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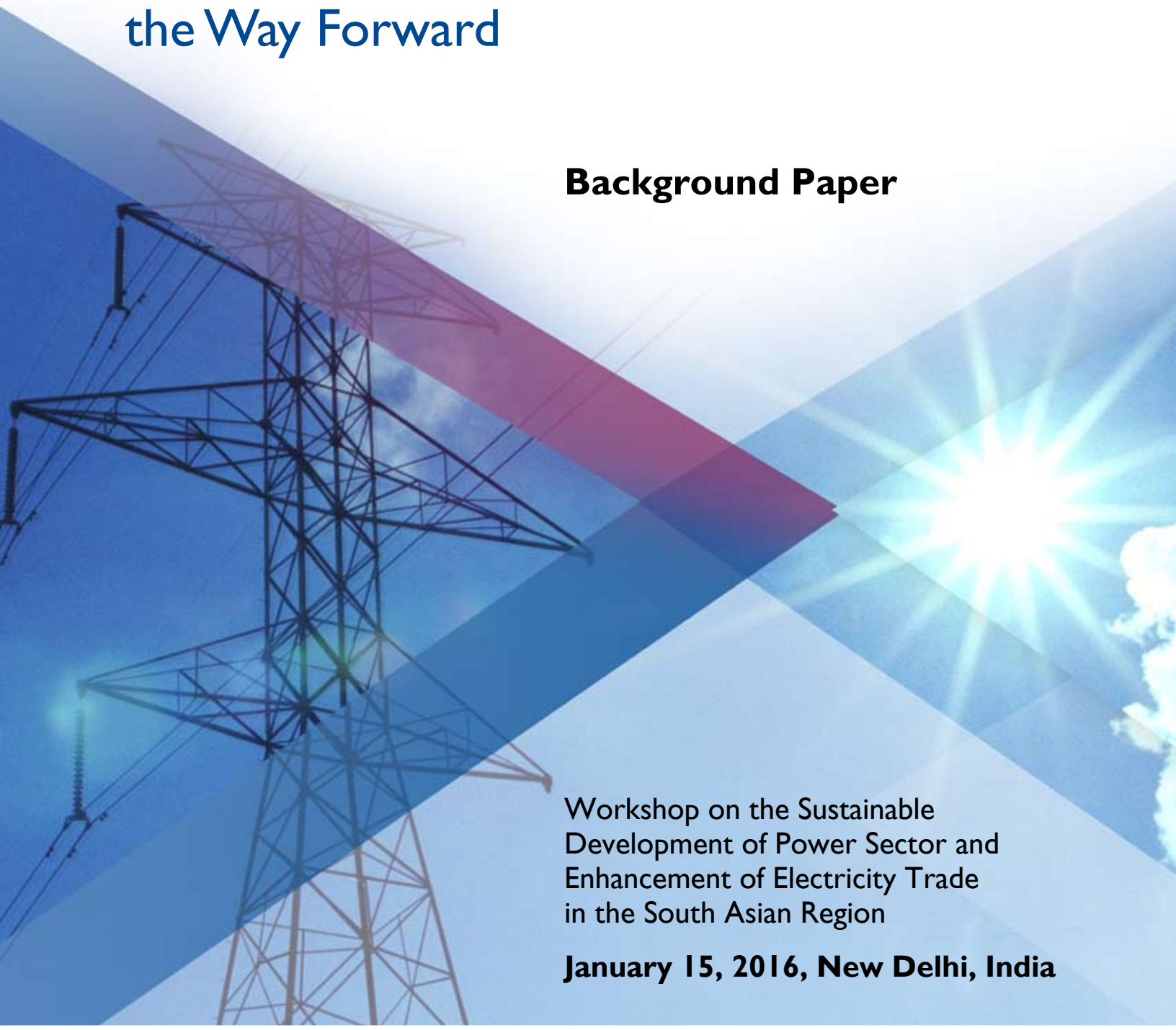
Cross-Border Electricity Trade in South Asia: Key Policy, Regulatory Issues/Challenges and the Way Forward



Background Paper

Workshop on the Sustainable Development of Power Sector and Enhancement of Electricity Trade in the South Asian Region

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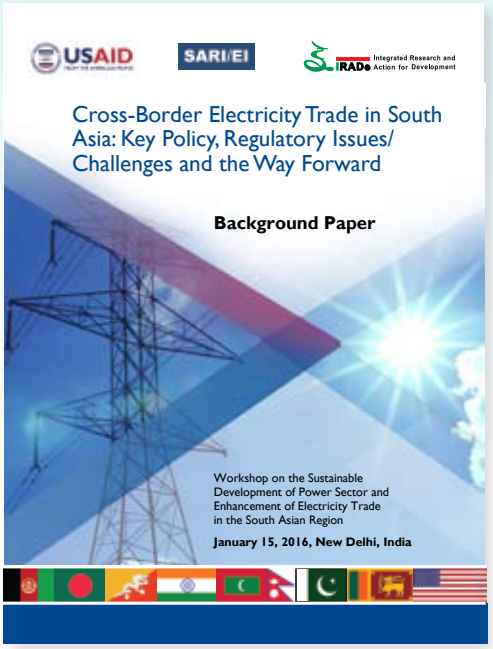

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Abbreviations

ABT	Availability Based Tariff
AC	Alternating Current
ACER	The European Agency for the Cooperation of Energy Regulators
ADB	Asian Development Bank
APS	Ashuganj Power Company
BEA	Bhutan Electricity Authority
BERC	Bangladesh Energy Regulatory Commission
BOO	Build Own Operate
BPC	Bhutan Power Corporation
BPDB	Bangladesh Power Development Board
CASA	Central Asia – South Asia
CASAREM	CASA Regional Energy Market
CBET	Cross Border Electricity Trade
CEA	Central Electricity Authority
CEB	Ceylon Electricity Board
CERC	Central Electricity Regulatory Commission
CO_2	Carbon dioxide
COP21	Conference of Parties 21
CRIE	Regional Electricity Interconnection Commission
CTU	Central Transmission Utility
DABM	Da Afghanistan BreshnaMossasa
DABS	Da Afghanistan Breshna Sherkat
DAM	Day Ahead Market
DBFOO	Design, Build, Finance, Own and Operate
DBFOT	Design, Build, Finance, Own and Transfer
DGPC	Druk Green Power Corporation
EAB	Electricity Act of Bhutan
ECOWAS	Economic Community of West African States
ENTSO-E	European Network of Transmission System Operators
EPF	Electric Power Forum
ERERA	ECOWAS Regional Electricity Regulatory Authority
ETFC	Electricity Tariff Fixation Commission
EU	European union
GCF	Green Climate Fund
GHG	Green House Gases
GMS	Greater Mekong Sub-region
HVDC	High Voltage Direct Current
IADB	Inter-American Development Bank
IEX	Indian Energy Exchange Ltd
IG	Implementation Groups
IGMOU	Inter-Governmental MOU
INDC	Intended Nationally Determined Contributions
IPP	Independent Power Producer
IPTC	Independent Private Transmission Company
IRADe	Integrated Research and Action for Development
ISO	Independent System Operator
JV	Joint Venture
KESC/KE/K-Electric	Karachi Electricity Supply Corporation
kWh	Kilo watt hour
LECO	Lanka Electricity Company Ltd
MEA	Ministry of External Affairs -(India)
MoEA	Ministry of External Affairs -(Bhutan)
MOF	Ministry of Finance

MOU	Memorandum of Understanding
MYT	Multi- Year Tariff
NEA	Nepal Electricity Authority
NEPRA	National Electric Power Regulatory Authority
NERC	Nepal Electricity Regulatory Commission
NHPC	National Hydro Power Corporation
NLDC	National Load Despatch Center
NTDC	National Transmission & Power Dispatch Company
NVVN	NTPC VidyutVitaran Nigam Limited
OTC	over the counter
PEPCO	Pakistan Electric Power Company
PGCIL/POWERGRID	Powergrid Corporation of India Limited
POC	Point -of -Connection
POSOCO	Power System Operation Corporation
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PTC	Power Trading Corporation
PUCSL	Public Utilities Commission of Sri Lanka
PXIL	Power Exchange India Limited
RCC	Regional Coordination Committees
RE	Renewable Energy
RERA	Regional Electricity Regulatory Association of Southern Africa
RERA	Regional Regulatory Authority
RLDC	Regional Load Despatch Center
RPTC	Regional Power Trading Coordination
RPTCC	Regional Power Trade Coordination Committee
RPTOA	Regional Power Trade Operating Agreement
SA	South Asia
SADC	Southern African Development Community
SAFIR	South Asia Forum for Infrastructure Regulation
SAPP	South African Power Pool
SAR	South Asian Region
SARI/EI	South Asia Regional Initiative for Energy Integration
SBD	Standard Bidding Documents
SEB	State Electricity Board
SERC	State Electricity Regulatory Commission
SG	Stakeholder Group
SHDP	Small Hydro Development Policy
SIEPAC	Central American Power Market
SLDC	State Load Despatch Center
SPV	Special Purpose Vehicle
STELCO	State Electric Company
STU	State Transmission Utility
TAM	Term Ahead Market
UMPP	Ultra Mega power plants
UNFCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee
VGF	Viability Gap Funding
WAPDA	Water & Power Development Authority
WAPP	West African Power Pool
WB	World Bank
WZPDC	West Zone Power Distribution Company

Foreword

South Asia Regional Initiative for Energy Integration (SARI/EI), a program of USAID being implemented by Integrated Research and Action for Development (IRADe), aims to promote the integration of energy systems and to enhance Cross-Border Electricity Trade (CBET) among the South Asian countries. The program focuses on three key outcomes for the overall socio-economic progress of the region: i) harmonization/ coordination of policy, regulatory, and legal issues, ii) advancement of transmission systems interconnections, and iii) establishment of South Asia regional electricity markets. We began this journey three-and-a-half years ago at IRADe. To address these issues, we at SARI/EI/IRADe constituted three dedicated task forces represented by government-nominated members from South Asian countries headed by a steering committee. Twenty-eight members from these countries have been working together for the last three years.

The eight South Asian nations (Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka) collectively account for over one-fifth of the world's population. The region is one of the fastest growing in the world, with an average annual growth rate of six per cent, as measured by GDP per capita. CBET in South Asia (SA) is currently done in bilateral mode; for example, between Bangladesh-India (500 MW), Bhutan-India (1416 MW), and Nepal-India (150 MW), though the potential of CBET in the region is huge. Currently SA is moving towards deeper regional integration in the region and CBET can play a crucial role in this process of regional integration. Various regional initiatives under SAARC, BIMSTEC, and BBIN frameworks clearly demonstrate this. For example, the SAARC intergovernmental framework agreement on energy (electricity) cooperation, signed among SAARC member states, lays the foundation for deeper power sector cooperation and enhancing CBET in the region.

The different sets of electricity regulation, policy, and legal frameworks in the South Asian Countries (SACs), are perceived to be a challenge for the long-term success of CBET. The existing frameworks primarily address domestic power sector issues and are not necessarily developed to address issues related to CBET. Therefore, a stable, transparent regional policy and regulatory environment for CBET is the key. The regional regulatory framework should address the thorny aspects of cross-border trade by looking at issues such as licensing process for trading, fair rules for non-discriminatory open access, transmission pricing, collective process of transmission planning, settling the imbalance by energy accounting and scheduling, harmonizing codes of voltage and frequency standards and, most important, taxes and duties harmonization, preferably the transition to a zero tax regime and, finally, suggesting a process of dispute resolution. It is important and prudent to develop a coordinated regional mechanism for aligning the regulation, policy, and legal frameworks for facilitating CBET at a much higher level of trade in a sustainable manner. This implies the establishment of common/coordinated norms, rules and protocols in technical, commercial, economic, and legal matters pertaining to CBET.

This background paper describes the current scene and future CBET scenario in SA. An analysis of prevailing policy and regulatory frameworks as well as international experiences and learnings have been incorporated here. We hope this paper will initiate thought-provoking discussions among SA country governments, electricity regulators of SACs, policy and decision-makers, power developers, investors, financial institutions and that it will serve as a valuable resource for addressing key policy, regulatory issues/challenges and the way forward for promoting CBET in the South Asian region.

Dr. Jyoti Parikh
Executive Director, IRADe

Preface

The eight South Asian nations (Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka) collectively account for over one-fifth of the world's population. The region is one of the fastest growing in the world, with an average annual growth rate of 6 per cent as measured by GDP per capita.

Recognizing the various benefits of Cross-Border Electricity Trade (CBET) for meeting electricity requirement and addressing the energy security of the region, South Asian countries are promoting regional electricity cooperation and CBET. At present, limited bilateral CBET is under way between Bangladesh-India (500 MW), Bhutan-India (1,416 MW), and Nepal-India (150 MW), though the total potential for CBET is immense.

Recent developments in the South Asian Association for Regional Cooperation (SAARC) from the perspective of CBET are extremely encouraging and give the direction for increased CBET in the region in the future. During the 18th SAAARC Summit, eight member states of SAARC countries concluded the historic Framework Agreement of Energy (Electricity) Cooperation. The political climate is becoming increasingly more conducive for CBET. Further, the historic Power Trade Agreement (PTA) has been signed between India-Nepal. It opens up a whole range of new possibilities for trade of electricity between India and Nepal and also gives access to the Indian power market. India-Bangladesh and India-Bhutan are taking steps to substantially increase the quantum of CBET. International experience suggests that a higher level of CBET on a sustainable basis is possible; however, it must be backed by a transparent and environment-friendly policy and regulatory frameworks among the participating member states.

The power sectors of the South Asian nations are at different stages of evolution in policy and regulatory frameworks. Policy and regulatory provisions, institutional frameworks and other aspects promoting/ facilitating CBET exist in some South Asian Countries (SACs) but are not exhaustive in nature from the perspective of CBET. The SACs envisage a manifold increase in the quantum of CBET by the end of the next decade. This scenario is rapidly changing with several new transmission interconnections being proposed that will enable the greater integration of power systems of the SACs. Such integration will also enable electricity trading on a regional basis. In the above context, there is a need to have a common/coordinated set of regulations, policies, and legal frameworks supported through a regional regulatory institutional mechanism, which addresses the mechanism of interconnection, recognizes the CBET, open access to transmission network, licensing, dispute resolution, and so on, among the SACs.

Without a consistent and coherent regional regulatory framework in place, investment opportunities and, consequently, large-scale CBET between nations that could benefit both importing and exporting nations may not happen. In the South Asian regional context, the risks associated with forging an intra-regional, CBET project would be greatly minimized if each participating country adopts complementary regulatory frameworks to facilitate cross-border interconnection and electricity trade. The SAARC Inter-Governmental Framework Agreement (IGFA) also calls for the need for institutional mechanisms for the coordination of regulations for promoting CBET in the South Asia (SA) region.

This paper brings out the above by analyzing the international experiences in power market development and CBET from a) Greater Mekong Region (GMS) b) South African Power Pool (SAPP) c) West African Power Pool (WAPP) d) The Central American Electrical Interconnection System (SIEPAC) e) Nordic Pool and the critical success factors for effective CBET and learnings for South Asian countries from international experiences. The report also highlights the various key drivers of CBET in SA and the current policy, legal, and regulatory frameworks in the region. I hope this paper will be able to initiate further thought-provoking discussions among regulators and power sector stakeholders to take forward the process of coordination of policy and regulation for promoting CBET.

V.K. Kharbanda
Project Director, SARI/EI/IRADe

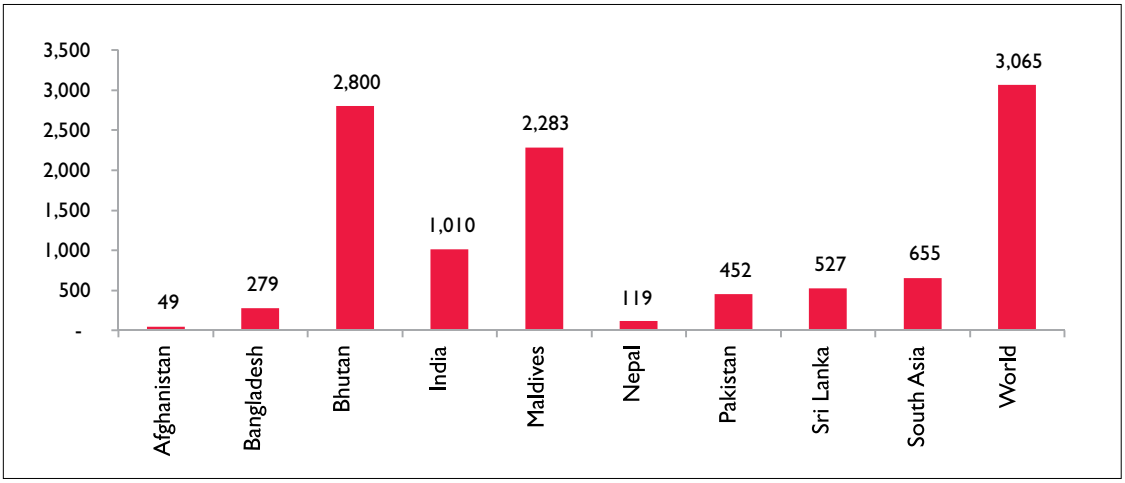
1. Introduction

This background paper is an endeavor to complement the increasing acceptance of Cross-Border Electricity Trade (CBET) in the South Asian Region (SAR) for the sustainable development of the power sector in the region. The paper contains the current status of the power sector in South Asia (SA) as well as policy and regulatory frameworks for the evolution of the power markets and CBET in the SAR. It draws upon key lessons learnt from international experiences.

1.1 Context: South Asian Power Sector

The countries of SA,[1] comprising Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka, are home to almost 20 per cent[2] of the global population and home to half the world's poor.[3] These countries are on the cusp of an economic turnaround but lack in a number of growth ingredients that hinder economic progress in the region. One of the key barriers to economic growth in the SAR is the low electricity availability/consumption in the region.

Figure 1 **Per Capita Electricity Consumption (kWh) in SAR**



Source: IRENA 2009 for Afghanistan, the Maldives, RoGB (2012) for Bhutan, CEA for India, and the World Bank (2013) for others

Besides India, Bhutan, and the Maldives, all other countries have a per capita electricity consumption of below 1,000 kWh (Figure 1). As a region, South Asia's per capita electricity consumption is only 20 per cent of the world level. Yet most countries in the region are struggling with generation capacity shortages and seasonal variations that impact the availability of the existing capacity and hence electricity access. These, coupled with the poor quality of supply owing to regular demand-supply mismatches, are resulting in a loss of economic output and productivity (Table 1). Electricity consumers, as a result, are forced to invest in costlier diesel generators, which impact environmental sustainability while increasing the import burden of the countries.

[1]Members of the South Asian Association of Regional Cooperation (SAARC).
[2]Analysis based on data from the World Bank and the Population Reference Bureau (PRB).
[3]The World Bank.

Table 1 Value Lost Due to Outages

Value lost due to electrical outages (% of sales)		
Afghanistan	2014	9.6
Bangladesh	2013	5.5
Bhutan	2015	3.7
India	2014	3.7
Nepal	2013	17.0
Pakistan	2013	33.8
Sri Lanka	2011	3.0
South Asia	2013	10.9
World	2013	4.8

Source: World Bank 2013

Despite the electricity shortages in the SA region, it is imperative to note that most of these countries have a significant potential of untapped energy resources, especially environment-friendly hydropower, which can be harnessed to balance out the electricity demand in the region through cross-border integration of the electricity systems.

Table 2 Installed Capacity (MW) from Different Sources in SAR

Country/Installed capacity from different sources (MW)	Coal	Oil/ Diesel	Gas	Renew-able	Hydel	Nuclear	Total
Afghanistan	0	268	0	0	254	0	522
Bhutan	0	17	0	0	1,488	0	1,505
Bangladesh	250	3,463	7,509	0	230	0	11,452
India	170,738	994	24,473	37,416	42,623	5,780	282,024
Maldives	0	79	0	0	0	0	79
Nepal	0	53	0	5	730	0	788
Pakistan	6,330	7,107	2,178	355	6,893	750	23,613
Sri Lanka		1,419	0	86	1,602	0	3,107
Total	**177,318**	**13,400**	**34,160**	**37,862**	**53,820**	**6,530**	**323,090**

Sources: India – CEA Installed Capacity Nov 2015, Pakistan – NEPRA, Bangladesh – BPDB, Sri Lanka – Ministry of Power & Renewable Energy, Bhutan – Reegle, Nepal – NEA Annual Report 2015, Maldives – STELCO, Afghanistan – DABS (2013)

The installed capacity (MW) from different sources (Table 2) in the SAR shows that there is a focus on fossil fuel despite limited availability. The significant untapped hydro potential can be used as a cleaner source of electricity for attending to the region's electricity shortfall in combination with renewable sources of electricity. This becomes all the more vital given the recent commitments at the Conference of Parties 21 (COP21) climate change meet in Paris.

The SAR countries have understood the criticality of the situation and the importance of CBET for fulfilling individual electricity requirements through a sustainable power sector development in the region. Over the years, there have been significant bilateral initiatives to share untapped power resources such as the India-Nepal and India-Bhutan tie-ups. However, these need to be converted into a multi-country cross-border electricity trading institutional mechanism to better utilize the diversity in generation mix and demand characteristics among the SAR countries. A number of international precedents such as South African Power Pool (SAPP) and Greater Mekong Sub-Region (GMS) have already transitioned from bilateral frameworks to fully integrated regional power institutions for CBET.

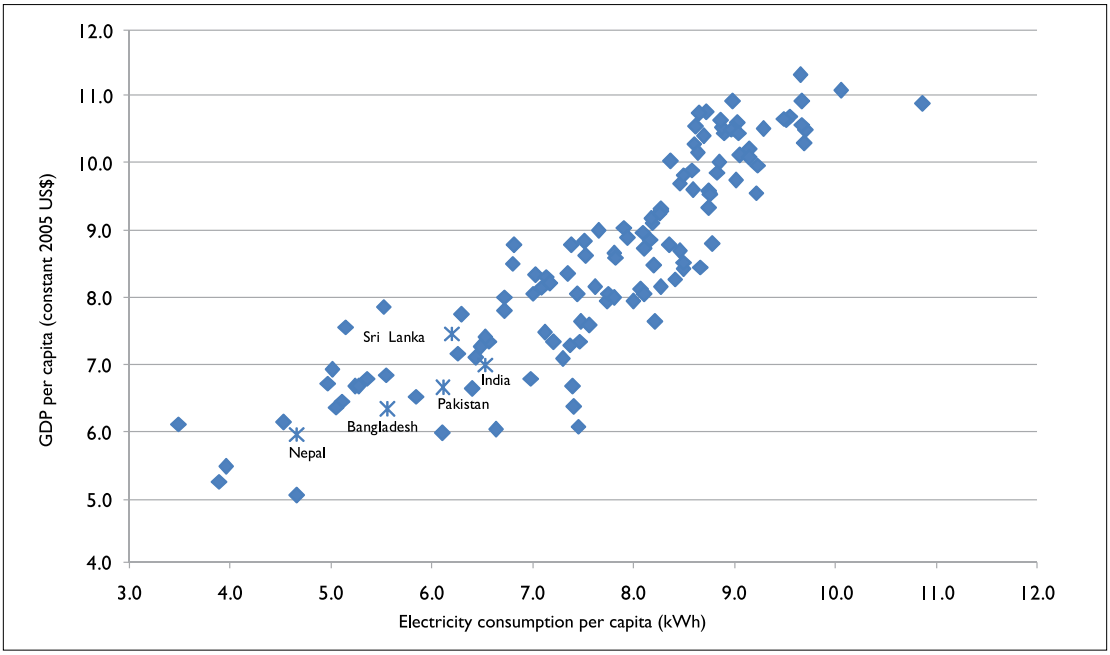
1.2 Key Drivers of CBET in South Asia

From a regional as well as domestic perspective of the South Asian countries, a number of key drivers provide a significant thrust to the need for strengthening electricity cooperation and CBET. This will lead to the sustainable development of the South Asian power sector.

1.2.1 Electricity Access and Socio-economic Development

Electricity access is instrumental in accelerating economic growth in South Asia and improving the quality of life. The widely acknowledged link between energy provision and economic development has spurred governments to develop ambitious plans to increase electricity access to the remotest parts of the region. Figure 2 shows that high per capita income countries exhibit high per capita commercial energy consumption, thus pointing to the relevance of the argument that South Asian countries need to increase electricity supply in order to support economic growth in the future. All countries in the SAR, barring the Maldives, are yet to provide electricity access (Figure 3) to the entire country's population. In addition, the gaps in demand and supply limit uninterrupted supply to the already connected consumers. Access and availability of energy, including electricity, is of significant relevance to the socio-economic development of a nation. A developing economy witnesses change

Figure 2 Electricity and GDP Relationship

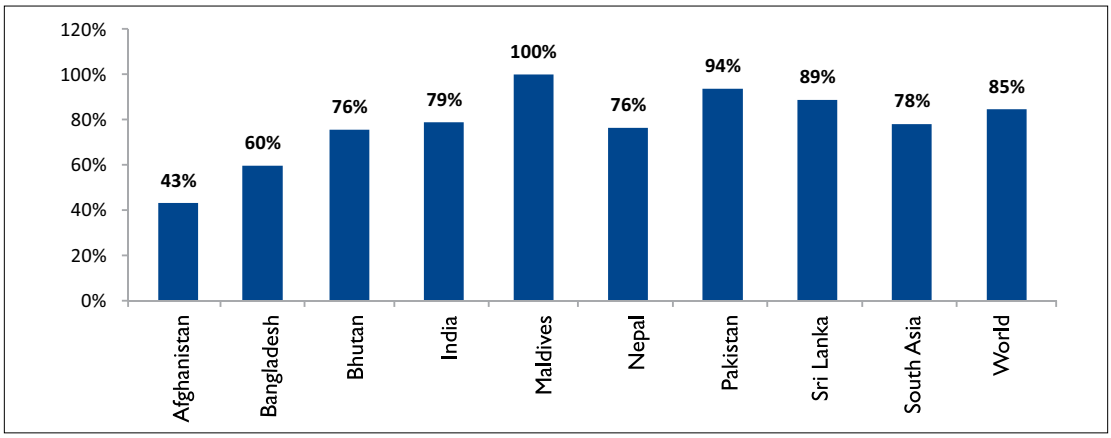


Source: World Bank (2013), Strategy for Developing a Regional Power Market in South Asia: Learning from International Experience

in the structure of the economy where the share of the energy-consuming industrial and services sector finds an increasing role. This leads to a significant demand for energy, including electricity. An increasing use of electricity in agriculture and the electrification of households equipped with energy-consuming appliances also lead to a growth in electricity demand. Lack of investment in electricity generation further inhibits investment in manufacturing and other economic activities, thus limiting the GDP growth opportunities for a nation. Economic growth and social welfare among the developing countries in the SAR continue to be hindered by a slow growth of energy/electricity supply, resulting in shortages and poor energy access in the region.

There are a number of factors associated with the restricted electricity access; a key component is the lack of adequate generation capacities to meet the unrestricted demand of the existing consumers and those who are yet to be connected to the grid. This has attracted the attention of the governments and policy-makers of the region and they have come up with massive rural electrification programs to enhance the access to electricity. While these efforts are laudable, the challenges are daunting, primarily due to the magnitude of the population to be connected and the growing power demand, which has to be catered to in an affordable and sustainable manner. CBET is one of the most credible options to address the energy access challenge in SA.

Figure 3 Electricity Access (%) in SAR



Source: http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS

Adding generation capacities and extending the network to the un-electrified consumer carries a significant cost. While the network extensions are a local constraint, countries are evaluating options to utilize capacities from other countries and for the exploitation of energy resources by setting up regional and cross-border interconnections. This would help bring in economies of scale while also avoiding environmental degradation. Utilizing the vastly available hydro potential in the region will also address the issue of electricity access in the SA region.

1.2.2 Electricity Shortages and Bridging the Demand-Supply Gap

SA is expected to witness moderate to high economic growth in the future. The region is growing at an average annual rate of 6 per cent GDP per capita and this is expected to be maintained in the coming years. To sustain this high-level economic growth in the long run, the electricity sector needs to grow in a sustainable manner as power is one of the key inputs/drivers to the economy. The projected demand for electricity to meet this annual average GDP rate is expected to grow at a CAGR of 7.4 per cent (Table 3). Given the current status of energy resources in individual countries, this goal presents

a challenge to the policymakers as a large percentage of power in the region is generated from fossil fuel, except in Bhutan and Nepal. A two-fold increase in electricity demand through the utilization of domestic resources would also place a significant environmental burden on the region. Therefore, there is an increasing understanding among the SA governments for the need of regional cooperation for the utilization of energy resources and the promotion of CBET.

Table 3 Projected Electricity Demand (GWh)

	Demand (GWh)		CAGR
	Year 2010	Year 2020	
Afghanistan	2,600	6,750	10%
Bangladesh	28,470	67,400	9%
Bhutan	1,749	3,430	7%
India	938,000	1,845,000	7%
Maldives	800	1,300	5%
Nepal	3,200	6,910	8%
Pakistan	95,000	246,000	10%
Sri Lanka	10,718	21,040	7%
Total	**1,080,537**	**2,197,830**	**7.4%**

Source: An Overview of Energy Cooperation in South Asia, Priyantha Wijayatunga and P. N. Fernando, No. 19, May 2013

1.2.3 Complementary Energy Sources for Electricity Generation

The region is endowed with limited fossil fuels but ample hydro resources (Table 4). In addition to the conventional energy resources, there are huge renewable energy resources such as solar and wind (Table 5). There is, however, a disparity in the distribution of these across the region (Table 4). Limited oil and gas resources have led to growing import dependency. Electricity generation largely depends on available domestic resources. Some countries of the region have significant dependence on coal while others are dependent on hydro resources to generate electricity. Nepal and Bhutan are dependent on Himalayan-fed hydro resources. Bangladesh, the Maldives, and Sri Lanka are largely dependent on fossil fuels. Afghanistan is struggling to rebuild its hydro-electric capacity, but investments for new capacity are yet to catch up with its requirements. In transit to the further creation of capacity, it is importing electricity from trans-border linkages. The two large economies, namely India and Pakistan, depend on a mix of hydro and fossil fuel-based capacity, though they are increasingly becoming more dependent on fossil fuels. In India, 65 per cent of the total electricity generation capacity is thermal-based; Bhutan and Nepal are almost completely dependent upon hydroelectricity to meet their requirements. The Maldives produces all its electricity from diesel, while natural gas dominates the generation mix in Bangladesh and Pakistan. Such excessive dependence on one energy resource (due to energy endowments in different countries) raises concerns related to energy security.

Table 4 Energy Resource Endowments in South Asian Countries

Country/Fuel sources	Coal	Oil	Natural Gas	Biomass	Hydropower*
	(million tonnes)	(million barrels)	(trillion cubic feet)	(million tonnes)	(MW)
Afghanistan	440	NA	15	18–27	25,000
Bhutan	2	0	0	27	30,000
Bangladesh	884	12	8	0.08	330
India	90,085	5,700	39	139	150,000
Maldives	0	0	0	0.06	0
Nepal	NA	0	0	27	83,000
Pakistan	17,550	324	33	-	59,000
Sri Lanka	NA	150	0	12	2,000
Total	**108,961**	**6,186**	**95**	**223-232**	**349,000**

Source: ADB (2012)

*Note: As per ADB (2012), the estimated hydro-electric potential of the region was only 294.33 GW due to lower estimates for Nepal and Pakistan. The above estimate is based on SAARC Secretariat (2010) for Bangladesh, Bhutan, India, Nepal, Sri Lanka; CWC (2005) for Indian States and WAPDA (2011) for Pakistan.

Table 5 Renewable Energy Resource Endowment in South Asia

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)	Very limited potential	151,918	3,000	4,825	24,000	25,000 MW

Thermal energy is cheaper to transport in the form of electricity rather than physical fuel transportation and hydel energy can only be transported in the form of electricity. With effective CBET, countries with limited resources, such as Sri Lanka, would benefit. Similarly, significant untapped hydro resources can be effectively utilized as in the case of Bhutan and Nepal. Hydro generation can be used in the summer (wet season) and thermal generation can be used to meet the power requirements of these countries in winters (dry season), thereby achieving optimal utilization of a cheaper and cleaner energy source. Moreover, the export of electricity would also bring along economic benefits to the countries that have relatively lower demands vis-à-vis generation potential.

1.2.4 Complementary Demand Requirements: Opportunities for Trade Due to Diversity in Demand and Supply

The countries of the SAR have non-coincident demand peaks across the year (Table 6), which shows the potential of gains from CBET.

Table 6 Non-coincident Peaks in SAR Countries

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

Source: How Much Could South Asia Benefit from Regional Electricity Cooperation and Trade? World Bank Group policy research working paper 7341, June 2015

For example, Bangladesh's generation is mainly gas-based and hence provides a contrast with Nepal/ Bhutan's hydro-based power generation and India's coal-based generation. Further, there is diversity in the demand profiles of Bangladesh and India, along with differences in weekly and festive holidays and time. All these facts point towards the need for a mutually beneficial power exchange mechanism among

Table 7 Key Prospects for Electricity Trade in the SA Region

Importing countries	Exporting countries				
	India	Bhutan	Nepal	Bangladesh	Sri Lanka
India	X	Significant quantities of hydro power (H)	Significant hydro power export possible	Significant amount of gas or power possible; resource uncertainty	Some peak power support possible
Bhutan	Dry season support	X	Unlikely. Similarity of resources and seasonal shortages	Small amount of thermal power and gas; connection via India (L)	No scope
Nepal	Thermal power support. Dry season support	Unlikely. Similarity of resources and seasonal shortages	X	Small amounts of thermal power and gas; connection via India (L)	No scope
Bangladesh	HVDC back-to-back link. Sharing reserves; electricity swap	Some hydro power; connection via India (L)	Some hydro power; connection via India (L)	X	No scope
Sri Lanka	Dry season and thermal power support	Unlikely (far off)	Unlikely (far off)	X	Unlikely (far off)

Source: World Bank (2008)

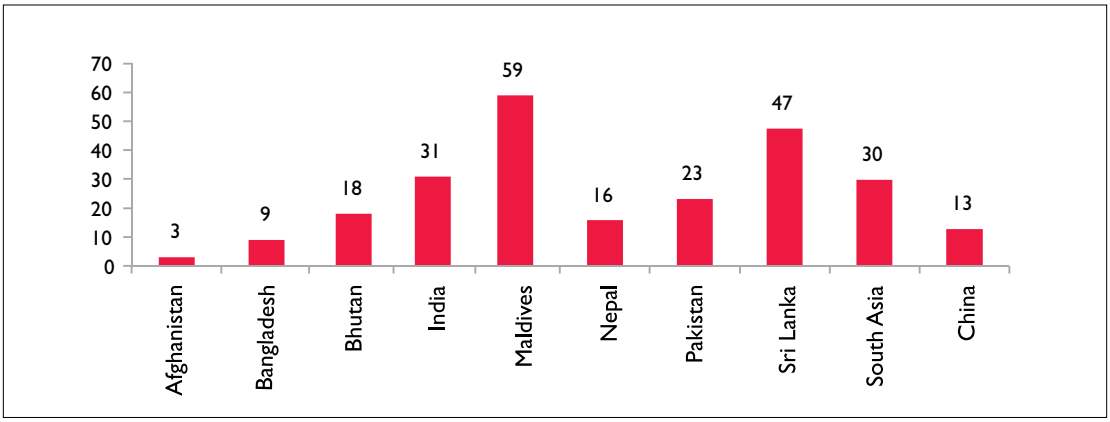
these countries. There is also a difference in time zone (15 to 30 minutes) between the countries of the region. The difference in the daily load curve provides opportunities for optimizing the load-generation balance across the region. Apart from this, the difference in designated weekends and annual festivities also offer similar opportunities. Seasonal differences among SA countries during the monsoon provides sufficient to excess hydro power output, whereas in lean periods (dry winter season), more thermal power support can be provided. Some of the key prospects for electricity trade are given in Table 7.

1.2.5 Dependence on Fossil Fuel Imports

Currently most of the SA economies are hugely dependent on fossil fuel resources for electricity generation and meeting energy requirements. To meet the growing demand for energy, primarily for electricity generation, these countries are importing fossil fuel resources from other regions of the world (Figure 4). An increasing proportion of oil import is being used to run millions of diesel-based agricultural pumps and back-up electricity support due to an unreliable grid supply. Those countries with a proportionately large share of diesel-based grid-connected generation capacity (especially the Maldives, Nepal, and Sri Lanka) also face the challenge of passing on an increasing oil cost to the ultimate consumers of electricity. Countries with a proportionately large share of diesel-based grid-connected generation capacity (especially Sri Lanka, Nepal, and the Maldives) also face the challenge of passing on increasing oil costs to the ultimate consumers of electricity.

To address the problem of an unreliable supply of electricity from the grid, telecom operators install diesel-based generators to power telecom towers. Fuel consumption by the diesel generators of telecom towers in India is estimated to be over 2 billion liters (TRAI, 2011), making it the second largest consumer of diesel in the country. Further, coal import for power plants in India during 2012-13 reached 62.5 million tons (CEA, 2013b). Sri Lanka remains most vulnerable to energy security due to a high dependence on energy imports. Owing to the lack of adequate domestic energy resources, Bangladesh and Sri Lanka are planning imported coal-based power plants (8,400 MW in Bangladesh by 2032 and 4,600 MW in Sri Lanka by 2030), thereby increasing their dependency on coal imports. Import-dependent countries in South Asia also face macroeconomic stress to balance of payment in case of slowdown in exports or inward investments. In the above context, to protect themselves from the increasing dependence on fossil fuel imports and price vulnerabilities, the South Asian nations are investing in the utilization of regional energy resources and cross-border transmission infrastructure.

Figure 4 **Net Energy Imports as a Percentage of Total Energy Use**



Source: World Bank (2013) and Prospects for Regional Cooperation on Cross-Border Electricity Trade

1.2.6 Synergies in Power System Development and Operation

The region currently witnesses power shortage and there is limited capacity for reserves in the national power systems. As the situation improves, the regulatory requirement could necessitate certain degree of reserves in the power system. Inter-connected power systems can significantly reduce the costs of maintaining such reserves across the region. Further, smaller nations cannot exploit economies of scale. By pooling cross-border electricity requirements, economies of scale in generation and investment can be exploited, thereby reducing the cost of supply to the exporting nation. A better hydro thermal mix will also be useful for balancing the load in terms of peak and off-peak load during a day. The existing hydro as well as thermal power plants can achieve better utilization by exploiting cross-border opportunities to meet daily as well as seasonal variations in demand as well as generation. Differences in daily load curves arise due to geographical location across the latitude, local weather conditions, difference in lifestyle and festivities, and so on. Better utilization of thermal capacities, particularly in the winter season when the output from hydro-electric plants is less, would also improve their overall thermal efficiency, thereby reducing the emission intensity of a unit of electricity production from such plants.

1.2.7 Sustainable and Clean Energy Development

The presence of large coal-based generation capacity, the use of oil in millions of diesel pumps in agriculture, and back-up electricity generators are imposing an increasing burden on the local as well as global environment. With a majority of the population residing in villages, the region's population is

Table 8 Key Targets Under INDC

Country	Key targets under INDC as submitted to UNFCCC
Afghanistan	NA
Bhutan	▪ Bhutan intends to remain carbon neutral where emission of greenhouse gases will not exceed carbon sequestration by our forests, which is estimated at 6.3 million tons of CO_2. ▪ Hydropower from run-of-the-river schemes accounts for almost 100 per cent of electricity generation in Bhutan with almost 100 per cent access to electricity in urban areas and 94 per cent in rural areas. Presently, Bhutan offsets 4.4 million tons of CO_{2e} through exports of hydroelectricity. ▪ In addition, Bhutan can offset up to 22.4 million tons of CO_{2e} per year by 2025 in the region through the export of electricity from clean hydropower projects.
Bangladesh	▪ An unconditional contribution to reduce GHG emissions by 5 per cent from Business As Usual (BAU) levels by 2030 or 12 Mt CO_{2e} by 2030 in the power, transport, and industry sectors, based on existing resources. ▪ A conditional 15 per cent reduction in GHG emissions from BAU levels by 2030 or by 36 Mt CO_{2e} by 2030 in the power, transport, and industry sectors, subject to appropriate international support in the form of finance, investment, technology development and transfer, and capacity building.
Nepal	NA
India	▪ To reduce the emissions intensity of its GDP by 33 to 35 per cent by 2030 from 2005 level. ▪ To achieve about 40 per cent cumulative electric power installed capacity from non fossil fuel-based energy resources by 2030 with the help of transfer of technology and low cost international finance, including from Green Climate Fund (GCF). ▪ To create an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent through additional forest and tree cover by 2030.
Pakistan	No specific targets
Sri Lanka	▪ Intends to reduce the GHG emissions against BAU scenario unconditionally by 7 per cent (energy sector 4 per cent, and 3 per cent from other sectors), and conditionally 23 per cent (energy sector 16 per cent and 7 per cent from other sectors) by 2030.

Source: Compiled by author from INDC submitted to UNFCC; http://www4.unfccc.int/submissions/INDC/Submission%20Pages/submissions.aspx

largely dependent on traditional fuels for cooking, lighting, and heating. In Afghanistan, 85 per cent of the energy needs are met by traditional fuels such as fuel wood, animal dung, and agricultural wastes; this dependence is about 87 per cent for Nepal. Women have to travel long distances to collect firewood in the rural areas, which are not yet electrified. South Asian countries are most vulnerable to the impact of climate change and expected to be at the receiving end of the impact of climate change unless significant effort is made to decarbonize the SA power sector. Apart from an improvement in the efficiency of existing and new generating plants and electrical appliances, the rapid deployment of renewable energy such as solar and wind and a higher share of hydro-electric capacity can significantly reduce the carbon footprint of the power sector in the region. Recognizing this, SAR governments have submitted Intended Nationally Determined Contributions (INDC) to the United Nations Framework Convention on Climate Change (UNFCCC), which will significantly decarbonize the South Asian power sector (Table 8).

Regional energy cooperation can help tap the available hydro and renewable resources, and improve the system's efficiency by exploiting opportunities to trade electricity. This will reduce the overall emissions from the sector at the regional level and help in achieving the INDC targets as well as spur the development of sustainable and clean energy in the SAR.

1.3 Benefits of Enhancing CBET in the SAR

As already stated, the concept of CBET in the SAR needs to be taken to the next level through developing a requisite inter-regional electricity transmission infrastructure and establishing a regional power market. The overall benefits from CBET can broadly be segregated across operational, economic, and environmental benefits:

1.3.1 Operational Benefits

Operational benefits would arise through the optimization of the available resources through robust system integration based on rational planning and execution. The key operational benefits would include:

- Achieving the optimal capacity utilization factor of a country's thermal and hydropower plants that would be independent of the seasonal/daily demand variations in the country owing to their utilization for meeting the regional electricity demands.
- Achieving economies of scale by consolidating the capacity addition requirements of smaller countries to develop a single generation plan of larger size.
- Enhanced reliability through multiple transmission links among generation pockets and demand centers in the region.
- Optimized transmission capacities through setting up *high voltage-high capacity* inter-regional transmission systems, thereby minimising land requirements for multiple intra-country transmission systems in a non-CBET regime.

1.3.2 Economic Benefits

CBET can provide significant economic benefits and, in fact, can drive the economies of South Asian countries. Some of the economic benefits are a) Power availability at competitive price b) High export income due to power export c) Less exposure to volatile international energy prices leading to a reduction in the buying of energy from outside.

The World Bank study, 'How Much Could South Asia Benefit from Regional Electricity Cooperation and Trade?' quantifies the key benefits from regional electricity cooperation as:

- Unrestricted electricity trading would result in electricity supply costs of USD 226 billion over the study period (25 years).
- Present value of benefits, in the form of reduction of fuel costs, to the present value of increased costs due to generation and interconnection, would be 5.3.
- Reduce regional power sector carbon dioxide emissions by 8 per cent, mainly because of substitution of coal-based generation with hydro-based generation.

1.3.3 Environmental Benefits

Environmental sustainability would be a key outcome from enhanced CBET in the SAR. Some of the major benefits to the environment include:

- Lower impacts on the environment by tapping the significant untapped hydropower capacities in the region.
- Enhanced electricity access would help minimise the usage of kerosene for cooking and domestic lighting, thereby reducing indoor air pollution.
- Fast tracking of the development of other renewable energy generation resources in the region through sharing of industry practices among the CBET members would help preserve the conventional sources for the future.

The benefits from a large-scale CBET are immense for the SAR. It is, therefore, imperative for all countries in the region to work closely to develop the necessary policy and infrastructural enablement for large-scale institutionalization of CBET at the earliest. The operational benefits would arise through the optimization of the available resources and robust system integration based on rational planning and execution.

2. Policy, Legal, and Regulatory Scenario: Evolution of Power Markets and CBET in the SAR

It is essential to understand the power sector institutional structure and the stage of evolution of the regulatory regime in the countries' power sector (impacting power trading, specifically) to understand barriers for CBET in the SAR. These have been detailed in this section.

2.1 Power Sector Institutional Structure in the SAR

SAR countries are in different stages of evolution in terms of power market structure. The ownership of the generation segment is mixed. There is private sector participation in the form of Independent Power Producers (IPPs) in Bangladesh, India, Nepal, Pakistan, and Sri Lanka. However, the bulk of generation assets remain state-owned, and many of the IPPs constitute small-scale and costly plants that started operation as a response to crises in electricity availability, particularly in Bangladesh and Pakistan.

Table 9 Institutional Structure of Power Sector in SAR

	Afghanistan	Bangladesh	Bhutan	
Policy	Under various ministries – Energy & Water, Mines, Commerce & Industries, among others	Ministry of Power, Energy, and Mineral Resources	The Ministry of Economic Affairs	
Regulation	-	BERC – Bangladesh Energy Regulatory Commission	Bhutan Electricity Authority (BEA)	
Generation	Da Afghanistan Breshna Sherkat (DABS)	Bangladesh Power Development Board (BPDB) and its subsidiaries companies, IPPs	Public sector (DGPC), IPPs	
Transmission	DABS	PGCB – Power Grid Company of Bangladesh Limited	BPC	
System operation	DABS	NLDC of PGCB	BPC	
Distribution	DABS	BPDB and subsidiary distribution companies	BPC	
Trading	DABS	BPDB	BPC	

Transmission and distribution remain largely under government ownership across the region. In India, private investors are permitted to invest in the creation of transmission infrastructure under a license. A number of transmission links have been created in this manner, including those between Bhutan and India, which have been constructed under a joint ownership agreement between the private investors and the Government of India. The Indian states of Delhi and Odisha, and one distribution area in Pakistan (in Karachi), are some of the examples of privatized electricity distribution in the region.

Independent regulatory commissions have been introduced in the majority of SAR countries. The process is still pending in Nepal and remains partially implemented in Bhutan. More generally, the reform process has been slow in most of the SAR countries. In Sri Lanka, for example, a new Electricity Act was enacted only in 2009. Even in India, where the reform process has operated for almost two decades, there is significant scope for reforms in the distribution segment.

A brief snapshot of the institutional structure of the power sector in the SAR is shown in Table 9.

In India, market-oriented reform has had to face a number of challenges, although market-oriented activity, including short-term competitive power markets, is increasing. There is evidence that reform

	India*	Nepal	Maldives	Pakistan	Sri Lanka
	Ministries of Power, Renewable Energy, Coal, Oil and Gas, state-level ministries/energy and power departments	Ministry of Water Resources; multiple councils and commissions	Multiple ministries of Energy, Water and Environment; Trade and Industries, etc.	Ministry of Water & Power, National Economic Council	Ministry of Power & Energy
	Central Electricity Regulatory Commission (CERC) and state-level SERCs	ETFC/NERC (still under finalization)	-	National Electric Power Regulatory Authority (NEPRA)	Public Utilities Commission of Sri Lanka (PUCSL)
	Public sector (NTPC, NHPC, and so on), state-owned generation utilities, IPPs	Nepal Electricity Authority, IPPs	State Electric Company, Island Development Committees (IDCs), and private companies	State-owned generation companies for thermal, WAPDA for hydel, and IPPs, Karachi ESCO	Ceylon Electricity Board (CEB) and IPPs
	PGCIL, state transmission utilities, and other licensees (private/joint ventures)	NEA	-	National Transmission & Power Dispatch Company (NTDC)	CEB
	POSOCO (NLDC and 5 RLDCs); SLDCs of states	NEA	-	NTDC	CEB
	State distribution companies (discoms), private discoms, franchisees	NEA	Electric provider is also responsible for distribution	Government-owned electric supply companies (ESCOs) and KESCO, a private company	CEB and Lanka Electricity Company Ltd (LECO)
	Discoms, traders (PTC, NVVN, private traders, captive plants, bulk purchasers, IPPs)	NEA	-	-	CEB

in India since the early 1990s has improved operational efficiencies though effects are not necessarily realized immediately. While the country has embraced deeper market reforms that improved competition in the generation and transmission sectors, the distribution sector continues to exhibit serious operational inefficiency as well as financial losses.

A summary of the power sector structure and the timelines of the reform process is shown in Table 10.

Table 10 Summary of Power Market Structure in SAR

Country	Nominal generation market structure	Private sector participation			Independent regulator	Transmission arrangement
		Generation	Transmission	Distribution		
Afghanistan	Vertically integrated	-	-	-	-	Vertically integrated
Bangladesh	Multiple sellers, single buyer	1992	-	-	2003	Unbundled transmission owner
Bhutan	Multiple sellers, single buyer	2008	-	-	-	Vertically integrated
India	Competition with organized trading, but includes state-owned enterprises	1991	2000 (MoP Guidelines: ITPC and Joint Venture routes for private investments)	1999 (Odisha); 2002 (Delhi); and in some large cities subsequently	1996 (Odisha); 1998 (national) and subsequently in all the states (except J&K) and of Union Territories (JERC)	Unbundled transmission and independent system operator
Maldives	Vertically integrated	NA	NA	NA	-	Vertically integrated
Nepal	Multiple sellers, single buyer	1992	-	-	1994/2011	Vertically integrated
Pakistan	Multiple sellers, single buyer	1994	1995	1998 (KESC)	1995	Unbundled transmission owner
Sri Lanka	Multiple sellers, single buyer	1996	-	-	2002/2009	Vertically integrated

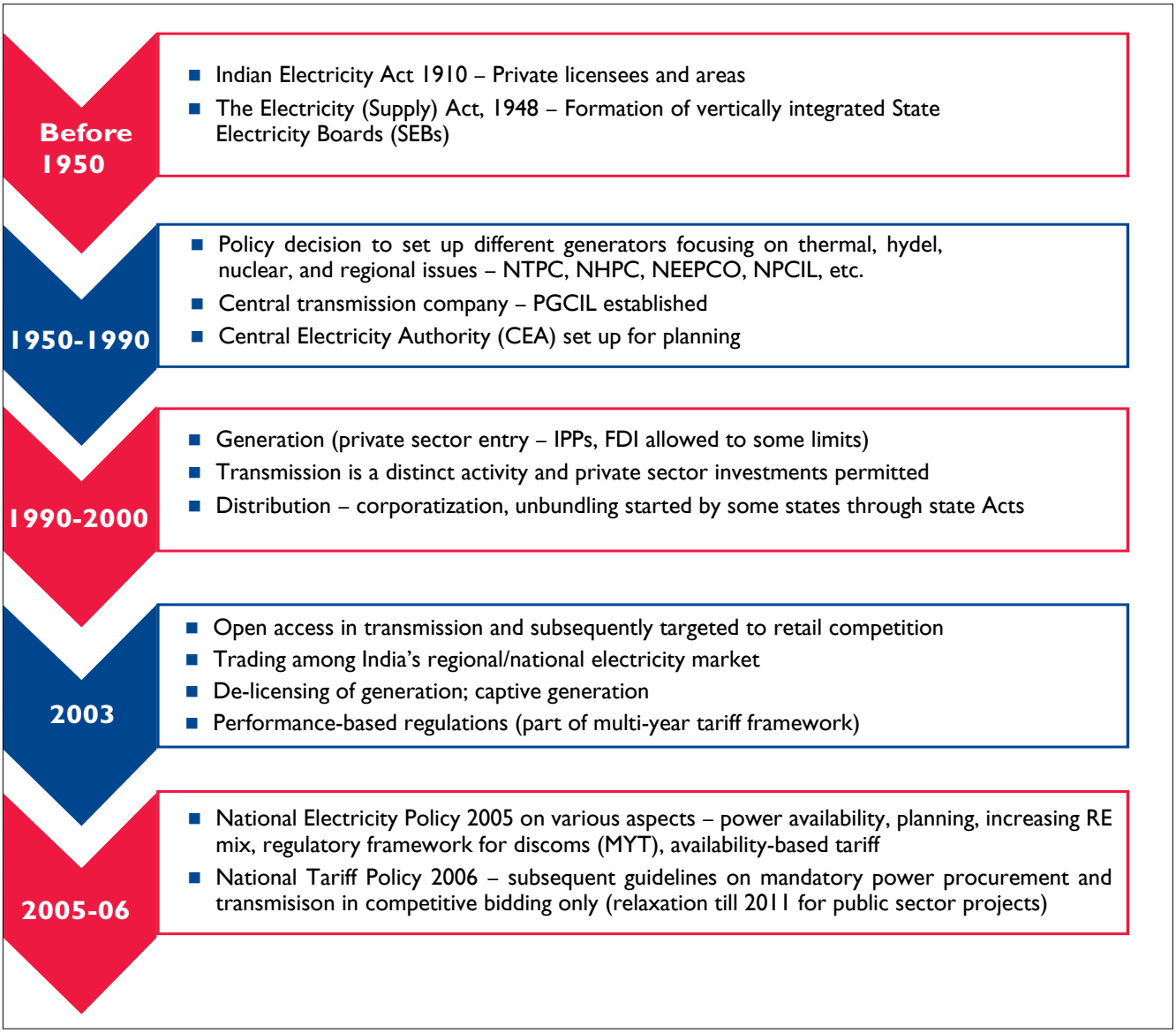
Source: World Bank Paper, Cross-Border Electricity Cooperation in South Asia, by Anoop Singh, Tooraj Jamasb, Rabindra Nepal, Michael Toman, June 2015

2.2 Key Legal, Policy, and Regulatory Frameworks from the Perspective of the Power Market and CBET Development in SA

2.2.1 India

India has an evolved power market among all the SAR countries. Although policy and regulatory reforms started in the 1990s in various states, the Electricity Act 2003 (EA '03) can be considered as a watershed event that has brought a paradigm shift in the power market structure of the country. The key points in the regulatory evolution in the country until the introduction of EA '03, the National Tariff Policy and the National Electricity Policy, are presented in Figure 5.

Figure 5 **Policy and Regulatory Evolution**



Key policy and regulatory changes that have an impact on the power market scenario today are:

Generation and Power Procurement

The EA '03 introduced competition in the generation segment and subsequently competitive bidding guidelines and standard bidding documents for the power procurement were introduced, as well as the National Electricity Policy and the National Tariff Policy. Also, policies on Ultra Mega Power Plants (UMPP) and mega power projects were introduced to incentivize large-scale power projects.

Post-2011, India has changed its approach for tariff determination from the cost plus regime to the competitive bidding regime. Procurement of power is mandated to be through open and competitive bidding only. There are two modes for power procurement:

- Case 1: Location, technology, and fuel being determined by the bidder, who is responsible for obtaining clearances/approvals.
- Case 2: Land and fuel is provided by the procurer, who is responsible for obtaining clearances.

These have subsequently been replaced with Design, Build, Finance, Own and Operate (DBFOO) and Design, Build, Finance, Own and Transfer (DBFOT) modes, which are currently in operation considering the challenges in fuel procurement and cost risks for bidders. The competitive bidding regime is still evolving and new bidding documents for power procurement are under finalization (on a Build, Own, and Operate [BOO] basis). Many private players/IPPs) have set up power plants (mainly thermal assets). As on November 30, 2015, the private sector contributed to 37 per cent of the total thermal installed capacity of ~196 GW in the country.

Transmission

The transmission segment was by public sector monopoly till EA '03 and private sector participation was effectively introduced after 2006 (Figure 6). Many bidders participated in intra-state and inter-state bidding for transmission projects and obtained the corresponding licenses.

Figure 6 Timeline of Major Policy in Power Transmission

2000
- MoP guidelines: Independent Private Transmission Company (IPTC) and Joint Venture routes for private investments

2003
- Electricity Act: Provision for private transmission licensees
- Separation of system operation from licensee

2005
- National Electricity Policy: Encourages private investments in transmission

2006
- Tariff-based competitive bidding guidelines for transmission by MoP
- VGF scheme notified along with model documents by MoF/Planning Commission

2008-till date
- Standard Bidding Documents (SBDs), transmission agreement, etc., notified for two modes of private sector participation
- Multiple amendments

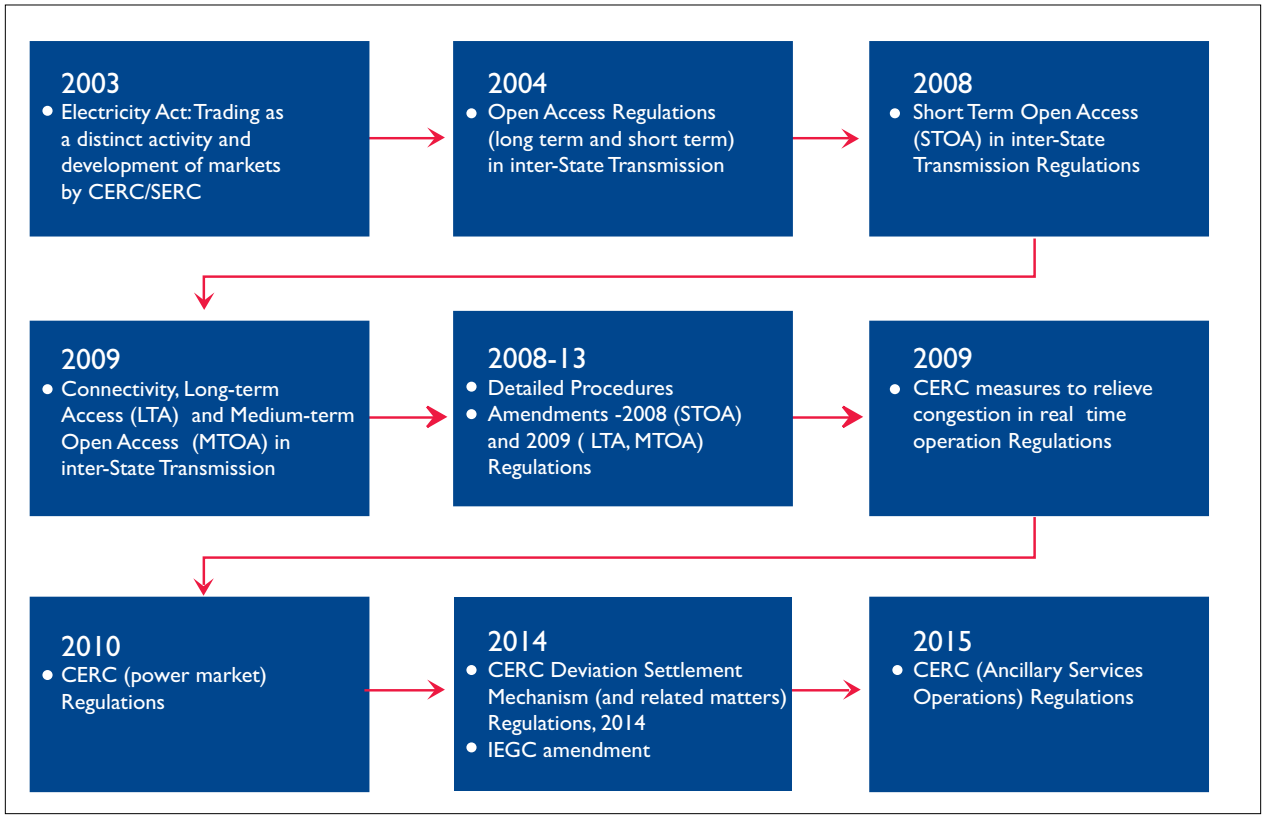
2010
- POSOCO grid operator formed as subsidiary of POWERGRID
- Expected to be completely government-owned and operate as independent system operator
- CERC POC regulations – sharing of inter-state transmission charges and losses

With the entry of multiple transmission licensees in the segment, there was a requirement to move from Transmission licensee and System Operator (TSO) to Independent System Operator (ISO). Power System Operation Corporation Limited (POSOCO) has been hived off by Powergrid Corporation of India Limited (POWERGRID) as a 100 per cent subsidiary. The transmission pricing has also moved from the postage stamp method to Point Of Connection (POC) in 2010, which incorporates distance and direction sensitivity in the pricing and avoids a pancaking effect in prices. This is particularly important for the long distance inter-regional transfer of power for effective price discovery.

Power Market and Trading

The EA '03 identified 'Power Trading' as a separate activity to maximize resource utilization and promote competition. A key enabler for power trading is the introduction of non-discriminatory open access to the transmission networks. CTU/STUs have also defined detailed open access procedures to promote power trading operations in the country. The open access regulations came into effect in 2004; these facilitated the evacuation of power from the generating sources to demand. In 2008, regulations for short-term open access were separated and, in 2009, regulations for connectivity, long-term access, and medium-term open access were in place. Subsequent amendments over 2012-14 took time limit for injection of infirm power, connectivity of renewable and start-up power. Considering the issues in the prevailing open access regime – higher withdrawal requirement of states than allotted, differences in foreseen and estimated power flows, and so on – a new concept is being proposed: General Network Access, which is expected to resolve these issues. The key milestones in policy and regulation related to the development of the power market are mentioned in Figure 7.

Figure 7 Key Milestones of Policy/regulation in Power Market Development in India



Scheduling and Balancing Mechanism

The Indian Electricity Grid Code is in place since 1999 (last revision in 2010) for scheduling and dispatch. For imbalance settlement, there is a deviation settlement regulation since February 2014, repealing the hitherto prevailing Unscheduled Interchange (UI) regulations. For handling congestion in real-time, CERC's congestion management regulations is in place. With the recent amendment of the Indian Electricity Grid Code and UI regulations/deviations settlement mechanism regulations, the frequency band is now narrowed to 49.9-50.05 Hz.

Types of Transactions and Power Exchanges

The operation of power markets in India are guided by CERC (power market) regulations, 2010 and amendments thereof. There are multiple transactions prevailing in the Indian power market for the short term.

Bilateral transaction between a specified buyer and a specified seller directly or through a trading licensee from a specified point of injection to a specified point of withdrawal for a fixed or varying quantum of power (MW).

Collective transactions: A set of transactions discovered in power exchange through anonymous, simultaneous competitive bidding by buyers and sellers. India has two power exchanges – IEX and PXIL. Power exchanges offer different products depending on time and tenure – day-ahead and term-ahead markets.

- Day-Ahead-Market (DAM) is a physical electricity trading market for deliveries for 15-minute time blocks in 24 hours of the next day, starting from midnight. The prices and quantum of electricity to be traded are determined through a double-sided closed auction bidding process. The operations are carried out in accordance with the 'Procedure for Scheduling of Collective Transactions' issued by the Central Transmission Utility (PGCIL), CERC (Open Access in Inter-State Transmission) Regulations, 2008, as amended from time-to-time and the Bye-Laws, Rules and Business Rules of the Exchange. Features:
  - Trading of 15-minute contracts.
  - Double-sided anonymous auction bidding process.
  - Clearance obtained from SLDC by power exchange based on the availability of network and ABT meters.
  - Congestion management through market splitting and determining Area Clearing Price (ACP) specific to an area.
  - Risk management through the requisite margin, including any additional margin as specified for the respective trading segment or the type of contracts.
- Term-Ahead-Market (TAM) provides a range of products allowing participants to buy/sell electricity on a term basis up to 11 days ahead. The operations are carried out in accordance with the 'Procedures for Scheduling of Bilateral Transactions' issued by the Central Transmission Utility (PGCIL), under 'CERC (Open Access in inter-State Transmission) Regulations, 2008', as amended from time-to-time and the Bye-Laws, Rules and Business Rules of the Exchange. Currently, products in TAM include Intra-day, Day-Ahead Contingency, Daily and Weekly contracts to help participants manage their electricity portfolio for different durations.[4]

The Electricity Act of 2003 does not mention CBET. The Act only recognizes domestic trading. Domestic electricity trading is a licensed activity and is governed by CERC regulations, 'Procedure, Terms, and Conditions for Grant of Trading License and Other Related Matters (2009)'. Further, the

[4]http://www.iexindia.com/products.aspx?id=14&mid=2

Clause 2(1) (k) of these Regulations mentions that 'Inter-state trading means the transfer of electricity from the territory of one state for re-sale to the territory of another state and includes electricity imported from any other country for re-sale in any state of India'.[5]

The Statement of Reasons issued by CERC while issuing the 'Procedure, Terms, and Conditions for Grant of Trading License and Other Related Matters' Regulations, 2009, states that the import and export of electricity falls under the purview of the Ministry of External Affairs (MEA). The concurrence of MEA has to be obtained before the grant of a license for the import and export of electricity. The Electricity Act of 2003 does not foresee the grant of a license by the Commission for the export of electricity. CERC regulations are intended to regulate electricity only after the stage of import. In 2012, CERC has amended the 'Procedure, Terms, and Conditions for Grant of Trading License and Other Related Matters' Regulations, 2009 and the Central Electricity Regulatory Commission (Procedure, Terms, and Conditions for Grant of Trading License and Other Related Matters) (First Amendment) Regulations, 2012, has come in to force. In these amended Regulations, the definition of 'interstate trading' has been amended as follows:

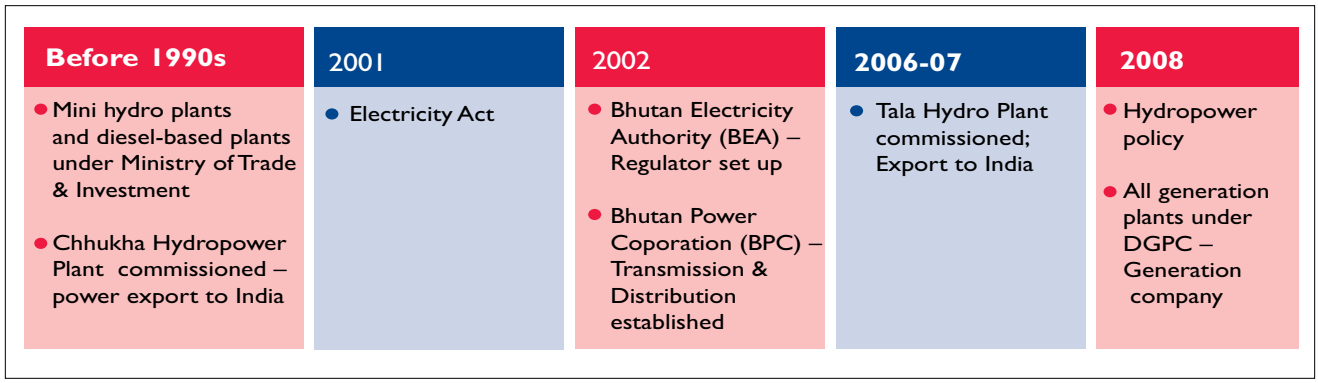
> 'inter-state trading' means purchase of electricity from one state for re-sale in another state and includes electricity imported from any other country for re-sale within India or exported to any other country subject to compliance with applicable laws and clearances by appropriate authorities.[6]

2.2.2 Bhutan

Bhutan is the only country in South Asia with surplus power generation capacity. A major turning point in the overall development of the power sector was the commissioning of the 336 MW Chhukha Hydro Power Plant together with transmission links to connect the power station to both Bhutan's domestic network and the Indian grid in 1988. In 2002, the Government restructured the Department of Power of the Ministry of Trade and Industry into the (i) Department of Energy (DOE) as the Government's policy and planning agency; and (ii) Bhutan Power Corporation (BPC) as the utility service company responsible for the transmission, distribution, and supply of electricity. DOE, under the renamed Ministry of Economic Affairs, continues to be the nodal agency for all planning and coordination activities for the energy sector.

The policy and regulatory scenario evolved subsequently and some of the key milestones are mentioned in Figure 8.

Figure 8 Policy and Regulatory Scenario Evolution in Bhutan



[5]http://www.cercind.gov.in/2012/regulation/11october.pdf
[6]http://www.cercind.gov.in/2012/regulation/11october.pdf

The Bhutan Electricity Authority (BEA) was set up as the sector regulator in 2002 under the Electricity Act of 2001. It was initially established as a functional autonomous agency as per Section 7 of the Electricity Act of Bhutan, 2001, to restructure and regulate the electricity supply industry, to allow private sector participation in the electricity supply industry based on the policy approved by the Royal Government of Bhutan, and to empower the Royal Government to create companies for carrying out all or any of the purpose of the Act. The BEA was, however, granted full autonomy by the Royal Government in January 2010. Bhutan's overall policy and regulatory framework is shown in Table 11.

Table 11 Bhutan – Policy and Regulatory Framework

	Generation	Transmission	Distribution	System Operator	Electricity Trade
Enabling Act/Policy	EAB 2001/ SHDP 2008	EAB 2001	EAB 2002	EAB 2003	EAB 2001/ SHDP 2008
Regulations	Dam safety guidelines (under formulation)	Grid code	Distribution code	Grid Code	PPAs/BAs
Licensing/Nodal authority	BEA/DHPS, MoEA	BEA/DHPS, MoEA	BEA/MoEA	BEA/MoEA	BEA/MoEA
Operational entity	DGPC/SPVs	BPC	BPC	NLDC (BPC)	DGPC/SPVs

The Electricity Act, 2001 and Bhutan Hydropower Policy, 2008, are the major Act and policy guidelines for the electricity sector of Bhutan. The Act enables the restructuring of the power supply industry, and the possible participation of the private sector, by providing mechanisms for licensing and regulating the operations of power companies. It defines the roles and responsibilities of suppliers and protects the interests of the general public. The major purpose of this Act is to provide the technical regulation of the electricity supply industry and to enhance revenue generation through the export of electricity. It also provides for the restructuring of the power sector.

The Electricity Act of 2001 recognizes the 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, and so on. For instance, the BEA has granted a license to Dagachhu Hydropower Corporation Limited (or licensee) to carry out the activities of construction, generation, supply, and export. The license is subject to the provisions of the Electricity Act of 2001, regulations and directives made by the BEA from time-to-time, and any other laws applicable to Bhutan. The license places certain obligations on the licensee to obtain environmental clearances as per the Environment Assessment Act of 2000. Further, the licensee is required to enter into one or more performance agreements as and when required by the Authority. The licensee is expected to plan, construct, and maintain the hydropower plant. The license clearly mentions that the licensee is authorized to construct, operate, distribute, and export electrical energy to India. In accordance with the conditions mentioned in the license, the licensee shall comply with Quality of Supply requirements and indicators set out in the BEA–Grid Code Regulations 2008. The license also mentions other conditions such as tenure and penalties in case of non-compliance.

The current India-Bhutan power trade is governed by a) bilateral projects through framework agreement between the Royal Government of Bhutan and the Government of India for cooperation in the field of hydropower power sector, and b) joint venture projects through an Inter-Governmental Agreement[7] between Bhutan and India on the development of joint venture hydropower projects.

[7]http://www.mea.gov.in/press-releases.htm?dtl/23230/InterGovernmental+Agreement+between+Bhutan+and+India+on+development+of+Joint+Venture+Hydropower+Projects

The framework, 'Inter-Governmental Agreement between the Royal Government of Bhutan and the Government of the Republic of India Concerning the Development of Joint Venture Hydropower Projects through the Public Sector Undertakings (PSUs) of the Two Governments', was signed on April 22, 2014 .The Inter-Governmental Agreement provides the framework for implementing four HEPs totalling 2,120 MW, subject to the completion of the due process of appraisal of their DPRs including techno-economic viability, on a joint venture-model between the PSUs of the two countries, as shown in Table 12.

Table 12 India-Bhutan Joint Venture Projects

Capacity and name of HEP	JV partners
600 MW Kholongchu HEP	SJVN Ltd. of India and Druk Green Power Corporation (DGPC) of Bhutan
180 MW Bunakha HEP (with 230 MW downstream benefit from Tala, Chukha, and Wangchu HEPs)	THDC Ltd. of India and Druk Green Power Corporation (DGPC) of Bhutan
570 MW Wangchu HEP	SJVN Ltd. of India and Druk Green Power Corporation (DGPC) of Bhutan
770 MW Chamkarchu HEP	NHPC Ltd. of India and Druk Green Power Corporation (DGPC) of Bhutan

There is no internal power market in the country since there is only one generation company (DGPC) and one transmission and distribution company (BPC). The balancing and settlement for power from Bhutan is being done currently at the periphery of the importing Indian states.

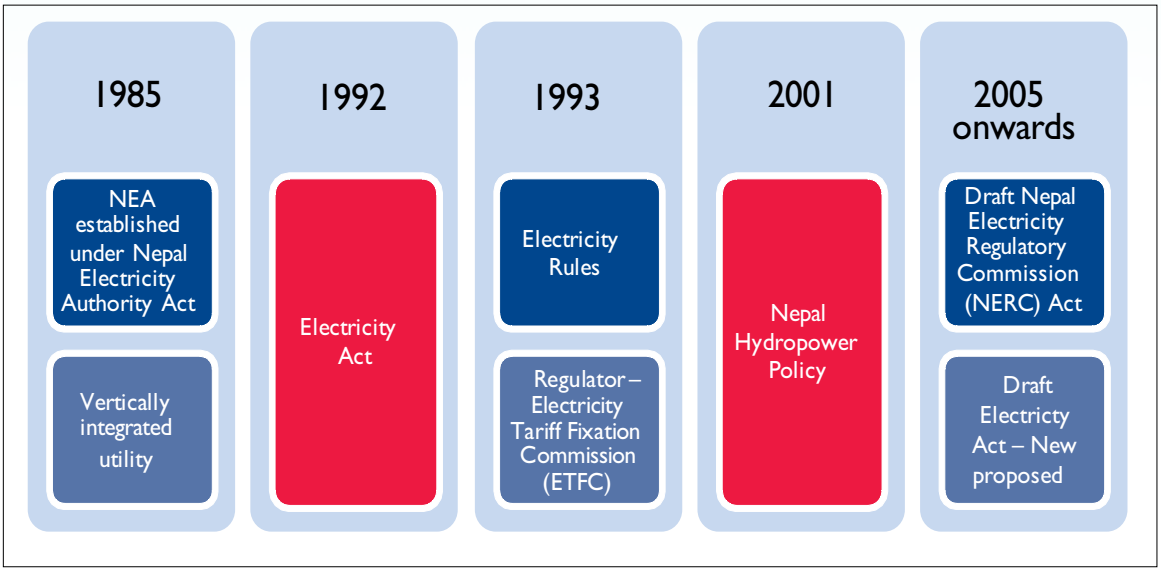
2.2.3 Nepal

Nepal's power sector has been dominated by the Nepal Electricity Authority (NEA), a 100 per cent government utility, established in 1985 under the NEA Act 1984, by amalgamating the Electricity Department, Electricity Development Boards, and the Nepal Electricity Corporation (NEC). The NEA is primarily responsible for planning, construction, and operation for electric supply. The Ministry of Water Resources has the general responsibility for all private and public activities related to electricity supply, including the NEA. The NEA is an entirely state-owned, vertically-integrated organization, responsible for the generation, transmission, distribution, and retail of electric power. The NEA is controlled by a management board, headed by the Minister and with members drawn both from within and outside the government.

Electricity Act 1992 was enacted for the management and development of electricity by regulating the survey, generation, transmission, and distribution of electricity and also to standardize and safeguard the electricity services. The Act details the licensing for hydro power, tariff determination by the Tariff Fixation Commission, royalty, taxes and duties, and import and export conditions. Subsequently, in 1993, the Electricity Rules & Regulations and the Electricity Tariff Fixation Commission (ETFC) regulations were framed. The Electricity Act, 2049 (1992) does not explicitly mention the import and export of electricity as licensed activities. However, Section 22 of the Act mentions:

> Import and Export of Electricity: 10 (1) If the licensee desiring to distribute electricity by importing the same within Nepal may do so by obtaining prior approval of the Government of Nepal as prescribed. (2) The licensee desiring to export electricity generated on its own to the foreign country may do so by entering into an agreement with the Government of Nepal.

Table 13 **A Brief Snapshot of Nepal Power Market Evolution**



Some of the key laws relevant to hydropower development in Nepal are: 1) Electricity Act, 1992 2) Water Resources Act, 1992 3) Foreign Investment & Technology Transfer Act, 1992 4) Industrial Enterprises Act, 1992 5) Environment Protection Act, 1997 6) Forest Act, 1993 7) National Parks and Wildlife Conservation Act, 1973 and its amendment 8) Land Acquisition Act, 1977.

Some of the key policies relevant to hydropower development in Nepal are 1) Hydropower Development Policy, 2001 2) Water Resources Strategy, 2002 3) National Water Plan, 2005.

The Draft New Electricity Act is presently under consideration of the Parliament. Some of its key features are:

- Rights and privileges of the local people
- Up to 10 per cent equity share for local people
- Electrification in the area of half-a-kilometer radius of headworks and powerhouse
- Free 20 units of electricity
- 52 per cent of the royalty goes to the local government
- Additional 1 per cent to the Village Development Committee (VDC) from free energy

There is also a Draft Nepal Electricity Regulatory Commission Act presently under consideration of the Parliament, which proposes the Nepal Electricity Regulatory Commission to a) be an independent commission b) create level playing field for all players c) create an investment-friendly environment d) protect the consumers' (and other stakeholders') interest d) monitor and regulate the sector and e) fix the tariff at various stages of transaction.

Model PPA with IPPs: Presently there are various IPPs who sell power to the NEA (single buyer) as per a model Power Purchase Agreement (PPA). Presently the NEA is also the nodal agency for power export to India.

Power Market: As the NEA is the only utility apart from private IPPs (generators), there is no internal power market. The Government has started the unbundling of the NEA[8] and has decided to form the National Transmission Grid Company (NTGC), paving the way for the formation of a separate entity to work for the development and operation of electricity transmission lines; NTGC has been registered.[9] The Government of Nepal is also in the process of setting up a trading company such as the Power Trading Corporation of Nepal to take care of electricity trading.

The history of power exchange goes back some decades. It started with the signing of the Koshi Treaty in 1954 between India and Nepal. In 1971, Indo-Nepal power exchange commenced with just 5 MW in the initial years. Cross-border power exchange was governed through the a) River Treaty: Koshi Treaty, Gandak Treaty, and Mahakali Treaty b) Contiguous Border Town Exchange Program c) Commercial Power trading with PTC India during dry seasons. Nepal-India power exchange is governed through the Power Exchange Committee (PEC).

2.2.4 Bangladesh

The electricity sector of Bangladesh has undergone reform since the mid-1990s, including the unbundling of the state-owned energy supplier, the BPDB, into separate companies responsible for power generation, transmission, and distribution. At present the BPDB is functioning as a single buyer, and purchases power from IPP as required. The BPDB is responsible for a major portion of generation and distribution of electricity mainly in urban areas except in Dhaka and the West zone of the country. The Board is under the Power Division of the Ministry of Power, Energy and Mineral Resources, Government of Bangladesh.

Although generation, transmission, and distribution have been opened to foreign and private sector involvement, these sectors remain dominated by state-owned entities. The BPDB accounts for over 70 per cent of the electricity generated in Bangladesh. This share also includes the first BPDB-founded subsidiaries, such as the Ashuganj Power Company (APS), which originated with the transformation, in 2002, of the state-owned Ashuganj Power Station into a joint stock company. IPPs have been allowed to enter the market since 1996. Since then, the responsibility for the operation and expansion of the entire electricity transmission grid has remained with the PGCB, a subsidiary of the BPDP. Since the start of the power reform process in 1996, the DPDCL (formally the DESA) has shared electricity distribution operations in the capital with the DESCO, a state-run joint-stock company. In addition, a power distribution company, the West Zone Power Distribution Company (WZPDC), was established in 2003 as a BPDB subsidiary, and is responsible for the country's south-west area. The BERC Act 2003 is the major Act in Bangladesh that makes the provisions for the establishment of an independent and impartial regulatory commission to create an atmosphere conducive to private investment in the generation of electricity, and transmission, transportation and marketing of gas resources and petroleum products, to ensure transparency in the management, operation, and tariff determination in these sectors; to protect consumers' interest, and to promote the creation of a competitive market.

A brief snapshot of key legal and policy interventions that lead to the power market evolution are shown in Table 14.

[8]http://www.nepalenergyforum.com/unbundling-of-nea-starts/
[9]http://www.nepalenergyforum.com/transmission-grid-company-registered/

Table 14 A Brief Snapshot of Bangladesh Power Market Evolution

Before 1990	1990-2000	2000 onwards
• Electrcity Act 1910 – Private licensees and areas	• National Energy policy in 1995 • Private sector power generation policy in 1996 to promote private sector investments • Policy guidelines for small power plants in the private sector – 1998	• BERC Act 2003 • Bangladesh electrity regulator – BERC set up in 2003 • Updated National Energy policy in 2005 • Policy Guidelines for Enhancement of Private Participation in the Power Sector 2008 • Policy Guidelines for Commercial IPP, 2008 • Policy Guidelines for Commercial IPP (Amendment), 2010 • Renewable Energy policy of Bangladesh

The Bangladesh Electricity Regulatory Commission Act of 2003 does not mention the export and import of electricity as a licensed activity. However, the Electricity (Amendment) Act, 2012,[10] intends to create a power market in Bangladesh and says that the BERC is to decide on the introduction, operation, and maintenance of an independent, fair and competitive market structure for bulk trading of electricity in the country. It also recognizes CBET and says that, "the Board and/or the Single Buyer may import electricity from and export to any foreign state using the transmission system of the country with previous sanction of the Government at such rate as may be determined by the Government".

2.2.5 Sri Lanka

Sri Lanka's electricity generation to serve the national grid until 1996 was operated entirely by state-owned institutions, initially by the Department of Electrical Undertakings (until 1969) and subsequently by the Ceylon Electricity Board (CEB). The CEB owns and operates the entire electricity transmission network, while some lines are owned and operated by the Lanka Electricity Company Ltd. (LECO). LECO was established in 1983 to distribute electricity in areas previously served by local authorities. It purchases electricity from the CEB, and distributes it among retail and bulk customers in their designated areas.

The Sri Lanka Electricity Act, No. 20 of 2009 was enacted on April 8, 2009. This Act repealed the Electricity Act of 1950 and the Electricity Reform Act of 2002, and brought minimal amendments to the Ceylon Electricity Board Act of 1969 to accommodate regulatory reforms to the electricity industry.

Previously, the regulatory and policy-making powers were with the Minister of Power and Energy. The Act clearly separates functions: operation, regulation, and policy-making in the electricity industry and the Government established the Public Utilities Commission of Sri Lanka (PUCSL) in 2002 as a regulator for the energy and water sectors, under the PUCSL Act 2002. The Electricity Reform Act 2002 was introduced to empower the PUCSL to issue licenses and determine electricity tariffs. The PUCSL is entrusted with the task of technical, safety, and economic regulation of the industry. This Act also makes it mandatory for the PUCSL to protect consumer interests, for instance via publishing consumer rights and obligations, and conducting public hearings when making critical decisions, such

[10]http://asialeds.org/sites/default/files/resource/file/33.pdf

as approving tariffs. However, the Act did not become fully effective and the PUCSL has only been advising the Government on policy decisions, including tariff settings. To complete the regulatory reform, the Sri Lanka Electricity Act was passed by Parliament in March 2009, to replace the Electricity Reform Act.

In 2010, Sri Lanka launched a program of feed-in tariffs and has now some of the highest tariffs in the developing world. The following technologies are eligible up to a capacity of 10 MW:

- Wind energy
- Hydro energy
- Mini-hydro
- Biomass technology

The tariffs are cost-based and technology-specific, and the developers have the option of selecting either a three-tier tariff or a flat tariff. The flat tariff is a fixed-price track without inflation protection, and a complex track that varies the tariff with the price of the base fuel rate, operations, and maintenance, and the year of operation. The three-tier tariff option provides a different tariff depending upon the year of operation. There is one tariff for years 1 to 8, another for years 9 to 15, and a third tariff for years 16 and above. The CEB is obliged to make Standardized Power Purchase Agreements (SPPAs) for electricity generated from Non-Conventional Renewable Energy (NCRE) sources, signed on or after November 25, 2010.

The state is expected to retain its dominance in power generation over the long term, as per the Sri Lanka Electricity Act of 2009. The Act requires that any plant with more than a 25 MW capacity be ultimately controlled by the Government.

The major policies related to the power sector include:

- Policy on Electricity Tariffs 2011 (Section 82 of Budget speech 2011)
- General Policy Guidelines on the Electricity Industry for the Public Utilities Commission of Sri Lanka (issued on June 2009)
- National Energy Policy and Strategies of Sri Lanka (Extraordinary Gazette No. 1553/10 published on June 10, 2008)
- National Policy for Off Grid Hydro Power Generation (DRAFT)
- Renewable Energy (Section 13 of 2013 Budget speech)

In the case of Sri Lanka, electricity trading does not receive a mention as a licensed activity in the applicable laws and regulations.

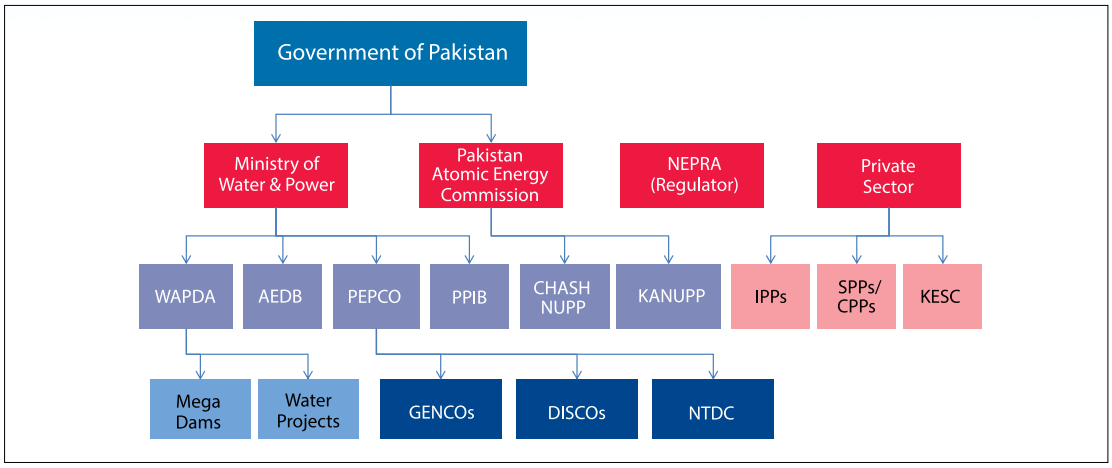
2.2.6 Pakistan

Pakistan's power sector is dominated by two vertically integrated entities – Water and Power Development Authority (WAPDA) and its associated entities and the K-Electric (KE), formerly Karachi Electric Supply Corporation. KE was privatized in 2005. These two entities are involved in power generation, transmission, distribution, and retail supply for the entire Pakistan.

In December 1998, the WAPDA Act was amended to permit the establishment of PEPCO and the unbundling of WAPDA. As a result, WAPDA was separated into corporate entities. Ultimately, the Power Wing of WAPDA, comprising Generation, Transmission, and Distribution, was restructured into 14 public limited companies. KE operates in Karachi and some parts of Baluchistan, and WAPDA has the remaining Pakistan as its license area. Multiple IPPs sell power to the distribution entities.

An independent regulator has been set up – the National Electric Power Regulatory Authority (NEPRA) – in 1997. The current power sector structure is depicted in Figure 9.

Figure 9 Power Sector Structure in Pakistan



Pakistan's regulatory evolution of power market structure can be briefly described with the following regulations:

Figure 10 Pakistan's Regulatory Evolution

Before 1960

- Electricity Act 1910 – Private licensees and areas
- Karachi Electric Supply Company (KESC) in 1913 for Karachi and adjoining areas
- Pakistan Water And Power Development Authority (WAPDA) Act, 1958 – WAPDA constituted

1960-1990

- Growth of power sector capacity matched demand growth till mid-1980s
- Supply constraints and financial constraints post that

1990-2005

- Power policies in 1994, 1998, 2002 to promote private sector investment in generation – resulted in increase in thermal assests (oil, diesel, etc)

1990-2005

- National Electricity Regulator (NEPRA) set up in 1997
- WAPDA/PEPCO restructuring in 1998 – NTDC (Transmission), 4 thermal power companies, and 9 distribution companies
- KE privatized again in 2005

2005

- NEPRA Interim Power Procurement (Procedure and Standards) Regulations governing power procurement by distribution companies
- National Transmission & Despatch Company Limited (NTDC) Grid code

2015

- Commercial Code for settlement of invoices of power purchase and transmission system usage

Pakistan follows a multi-seller, single-buyer model in its power market. Central Power Purchasing Agency Guarantee Limited, a company created by the Government of Pakistan, is a non-profit independent company established under the Companies Ordinance, 1984. It is solely responsible for implementing and administering the "Single Buyer Plus" market mechanism (ultimately leading to competitive market operations).

2.2.7 The Maldives

The Government-owned State Electric Company (STELCO) is the largest provider of electricity. It operates 27 power systems in 27 islands, providing electricity to 43 per cent of the population of the country. Each power system is independent with its own power generation and distribution infrastructure. STELCO has its largest operation in Malé, the capital of the Maldives, with an installed capacity of 61.42 MW, and a 26 km underground 11 kV distribution network feeding power to 99 distribution transformers to provide electricity to 33,341 customers. Marine gas oil is the only fuel used for power generation. The exhaust heat from the power station is used by an ME desalination plant with a daily production capacity of 150 tonnes per day to produce water for the Malé power station.

The Maldives is the only country in the region without any fuel resources of its own. It imports all its fuels in refined form and in very small quantities, which makes it even more expensive. Electricity requirements are met primarily through oil-based generation. Renewable energy is used to power navigational lights and communication transceivers on fishing boats, and for providing power supply to the remote installations on the national telecommunication network. The country is geographically separated from the mainland and is unlikely to be connected to the regional grid in an economic manner. However, it can benefit from the experience of other nations in fruitfully developing its renewable energy potential and thus reduce its dependence on oil imports.

Today, STELCO has an installed capacity of 79.2 MW, 471 employees, and a customer base of 41,743. The rest of the country receives its electricity from Island Development Committees (IDCs), private companies, and non-governmental organizations (NGOs). The power supply on resort islands is provided by the resort operators; each electric provider is not only responsible for generating power but also for distributing it.

Most of the inhabited islands have had their own IDCs or Independent Power Producers (IPPs) to provide electricity to the local community from fuel-driven generators, with an installed capacity ranging from less than 100 kW to 2-3 MW. Recently, the Government has established six regional utilities – in addition to STELCO – to provide electricity and other services including water and sewerage, and has started a process of consolidating the power sector. All utilities are owned at present by the Ministry of Finance though there is intent at some stage to move to introducing private capital.

The Maldives has abundant renewable energy resources but its use is minimal beyond solar water heating in resort islands. The country depends overwhelmingly on petroleum imports for its electricity production. The bulk of the fuel imports to the country is diesel fuel oil, which is mainly used for power generation, both by the state power utility (STELCO), and by close to 1,000 other electricity generators in the outer islands.

Two hundred inhabited islands have electricity supply but only about 23 have continuous supply. The dispersed nature of the islands does not allow for the installation of a single national grid. Each island operates and maintains its own power generation and power distribution system. The initial investment costs and subsequent running costs of powerhouses on other, smaller islands are very high. Petroleum-

based fuels are a major import in the Maldives, with the country almost entirely dependent on these imports for power generation. Fuel imports comprise nearly 16 per cent of the country's gross domestic product and this has resulted in the Maldives facing the impact of significant fluctuations in international fuel prices.

The Maldives Energy Authority (MEA) was established in April 2006, which was followed by the abolishment of the former Maldives Electricity Bureau (MEB). The MEA functions under the Ministry of Environment, Energy and Water (MEEW), forming a new regulatory body, with a broader mandate for increased effectiveness of energy interventions. The MEA is a subsidiary organization of the MEEW, with little, if any, operational or financial autonomy. The MEA has the remit of regulating the energy sector but is constrained to regulating the activities of STELCO and part of the activities of the regional utilities. The MEA in its current form lacks the proper regulatory framework and legal mandate to effectively regulate the sector. The MEA is responsible for regulating the construction and operation of new power generation infrastructure, and is also involved in the harmonization of tariff structures, and the formulation of new tariff regimes. Both the MEEW and the Ministry of Home Affairs are responsible for the formulation and implementation of the current national energy policy, which includes, to an extent, measures to regulate the energy sector, including efficiency standards in power generation and distribution, and the creation of an adequate institutional framework to implement Clean Development Mechanism (CDM) projects.

The Government of Maldives has pledged to be carbon neutral by 2020 while enhancing greater energy security and reaping economic, social, and environmental benefits. Towards achieving this goal, the Ministry of Housing and Environment (MHE) formulated the Maldives National Energy Policy & Strategy in October 2010.

2.2.8 Afghanistan

The country's sector is still in the early stages of evolution and the majority of the country does not have associated infrastructure. Afghanistan corporatized the national electricity service department, Da Afghanistan Breshna Mossasa (DABM), into an independent state-owned utility, Da Afghanistan Breshna Sherkat (DABS), in May 2008. Da Afghanistan Breshna Moassessa is responsible for the O&M of the generation, transmission, distribution, and sales of electricity in Afghanistan.

Electricity Sector Policy

The purpose and objectives of the Electricity Sector Policy 2003 of Afghanistan is to provide the organizational structure and the legal and regulatory framework, which would allow the Ministry of Energy and Water (MEW) to accomplish its vision, while at the same time transforming the power sector into a commercially viable and stable sector that attracts and retains private investors.

The Government supports the liberalization of the electricity sector, through a combination of competition and regulations, as market forces. The Government, where possible, will encourage the joint use of its physical electric infrastructure to provide other services. Where joint use is possible, the MEW intends to competitively price the cost of providing and managing these services. According to this policy, the role of MEW would be to provide overall direction for electricity sector development and formulate broad policies and regulations for the benefit of all of Afghanistan that is consistent with other national development plans and laws; initiate the establishment of an independent electric regulatory commission, which would set technical, financial, and operational performance standards and regulate the power sector; represent the Government of Afghanistan in electricity matters pertaining to regional interconnections and international organizations. Presently, tariffs setting is done by MEW. As per policy, the Government would update the electricity law, which was last revised in 1984.

Electricity Law of Afghanistan
The draft law states the powers and duties of a proposed Afghanistan Electricity Regulatory Authority (AERA); the procedures to be followed in carrying out these powers and duties; and describes the related duties, which remain with the MEW. The purpose of this law is to provide further access to electricity services to the public throughout the country; promote non-discriminatory entry of service providers and operators to the market; strengthen electricity markets in order to promote the quantity and quality of their services in the country; use impartial technology for the support of customers and competitors and to prevent the abuse of significant market power by electricity service providers and operators.

Regulatory Authority
The Afghanistan Electricity Regulatory Authority (through a process for the development and adoption of regulations) is responsible for regulating the affairs related to the electricity sector in the country. It will perform the duties and functions defined by this law in an independent, open, objective, transparent, and non-discriminatory manner.

2.3 CBET in SAR – Current Status and Future Plans

2.3.1 India-Nepal

The foundation for power exchange between India and Nepal was laid with the signing of river treaties for Koshi and Gandaki in the 1950s. Currently, there are three power sharing arrangements between India and Nepal:

- Koshi Treaty: Although Nepal is entitled to draw 50 per cent of power from the plant on Koshi, it only draws 10 MW because of technical issues.
- Border town power exchange: A power exchange agreement in the 1970s to supply power to the border towns of Nepal and India from the other country's grid.
- Mahakali Treaty: A treaty for the integrated development of the Mahakali river including Sarda Barrage, Tanakpur Barrage, and Pancheshwar Project, according to which, 70 MU has to be provided to Nepal via Tanakpur.

The Indo-Nepal Power Exchange Committee (PEC) was set up in 1991 to regulate power exchange between the two countries. In the sixth PEC meeting it was agreed in principle for a 150 MW power exchange. The Government of India has nominated Power Trading Corporation (PTC) as a nodal agency.

Although Nepal and India are connected at 22 points in 132/33/11 kV lines, these connections are radial and cannot export/import significant power between India and Nepal. Nepal is presently a net importer of electricity from India and has plans to develop 10,000 MW of hydropower in 10 years and 25,000 MW of hydropower in 20 years from various proposed power projects. Discussions are under way between the Governments to jointly develop the Pancheswar project (5,600 MW), Sapat Koshi (3,330 MW), Karnali (10,800 MW), and Naumure (225 MW) as the total power output from these plants cannot be internally consumed. High capacity transmission inter-connection needs to be planned for the evacuation and transfer of power from these projects. Project Development Agreements (PDAs) for the following projects have been signed: a) 900 MW Upper Karnali with GMR India b) 900 MW Arun-3 with SJVNL. The PDAs in the pipeline are a) 600 MW Upper Marsyangdi – GMR b) 750 MW West Seti – CWE (Three Gorges) c) 880 MW Tamakosi III (SN Power).

Figure 11 **Interconnections between India and Nepal**

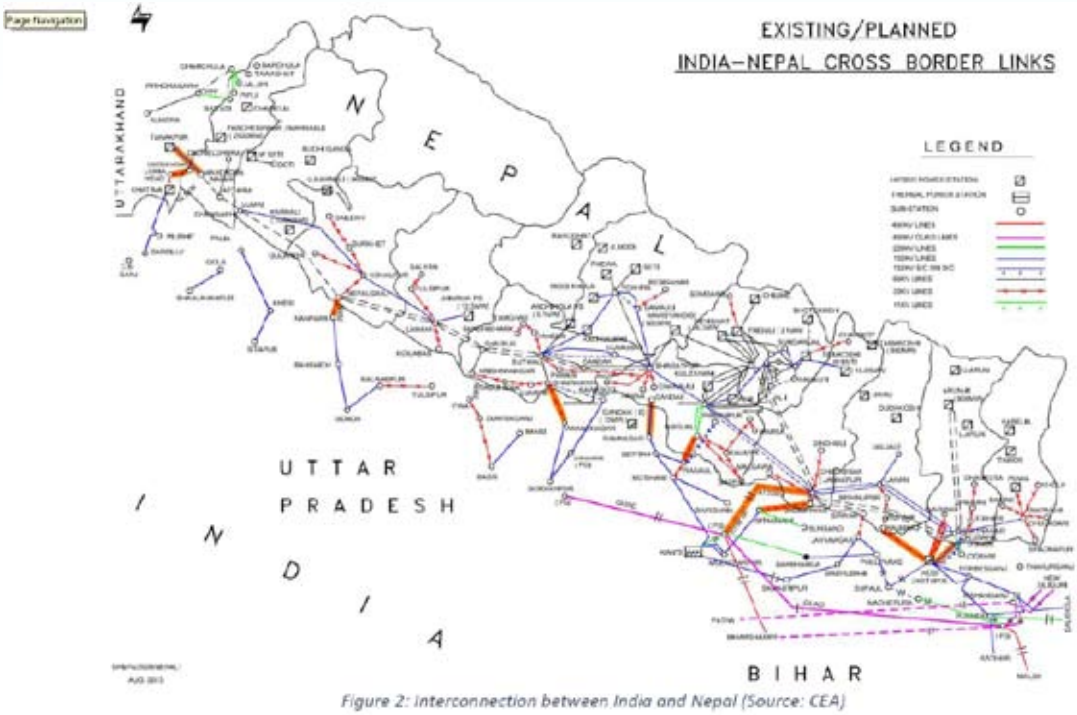


Figure 2: Interconnection between India and Nepal (Source: CEA)

A Power Trade Agreement (PTA) signed in October 2014 envisages the interconnection of the national grids of the two countries and augments avenues for investment, both from private and public entities. The NEA is gearing up to import an additional 90 MW of electricity from India by January end in view of easing off the power outage in the country. Currently, Nepal is importing a total of 235 MW electricity from the southern neighbor. The import of additional power is thanks to the PTA inked between Nepal and India in October last year.[11]

Further, a 140 km 400 kV Dhalkebar-Muzaffarpur transmission line under construction (funded by the World Bank through a loan), is expected to be completed shortly. It will provide an export line to India as surplus capacity builds in Nepal. This link, which will synchronously connect the Indian and Nepal power grids, will be charged at 220 kV level initially and is expected to facilitate 150 MW import for Nepal. Power Transmission Company Nepal Limited (PTCN) and Cross Border Power Transmission Company India (CPTC) were established for this purpose. PTCN will construct, operate, and maintain about 41.5 km of transmission line from Dhalkebar to Bitthamod in the Nepalese territory. CPTC will construct, operate, and maintain 87 km of line from Muzaffarpur to Sirsand in the Indian territory. Initially the line will be charged at 220 kV; operated in synchronous mode between Indian and Nepalese power grids. The Implementation and Transmission Service Agreement (ITSA) was signed on December 12, 2011. The Power Sale Agreement (PSA) with PTC India for the purchase of 150 MW of power in a long-term basis was signed on December 13, 2011. The details of the cross-border interconnection (existing, under construction, planned, and proposed) are given in Table 15.

[11] http://www.nepalenergyforum.com/nepal-to-import-90-mw-more-power-from-india/

Table 15 **India-Nepal Cross Border Interconnection (Existing, Under construction, Planned, and Proposed)**

Existing Lines			
Transmission link	Evacuation cap. (MW)	Traded (MW)	Voltage level (kV)
Kusaha-Kataiya	130	80	132
Gandak-Rampur	50	25	132
Mahendranagar-Tanakpur	50	30	132
Kataiya-Rajbiraqj	10	8	33
Raxual-Birgunj	10	10	33
Sitamadhi-Jaleswor	10	8	33
Nepalgunj-Nanpara	10	8	33
Jayanagar-Siraha	8	8	33
Under Construction, Planned, and Proposed			
Transmission Link	Transfer cap. (MW)	Voltage level (kV)	Status
Dhalkebar-Muzaffarpur	1,200	400	Under construction
Bardaghat-Gorakhpur (HVDC)	2,500	400	Planned
Duhabi-Jogbani	1,800	400	Proposed

2.3.2 India-Bangladesh

In 2010, a Memorandum of Understanding (MoU) was signed to import 250 MW of electricity from India. Subsequently, a PPA was signed between NVVN (a subsidiary of NTPC) and Bangladesh Power Development Board (BPDB). According to this MoU, NTPC will export 250 MW power to Bangladesh for a period of 25 years from the unallocated quota available with the Ministry of Power, India. The tariff for this power trade is determined by CERC regulations.

The first cross-border transmission line between these two countries, a 125 km transmission line from Bharampur of eastern India to Bheramara of western Bangladesh (combination of AC and DC lines) with a 500 MW capacity, became operational in September 2013 (Figure 12). Recently, a 47 km, 400 kV transmission line from Suryamaninagar in Tripura to South Comilla of Bangladesh was test charged and once commissioned, it will supply 100 MW from Tripura to Bangladesh. The line is charged at 132 kV and a higher voltage (400 kV) is planned considering future CBET.

PTC India is already supplying another 250 MW for three years till August 2016. Also, BPDB has recently called for competitive power procurement from Indian bidders for 250 MW for 15 years (post-August 2016) in which PTC, NVVN, and other bidders have participated.

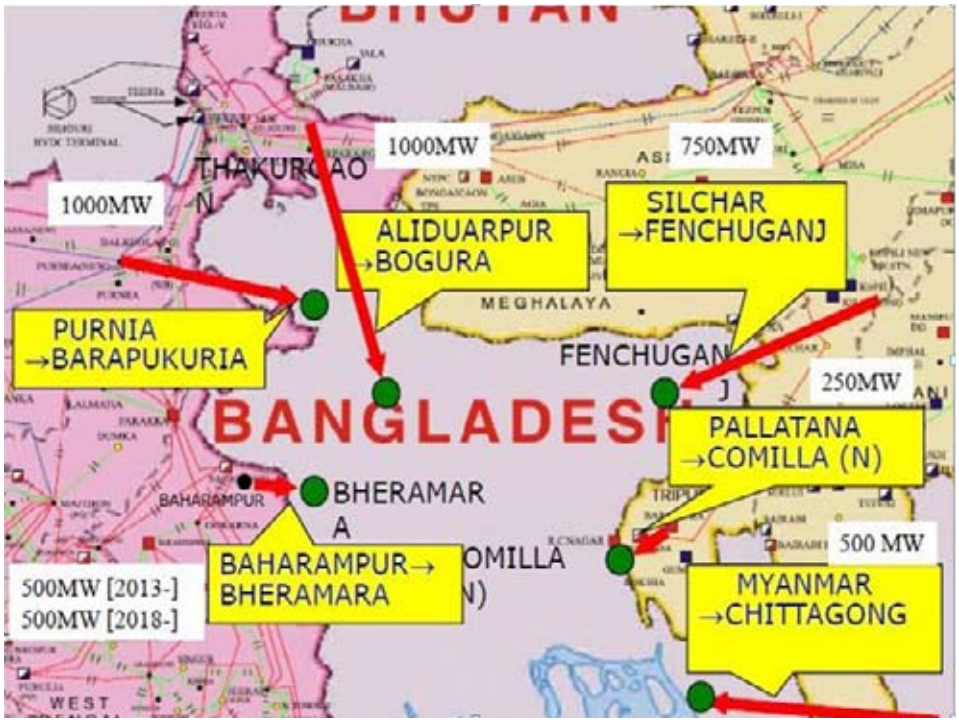
The Indian state of Tripura will supply 100 MW from the Palatana gas power project after the finalization of tariff. The Palatana project is a symbol of cooperation between India and Bangladesh; the heavy equipment and turbines to Palatana have passed through Bangladesh's territory by road and waterways from Haldia port in West Bengal.

Future Plans

Generation

NTPC has a joint venture with BPDB for the development of a 1,320 MW import coal-based project near Khulna. Bangladesh targets to have an installed capacity of 24,000 MW by 2021, which is almost three times the current capacity. It is also looking for foreign investment. In this context, two Indian private players, Adani Power Limited and the Reliance Group, signed MoUs with BPDB worth USD 5.5 billion to build 4,600 MW power plants in the country. Bangladesh has further plans of importing 500 MW from the Indian power market for 15 years, starting from December 2017.

Figure 12 Interconnections between Bangladesh and India



India and Bangladesh are also cooperating in the area of fuel supply. India has agreed to export one MTPA diesel from Assam's Numaligarh Refinery Limited after the completion of the Rs 200 crore pipeline project from Siliguri in India to Parbatipur in Bangladesh.

Transmission

The Bheramara HVDC Station project is being upgraded to import an additional 500 MW power from India through the capacity upgradation of the existing Bangladesh (Bheramara)–India (Baharampur) Grid Interconnection. This will meet the ever-increasing demand of electricity for the socio-economic development of both the countries.

As a part of the South Asia Sub-regional Economic Cooperation (SASEC) Program, comprising Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka, ADB is funding the augmentation in transfer capacity (500 to 1,000 MW) of the existing transmission corridor from Bharampur to Bheramara.

Various high-capacity multi-terminal HVDC bipole lines between NER (India)–Bangladesh-NR (India) are planned for the evacuation of power from the North-eastern region of India to other parts of India through Bangladesh. Three alternative routes have been identified:

- Shilchar-Meghnaghat/Bhulta-Bahrampur High Capacity 400 kV line (dropping of 500/1,000 MW by HVDC BtB Station at Meghnaghat/Bhulta).
- A ±800 kV, 6,500 MW HVDC multi-terminal line from Rangia/Rowta (India) to Jamalpur/Barapukuria (Bangladesh), a suitable location in WR/NR/SR (India).
- A 765 kV Bongaigaon (NER/India)–Jamalpur/Barapukuria (Bangladesh)–Purnea (ER/India). Barapukuria dropping 500-1,000 MW to Bangladesh by HVDC BtB station.

For regional power trading and joint investment for the development of the hydroelectricity generation capacity in Nepal and Bhutan and also for the development of transmission facilities from Nepal and Bhutan through India are being discussed. Bangladesh is in talks with Nepal (Kishanganj-Bogra: 500 MW) and Bhutan (Alipurduar-Bogra: 500 MW) for power import. The total investment for building the link is around USD 200 million.[12] Bangladesh has also shown interest in investing in hydropower projects in Bhutan.[13]

Table 16 India-Bangladesh Cross Border Interconnection (Existing, Under Construction, Planned, and Proposed)

Countries	Interconnection description	Capacity (MW)	Status
Bangladesh-India	400 kV HVDC back-to-back asynchronous link	500 MW	Existing
Bangladesh-India	Capacity upgradation (500 MW) of existing Bheramara HVDC station project	500 MW	Under planning and finalization
Bangladesh-India	(Eastern interconnection project) Tripura (India)-Comilla (Bangladesh) grid interconnection project (400 kV)	Initially 100 MW will be exported	Under implementation
India-Bangladesh-India	Evacuation of power from the North-Eastern region of India (Rangia/Rowta) to Muzaffarnagar of India through Bangladesh. +/-800 kV, HVDC multi-terminal bi-pole DC line	7,000 MW	Proposed and agreed in principle

2.3.3 Bhutan-India

Hydropower export has contributed significantly to Bhutan's economy. Bhutan exports 1,416 MW from hydropower stations at Tala, Chukha, and Kurichu, which contributes 14 per cent to the GDP and comprises about 35 per cent of the country's total exports. Bhutan is using the royalty power (12 per cent) from hydropower plants to increase electricity access. Also, Bhutan imports power from India during the lean season (winter). Bhutan-India's cooperation in hydropower dates back to more than 50 years and some key events in the timeline are shown in Figure 13.

[12]Power Grid Company of Bangladesh Ltd. (PGCB), Bangladesh, 2013.

[13]http://energybangla.com/pm-for-joint-hydro-power-plant-with-bhutan/

Figure 13 Hydropower Cooperation between Bhutan-India

1960s

- Jal Dhaka agreement in 1961
- First hydro plant (360 kW) in 1967

1970s

- Bilateral connections b/n villages and towns of West Bengal/Assam and Bhutan
- Chukha agreement signed in 1974

1980s

- Chukha hydro plant (336 MW) completed in 1988

1990s

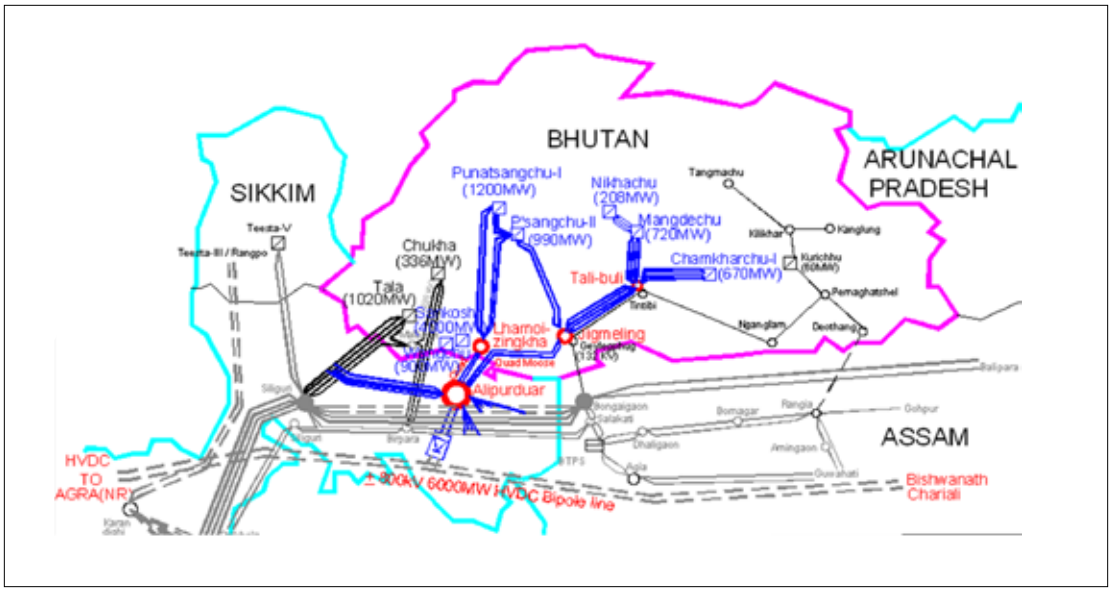
- Agreement for joint development of Kurichhu hydropower plant in 1994
- Tala agreement signed in 1996

2000s

- Kurichhu (60 MW) completed in 2001-02 and Tala completed (1,020 MW) in 2006
- Umbrella agreement in 2006 – facilitate and cooperate in hydropower development and trade through public and private sector participation
- Agreement for joint development of 10,000 MW by 2020 in 2008

Bhutan has rich hydropower potential and has tapped ~5 per cent of its potential capacity till date. The country targets to achieve an installed capacity of >26,500 MW by 2030. Ten projects were identified in 2008 for the execution of which four projects with a cumulative installed capacity of 3,066 MW are scheduled to be commissioned by 2018. Four other plants, with a cumulative capacity of 2,120 MW,

Figure 14 Bhutan-India interconnection



will be executed in JV mode for which a framework agreement has been signed between both the Governments. Bhutan also intends to export hydro electricity to Bangladesh.[14]

Power is exported from Bhutan through the 400 kV (Tala HEP), 220 kV (Chukha HEP) and 132 kV (Kurichhu) transmission system. Considering future CBET, a high capacity HVDC corridor, 800 kV, 6,000-7,000 MW, is being planned. A 3,000 MW HVDC terminal is being established at Alipurduar to take care of the evacuation of Punatsangchu-I, II, and Mangdechu, which will connect to the Biswanath Cheriyali-Agra HVDC corridor. Bhutan has prepared a detailed transmission system master plan for the evacuation of power to India. The key highlights of the transmission interconnection with India are shown in Figure 14. The details of the existing and planned cross-border interconnection and some of the key hydropower projects under developmentare given in Tables 17 and 18, respectively.

Table 17 Cross-Border Transmission Interconnection: India-Bhutan

Existing		
Countries	**Interconnection description Transmission link**	**Voltage level**
India-Bhutan	Export of power from Chukha (336 MW) to India. Chukha-Birapara (India) (one D/C line on the same tower and one S/C line)	220 KV
India-Bhutan	Export of power from Tala (1,020 MW) to India. Tala-Siliguri (India) 2*D/C	400 KV
India-Bhutan	Export of power from Kurichu (60 MW) to India. Gelephu-Salakati (India) S/C	132 KV
Planned		
Grid reinforcement to evacuate power from Punatsangchhu-I & II	Punatsangchhu-I HEP, the two numbers 400kV D/C twin moose lines from Punatsangchhu-I up to Lhamoizingkha/Sankosh (Indian border) with one D/C via Punatsangchhu-II HEP. From Sankosh, one 400kV high capacity D/C line (quad moose conductor) up to the Indian pooling point at Alipurduar. At Alipurduar, an HVDC station with ±800 kV, 3,000 MW converter for import of power from Punatsangchhu-I & II.	400 KV and 800 KV
Grid reinforcement and evacuations of power from various hydropower projects have been planned as per the NTGMP of Bhutan.		

[14]http://energybangla.com/bhutan-to-export-hydroelectricity-to-bangladesh-at-cheapest-rate-wangchuk/

Table 18 **Key Hydropower Projects Under Development in Bhutan**

Project name	Implementation mode/Remark	Capacity	Investment requirements (Rs. crore)	Associated transmission cost (Rs. crore)
Punatsangchhu-I HEP	IG*/Under construction	1,200	Punatsangchhu-I HEP Is at final stage of implementation and Dagachhu has been commissioned	
Dagachhu HEP	PPP-commissioned	126		
Punatsangchhu-II HEP	IG/Under construction	1,020	8,160	434.1
Mangdechhu HEP	IG/Under construction	720	5,760	905.5
Amochhu Reservoir HEP	IG/DPR cleared	540	4,320	105.1
Chamkharchhu-I HEP	JV/DPR under review	770	6,160	586.95
Kholongchhu HEP	JV/DPR cleared	600	4,800	811.45
Wangchhu HEP	JV/DPR under review	570	4,560	53.8
Sunkosh Main HEP	IG/DPR under review	2,500	20,000	
Sunkosh Barrage HEP	IG/DPR under review	85	680	296.95
Bunakha Reservoir HEP	JV/DPR cleared	180	1,440	104
Nikachhu HEP	PPP/DPR cleared	210	1,680	147
Kuri-Gongri HEP	IG/DPR to begin soon	1,800	14,440	809.9
Bindu Khola HEP	NA	13	104	4.75
		10,334	72,104	4,259.5
Total investment required			**76,363.5 (USD 12.62 billion)**	

2.3.4 India-Sri Lanka

India and Sri Lanka do not have any CBET currently, even though there are plans for it.

Generation

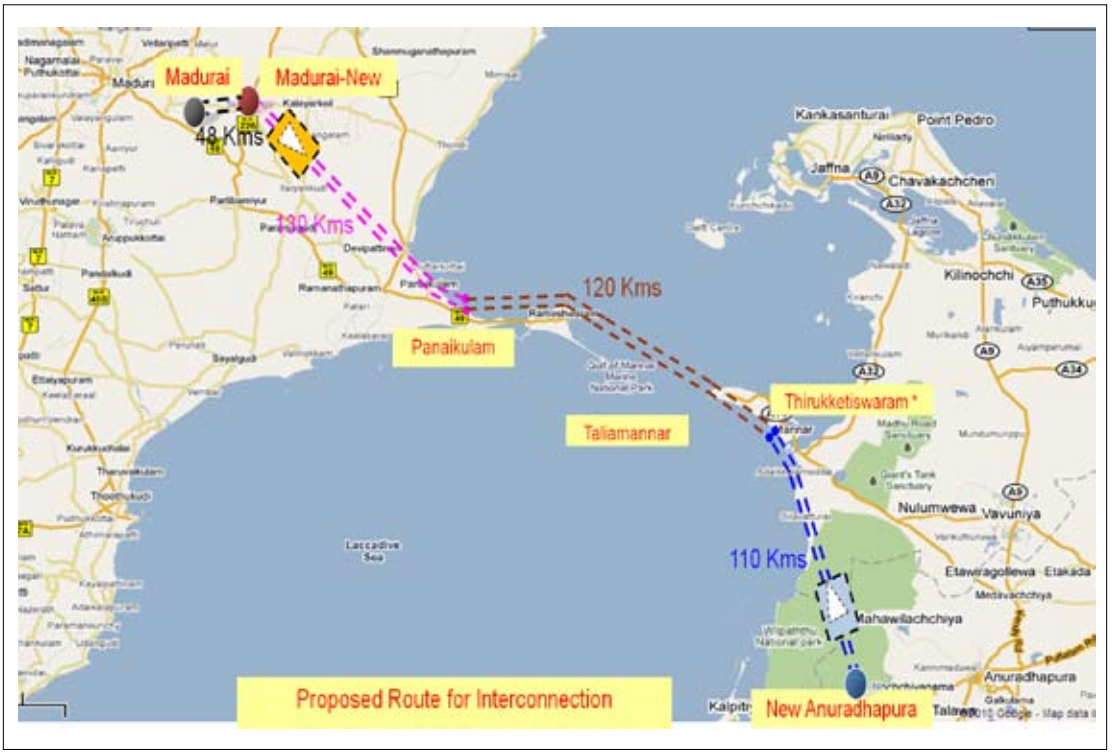
India and Sri Lanka entered into Memorandum of Agreement (MoA) to develop a coal power plant in Trincomalee as a joint venture between the Ceylon Electricity Board (CEB) and NTPC of India. The plant capacity is 2 x 250 MW and the MoA has provision for the extension of up to a total of 1,000 MW. All agreements, such as PPA, implementation agreement, land lease agreement, and coal supply agreement, were signed in October 2013. The total estimated cost is USD 512 million and the project is expected to be commissioned in 2017-18.

Further, Sri Lanka has plans to import power (~500 MW) from India via the proposed HVDC link.

Transmission

It is proposed to build a HVDC interconnection between India and Sri Lanka, operating at ±400 kV with a total power transfer capacity of 1,000 MW (Figure 15). The MoU has been signed between both countries for carrying out feasibility studies. PGCIL and CEB are the executing agencies for the line. Feasibility studies have been done for multiple options and the following scheme has been finalized:

Figure 15 Proposed Interconnection between India and Sri Lanka



India (Madurai)–Sri Lanka (Anuradhapura) HVDC bipole line: 360 km

- Indian territory: 130 km
- Sea route: 120 km
- Sri Lankan territory: 110 km
- Tentative cost: Rs 5,000 crore*

Consultations/clearances from various agencies are in process. However, in a meeting between India and Sri Lanka, it has been decided that the project cost has to be reduced to make it economically viable. The following measures are to be studied for reducing the cost of the project:

- Reduction in length of the submarine cable (~75 km) by changing termination points (Talaimannar instead of Thirukketiswaram and Dhanushkodi instead of Panaikulam).
- Explore possibility of reduction of HVDC terminal cost.
- Consider multilateral funding for carrying out cost estimate (JICA funding being tried).

2.3.5 Pakistan-Afghanistan

Pakistan, Afghanistan, the Kyrgyz Republic, and Tajikistan have been pursuing the development of electricity trading arrangements and the establishment of the CASA Regional Energy Market (CASAREM) since 2005. The Central Asia- South Asia (CASA) Electricity Transmission and Trade project (CASA-1000) is the first phase of the CASAREM initiative. It is planned to export a total of 1,300 MW of excess summer electricity from Tajikistan and Kyrgyzstan – 1,000 MW to Pakistan and 300 MW to Afghanistan. Tajikistan is expected to supply 70 per cent of the requisite electricity, with Kyrgyzstan supplying the remaining 30 per cent. An MoU with the four Governments was signed on November 16, 2007, in Kabul.

Figure 16 CASA-1000: Connecting Central Asia-South Asia

The project (Figure 16) has the following major components: a) A 500 kV HVAC transmission link (477 kM) between Kyrgyz Republic and Tajikistan b) A 500kV ± HVDC transmission link (750 kM) between Tajikistan and Pakistan c) A 300 MW substation and related facilities for power off-take in Afghanistan (Kabul) d) A 1,300 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. A formal master agreement and PPA has been signed in April 2015 among the participating countries.

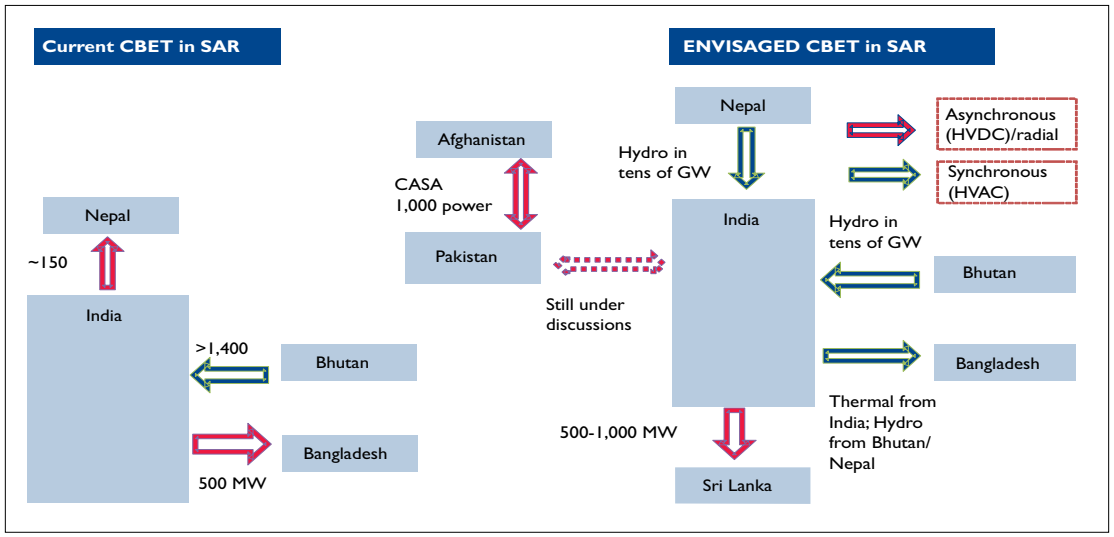
2.3.6 India-Pakistan

At present, no power exchange happens between India and Pakistan. A proposal aimed at setting up a transmission infrastructure (Amritsar-Lahore interconnection) on a joint ownership basis is being considered. This will facilitate the transfer of around 500 MW power between the two countries. On April 14, 2012, the Federal Minister for Water and Power in Pakistan announced its decision to import electricity from India to meet its energy requirements. In that context, Pakistan could initially import up to 500 MW through a new 45 km, 220 kV power transmission line. A higher capacity power link through an HVDC link for operational separation between the two power systems could be subsequently executed. This was discussed in the third meeting of expert groups in March 2014 and a Joint Technical Team comprising four sub-groups has to be formed to finalize the scope of work, deliverables, timelines, and so on.

2.3.7 Summary of Cross-Border Trade Initiatives in SA

Currently, CBET among SAARC members is on a bilateral level among certain countries. Future interconnections and CBET planned is shown in Figure 17 below.

Figure 17 CBET Among SAARC Members



**Direction of arrow shows direction of net power flow*

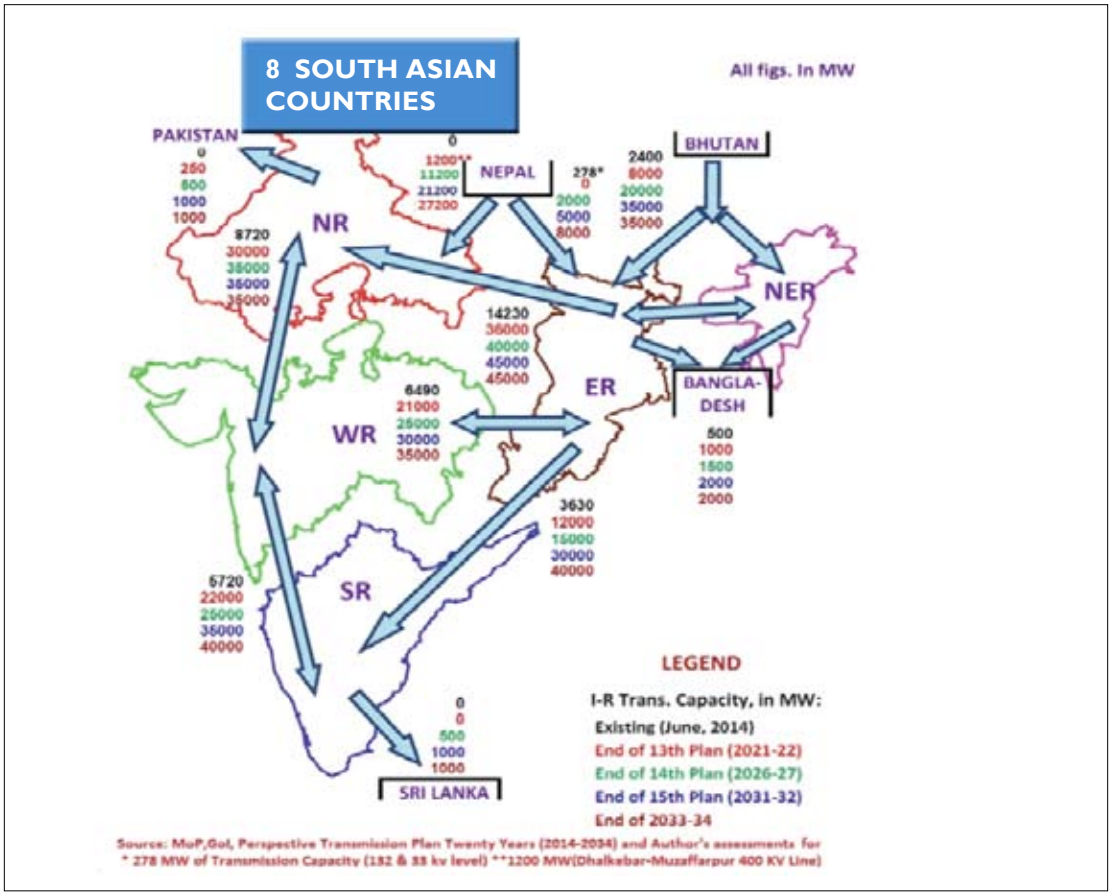
In November 2014, SAARC members signed a 'framework agreement' for regional cooperation in electricity with wide ranging provisions on CBET, which included the planning of cross-border interconnections, the development of institutional mechanisms, system operation and settlement mechanism, electricity grid protection system, transmission service agreements, on-discriminatory access to transmission, dispute settlement mechanism, among others. This is expected to provide a fillip to regional electricity cooperation in SAARC. In this context, the Indian Energy Exchange (IEX) is awaiting permission/guidelines from CERC/Ministry of Power of India to start short-term cross-border trading of electricity with three nations – Bhutan (120 MW) and 50 MW each with Nepal and Bangladesh. Regional agreements for CBET can take time to achieve the desired scale and benefits. For example, the Central American Power Market (SIEPAC) has become operational 23 years after the feasibility study. Also, electricity sector cooperation in the Greater Mekong Sub-region (GMS) also witnessed a timeline over two decades, and still continues to evolve. The governments within the

region will need to synchronize their efforts on a range of technical, institutional, and political issues and barriers to realize the benefits of CBET.

The pace of progress of CBET can be attributed to technical, operational, political, and commercial issues. These vary according to the socio-economic and political circumstances in the region. A number of electricity cooperation initiatives around the world have faced some common challenges, even in sophisticated OECD electricity systems. For example, transmission and trade cooperation arrangements, such as the Southern Africa Power Pool and the West African Power Pool, have failed to realize their full potential without the development and timely implementation of a long-term transmission plan, and differing expectations of electricity prices by buyers and sellers.

The CBET historically has been mainly through bilateral government-to-government arrangements based on case-to-case negotiations, though in the recent past market-based CBET began to start between India-Bhutan and India-Bangladesh. It is expected that in the future CBET in SA will be more market-oriented and will require significant inter-regional transmission capacities, which need major investment. The inter-regional transmission capacities by 2033-34 could be 72,000 MW (Figure 18). To achieve the above clearly needs many efforts to be made on the legal, regulatory, policy, technical, operational, and market aspects of trade.

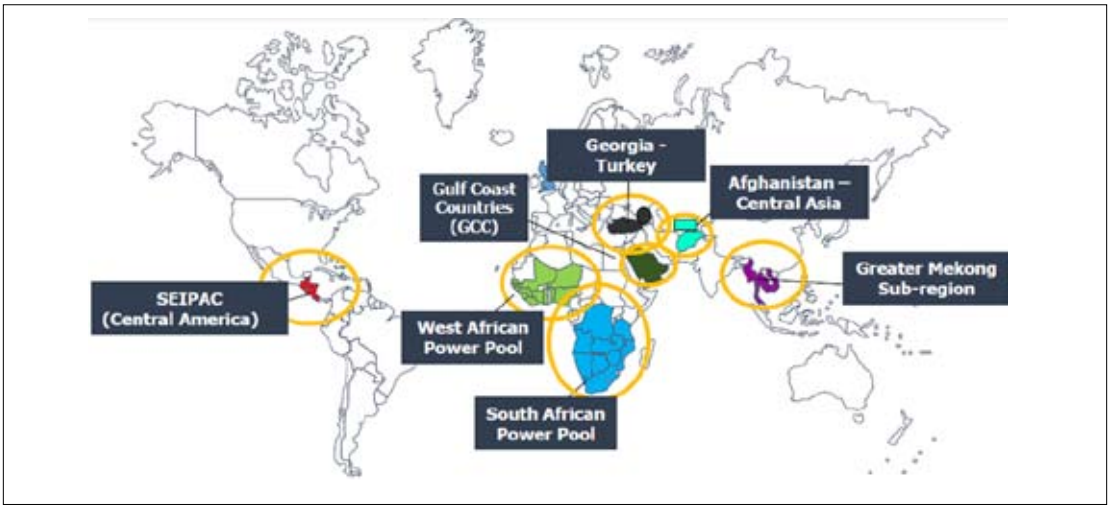
Figure 18 **South Asia Inter-Regional Transmission Capacity by 2033-34**



3. International Experiences in Power Market Development and CBET: Key Learnings

A look at the international experiences (Figure 19) on the cross-border electricity trading mechanism further strengthens the case for replicating similar models within the South Asian region, which has immense untapped power potential to cater to the energy requirements of all countries.

Figure 19 **Cross-Border Electricity Trading**



3.1 Greater Mekong Region (GMS)

The Greater Mekong Sub-region (GMS) comprises Cambodia, the People's Republic of China (PRC), Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Vietnam. In 1992, with the assistance of the Asian Development Bank, the six countries entered into a program of sub-regional economic cooperation, designed to enhance economic relations among these countries. The establishment of an integrated electricity market is one the major components of such cooperation.

GMS countries are characterized by uneven load demand and different resource bases. On one hand Myanmar and Laos have abundant hydropower resources, Thailand has limited hydropower, and Cambodia has diverse resource potential including hydro and natural gas. With Vietnam and Thailand having huge power demand, CBET presented excellent opportunities for efficient utilization of energy resources.

3.1.1 Key Instruments of CBET in GMS

Inter-Country MOU, Treaties, Agreements

In GMS, an Electric Power Forum (EPF) was constituted in 1995 under the GMS Economic Cooperation Program to serve as an advisory body on sub-regional power projects and issues. The EPF reported to the Ministerial Conference and the respective governments on treaties and protocols. The inter-governmental agreement provided a framework to implement the Policy Statement on Regional Energy Trade in the GMS. The major milestones in the development of the GMS Electricity Market are shown in Table 19.

Table 19 Major Milestones in the Development of the GMS Electricity Market

Month/Year	Milestone
April 1995	The Subregional Electric Power Forum (EPF) was formally inaugurated at a meeting in Yangon, Myanmar. Establishment of the EPF was agreed at the Fourth Conference on Subregional Economic Cooperation (Ministerial Meeting) held in Chiang Mai, Thailand, in September 1994.
January 1998	The Expert's Group on Power Interconnection and Trade (EGP) was established to provide recommendations on regional power issues in the GMS.
January 2000	At the Ninth GMS Ministerial Meeting in Manila, ministers endorsed the Policy Statement on Regional Power Trade in the Greater Mekong Subregion (the Policy Statement). This establishes the objectives and principlesfor power trade among the GMS member countries. It also provided for anintergovernmental agreement on regional power trade to be prepared, which would provide the framework to implement the policy statement.
November 2002	The Inter-Governmental Agreement on Regional Power Trade in the Greater Mekong Subregion (the Inter-Governmental Agreement, IGA) was signed in Phnom Penh. The IGA provided for the establishment of a Regional PowerTrade Coordination Committee (RPTCC).
July 2005	A Memorandum of Understanding on the Guidelines for the Implementation of the RPTOA – Stage #1 (MoU #1) was signed in Kunming. This approved the draft RPTOA issued by the third RPTCC meeting (April 2005) as guidelines for Stage 1 of the regional power market. It also established two new institutions to support the work of the RPTCC: ■ The Focal Group (FG) ■ The Planning Working Group (PWG)
March 2008	A Memorandum of Understanding on the Road Map for Implementing the Greater Mekong Subregion Cross-Border Power Trading (MoU 2) was signed in Vientiane.

Policy Statement on Regional Power Trade

The Policy Statement was endorsed by the Energy Ministers of the GMS. It established the objectives and principles for power trade among the GMS member countries. One of its key objectives is to promote the efficient development of the regional power sector and regional power trade in order to aid economic growth. Further, the objectives are supported by a set of guiding principles recognized by each GMS country:

- Each member recognizes and endorses international trading in electric power to be an integral part of its policies to strengthen its electricity sector.
- Each member recognizes the importance of technical harmonization of electric power transmission parameters and practices with eventual interconnection in mind.
- Each member recognizes the desirability of foreign direct investment on reasonable terms in its electricity power sector in order to speed economic development in the GMS.

The Statement also provided for the establishment of an intergovernmental agreement on regional power trade.

Inter-Governmental Agreement on Regional Power Trade (IGA)[15]

The Agreement was signed, ratified, and accepted as the overall framework for development of the regional market structure in the same year. The IGA stipulated the establishment of the Regional Power Trade Coordination Committee (RPTCC), as the high-level body responsible for actively coordinating and guiding the market's development. The RPTCC was tasked with determining the initial steps to establish and implement regional power trading arrangements.

Memorandum of Understanding on the Overall Framework of Regional Trade in GMS

This MoU detailed the guidelines for the implementation of the Regional Power Trade Operating Agreement (RPTOA). Two institutions under the RPTCC were established. The Focal Group (FG) was established to coordinate implementation activities in each GMS country and would subsequently evolve into a technical secretariat. The Planning Working Group (PWG) was established to fulfil the functions of the operational and system planning working groups, identified in the draft RPTOA. The responsibilities included identifying priority interconnection projects and establishing common regional performance standards and database. The RPTCC, FG, and PWG are comprised of representatives of national governments and utilities.

Transmission Planning/Infrastructure

The **Planning Working Group (PWG)** was established to fulfil the functions of the operational and system planning working groups, identified in the draft RPTOA. The PWG's membership comprises a senior-level representative from each member country's transmission system operator with responsibility for national transmission planning. Its main objectives included identifying priority interconnection projects and establishing common regional performance standards and database. The functions of PWG cover:

- Preparing a plan for developing a regional network with facilities that are dedicated to cross-border transactions but are not linked to specific PPAs.
- Planning and prioritizing the addition of new transmission capacity, including recommendations regarding ownership and financing.
- Defining excess transmission capacity that is available on a non-firm basis to support short-term opportunity exchanges of power.
- Preparing plans for augmenting the capacity of existing cross-border transmission facilities and reinforcements required in national transmission systems to facilitate cross-border power trading.
- The transition of the GMS from bilateral to regional power integration was been envisaged in four stages:

Stage 1: Bilateral trade through surplus capacity available in existing cross-border transmission system (specific to a PPA) between countries.

Stage 2: Grid-to-grid power trading between any pair of GMS countries, eventually using transmission facilities of a third regional country.

Stage 3: Interconnectors developed exclusively for cross-border power trading, and third parties (other than national utilities) will be permitted to begin trading over these. A regional system operator centrally operates the regional transmission network.

Stage 4: Establishment of a regional power market. The development of an efficient regional transmission system that is not linked to a specific PPA.

The GMS is currently at Stage 1 and in process of transitioning into Stage 2.

[15]Review of Electricity Laws, Regulations, Policies (EI&R&P) and legal structure of South Asia Countries (SAC) to identify areas that can hinder CBET and to recommend changes/amendments therein for consideration of the SAC (Sari/Ei-2014-01), IRADe.

Open Access (OA) to Network

Currently, the trade happening in GMS is solely bilateral. There seems to be no provisions related to OA. However, the study undertaken by the World Bank in 1999 ('Report on Power Trade Strategy for Greater Mekong Sub-region'), did recommend framing of provisions for non-discriminatory access to transmission facilities.

Interconnection Mechanism

Operating as large synchronous alternating current (AC) power grids, in which all the interconnected systems maintain the same precise electrical frequency and the network operates as a single synchronized system. Here all the countries follow same operating codes (regional grid codes) to ensure system stability.

Transmission Pricing/Wheeling Charges and Transit

Grid-to-grid power trading between any pair of GMS countries, eventually using transmission facilities of a third regional country. However, in this stage the available cross-border capacity is limited and based on surplus capacity of lines linked to PPAs. It is expected that some transit trade will develop, but this will continue to largely use interconnector capacity constructed under bilateral arrangements.

Power Procurement Terms

Currently the trade being undertaken is primarily bilateral exchange of power between parties under specific PPAs. The Nam Theun 2 (NT2) project in Laos PDR for the export of electricity to Thailand is being undertaken through a Concession agreement and a PPA. The CA (2002) describes the critical governing arrangements and responsibilities for designing, constructing, and operating of the project.

Commercial Mechanism to Settle Imbalances

ADB has been assisting in setting up the road map for regional integration. Two working groups have been set up to determine market rules, standards, mechanism, and so on, for trade:

- Working Group on Performance Standards and Grid Code (WGPG)
- Working Group on Regulatory Issues (WGRI)

The interim technical group WGPG will determine technical performance standards and grid codes. It will also conduct studies to determine policies and regulations on scheduling and accounting, metering, imbalance settlement, and so on.

Sustainable Development of Energy Trade and Provision for Projects Committed to Trade

In June 2009, the 15th GMS Ministerial Meeting adopted a roadmap for expanded cooperation in the energy sector of the GMS taking into account the need for improved energy security in the GMS, better utilization of energy resources, and mutually beneficial energy trade, to meet national and regional energy needs in a sustainable manner. The roadmap specifies:

- The goal and strategic objectives for expanded GMS energy cooperation, to provide overall guidance to the GMS countries energy cooperation;
- A desired policy framework that include the measures and actions that should be given priority in expanding GMS energy cooperation; and
- A concrete, practical and implementable short to medium-term (2010-2015) work plan that details the specific activities and general timetable for realizing the road map's objectives.

Dispute Resolution

The concession agreement and the PPA for NT 2 include provisions for dispute resolution through three avenues: (a) consultation and dispute committee (b) experts (c) international arbitration according to UNCITRAL arbitration rules.

3.2 South African Power Pool (SAPP)

The South African Power Pool (SAPP) is a regional body that was formed in 1995 through a Southern African Development Community (SADC) treaty to optimize the use of available energy resources in the region and support one another during emergencies. The pool includes 12 countries in the mainland African Region – Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Madagascar, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe. In SAPP countries multiple interconnections were established between hydro-dominant and coal-dominant countries to ensure that the systems do not become over-dependent on hydropower, which is prone to much more natural risks than coal. The major milestones in the development of SAAP are shown in Table 20 below.

Inter-country MoUs, Treaties, Agreements

In 1992, the heads of countries of South Africa signed the **Declaration and Treaty of the Southern African Development Community (SADC).** The Treaty recognized the need for stronger regional integration throughout Southern Africa for further development of the region in different areas of cooperation including Infrastructure.

Table 20 Major Milestones in the Development of the SAPP

Year	Milestone
1991/2	Regional drought of once-in-a-century severity; tripartite agreement for wheeling of power from DRC to Zimbabwe through Zambia
1992	SADCC reconstituted as SADC
1994	First democratically elected government in South Africa
1995	Formation of the Southern African Power Pool (SAPP); initial focus on trading of excess generation capacity available in the region based on ongoing transmission projects
1996	Completion of 400 kV line between Matimba and ZESA; significant exports of Eskom power to Zimbabwe commences
1997	Completion of 400 kV line between HCB and ZESA; export of Cahora Bassa power to Zimbabwe commences, wheeling the power through EDM power line in Mozambique
1998	New HCB-Eskom tariff agreement and resumption of electricity exports to South Africa
1998	400 kV interconnector is built between South Africa, Swaziland and Mozambique (MOTRACO, primarily to supply MOZAL aluminium smelter at Maputo)
2000	SAPP Coordination Centre is established in Harare
2001	Short Term Energy Market (STEM) commences operation
2002	Regional Electricity Regulatory Association of Southern Africa (RERA) is established (Secretariat is located in Namibia)
2007	Emergence of regional shortage of generation capacity
2008	Emergency plans launched to deal with regional shortage
2009	Day-Ahead Market (DAM) due to commence operations

Source: The Potential of Regional Power Sector Integration – South African Power Pool (SAPP) Transmission and Trading Case Study, ECA, October 2009

Inter-Governmental MoU (IGMoU)
The IGMoU was signed by SADC member countries in 1995 for the formation of a power pool in the region. The document was revised in 2006 and then subsequently in 2010 the MoU granted permission for the utilities to participate in the SAPP and enter into new contracts and guarantees the financial and technical performance of the power utilities. The IGMoU establishes that the SAPP agreements must be interpreted in a manner consistent with the SADC treaty and the final and binding dispute resolution forum is the SADC dispute resolution tribunal.

Inter-Utility MoU
SADC passed the SAPP Inter-Utility MoU in December 1994. The MoU established an official cooperation among SADC member states for sharing the costs and benefits of energy generation. The document was revised in 2007. The MoU specifies the power pool's operating principles, objectives, and organizational structure, stipulating a system of committees and subcommittees dedicated to aspects of power generation – operations, planning, environmental effects, technical and administrative work – and naming each group's duties, schedule of meetings, and decision-making procedures.

Agreement between Operating Members
It determines the interaction between the utilities with respect to operating responsibilities under normal and emergency conditions. This agreement lays down the specific rules of operation and pricing.

Operating Guidelines Framed in 1996
These guidelines define the sharing of costs and functional responsibilities for plant O&M, including safety rules and standards and operating procedures.

Transmission Planning/Infrastructure
The SADC guidelines provide an enabling framework for cross-border trade and investment in infrastructure helping address the current trade barriers. The first SAPP energy plan was prepared in 2001 with successive updates in 2005 and 2009. The existing interconnections in SAPP were largely inherited from pre-SAPP days. These were mainly bilateral projects for firm, economy, and emergency power purchases.

Generation and transmission projects of regional importance are prioritized and a majority of them are developed together with the private sector. Export-oriented projects are identified and their development is linked with the development of the transmission lines. In SAPP, the prioritization of the transmission projects is done on the following basis:

- **Category A:** Transmission projects for alleviating congestion caused due to the regional trade and development of the DAM.
- **Category B:** Transmission projects to ensure interconnection of all non-operating members; outstanding transmission interconnectors whose aim is to interconnect non-operating members of the SAPP.
- **Category C:** Transmission projects related to new generation capacity; new transmission interconnectors aimed at evacuating power from generating stations to the load centers.

Open Access to Network
In SAPP, all operating members are obligated to wheel except where technical problems prohibit**.** In SAPP, '**Wheeling**' is referred to as the transmission of power through a member's system who is neither the seller nor the buyer of this power. This is based on the point-to-point concept recognizing national borders as the points of entry and exit (MWh/km). There are two types of wheeling depending upon the trading arrangements:

- **Firm Wheeling**: Wheeler guarantees that the wheeled power enjoys the same priority as any firm supply to its own customers – penalties apply in case breach. Often applicable in case of a single wheeler.

- **Non-firm Wheeling**: The wheeler in non-firm wheeling may curtail or interrupt the flow of wheeled power based on technical and economic considerations for its system without any penalty. The reasons for interrupting wheeling must be disclosed and should be open to investigation. Normally applicable in case of multiple wheelers.

Currently, with CBET dominated by large number of bilateral contracts, the order of access for wheeling in SAPP is as follows:

- Bilateral agreements recognizing maturity dates
- Stem monthly contracts
- Stem weekly contracts
- Stem daily

Mechanism of Interconnection

Operating as large synchronous AC power grids, in which all the interconnected systems maintain the same precise electrical frequency and the network operates as a single synchronized system. Here all the countries follow same operating codes (regional grid codes) to ensure system stability. In SAPP some far placed power systems are also connected via HVDC system to ensure efficient transmission of power.

Transmission Pricing/ Wheeling Charges and Transit

The transmission systems in the majority of these countries are interconnected. A fundamental SAPP objective is to allow wheeling of energy through the transmission systems. For short-term and Dams, SAPP has been using the following mechanisms to determine the wheeling charges:

- Initially, the methodology for price determination was based on 'Postage Stamp' where costs were based on the specific path agreed for an individual wheeling transaction under a contract. However, the method did not take into account the exact utilization of the system and potentially discriminated between users.

- In 2003, SAPP moved to 'MW-Km' based pricing which uses power flow model, hence wheeling prices reflect to a better extent the actual use of the system. A large portion of the electricity is wheeled through transit countries where the transit countries are the members of the SAPP. For all types of trade a pre-agreement is entered with the transit countries that allow for the use of transmission networks on the sharing of wheeling charges.

- Nodal Transmission Pricing Model has now been developed to determine PoC charges.

PPA Terms

Historically, the inter-country exchanges have been through bilateral agreements. However, terms and conditions provided for in the PPAs have remained unchanged over a long period of time and have not guaranteed the reliability of supply. There was no coordinated planning of power system expansion. This led to in-supply unreliability due to power generation capacity constraints which resulted in exporting utilities inability to meet their export obligations.

Currently, SAPP is largely governed by agreements. The agreement between operating members determines the interaction between utilities with respect to operating responsibilities under normal and emergency conditions. This agreement lays down the specific rules of operation and pricing. Further,

the operating guidelines define the sharing of costs and functional responsibilities for plant operation and maintenance including safety rules, standards, and operating procedures.

Apart from firm energy sales, exchanges that are happening include back-up and marginal exchanges for energy support and spinning reserve. The rules of power-pool operations have helped member utilities to ensure mutual support in emergency conditions and improve reliability by sharing capacity reserves. In addition, transactions on the short-term energy market (STEM) allow pooling participation to complement bilateral power trading contracts.

Commercial Mechanism to Settle Imbalances

The settlement of inter-utility power transactions under long-term bilateral trading agreements is governed by the conditions that are attached to such bilateral agreements. Currently the interchange imbalances in SAPP are being handled based on hourly average power system frequency at different blocks of pool generation costs. The settlement happens in cash.

Sustainable Development of Energy Trade and Provision for Projects Committed to Trade

The SADC Protocol on Energy (signed in 1996 and revised in 2006) recognizes the need for a coordinated approach to energy strategy formulation and planning for the SADC region. The protocol on energy aims at ensuring the harmonization of sectoral and sub-sectoral regional energy policies and programs with the overall policies and program of SADC and with the strategies and programs of other SADC sectors.

Regulatory Coordination

The Regional Electricity Regulators Association of Southern Africa (RERA) is a formal association of independent electricity regulators whose establishment was approved by the Southern African Development Community (SADC) Ministers responsible for Energy in Maseru, Lesotho, on July 12, 2002. The Association was officially launched in Windhoek, Namibia, on September 26, 2002 and it provides a platform for effective cooperation between independent electricity regulators within the SADC region. Eleven out of 15 SADC countries have energy/electricity regulators and 9 out of 11 are members of RERA. RERA regulatory guidelines for cross-border power trading in South Africa (SADC region) has been developed with an objective to a) Ensure that efficient cross-border deals are not constrained by unclear or complicated processes for making regulatory decisions. More specifically, the objective of RERA regulatory guidelines clarify how regulators will carry out their powers and duties in regulating cross-border electricity transactions in order to minimize regulatory risks for power investors and customers b) Promote efficient and sustainable cross-border electricity transactions that are fair to selling and buying entities, are consistent with least-cost sector development, and help to ensure security of supply c) Promote transparency, consistency, and predictability in regulatory decisions.

SADC Energy Ministers approved the guidelines in Luanda, Angola, in April 2010 and this decision placed emphasis on adopting the guidelines as regulatory best practice and implementing them in SADC member states.

In April 2007, the SAPP and the Regional Electricity Regulatory Association (RERA) signed an MoU to:

1. Enable the exchange of information between the two parties,

2. Identify the challenges and problems facing the energy industry in South Africa and work together in order to confront such challenges and find solutions to problems.

3. SAPP is now supporting RERA in its effort to change from an electricity regulator into an energy regulator and also from an association into an authority.

RERA and SAPP have also recognized that a tighter regime is needed to expand electricity trading and to attract private investors. In this regard, some of preliminary discussions on joint RERA/SAPP initiatives include the following:[16]

- Regional (SADC) grid code development to establish the obligations of industry participants around the use of the transmission system, operation of the interconnected power system, and maintain appropriate standards.
- Public consultation on regulation of new transmission interconnections is a public consultation by RERA in conjunction with SAPP to produce additional guidelines on cost recovery, transmission pricing and access conditions for major new transmission lines.

Dispute Resolution
The IGMOU establishes that the SAPP agreements must be interpreted in a manner consistent with the SADC Treaty and the final and binding dispute resolution forum is the SADC dispute resolution tribunal.

3.3 West African Power Pool (WAPP)

The West African Power Pool is a regional body that was formerly established in 2006, through an inter-governmental MoU among the West African states, called the ECOWAS (Economic Community of West African states). It includes 14 ECOWAS member countries: Benin, Togo, Nigeria, Niger, Mali, Cote d'Ivoire, Ghana, Gambia, Sierra Leone, Liberia, Senegal, Burkina Faso, and Guinea Bissau.

3.3.1 Key Instruments of CBET in WAPP

Inter-country MoU, Treaties, Agreements
In 1975, the Treaty of Lagos created the Economic Community of West African States (ECOWAS) a regional group of 15 countries with a mission to promote economic integration in different fields including infrastructure. One of the objectives of ECOWAS is harmonization and co-ordination of national energy policies and the promotion of integration programs, projects/activities in the energy sector and ensuring inter-connection of electricity distribution networks.

The ECOWAS Ministers of Energy adopted an inter-governmental MoU on the establishment of WAPP in 2000. The MoU set forth the mutual obligations of the Parties and created an oversight, coordination, and administrative apparatus.

Articles of Agreement set out the objectives of WAPP and its operating procedures among the member states including regulatory affairs and dispute resolution.

Transmission Planning/Infrastructure
The WAPP investment program is derived from the ECOWAS Master Plan for the Generation and Transmission of Electrical Energy developed in 1999, with subsequent revisions in 2005 and 2012. The Master Plan defines priority projects in the region (as identified by the Secretary-General in collaboration with funding/donor agencies) for development. The Master Plan focuses on the interest of developing massively the hydroelectric resources in West Africa and to build a reliable transmission network to share the resources in the whole region.

[16]http://www.icer-regulators.net/portal/page/portal/ICER_HOME/activities/ICER_Events/ICER_SoS_Workshop/13.%20debbie%20roets.pdf

Open Access to Network

With regard to open access, the Energy Protocol of ECOWAS has specific provisions related to non-discriminatory conditions for trade in energy to ensure reliable cross-border energy transit flows. As per Article 6(1), 'Each Contracting Party shall work to alleviate market distortions and barriers to competition in Economic Activity in the Energy Sector' and Article 6(8), 'Contracting Parties agree that open and non-discriminatory access to power generation sources and transmission facilities'. The Supplementary Acts (Supplementary Act A/SA.2/01/08 of January 2008 and Regulation C/ REG.27/12/07 of 15 December 2007) that govern the implementation of WAPP provides for the regional electricity market to be organized on the principles of free exchange between member states within a competitive framework founded on the application of non-discriminatory rules of exchange. Commitment was obtained from all member states on the application of principles so as to encourage freewheeling of electricity energy on the basis of non-discriminatory, transparent, and available network access at fair price.

Mechanism of Interconnection

Operating as large synchronous AC power grids, in which all the interconnected systems maintain the same precise electrical frequency and the network operates as a single synchronized system. Here all the countries follow the same operating codes (regional grid codes) to ensure system stability. In WAPP, some far placed power systems are also connected via an HVDC system to ensure efficient transmission of power.

Transmission Pricing/Wheeling Charges and Transit

In WAPP, all the countries are vertically integrated with the exception of Ghana and Nigeria. Transmission tariff is only separately calculated in Ghana and Nigeria. Separate kVA charge and locational transmission prices are determined in Cote de Ivoire, Mali, and Nigeria. Currently, the utility is purchasing power from neighboring countries only in Togo and Mali. However, no wheeling charge is applicable.

In most of the contracts undertaken in WAPP, transmission charges are not specified separately. If there are transmission charges these are included in the energy tariff. Further, the PPAs do not mention about any wheeling arrangement**.** Since most of the projects in West Africa are funded with grants or credits from multilateral donor agencies and direct bilateral agencies absence of a common pricing approach is not perceived as a major constraint on new investment. This is primarily due to the reason that donor funding enables project to proceed without firm off-take agreements in place, in contrast to the projects being developed using concessionary or commercial finance, which typically need to show repayment of loans through future tariff revenues.

PPA Terms

Electricity trading in the ECOWAS region has been taking place under long-term bilateral/trilateral power purchase agreements (PPAs) since early 1970s. Many of these PPAs have been renegotiated or replaced with shorter term contracts as these agreements expired. Historically the contracts and agreements have not been well drafted in payment terms resulting payments by the importer and disputes. PPAs being enforced were largely old and did not comprise revisions in line with the sector reform.

Commercial Mechanism to Settle Imbalances

The draft version of WAPP operation manual contains policies for operations security and mitigation plan. It governs the operation of WAPP interconnected network (Grid Code) including interchange scheduling and accounting between control areas.

Rules for proposed full-fledged energy market in WAPP were developed in 2012. Under settlement of balancing energy following have been proposed:

- The balancing energy will be settled "in kind".
- Each day after operation the SMO shall calculate the imbalances (difference of energy verified during real time operation with scheduled) due to and from each participant for each trading interval in the previous day.

Sustainable Development of Energy Trade and Provision for Projects Committed to Trade

One of the objectives of ECOWAS is harmonization and co-ordination of national energy policies and the promotion of integration programmes, projects/ activities in the energy sector and ensuring inter- connection of electricity distribution networks. There is a strong commitment from national governments, that is, legally enforceable agreements in a regional energy treaty or energy protocol.

The Master Plan defines priority projects in the region (as identified by the Secretary General in collaboration with funding/donor agencies) for development. The Master Plan focuses on the interest of developing massively the hydroelectric resources in Western Africa and to build a reliable transmission network to share the resources in the whole region.

Regulatory Coordination

The ECOWAS Regional Electricity Regulatory Authority (ERERA) is the regulator of regional cross-border trade of electricity in West Africa. Within the framework of the Energy Protocol and the West African Power Pool Program (WAPP) , the member states of ECOWAS, in January 2008 established, the ECOWAS Regional Electricity Regulatory Authority (ERERA) by Supplementary Act A/SA.2/1/08, as a specialized institution of ECOWAS. ERERA's main objective is to ensure the regulation of interstate electricity exchanges and to give appropriate support to national regulatory bodies or entities of the member states.

The main ECOWAS Regional Electricity Regulatory Authority (ERERA) missions and objectives of ERERA include the following:

- Regulation of cross-border electricity connections and trading among ECOWAS member states.
- Establishment of clear and transparent tariff setting methodology for regional power pooling.
- Facilitating the setting up of regulatory and economic environment for the development of the regional market.
- Technical regulation of the regional power pooling and monitoring of regional market operations.
- Assisting the ECOWAS Commission in defining the strategy for the regional energy policy.
- Establishing effective dispute resolution methods among regional market participant.
- Assisting national regulatory bodies in ECOWAS on capacity building and technical issues upon request.

Dispute Resolution

Dispute Resolution was defined in the bilateral/trilateral agreements entered into by the parties. Primarily these agreements provided for mutual settlement of disputes amongst the parties themselves. Later the dispute resolution procedures were laid down Energy Protocol adopted and ratified in 2003 and 2007, respectively. Chapter V, Article 26 of the Energy Protocol provides for settlement of disputes between an investor and a contracting party. Further, Article 27 provides for SETTLEMENT OF DISPUTES BETWEEN CONTRACTING PARTIES: This article stipulates the time frame within which the disputes have to be resolved through tribunal set up for this purpose.

The ECOWAS Regional Electricity Regulatory Authority (ERERA) is also empowered to resolve disputes among regional market participant and particularly litigation procedures to ensure compliance of trade regulations and contracts.

3.4 The Central American Electrical Interconnection System (SIEPAC)

The Central American Electrical Interconnection System (SIEPAC) project is an initiative to create an integrated regional electricity market among six Central American countries: Guatemala, El Salvador, Honduras, Costa Rica, Nicaragua and Panama. The concept of a regional market (SEIPAC) was first introduced by the six Central American governments in 1987 with the encouragement of the government of Spain and the (then state-owned) Spanish utility, Endesa. The major milestones in the development of the SIEPAC are shown in Table 21 below.

3.4.1 Key Instruments of CBET in the SIEPAC

Inter-country MOU, Treaties, Agreements

In 1979, the governments and the state utilities of the six countries consented to the formation of a regional planning body the Central American Electrification Council (CEAC). The CEAC was formally established in 1989 as a forum for discussion and coordination among the utilities in the region. CEAC played a key role in overseeing and coordinating the development of the SIEPAC institutions.

Within CEAC a number of committees and groups were formed to coordinate the design and implementation phase of the Regional Energy Market (MER). Two further groups were formed to

Table 21 Major Milestones in the Development of the SIEPAC

Year	Milestone
1976	First interconnection in the region built between Honduras and Nicaragua.
1979	The governments and state utilities of the six countries agree to create the Central American Electrification Council (CEAC).
1989	CEAC is formally established following ratification of its Constituent Agreement.
1993	Protocol Treaty on Economic Integration of Central America agreed to at summit of Central American Presidents.
1996	The six countries sign the Marco Treaty of the Electrical Market of Central America.
1997	IADB and the government of Spain approve loans to the SIEPAC project.
1998	Marco Treaty ratified. Economic-technical study of SIEPAC carried out.
1999	Marco treaty comes into effect. Regional transmission line company (EPR) incorporated.
2000	MER design approved by six governments following two-year development process. Regional electricity market regulator (CRIE) established.
2001	Regional electricity system and market operator (EOR) established.
2002	Transitional Regulations for the Regional Electricity Market (MER) finalized by CRIE and signed by the governments. MER begins operation under transition code.
2003	Environmental impact assessments for the SIEPAC line completed for each of the six countries.
2005	Transitional MER regulations replaced by updated code approved by CRIE. Central American Free Trade Agreement (CAFTA) signed into US law.
2006	Construction of the SIEPAC transmission line begins. Construction begins on the strengthened interconnection between Mexico and Guatemala.
2008	The state-owned Mexican utility, Comisión Federal de Electricidad (CFE), becomes the ninth shareholder.

provide advice on the technical and market design aspects: Programming and Evaluation Committee (CPE) and Advisory Group.

SIEPAC was formed basis an intergovernmental framework agreement, known as the Marco Treaty which was signed by the six governments in 1996 and came into force in 1999. This agreement provides the legal foundation on which the regional market and the supporting institutional and physical infrastructure are built. The treaty provided the basis for integration of the SEIPAC and included provisions for the establishment of three permanent international organizations as legal entities. These are the core regional market organizations:

- International transmission Line Company (EPR, incorporated in 1999). EPR is subject to private law in each of the Central American Countries, providing some assurance that it will not expropriate private assets.
- Regional Regulator (Regional Commission on Electrical Interconnection), CRIE began operations in 2000.
- Regional system operator--dispatcher-regional market administrator (Ente Operador Regional, EOR), established in 2001).

Marco treaty includes the roles and responsibilities of CRIE and EOR. The treaty further confers CRIE and EOR with the status of a regional/a supranational entity with its own juridical identity and powers under public international law. This gives both CRIE and EOR independence from national legal systems.

Transmission Planning/Infrastructure

The transmission plan determined which parts of the national transmission systems were necessary for the initial regional transmission system, and the governments facilitated the transfer of the relevant regional transmission assets to the regional transmission owner. Additionally, an expansion plan was formulated for generation and regional transmission, envisaging the establishment of regional reserve margins and allocating reserve responsibilities within the regional system. The regional regulator is then responsible for approving the plan.

PPA Terms

Most of the existing contracts are still dominated by long term PPAs. The terms and conditions are bilaterally negotiated including pricing, dispute resolution, settlement and so on. Bilateral contracts are complemented by short term contracts in day ahead and intra-day contracts. Further, rules of power-pool operations have helped member utilities to ensure mutual support in emergency conditions and improve reliability by sharing capacity reserves.

Regulatory Coordination

Regional Electricity Interconnection Commission (CRIE) is the regulator of the regional market created by the Framework Agreement, with legal personality and capacity of international public law. According to the Framework Treaty for the Electricity Market in Central America the general objectives of the Regional Electricity Interconnection Commission are:

- Enforce the Framework Agreement and its protocols as well as its regulations and other complementary instruments.
- Pursue the development and consolidation of the market and ensure transparency and proper functioning.
- Promote competition among market players.

Dispute Resolution

The Marco Treaty establishes CRIE as a supranational entity with its own juridical identity and powers under public international law. One of the major responsibilities of CRIE includes settling disputes among participants. A phased dispute resolution process has been established:

- Initially, the general managers of the concerned control center seek amicable agreement.
- If this is not successful, then the dispute is referred to higher levels of the concerned TSOs. These initially appoint representatives for formal amicable discussions.
- If the dispute relates to a technical matter, then the TSOs may agree on an independent expert to provide an opinion.
- If an amicable resolution cannot be reached, the dispute is referred to arbitration. A three-member panel is appointed operating under UNCITRAL rules. Arbitration hearings are to be held in a neutral country and conducted in English. The decision of the panel is final and no appeal is allowed to the courts.

A summary of the key learnings from the aforementioned international experiences that are relevant to the SAR, in its endeavour to develop a robust CBET mechanism in the region, have been summarised in the subsequent table.

3.5 Nordic Pool

Nord Pool, the Nordic Power Exchange, is the world's first international commodity exchange for electrical power, At present It operates in Norway, Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Germany and the UK. All Nordic countries have liberalised their electricity markets, opening both electricity trading and electricity production to competition. The purpose of the liberalisation was to create better conditions for competition, and thus to improve utilisation of production resources as well as to provide gains from improved efficiency in the operation of networks. The liberalisation process in the middle of the 1990s was followed by an integration of the Nordic markets. The establishment of Nord Pool, the Nordic electricity exchange, was an important part of this integration. The major milestones in the development of the Nordic Pool are shown in Table 22.

3.5.1 Key Instruments of CBET in Nordic Pool

Inter-country MOU, Treaties, Agreements

The inter-Nordic Transmission System Operation Agreement (TSOA) defines this framework, which incorporates the following main elements:

- Security standards
- Balance management standards
- Information exchange
- System protection schemes
- System services
- Principles for joint operation among the different subsystems
- Congestion management and managing capacity limitations
- Rules for power shortage
- Joint operation with other systems

Table 22 **Major Milestones in the Development of the Nord Pool**

Year	Milestone
1963–90	A stable policy environment existed in this period for national power grids of Nordic countries.
From about 1990	Power industry liberalization began. Politicians and regulators engage NORDEL.
1993 and 1998	New by-laws were put in effect in both years. Large generators, mostly incumbents, remained members of NORDEL, but Nordic TSOs took over the leadership role.
2000	Changes were agreed to at the NORDEL annual meeting. From then on, NORDEL was reconstituted exclusively as an organization of Nordic TSOs and no other power companies were allowed as members.
Up to 2000	NORDEL remained an advisory body in which the organization's governance structure was based primarily on "gentlemen's agreements.
From 2000	NORDEL governance structure was transformed with introduction of legally binding agreements among the TSOs

Transmission Planning/Infrastructure
Transmission planning is done by Planning Committee; its members are managers of planning functions for the various Nordic TSOs.

The objectives and tasks of the Planning Committee include the following:

- Achieve continuous and coordinated Nordic planning among the TSOs, so that the best possible conditions can be provided for a smoothly functioning and effectively integrated Nordic electricity market
- Initiate and support changes in the Nordic power system enabling satisfactory reliability of system supply through effective utilization of existing and new facilities
- Be instrumental in developing the Nordic power system in ways that are consistent with environmental sustainability. When planning transmission facilities, impact assessments must integrate the need to preserve and protect the natural environment.

Open Access to Network
All networks were opened for third-party access.

Transmission Pricing/Wheeling Charges and Transit
The Nord Pool transmission pricing methodology is based on a point or stamp tariff system, where the producers and consumers pay a fee for the kWh injected or drawn from the system. The distance or transmission path between the seller and buyer is of no significance to the transmission price. The actual transmission price depends on where (what point in the grid) the power is injected or consumed and how much power is injected or consumed. The charges are determined by the individual TSOs and paid to the TSO to which the connection is made. However the payment allows trading of electricity across the whole Nord Pool market area. Within each member country there is a transmission tariff payable within the country. In Norway the transmission tariff comprises several components, a fixed component, a load component and an energy component.

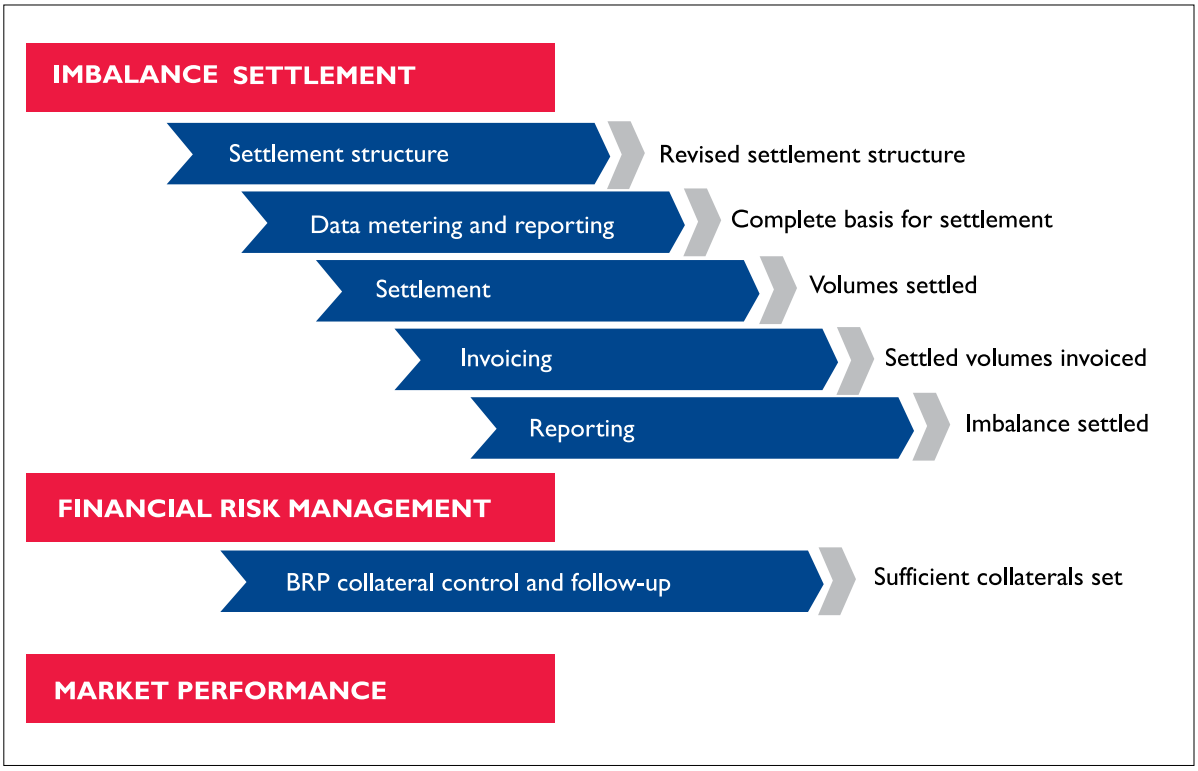
In addition to the transmission tariff cost congestion costs are recovered through congestion rents which are the income or cost that arise due to the price differences between the areas. The congestion rent from the interconnectors is shared among the four TSOs in accordance with a separate agreement. The available transmission capacity and the price differences in the surplus and deficit area manage the congestion day ahead implicitly within the energy market auctions.

Commercial Mechanism to Settle Imbalances

A common imbalance settlement solution is supported by the governments and regulators in the Nordic countries. Harmonising the imbalance settlement in Finland, Norway and Sweden is regarded as an important step towards a fully functional common end user market. Common imbalance settlement is therefore a prerequisite for a common end user market. Objectives of the Imbalance Settlement Model were:

- Imbalance settlement performed with as similar principles as possible through eSett.
- Design and provide similar operational preconditions for BRPs regardless of an MBA
- Harmonise common rules and standards for information exchange
- Contribute to the implementation of a common Nordic retailer market
- Be a forerunner in imbalance settlement issues on European level

Figure 20 The Imbalance Settlement Model Function



The Nordic Imbalance Settlement Model ensures a transparent and common imbalance settlement and equal treatment of market participants. The main objective of the Nordic Imbalance Settlement Model is to perform imbalance settlement across included countries with the same principles and based on two balances; production balance and consumption balance. Both are calculated and settled separately. The model provides harmonised and necessary procedures for imbalance settlement.

3.6 Regulatory Coordination

NordREG is an organization for the Nordic energy regulators. Our mission is to actively promote legal and institutional framework and conditions necessary for developing the Nordic and European electricity markets. NordREG mission is "In cooperation, we actively promote legal and institutional framework and conditions necessary for developing the Nordic and European electricity markets". The basis for the co-operation within NordREG is to identify areas of work where cooperation can take the following forms:

- Exchange of views
- Working together to map and analyse energy market issues
- Producing reports and statements
- Taking common action to influence the development of the Nordic or the European energy markets

With deeper energy integration in across Europe, the AGENCY FOR THE COOPERATION OF ENERGY REGULATORS (ACER) IN THE EUROPEAN UNION is taking lead for regulatory coordination across the Europe.

The European Agency for the Cooperation of Energy Regulators (ACER) is an Agency of the European Union by the Third Energy Package in 2009. The Third Energy Package is a legislative package for an internal gas and electricity market in the European Union. The Board of Regulators (BoR) comprises senior representatives of the National Regulatory Authorities (NRAs) and one non-voting representative of the European Commission. Each NRA also appoints an alternate representative. The NRAs of Nordic countries are also the members of the BoRs of ACER.

The BoR plays a key role within ACER. It decides on the regulatory policy of ACER. It has a substantial influence on the decisions, opinions and recommendations of the Agency. Concretely, it provides opinions to the Director which the Director shall follow. In addition, the BoRs, within its field of competence, shall provide guidance to the Director in the execution of his tasks and the Director shall act in accordance with this guidance. The central role of the BoR within ACER is underlined by the condition that the appointment of ACER's Director and ACER's work program need to be approved by the BoR.

The Agency's overall mission, as stated in its founding regulation, is to complement and coordinate the work of national energy regulators at EU level, and to work towards the completion of the single EU energy market for electricity and natural gas. ACER plays a central role in the development of EU-wide network and market rules with a view to enhancing competition. The Agency coordinates regional and cross-regional initiatives, which favor market integration. It monitors the work of European networks of transmission system operators (ENTSOs), and notably, their EU-wide network development plans. Finally, ACER monitors the functioning of gas and electricity markets in general, and of wholesale energy trading in particular.

The tasks undertaken by the Agency include:

- Complements and coordinates the work of national regulatory authorities in member countries,
- Participates in the creation of European network rules,
- Issues non-binding opinions and recommendations to national energy regulators, transmission system operators, and the EU institutions.
- Take binding individual decisions in specific cases and under certain conditions on cross-border infrastructure issues.
- Upon request from the European Commission, ACER submits draft framework guidelines which serves as basis for the drafting of network codes. The network codes only become binding after comitology procedure involving member states and the European Commission.

In ACER, **Framework Guidelines and Network Codes** aim at providing harmonized rules for cross-border exchanges of electricity. The drafting of those documents involves the European Commission, ACER and European Network of Transmission System Operators of Electricity or ENTSO-E (of which Nordic countries are also members).

ACER carries out various activities related to **Network Development and Infrastructure Regulation**. They relate to the following specific aspects:

- Network development, which includes activities related to the ENTSO-E Ten Year Network Development Plan and national plans;
- Infrastructures, which includes activities for the implementation of Regulation regarding trans-European energy infrastructures;
- Inter-TSO compensation mechanism, which includes activities about the compensation for the costs of losses incurred as a result of hosting cross-border flows of electricity and for the costs of making infrastructure available for them.

The **Regional Initiatives** of ACER have been set up in a way which ensures that stakeholders are effectively engaged. They bring together regulators, the European Commission, Member State governments, companies and other relevant parties.

- The **Regional Coordination Committees (RCC)** (of the regions' national regulators) fulfill the task of coordinating, facilitating and driving forward the priorities in each region – under the guidance of the lead regulator.
- The **Implementation Groups (IG),** which include market operators such as TSOs, power exchanges and interconnector operators provide a proper framework for implementing practical solutions.

Other key **market participants** such as traders, suppliers, customers and electricity generators have been brought together in a Stakeholder Group (SG) in each region.

Table 23 Summary of Relevant Learnings from International Experiences

Key Ingredients of CBET	Learnings from International Power Pools/Regions				
	Nord Pool	**SAPP**	**WAPP**	**GMS**	**SIEPAC**
Inter-Governmental Commitment and Regional Coordination	The inter-Nordic Transmission System Operation Agreement	Treaties	Energy Protocols	MOUs	Treaties
		MOUs	MOUs	Inter-utility MOUs	Inter-Governmental Agreement on trade
		Inter-utility MOUs	Articles of Agreement	Inter-Governmental Agreement on trade	
				Policy Statement on Regional Trade	
Regional Cooperation on Regulatory and Contractual Aspects	The Regulator determines guidelines and bylaws for regulation of monopolies within the power Business. Generally this covers grid issues such as Guidelines and by-laws for cost recovery through network tariffs Nord Reg and ACER	Common set of regulatory guidelines and Regional Regulatory Authority (RERA)	ECOWAS Regional Electricity Regulatory Authority (ERERA)	Electric Power Forum, Regional Power Trading Coordination Committee (RPTCC)	Regional Electricity Interconnection Commission (CRIE)
Transmission Planning/ infrastructure Development	Master Plan at the Regional Level	Master Plan at the Regional Level	Master Plan at the Regional Level	Master Plan at the Regional Level	Master Plan at the Regional Level
		Majority of Generation and Transmission projects of regional importance are developed together with the private sector through PPP mode	Majority of Generation and Transmission projects of regional importance are developed together with the private sector through PPP mode		
Third Party Access/Open Access	All networks were opened for third-party access	Provisions for Open Access exist. All operating members are obligated to wheel except where technical problems prohibit (Open Access). Bilateral Contracts are given priority over short term contracts	OA has been recognized through Protocols and Supplementary Acts	OA has been recognized through Strategy Documents	Some of the countries have unbundled, that is, separation of transmission from generation
Transmission Pricing	The point-of-connection tariff is used in transmission pricing in the Nordic region	Transmission usage charges (transit charges) for long term bilateral trade agreements - Bilaterally negotiated in PPAs. In terms of pricing, generally 'Postage Stamp' method being used	Transmission usage charges (transit charges) for long term bilateral trade agreements - Bilaterally negotiated in PPAs. In terms of pricing, generally 'Postage Stamp' method being used	Transmission usage charges (transit charges) for long term bilateral trade agreements - Bilaterally negotiated in PPAs. In terms of pricing, generally 'Postage Stamp' method being used	
		Transmission pricing for short term trade- 'MW-km' method prevalent earlier. Recently, graduated to 'Nodal Pricing'			

Table 23 Summary of Relevant Learnings from International Experiences (Contd..)

Key Ingredients of CBET	Learnings from International Power Pools/Regions				
	Nord Pool	**SAPP**	**WAPP**	**GMS**	**SIEPAC**
Mechanism of Interconnection	System synchronized: AC interconnection	System synchronized: AC interconnection	System synchronized: AC interconnection	System synchronized: AC interconnection	System synchronized: AC interconnection
	HVDC links also in place	HVDC to interconnect far placed systems	HVDC to interconnect far placed systems		
Settlement of Energy Imbalances and Grid Security	Settlement procedure for long term bilateral trade agreements- Governed by the conditions that are attached to such bilateral agreements	Settlement procedure for long term bilateral trade agreements- Governed by the conditions that are attached to such bilateral agreements	Settlement procedure for long term bilateral trade agreements- Governed by the conditions that are attached to such bilateral agreements	Settlement procedure for long term bilateral trade agreements- Governed by the conditions that are attached to such bilateral agreements	
		Settlement procedure for short term trade- Being handled based on hourly average power system frequency at different blocks of pool generation costs. The settlement happens in Cash			
PPA/Contract terms	All contracts are standardised in conformity with most Nordic OTC and bilateral market trade. Nord Pool Clearing clears all contracts traded on the Nordic Power Exchange and a substantial proportion of financial contracts traded in the Nordic OTC and bilateral power markets.	Dominated by bilaterally negotiated long term contracts	Dominated by bilaterally negotiated long term contracts	Dominated by bilaterally negotiated long term contracts	Dominated by bilaterally negotiated long term contracts
		bilateral contracts are complemented by short term contracts in day ahead and intra-day contracts			bilateral contracts are complemented by short term contracts in day ahead and intra-day contracts
Funding		IFIs, Development banks and National governments	Multilateral development banks (WB, KFW) securing grant or credit financing for the projects, creation of SPVs for members to take equity stake	Concessional debt financing and technical assistance (ADB, WB), Several CBET feasibility studies funded by ADB and WB	Funding primarily by loans from the Inter-American Development Bank (IADB) and the Central American Bank for Economic Integration
Dispute Resolution	Treaties and Agreements contain the dispute resolution and settlement procedures. (Client agreement)				
	Most preferred method of dispute settlement resolution is amicable settlement between the parties.				
	The last resort of settlement is through international arbitration as per UNCITRAL rules/procedure as mentioned in the agreements/treaties.				

3.7 Critical Success Factors for Effective CBET and Learnings for SAR from International Experiences

The relevant learnings from the international experiences on CBET are useful in identifying the critical success factors for establishing an effective CBET from the SAR perspective.

3.7.1 Coordinated Legal and Regulatory Framework

Increased electricity cooperation and trade among participating countries requires to pay more attention to harmonization and coordination of their regulatory practices. Technical aspects such as rules and procedures concerning transmission access and its pricing, congestion management, operational codes and protocols for system operation, energy accounting and payment thereof, and data transfer protocols need to be gradually harmonized through appropriate regulations for seamless and stable operation of the transmission systems and enhancing CBET.

Figure 21 International Best Practices on Regional Regulatory Forum

Based on international experience, the core building blocks is in establishing a robust legal and regulatory framework. Certain consensus-building activities must be undertaken before any organizational activities get startedfor facilitating the implementation of Coordinated Legal and Regulatory Framework a strong, robust and transparent institutional mechanism is required.

For example, in Europe, the Agency for the Cooperation of Energy Regulators (ACER) issues non-binding opinions and recommendations to national energy regulators, transmission system operators for facilitating CBET. ACER is an independent agency which fosters cooperation among European energy regulators and ensures that market integration and the coordination of regulatory frameworks are achieved within the framework of the EU's energy policy objectives. Similarly, the Regional Electricity Regulators Association (RERA) of Southern African Development Community looks after regulatory coordination and ensure that the regulatory & contractual aspects done through common set of regulatory guidelines.

3.7.2 Robust Framework for Systems Planning and Operation

Once consensus is achieved on putting in place a coordinated legal and regulatory framework, another critical success factor is to maintain flexibility in the setting up of a viable, multi-country, institutional structure to leverage the individual and collective capabilities of TSOs/Transmission utilities to

- Plan for and implement cross-border interconnection facilities,
- Harmonize the operational rules of practice for their interconnected national power grids,
- Put in place a transparent, fair, and viable commercial framework for cross-border trading in energy services.

The basic mission of such TSO-led regional institutional structure is to promote equitable sharing of responsibilities for planning, developing, operating, and maintaining the technical hardware and software infrastructure required to assure safe, reliable, and cost-effective integration of national power grids. Invariably, such regional organizations evolve with time, as they build in-house capacity to accomplish their core responsibilities within clear, transparent, and harmonized frameworks. The development of a clear, transparent, and harmonized set of "Operational Rules of Practice" to be adhered to by the interconnected national power utilities, covering the following: (a) operation of the interconnection(s), (b) metering, accounting, and billing, (c) coordination of maintenance, (d) matching demand and capacity, and (e) determining and allocating losses.

For example, European Network of Transmission System Operators (ENTSO-E) in Europe, represents 41 electricity transmission system operators (TSOs) from 34 countries across Europe. ENTSO-E promotes closer cooperation across Europe's TSOs to support the implementation of EU energy policy and achieve Europe's energy & climate policy objectives, which are changing the very nature of the power system. Security – pursuing coordinated, reliable and secure operations of the interconnected electricity transmission network, while anticipating the decision to cope with upcoming system evolutions. The ENTSO-E works in the area of:

1. **Security –** pursuing coordinated, reliable and secure operations of the interconnected electricity transmission network, while anticipating the decision to cope with upcoming system evolutions.

2. **Market –** providing a platform for the market by proposing and implementing standardised market integration and transparency frameworks that facilitate competitive and integrated continental wholesale and retail markets.

3. **Sustainability –** facilitating secure integration of new generation sources, particularly renewable energy, as well as significantly contributing to the EU's greenhouse gases reduction and renewable energy supply goals.

ENTSO-E also work on Network Adequacy, that is, promoting the adequate development of the interconnected European grid and investments for a reliable, efficient and sustainable power system.

3.7.3 Commercial Framework for Energy Exchanges

Once deployed, the operation of cross-border interconnection facilities inevitably opens up numerous opportunities for national power utilities to exchange a range of energy services that are germane to the delivery of reliable electricity supply at minimum cost, including the following:

- Lowering of generation capacity reserve requirements
- Ability to achieve scale economies
- Opportunity to interchange economy energy
- Increased load and fuel diversity
- Opportunities for sale of surplus firm energy and
- Emergency support on major breakdowns

Thus it is important for a clear, transparent, and harmonized set of "Commercial Rules of Practice" to be put in place and adhered to by the interconnected national power utilities, with the following aims:

- Set the commercial framework within which energy exchanges will be conducted
- Agree on pricing principles
- Oversee and settle transactions
- Agree and enforce technical standards for metering and
- Arbitrate between and among power utilities

The aforementioned success factors are critical but not the only ingredients for enhancing CBET in the SAR. It is pertinent to mention that the international experiences provide a series of learnings that need to be referred at various stages of the process for introducing/strengthening cross border trading. The relevance of a particular lesson, from international experience, would depend on the previous approach and the next step planned on the course of CBET evolution in the region

3.7.4 Regional Transmission Master Plan

At an operational level, developing a long term regional grid master plan would help provide the necessary blue print towards attaining regional integration in power sector in the long term. The availability of such regional grid master plan would help countries align their capacity addition plans and developers prioritise their investments for regional projects. It would also help transcend from the currently bilateral approach of cross-border electricity exchange in the region to a full-scale CBET regime in the region. For example, in Europe and in SAAP, the regional transmission master plan has been prepared.

3.7.5 Coordinated Grid Codes and Regional Operating Mechanisms

Another operational initiative for sustainable development of power sector and enhancing CBET is the harmonization of various grid operating principles across all countries in the region for seamless energy exchange across the political boundaries. This would include, among others, aligning the existing grid codes, power system operating procedures, system protection code, metering code, system planning norms, system security, scheduling and dispatch frameworks, introducing open access, power market principles, and so on. The undelaying principles for such grid harmonization are already in place through the existing bilateral arrangements within the region. The next step has to be an extension of the learnings from existing arrangements to develop regional grid integration through requisite operating principles for smooth, optimal, secure, and reliable CBET across the region. For example, in Europe framework guidelines on connection, scheduling and despatch, and congestion management have been developed; based on these, detail network codes have been prepared.

4. Way Forward

Electricity sector integration in South Asia is in an evolutionary stage and awaits a structured approach to develop a regional power market. Although there are no formal market-based trading arrangements supported with harmonized/coordinated commercial, regulatory, and legal framework, successful bilateral trading arrangements are in place between Bhutan and India, India-Nepal, and India-Bangladesh. The benefits from enhancing CBET in the SAR are manifold but to realise them would require a focused approach to addressing key challenges and concerns. A number of initiatives, from policy to infrastructure, need to be undertaken to realize an integrated regional electricity trading institutional framework for seamless sale and procurement of electricity among the SAR countries.

Deeper power sector integration in the region will be driven by sound economics that would, in turn, depend on the demand-supply balance in each country as well as the policy and regulatory environment. The economic rationale and the benefits to accrue would differ from country to country. Hydro resource development in Bhutan and Nepal will, for instance, be an attractive proposition only if the demand in the rest of the South Asian countries is sufficiently high and the delivered cost of power is economic, relative to the importing countries' own resources. Bangladesh can benefit from a higher share of hydro resources in its generation portfolio if it can import hydro-electric power generated in nations richly endowed with hydro resources. Sri Lanka can improve its energy security by tapping electricity generation resources from India.

The existing and the proposed cross-border electric inter-linkage in the South Asian region is the culmination of bilateral negotiations. The initial focus on a strong bilateral form of power trade would ensure investment in viable interconnections. With the gradual harmonization of electricity codes and balancing mechanism, and strengthening of institutional cooperation, short-term transactions through OTC/bilateral and energy exchanges would become increasingly feasible. Experience from regional integration of power systems across various parts of the world suggests that development of a regional level mechanism to enhance CBET would require the identification and harmonization of key technical, commercial, economic, and regulatory/legal aspects. A number of successful international experiences clearly suggest that regional investments in CBET infrastructure, complemented by policy and regulatory arrangements, can help not only address electricity security issues but can also provide a positive thrust to the regional/country economy. International experience further strengthens the argument and, in the long run, supports a regional framework to promote regional investment in developing cross-border generation and transmission infrastructures and developing a competitive regional power market. These also suggest the need for a regional regulatory framework supported by an enabling regional institutional set-up for the long-term success of CBET.

Globally, many regional and other international electricity trade/cooperation have been sustained through regional regulatory forums/organizations such as the Regulators Forum, Agency for Energy Cooperation (ACER), and Council of European Energy Regulators (CEER) in Europe; Energy Regulators Regional Association (ERRA) in countries of Central and Eastern Europe and the newly-independent states of Eurasia; Utility Regulators Forum (URF) in Australia; Regional Electricity Regulatory Authority (RERA) in the South African region and ECOWAS Regional Electricity Regulatory Authority (ERERA) in West Africa. These regional institutional/forums have been helpful in coordinating/harmonizing regional legal, regulatory, and policy frameworks to promote CBET and related sector investments. SAARC IGFA also calls for the need for institutional mechanisms for the coordination of regulations for promoting CBET in the SAR.

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About SARI/EI

Over the past decade, USAID's South Asia Regional Initiative/Energy (SARI/E) has been advocating energy cooperation in South Asia via regional energy integration and cross-border electricity trade in eight South Asian countries (Afghanistan, Bangladesh, Bhutan, India, the Maldives, Nepal, Pakistan, and Sri Lanka). This fourth and the final phase, titled South Asia Regional Initiative for Energy Integration(SARI/EI), was launched in 2012 and is implemented in partnership with Integrated Research and Action for Development (IRADe) through a cooperative agreement with USAID. SARI/EI addresses policy, legal, and regulatory issues related to cross-border electricity trade in the region, promotes transmission interconnections, and works toward establishing a regional market exchange for electricity.

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For more information on the South Asia Regional Initiative for Energy Integration (SARI/EI) program, please visit the project website:

www.sari-energy.org