated by the Govts. of Tajikistan and Pakistan.
4. A PPA between entities designated by the Govts. of Tajikistan and Afghanistan.

# Connecting South Asia (Pakistan)-IRAN

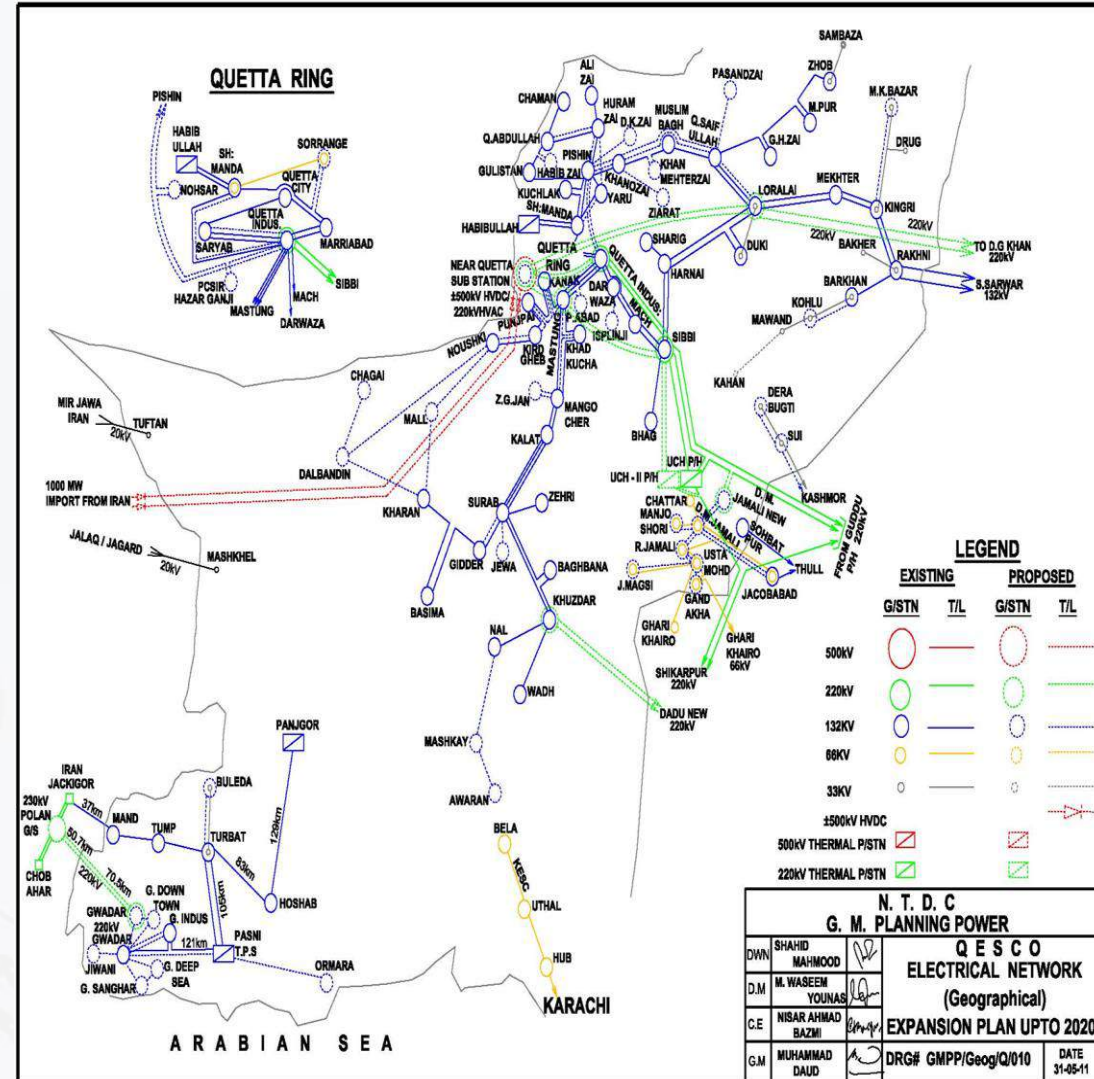
## 1. Existing Interconnection Projects:

- Import of 74 MW Power by Pakistan in border areas of Pakistan (in Baluchistan Province):
  - i. 70 MW at 132 kV (continued since 2003. Initially, it was 35 MW)
  - ii. 4 MW at 20 kV (continued since 2002)
  - iii. (Tariff: US cents 7-10. Contracts is renewed after every 3-years)

## 2. Planned Interconnection Projects:

- i. Import of 100 MW at Gwadar through 220 kV D/C T/Line (contract signed)
- ii. **Import of 1000 MW at Quetta through  $\pm 500$  kV HVDC Bipole** (MoU signed)

*For import of power from Iran, Tariff is linked with International Oil prices.*



# Regional Energy Cooperation Afghanistan-Pakistan-CASA-1000: Connecting Central Asia-South Asia

CASA-1000 is a project designed to transmit 1300 MW of surplus electricity from Tajikistan and Kyrgyz Republic through Afghanistan (300 MW) to Pakistan (1000-MW). MOU among four Governments was signed on November 16, 2007 at Kabul

The project has following major components.

- A 500 kV HVAC Transmission link (477 kM) between Kyrgyz Republic and Tajikistan.
- A 500kV ± HVDC Transmission link (750 kM) between Tajikistan and Pakistan.
- A 300 MW substation and related facilities for power off-take in Afghanistan (Kabul).
- A 1300 MW substation and related facilities for power off-take in Pakistan (Peshawar).
- The approximate total length of the corridor is 750 kM. the total line lengths within each country



| Country      | Transmission Line Length (km) |
|--------------|-------------------------------|
| Tajikistan   | 117                           |
| Afghanistan  | 562                           |
| Pakistan     | 71                            |
| <b>Total</b> | <b>750</b>                    |



# Regional Energy Cooperation Afghanistan-Pakistan-CASA-1000: Connecting Central Asia-South Asia

- Inter-governmental Council (IGC) has been formed ,in which each country is represented by the Minister / Deputy Minister runs the affairs.
- The project was to be funded by the WB, ADB and IDB . ADB, expected to contribute 40% of project cost, has decided to pull out of this project.
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