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Brief Report

On

SARI/EI Participation in "NEPAL POWER INVESTMENT SUMMIT"

May 31-June 3, 2016

Hotel Yak & Yeti

Kathmandu, Nepal

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Brief Report:

Based on the invitation from organiser of Nepal Power Investment Summit 2016- the future battery of South Asia, Mr.Rajiv Ratna Panda, Head-Technical,SARI/EI/IRADe participated in the Nepal Power Investment Summit 2016 held on May 31-June 3, 2016, Hotel Yak & Yeti, Kathmandu, Nepal.

Rt Honorable Prime Minister KP Oli inaugurated a four-day long summit 'Nepal Power Investment Summit 2016' organized by Energy Development Council- the umbrella organization of the entire energy sector of Nepal and Neoventure Corporation with the government partnership, Ministry of Energy and Investment Board of Nepal at Hotel Yak & Yeti, Kathmandu with the theme, Nepal- the future battery of South Asia. Dr. Yubaraj Khatiwada, Vice Chairperson,National Planning Commission- Nepal, H.E. Mrs. Alaina B.Teplitz, Ambassador of USA Embassy, Nepal and Mr. Radhesh Pant, CEO of Investment Board of Nepal also participated in the inaugural of the summit.

Mr. Rajiv participated in the session titled "Power Transmission & Distribution in Nepal "made a detailed presentation on "Accelerating the development of South Asian Power Sector through Cross Border Electricity Trade (CBET)". His presentation covered *a)* Overview of SARI/EI & framework for development of CBET in South Asia (SA) *b)* SA Power Sector and regional energy resource potential *c)* Key drivers for CBET and regional exploitation of energy resources d) Current status of CBET &Trading Potential *e)* Central Asia & SA Power Transmission Project *f)* Regional transmission capacity by 2033-34, 2040 *g)* Benefits of CBET and regional hydro power development *h)* Key challenges and risk associated with CBET projects *i)* key Issues and challenges in hydro power *j)*Accelerating responsible hydropower development in South Asia : Policy making perspective *k)* Non energy benefits of hydropower in South Asia : Policy making perspective *l)* Regional hydro power for renewable energy Integration and grid balancing *m)* CBET Investments risks *n)* Investment requirement in electricity sector in South Asia by 2020 *o)* Cost of cross border various transmission interconnections *p)* Need for a compressive investment friendly regional policy framework for CBET hydropower development in South Asia *q)* Power sector structure in SA &CBET policy governing framework *r)* Moving towards market form of development of CBET-possible phase of market development in SA *s)* way forward. His detailed presentation is attached as Annexure–I.

He also participated as a panellist in the panel discussion on "Strengthen South Asia Power Grid Interconnection-A New Future of Win-Win Cooperation" The panel discussed and deliberated on various technical, investment aspects transmission system interconnection among SA countries, public vis-à-vis private investment in cross border transmission interconnection, rationale & choice of technology (HVDC & HVAC) for cross border transmission interconnection and benefits & win-win nature of cross border transmission interconnection and CBET in SA etc. The session was moderated by Mr. Sher Singh Bhat, Deputy Managing Director, Nepal Electricity Authority (NEA) and other distinguished panellists were Shri R. P. Sasmal, Director (Operations), Power Grid Corporation of India Limited, Mr. Surendra Rajbhandari, Deputy Managing Director, NEA.

The conference was participated by more than 200 participants from China, USA, Canada, Bulgaria, Norway, India, Bhutan, Slovenia, Czech Republic, Thailand, Vietnam, France, Austria, and UK among others.[1] In the conference, 40 speakers from India, Singapore, Thailand, Bhutan, China, US, UK among others highlighted about the investment challenges and opportunities on energy and infrastructure development in Nepal. Speakers discussed about Nepal power market, cross border electricity trade, policy updates and financing methods for power development in Nepal, power transmission and distribution in Nepal, role of Nepal's decentralized renewable in the energy mix and various hydropower project showcased in the two-day conference. Speakers also stressed on the need to develop alternative source of energy.

The Summit declared that Nepal requires USD 20 billion to develop 10,000 MW on grid hydropower projects in next 10 years, and there is the need of USD 5 billion dollars for investment in high voltage transmission line projects to complete within 2035. Budhigandaki 1,200 MW, Nalsingad 410 MW, Tamor 762 MW, Andhikhola 180 MW, Tamakoshi V 87 MW, Upper Tamor 415 MW, Tamakoshi III 650 MW and ThuliBheri 530 MW projects were identified as prominent opportunities for investors. Investors expressed interest to explore investing in mid and large scale power projects in Nepal worth billions of dollars provided the investment environment improved and Nepal's ranking in the ease of doing business increased. They expected to soon have a one-window policy to get all necessary approvals and permits for doing business.[2]

1 http://edcnepal.org/wp-content/uploads/2016/06/e-newsletter-April-May-2016.pdf
2 http://edcnepal.org/wp-content/uploads/2016/06/e-newsletter-April-May-2016.pdf

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Annexure-I
Accelerating the Development of South Asian Power Sector through Cross Border Electricity Trade

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

NEPAL POWER INVESTMENT SUMMIT 2016
Hotel Yak and Yeti,Kathmandu, Nepal, May 31-June 3, 2016

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Outline of the Presentation

- *Overview of SARI/EI & Framework for development of CBET in SA*
- *South Asian Power Sector and Regional Energy Resource Potential*
- *Current Status of Cross Border Electricity Trade (CBET) &Trading Potential*
- *Key Drivers for CBET*
- *Central Asia and South Asia Power Transmission Project*
- *Regional Transmission Capacity by 2033-34, 2040*
- *Benefits of CBET and Regional Hydro Power Development*
- *Key Challenges and Risk associated with CBET projects*
- *Way Forward*

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Brief Overview of SARI/EI

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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.*

- **Demand Driven 'Bottom Up' Approach**

- **IRADe, a regional organization, is implementing partner**

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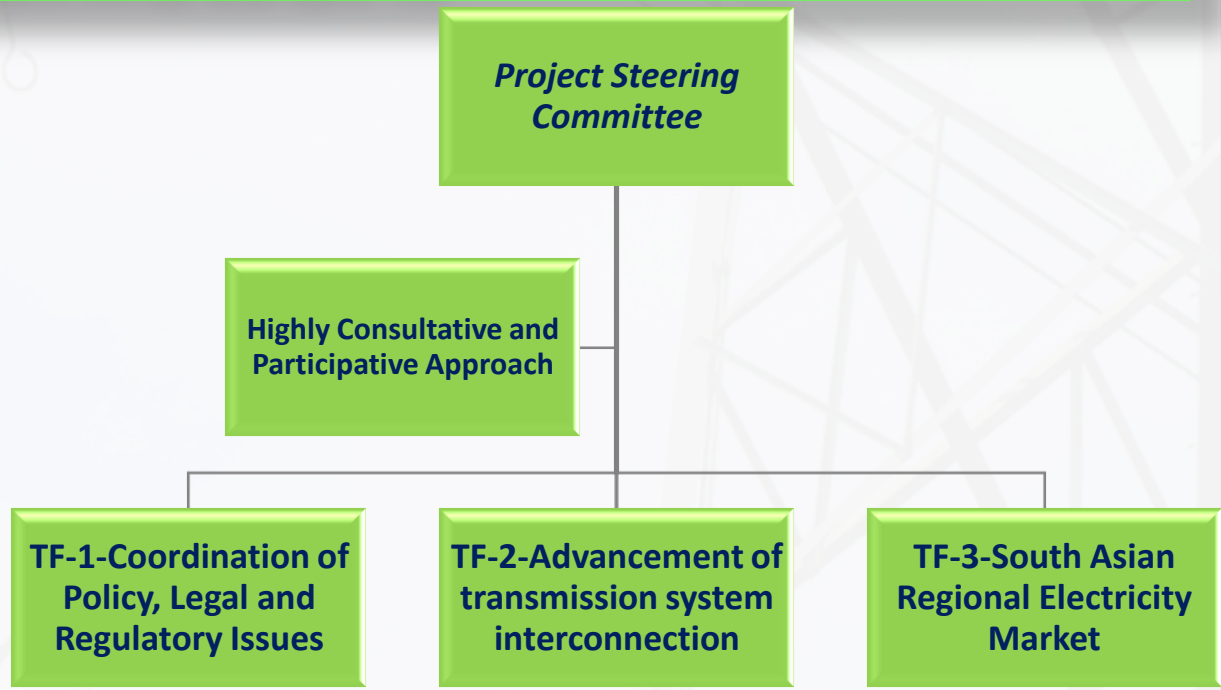
SARI/EI Framework

- **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.**



- **TF1: Coordination of Policy, Legal and Regulatory issues**

- **TF-2: Advancement of transmission system interconnection**

- **TF 3: South Asian Regional Electricity Market**

Overall Framework for development of CBET in South Asia

SAARC Framework Agreement on Energy (Electricity) Cooperation

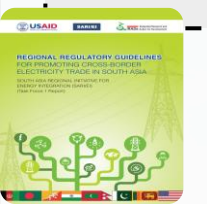
CBET facilitation through

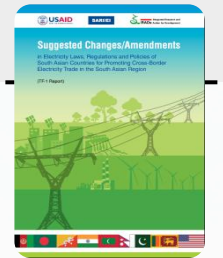
Institutional Mechanism

- Regional Regulatory Guidelines
- Regional Investment Framework and Investment Policy Guidelines
- Harmonization of Grid Codes
- Assessment of trading Potential
- Model framework for Open Access and Trading License Regime
- Transmission Pricing rules & methodology
- Model Regulation for Power Market Development
- Standard Contracts (Bankable PPAs/TSAs)
- Mock Exercise for SARPEX

Undertaken as part of the TF-1 and has been Published

Suggested Changes/Amendments in Electricity Laws, Regulations and Policies (L&R&P) of South Asian Countries.





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Overview of South Asian Power Sector

Total Installed capacity of around 3,47,593 MW

Afghanistan: Small Power system (1341 MW), High 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 Crunch, Imports Electricity from India and in future will remain as one of the Leading importer of electricity.

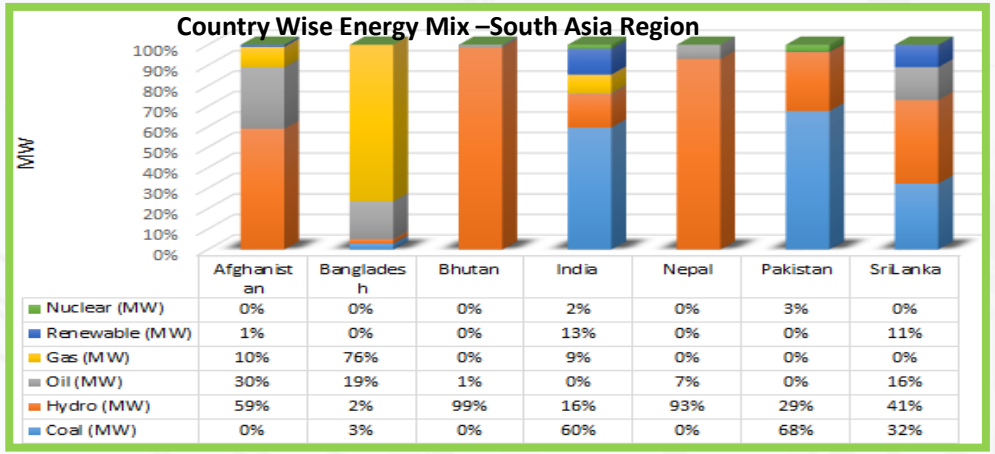
India: Large Power System, Coal dominated, reducing deficits, Long terms electricity demand are huge and potential large market, The Leading importer & exporter of electricity. 42 GW of RE.

Nepal: Very small power system (765 MW), Hydro based, very high deficits, Importing Electricity from India, Potential exporter for Hydro Electricity in medium term and importer of electricity in Short 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	302833
Nepal	765
Sri Lanka	4050
Pakistan	24,829
Maldives	90
Total	**3,47,593**

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



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Regional Energy 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 large scale exported oriented hydro plants.
- Significant Coal deposits in India and Pakistan.
- Coal deposits in Bangladesh yet to be exploited effectively.
- In addition , there is a huge renewable energy resources like solar and wind.

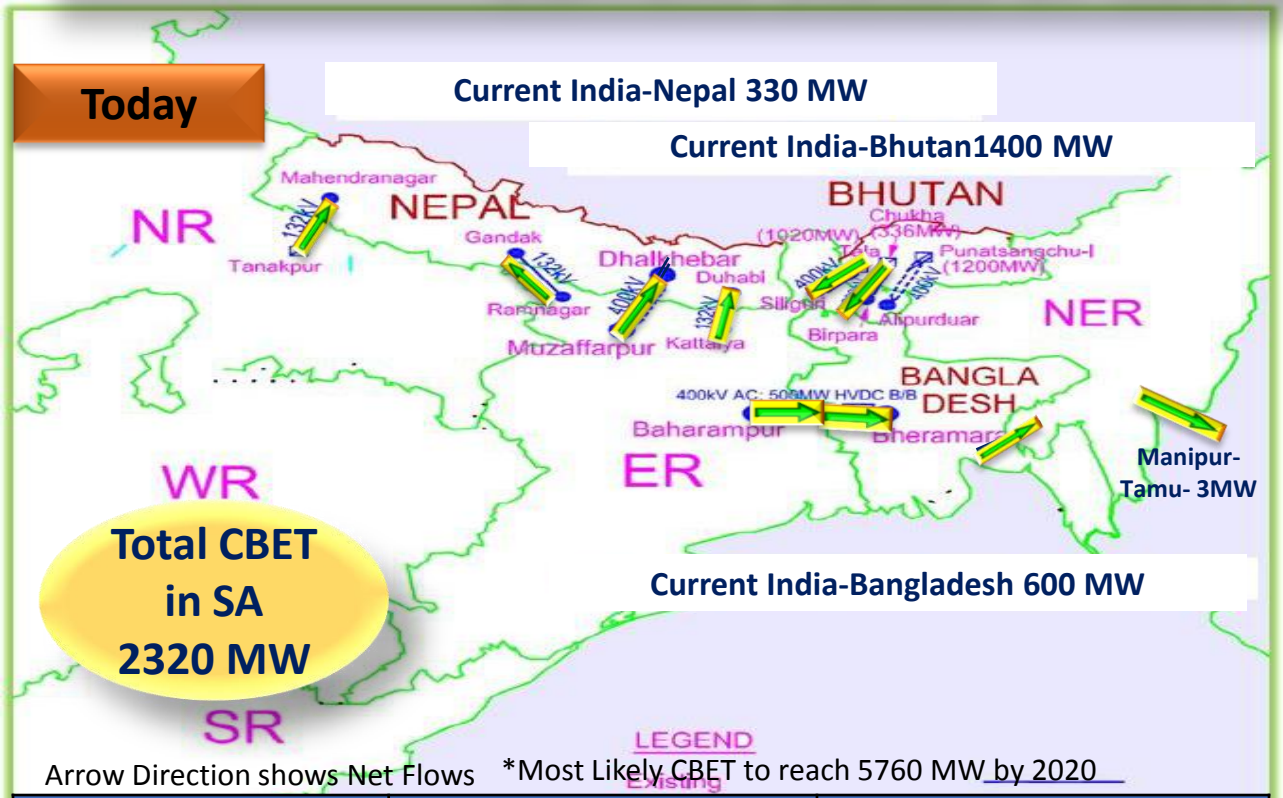
Country	Coal (million tons)	Oil (million barrels)	Natural Gas (trillion cubic feet)	Biomass (million tons)	Hydro (GW)
Afghanistan	440	NA	15	18–27	25
Bhutan	2	0	0	26.6	30
Bangladesh	884	12	8	0.08	0.33
India	90,085	5,700	39	139	150
Maldives	0	0	0	0.06	0
Nepal	NA	0	0	27.04	83
Pakistan	17,550	324	33	NA	59
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	Afghanistan	Bangladesh	India	Nepal	Bhutan	Pakistan	Sri Lanka
Average Solar (kWh/m2/day)	4.7-5.47	4.51-4.99	3.95-6.07	5.03-5.37	4.63	4.02-5.54	4.8-5.88
Wind (MW)	NA	limited potential	151,918	3,000	4,825	24,000	25,000MW

Source: ADB 2011, Parthan 2014, NASA Langley Research Centre 2015

Current Status of CBET and Trading Potential



Arrow Direction shows Net Flows *Most Likely CBET to reach 5760 MW by 2020

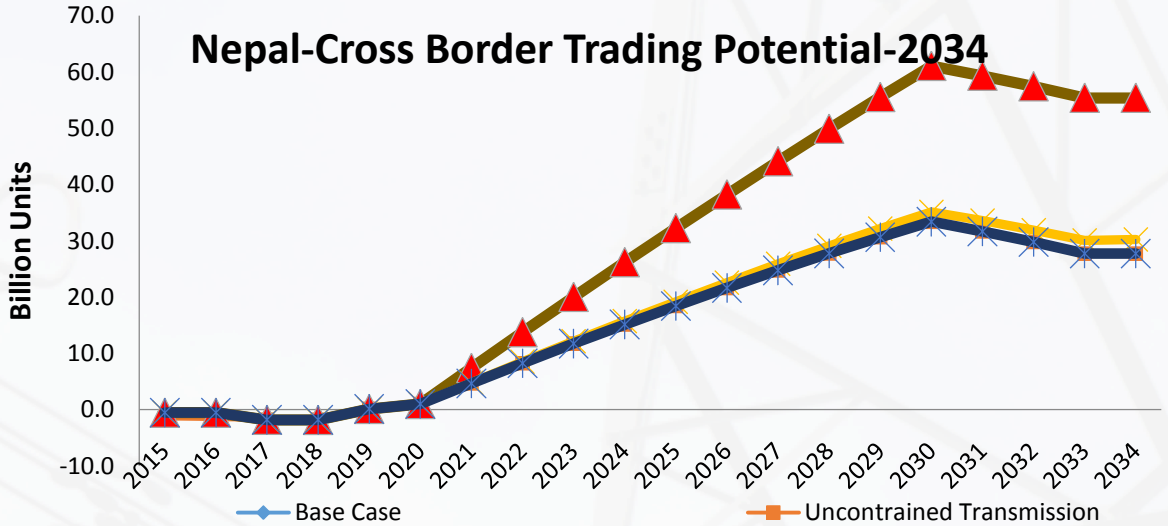
Bhutan→ India	India→ Bangladesh	India→ Nepal
• Tala: 1.80 INR/kWh for 1st year (now 1.98 INR/kWh) • Dagachhu: 2.40 INR/kWh for 1st year (started in 2015)	• NVVNL: 2.40-2.86 INR/kWh (Aug'14-May'15) • PTC: 4.26-5.00 INR/kWh (Dec'13-May'15) • Tripura-Bangladesh INR Rs 5.50 per unit	• Treaty/Bilateral: Current 5.40 INR/kWh • PTC: 4.55, 4.35, 4.30, 3.75 INR/kWh (FY11-FY14) • NVNL-NEA PPA (80 Mw) INR 3.44

Annual regional Cross Border Electricity Trade Potential

~11 BU to ~31 BU in the near term (2015-2020) which increase 330 Billion Units by 2034

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. Source-SARI/EI Task Force - 2 study on Assessment of Trading Potential.**



1,369 GWh (1.36 billion units) Imported from India-2014/15

Source-SARI/EI Task Force - 2 study on Assessment of Trading Potential.

Source: Compiled from various sources, News Paper articles etc. * 500 MW (I-BI), 2940 MW (I-Bh)

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 -regional electricity market.
- Seasonal complementarities

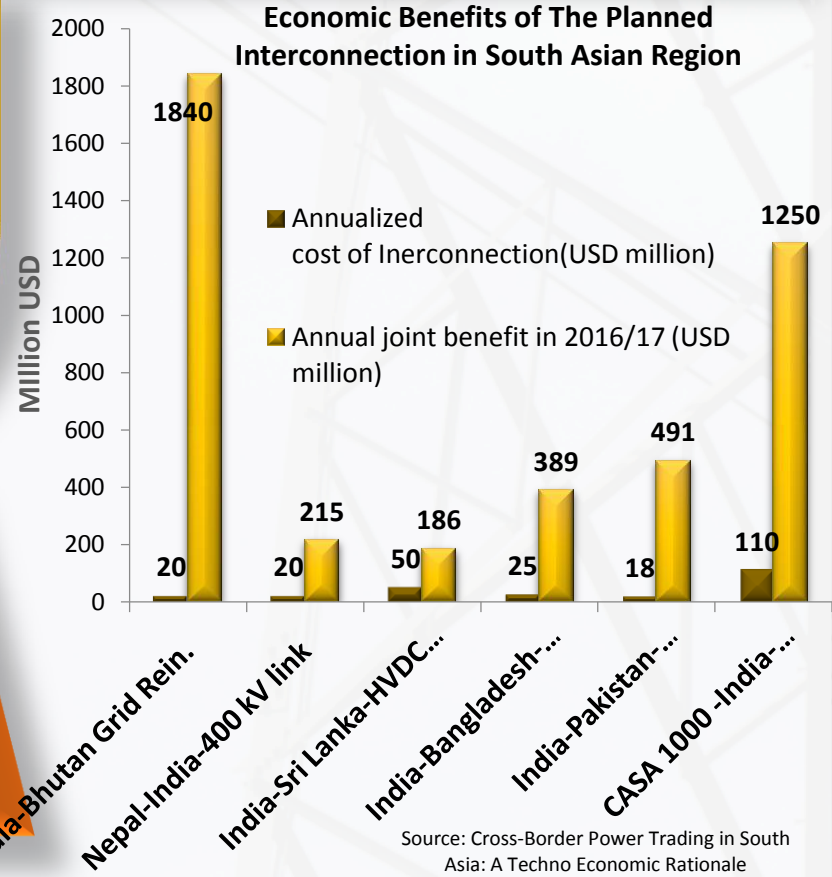
Nepal and Bhutan Large hydropower resources; Nepal -severe power shortages , Economic benefits of Trade

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

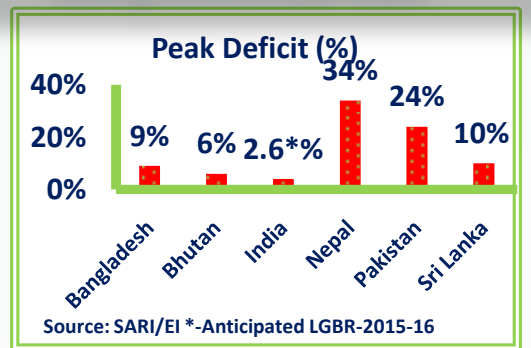
Afghanistan and Pakistan Access to large hydropower resources, Severe power shortages, High demand growth

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

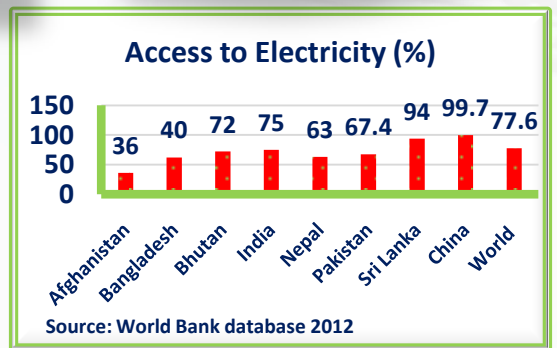
India :High demand growth, coal power dominated, power deficits, renewable energy growth



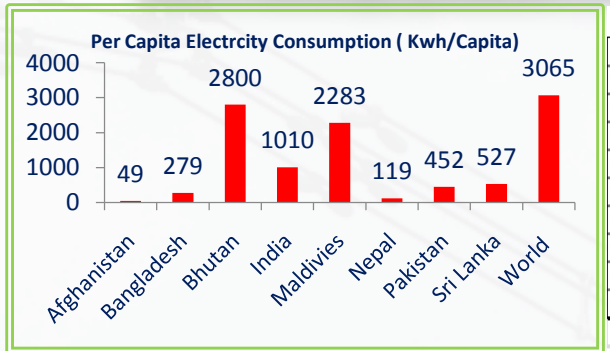
Source: Cross-Border Power Trading in South Asia: A Techno Economic Rationale

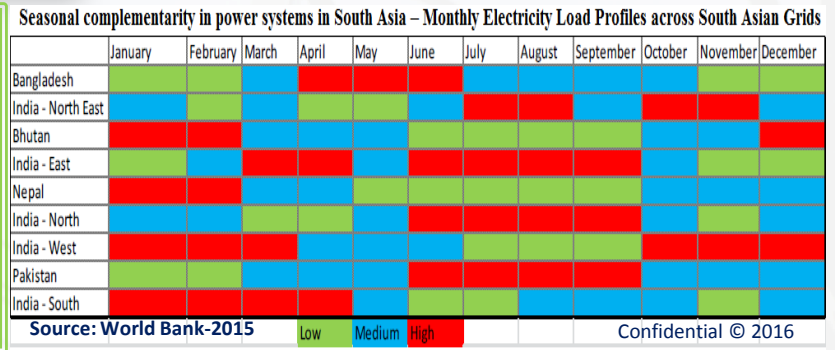


Source: SARI/EI *-Anticipated LGBR-2015-16



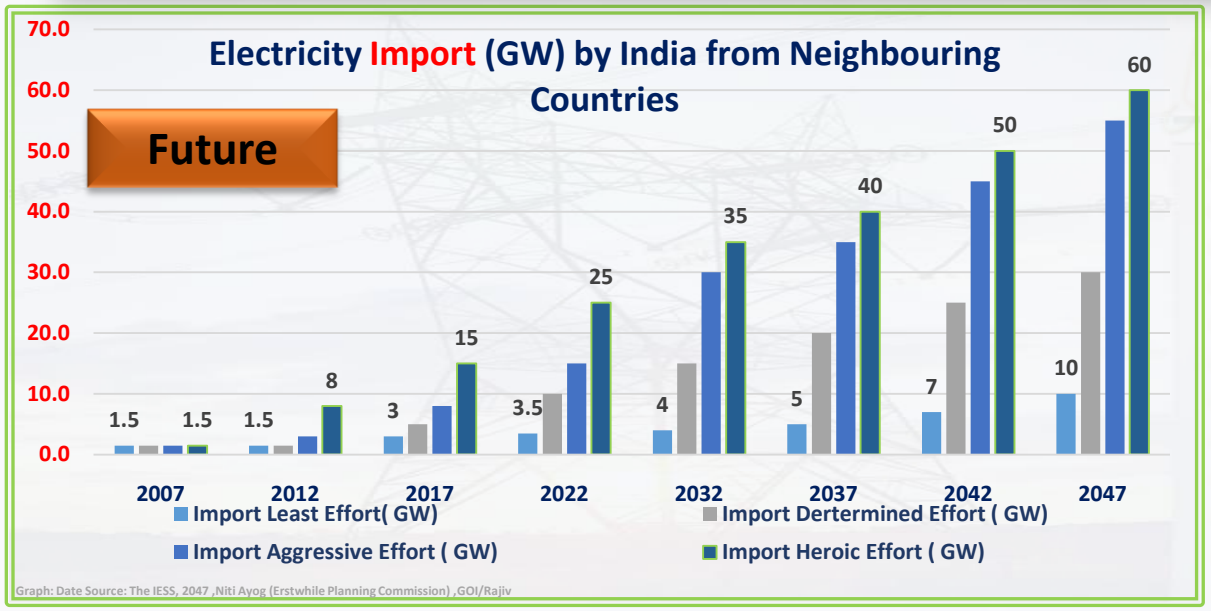
Source: World Bank database 2012

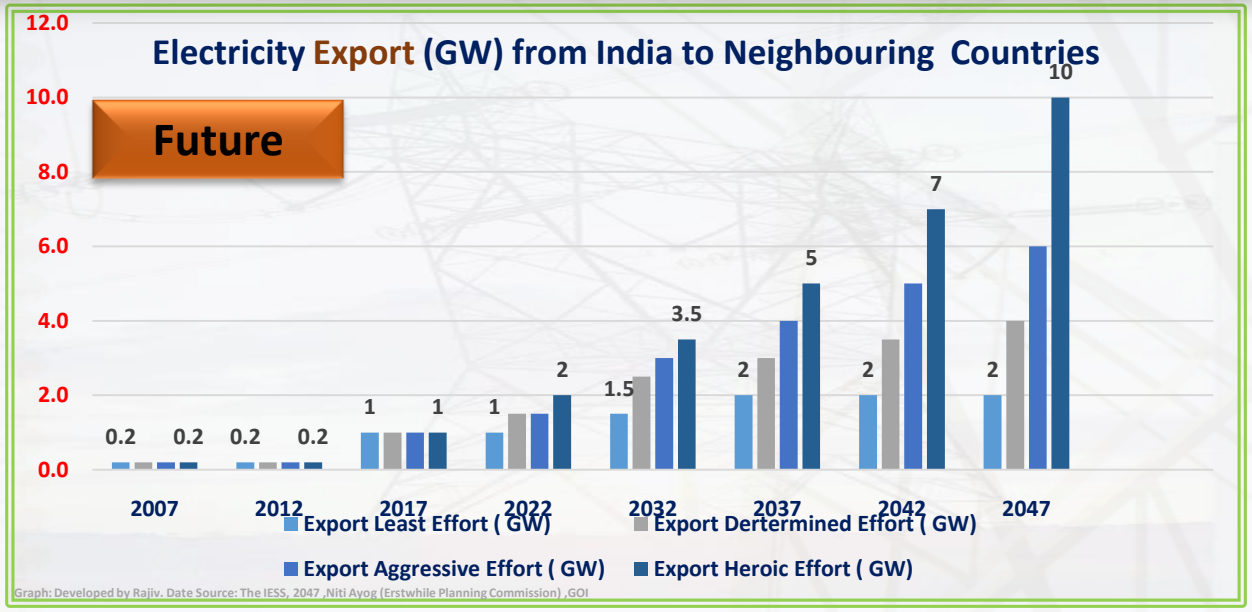


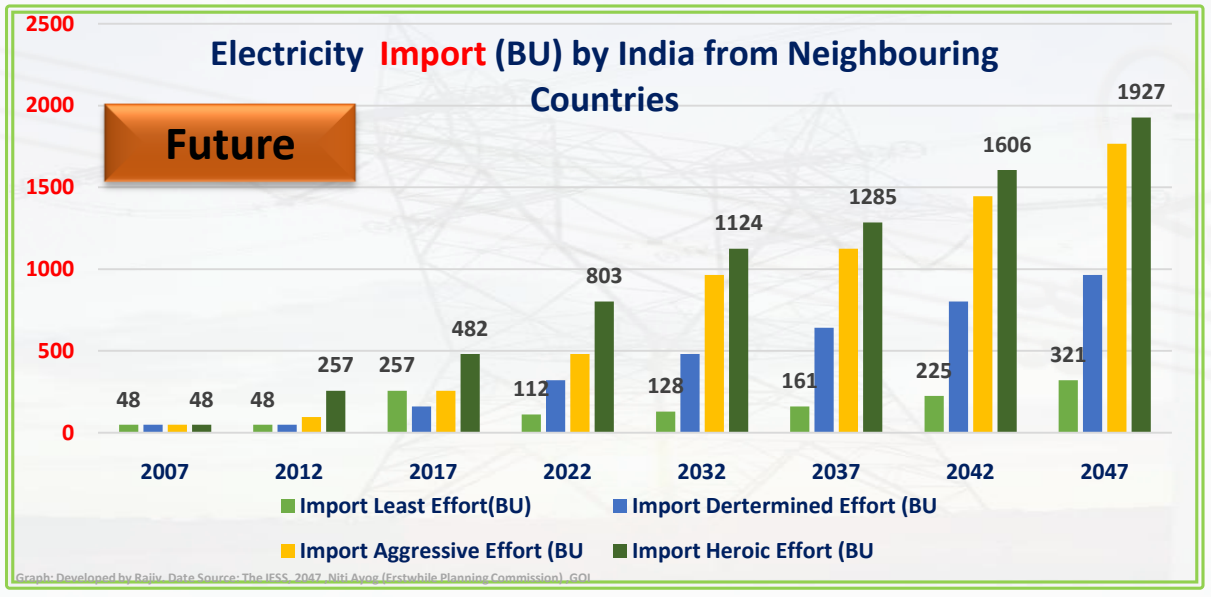


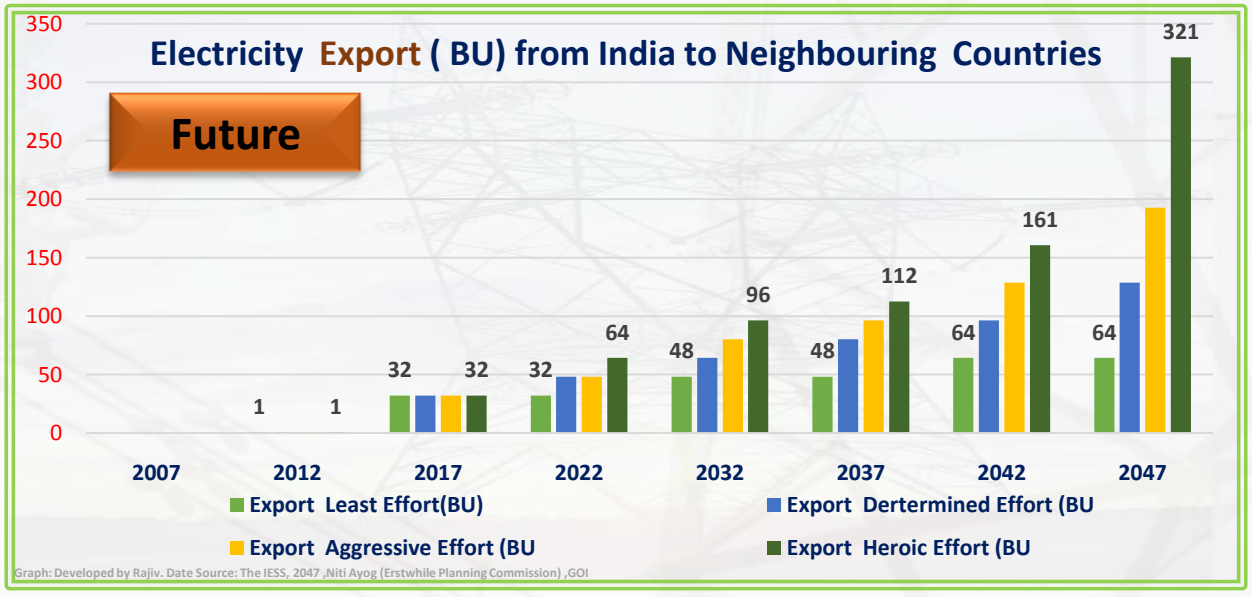
Source: World Bank-2015

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









Source: The IESS, 2047 ,Niti Aayog (Erstwhile Planning Commission) ,GOI

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Central Asia and South Asia Power Transmission Project

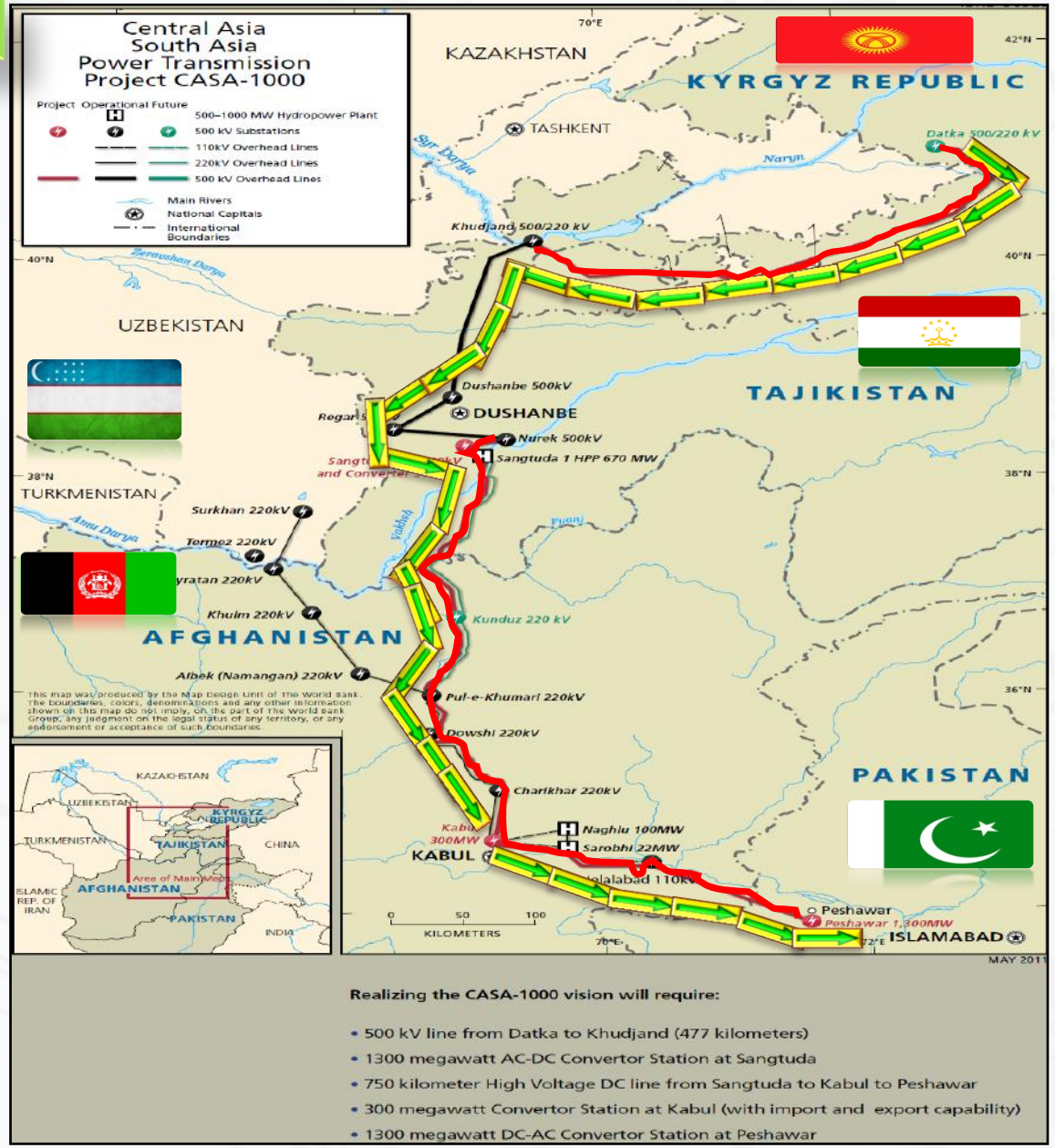
- CASA-1000 project designed to transmit 1300 MW of surplus electricity from Tajikistan and Kyrgyzstan through Afghanistan (300 MW) to Pakistan(1000-MW).

- CASA-1000 power project has been inaugurated by officials from Afghanistan, Pakistan, Tajikistan, and Kyrgyzstan on May 12, 2016

- It is scheduled to be completed by 2018.

The project has following major components.

- A 500 kV HVAC Transmission link (477 KM) from Kyrgyzstan to 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, DC-AC Converter Station, related facilities for power off-take in Peshawar.



CASA-1000 has the support of the World Bank Group, Islamic Development Bank, USAID,US State Department, Department for International Development (DFID), Australian Agency for International Development (AusAID),

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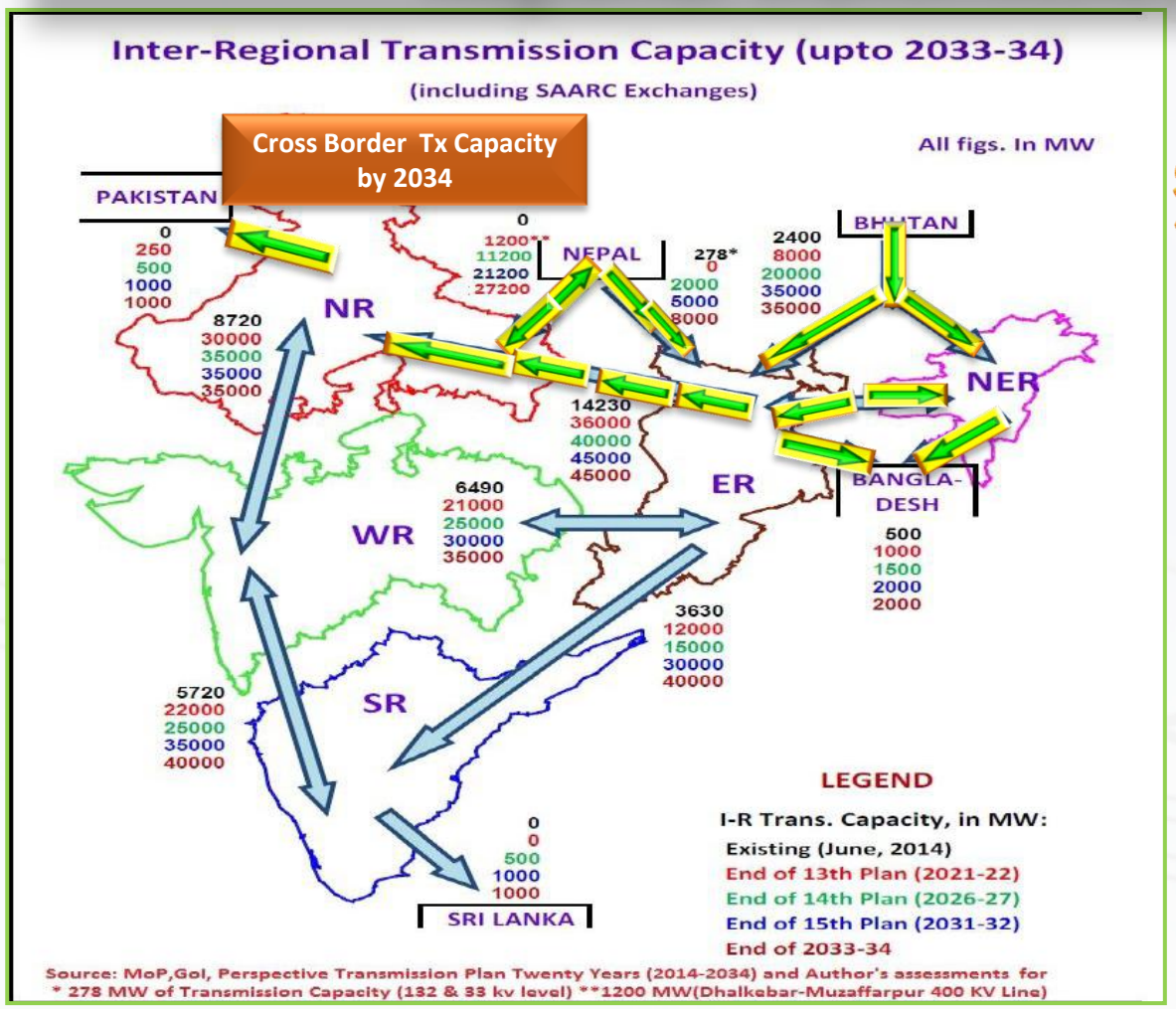
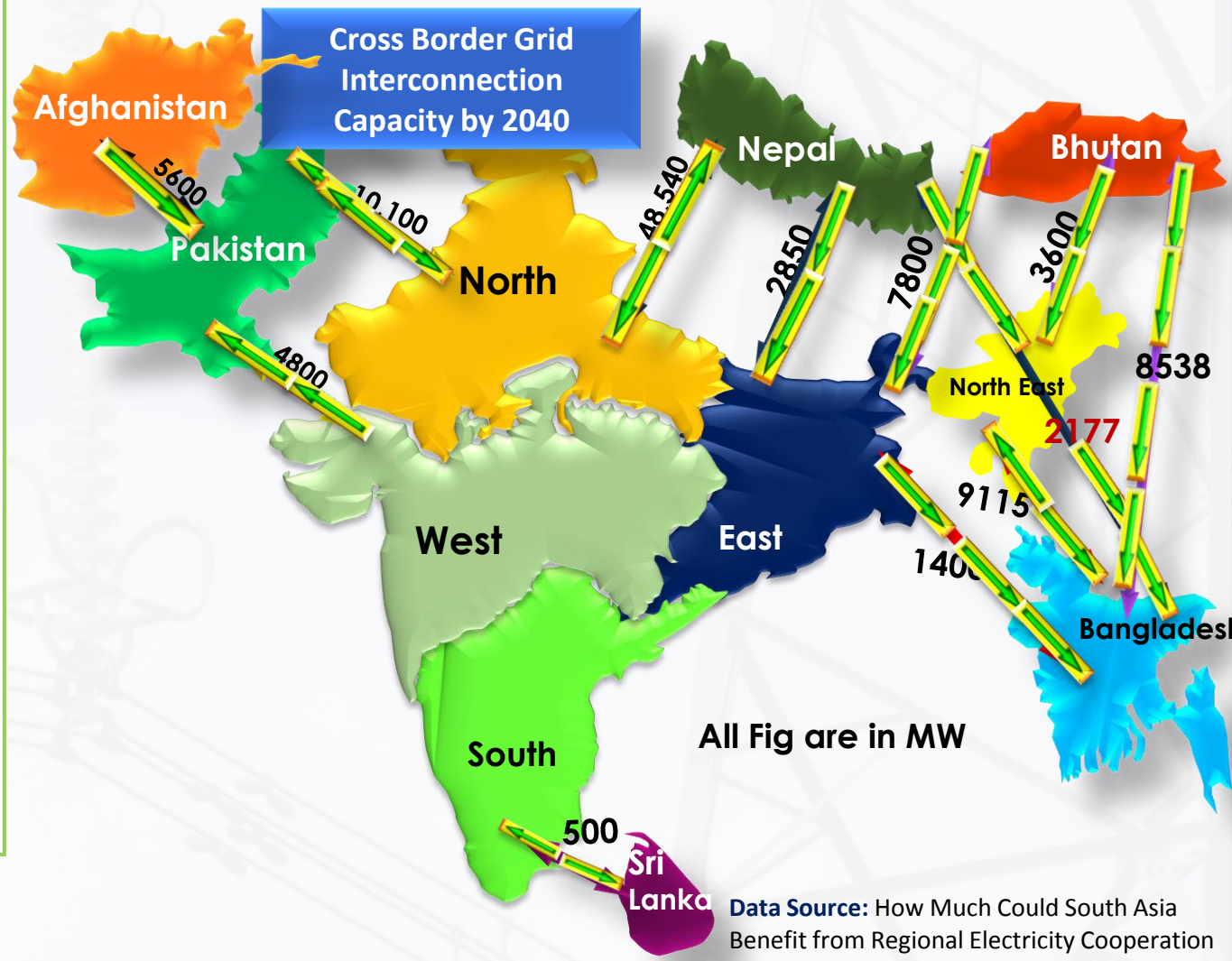
Regional Transmission Capacity by 2033-34,2040



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,4th June,2015)



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

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_2 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

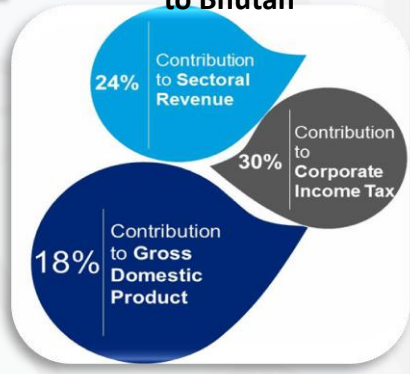
Regional Hydro Power Dev.

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

Regional Stability

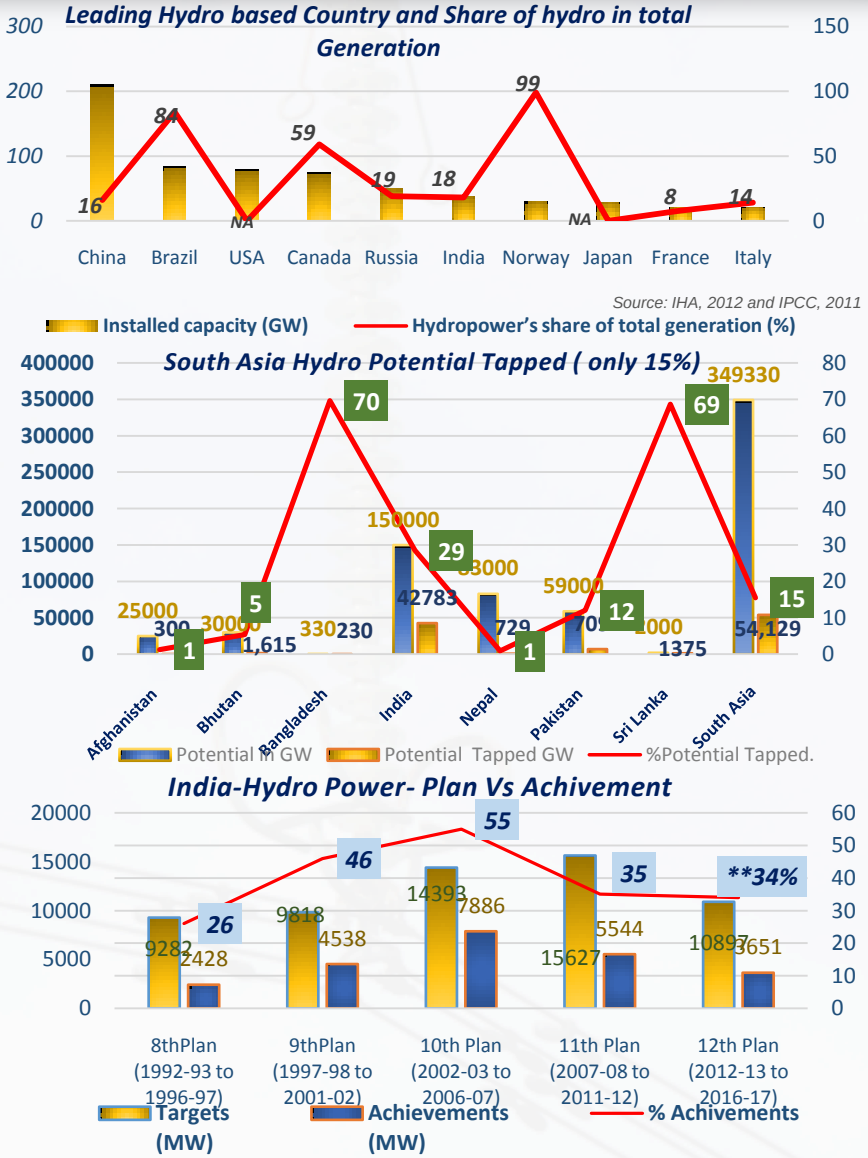
- ✓ Regional Stability

Hydropower Benefits to Bhutan



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.

* http://www.iea.org/publications/freepublications/publication/hydropower_essentials.pdf

** Till 31.10.15 6746 (62%)-Estimated

Accelerating Responsible Hydropower Development in South Asia: Policy Making Perspective

Governance framework

- ✓ Efficient coordination for implementation of policy goals and targets
- ✓ Planning for integrated river basin development
- ✓ Project allocation procedures

→ Regional and Integrated planning Forum
Regional Regulatory Framework
comprehensive cost-benefit analysis
MoU vs competitive bidding

Benefit Sharing Mechanism

- ✓Focus on responsible development
- ✓Public private people participation
- ✓Benefit-sharing with PAPs

→ Social and environmental impact assessments
Involvement of project affected persons
Optimal & balance mechanism for sharing:
• Revenue sharing • Local development funds
• Ownership structure • Preferential electricity

Facilitate investment and Financin

- ✓Streamlining clearance , land acquisition
- ✓Fiscal incentives
- ✓Evacuation infrastructure
- ✓Innovative financial products

→ Single Window
long-term debt financing, Tax-free bonds
Green funds etc.

Facilitate Market Developmen

- ✓Regional Power market
- ✓Hydropower purchase obligations
- ✓Market for ancillary services

→ Regional Trading Platform
Commercial Pricing of Non Energy Benefits

Technical Capacity Developme t

- ✓State-of-the-art investigation and
- ✓construction techniques , skilled manpower

→ Detailed geological and seismic mapping
Drilling Techniques , Skill Development

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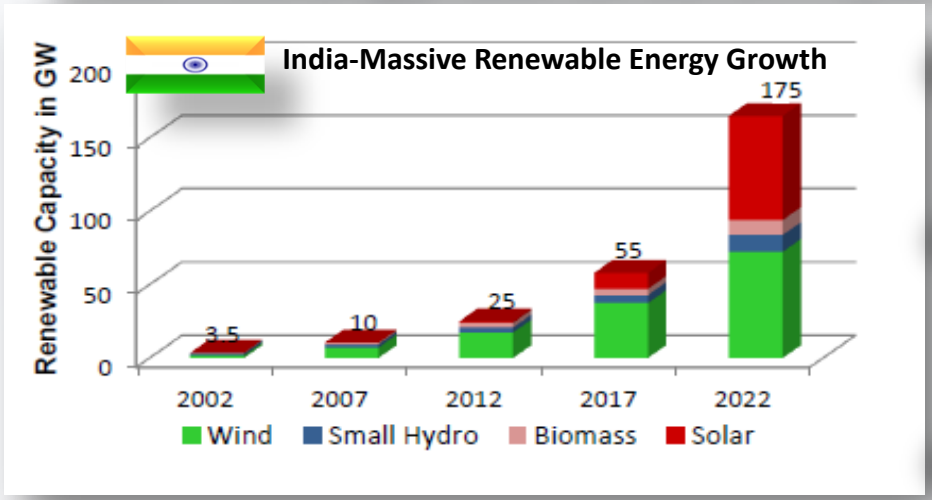
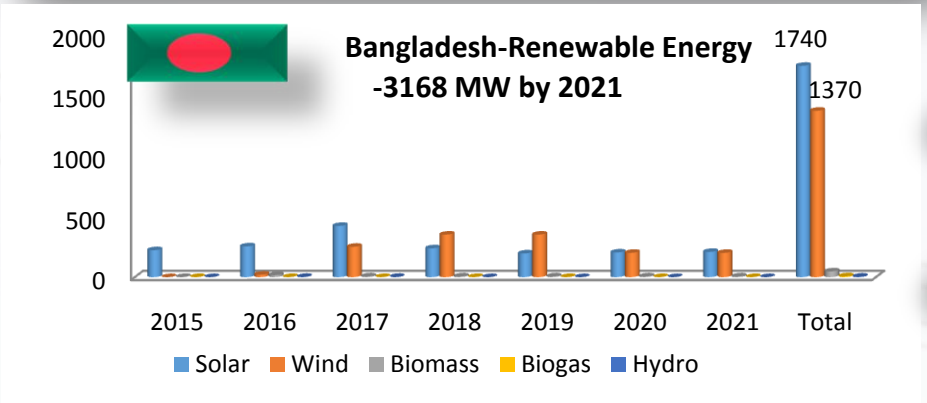
Non Energy Benefits of Hydropower in South Asia: Policy Making Perspective



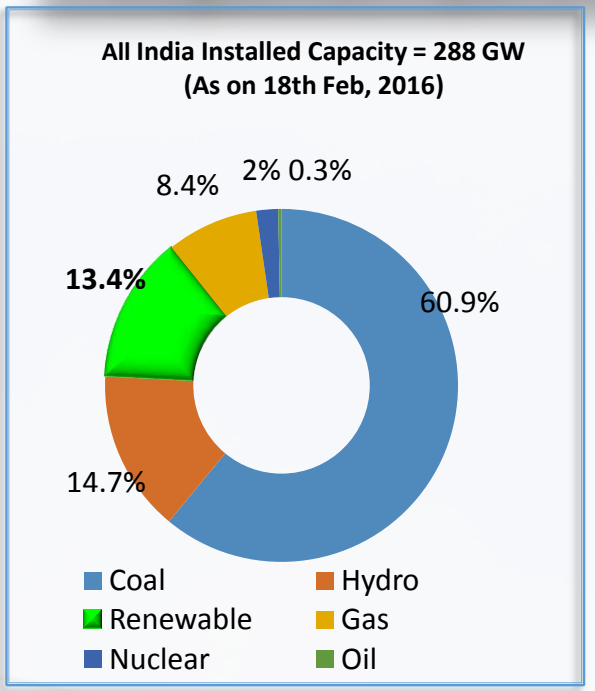


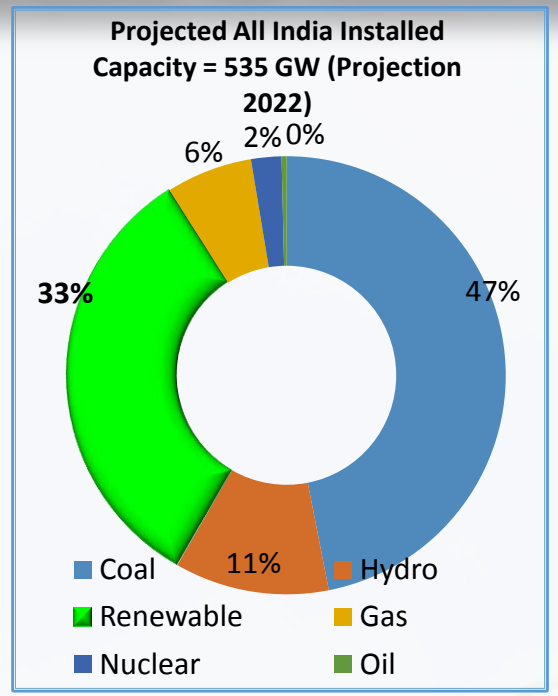
Sri Lanka to increase the share of electricity generation from renewable energy sources from 50% in 2014 to 60% by 2020 and finally to meet the total demand from renewable/other indigenous energy resources by 2030.

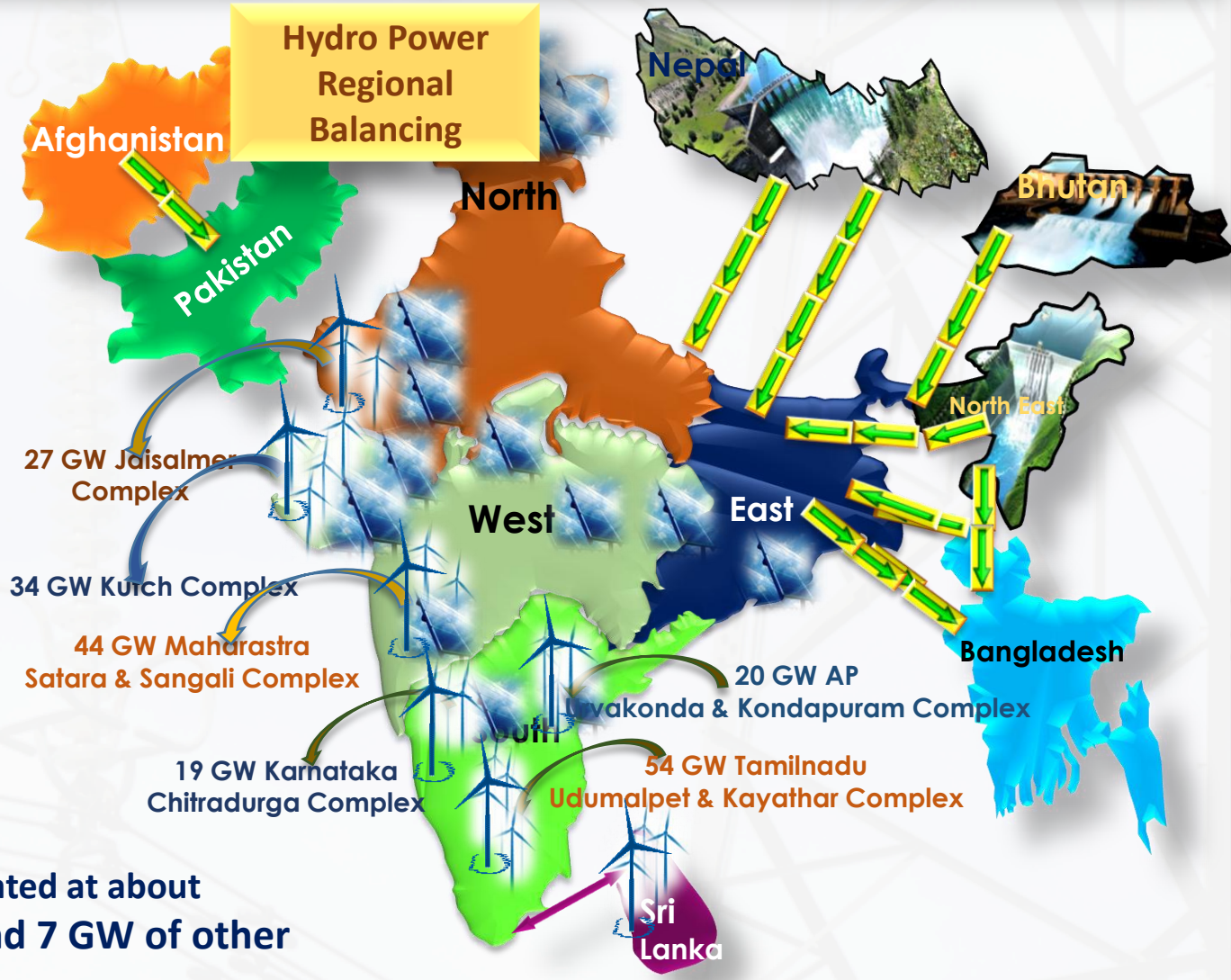
- High Renewable Energy Growth in SA power system needs a flexible, fast responsive with Demand response SA power system.
- Both reservoir and pumped storage hydropower are flexible sources of electricity that can help in handle the variability of other renewable energy such as wind power and photovoltaic 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)
- As per National electricity policy (GoI), 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.

*Technical Committee for "Large Scale Integration of Renewable Energy, need for balancing, Deviation Settlement Mechanism (DSM) and associated issues"

Regional Hydro Power for Renewable Energy Integration and Grid Balancing







- 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%. With 275 GW generating capacity existing as on date and nearly 150 GW peak demand, the quantum of reserves has been estimated at about 4 GW of primary reserve, 3.6 GW of secondary reserve and 7 GW of other reserves.

Need for a Regional Ancillary Market-India Has started ancillary market recently.

Key Challenges and Risk for CBET: Need for a Comprehensive Framework

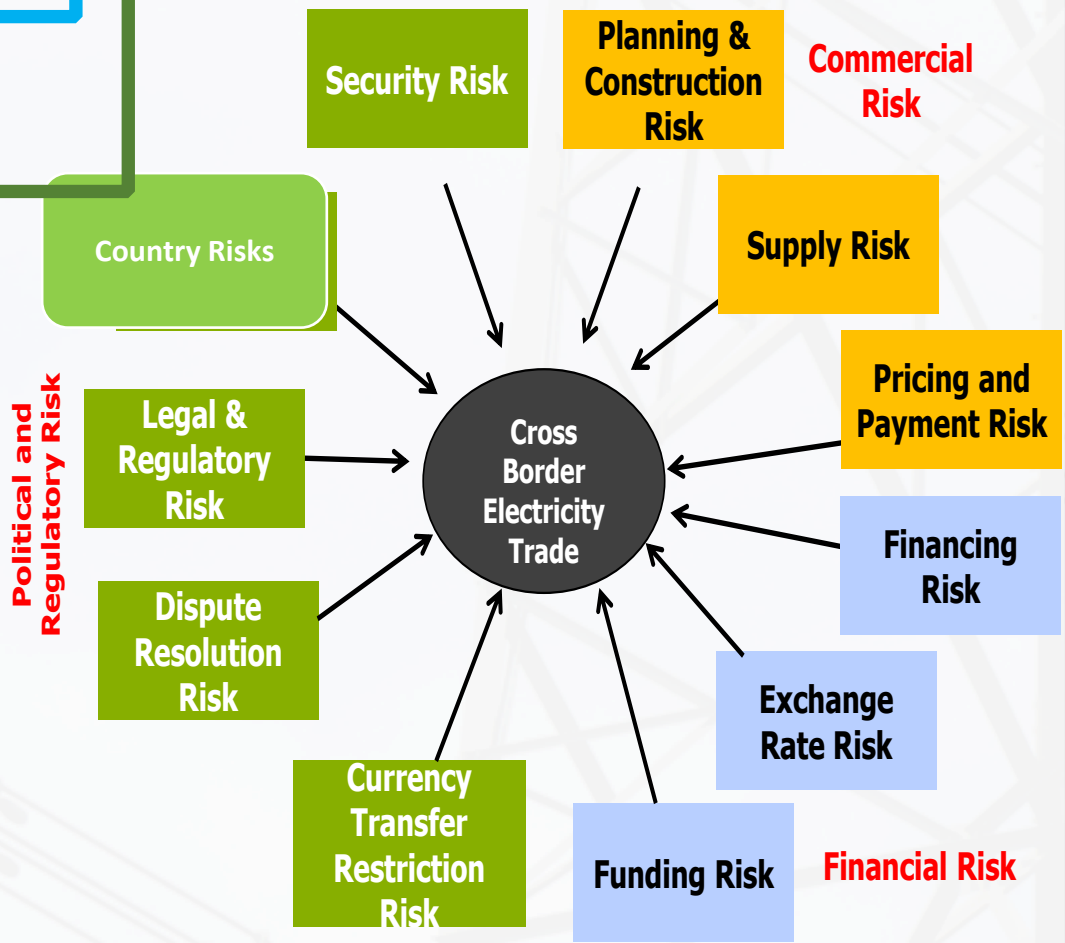
Key Challenges

1. Political Conesus: Regional Cooperation and Recognition of CBET/Trade in the National Policy, Law etc.
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

Motivation behind these challenge is to address the typical Risks in Cross-Border Projects. What are the Risk?

Regional Power System/ at Initial Stages

Regional Power System in Transition and in Mature Stages



Cross Border Electricity Trade Investments: Risk

Why Cross-border Electricity Trade Investment are Risky

- Project risks in general tend to be high with out a comprehensive Policy, Regulatory framework for **large CBET project development.**
- Cross-border element greatly amplifies the risks due to **geopolitical, economic and trade related factors.**
- Even projects that appear to have feasible , rationale, economical **in practice struggle to get it financed and built.**
- Project risks in general tend to be high in **countries without wide experience on large project development.**

Political: What happens if for political reasons the flow is prevented in the exporting, intermediary (if relevant) or importing country ?

Regulatory: What happens if the domestic Policy, regulatory framework changes which impacts CBETproject/Investment ? What is the protection available to buyers/sellers/Investor ?

Economic: What happens if the economic assumptions on the project changes? What is the protection available to buyers and sellers ?

Trade Barrier: What happens if a tax or duty that affects the economic fundamentals is imposed ?

Infrastructure: What happens if the infrastructure to transfer the energy is not built or is not available when needed ?

Example: Some Key Issues

Tariff determination for power from projects across the border ? Competitive bidding vis-à-vis negotiation

Power Procurement Policy- Buyers' requirements.

* Competitiveness of Hydropower- High Tariff in Initials Years .

	Bhutan-India	India-Bangladesh	India-Nepal
Principle of determination	The tariff for both Tala and Dagachhu PPAs was determined on a negotiated basis	The tariff for NVVNL PPA is as per CERC regulations (agreed based on negotiation). On the other hand, tariff for PTC PPA was determined through competitive bidding	The tariff in both Treaty/Bilateral arrangement and PTC PPA was agreed based negotiation

* New Tariff Policy - 5.8 The Appropriate Commission shall provide for suitable regulatory framework for incentivizing the developers of HEPs for using long-term financial instruments in order to reduce the tariff burden in the initial years.

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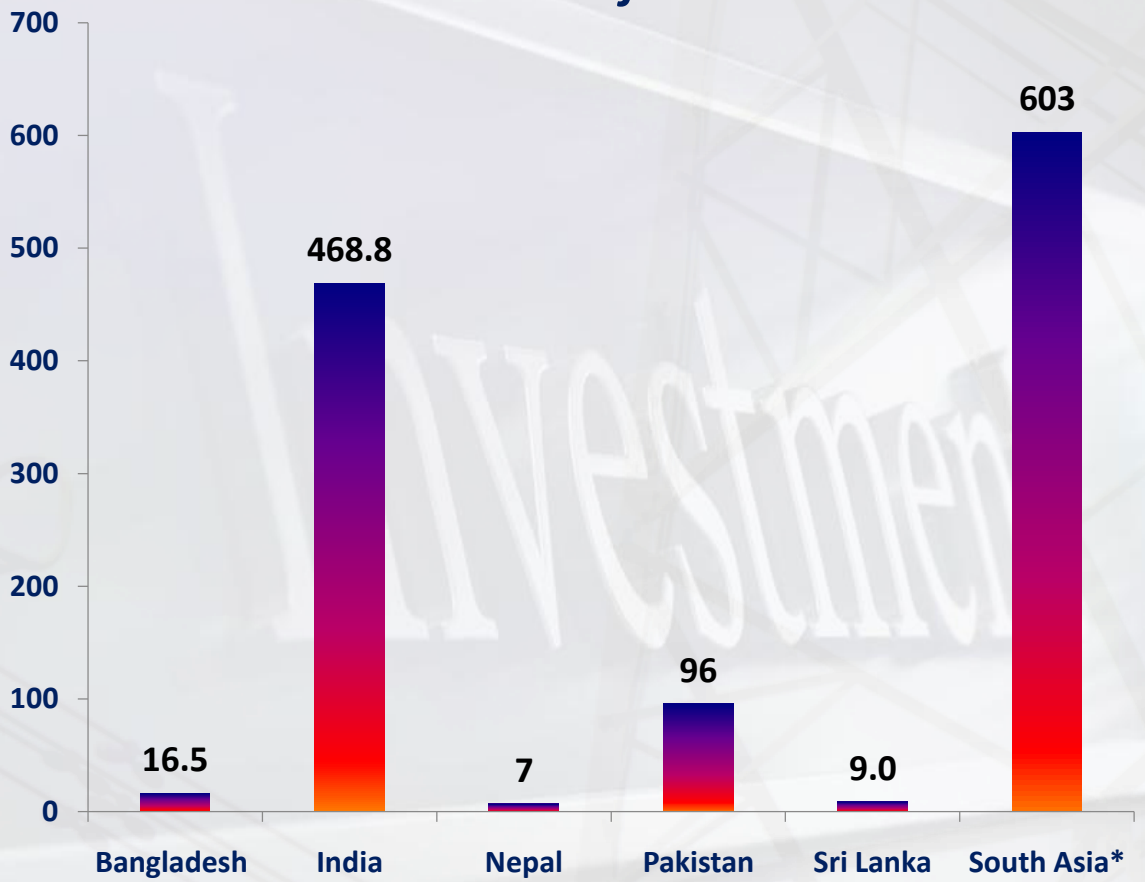
Investment Requirement in Electricity Sector in South Asia 2020

- South Asia is now 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 standard needed to serve the population.
- Total investment of **USD 603 billion** is required for SAARC countries for **Electricity Infrastructure development.**
- Bangladesh, India, Nepal, Pakistan & Sri Lanka need to invest around **US$ 16.5 Billion, US$ 468.8 Billion, US$ 7billion, US$ 96 Billion & US$ 9** Billion respectiv. by 2020.

Investment Requirements 2011–2020 in total- in billions of dollars 2010



Source : World Bank- Reducing Poverty by Closing South Asia's Infrastructure Gap Luis Andrés, Dan Biller, and Matías Herrera Dappe December 2013

* Including Bhutan, Afghanistan, Maldives

Cost of Cross border Transmission Interconnections

Countries	Interconnection Description	Capacity (MW)	Cost
Bhutan -India-	Grid reinforcement to evacuate power from Punatsangchhu I & II	Reinforcement of 2,100 MW	140-160 USD Million (2010 Estimate)
Nepal -India	Dhalkebar-Muzaffarpur 400 kV line	1,000 MW	186 USD Million (2010 Estimate)
Nepal -India	Bardaghat- Gorakhpur(400 KV)	2500 MW evacuation capacity	32 USD Million
Nepal -India	Duhabi- Jogbani (400 KV)	1800 MW evacuation capacity	16 USD Million
Sri Lanka- India-	400kV, 127 km HVDC line with submarine cable	500 MW in the short-term	600 Million USD
Bangladesh-India	400kV HVDC back-to-back asynchronous link	500 MW	190-250 USD Million(2011 Estimate)
Bangladesh-India	Capacity Up gradation(500MW) of Existing Bheramara HVDC Station Project	500 MW	184.37 USD Million Bangladesh side only)
Bangladesh-India	(Eastern Interconnection Project) Tripura (India)- Comilla (Bangladesh) Grid Interconnection project(400 kV)	100 MW	24.04 USD Million (Bangladesh side) and 2.73 USD Million (Indian side)
India-Pakistan	220 kV in the short-term (could be upgraded to 400 kV later)	250-500 MW	50-150 USD Million (2012 Estimates)
CASA	500 KV AC line from Datka (Kyrgyzstan) to Khudjand (Tajikistan) 500 KV HVDC line :Tajikistan-Afghanistan-Pakistan	1300 MW	1.17 billion(2011 Estimates)

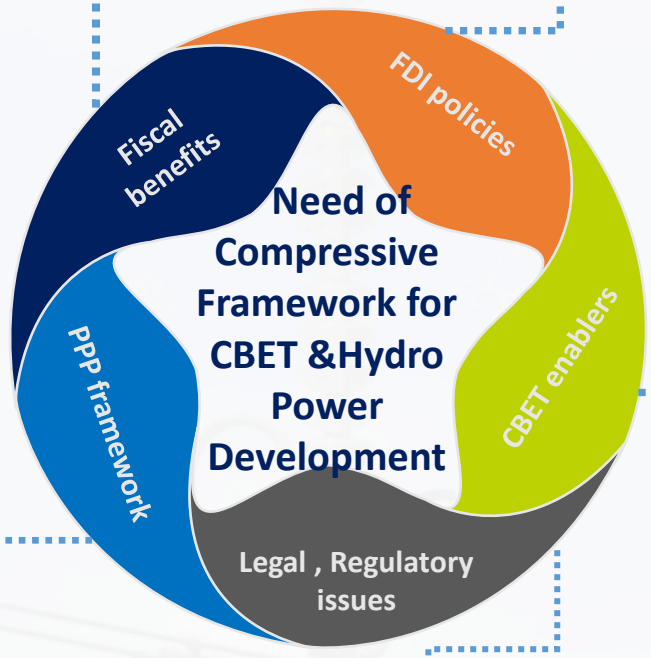
Need for Compressive Investment Friendly Regional Policy Framework for CBET Hydropower Development in South Asia

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

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



PPP attractiveness

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

Cross border power trade

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

For investment protection

- Protection of Investment
- Dispute settlement mechanism
- Contract enforcement
- Regulatory framework
- Regional Investment Protection Treaty

Power Sector Structure in South Asia and CBET Policy Governing Framework

- Afghanistan (DABS)
- Maldives (FENAKA)
- *Nepal (NEA)
- Sri Lanka (CEB)
- Bangladesh (Separate Trans. Utility)
- Bhutan (Separate Gen. utility)
- India (Separate G,T,D utilities)
- Pakistan (Separate G,T,D utilities)

Country	Policy	Regulation	Trading
Afghanistan	Ministry of Energy and Water	Afghanistan Electricity Regulatory Authority (AERA) (Proposed)	SB Model
Bangladesh	Ministry of Power, Energy and Mineral Resources	Bangladesh Energy Regulatory Commission (BERC)	SB Model , BPDB
Bhutan	Ministry of Economic Affairs	Bhutan Electricity Authority (BEA)	Export Licensees,B Model
India	Centre- Mop, GOI State: Power/Energy Department State Government	Central: CERC, State: SERCs/JERCs	MB and MS Model Central: Inter-state Licensees State: Discoms/Trade Cos / Intra-state Licensees
Nepal	Ministry of Energy (MoE)	Electricity Tariff Fixation Commission (ETFC)	SB Model , NEA
Pakistan	Ministry of Water and Power	National Electric Power Regulatory Authority	Central Power Purchase Agency
Sri Lanka	Ministry of Power and Energy	Public Utilities Commission of SL	SB Model , CEB

* A **Transmission Grid Company** is already registered. Preparation for registration of a public generation company is underway. A public **Power Trading Company** is also conceived and discussions ongoing on its modality.

CBET Policy Governing Framework

It is mainly through Bilateral Agreements/MoU between Countries.

India-Bhutan:

1. **2006 Framework Agreement on Hydropower development & Trade**
2. **Framework IG Agreement for joint venture projects.**

India-Bangladesh: A MoU signed on January 2010 between Governments for bilateral Co-operation in the areas of Power Generation, Transmission.....

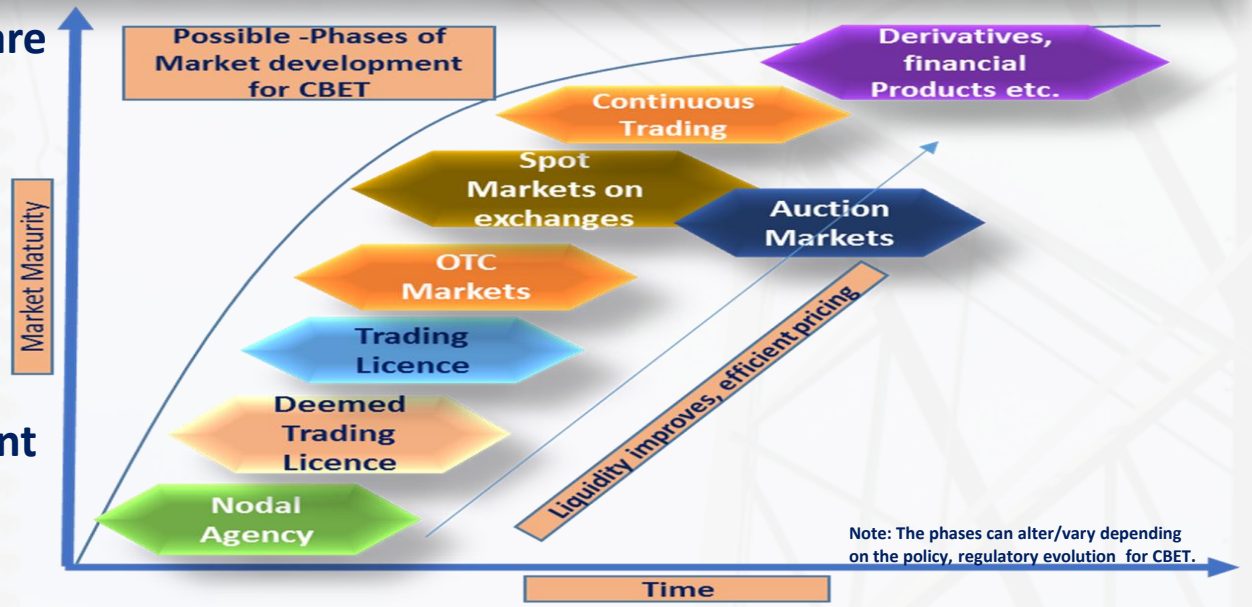
India-Nepal-: 1.Power Exchange Treaty 2. Agreement on electric power trade, cross-border transmission interconnection .... 3. River Treaties

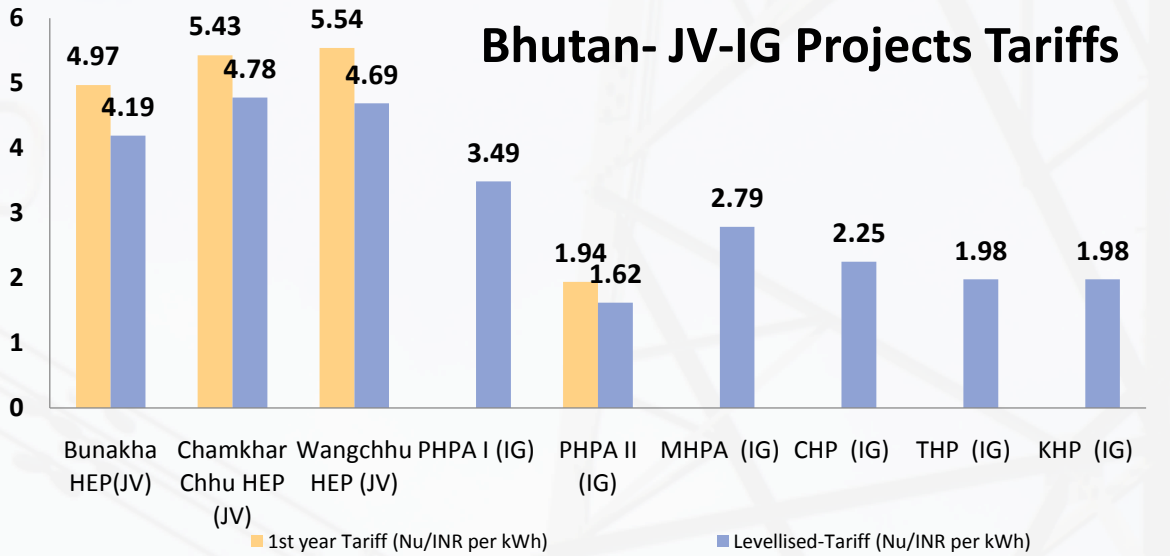
Regional Agreement: SAARC Framework Agreement on Energy (Electricity) Cooperation.

Countries are taking steps on domestic Regulation and on Policy side to remove any barrier to CBET if any.

Moving Towards Market Form of Development of CBET

- Currently most of the Cross Border Electricity Trade projects are backed by government and rightly so as it brings confidence.
- Currently trade is facilitated by G2G agreements, Nodal agencies facilitates the trade.
- However looking at the scale of investment required, there is need for market form of development of CBET with Government playing a strong facilitator role.
- There is a need to create a Regional Power Market to support these development.
- Development of power exchange in India opens up new oppourtinutes for CBET.





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Source: Complied from various sources. Note- Tariff for 1st year for IG projects of PHPA,MHPA,CHP,THP,KHP are not Available

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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 R**eview of policies, regulations and laws, preparation regulations etc. ***(1st Report on Regional Regulatory Guidelines and 2nd Report on Suggested Changes/Amendments in Electricity Laws, Regulation and Policies -Published.***
- **Study-2:** Study on Investment policies/guidelines for SA countries ***(Study has started-Ongoing)***

TF-2 :

- **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 ***(RFP issued)***

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.**

Way Forward

- **Start with Bilateral and Simple :** Bilateral flows under a commonly accepted legal and contractual framework creates confidence. Prior to investing in specific cross-border assets, simple trading contracts provide the experience.
- **Learn by doing From the Experience:** Trade will throw valuable experiences. Create the institutional structure and capabilities that can record/retain that experience and put to use at the investment stage.
- **Need to Increase Per Capita Electricity Consumption:** For economic growth, quality of life, sustainability and stability region.
- **Non-Energy Benefits of Hydro:** Non-Energy Benefits of Hydro needs to be captured in the context of Renewable Energy Integration and Grid Balancing. Need to build Market Mechanism. Declaring Hydro as Renewable Energy.
- **Regional Regulatory framework :** Political Consensus backed by a Regulatory framework will be key for success of CBET in SA.
- **Harmonization/Coordination of Policy and Regulations:** Regional policy and regulatory framework. Dispute settlement mechanism. Regional Transmission master plan for CBET.
- **Institutionalization of the CBET Process:** Regulatory Forum for Coordination of Regulations and Forum of Transmission utilities etc.
- **Need for Regional Investor Friendly Policy Framework:** For sustainable exploitation of the energy resources and protection of investments.
- **Keep up the Momentum and Visibility:** Large scale Investment will require much more than trade. Keep building on the institutional structures, treaties and agreements that will provide long term visibility.
- **SA Regional Power Market:** Development of Competitive Regional Power market.
- **Climate Change Mitigation:** CBET through Hydro can address climate change /INDC Targets/GHG emission of SA.

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Thank You

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) State: Power/Energy Department under the State Government	Central: CERC State: SERCs/ JERCs	Central: NTPC, NHPC, NPCIL, UMPPs, IPPs, MPPs State: State-owned GenCos, IPPs,CPPs	Central: POWERGRID (CTU), Private/JV Licensees State: STUs, Private/JV Licensees	Central: POSOCO (NLDC & 5 RLDCs) State: SLDCs	Central: Nil State: State-owned Discoms,Private Licensees,Distribution Franchisees	Central: Inter-state Licensees 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 1-4 LECO	-

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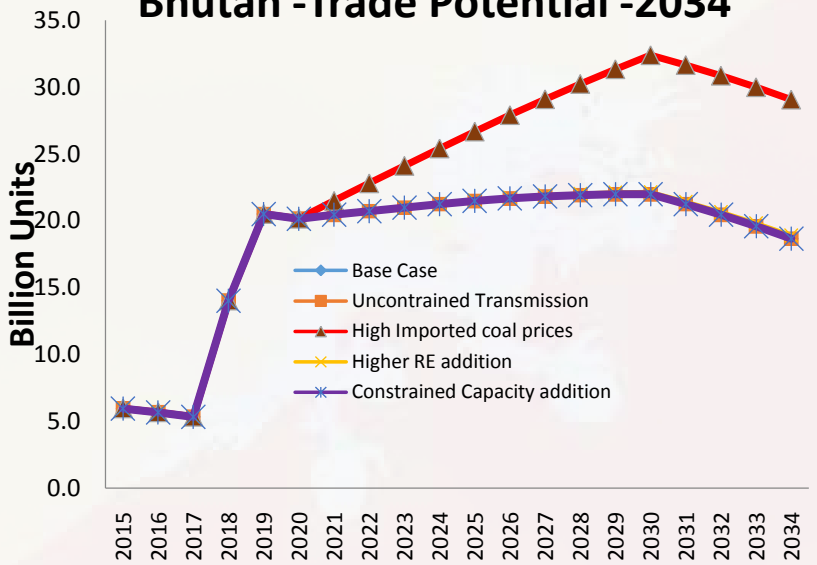
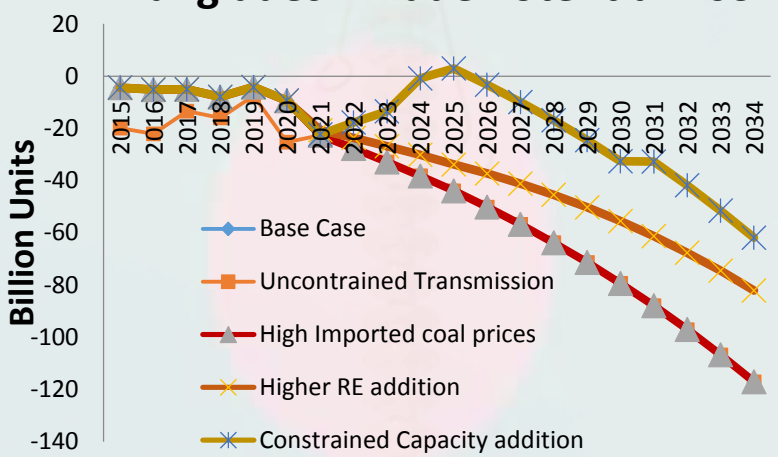
Bhutan -Trade Potential -2034



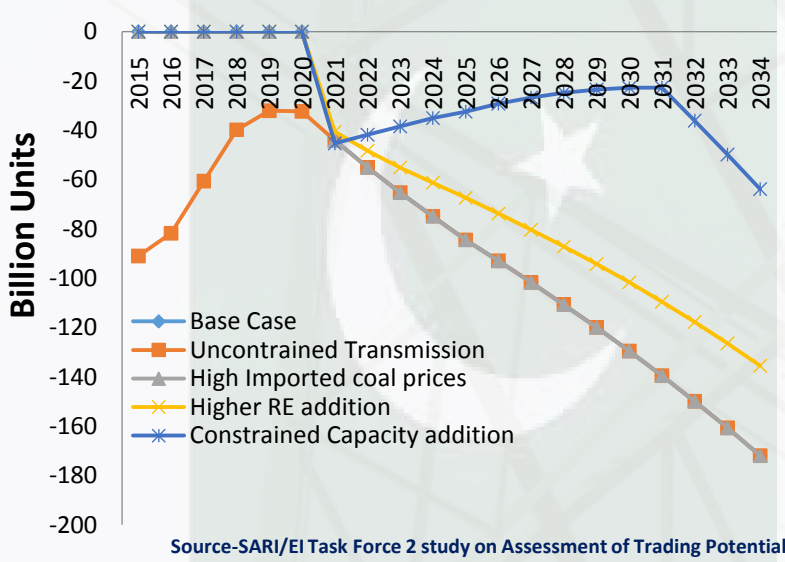
Source-SARI/EI Task Force 2 study on Assessment of Trading Potential.

Bangladesh-Trade Potential-2034



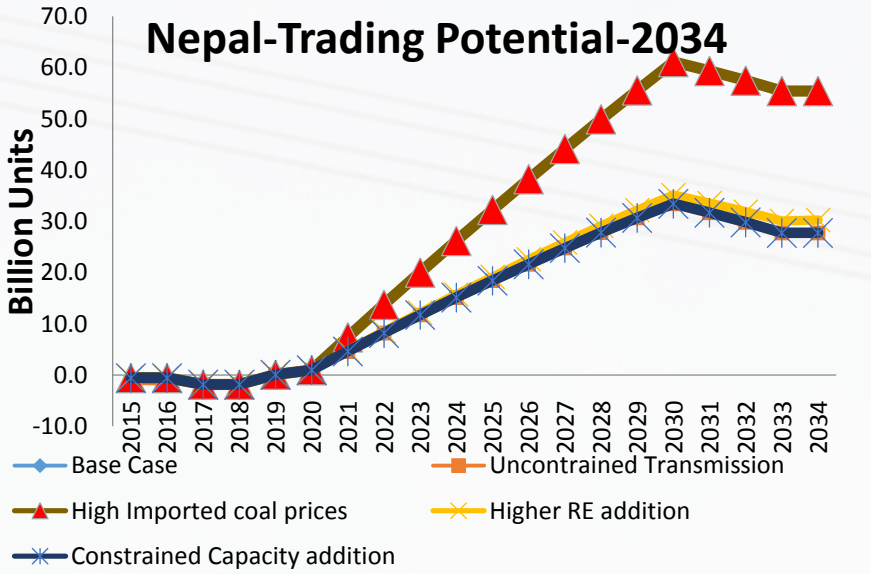
Source-SARI/EI Task Force 2 study on Assessment of Trading Potential.

Trading Potential -Pakistan-2034



Source-SARI/EI Task Force 2 study on Assessment of Trading Potential.

Nepal-Trading Potential-2034



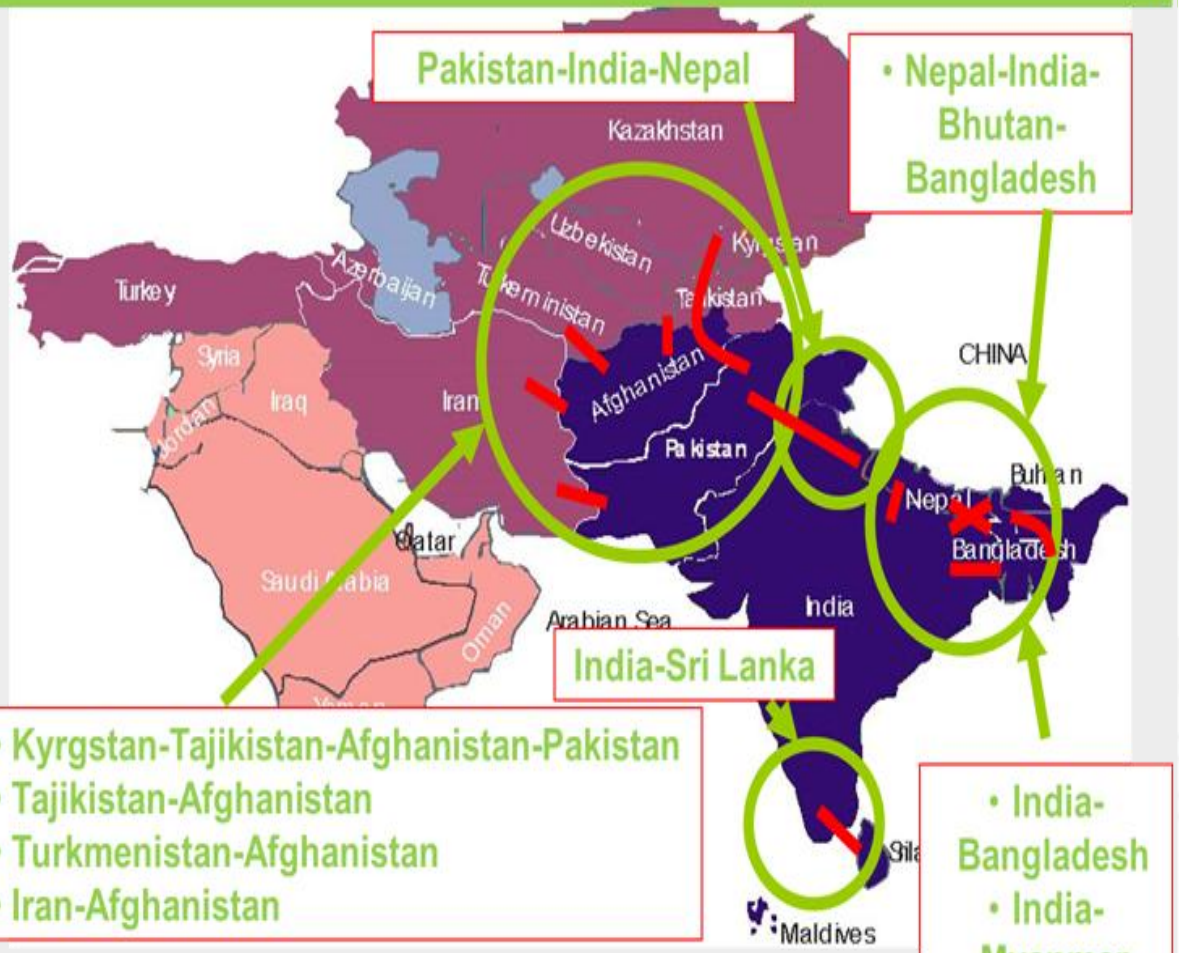
Source-SARI/EI Task Force 2 study on Assessment of Trading Potential.

India-Trading Potential-2034

Source-SARI/EI Task Force 2 study on Assessment of Trading Potential.

SAARC Energy Grid: Power and Gas Grid

SAARC Energy Ring – Power Grid

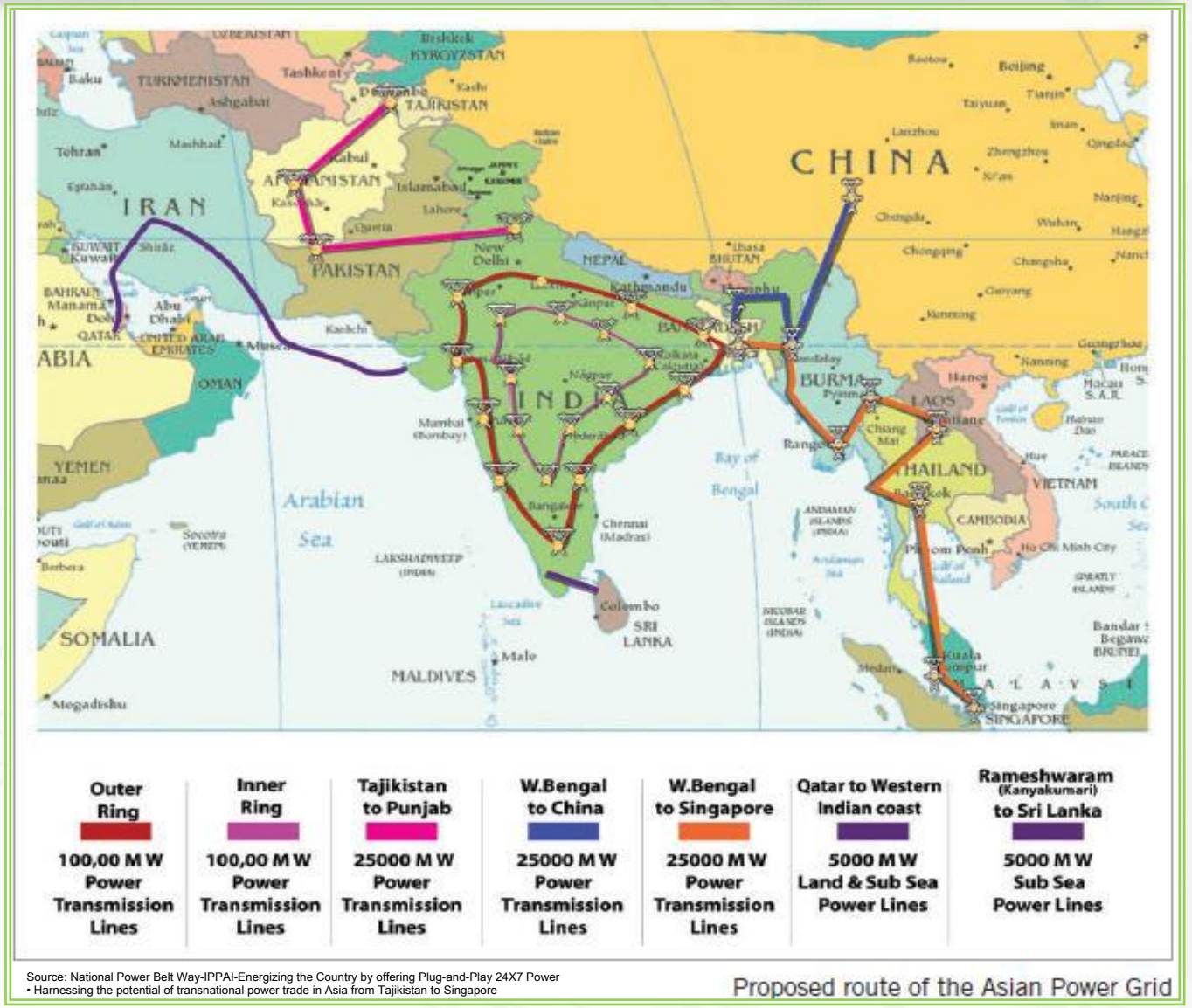


SAARC Energy Ring- GAS GRID

Pipelines from the east and the west can further be extended to Nepal

Prospects of creating a Regional Energy Grid: Connect the Gulf -Central Asia, South Asia and South East Asia

1. Cross Border Power Trade is Increasing Significantly in the South Asia and South east Asia (GMS) Region. These region complementarity is very high.
2. CASA-1000- Central Asia-South Asia.
3. Pakistan-Iran Power Link
4. TAPI-IPI Pipelines
5. India- Oman Pipe Line
6. Many countries in the region per capita electricity consumption and access of electricity is among the lowest in the world.
7. Asian region untapped energy resource availability is very good.



Source: National Power Belt Way-IPPAI-Energizing the Country by offering Plug-and-Play 24X7 Power
• Harnessing the potential of transnational power trade in Asia from Tajikistan to Singapore

Proposed route of the Asian Power Grid

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

✓Promoters financial strength
✓Capability to bring equity
✓Sound DSCR, Credit rating
✓Business History & experience of promoter

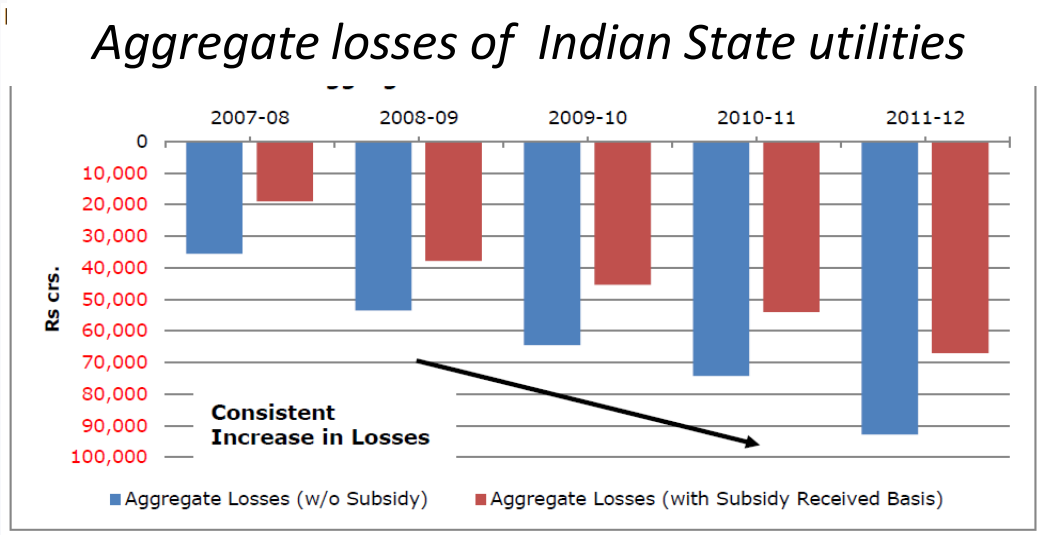
Protection of Investment

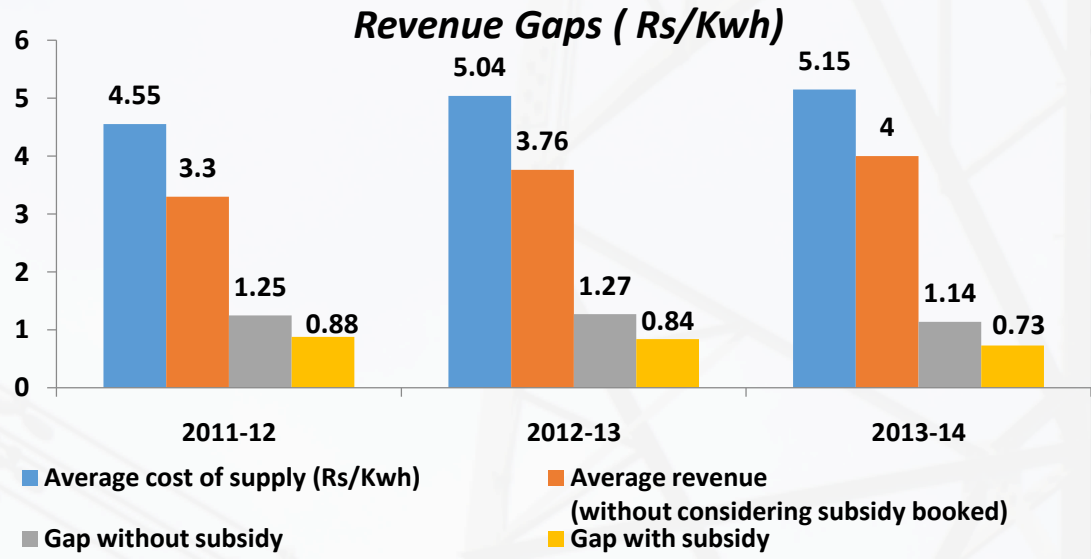
Considering large scale investment requirement and long term nature of investment , need for appropriate protection of investment

- ✓ 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





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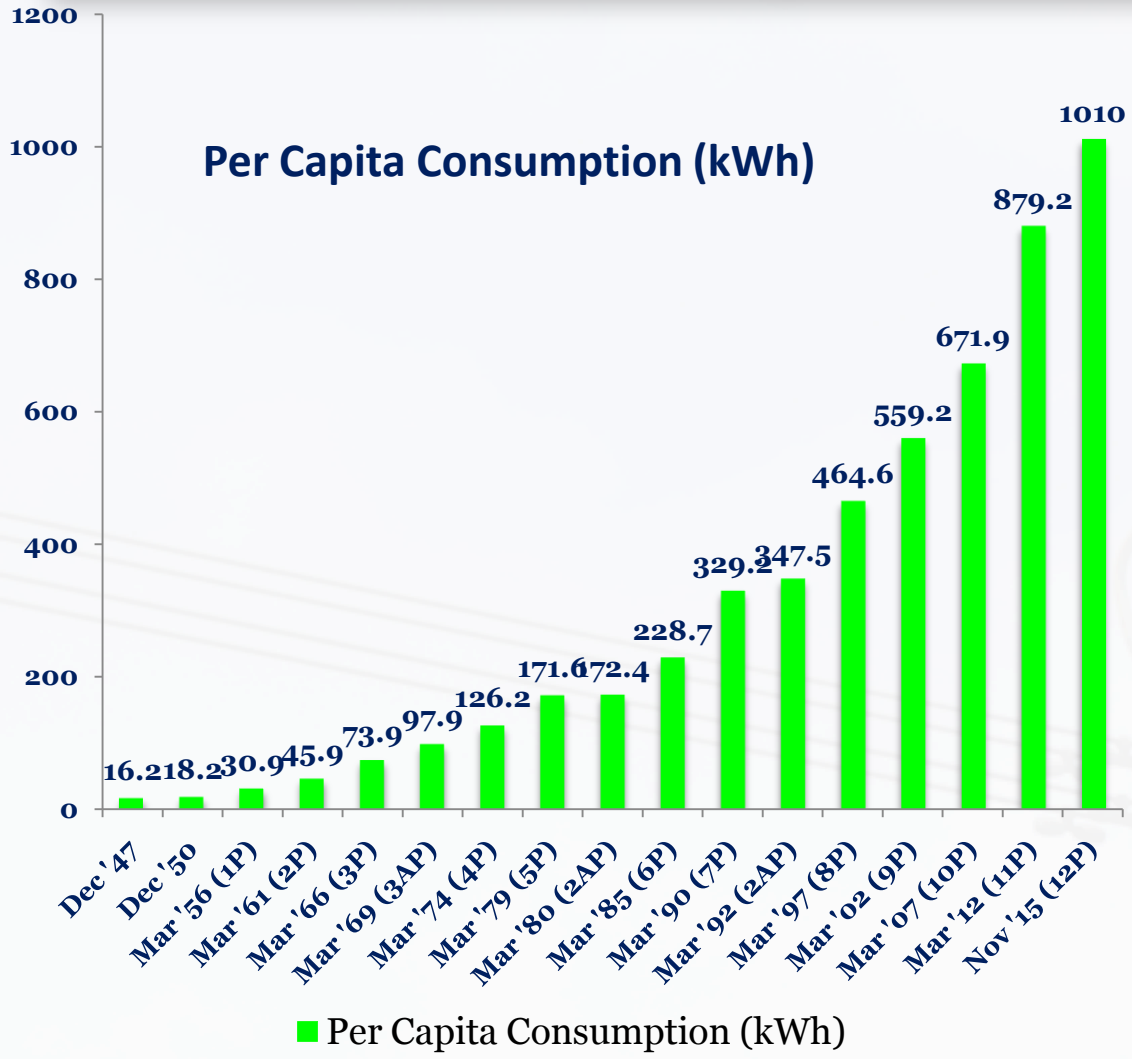
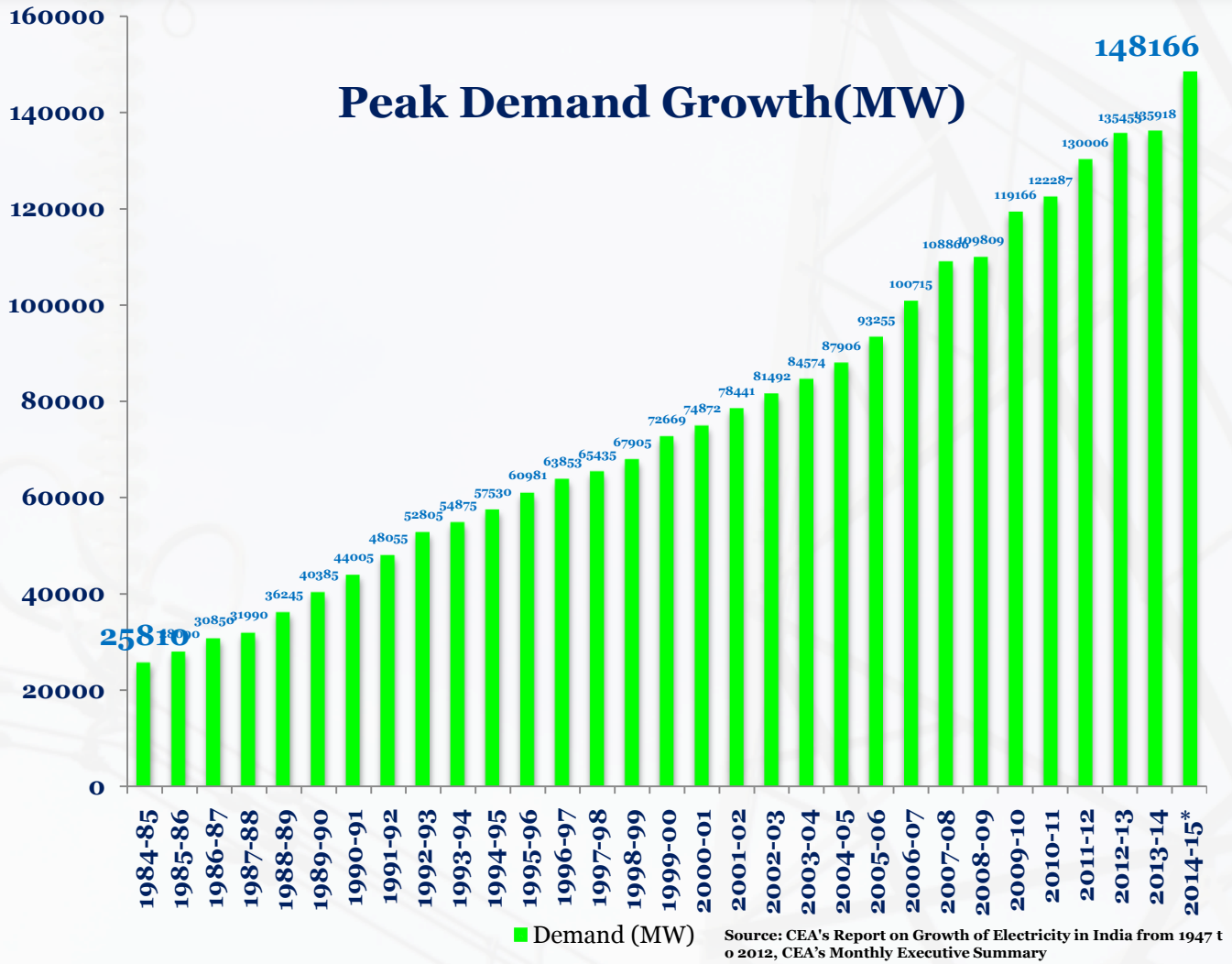
India: Per Capita Consumption (kWh) and Demand Growth





Source: CEA's Report on Growth of Electricity in India from 1947 to 2012, CEA's Monthly Executive Summary

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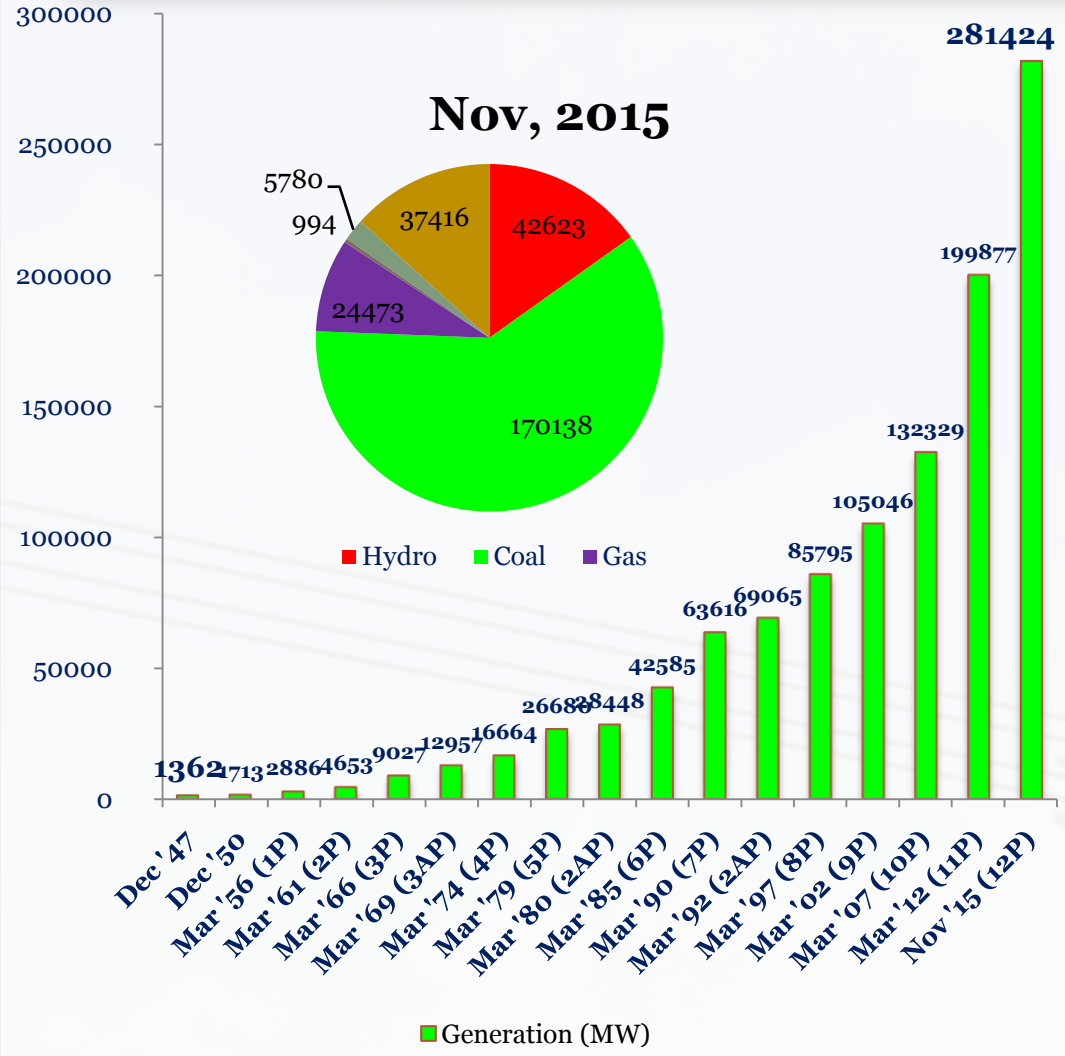
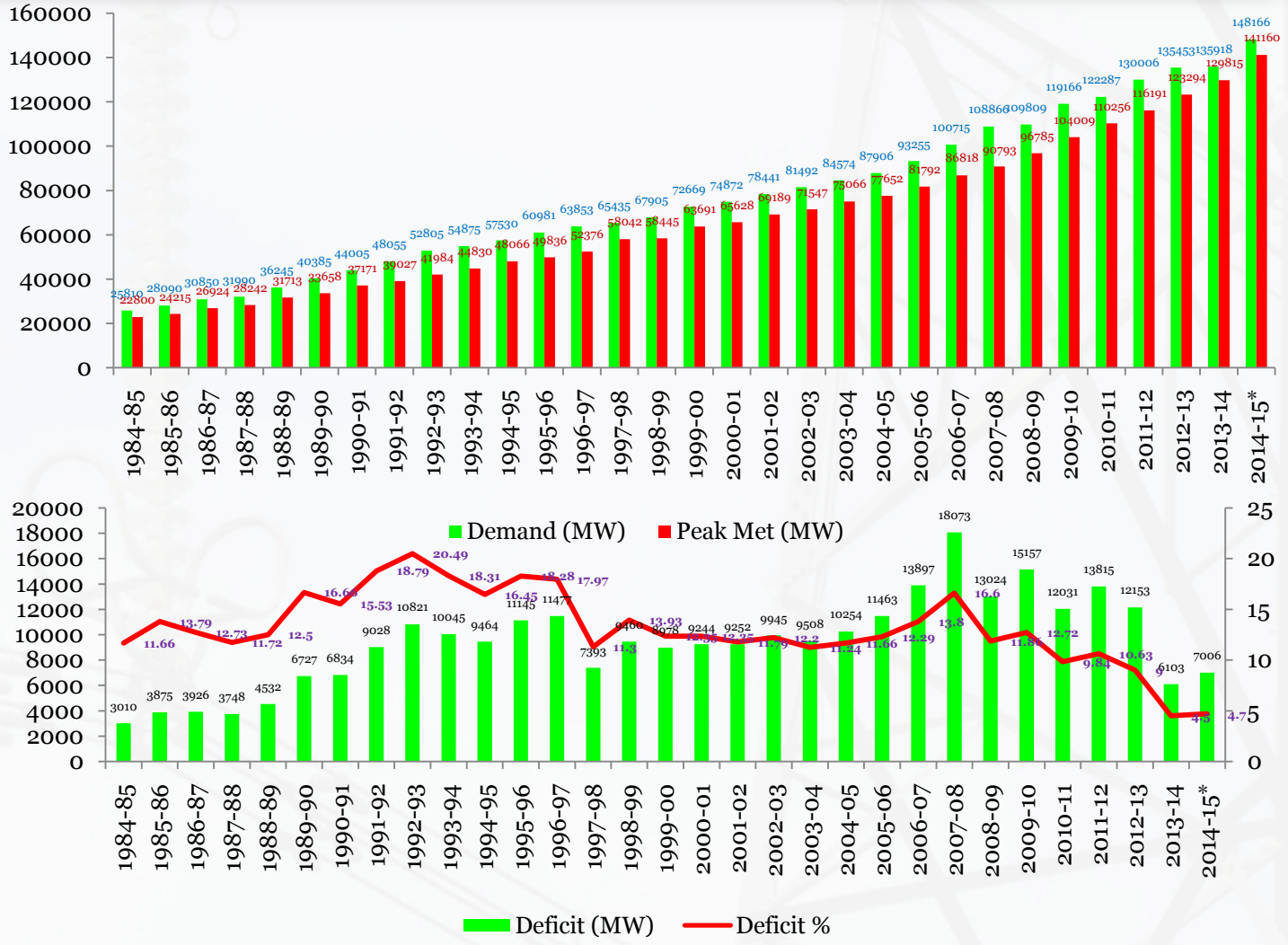
India: Growth in Generation Capacity (MW) and Peak demand Met





Source: CEA's Report on Growth of Electricity in India from 1947 t o 2012, CEA's Monthly Executive Summary

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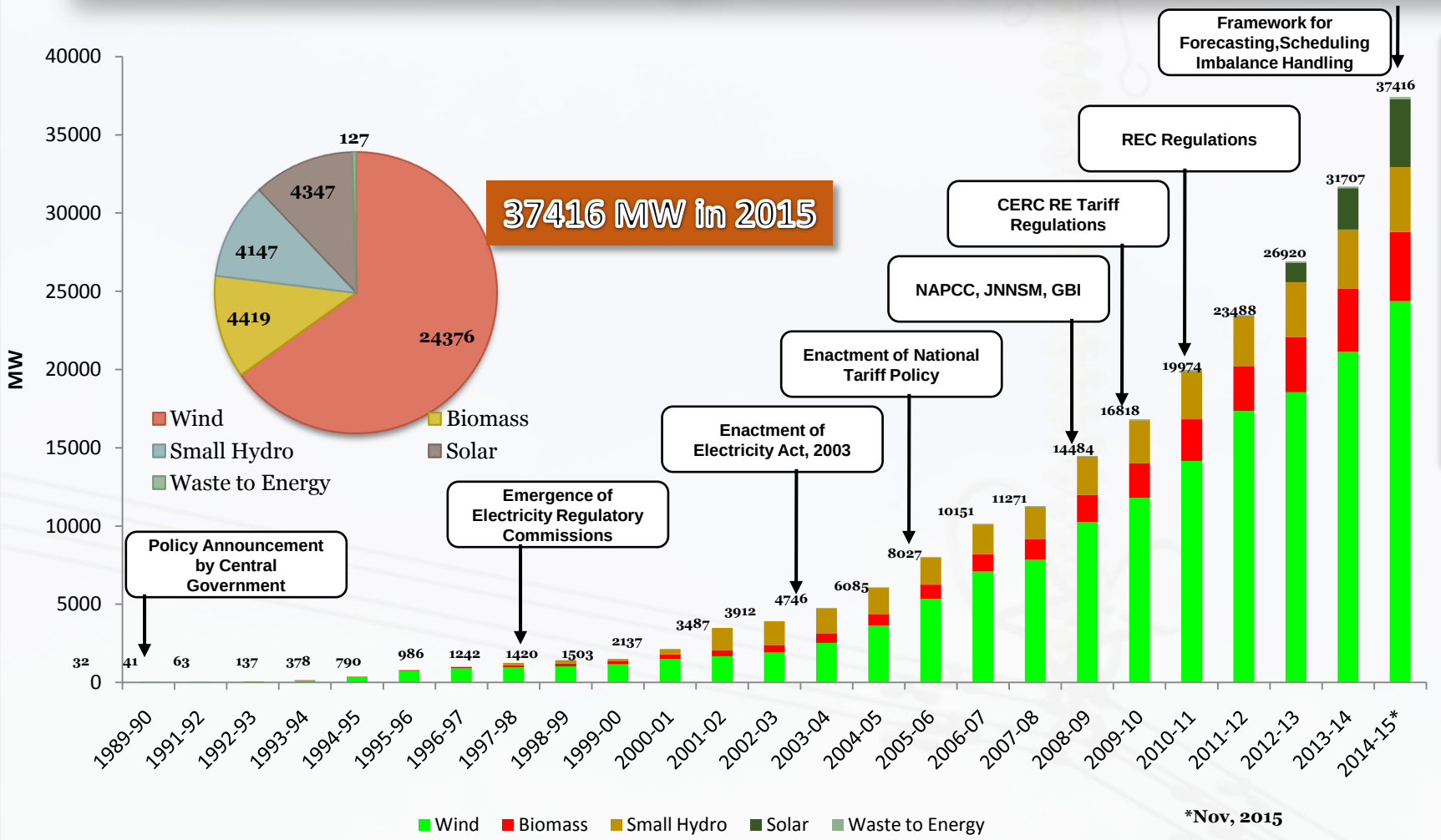
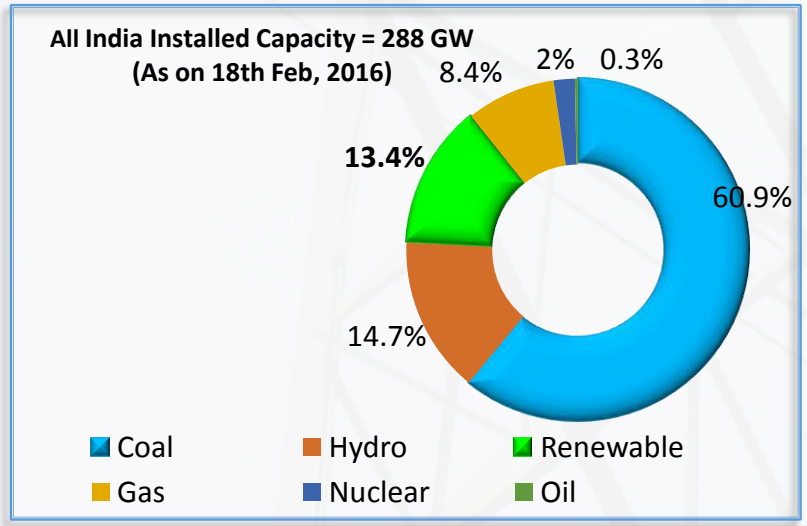
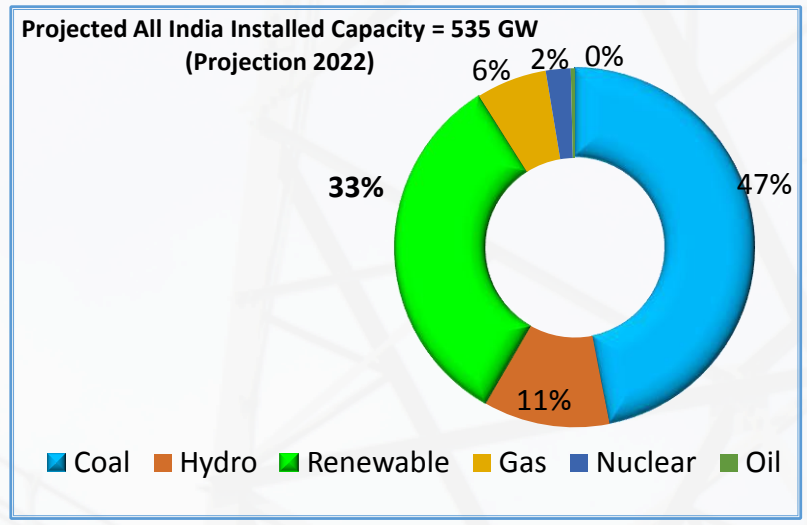
India-Renewable Energy Growth (MW) , Ambitious 175 GW Target by 2022







Source: CEA's Report on Growth of Electricity in India from 1947 to 2012, CEA's Monthly Executive Summary

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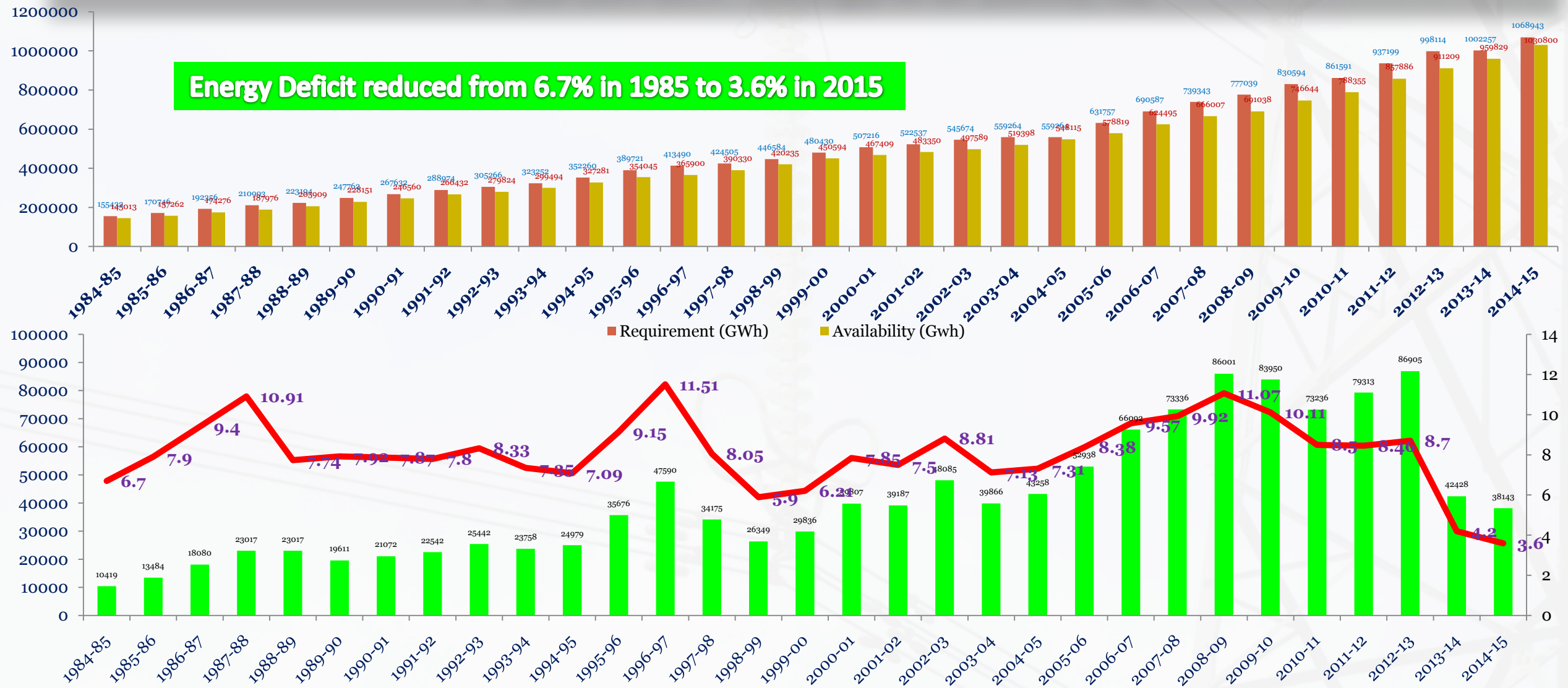
India-Deficit in Energy Met (Gwh, %)

Energy Deficit reduced from 6.7% in 1985 to 3.6% in 2015



Source: CEA's Report on Growth of Electricity in India from 1947 to 2012, CEA's Monthly Executive Summary

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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 pursed currently which are Cross Border Power in nature

PDA Concluded:

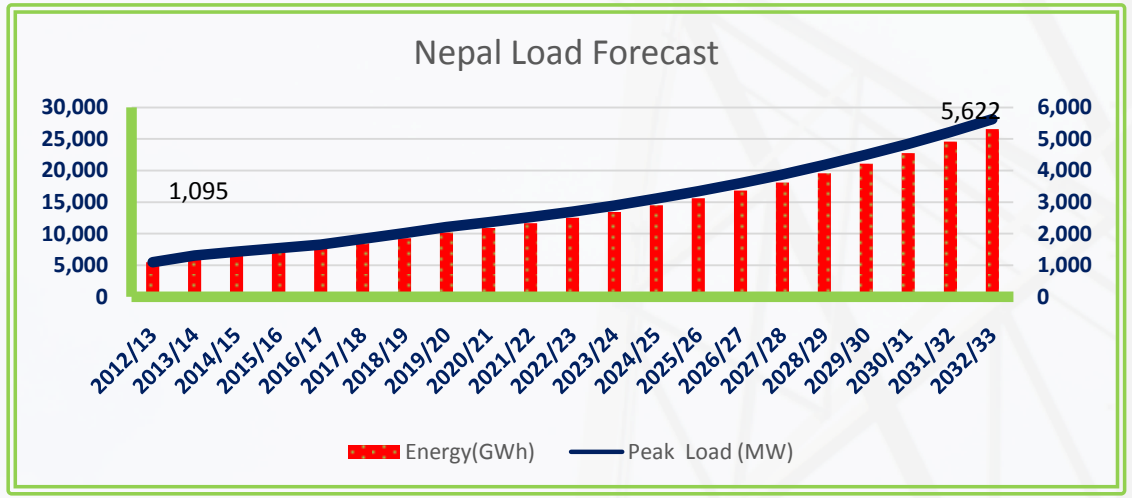
1. 900 MW Upper Karnali with GMR India
2. 900 MW Arun -3 with SJVNL

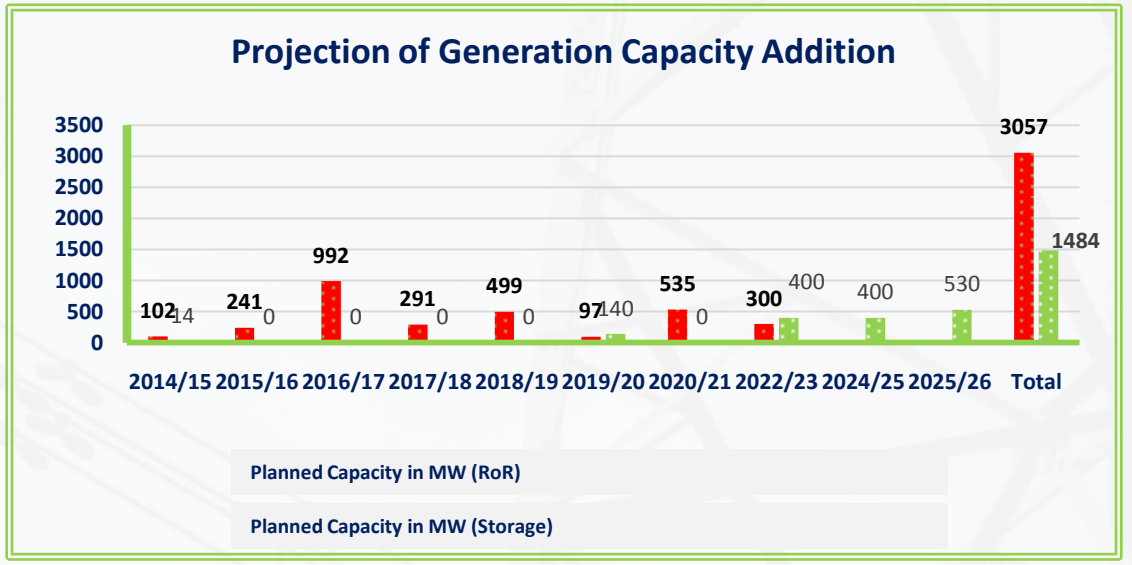
PDA in the pipelines:

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

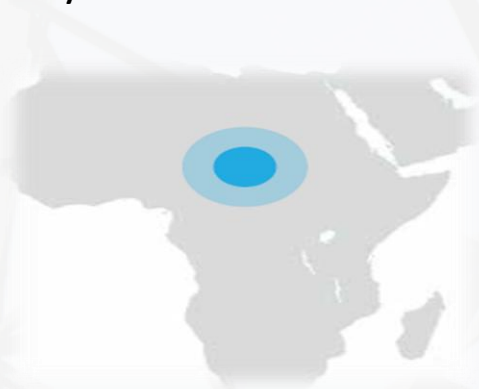
- 405 MW added in 2014.
- Pumped storage remains a focus of activity, with 8,600 MW planned or under construction, including 2,500 MW expected in the Swiss Alps by 2017.
- In 2015, Norway and the UK announced agreement for the world's longest submarine high–voltage cable (730 km,1.4 GW), allowing the UK to import Norwegian hydropower.
- • In preparation for the 2015 climate
- summit in Paris, the EU committed to a
- 40% reduction in GHG emissions by 2030
- compared with 1990, cor by
- a 27% target for renewab

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.



Source: IHA-2015 World Hydropower Status Report

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South and Central Asia

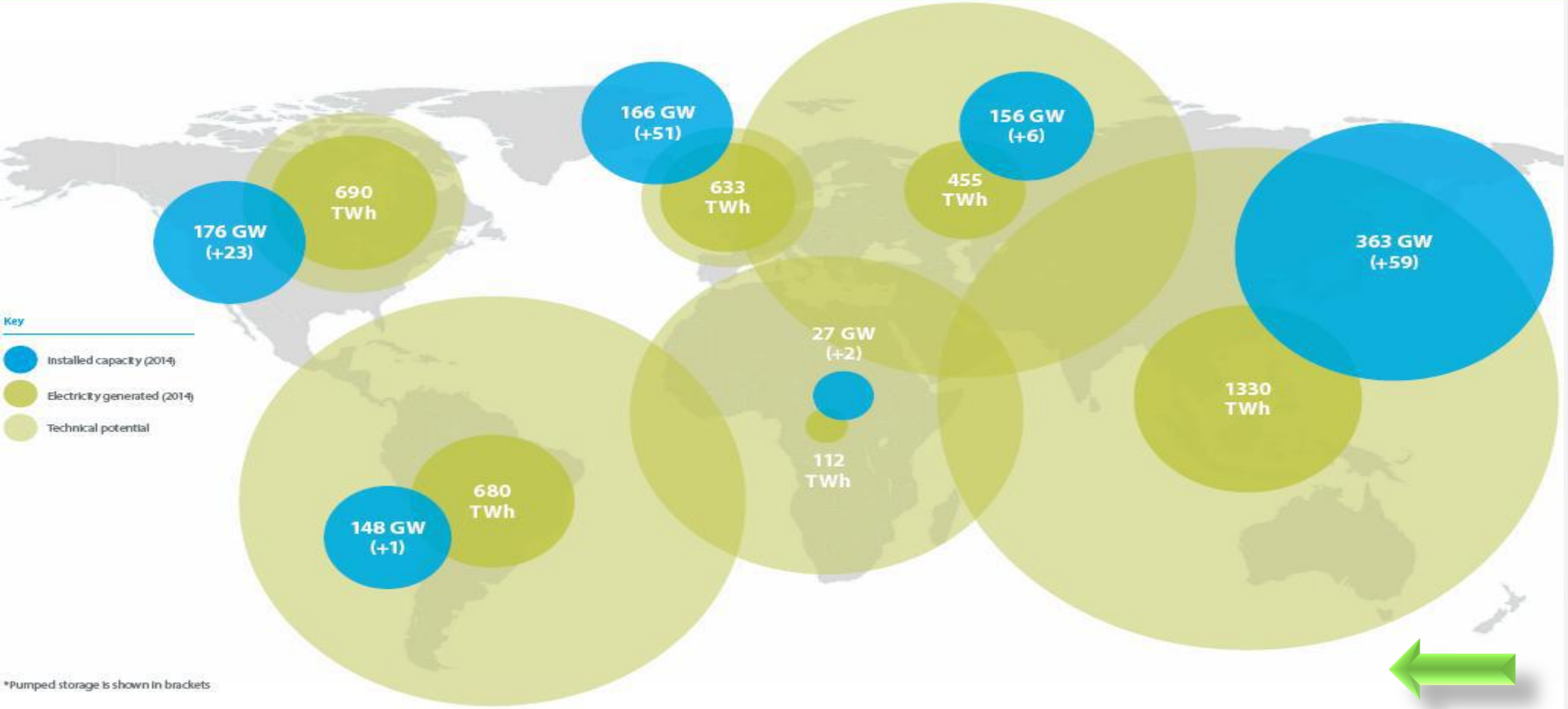
- 4,073 MW added in 2014.
- The policy environment is shifting in support of more hydropower in India, with the government considering market incentives and encouraging private sector investment.
- Regional interconnection projects could drive further optimisation of hydropower, with the CASA-1000 transmission 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.

Source: IHA-2015 World Hydropower Status Report

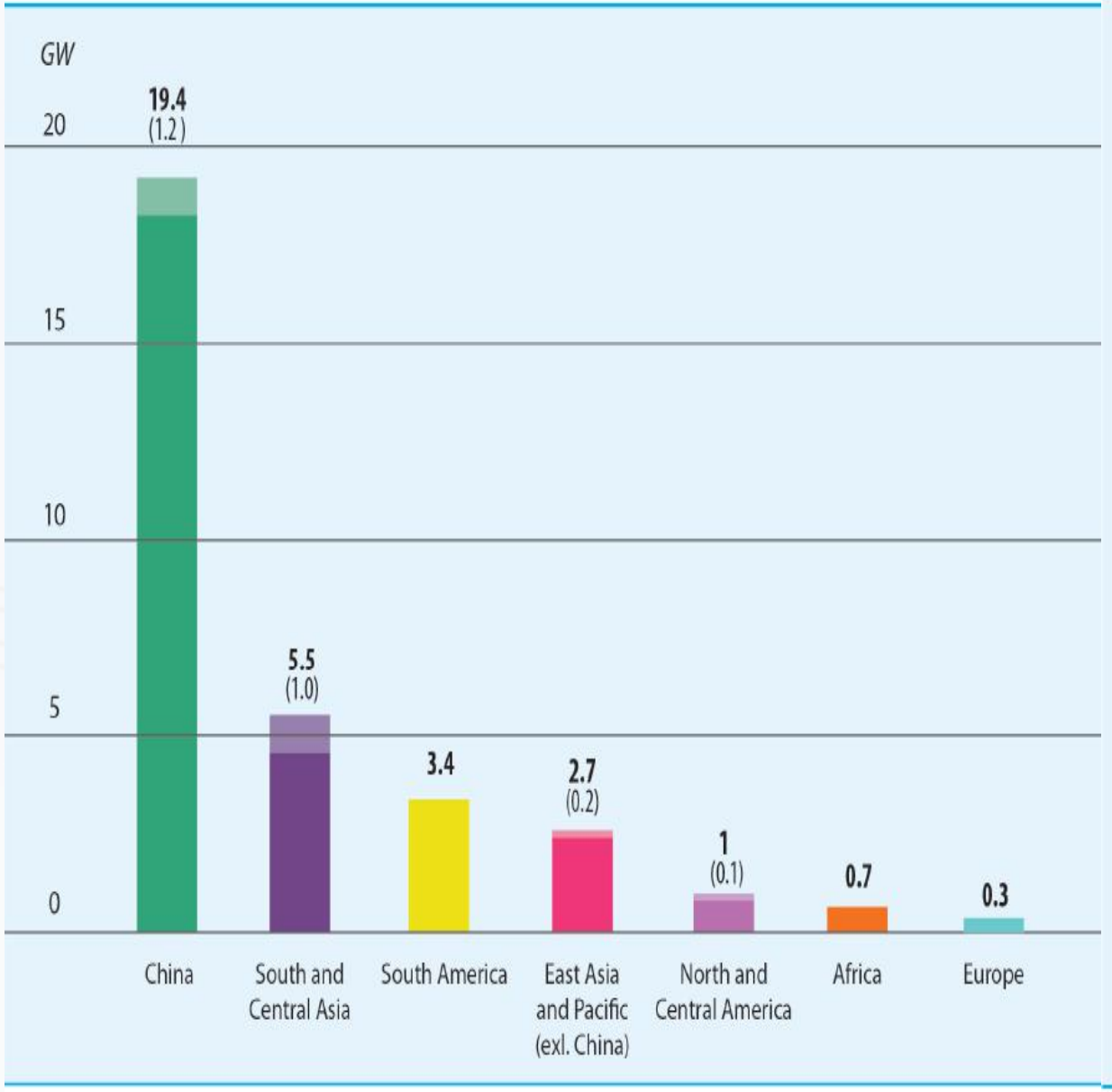
GLOBAL HYDROPOWER TECHNICAL POTENTIAL, GENERATION AND INSTALLED CAPACITY BY REGION*



Source: 2016 Key Trends in Hydropower

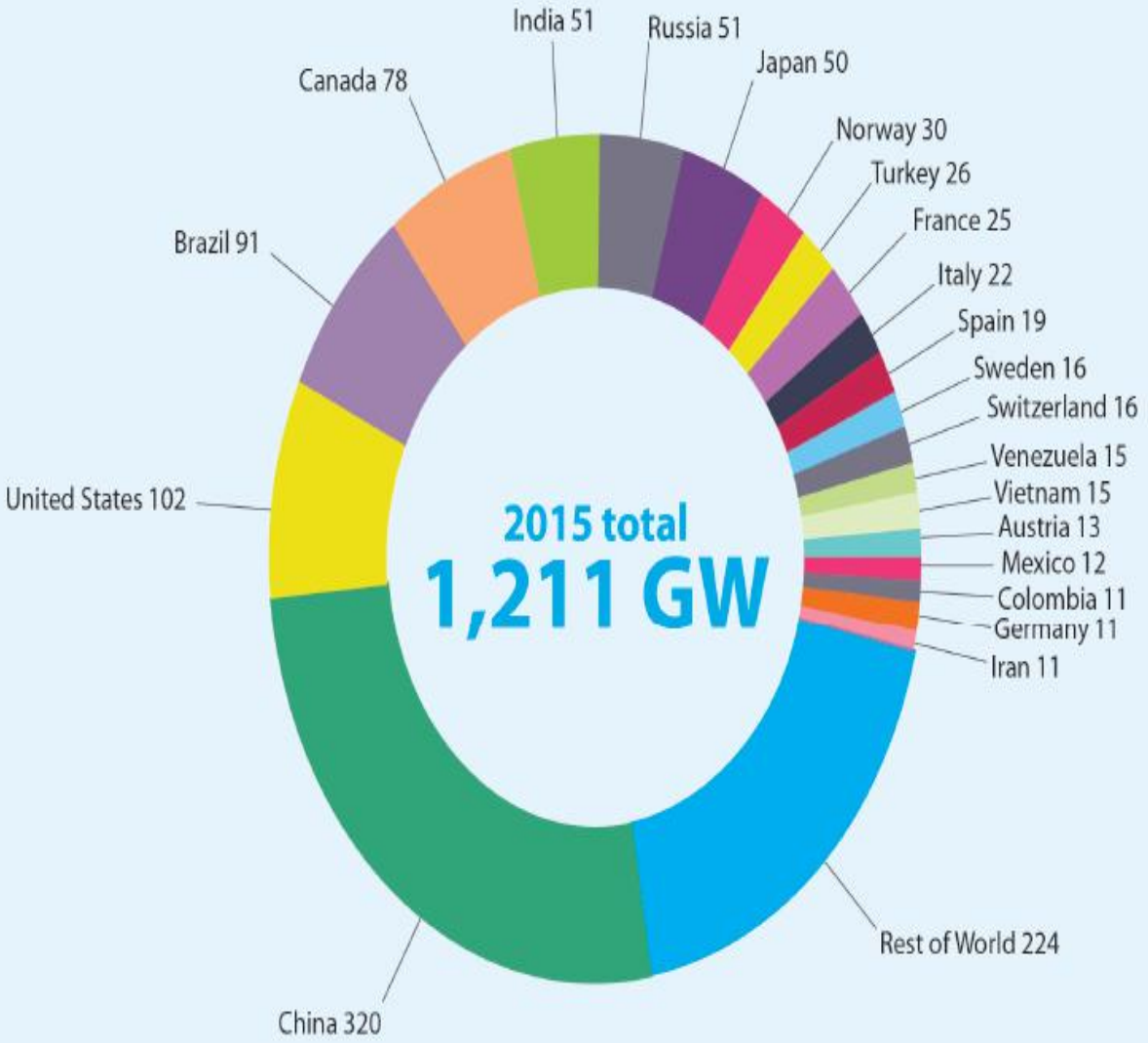
Total capacity added in 2015 by region:

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)



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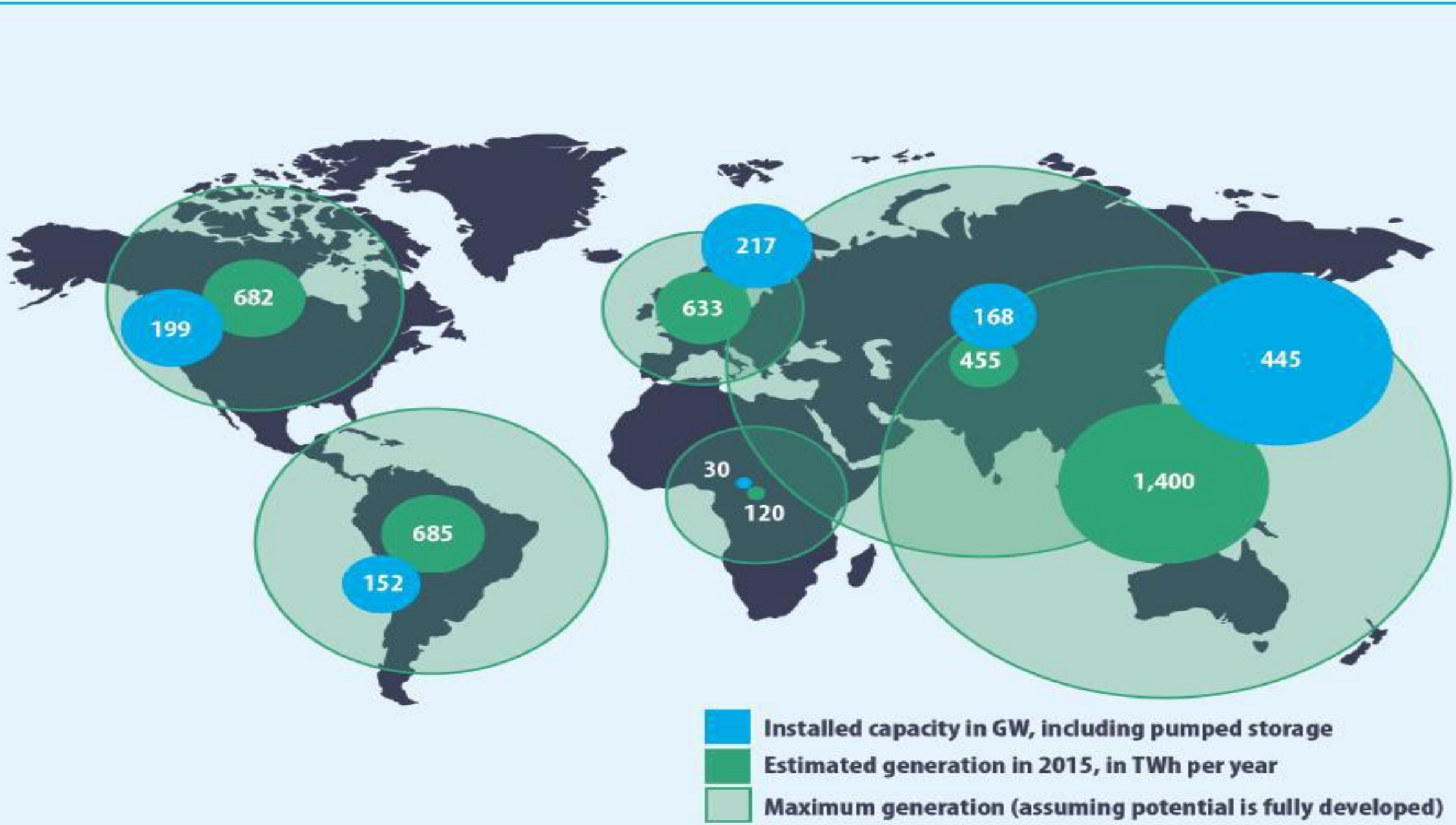

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