

India-Pakistan
Energy Cooperation :
Rethinking Opportunities
and Newer Approaches

Prof Mahendra P Lama

Jawaharlal Nehru University
New Delhi

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Energy Security : Critical issue in India-Pakistan sub-region

Energy demand is steadily growing.
Per capita electricity consumption remains rather low.
Recorded low electrification coverage in entire sub-region.

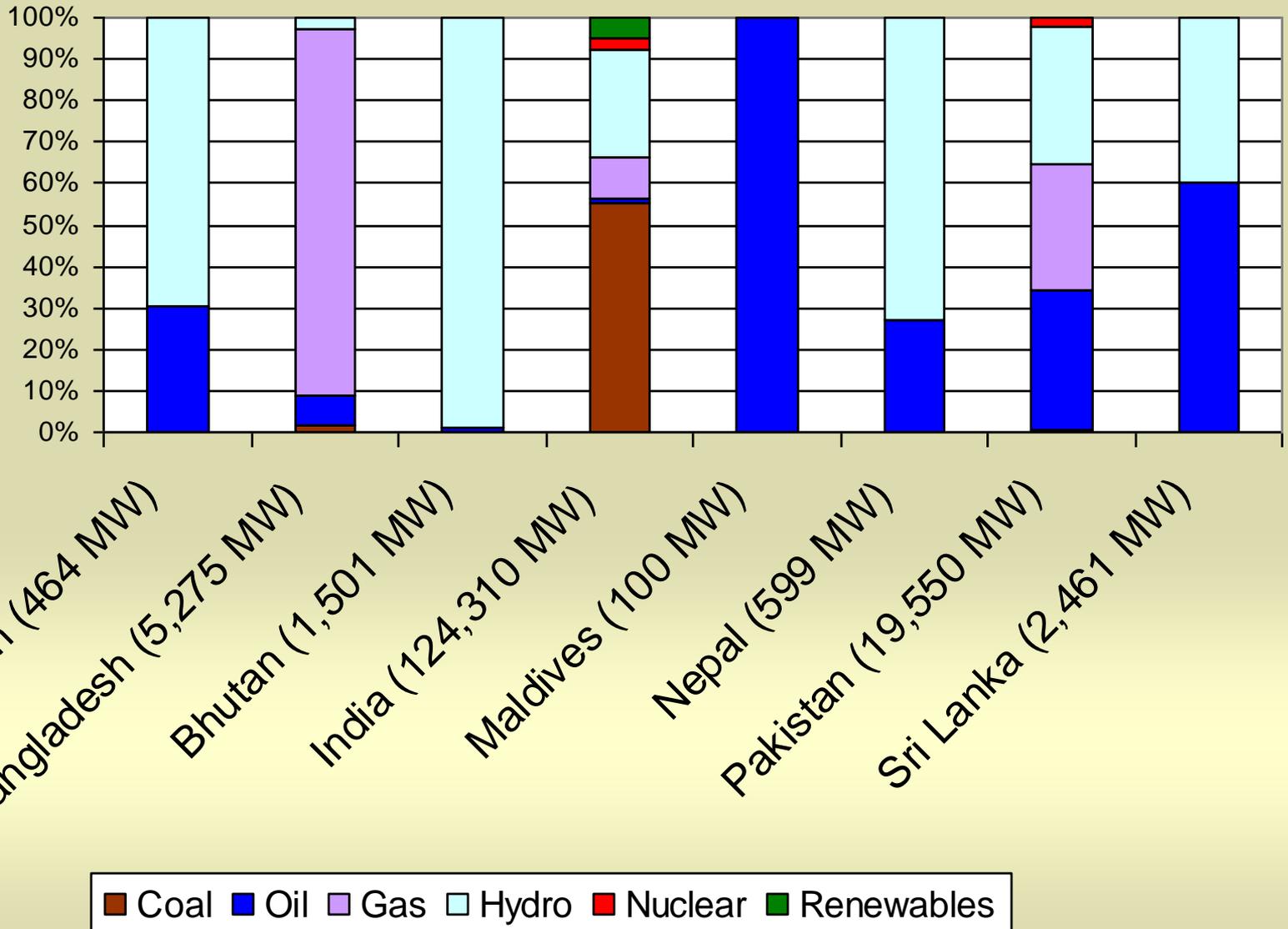
Concentration of energy resources in this sub-region has been very high and could in fact be a major instrument of development.

Disruption of power and other energy supplies : affected both human (food, livelihood, employment and economy) and national security

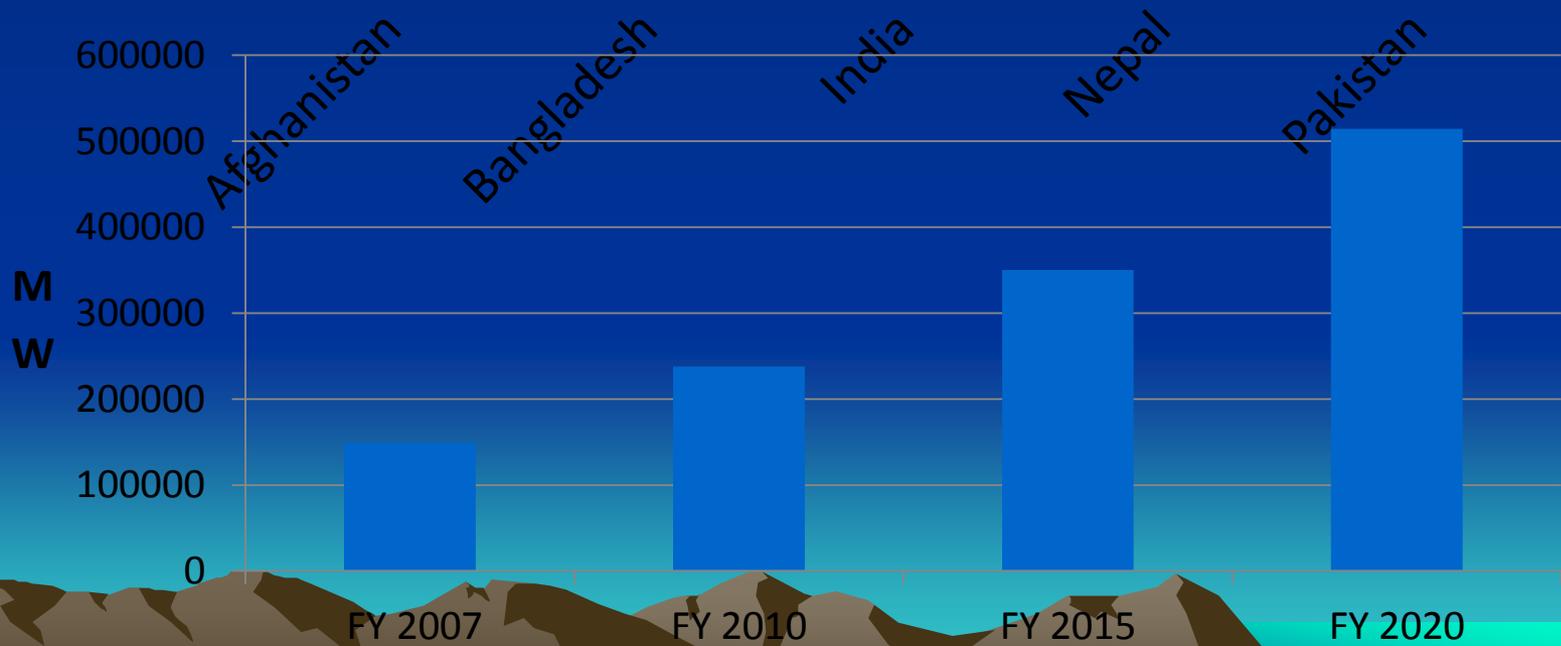
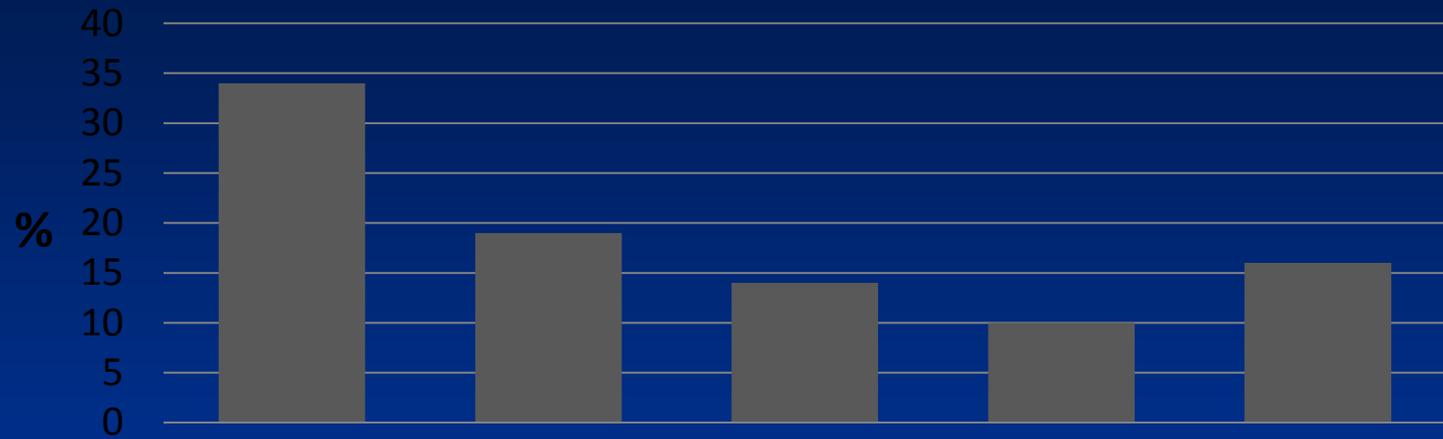
Adversely affected their productive activities, social development and investment climate.
Massive reforms in electricity, gas and petroleum and coal sectors.

Energy security : dominant driver of regional geopolitics.

Energy Mix in Power Generation



Shortages VS Growing Demand

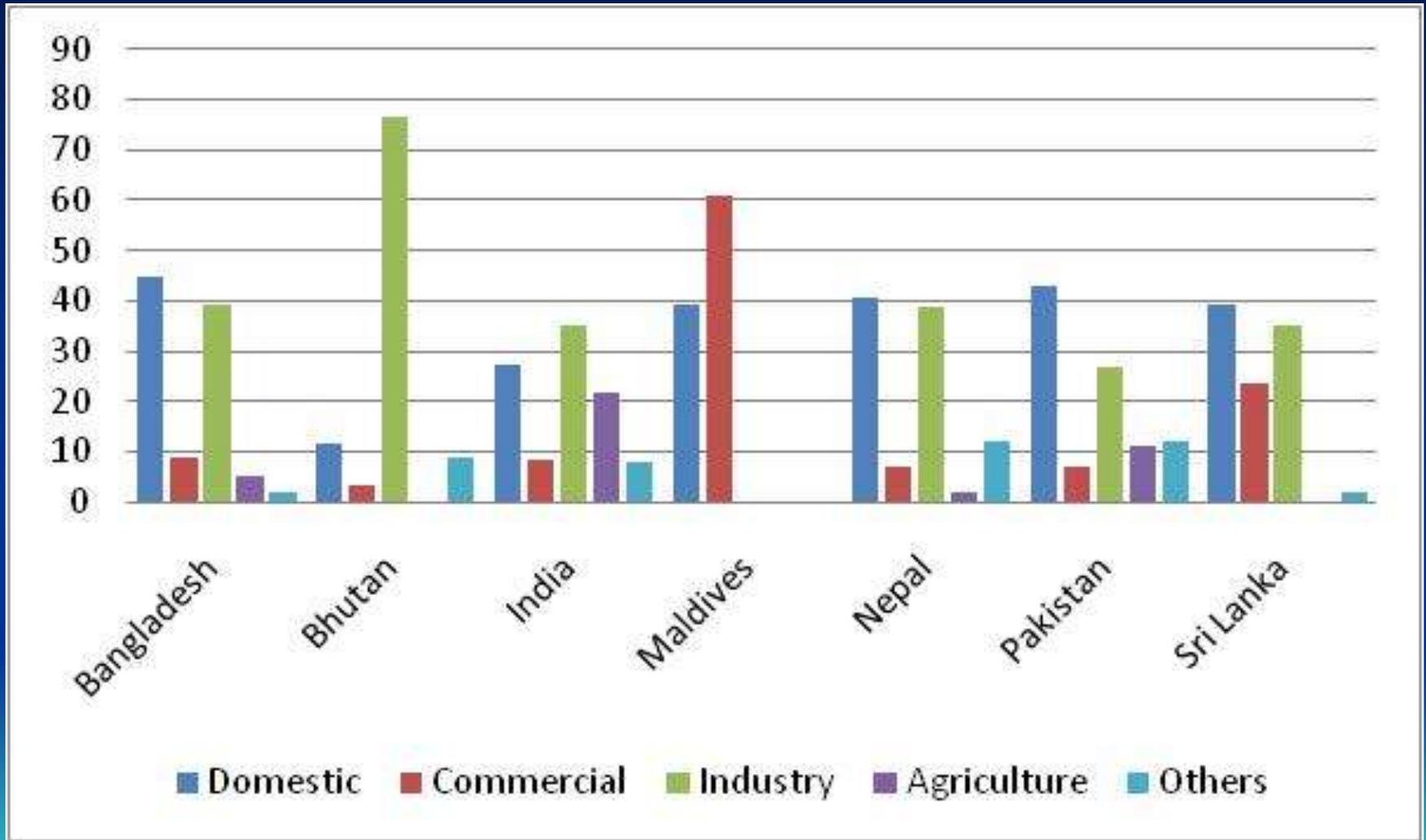


Electricity Demand

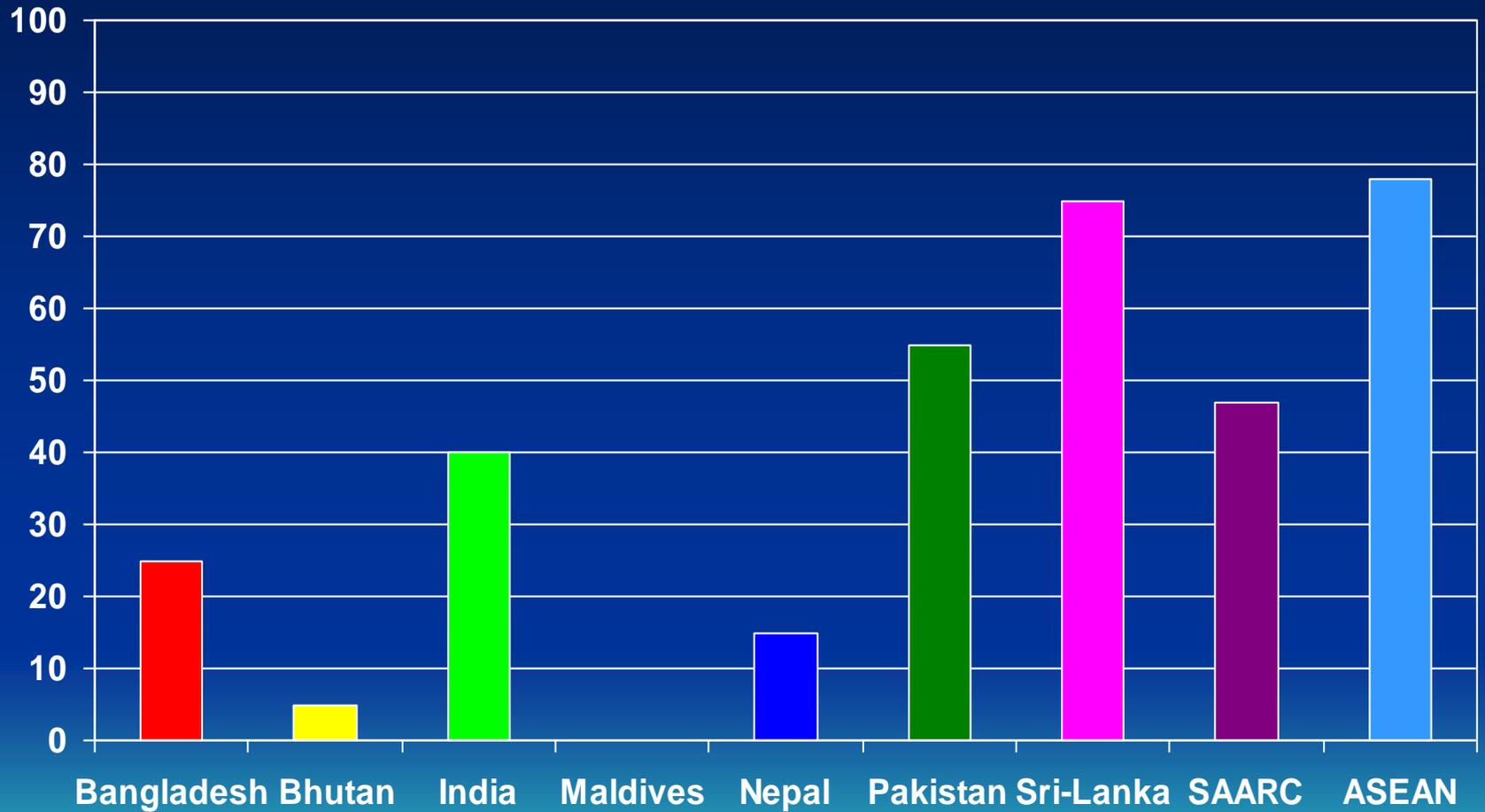
Countries	Present Fuel dominance	Additional power requirement by 2020 (MW)
Bangladesh	Gas (85%)	15000
India	Coal (50%)	100000
Pakistan	Gas, Hydro, Oil (equal)	20000
Rest	Hydro, Oil	15000

Except Bangladesh, all SAARC countries have more than 50% of their hydro potential Unutilized (100,000 – 150,000 MW)

Consumer Mix of Electricity Consumption

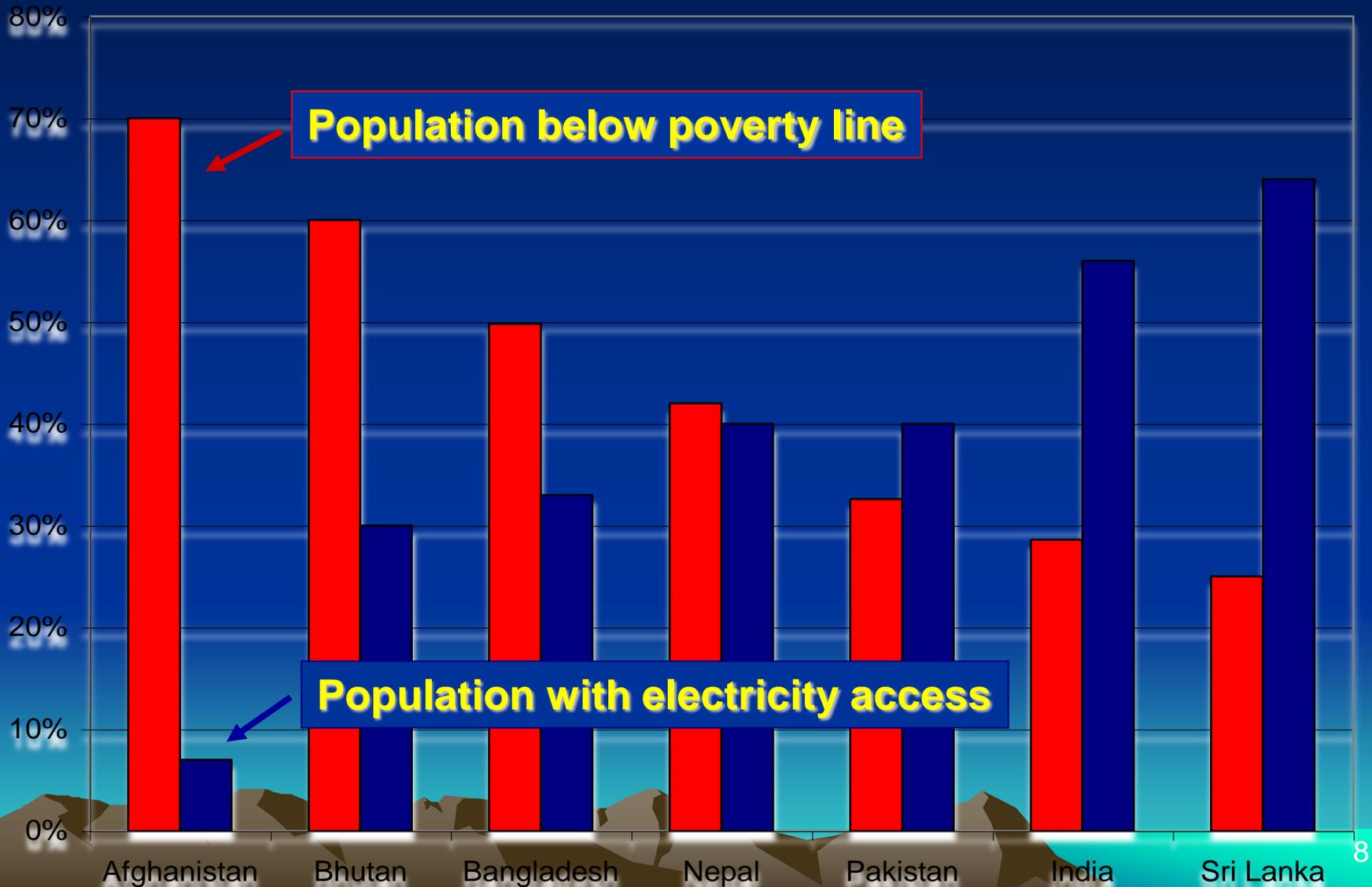


SAARC Countries Electricity Access (%)



Why does Energy Security matter?

Access to Energy Results in Economic Growth



Energy Exchange and Trading : Rationale and Benefits

Economic gains based on regional cooperation in the energy sector has become a firmly established practice across regional groupings.

Cross border energy trade could lead to effective utilisation of natural resources,

increase in supply reliability, economy in operation & mutual support during contingencies,

bring about large scale transformation in sectors contributing to economic growth,

It will act as the single most effective confidence building measure (CBM) through the participation of multiple stakeholders and

substantially promote market integration in energy related goods and services.

Savings in Capital & Operating Costs

Optimal Use of Available Generating Capacity

Feasibility of marginal power plants which are not viable on a national level but feasible in the regional context (i.e. large scale hydro & coal)

Seasonality factor in both generation and demand is highly noticeable.

Five reinforcing factors that are likely to promote power trading

I High potentials yet huge deficit

**Huge power crisis leading to long hours of load shedding
Affect : social and economic and commercial activities.**

Tremendous public pressures on the respective govts to act upon. This could even lead to political instability.

**Pakistan imports petroleum - \$ 6 billion /yr,
Value of its total export is \$ 12 billion**

**In India the cost of unserved energy (55 Twh) in 2007
was valued at \$ 12.1 billion**

People are willing to pay for the electricity.



II Increasing realizations among leadership to Expedite process of energy exchange.

For instance : Declarations in various SAARC Summits.

Islamabad Declaration 2004 : Concept of Energy Ring discussed.

Dhaka Declaration 2005 : Establishment of the SAARC Energy Centre to promote development of energy resources and energy trade in the region;

Colombo Summit 2008 :
Concept of Regional Inter-governmental Framework

Colombo Meeting of Energy Ministers 2009 :
Pursuing Energy Ring and Formation of Sectoral Expert Groups (e.g. gas, electricity, renewable energy etc.)

***Thimphu Summit- April 2010* : Authorized the SAARC Energy Centre in Islamabad to prepare an Action Plan on Energy Conservation
Noted India's proposal to prepare a Roadmap for development of SAARC Market for Electricity (SAME) on a regional basis**

***Male Summit – 2011* : It directed the conclusion of the Inter-governmental Framework Agreement for Energy Cooperation and the Study on the Regional Power Exchange Concept as also the work related to SAARC Market for Electricity.**

ASEAN : Far ahead – with ASEAN Grid in

Energy Cooperation : SAARC Institutional Mechanism

- Ministerial Level Energy Forum
- Working Group on Energy
- Expert Groups for different energy commodities
- SAARC Energy Centre

- **Four Expert Groups preparing way forward in:**
 - Oil and Gas
 - Electricity
 - Renewable Energy
 - Technology Transfer (including Coal and Energy Efficiency)

III Various levels of sensitisations and preparations for energy trading.

A number of organizations (regional and outside) engaged.

Technical and professional public and private sector organizations are often meeting and seriously deliberating

**And UNDP, ADB, World Bank, USAID are active agencies
Large number of studies and policy suggestion :**

South Asia Network of Econ Research Institutes (SANEI),

Coalition for Action on South Asian Cooperation (CASAC),

**South Asian Centre of Policy Studies (SACEP) ,
Bangladesh Unnayan Parishad (Dhaka),
Centre for Policy Dialogue (Dhaka),
Institute for Integrated Development Studies (Kathmandu),
Centre for Policy Research (New Delhi) and
The Energy Research Institute (New Delhi)
Jawaharlal Nehru University (New Delhi),**

**BUET (Dhaka),
Quad-i-Azam University (Islamabad),
Lahore University of Management Sciences
Tribhuvan University (Kathmandu) and
Colombo University (Sri Lanka).**

**Several Training programmes and capacity
building projects : including by USAID's SARIE project**



IV Massive power sector reforms taken place

■ India - Electricity Act 2003

- to develop power market through increased competition, more players and protect consumer interests
- Recognized Trading as a distinct activity
- Adequate and progressive provisions governing open access both :
 - to transmission networks (inter-state and intra-state) and
 - to distribution networks

■ National Electricity Policy, 2005

Identifies hydro generation as a thrust area for development, being clean and renewable source of energy

■ Integrated Energy Policy 2006

recognizes that energy security can be increased not only by diversifying sources of import of a particular fuel but also by diversifying the energy mix by using different types of fuel

Use of coal, oil, gas, nuclear, hydro and renewables of various kinds : less vulnerable to supply disruptions of either domestic or imported energy sources

Enhancing inter-regional energy trade, particularly electricity trade seems to be an attractive option

recognizes that substantial scope exists for import of hydro power from Bhutan, Nepal (and Myanmar)

notes that import of hydro power through Bhutan and Nepal could enhance energy security

recommends Nepal and Bhutan may be given the right to sell power to any one in market

Licensed Activity, more than 40 inter-state trading licensees

- **Power Market Size > 30 Billion Units per Annum – about 3% of total generation**

Cross-Border Trade ~ 20% of power trade

- **Generation de-licensed – merchant generation encouraged**
- **Non-discriminatory Open Access in Transmission**

- **The wholesale market for electricity in India is completely voluntary by design**
- **This is because the buyer is free to choose from various options:**
 - **Long/Medium term PPA based mechanisms**
 - **Short term bilateral trades**
 - **Day ahead market (through the power exchange)**
 - **Real time mechanisms (UI)**
- **Provides tremendous flexibility to market participants**
- **Further, the rules regarding standards of supply are more liberal, permitting greater flexibility to utilities on demand side response**

A NEW INITIATIVE : Indian Energy Exchange (IEX)

- First National level Power Exchange, Indian Energy Exchange (IEX) commenced operation in June, 2008
- In last 18 months, PX has attracted more than 200 participants including 25 States, 4 Union Territories, Captive Power Plant and direct consumers
- Facilitated trading of more than 6.7 Billion units, Rs. 45 Billion
 - Hourly Prices
 - Low: 13 p/kWh
 - High: Rs. 16/kWh
 - Average Rs. 7/kWh
- **Buyers and Sellers are exercising their choice**
 - Buyers procuring prudently, keeping in mind “affordability” and “prudence-checks”
 - Sellers supplying to credible buyers with a view to maximize revenue and minimize risks
- Prices are reflective of what market can absorb: an interplay of demand and supply

Pakistan - Commercial Framework for IPPs & Fiscal Concessions

- Multi-year / long-term tariff – Approved by Regulator
- 100% foreign ownership allowed
- Maximum 80% equity contribution
- 5% concessionary Import Duty on plant and equipment not manufactured locally
- No levy of sales tax on such plant, machinery and equipment
- Exemption from income tax (including turnover rate tax and withholding tax on import)
- Specified tariff adjustments for variation in exchange rates
- Government ensures conversion of Pak Rupee & remittance of foreign exchange for project-related payments

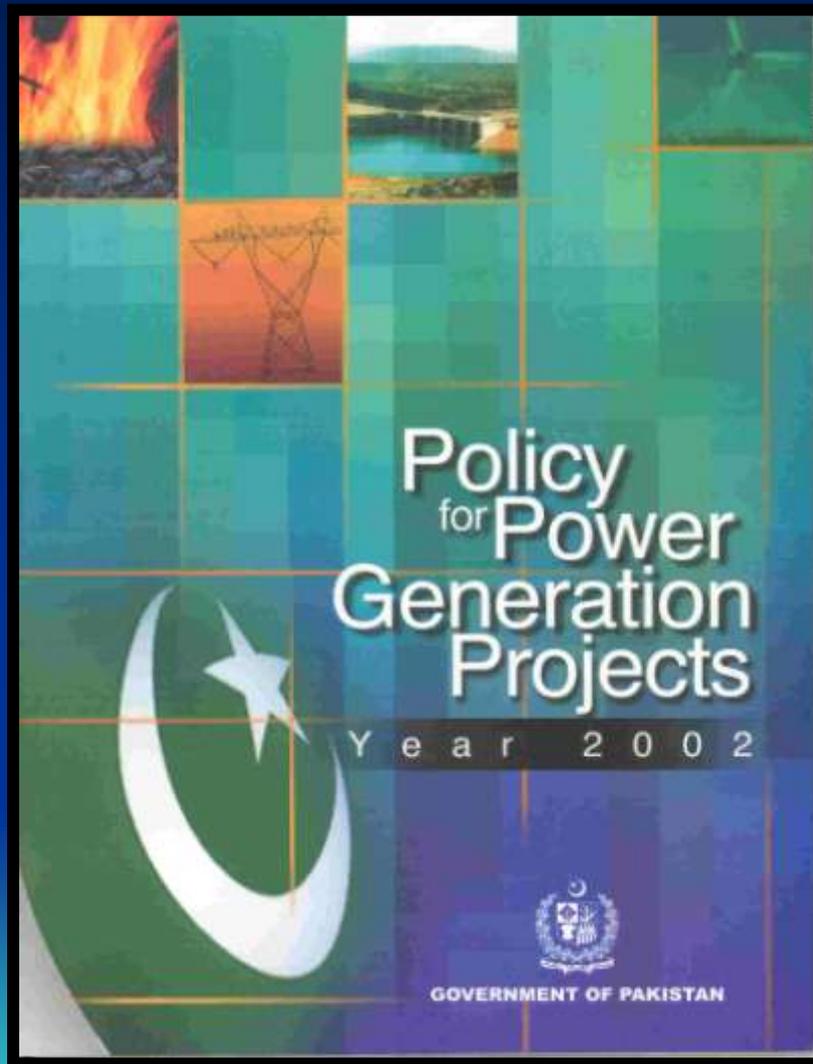


Private Power & Infrastructure Board (PPIB)

- **Created in 1994 to promote private investments in power sector**
- **Successfully implemented 1994 Power Policy**
- **Successfully negotiated, executed and administered long term concession agreements such as IA, PPA and FSAs**
- **Total 14 projects have been commissioned with the cumulative capacity of 4,300 MW**
- **Attracted world-leading energy players to Pakistan's Private Power Sector – US\$ 3.8 Billion of FDI**
- **Successfully handled post commissioning issues of IPPs**
- **Bulk of financing was foreign through multi-lateral lending agencies**



An “Investor-Friendly” Policy

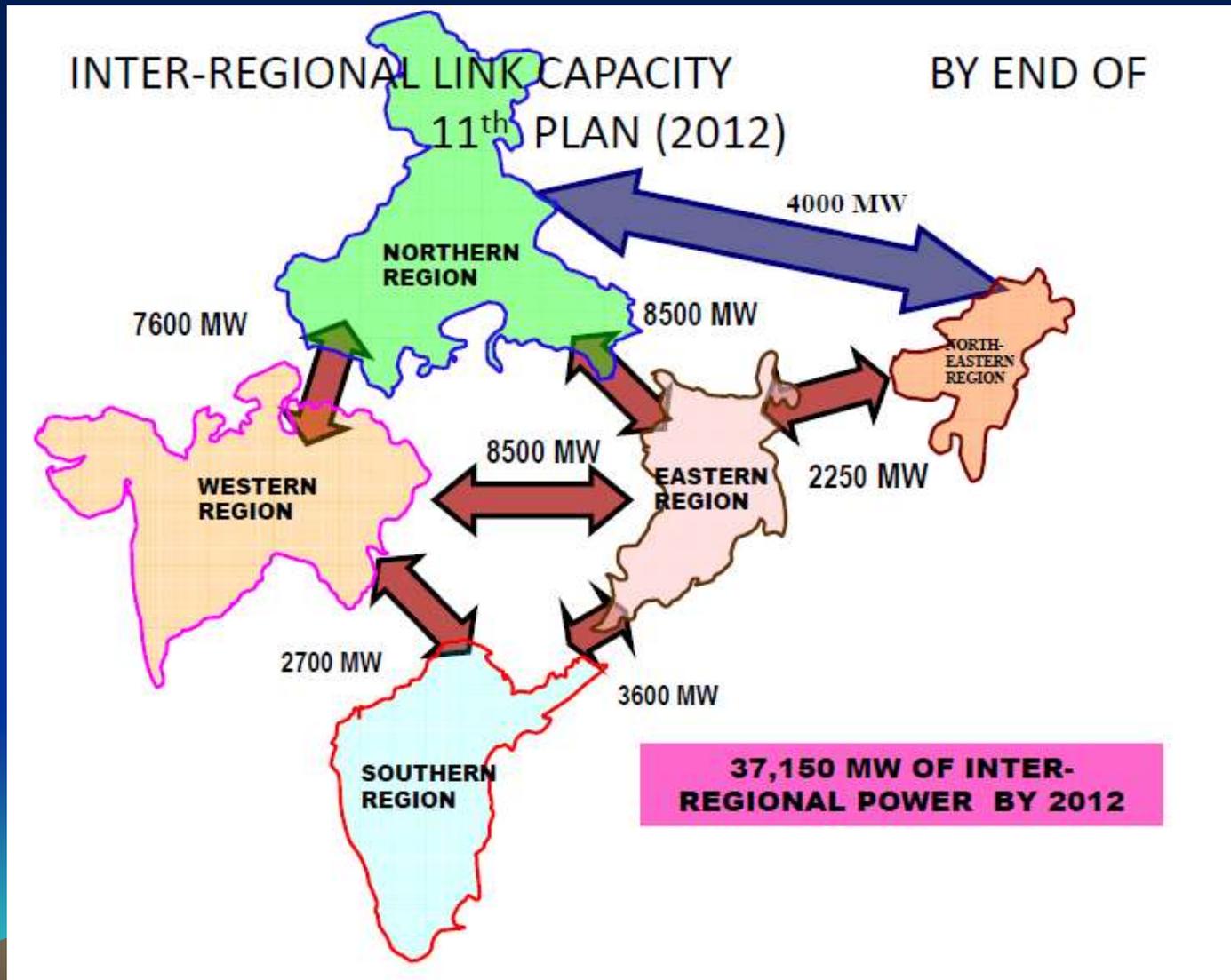


IV Significant level of Transmission Systems are in place

India : two varieties of exchanges viz. Inter-state and Inter-regional

- Present installed capacity - **294000ckm**
 - ✓ 220kV Transmission Line - 150000ckm
 - ✓ 400kV Transmission Line - 125000ckm
 - ✓ HVDC 800/600kV Line - 3600ckm
 - ✓ HVDC 500kV Line - 7400 ckm
 - ✓ 765kV Transmission Line - 7600ckm
- Present Inter regional Capacity - **38650MW**
 - Expected by 2017 - **75000MW**
- Estimated Additions of Transmission Network in 12th Plan – **155000 to 180000ckm**

India - Transmission System



TRANSMISSION SYSTEM

Voltage	Sub Stations				Transmission Lines	
	WAPDA		KESC		WAPDA	KESC
	No.	MVA	No.	MVA	(circuit km)	
500 kV	11	13000	-	-	4490	-
220 kV	27	10369	6	2500	7218	276
132 kV	464	24404	40	3459	28894	604
66/33 kV	197	2629	6	215	7617	219
Total	699	50404	52	6174	48219	1099

Regional Power Trade

What does it require ?

To Interconnect the Electricity Grids of Member Countries through High Voltage Transmission Lines to facilitate exchange (import and export) of electrical power across borders.



India-Pakistan Power Exchange

Three Options :

- 1 Bilateral power trade
- 2 Pool based exchange and
- 3 Wheeling Facility



1 Bilateral Options : Success Stories

- India - Bhutan Energy Exchange:
 - Long term PPAs with Department of Energy, Bhutan
 - Chhukha HEP (336 MW); Kurichu HEP (60 MW)
 - Tala HEP (1020 MW)
 - Run-of –the River Projects : 4 Hrs peaking

Electricity export – over 84% of total generation [1,494 MW]
Internal consumption ~ 1152 MU (Peak load 187.5MW)
Annual export ~ 5922 MU

Electricity Sale revenue US \$ 203 million
[47% of national revenue].

- A number of hydro projects under development in Bhutan 10,000 MW by year 2020

India- Bangladesh : Three Far reaching Projects underway

i) 250 MW exports from India likely to start in mid 2013

ii) A grid inter-connection between Bheramara in Bangladesh and Bahrampur (West Bengal) in India is likely to be completed by mid 2013. ADB loan critical role

iii) 1320 MW coal based unit at Rampal (350 kms S-South West of FD=Dhaka by Bangladesh-India Friendship Power Company consisting of BPDB and NTPC costing \$1.5 billion by 2017

These three projects are going to be landmark starting projects as they for the first time break a long journey between potential, negotiations and implementations.

Could lead to several such exchanges

2 Pool based approach : Sub-regional power Pool

-The pool based approach : agent based integrated simulation can possibly provide support to develop a competitive long run market equilibrium in sub-regional power trade.

Involves working together of a set of agents (manufactures), a monitoring, advisory and channelising regional body in close harmony.

Key feature : uses a micro level, bottom-up representation of the market with each generating firm (public and private) represented at the level of its individual plants.



Establishing a Sub-Regional Power Trading Corporation (SRPTC) would be highly beneficial to launch this type of market mechanism in India-Pakistan sub-region also.

This could be called “Indo-Pak-SRPTC” which could provide market feed-back to individual power producers (agents) as well as the power consumers.

Indo-Pak-SRPTC can maintain and disseminate information.

To facilitate the process of setting up of Indo-Pak-SRPTC , essential to assess and understand the nature, direction and extent of intra-country power exchange between India and Pakistan.



Some Successful Power Pools based examples of energy exchange

Regional Arrangement	Member Countries
Union for the Coordination of Transmission of Electricity (UCTE)	Spain, Portugal, France, Belgium, Italy, Netherlands, Luxemburg, Austria, Germany, Switzerland and now extended to Poland, Czech Republic, Slovak Republic, Hungary, Slovenia and Croatia.
Nord Pool	Norway, Sweden, Finland & Denmark
North American Electric Reliability Council (NERC)	United States and Canada.
Southern African Power Pool (SAPP),	South Africa, Lesotho, Mozambique, Namibia, Malawi, Zimbabwe, Zambia, Botswana, Angola, Swaziland & Tanzania
The Commission of Regional Power Integration (CIER)	Jordan, Bahrain, Tunisia, Algeria, Saudi Arabia, Syria, Libya, Egypt, Morocco, Mauritania, Yemen, Iraq, Lebanon, Palestine, Dubai and Qatar
South America, power trading	Argentina, Paraguay & Uruguay. Central America

Regional Arrangement	Member Countries
IPS/UPS (Russia and CIS Countries) Interconnected Power System of Russia, Baltic States and CIS Countries	(Presently 15 Countries/States are interconnected with IPS/UPS) (Lithuania, Latvia, Estonia, Belarus, Ukraine, Moldova, Russia, Georgia, Azerbaijan, Kazakhstan, Turkmenistan, Uzbekistan, e, Tajikistan, Mongolia)



SOUTHERN AFRICAN GRID



3 Wheeling Facility

- **Distinct advantages for Pakistan to import power from Bhutan and Nepal both because of the lower tariff and supply reliability.**

Bhutan : like to diversify the markets from India's monopsony situation to Regional Market

Other major supplier : Number of hydro plants are under construction in the North East region



Bhutan : Huge Generation Surplus by 2020 & 2030

Existing Installed Capacity (IC)	Capacity addition by 2020	I.C. by 2020	Capacity addition by 2030?	I.C. by 2030?
1,480	11,864	13,344	14,653	27,997
5 HEPs	13 HEPs	60 HEPs	78 HEPs	



In addition, the countries neighboring SAARC Member Countries have abundant natural resources

- Central Asia (hydropower, gas, coal, oil)
- Iran (gas, oil)

Opportunity exists for Pakistan to import electricity from Central Asia/Iran etc. and provide transit to India and other SAARC countries.



Example CASAREM :

The governments of Afghanistan, Kyrgyz Republic, Pakistan and Tajikistan have entered into MoU for overall development of Central Asia-South Asia Regional Energy Markets (CASAREM)

- Working Groups formed on project sponsors, project finance structuring and supplier and buyer issues**
- Developed a ‘working paper’ to outline Pakistan’s position for presentation by MOWP at the working group meeting held on Nov 15, 2011 at Dushanbe**

Central to South Asia Electricity Transit

The Emerging Picture

PHASE 1

Import of Currently Available Electricity to Afghanistan from Taj, Turk & Uzbek via 220kV

PHASE 2

\$ 1 billion project to deliver 1300 MW of power from Tajik and Kyrgyz via HVDC 750 km Transmission line thru Afghanistan to Pakistan. AC to DC substation at Songtuda hydro in Tajik
Kabul DC to AC substation to drop off 300 MW
Peshawar DC to AC substation to drop off 1000 MW

(CASA 1000 MoU signed, but ADB has stepped out)

PHASE 3 (?)

Import of Available and New HPP & TPP Electricity from Tajikistan, Kyrgyzstan, Turkmenistan & Kazakhstan to India via HVDC



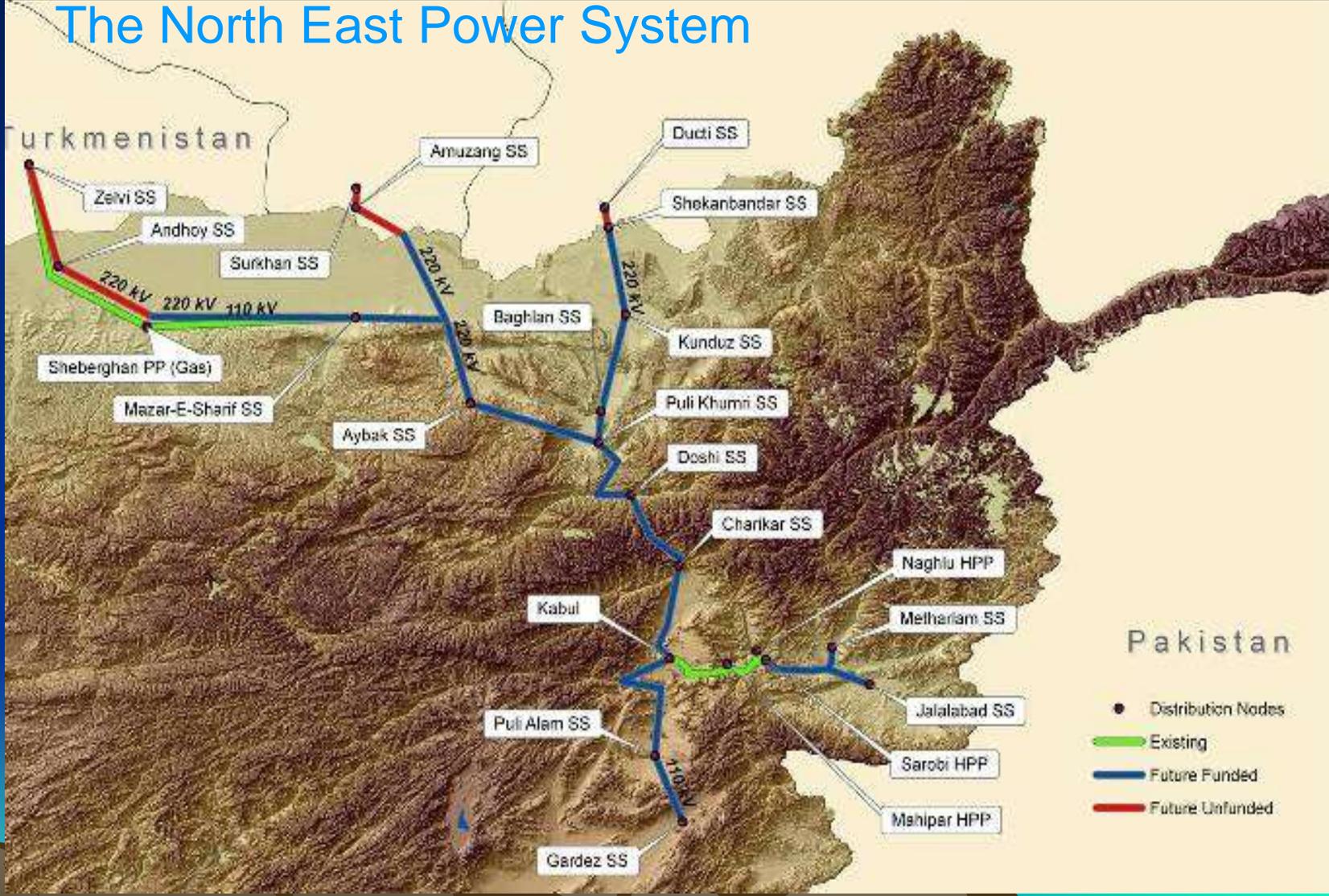
Afghanistan Foundation Laid: North East Power System (NEPS)

- Power Grid in initial stage of construction
- Potential to serve over 15 provinces in Northern and Eastern regions of Afghanistan
- Target completion date: October 2011
- Major Components
 - Power import: up to 300 MW from each of Uzbekistan, Tajikistan, Turkmanistan
 - Sheberghan gas thermal plant: up to 150 MW



NEPS Geographically

The North East Power System

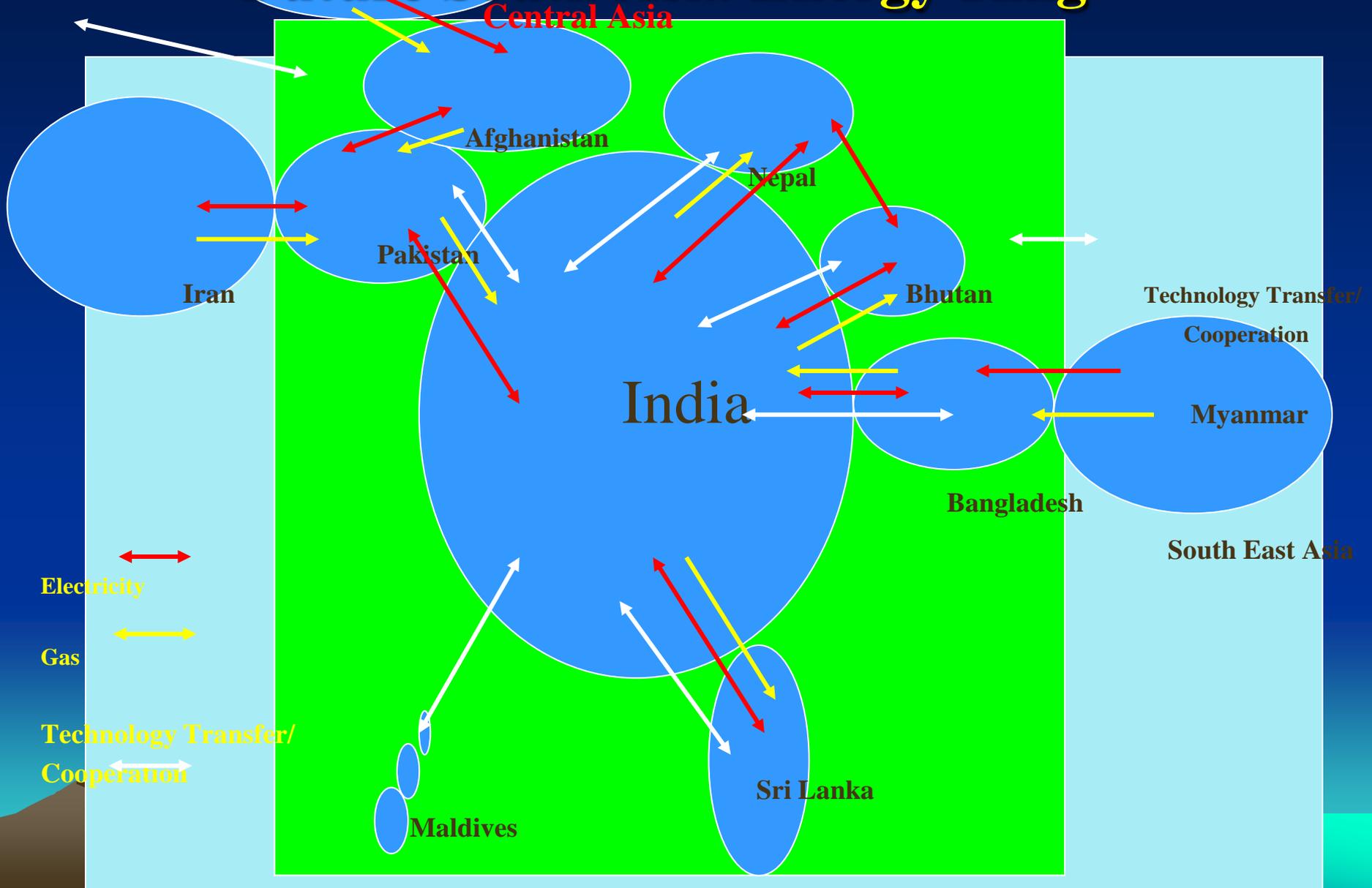


Energy Reserves and Production of Countries Around South Asia

Country / Region	Hydro power Potenti al (MW)	HEP Developed (MW)	Oil Reserves (BBI)	Oil Production (MBI)	Gas Reserves (tcf)	Gas Production (bcm)
Central Asian Republics	52,400	10,719	1,264	NA	5,238	NA
Iran	42,000	2,000	132	4.2	971	3.5
Myanmar	39,720	747	3.2	7.3	18	3.62
Total	134,120	13,466	1,399	11.5	6,227	7.12



India and Pakistan could be integrated in the Future South Asia Energy Ring



India and Pakistan Several Bilateral Options

HUGE potentials between India and Pakistan

**India's North East regions are now harnessing the
hydel power potentials in a massive way**

For Example : Sikkim – 2000 MW by 2015

Domestic Demand is hardly 100 MW

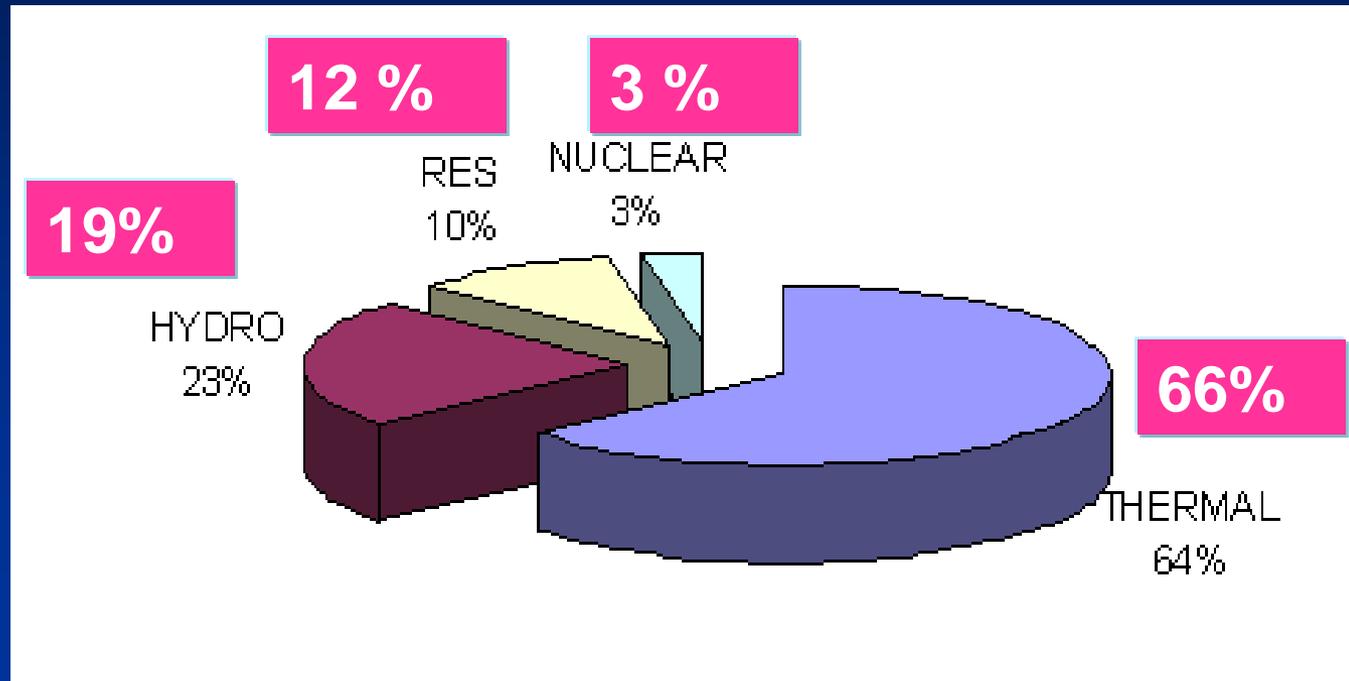
**Options : to export power to Pakistan
Bangladesh, Myanmar and China**



Hydro Power Potential in North East India

States	Potential (MW)	Capacity developed (MW)	% of the capacity developed
Arunachal Pradesh	50328	423.5	0.84
Assam	680	375.0	55.15
Manipur	1784	105	5.89
Meghalaya	2394	185	7.74
Mizoram	2196	0	0.00
Nagaland	1574	99	6.29
Tripura	15	15	100
Total NE	58971	1202.7	2.04
All India	148701	33222.5	22.34

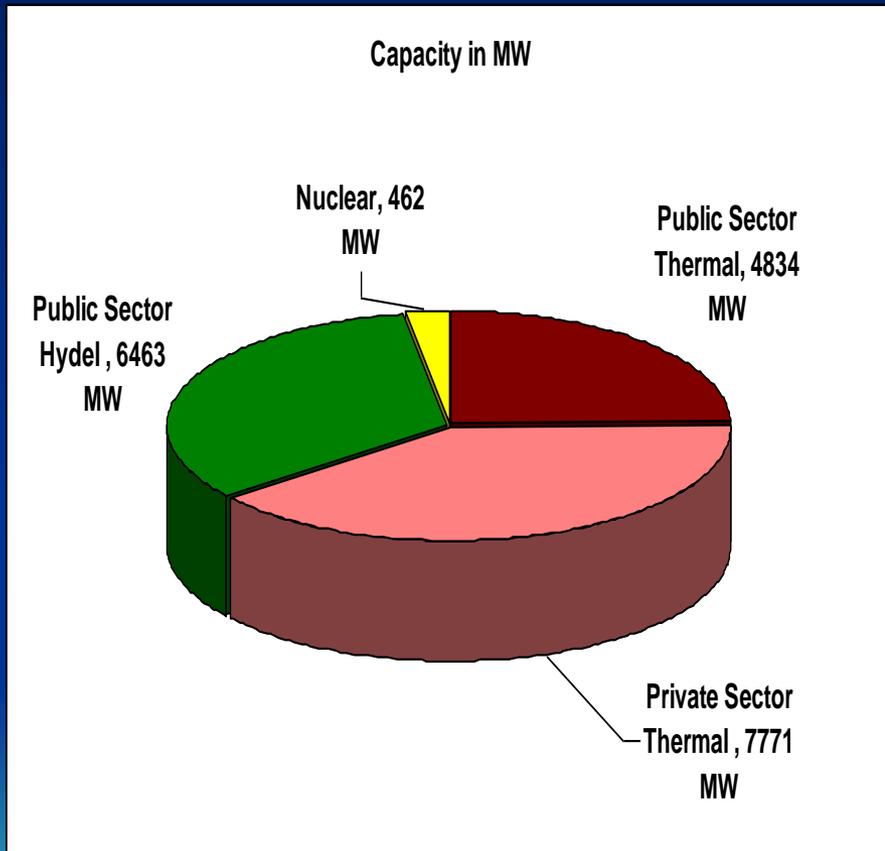
India: Installed Power generation capacity



**Installed capacity : 209
GW**

RES : Renewable Energy
Sources

Pakistan Power Sector – Total Installed Capacity



Public Sector

MW

%

WAPDA

11,297

58

PAEC

462

2

Sub-Total

11,759

60

Private Sector

IPPs

6,045

31

KESC - Private

1,756

9

Total

19,560

100

Reasons for Current Power Deficit / Load Shedding

Quantum jump in power demand during 2008-2011 due to:

➤ Increase in load as under:

Activity	No.	Increase in Demand (MW)
Villages electrified <i>Population benefitted: 7 m +</i>	47,076	188
Connections given (2008-2011) excluding tube-well connections	3,062,215	190
Agriculture tube-wells Connection	40,577	100
Load addition due to installation of air-conditioners	1 Million	2,500
	Total	2,978

➤ Non-availability of fuel oil for power plants

➤ Shortage of Gas Supply to Power Sector

India's proposed Power Import from Pakistan
**1998 Pakistan's offer to India to sale
surplus power**

**Discussions : Power Grid Corporation
of India Limited (PGCIL) and WAPDA led various
independent power producers (IPPs) in Pakistan**

**Feasibility of export of 300-1000 MW power
to India was studied**

**Delivery points were identified and number
of options were explored**

**System studies were also carried out under
various loading conditions**



- Technical and commercial aspects were also considered
- **2nd Draft of the Interconnection and Operating Agreement was discussed on 1 February 1999**
 - **Tariff : major stumbling block**
 - **WAPDA offered : US 7.2 cents/KWH**
 - **While Indian side offered : US 2.25 cents**
 - **Negotiations broke off**



Transmission Arrangement : Easy Access

Pre-Partition plans/arrangements also available

**Pakistan - 500 KV primary transmission system
Extending from Jamshoro in the south to Tarbela and
Peshawar in the north.**

**Lines run very much near to the adjoining borders
of India**

May not require complex transmission extensions :

**Designated substations
Dinanath (Lahore) in Pakistan and
Patti (Punjab) in India.**



"There is a complete network on our side and of course on their (India) side as well. What we need are the connections, which would take only a couple of weeks"

- Statement by the Power Minister of Pakistan Gohar Ayub Khan,

New Negotiations

- **Group of Experts on Energy have met thrice (5th round of Secretary level talks on commercial and economic co-operation between India and Pakistan 27-28 April, 2011, Islamabad)**

To negotiate on a cross-border interconnection between India and Pakistan to facilitate exchange and trade in electricity 500 MW power from Indian power market on commercial terms.

Policy Recommendations :

India and Pakistan should have four way approach in order to initiate the energy cooperation ventures.

1. To provide the policy and institutional framework for increasing Cooperation in power trade. This should include :

- **Inter-Governmental Agreement on Bilateral / Regional Power Trade**
- **Regional Power Trade Coordination Committee**
- **Setting up of Focal Groups**
 - **Study: Options for the Future Power Market**
 - **Study: Regional Power Trade Operating Agreement in the India-Pakistan sub-region**
- **Energy Sector Strategy Study**
- **Convening the Energy Sector Forum**

2 To develop the grid interconnection infrastructure through a building block approach allowing cross-border dispatch of power.

This should include :

- Essential physical power interconnection**
- Harmonization of transmission planning, design, and operational practices (performance standards)**
- Power infrastructure database design and implementation**

Preparation of Regional Indicative Master Plan on Power Interconnection

Preparation of Regional Master Plan



3 Cross Border Investment : Project based approach

Establish a sub-regional infrastructure investment fund under the guarantee cover or funding from multilateral institutions such as World Bank or ADB.

Establish a Fund for equity investments in electricity and energy infrastructure

Competitive tariff in energy and capacity payment –

Pool price in importing country + Transmission Tariff

Allocation of Risk – Political & Force Majeure

Sales of electricity to other country by importing country



4 Tariff Structure for Regional/bilateral Electricity Trade

Tariff is going to be critical in all the 3 models of Power Exchange between India and Pakistan and between South Asia and Central Asia

Importing country would purchase power/dispatch based on price of electricity and its priority in the merit order

Three Tariff Structures could be considered

- Two Part Tariff – Fixed charge & Commodity Price**
- Single tariff on units transmitted basis**
- Separate Tariffs for power purchase & transmission/wheeling**

Electricity Tariff in cents/kWh

(Domestic energy rate)

Blocks (units)	Maldives (2005)	Bhutan (2009)	Bangladesh (2007)	Sri Lanka (2008)	India, N Delhi (08-11)	Pakistan (2008)
0-100	12.5	1.62	3.6	3.5 ave	5.29	3.65
100-200	13.3	3.0	4.57		5.29	4.8
200-300	16.81	3.0	4.57	13.0 ave	8.53	4.8
300-400	17.2	4.0	4.57		8.53	7.73
400-600	17.2	4.0	7.62		10.0	7.73
600>	17.2	4.0	7.62	21.4	10.0	7.73
1000>						9.23

Political Inhibitions

Projects having cross-border implications are more often treated on political lines rather than on commercial considerations.

Yet to appreciate new dynamics of global energy politics.

Governments need to only provide enabling agreements covering the project and sector at large.

Depoliticisation of deals though hard to practice, will also do away with unnecessary national prejudices.

One bilateral project like that of India-Bangladesh should be used as a breakthrough project.

Capacity Building

Critical question is to build the capacities of the policy makers in the energy sector across the region by re-skilling and reorienting them to the advantages of cross border energy exchanges.

Large scale transformation the energy sector is undergoing and the varieties of cross border stake holders created therein. Policy makers in the region lack information, sensitization and the alternative options

Require more of a regional outlook rather than the traditionally followed national or at most bilateral outlook.



thank you