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BIMSTEC-Japan Cooperation in Energy Sector:

Bangladesh Perspective

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BIMSTEC-Japan Cooperation in Energy Sector: Bangladesh Perspective

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Abstract: Looking at Bangladesh's perspectives, an attempt has been made in this paper to capture the various aspects of energy resources and energy cooperation in BIMSTEC. In order to foster greater economic and social development in the region, this paper explores the role of Japan in enhancing development, exploration and production of energy resources. It is quite evident from this study that the BIMSTEC countries are acutely hungry for energy resources to quench rising demand in growing economic activities in the region. Some countries have huge potentials in hydroelectricity and other non-traditional means like wind, solar, biogas, etc., whereas some like Nepal and Bhutan have potentials in hydroelectricity due to natural advantages. Bangladesh, India, and Sri Lanka too can explore their potentials in solar, wind and biogas. The projection of some key energy resources suggests that the growth of energy demand in the region is going to be exponential in the near future. Unfortunately most of the BIMSTEC countries do not have enough capacity and pragmatic outlook of about the potential and intrinsic strength of their economies. This paper concludes that Japan may play a significant role through investment, assistance and participation for its direct and indirect economic benefits as it is one of the biggest development partners in almost all the BIMSTEC countries.

1. Introduction

The economies of Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) are growing rapidly in the new millennium. Over the last five years all of the countries witnessed high positive economic growth rate.[1] Growing size of the economy and growing demand for energy go hand in hand, particularly when

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the thrust of the economy is to maximise economic growth for accelerated poverty reduction and social development. This is the principal economic objective of most of the BIMSTEC countries in the 21st century for which one of the priority areas of cooperation is energy. The countries are energy-hungry although some have considerable hydrocarbon reserve (*e.g.*, India and Myanmar) and some have immense potential of renewable energy like hydroelectricity (*e.g.*, Nepal and Bhutan). At present the countries are lagging behind full potential in exploration and utilisation of energy resources which could be transformed into higher level of development through accelerated economic growth and poverty reduction.

The BIMSTEC countries currently have around one-fifth of world population, of whom about half life under abject poverty. BIMSTEC Free Trade Area (FTA) has been established in July 2006 with aiming to attain deeper integration of the region. The intra-regional trade and investment are negligible despite tremendous potential for market- and efficiency-seeking investments within the region. Bangladesh, by virtue of its geographical location and economic potential, has important role to play in energy cooperation among the member countries. Being one of the largest investors and trade partners in BIMSTEC region, the facilitating role of Japan in technological progress, energy cooperation through infrastructure development, investment, and technical cooperation is a natural choice. Now what potentials are there for energy cooperation within BIMSTEC countries and what role can Japan play in energy exploration, development, trade and efficient utilisation and what are Bangladesh's roles in greater energy cooperation are important analytical questions in making vision and suggesting future agenda for BIMSTEC-Japan Comprehensive Economic Cooperation. In this broad context the paper analytically discusses about possible avenue of energy cooperation at intra-BIMSTEC countries and BIMSTEC-Japan level from Bangladesh's perspectives.

2. Energy Resources in Bangladesh vis-à-vis Other BIMSTEC countries

Pattern of energy use in BIMSTEC countries exhibits availability and reserve of energy resources in these countries. For example, India is

heavily dependent on coal, Bangladesh on natural gas, Sri Lanka on petroleum, and Nepal and Bhutan on hydroelectricity.

Bangladesh. Currently Bangladesh has 28 million barrels of proven oil reserves (as of January 2006). The country produced an estimated 4,000 barrels per day of oil in 2005. The country's lower level of reserves and production capacity make it a net oil importer. Petroleum exploration has been unsuccessful. Bangladesh has 33,000-bbl/d of crude oil refining capacity at Eastern Refinery Ltd.'s (ERL) facility at Chittagong. The ERL complex is a subsidiary of the state-owned Bangladesh Petroleum Corporation (BPC).

Natural gas reserve estimates vary far and wide. In 2004 estimates from state-owned Petrobangla put net proven reserves at 15.3 tcf. Natural gas exploration and production is dominated by three state-owned companies, all of which are subsidiaries of Petrobangla. Bangladesh's largest gas production company, Bangladesh Gas Fields Company Ltd. (BGFCL), operates the Sylhet, Kailashtila MSTE, Kailashtia, Rashidpur, and Beanibazar gas fields.

Bangladesh has small but very high quality coal reserves at Barapukuria and Phulbari. Bangladesh began commercial coal production in April 2003 with the opening of the Barapukuria Coal Mine, which is expected to produce one million tons of coal per year (mmst/y) mainly for electricity generation. Another possible coal mining project at Khalashpir is under consideration as well.

In 2004, Bangladesh had 4.7 gigawatts (GW) of installed generation capacity, up from 3.6 GW in 2002. Almost all of this capacity was conventional thermal power (primarily natural gas based) and only 5 per cent hydroelectric power. Electricity generation per capita is one of the lowest in the world, which was about 155 kilowatt-hours (kwh) in 2005. Only about one-third of the population has access to electricity, primarily in the more developed eastern zone of the country.

India. Petroleum accounts for about 34 per cent of India's total energy consumption, and has been growing gradually in recent years.

The country's average level of oil production (total liquids) in 2005 was 837,000 bbl/d, of which 632,000 bbl/d was crude oil. India had net oil imports of nearly 1.7 million bbl/d in 2005. Among others, Reliance Petroleum's Jamnagar refinery has full capacity of 660,000 bbl/d. Another major downstream infrastructure development is the construction of pipelines being undertaken by Petronet India. This construction is expected to add 500,000 bbl/d to India's current 325,000 bbl/d capacity for pipeline transportation of refined products. On the other hand, India's consumption of natural gas has risen faster than any other fuel in recent years. The use of natural gas in India was 1.01 tcf in 2004. A major development in December 2002 the discovery of a large amount of natural gas in the Krishna-Godavari Basin offshore in Andhra Pradesh by Reliance Industries, is investing heavily in the infrastructure required to support increased use of natural gas.

Coal is the dominant commercial fuel in India, satisfying more than half of India's energy demand. Power generation accounts for about three-quarter of India's coal consumption, followed by heavy industry. India is the world's third largest coal producer (after China and the United States). Nearly all of India's 390 mines are under Coal India Ltd. (CIL), which accounts for about 90 per cent of the country's coal production. However, India is trying to expand electric power generation capacity. Although about 80 per cent of the population has access to electricity, power outages are common, and the unreliability of electricity supplies is severe enough to constitute a constraint on the country's overall economic development.

Thailand. The country has 291 million barrels of proven oil reserves. In 2005, Thailand produced 306,000 barrels per day (bbl/d) of oil, of which only about 114,000 bbl/d was crude oil. Oil consumption was 838,000 bbl/d in 2005. Demand growth in Thailand has somewhat slowed in the recent years due mainly to increasing substitution of natural gas in electricity generation and use of ethanol in motor vehicles. Thailand has four oil refineries, with a combined capacity of 703,100 bbl/d.

Thailand has about 12.5 tcf of proven natural gas reserves. The

Table 2.1: Reserve of Non-renewable Energy

	Natural Gas[1] (trillion cubic feet) End-year 2005	**Recoverable Coal**[2] (million short ton)	**Oil**[3] (billion barrel), January 2006 Estimate
Bangladesh	15.391 (18.235)	1,054* (1.009)	0.028 (0.450)
Bhutan	0.000 (0.000)	0.089** (0.000)	0.000 (0.000)
India	38.865 (46.047)	101,903 (97.559)	5.848 (94.065)
Myanmar	17.650 (20.912)	2 (0.002)	0.050 (0.804)
Nepal	0.000 (0.000)	1 (0.001)	0.000 (0.000)
Sri Lanka	0.000 (0.000)	0 (0.000)	0.000 (0.000)
Thailand	12.496 (14.805)	1,493 (1.429)	0.291 (4.681)
BIMSTEC	84.402	**104,453**	6.217
World	6,347.300	997,506	1,292.550
BIMSTEC as % of world total	1.330	10.471	0.481

Notes: Figures in the parentheses indicate percentage of BIMSTEC reserve.

* This information has been gathered from www.unescap.org/esd/energy/publications/Co-gen/part3ch3.pdf.

** www.techno-preneur.net/bisnet/countries/bhutanprofile4.htm.

Sources:

1. BP (2006), *BP Statistical Review of World Energy*, June.
2. EIA (2004): *International Energy Annual 2004*, USA.
3. PennWell Corporation (2005), *Oil & Gas Journal*, 103(47), 19 December.

country consumed 1054.5 bcf in 2004, including imports from Myanmar. Much of the country's natural gas is used for generating electricity. On the other hand, Thailand had 24 gigawatts (GW) of power generation capacity in 2003, from which it produced approximately 115 billion kilowatt-hours (Bkwh) of electricity.

Myanmar. Natural gas has become the country's primary domestic fuel for power generation and some major industries, as well as an export earner for the country. It had a proven reserve of natural gas of 17.65 tcf. About 62 per cent of natural gas has been used in power generation and industry respectively in 2001. The use of pipeline to utilise gas reserves of Myanmar and Bangladesh would be highly beneficial for the region. Nevertheless, the country has three refineries with total crude refining capabilities of 57,000 bbl/d[2]. These refineries presently are running on low capacities. The Myanmar Government has plans to upgrade or revamp the existing facilities. The country, however, also has 2 million short ton of coal reserve.

Sri Lanka. Sri Lanka's installed generating capacity increased to 2.1 GW in 2002 from 1.6 GW in 2001. Recently the Government is trying to attract foreign investors to build independent thermal power plants. A 168 MW combined cycle power project has recently been completed in the Southern part of the country. India's state-owned National Thermal Power Corporation (NTPC) is, however, on the threshold of an opportunity to help Sri Lanka improve its weak state of power sector (Sekaran and Arulraj, 2005). The country has also approved the development of its first coal-fired plant (300 MW) on its northern coast but eventually plans to use imported coal for fuel. The country has small coal reserves but currently consume little amount of coal through import. Sri Lanka imports all of its crude oil and uses it largely for electricity generation and transportation. In recent years, Sri Lanka has further increased oil imports in an effort to avoid over-dependence on hydroelectricity. In Sri Lanka, where oil is the dominant source of energy, oil consumption roughly doubled between 1991 and 2000.

The country has approved the development of its first coal-based electricity generation plant (300 MW) on its northern coast using imported coal. The country has no domestic natural gas resources, and at the same time distance matters from regional sources of supply. On the other hand, the projected demand build up for gas from Sri Lanka is fairly below the level required to make traditional gas projects viable, both pipeline and LNG. Nevertheless, smaller-scale LNG

projects and the supply of gas may offer economic price to the Sri Lanka. In addition, there is the possibility of utilising regional gas sources via offshore pipelines from India.

Nepal and Bhutan. Hydropower is the dominant source of commercial energy for Bhutan, and revenue from hydroelectricity exports to India constituted about 45 per cent of the government's revenue and 11.6 per cent share of GDP in 2001. Nepal and Bhutan have potential to export electricity to other member countries. Nepal relies almost exclusively on hydroelectricity to meet its power requirements, and at the end of 2002, its installed capacity was 400 MW.[3] Nepal has large untapped hydroelectric potential (estimated at 43,000 MW), which could be developed to provide for the 60 per cent of the population without electricity, as well as for export. Bhutan's hydropower potential is estimated at 30,000 MW. Hydropower is the dominant source of commercial energy for the country and sales of hydroelectricity exports to India provided 45 per cent of the government's revenues and constituted an 11.6 per cent share of GDP in 2001.

3. Demand, Supply and Trade of Energy Resources

The demand and supply of energy resources can be easily traced from the consumption and production of these resources respectively. It can be clearly revealed from the following tables that Bangladesh's production and consumption of natural gas has been the third (462.6 bcf in 2004) for among four natural gas producing countries. However, the country produced an estimated 4,000 barrels per day (bbl/d) of oil in 2005. Bangladesh's relatively low level of domestic reserves and production capacity make it a net oil importer, as the country consumed an estimated 91,000 bbl/d of oil in 2005. Bangladesh is also a producer of hydroelectricity, although, as indicated earlier, the share of hydroelectricity is very low in the total electricity production. The country is also a net importer of coal (0.7 million short ton in 2004).

India is the largest producer and consumer of natural gas among the BIMSTEC countries (995.8 and 1088.7 bcf in 2004 respectively). The country, however, imported small amount of natural gas in 2004 (92.87 bcf), which was only 8.53 per cent of the total consumption.

Table 3.1: Production, Consumption and Trade of Natural Gas, 2004

	Natural Gas (billion cubic feet/year)		
	Production	Consumption	Trade [Import(-) / Export(+)]
Bangladesh	462.626 -17.755	462.626 -17.126	
Bhutan	0 0	0 0	
India	995.883 -38.222	1088.761 -40.306	-92.878
Myanmar	360.213 -13.825	95.35 -3.53	264.863
Nepal	0 0	0 0	
Sri Lanka	0 0	0 0	
Thailand	786.818 -30.198	1054.505 -39.038	-267.687
BIMSTEC	2605.54	2701.242	625.428
World	98620.253	99665.182	57733.874
BIMSTEC as % of world total	2.642	2.71	1.083

India is also the highest producer, consumer and importer of coal (about 95, 94 and 81 per cents respectively in 2004). Myanmar also produces coal, but majority of its production is exported. Though very low compared to India, Thailand's production and consumption of coal is the second in BIMSTEC (around 5 per cent in 2004), but the country's import of coal is significant, which was about one-fifth of total coal import in BIMSTEC. Of course, the country's natural gas production and consumption are significant, about 30 and 39 per cents of BIMSTEC production and consumption, respectively. It imported about a quarter of BIMSTEC import of natural gas in 2004.

Being net importers the BIMSTEC countries import huge quantity of petroleum although India and Thailand produce notable amount of

Table 3.2: Production, Consumption and Trade of Coal, 2004

	Coal(million short ton/year)		
	Production	Consumption	Trade [Import(-) / Export(+)]
Bangladesh	0 0	0.771 -0.151	-0.771 (1.812
Bhutan	0.057 -0.012	0.068 -0.013	-0.011 -0.026
India	443.723 -94.951	478.157 -93.781	-34.434 -80.939
Myanmar	1.439 -0.308	0.136 -0.027	1.303 (-3.063)
Nepal	0.013 -0.003	0.321 -0.063	-0.308 -0.724
Sri Lanka	0 0	0.004 -0.001	-0.004 -0.009
Thailand	22.088 -4.727	30.406 -5.964	-8.318 -19.552
BIMSTEC	467.32	509.863	43.846
World	6,078.58	6098.778	36,047.539*
BIMSTEC as % of world total	7.688	8.36	0.122

oil. In 2004, India, Myanmar and Thailand produced about 33, 54 and 26 per cents of their domestic consumption, respectively. However, among the BIMSTEC countries, India alone consumed about 70 per cent of total consumption.

The tables also make it overt that the total production, consumption and import of non-renewable energy are very low when compared to those of the world. For example, production and consumption of natural gas is hovering at around 3 per cent, and in the case of coal these are about 8 per cent. Nevertheless, for oil these were about 1.3 and 4.3 per cents. Intra-BIMSTEC trade of non-renewable energy resources is also meagre.

Table 3.3: Production, Consumption and Trade of Oil, 2004

	Oil (thousand barrel per day)		
	Production	Consumption	Trade [Import(-) / Export(+)]
Bangladesh	6.2 -0.576	85 -2.382	-78.8 -3.16
Bhutan	0 0	1.16 -0.033	-1.16 -0.049
India	811.415 -75.439	2450 -68.644	-1638.585 -65.712
Myanmar	20.15 -1.873	37 -1.037	-16.85 -0.676
Nepal	0 0	16 -0.448	-16 -0.642
Sri Lanka	0 (-0.048)	80 -2.241	-80 -3.208
Thailand	237.823 -22.111	900 -25.216	-662.177 -26.555
BIMSTEC	1075.588	3569.16	2493.57
World	80938.013	82594.656	45799.000*
BIMSTEC as % of world total	1.329	4.321	5.445

Notes for Tables 3.1 to 3.3:

1. Figures in the parentheses indicate percentage of BIMSTEC.
2. Information of world oil trade indicates only import because most of the countries in the world are oil importers. Source: BP (2005): *BP Statistical Review of World Energy*, London, June.

* World trade data for 2004 is not available. Therefore we used 2003 data for making comparison.

Sources of Tables 3.1 to 3.3: US Energy Information Administration (2006) and Khan *et al* (2006).

The time series information on production and consumption depicted in the figures show that India's production of natural gas was all through higher than the other BIMSTEC countries, and it have been increasing with few exceptions. On the other hand, Thailand's production was in the second position all over since 1988, followed by Bangladesh and Myanmar. However, the pattern of consumption

Figure 3.1: Production of Natural Gas, 1980-2004

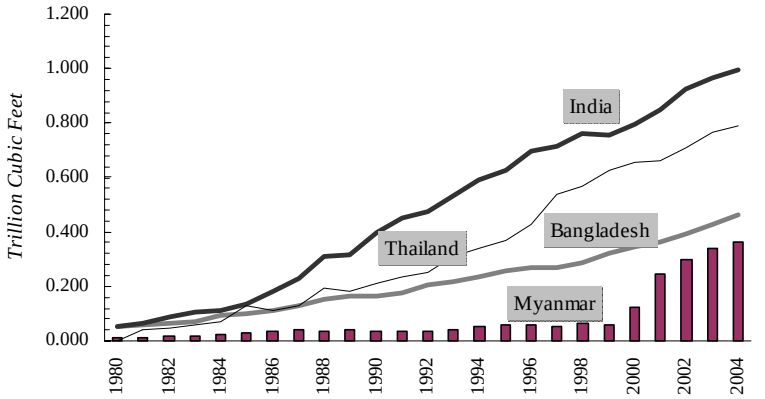
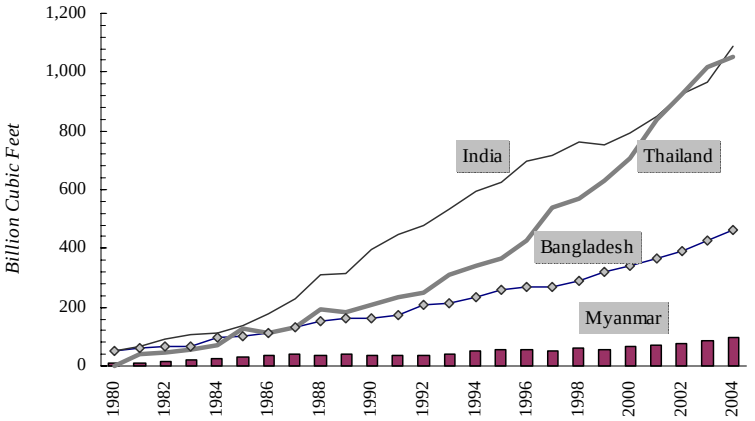


Figure 3.2: Consumption of Natural Gas, 1980-2004



of natural gas provides a bit different picture. For example, India's consumption had been the highest with few exceptions in the early 1980s and in the new century. For Thailand and Bangladesh, although the level of consumption was almost same till 1987, it grew continuously for both the countries but Thailand's consumption grew at much faster rate than that of Bangladesh.

Figure 3.3: Consumption of Coal, 1980-2004

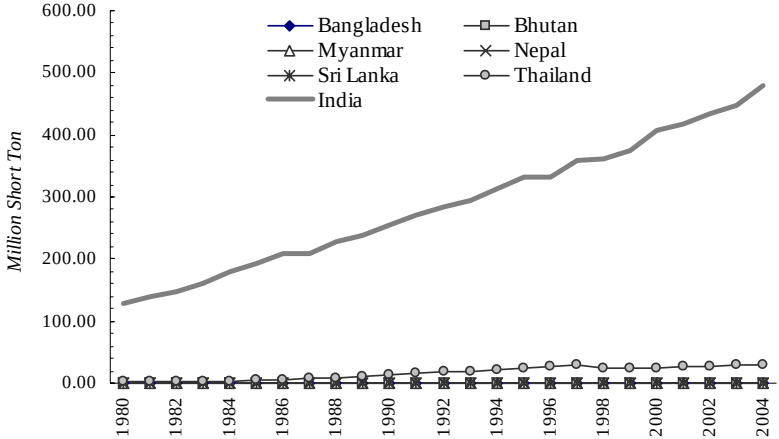
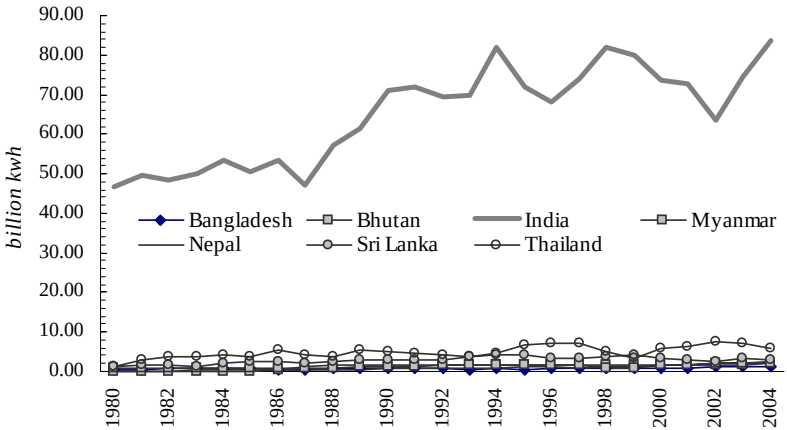


Figure 3.4: Production of Hydroelectricity, 1980-2004



The Figures 3.3 and 3.4 show that the level of consumption (aggregate figure) of coal and production of hydroelectricity has been much higher in India than the other BIMSTEC countries since 1980. On the other hand, data on renewable energy show a dismal aggregate share of BIMSTEC countries in world production and consumption. Specifically, production and consumption of hydroelectricity, nuclear energy and other renewable energy hovered nearly 4, 0.6 and 3 per

Table 3.4: Production and Consumption of Renewable Energy, 2004

	Hydroelectricity (billion kilowatt-hours, net)		Nuclear energy (billion kilowatt-hours, net)		Others (billion kilowatt-hours, net)	
	Production	Consumption	Production	Consumption	Production	Consumption
Bangladesh	1.139	1.139	0	0	0	0
	-1.134	-1.079	0	0	0	0
Bhutan	2.05	2.07	0	0	0	0
	-2.041	-1.962	0	0	0	0
India	83.764	85.264	15.044	15.044	6.41	6.41
	-83.416	-80.795	-100	-100	-66.226	-66.226
Myanmar	2.246	2.246	0	0	0	0
	-2.237	-2.128	0	0	0	0
Nepal	2.347	2.553	0	0	0	0
	-2.337	-2.419	0	0	0	0
Sri Lanka	2.931	2.931	0	0	0.005	0.005
	-2.919	-2.777	0	0	-0.052	-0.052
Thailand	5.94	9.328	0	0	3.264	3.264
	-5.915	-8.839	0	0	-33.722	-33.722
BIMSTEC	100.417	105.531	15.044	15.044	9.679	9.679
World	2746.878	2746.878	2619.178	2619.178	334.267	334.267
BIMSTEC as % of world total	3.656	3.842	0.574	0.574	2.896	2.896

Notes: 1. Figures in the parentheses indicate percentage of BIMSTEC.

2. “Others” incorporate geothermal, solar, wind, and wood and waste electric power generation.

Source: US Energy Information Administration (2005).

cents respectively in 2004. Among them, India had the largest share, having 100 per cent production of nuclear energy in BIMSTEC.

Table 3.5 provides the projection of demand for various energy resources up to 2020 based on ten years' annual average growth, from 1994 to 2004. Out of five categories, we found that annual average growth was the highest for coal in Bangladesh. India's annual average growth of nuclear energy was about 22 per cent in India. Negative growths were observed for coal in Bhutan and hydroelectricity in India, although the rates of recession were very low. Other than these extraordinary growth rates, the other growth rates indicate that the demand for energy resources will be huge for BIMSTEC countries. But the existing trade relationship due to discouraging inter-state relations indicates that the countries will not be able to quench the demand for that demand. Hence, engagement of Japan as an external partner can create a positive environment for exploration, development and trade of both non-renewable and renewable energy resources.

4. Energy Cooperation in South and Southeast Asia

South and Southeast Asia comprises three regional bodies namely SAARC, BIMSTEC and ASEAN. Since some of the member countries of BIMSTEC are member of SAARC and ASEAN, BIMSTEC has created a linkage among these three bodies in South and Southeast Asia. So, to analyse the energy cooperation under the umbrella of BIMSTEC we must consider the energy cooperation in other two bodies in this region SAARC and ASEAN.

4.1 Energy Cooperation in SAARC

The prospects for trans-border energy cooperation have emerged as one of the more exciting ideas in the political discourse within the SAARC.[4] Cooperation among the SAARC countries in the field of energy would lead to operating up of a number of opportunities for profitable investment and promote trade within the region. All SAARC member countries are dependent on imported energy which is likely to increase due to accelerated economic growth, if in the meantime no major discoveries of oil or gas are made. India's commercial energy demand is projected to increase by 3.8 per cent to 4.3 per cent a year

Table 3.5: Energy Demand Projection

		1994	2004	Annual ave. change, %	2010	2015	2020
Bangladesh	Natural gas	234.84	462.626	9.7	731.864	1086.804	1613.884
	Coal	0.065	0.771	108.615	5.796	37.27	239.674
	Oil	45.938	85	8.503	128.366	182.943	260.722
	Hydroelectricity	0.839	1.139	3.576	1.383	1.631	1.922
	Nuclear energy						
Bhutan	Natural gas				0	0	0
	Coal	0.09	0.068	-2.444	0.058	0.051	0.045
	Oil	0.742	1.16	5.633	1.552	1.989	2.55
	Hydroelectricity	1.658	2.07	2.485	2.379	2.674	3.006
	Nuclear energy						
India	Natural gas	593.64	1088.761	8.34	1633.605	2314.853	3280.195
	Coal	313.564	478.157	5.249	628.751	793.77	1002.099
	Oil	1413.274	2450	7.336	3528.338	4822.468	6591.261
	Hydroelectricity	81.9	85.264	0.411	87.365	89.16	90.991
	Nuclear energy	4.72	15.044	21.873	34.787	72.832	152.485
Myanmar	Natural gas	50.5	95.35	8.881	146.159	211.063	304.787
	Coal	0.071	0.136	9.155	0.211	0.307	0.448
	Oil	18.923	37	9.553	58.207	86.01	127.092
	Hydroelectricity	1.598	2.246	4.055	2.792	3.359	4.04
	Nuclear energy						

Table 3.5 continued

Table 3.5 continued

		1994	2004	Annual ave. change, %	2010	2015	2020
Nepal	Natural gas				0	0	0
	Coal	0.133	0.321	14.135	0.593	1.013	1.728
	Oil	6.834	16	13.412	28.876	48.241	80.591
	Hydroelectricity	0.924	2.553	17.63	5.254	9.885	18.598
	Nuclear energy				0	0	0
Sri Lanka	Natural gas						
	Coal	0.004	0.004	0	0.004	0.004	0.004
	Oil	44.657	80	7.914	117.989	164.679	229.845
	Hydroelectricity	4.048	2.931	-2.759	2.446	2.108	1.817
	Nuclear energy						
Thailand	Natural gas	341.84	1054.505	20.848	2373.559	4847.746	9901.014
	Coal	20.636	30.406	4.734	39.043	48.286	59.716
	Oil	603.168	900	4.921	1165.746	1452.59	1810.015
	Hydroelectricity	4.469	9.328	10.873	15.413	23.792	36.727
	Nuclear energy						
BIMSTEC	Natural gas	1220.82	2701.242	12.126	4666.632	7496.117	12041.183
	Coal	334.563	509.863	5.24	670.154	845.723	1067.289
	Oil	2133.536	3569.16	6.729	5010.14	6695.764	8948.503
	Hydroelectricity	95.436	105.531	1.058	112.229	118.164	124.414
	Nuclear energy	4.72	15.044	21.873	34.787	72.832	152.485

Note: Natural gas, coal, oil, hydroelectricity and nuclear energy are expressed in terms of billion cubic feet per year, million short tons per year, thousand barrel per day, billion kilowatt hours, and billion kilowatt hours respectively.

through 2020. The oil demand growth rate for India is projected at 2.3 per cent per year in the low economic growth scenario and is the highest in Asia.[5] Government of Pakistan's Medium Term Development Framework (MTDF) projects the growth in the demand of electricity, petroleum products, natural gas and coal at an average annual rate of 8.4, 4.3, 7.6 and 18.9 per cents respectively.[6] Overall energy demand situation of other SAARC countries is not much different from that of India and Pakistan. Moreover, development of energy infrastructure projects requires large capital outlays, not easily affordable by many countries. However, despite rapid growth in energy demand, the per capita energy consumption in SAARC continues is likely to be lowest in the world, while energy consumption per unit of GDP is amongst the highest.[7] Closer cooperation among SAARC countries in energy field has the potential to improve energy availability, efficiency and trade. Energy sector has received more attention at SAARC only recently.

Realising the importance of the regional cooperation in energy sector, the 12th SAARC Summit held at Islamabad on 4-6 January 2004, laid emphasis to the setting up of a Working Group on Energy (WORGEN). The working group has been mandated to conduct a study on creating a South Asian Energy Cooperation including the concept of an Energy Ring. Two meetings of the working group on energy were held in Islamabad on June and December 2004. The first Energy Ministers' Meeting was held in Islamabad on October 2005. The working group prepared a programme which included workshops and seminars on the subjects of energy trade, independent power producers' energy efficiency, rural electrification, micro-hydroelectricity from the collective experiences in priority areas. The working group approved to seek cooperation between SAARC and ASEAN to learn experiences in various energy sectors. A delegation from SAARC member countries was to visit ASEAN energy institutions for this purpose.

In the first Minister's Meeting, the SAARC Energy Ministers agreed that the SAARC Member States shall cooperate in the development and use of all forms of energy, whether commercial,

non-commercial, renewable or non-renewable, in modalities that may be appropriately designed by them for this purpose so as to achieve the objective of creating an Energy Ring in South Asia. The cooperation in the energy sector will cover, inter alia, planning, development, trade, transportation, information exchange, capacity building, encouraging private sector participation and international cooperation including, but not limited to, the following areas:[8]

- Establishment of a SAARC Energy Centre in Pakistan;
- Facilitation of private investment in the energy sector;
- Accessing resources from International Financial Institutions for harnessing regional energy potential;
- Development of a regional energy database;
- Promotion of energy trade including establishment of regional energy grids;
- Exploitation of vast coal resources using economic, clean fossil fuel technologies;
- Exchange of geological information for expediting fossil fuels exploration and development;
- Development of hydro power resources;
- Development of renewable and alternate energy resources, particularly in the rural areas, for poverty alleviation;
- Sharing of best practices in energy sector including, but not limited to rural electrification, CNG, solar, wind, bio-fuels, and other technologies;
- Promoting energy efficiency and conservation;
- Human resource development in the energy sector and exchange of experts; and
- Cooperating with regional and international organizations and learning from the experience of energy cooperation programmes in other parts of the world.

At the 13th the Heads of State or Government welcomed the Joint Statement of the first SAARC Energy Ministers meeting. They agreed to the recommendation to establish the SAARC Energy Centre in Islamabad; to promote development of energy resources, including hydropower; and energy trade in the region; to develop renewable and alternative energy resources; and promote energy efficiency and

conservation in the region.[9] Considering this cooperation among the Member States in ensuring and developing sources of energy is a basic component for strengthening economic resilience of the individual Member States as well as the economic growth and prosperity of the SAARC region.

4.2 SAARC-ASEAN Cooperation in the Energy Sector[10]

SAARC-ASEAN cooperation recently developed between the two Secretariats recommended the proposal of visit by the Experts from the SAARC region to relevant ASEAN institutions coordinated by the ASEAN Secretariat.

South Asia, which is the home to nearly half of the world's poor, registered an impressive economic growth rate of 7.0 per cent in 2003 with projections of 6.5 and 6.0 per cents for 2004 and 2005 respectively. The region would have the highest growth rate of energy consumption in the world in the near future. The region needs to improve energy access and greater investments. At the same time, the countries should have policy regimes conducive to private and foreign investors, diversify energy imports, source lower cost energy, and improve efficiencies.

There are some on-going efforts in bilateral power trade in the region. Bangladesh is now interested to source cheap hydropower from Bhutan and Nepal. India has been playing crucial role in Hydro power development of Nepal and Bhutan. India-Nepal power trade is going to increase from 50MW to 150 MW in forthcoming years. The substantial Indo-Bhutan power trade is more than 75 per cent of the electricity generated in Bhutan is exported to northern Indian markets. India is keen on sourcing gas through pipeline. The pipeline proposals include Iran-Afghanistan-Pakistan-India Pipeline, India-Bangladesh gas pipeline India-Myanmar gas pipeline, among others.

4.3 Energy Cooperation in BIMSTEC

The member countries of BIMSTEC are now facing multiple challenges of sustainable energy development such as increasing energy demand, harnessing vast local natural resources for import

substitution, making available cleaner and cheaper energy, developing an international and intra-regional market and an energy grid while exploiting the economy of scale, reforming an inefficient power sector and attracting private investment, conserving natural resources and protecting environment.[11] However, BIMSTEC members are in various stages of energy development and their energy situations also vary. Each of the member countries of the region has high-energy production potential. To meet the growing energy demand and ensure the efficient management of this sector require cooperation among the member countries.

At the Second Ministerial Meeting of BIMSTEC at Dhaka in 1998, six priority sectors were identified including energy sector. Myanmar was designated the Lead Country and the Chair Country for the energy sector. At that moment two projects were identified for cooperation.[12] The projects are i) The Energy Infrastructure Development (natural gas) project and ii) The Development of New and Renewable Sources of Energy project. Thailand and India were designated coordinating countries respectively for the two projects.

At the first energy ministers' meeting held on October 04, 2005 in India, the heads of delegations of the BIMSTEC member countries adopted a Declaration and a Plan of Action for greater energy co-operation in the region. The Plan of Action covers: a BIMSTEC trans-power exchange and development project, trans-BIMSTEC gas pipeline(s), tapping the hydro potential in the region, exploring non-conventional sources of energy as well as building on energy security for the region and energy efficiency.[13] Among the six areas, the most concrete decision taken is on the power transmission network. The proposed power grid would run from Thailand to Sri Lanka and Thailand would head a task force to work out the draft memorandum of understanding (MOU) for the inter-country grid connections. The task force, which is to submit its report within a year, would also take into account crucial factors like flow of electricity between the member countries in a non-discriminatory manner.[14]

It has also been agreed to study the possibility of a trans-BIMSTEC gas pipeline network. Separate task forces would be set up to examine

the feasibility of setting up such a pipeline network. Thailand would host the first meeting of this task force. On the other areas of energy cooperation, the member countries plan to share their individual experiences in developing hydro projects. For this, a workshop would be held. In non-conventional energy sources, though there was no concrete outline on the way forward, it was decided that the members would focus on small hydro projects, solar energy and power generation from rice husk, as areas where they could cooperate. On energy efficiency, India would be the lead country, whereby with inputs from other countries, standards and labelling would be outlined.

Finally, on energy security the member countries would draw upon individual experiences on rural electrification as well as on efficient development of coal resources.[15]

4.4 Energy Cooperation in ASEAN

After the severe oil crisis in 1973, Asian countries thought of forming a smaller energy cooperative network to make strategies for energy management in crisis situations. In this regard, the heads of the ASEAN countries formed an association called ASEAN Council on Petroleum (ASCOPE) on October 15, 1975. The aim of this association is to establish cooperation among the member countries to navigate the energy problems and issues in times of emergencies due to shortage or oversupply of petroleum. Because of this principal, the ''Emergency Petroleum Sharing Scheme in Circumstances of Shortage and Oversupply'' was adopted in July 1977 by the member countries.[16] In continuation with these agreements the ASEAN Vision 2020 adopted in 1997 calls for cooperation to establish interconnecting arrangements for electricity and natural gas within ASEAN through the ASEAN Power Grid and the Trans-ASEAN Gas Pipeline Projects. Under the Hanoi Plan of Action for the energy sector, ASEAN countries are to institute the policy framework and implementation modalities by 2004 for early realization of the interconnection infrastructures. The 17th ASEAN Energy Ministers Meeting, held in Bangkok on July 03, 1999, adopted the ASEAN Plan of Action for Energy Cooperation 1999-2004. This action plan serves as a guide in the identification, formulation, and implementation of specific projects and activities in

the ASEAN energy sector covering six program areas: (1) ASEAN Power Grid; (2) Trans-ASEAN Gas Pipeline; (3) Energy Efficiency and Conservation; (4) New and Renewable Sources of Energy; (5) Coal; and (6) Regional Energy Outlook, Energy Policy, and Environmental Analysis. The plan's implementation is being carried out by various Senior Officials Meeting on Energy sub-sector networks, and ASEAN-related energy organizations, such as the Forum of the Heads of ASEAN Power Utilities/Authorities (HAPUA), the ASEAN Council on Petroleum (ASCOPE), and the ASEAN Centre for Energy (ACE). The ASEAN Plan of Action for Energy Cooperation 2004-2009 was formulated and is being implemented under the leadership of the ASEAN Center for Energy, located in Jakarta, Indonesia, as a response to this action plan.

5. Japan's Involvement in BIMSTEC Energy Cooperation

Since the inception of the BIMSTEC regional grouping, the energy sector programme has made considerable achievements. It has formulated a complete framework for implementing the cooperation programme and the project. But, differences in the administration system, and the organizational set up of institutions are posing several difficulties to coordinating countries are currently encountering difficulties due to certain barriers and in some cases constraints in proceeding with the planned studies resulting undue delays. Another problem is that the BIMSTEC countries do not have the same energy resource base, the same level of economic and industrial development, the same judicial and administrative systems, the same energy sector institutional setup and the same physical infrastructure.

With the barriers mentioned above, the BIMSTEC grouping currently lacks a partner, which is economically and technologically advanced and is a significant capital exporter, as well as has been a significant contributor to official development assistance flows.[17] Japan as the second largest economy in the world and among the largest donors, could definitely play an important role in supporting the activities of the energy sector as well as other cooperation program. Japan has close political as well as economic links with all BIMSTEC

countries. There is also close cultural and religious links between Japan and most BIMSTEC countries.[18]

Any effective energy cooperation among the BIMSTEC countries surely requires adequate energy infrastructure within the countries. Keeping in mind the availability and potentials of both renewable and non-renewable energy resources, three types of infrastructural issues we need to concentrate on.

a. physical facilities for cooperation in natural gas, coal and other types of non-traditional energy resources;
b. gridline for electricity transmission and interconnection both in rural and urban areas; and
c. refinery capacity in the BIMSTEC countries.

Against this backdrop, Japan being an economy with strong technological expertise, could assist BIMSTEC countries with the financial and technical expertise to meet the challenges from globalisation. Japanese investment in this sector can bring benefits for both the parties. Japan's energy security and trade flows are heavily dependent on secure routes through the Indian Ocean and the Bay of Bengal. Since most BIMSTEC countries border the Bay of Bengal and have common interests with Japan in keeping this vital sea route secure, there is a need to develop capability to constructively cooperate with Japan in this area.

In case of renewable energy, different levels of institutional arrangements, preparations and incentive regimes are prevalent in the BIMSTEC countries for the promotion of RE resources. Apart from institutional weaknesses in many of the BIMSTEC countries, following constraints are hindering the growth of the sector:

- Most of the developing countries of BIMSTEC are unable to meet the high initial installation cost.
- The existing tariff structure and subsidy system in all the BIMSTEC countries is favourable to the import and utilisation of fossil fuel. Thus, the existing price structure has made NRE uncompetitive vis-à-vis fossil fuel.

- There is a definitive lack of technological know-how and capability in the development initialisation and commercialization of RE projects.
- This sector has failed to attract sufficient attention from the international donor community.
- Lack of sufficient incentive and low profitability keeps the private entrepreneurs disinterested to invest in this sector.
- Coupled with the lack of technological know-how, there is a dearth of adequate up-to-date data to aid policy making process.

Japanese dominance in the world RE equipment market has been built upon the strength of its investment and research and development (R&D) capabilities. These are the two major factors that the BIMSTEC countries lack for the development of RE resources. But the complementarities in RE resources endowments leave enough room for both Japan and the BIMSTEC region to cooperate. Following are some of the suggested ways that Japan can undertake in her efforts to help the region in developing the RE capabilities:

Japan can invest in various RE projects in this region, depending on individual countries comparative strengths. Such assistance in the RE sector would not only strengthen her cooperation with the BIMSTEC countries but would also enable her to meet the obligations imposed by the Kyoto Protocol. According to the Article 12 of the KP, in order to meet the green house gas (GHG) emissions reduction targets developed countries[19], like Japan, can invest in projects in developing countries to create an enabling environment to support their participation in reducing emissions.

For such investments, developed countries may claim credits for the emissions reductions that the projects achieve[20]. These projects can range from transfer of low emissions technology to implementing environmentally sustainable projects in the developing countries. This mechanism of the Kyoto Protocol is known as clean development mechanism (CDM) programme. Such investments can reap benefits for both the countries. For Japan, it would help her reduce emission where the cost is the lower than doing it in her own country and at the

same time receiving carbon credits for the emission reduction. For BIMSTEC member country, it would provide access to cleaner technologies, foreign investment and help meet their sustainable development goals. Japan can help those countries that lack effective policies for the promotion of RE resources in drafting the same.

Some proposals through which Japan may be engaged in BIMSTEC are as follows.

Investment

- To meet the obligations of the Kyoto Protocol, Japan may invest in environment-friendly energy projects taking advantage of the clean development mechanism (CDM) provision of the treaty.
- Japan can invest in Liquefied Petroleum Gas (LPG) projects rapidly flourishing in Bangladesh and other parts of the region particularly to quench increasing demand in household and transport sectors.
- Currently most of the countries of the region lack adequate refinery capacity. Therefore investment can also be made in construction, upgradation and modernisation of refinery capacity.
- Japan can also initiate solar energy projects in rural areas and make investment. JICA's solar energy projects demonstrated significant success in many parts of Bangladesh.[21] These success cased may be widely replicated in Bangladesh and other BIMSTEC countries.

Assistance

- Japan can cooperate with advanced technology in creating a BIMSTEC common power grid. This will foster trade of hydroelectricity within the region.
- Japan can also cooperate in establishing a BIMSTEC strategic oil reservoir to protect shock originated from the volatile global oil market.
- Upgradation of the existing gridlines in Bangladesh will foster power trade between Bangladesh and Nepal and/or Bhutan. Assistance is also required in this area.
- Japan's technological assistance will improve energy efficiency in BIMSTEC region.

- There is a scope for institutional assistance in formulating policies for inter-BIMSTEC power trade.

Participation

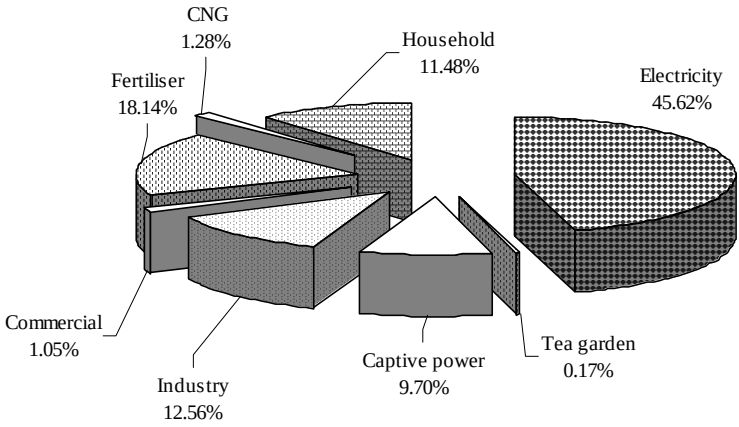
- Japan can participate in the third round bidding for offshore energy block in the Bay of Bengal.
- They can also participate to safeguard the sea lanes carrying energy supply to Japan to ensure mutual energy security.

The mutual economic benefits from investment, assistance and participation are obvious. Energy has a decisive positive impact on economic development in BIMSTEC countries cooperation, which has been mentioned earlier in this section. Japan's investment in individual energy projects in BIMSTEC countries will be directly profitable for its companies since these are still less competitive and highly economically prospective. On the other hand, assistance and participation in energy cooperation in the region would have positive impact in Japan's trade and investment in the region. Therefore Japan should come forward in every aspects of cooperation in BIMSTEC energy sector.

6. Bangladesh's Perspective on BIMSTEC Energy Cooperation

Plentiful supply of natural resources contributes significantly in economic development of a country. Bangladesh is a least developed country (LDC) with about 140 million people and per capita national income of only US$ 482. Nearly half of the population live under the absolute poverty line. Although Bangladesh is not rich in natural resources, the country has reserve of high quality natural gas which has been contributing remarkably in its economic development through domestic utilisation of natural gas in industry and commerce as an important source of energy. Currently natural gas meets up about 70 per cent of commercial energy requirement of the country (Finance Division, 2006). Currently in 22 discovered gas fields the proven gas reserve is 20.51 trillion cubic feet (TCF). Up to June 2005 the cumulative real production of gas was about 6.033 tcf, and from July

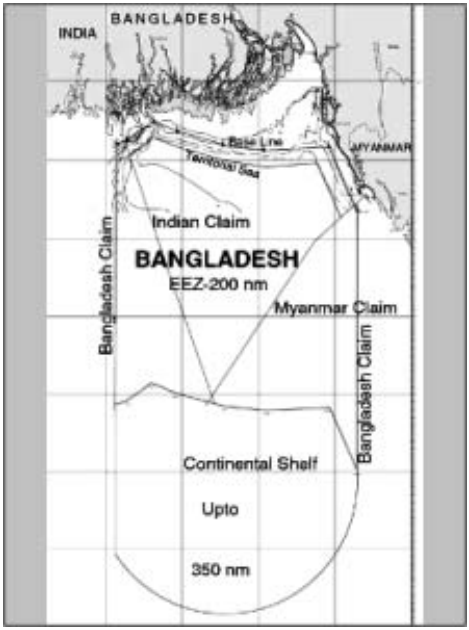
Figure 6.1: Use of Natural Gas in Bangladesh by Sub-sectors, 2005-06



2005 the net reserve is about 14.475 tcf. Currently gas is being produced in 15 gas fields. Natural gas is a major source of energy in electricity generation, fertiliser factories, industrial plants, commercial enterprises and household sectors in the country.

Recently an important issue has come forward that effected relations with the neighbours of Bangladesh, namely India and Myanmar, in the question of gas exploration in the offshore area (Bay of Bengal). The government has recently taken the initiative to float international tender for hydrocarbon exploration and also to establish the country's legitimate claim on its territorial waters, a part of which, allegedly, has been encroached by neighbouring India and Myanmar. Both India and Myanmar have created some obstacles and floated international tenders for awarding those to the potential oil and gas exploration companies. In its sixth round bidding recently, India had shown 19,000 square kilometres with a triangular shape in its eastern part under its possession, while Myanmar had shown 18,000 square kilometres with the same shape to its western side drawing a line up to Andaman, squeezing Bangladesh's economic zone.

Map 1: **Conflicting Claims of India and Myanmar in Bay of Bengal**



Source: Alam (2006).

Map is 1 showing conflicting claims of India and Myanmar. The above issue is, however, creating hindrance to strengthening greater regional cooperation under BIMSTEC. It, therefore, has to be settled by discussion and mutual cooperation for greater benefit of the nations.

Among the other energy resources, Bangladesh has some reserve of coal and petroleum as mentioned earlier. The country is a net importer of huge amount of petroleum and coal from within and outside the region. In 2004, Bangladesh had to import about 0.78 million short ton of coal and 78.8 thousand barrel petroleum per day. Of course, Bangladesh domestically produces and consumes its electricity. Due to capacity constraint the country is currently falling short of supply in front of increasing demand. The demand for other categories of energy resources is also rising

day by day. On the other hand, most of the BIMSTEC countries have become energy-hungry to quench increasing demand from growing industrial plants and particularly transport sector.

It is often argued that energy is indeed instrumental in economic growth and development of a country.[22] As a primary source of energy natural gas meets about 18 per cent of energy requirement of Bangladesh (Jaccard *et al*, 2000). Therefore, it must have significant impact of economic development of the country. Now if we consider per capita real GDP (in purchasing power parity US dollar) as a broad indicator of overall economic development of the country, the contribution of energy consumption in economic development can be revealed by its ability to explain the variation of per capita GDP.

Using the following logarithmic regression model let us examine the significance of natural gas in economic development of Bangladesh:

$$\ln PCGDP = a_1 + a_2 \ln NGCON + e$$

where, lnDPCGDP = natural log of yearly change in per capita GDP in PPP US dollar, 1980-2004

lnNGCON = natural log of yearly change in natural gas consumption per one million people, 1980-2004

Table 4: Long-term demand for natural gas

	Coefficient	Standard Error
Constant	2.986***	0.339
lnNGCON	0.310**	0.123
R^2	0.26	
$\bar{R}^2$	0.21	
F	6.34**	
Model Specification(Ramsey RESET)	0.54	

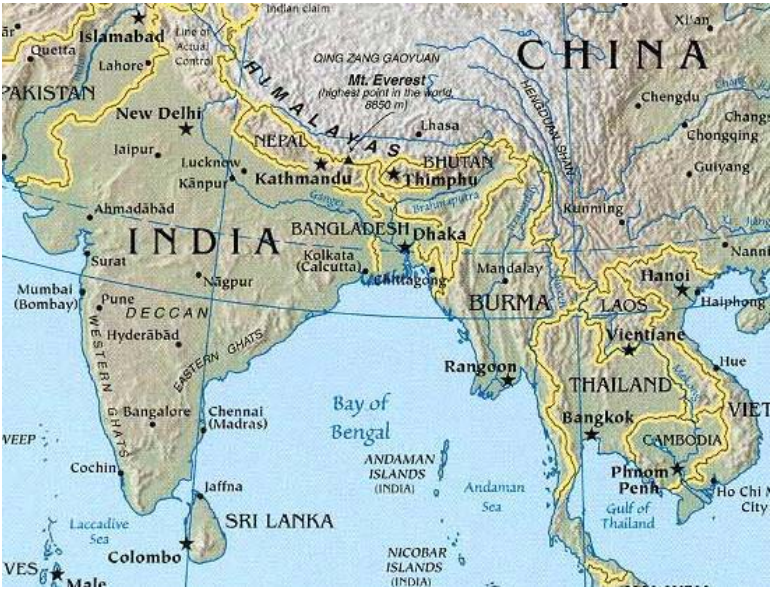
Note: *** and ** indicate that the coefficients and test statistic are significant at 1 and 5 percent levels respectively.

The coefficient of lnNGCON is statistically significant at 5 per cent level, which clearly indicates that natural gas consumption can effectively explain variability of per capita real GDP in Bangladesh. This means, gas consumption has important impact on economic development of the country. Khan *et al* (2006) also analysed long-term price and income elasticities of oil in the BIMSTEC countries. While the price elasticity was significant at 10 per cent in Bangladesh and Sri Lanka, income elasticity was significant at 1 per cent in all the countries. That is, long-term demand for oil was not responsive to price signals in most of the BIMSTEC countries. These imply that growth of economic activities would lead to higher growth in demand for oil. To be more concrete, increased economic activities has to be accommodated with higher long-term supply of energy for long-term sustained increase in per capita real GDP in the BIMSTEC countries. It has also been found using time series data for 1980-2003 period that cooperation in any kind of energy resources would significantly benefit Thailand. In addition, both India and Bangladesh would be highly benefited if both of them get natural gas regional cooperation. Electricity cooperation would, somewhat surprisingly, benefit all the countries except India. These demonstrate that energy resources have significantly positive impact on economic development of the BIMSTEC countries.

Bangladesh's geographical position is very important in BIMSTEC energy cooperation. But still due to political barrier and popular attitude of the policymakers Myanmar-Bangladesh-India gas pipeline has been thrown to cold storage. On the other hand, the issue of Bangladesh's import of hydroelectricity from Nepal and Bhutan via India has been deadlocked. Bangladesh also has an ample scope of production of alternative energy resources (*e.g.*, wind power, biogas, solar energy, etc.) which is still not flourishing at desired level. All these call for greater energy cooperation among BIMSTEC countries and external assistance of Japan in exploration, development, production and technology transfer in energy sector of Bangladesh as well as other BIMSTEC countries.

Cooperation literally means that one party one party would provide some benefits to the other on a mutually reciprocal basis. Geographical

Map 2: Bangladesh's Geographical Position in BIMSTEC Countries



location is an important factor both in trade and communication for an individual country in a regional/sub-regional grouping. Central location of a country in a regional grouping provides her not only with cheaper transportation, communication and trade facilities but also the option to choose the goods or services and the location or countries which best suit her economic and political interests. Thus, the geographic centrality of Bangladesh in BIMSTEC (Map 2) can bring benefits for Bangladesh.

However, during the late 1990s and the early 21st century there has been a lot of buzz in the media on the hydrocarbon, particularly gas potential of Bangladesh. Speculations about potential gas reserve ran as high as 33.5 tcf (trillion cubic feet)[23]. Based on such studies, the Government of Bangladesh was under pressure from the IOCs and the bilateral and multilateral donor agencies to export gas. Such hype died down after 2003 and the newspapers started reporting of production shortfall in the power and fertilizer industries due to

inadequate supply of gas. The inadequate supply of gas is party resultant of the inefficient supply infrastructure and a lack of capital or initiative in discovering or developing new gas fields. Thus, the present state of its demand and supply of natural gas would not allow export of the same as an option.

Shortfall in electricity supply is, one of the major crises plaguing Bangladesh at present. Supply of electricity failed to keep pace with the economic growth rate and the demand for electricity. The crisis exacerbated as the access to electricity increased but not the production.

Despite having a considerable gas reserve, the shortfall in electricity production in the country cannot be solved overnight as the installation of a power plant requires 5 years. So, to save the economy from slowing down or to meet the demands the easiest option for the country is to import electricity from the neighbouring countries with surplus potentials. Proximity and potential of Nepal and Bhutan in producing hydroelectricity brings them into the picture. They have already been producing and exporting electricity to India.

Achieving the goals of development, particularly that of poverty alleviation requires affordable and equitable supply of energy. Like many of the BIMSTEC countries, Bangladesh has also been trying to broaden the supply of sustainable energy resources to reach the mass. The government is constitutionally obliged to supply energy to all of its citizens and the recently formulated Poverty Reduction Strategy Paper (PRSP) all emphasises on the need for supply of energy as one of the prime tools for poverty alleviation. The development partners to the country also feel that the key to development lies in broadening the mass access to energy.

Despite the constitutional obligations, the government in the last 35 years since independence has only been able to connect 30 per cent of the people with gridline electricity[24]. The picture is further dismal in case of piped gas supply[25]. Connection to gridline electricity does not necessarily ensure the uninterrupted supply. Bangladesh currently is experiencing a huge shortfall in electricity supply. The

void of the government has been somewhat filled by the innovation and entrepreneurship of the people in off grid areas. In some areas different NGOs have loaned money to the villagers to buy solar panes and the villager were selling electricity in the neighbourhood and repaying the debt. Such ideas helped solve a number of problems, including poverty and energy. Another group of micro-entrepreneurs are supplying electricity to the rural areas using standalone diesel generators. Such successful cases need to be encouraged and replicated throughout the country and the region also.

It has been mentioned earlier that the discovered amount of gas in Bangladesh is quite insignificant. The offshore and onshore areas of the country have been divided into blocks which were then allotted to different IOCs for exploration, extraction and transmission. The deep sea areas, however, are yet to be open for bidding. Of late, however, the government has taken up measures for inviting IOCs to take part in the bidding. National or private oil exploration companies of BIMSTEC and Japan can take part in the bidding should at one hand would help develop the country's economy and provide benefits to the oil companies on the on the other.

The availability of sunshine, long coastal area with sufficient amount of wind, production of bio-degradable waste provides the country with enormous RE potential[26]. Despite such potential, the country is unable to harness them as the technology is still in its development stage making it difficult for a developing country to purchase the same. Such handicap is not particular to Bangladesh only but it draws commonality, albeit in varying degrees, throughout the BIMSTEC region. One way of addressing such handicap is through cooperation in the regional sphere. Such cooperation should not be one-way traffic but should be reciprocal and beneficial for all the member countries.

The BIMSTEC countries have joined the grouping with the view to developing their economies. The decision the join the grouping and the subsequent programs has been a political as well as bureaucratic one where the common people had very little involvement. Proper

decision making and its implementation, however, requires the participation of the people for whom the project or the program is to be undertaken. The BIMSTEC grouping has to device mechanism to accommodate the viewpoints of the common people, civil society, NGOs and the like.

Export of electricity from another country does not necessarily require the framework of a regional cooperation body. However, for the capital and technology starving countries like Bangladesh, India, Nepal and Bhutan a regional framework can be helpful in providing support for investment in the power plant. Moreover, a regional power grid for the transportation and export of energy from the surplus countries to the countries with demand for the same can be created. This would involve harmonization and upgradation of the existing grid systems of the countries, which the countries themselves lack the financial and technological capabilities to achieve. Japan with its financial and technological endowments can assist the BIMSTEC countries in sharing surplus electricity generated by cleaner hydropower plants.

Japan's participation in the development of energy resources and energy cooperation of BIMSTEC countries should not necessarily be one-way traffic. Japan has already been a large investor in many of the CDM projects in India. Despite having potential other BIMSTEC countries have not been so successful in attracting CDM projects. Therefore, the BIMSTEC countries should identify projects that might maximise Japan's benefits as well as enhancing the energy security of the BIMSTEC countries in the longer run.

Petroleum and petroleum based products constitute the main source of energy for the BIMSTEC countries. For the BIMSTEC countries almost all of it is imported from the international market. There is, however a huge difference in the price of crude oil and the refined product. Cash crunched countries of BIMSTEC find it difficult to purchase the refined product as all of them except India do not have substantial refinery capacity. Therefore, Japanese companies can invest in the construction of refineries on a commercial basis which should

be mutually beneficial as the BIMSTEC countries are provided with energy security and dividends for the companies.

Energy profile of the BIMSTEC countries is characterized by inefficiency. This inefficiency ranges from inefficient system of bureaucracy to inefficient use of energy in the domestic, industrial and transportation sectors. Such inefficiency not only hinders from receiving maximum benefits from energy resources but also strains the national coffers as the payment for much of the energy is made through hard earned foreign currency. Therefore, streamlining the ineffective bureaucracy and overhauling or replacement of energy guzzling technologies should constitute an important part in ensuring energy security of the BIMSTEC countries. Technologically advanced country like Japan can provide technical support for different sectors of the economy and training and policy guidelines for the bureaucracy.

One of the major irritating factors between the BIMSTEC countries is the smuggling of petroleum products from one country to another. As mentioned earlier, since this region is a net oil importer some of the countries provide higher amount of subsidies for petroleum products in the country. Such subsidies result in lowering the price of the same within the country and are suppose to benefit the poor who might not be endowed to buy petroleum products at a higher price. In reality, the actual benefit of such subsidies is reaped by the smugglers which in draining the national coffer and undermining national security. Therefore, the BIMSTEC countries can create a body that should work to harmonise petroleum price across the countries.

7. Conclusion

The paper has tried to capture the various aspects of energy resources and energy cooperation with BIMSTEC to foster greater economic and social development in the region focusing on Bangladesh's perspectives. We also explored the role of Japan in enhancing development, exploration and production of energy resources. It is quite evident that the countries in the region are acutely hungry for energy resources to quench rising demand in growing economic activities in the region. Some countries have huge potential in

hydroelectricity and other non-traditional means like wind, solar, biogas, etc. Whereas Nepal and Bhutan have potentials in hydroelectricity due to natural advantages, Bangladesh, India, Sri Lanka, etc. too can explore their potentials in solar, wind and biogas. The projection of some key energy resources suggests that the growth of energy demand in the region is going to be exponential in the near future. Unfortunately most of the countries do not have enough capacity and pragmatic outlook of about the potential and intrinsic strength of their economies. Japan may play a significant role through investment, assistance and participation for its direct and indirect economic benefits as it is one of the biggest development partners in almost all the BIMSTEC countries.

Endnotes

1 In 2000-05 most of the BIMSTEC grew at on average 5 per cent or more. See World Bank (2006a) and World Bank (2006 b) World Development Report 2007 and World Economic Indicators 2006.

2 Raffar, S. A. (2004), 'Regional influence of local refineries – Impact in the global market and meeting product quality' available from http://www.hcasia.safan.com/mag/hjan05/r28.pdf [accessed 12/09/05].

3 For detail see EIA (2004)

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