



COOPERATION ON ELECTRICITY TRADE IN BETWEEN CARs AND WITH – SOUTH ASIA

By

D.N. RAINA

Bishkek

April 26, 2007





Contents


- South Asia – Economy & Energy Situation
 - Central Asia – Energy Resources
 - Compatibility in CA-SA Energy Scenarios
 - Advantages of Cooperation
 - Transmission System Requirements
 - Development of CA-SA Transmission Systems
 - Legal and Regulatory Frameworks
 - Next steps
- 



South Asia – Economy & Energy Situation



South Asia – An Overview

- Highest population density – over 22% of world population living on 5% of land mass
 - All developing nations with high GDP growth (8%+)
 - All energy importing countries, mainly oil (up to 98%)
 - Vast undeveloped hydro and renewable energy resources
 - Financial and physical resources the main impediment in exploiting indigenous resources
 - Energy trade opportunities exist but not exploited
 - Energy import dependence will continue to sustain economic growth rate and to alleviate poverty
 - Energy imports at reasonable prices an ideal options
- 

Key Economic Indicators-SA

Country	Population (Million)	GNP (b\$)	GNP per capita (\$)	En. Cons. / capita (kgoe)
Afghanistan	22	4	186	16
Bangladesh	138	55	398	89
Bhutan	0.7	-	-	243
India	1,064	568	534	315
Maldives	0.3	0.5	1,800	-
Nepal	25	6	243	44
Pakistan	146	85	582	380
Sri Lanka	19	18	938	200
Total	1,416	737	520	289

Commercial Energy Resources-SA

Afghanistan	Moderate Gas/hydro potential
Bangladesh	Large Gas/Coal, Low Hydro
Bhutan	Large Hydro potential
India	Large Coal/Hydro/Wind/Solar Moderate Gas/Oil.
Maldives	Moderate Wind; High solar
Nepal	Large Hydro potential
Pakistan	High Coal/Gas/Hydro, Low oil
Sri Lanka	Moderate hydro, no fossil fuels

Commercial Energy Resource Mix - SA

• Coal	:	46%
• Petroleum	:	34%
• Natural gas	:	12%
• Hydropower	:	6%
• Nuclear	:	1%
• Others	:	0.3%

Dominance of Energy Sources - SA

- Afghanistan (Petroleum) : 65%
- Bangladesh (Natural gas) : 66.4%
- Bhutan (Hydro) : 31%
- India (Coal) : 54.5%
- Maldives (Petroleum) : 100%
- Nepal (Hydro) : 31%
- Pakistan (Petrol./Nat. gas) : 42.7%; 42.2%
- Sri Lanka (Petroleum) : 82%

Petroleum imports pose a major challenge to the economies of all these countries

Electricity Industry Status in South Asia

Item	Unit	Afghanistan	Bangladesh	Bhutan	India	Maldives	Nepal	Pakistan	Sri Lanka
Electricity sold	mkWh	315	14,777	640	379,531	146	1,778	57,491	6,161
Electricity supply	mkWh	423	19,179	640	588,134	146	2,362	80,827	7,087
Per capita electricity supply	kWh/yr/person	19	139	914	553	429	96	545	369
Generation capacity	MW	454*	4,710	445	112,683	106	628	19,252	2,168
Capacity									
(i) Hydro	MW	261	230	428	29,507	0.0	571	6,491	1,259
(ii) Nuclear	MW	0.0	0.0	0.0	2,720	0.0	0.0	462	0.0
(iii) Renewable	MW	0.0	0.0	0.0	1,870	0.0	0.0	0.0	0.0
Capacity thermal									
(i) Oil	MW	193	(i) 494	17	3,661	106	57	***	909
(ii) Gas	MW	-	(ii) 3986	0.0	11,840	0.0	0.0	12,149	0.0
(iii) Coal	MW	0.0	0.0	0.0	64,956	0.0	0.0	150	0.0
Share of generation from primary sources	mkWh (%)	113 27	959 5	604 94	95,905 15	0.0 0.0	583 25	28,704 36	3,493 49
Share of generation fossil fuels	mkWh (%)	310 73	18,220 95	36 6	492,229 84	146 100	1,779 75	52,123 64	3,594 51
Capacity public sector	% share	100 %	73	100	90	39	79	100	85
Capacity private sector	% share	0.0	27	0	10	61	21	0	15

Import Dependence

Country	Energy Imports as % of Total Commercial Energy Consumption
Afghanistan	60 %
Bangladesh	81 %
Bhutan	29 %
India	27 %
Maldives	98%
Nepal	87 %
Pakistan	30 %
Sri Lanka	78 %
Total	37%

Energy Demand Forecast 2020 (mtoe)

Country	Consumption 2004	Forecast 2020	Annual Growth Rate
Afghanistan	0.4	5	19 %
Bangladesh	46	74	3 %
Bhutan	0.2	2	18 %
India	336	1,218	8 %
Nepal	1	4	9 %
Pakistan	55	192	8 %
Sri Lanka	4	21	11 %

Supply-Demand Gap of Afghanistan, India and Pakistan

S.NO	Country	GAP (MW)
1	Afghanistan	862
2	India	12,763
3	Pakistan	5,500
	Total	18,176

Source: Ministry of Power GOI, WAPDA Pakistan and Ministry of Water and Power Afghanistan


- Even if only 20% of the above gap had to be met thru imports from CARs the quantum works out to 3,035 MW, which is good enough to lay a robust power transmission system



Central Asia - Energy Resources



Central Asian Republics (CARs)

- One of the major energy rich regions of the world
 - Inter/Intra-region energy trade already taking place
 - Electricity Demand/Supply growth manageable even through energy efficiency/loss reduction measures
 - Large energy export potential (Power/Gas)
 - Energy resource development high on agenda of Govts.
 - Energy can emerge as a major export commodity
 - Energy infrastructure well laid throughout the region
 - Incremental investments in energy infrastructure can bring in rich dividends through exports
- 

Central Asia - Primary Energy Resources

Fossil Fuel Reserves	Unit	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan	Total
Crude Oil	MTOE	1,100	5.5	1.7	75	82	1,264.20
Natural Gas	MTOE	1,500	5	5	2,252	1,476	5,238
Coal	MTOE	24,300	580	500	Insignificant	2,851	28,231
Total	MTOE	26,900	591	507	2,327	4,409	34,734
% of Total		77.4	1.7	1.5	6.7	12.7	100
Hydro Potential	GWh/year	27,000	163,000	317,000	2,000	15,000	524,000
	MTOE/year	2.3	14	27.3	0.2	1.3	45.1
% of Total		5.2	31.1	60.5	0.4	2.9	100

CAR-Electricity Supply/Demand Scenario

Item	Kyrgyzstan	Tajikistan	Uzbekistan	Kazakhstan	Total
Installed Capacity Hydro (MW)	2,950	4,059	1,710	2,000	10,719
Installed Capacity Therm.(MW)	763	346	9,870	16,240	27,219
Installed Capacity Total (MW)	3,713	4,405	11,580	18,240	37,938
Available Capacity (MW)	About 3,100	3,428	7,800	13,840	25,068
Peak Demand (MW)	2,687	2,901	7,925	9,432	22,945
Generation Hydro (GWh)	10,778	15,086	7,278	8,861	42,003
Generation Thermal (GWh)	1,115	138	42,021	49,317	92,591
Generation Total (GWh)	11,893	15,224	49,299	58,178	134,594
Exports (GWh)	1,216	266	634	595	2,711
Imports (GWh)	430	1,058	609	464	2,561
Gross supply to domestic Market (GWh)	11,107	16,016	49,274	58,048	134,445
Domestic Billed Consumption Annual (GWh)	6,836	12,988	38,112	40,053	97,989

Gross Electricity Demand Projections

Country	Actual	Forecast Demand (GWh)				Annual Growth rates			
	2003	2010	2015	2020	2025	2003-2010	2003-2015	2003-2020	2003-2025
Kazakhstan	58,944	72,056	84,034	98,367	115,146	2.91%	3.00%	3.06%	3.09%
Kyrgyzstan	12,145	9,222	10,033	11,296	12,719	- 3.86%	-1.58%	- 0.43%	0.21%
Tajikistan	16,348	11,267	12,410	13,972	15,731	- 5.18%	- 2.27%	- 0.92%	- 0.17%
Uzbekistan	48,691	46,597	51,255	56,589	62,479	- 0.63%	0.43%	0.89%	1.14%
Total	136,128	139,142	157,731	180,225	206,075	0.31%	1.24%	1.66%	1.90%




Compatibility in CA-SA Energy

Scenarios





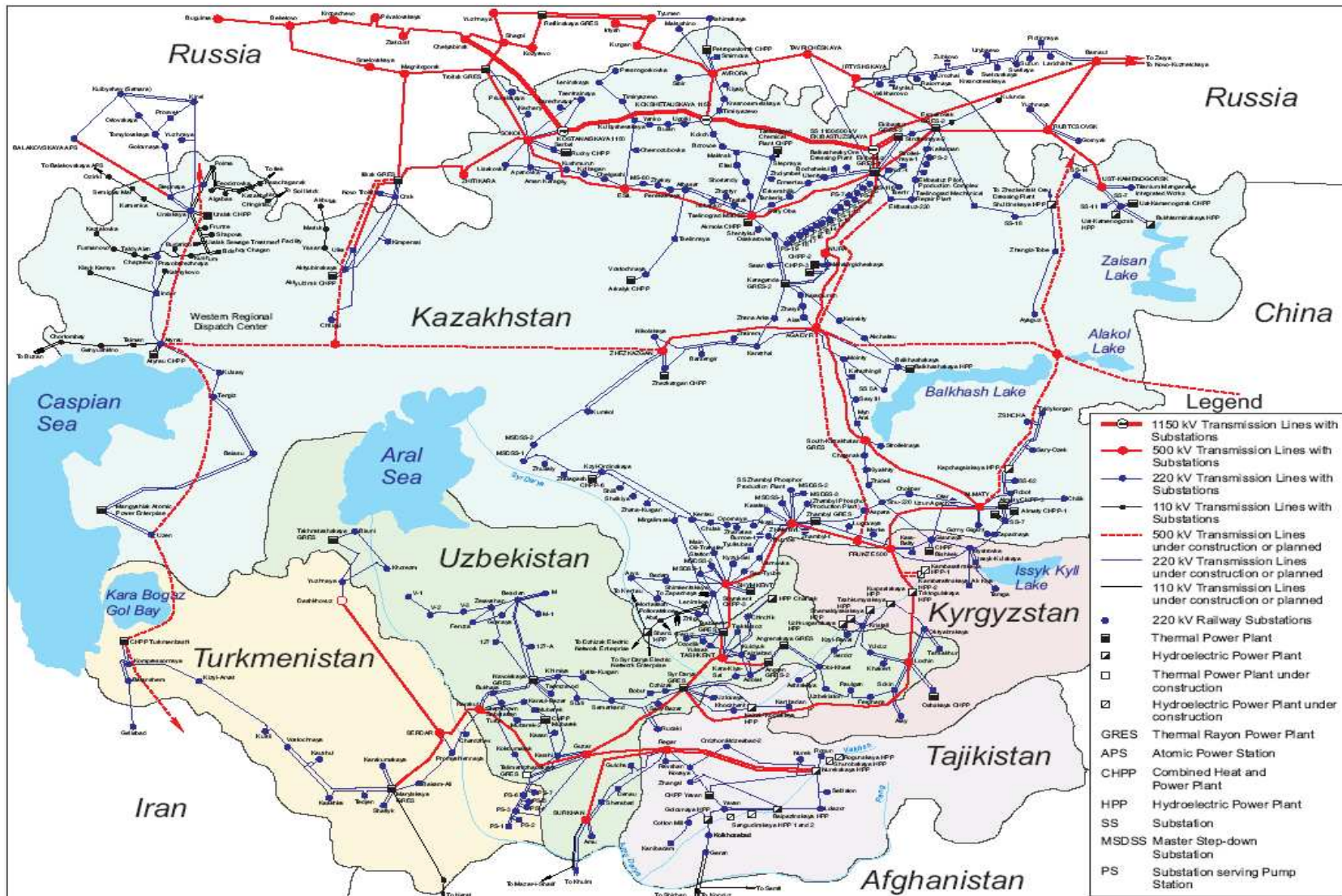
Compatibility of CA-SA Power Systems

- The two regions are in close proximity
 - Endowed with diverse energy resources
 - There is seasonal variation in Demand
 - Peak Diversity due to time variation
 - Power trade will provide economic benefits to both regions
- 

CAR- SA Location



CAR - Grid Map



North Eastern Power Grid Map of Afghanistan





Development of CA-SA Transmission Systems



Issues

- Implementation of 1998 Framework Agreement among CARs in energy cooperation
 - The security situation in Afghanistan
 - Indo-Pak relations
 - Non-discriminatory Open Access on transmission systems
- 



Prospects of Mitigating Issues

Central Asia:


- Proper implementation of the 1998 Framework Agreement would benefit all the CARs and it is expected the parties involved will address this issue

Afghanistan:

- Support of international community for reconstruction of Afghanistan
- Afghan's craving for peace due to realization of harmful effects of war
- Economic reconstruction mediated thru electricity supports peace process
- Industrialization, rehabilitation of agricultural thru irrigation facilities and improved educational/medical facilities will wane away the support base terrorism over time
- Following stakeholders will support rehabilitation/reconstruction of the Power sector:
 - Domestic consumers enjoying benefits of electricity for his day to day life
 - Participants in process of economic and industrial reconstruction of Afghanistan
 - Participants in Power transmission projects




Pakistan-India relationship

- Both countries realize the negative impacts of non-cooperation and its impacts on economic development
 - Utilization of the scarce resources on armament instead of social sector spending which lead to deprivation and tardy progress in their social performance indicators
 - Peace/reconciliation thrust areas of renewed cooperation effort
 - Appreciation of benefits of cooperation in trade, commerce and other activities
 - Joint efforts to negotiate agreements with energy suppliers to import natural gas supplies
- 




Non Discriminatory Access

- Two important factors that merit attention while examining the options for the CAR-SA power trade are:
 - Strengthening of intra-regional transmission system within CARs to facilitate/increase intra-regional power trade, and
 - CARs to provide non-discriminatory third party access on transmission systems to assure that transmission bottlenecks would not hold back the power transfers within and outside the region
 - Long distance and rugged terrain between CARs and SANs, robust HVDC transmission systems capable of handling large volumes of power, most likely at 500 kV and 800 kV would have to be built to meet the electricity import requirements of India, Pakistan and Afghanistan.
- 



Economic, Technical and Commercial Factors

Project Financing:

- CARs or SANs may not be able to finance these projects through internal resources
 - Private participation difficult to achieve for the first project
 - Support of MFIs essential to address security/environment concerns
 - ADB/WB committed to support infrastructure projects across CARs/SA.
 - MFIs supporting proposed Tajikistan-Pakistan power transmission system
 - Supporting the CARs-South Asia power transmission system would be an extension of their existing commitment to these regions
- 



Techno commercial issues

Cost of Financing will be dictated by:

- Project profitability
- Structuring of financing
- Equity participation by promoters
- Security packages offered by project participants
- Support of participating governments
- Bank-ability of PPAs, TSAs
- Socio-political and security environment in the regions

Technical Issues:


- Technical challenges in project construction

Commercial Issues:

- Electricity tariff
 - Wheeling Charges
 - Transit fee levied by the transit countries
 - Payment security mechanism
- 



Existing Interconnections CAR-Afghanistan

- Four power transmission interconnections from the CARs to Afghanistan
 - These are one each between Tajikistan-Afghanistan and Uzbekistan-Afghanistan and the other two are between Turkmenistan to Afghanistan.
 - There are also two transmission interconnections between Iran and Afghanistan.
 - These are small interconnections and help Afghanistan to import 64 MW to meet local import requirements
 - Donor agencies have pledged to help build interconnections at 220kV level to facilitate transfer of larger volumes of power
- 



Existing Interconnections in SA

Bhutan-India:


Four transmission interconnections one at 440 kV, one 220 kV and two 33/11kv levels help India import nearly 1360 MW power

India -Nepal:

Thirteen interconnections at 66/11 kV and 33/11 kV levels facilitate 50 MW power exchange to be increased to 150 MW


Iran-Pakistan:

Two interconnections exist between Iran-Pakistan for importing small quantities of electricity from Iran to meet the local demand in bordering areas





Proposed Interconnections in SA/CA-SA


- Pre-feasibility studies to establish 220 kV power transmission interconnections between India-Bangladesh and India-Sri Lanka have been completed recently, governments serious to implement these projects
 - Pre-feasibility study for 1000 MW power export from Tajikistan to Afghanistan and Pakistan initiated
- 



Legal and Regulatory Frameworks



Regulatory Framework in SA

- India: CERC at national level and SERC at state levels established and fully functional
 - Pakistan: NEPRA fully functional
 - Afghanistan: Restructuring model envisions creation of Regulator but yet to be set up
- 




Regulatory Mechanism in CARs

- Kazakhstan: Regulation of the power industry in Kazakhstan is carried out by the State Committee for Regulation of Natural Monopolies and Protection of Competition. The regulatory body at the national level has also a major role to play in regulation of tariffs
 - Kyrgyz Republic: the State Energy Agency is the regulatory body for the whole energy sector, while the policy formulation is in the hands of the Department of Fuel and Energy Complex under the Prime Minister.
 - Tajikistan: Barki Tajik (BT), though from a legal point of view the generation, transmission and distribution entities are separate companies, BT functions as a vertically integrated utility.
 - Uzbekistan: UzGosEnergoNadzor, has been established as the regulatory body for regulating the technical aspects for electricity, coal and heat energy. It reports to the Cabinet of Ministers. The financial/economic regulation continues to remain with the Ministry of Finance.
- 



Prevailing Commercial Mechanisms

- Existing PPAs/TSAs etc. are a legacy of the past and not commercially bankable
 - Setting up of new projects and/or new trade deals would require bankable commercial documentation
 - Retail tariffs do not cover cost of supply that would help generate resources to meet new investments
 - Non-transparent/non-focused subsidies
 - Present payment security mechanisms do not give confidence to investors and lenders
- 



Advantages of Cooperation




Advantages of Cooperation

- Optimization of investments in new capacity addition
- Reduce T&D losses thru HV long haul transmission systems
- Improved reliability of supply
- Improved operational stability of electricity grids
- Reduced overall reserve requirements
- Provides forum for joint planning and operations
- Benefit from the fuel price advantages across regions
- Power wheeling from low cost areas to high cost areas possible

.....continued




Advantages of Cooperation

- Merit Order Dispatch will help to reduced energy cost
 - Short-term firm energy transactions in the event of temporary surplus
 - Reduces capacity needs by sharing of firm resources, depending on daily and seasonal load diversity
 - Remote areas along cross border transit routes can be served economically
 - Power availability in border areas will trigger economic growth leading to poverty alleviation
- 




Benefits of Cross-border Interconnection

- Regional power Exchanges help to optimize generation capacity to meet peak load
 - Optimal hydro-thermal maximizes efficiency of fuel sources
 - Economy of scale thru large sized generating plants
 - Interconnections increases the reliability of the whole system
 - Provide flexibility to meet unforeseen energy demand
 - Reducing investment in the interconnected countries thru reduced spinning reserve
 - Demand in neighboring countries can be met economically
 - Provide interconnected countries access to a larger market
 - Help in reducing the adverse impact on environment by better utilization of renewable and “clean” energy resources
- 



Benefits of Cross-border Interconnection


- Need of Meeting Growing Power Demand in interconnected countries
 - Various types of energy in different countries can be shared to the benefit of the involved parties
 - Economy of Scale of building large projects
 - Improved Security and Reliability of connected systems
 - Economic benefit due to availability of electricity
 - Optimization of transmission network
 - Increased economic efficiency in system operation
 - Reduced environmental damage
- 



Next Steps




Technical

- Conduct Feasibility Studies to assess technical options for interconnections
 - Review of generation/load profiles, transmission system capacities
 - Review power sector expansion plans of participating countries
 - Review Tech. parameters for grid operation & information on existing cross border interconnections
 - Identify interconnection points, physical configurations & develop cost estimates for interconnections
 - Identify quantities of power that are available for trade
- 



Commercial/Financial

- Review non-technical aspects for establishing and operation of the proposed regional grids
 - Identify quantities of power that can be traded
 - Reach a broad understanding on pricing of power
 - Work out a formula for calculating wheeling charges
 - Work out the payment settlement mechanisms
 - Payment security option/mechanisms
 - Dispute resolution mechanisms
 - Identify sources of financing the interconnection projects
- 



THANK YOU!






Benefits to Members within ECT Domain

ECT helps member countries to harness benefits of cooperation on equal footing

- Promotes energy market reforms, structuring, commercialization, energy price reforms and promotes higher energy efficiency
 - It helps in securing trade and transit of energy, facilitates overcoming the barriers to trade, transit, tariffs and protection of investments in energy projects.
 - The key elements of the treaty are:
 - Freedom of transit
 - Non-discrimination
 - Not less favourable than conditions for national import or export transportation.
- 



Benefits to Members within ECT Domain

- Provides for negotiated Transit Protocols with basic principles in ECT
 - Provides for energy sector-specific principle of non-discrimination and national treatment for established investments
 - Treaty offers intermediary step towards WTO membership
 - The “Best Endeavour Clause” for investments in the making confirms national sovereignty over natural resources and acts as a permanent discussion forum for energy-related investments
 - Facilitates overcoming comprehensible barriers in energy transit/trade
 - CARs-SA trade negotiations will get expedited, once SANs becomes ECT Members
 - As ECT members they will get a fairer deal while entering in to PPAs, TSAs
 - They will get equal and non-discriminatory treatment in trade negotiations
- 



Background to the Treaty's creation

- Need for Energy cooperation among CIS -Western world lead to creation of ECT
 - ECT began with inter-governmental framework to provide legal stability for investments and to secure trade and transit of energy
 - Objective - promote energy market reforms, structuring, commercialization, energy price reforms and promote higher energy efficiency.
 - **ECT's Central Principles:**
 - Openness,
 - Non-discrimination and market orientation
 - These principals allow producer-states to increase attractiveness to foreign investors
 - Facilitate transit and bind together interests of energy producers and consumers
- 


- 
- **Structure of ECT:**
 - Treaty is unique in covering investment, trade, transit and efficiency in energy sector.
 - It offers intermediary step towards WTO membership.
 - Facilitates establishment of inter-governmental forum to discuss energy cooperation issues.
 - **Geographical scope:**
 - ECT covers Eurasia, Euro-Mediterranean regions and the rest of the world
 - China, Iran, South Korea, ASEAN and Nigeria have become the observers
 - India, Pakistan and several Latin America countries exhibited interest in ECT
- 



- **Trade Provisions:**

- Currently twelve of the ECT signatures are non-WTO members
- ECT acts as a bridge to WTO membership
- Seven ECT member countries have become WTO members since 2000
- WTO rules are applied by reference for energy products and equipment
- Most Favored Nation Clause (MFN) is one of the major benefits; and
- Access to Dispute Settlement mechanisms under the WTO

- **Key Elements:**

- The key elements of the treaty are:
 - Freedom of transit;
 - Non-discrimination,
 - Not less favourable than conditions for national import or export transportation.
 - It provides for the negotiated Transit Protocol with the basic principles as in the Treaty
- 



- **Investment:**


- The Treaty facilitated the first multilateral investment agreement.
- It provides for energy sector specific principle of non-discrimination/national treatment for established investments;
- Best endeavour clause for investments in the making;
- Confirms national sovereignty over natural resources and
- Acts as a permanent discussion forum for energy-related investment issues

- **Energy Efficiency activities:**

- The treaty promotes development of energy efficiency strategies
 - Fiscal and taxation policies for improving energy efficiency
 - Development of energy efficiency institutions
 - Financing mechanisms and third party financing
 - It supports adoption of energy efficiency policies to market liberalization and development of cogeneration and district heating systems
- 



Working of the ECT

- There are three permanent working groups on:
 - Trade & Transit
 - Investments and
 - Energy Efficiency
 - Experience exchange between members in different stages of development with different policy strategies
 - Regular country reviews of investment climate, restructuring and privatization policies and energy efficiency policies are carried out
 - The Charter supports the carrying out of analysis on cooperation, trade, transit issues, transit tariffs and access conditions.
 - Issues related to trade distortions, trade facilitation are dealt with and interaction with the private sector is encouraged.
 - To look after the above issues an Industry Advisory Panel was created in 2004.
- 



Objectives

Charter promotes:

- Investments and investment flows,
 - Development of energy resources
 - Development of infrastructure
 - Opening up of trade and
 - Easier transit and efficiency in end-use of energy
- 