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BIMSTEC-Japan Cooperation in Energy Sector: Myanmar Perspective

Myat Thein
Myoe Myint

Centre for Studies in International Relations and Development (CSIRD)
Kolkata

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Centre for Studies in International Relations and Development
P 534 Raja Basanta Roy Road, Kolkata 700029, India
Phone: +91-33-2463 7322
Fax: + 91-33-2463 7322
Email: membersecretary@csird.org.in;
csirdindia@yahoo.co.in
Websites: http://www.csird.org.in; http://www.bntt.org

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Myat Thein* and Myoe Myint**

Abstract: The cooperation in energy has been a central subject of BIMSTEC initiative. The energy situation in BIMSTEC is characterized by low per capita consumption and fast growing demand, limited supply of nonrenewable energy, and heavy reliance by a large part of the population in most member countries on traditional energy. As a result, BIMSTEC countries are largely dependent on import of non-renewable energy, particularly oil. However, some countries in BIMSTEC have considerable reserve of hydrocarbon including natural gas, coal and oil. Myanmar, with naturally endowed primary energy resources, has immense potential for the cooperation in energy sector especially with BIMSTEC countries and Japan. This paper discusses the energy resources in BIMSTEC countries and the possible complementarities in energy sector among the BIMSTEC countries and between BIMSTEC and Japan. The paper concludes that there are ample opportunities for regional cooperation, not only in the production and utilization of natural gas but also in hydroelectricity; and in the development of new and renewable sources of energy. One of the conclusions of this paper is that greater cooperation with Japan would help BIMSTEC countries in strengthening energy related infrastructure and sourcing modern technology.

1. Introduction

Bangladesh-India-Myanmar-Thailand Economic Cooperation (BIMST-EC) came in 1997 as a result of Thailand's initiative, and was originally known as BIST-EC, prior to the admittance of Myanmar. Nepal and Bhutan later joined BIMST-EC in December 2002. At the Second Ministerial Meeting of BIMST-EC in Dhaka in 1998, six priority areas were identified for cooperation. The energy sector was among the six areas, and following two projects were identified for cooperation.

* Chairman and Chief Economist, Myat and Associates, Yangon, and Former Rector, Institute of Economics Yangon, Myanmar.

** Researcher, Economic Studies and Research Institute, Yangon, Myanmar

- The energy infrastructure development (natural gas) project, and
- The development of new and renewable sources of energy project.

Since then, at subsequent meetings of the BIMSTEC-Japan Comprehensive Economic Cooperation a number of papers presented on the potentials and prospects for cooperation in the energy sector. These papers have identified the demand for and supply of energy resources in BIMSTEC countries; and also possible complementarities in energy sector among the BIMSTEC countries and between BIMSTEC and Japan.[1]

Therefore, there is not much point in going over the same grounds. We shall, however, summarize some of the findings of these papers and other reports briefly by way of providing a backdrop to the present paper. We shall then present a detailed description of the energy situation in Myanmar including Myanmar's energy policy before finally considering energy cooperation amongst BIMSTEC countries and between BIMSTEC and Japan from the perspective of Myanmar.

2. Energy Situation in BIMSTEC

The energy situation in BIMSTEC is characterized by low per capita consumption, but fast growing demand and limited supply of non-renewable energy, on one hand, and heavy reliance by a large part of the population in most member countries on traditional energy, on the other.[2]

As a result, BIMSTEC countries are largely dependent on import of non-renewable energy, particularly oil. However, some countries have considerable reserve of hydrocarbon including natural gas, coal and oil. Supply of electric power in member countries, with the exception of Thailand and Sri Lanka, still lags far behind the demand. Tables 1 and 2 summarize the situation.

Natural Gas

All natural gas production in BIMSTEC countries, except Myanmar is used up domestically. Natural gas is abundant in Bangladesh, eastern India and Myanmar, but in the former two countries it is used domestically for power generation. In fact, "natural gas is seen as

Table 1: Production, Consumption and Trade of Non-renewables in BIMSTEC, 2003

	Natural gas (billion cubic feet/year)			Coal (million short ton/year)			Oil (thousand barrel per day)		
	Production	Consumption	Trade	Production	Consumption	Trade	Production	Consumption	Trade
Bangladesh	420.25	420.25	..	0.00	0.80	-0.80	6.83	84.00	-77.17
Bhutan	0.00	0.00	..	0.07	0.09	-0.02	0.00	1.10	-1.10
India	957.04	957.04	..	403.12	430.62	-27.49	814.94	2320.0	-1505.1
Myanmar	324.89	82.28	242.61	0.15	0.14	0.01	15.60	32.00	-16.39
Nepal	0.00	0.00		0.01	0.38	-0.37	0.00	15.40	-15.40
Sri Lanka	0.00	0.00		0.00	0.002	-0.002	-0.53	79.00	-79.53
ThaiLand	786.82	1029.43	-242.6	20.70	26.37	-5.67	255.46	810.00	-554.54
BIMSTEC as % of world total	2.615	2.606	0.941	7.844	8.427	0.095	1.371	4.172	-4.911

Sources: Abdur Rob Khan et al. 2005; US Energy Information Administration, 2005

Table 2: The Poor's Reliance on Traditional Fuel and Lack of Access to Electricity

	Population below poverty line	Traditional fuel consumption (as % of total energy use)	Electrification rate(%)
Bangladesh	36.0	63.6	20.4
Bhutan	..	..	..
India	34.7	24.3	43.0
Myanmar	..	81.1	15.0
Nepal	37.7	88.0	15.4
Sri Lanka	6.6	34.8	62.0
Thailand	2.0	15.9	82.1

Source: UNDP(a) 2004
.. Not available

playing an important component in supplying power plants in the region and diversifying from expensive oil imports" (Abdur Khan *et al.* 2005). The usage of natural gas in Myanmar is still limited due to its low level of industrial development.[3] As a result, Myanmar has been exporting gas to neighboring Thailand.

In 2004, Daewoo International (a Korean company) found commercial scale natural gas deposit at Myanmar offshore Block A-1 and that could be supplied to energy-hungry India through Bangladesh. For the profitable exploitation of gas reserves, markets have to be viewed as integrated, cutting across national boundaries. Gas pipelines are an economically viable prospect for the region, but require transit through more than one country to take advantage of the economies of scale.

Bangladesh, India and Myanmar have agreed to an understanding for a tri-nation gas pipeline project, reflecting the necessity for enhanced regional co-operation in the energy and infrastructure development sector for the common benefit among BIMSTEC nations. The understanding would enable transshipment of gas from the offshore block Shwe gas field of Myanmar having an estimated reserve

of 5~6 trillion cubic feet (tcf). The pipeline was one of three options Daewoo has been considering to commercialize gas reserves from the Shwe Field's Block A-1 site. Bangladesh would gain out of this major transport corridor given to Myanmar and India and could earn about US$ 125 million fees per year.

However, to date, Memorandum of Understanding (MoU) among three countries for tri-national gas pipeline has not been signed because Bangladesh needs an assurance through which it can trade with India and its North Eastern states and the Himalayan countries of Nepal and Bhutan, and also gain an equitable share in the water and power resources of the neighboring countries - India, Nepal and Bhutan.

Dhaka has set three conditions for signing a tri-nation agreement on installation of a gas pipeline from Myanmar to India through Bangladesh. Bangladesh demanded to bring hydroelectricity from Nepal and Bhutan through India, provide the two Himalayan countries with transit facilities, and reduce the trade gap between India and Bangladesh. On the other hand, India proposed two separate agreements - a tripartite agreement involving Dhaka, Yangon and Delhi on a gas pipeline and a bilateral agreement between Dhaka and Delhi on hydroelectricity, transit and trade gap.[4]

There is also a proposal regarding a joint pipeline from Tripura via Eastern Bangladesh, through Western Bangladesh, on to West Bengal in India. This could turn out to be a very convenient and cheap route for India and also enable gas transfer between the eastern and western portions of Bangladesh. Here again, Bangladesh could provide a corridor for the passage of gas. Transporting gas or transmitting gas based power from Bangladesh are two comparable options which need to be investigated. The first BIMSTEC Energy Ministers' conference held at Delhi in October 2005 agreed to study the feasibility of an interregional gas pipeline and power network.

Thermal Power and Coal

Thermal power is the dominant source of energy in most of the BIMSTEC countries. It accounts for about 92 percent of installed

capacity in Bangladesh and 73 percent in India. India has a large reserve of coal (206 billion tones), accounting for about 7 percent of the world reserves. In India, 72 percent of coal was used for thermal power plants in 1998.[5] As noted earlier, the energy demand is likely to record higher during the years to come. As such, there is scope for cooperation among countries for their mutual benefit. Bangladesh, for example, could import coal from Raniganj in West Bengal in India and reap the benefit of proximity because coal can be transported at minimum cost by rail.

Hydroelectricity

A large potential for hydroelectricity exists in Myanmar, Bhutan and Nepal, having hydroelectric potentials of 108,000 MW, 30,000 MW and 43,000 MW respectively. These can be exploited to export power to Thailand, India and Bangladesh and earn much needed foreign exchange. Currently the two major hydro power projects in Bhutan are the Chukha (336MW) and Kurichu (60MW). In fact, Bhutan is currently exporting 80 per cent of its energy generation to India. Bhutan's export of energy accounts for 45 percent of the government's revenues and constituted an 11.6 percent of its GDP in 2001. In return, Bhutan imports all its requirements of petrol and products from India.

Bhutan received technical and financial assistance from the Indian government for Chukha hydropower in 1986-88. The other cooperative projects between India and Bhutan include the 60 MW Kuricchu project in Eastern Bhutan for domestic energy use and the 1020 MW Tala hydroelectric project for export of energy to India. Similarly, Bangladesh can also be supplied with Bhutanese power through India. The latest available figures show that Bhutan has 23 technically and economically feasible sites of about 16500 MW. Upon completion of these projects, developed potential by 2005 would be 1,487 MW, which is about 5% of estimated total potential. With this expanded power generation Bhutan can earn enormous foreign exchange for its developmental efforts.

Nepal has large untapped hydroelectric potential estimated at some 30,000 to 43,000 MW with installed capacity of 400 MW at the end of 2002. West Seti hydroelectric dam in Nepal with the capacity of

750 MW is under construction with the cooperation of Australian Company and ADB and it is scheduled for completion in 2008. However, the overall quality of Nepal's electricity infrastructure is low and over 60 percent of its population is living without electricity. This situation is very much like that of Myanmar. If the water systems of Nepal–Karnali, Gandak and Kosi – are developed for hydropower generation, it could ease the quest for irrigation water and waterways for India and Bangladesh. Therefore, Nepal, India and Bangladesh should coordinate very closely in order to achieve mutually beneficial outcome.

Table 3: Hydropower Potential and Demand in BIMSTEC Countries

Country	Potential (MW)	Demand (MW)
Bangladesh	5,000	4,000
Bhutan	30,000	100
India	150,000	100,000
Myanmar	40,000	2,000
Nepal	30,000	200
Sri Lanka	1,000	1,500
Thailand	5,000	10,000
TOTAL	**261,000**	**117,800**

Source: Authors.

In so far as estimates of potential can be relied upon, there is a huge potential (261,000 MW) of hydropower in BIMSTEC region, but it is rather unfortunate that only a very small portion has been exploited so far. In particular, it is ironical that the electrification rate of Myanmar and Nepal at around 15 percent should be the lowest in the region (Table 2). Hydropower generation plant and additional infrastructure need huge investments. Affordability to tap this potential at the present economic situation is limited in each of these countries. Moreover, the hydroelectricity potential can be fully tapped only if an integrated market is developed.

Non-Conventional Energy

As noted in *RIS Policy Brief*, "a large part of the population in BIMSTEC countries live in remote villages, which are inaccessible

to conventional sources of energy. Proper utilization of non-conventional energy sources (e.g. biogas plants, biomass utilization, etc.) would be an appropriate option in such areas" *(RIS* Policy Brief December 2003). However, non-rational use of biomass has harmful consequences for health and the environment. There are also strong links between energy and gender. The burden of survival activities such as collecting biomass and using it for cooking often falls on women and children.

The BIMSTEC region is blessed with abundant sunlight throughout the year. But given the present state of technology, solar photovoltaic cells are cost intensive and require an integrated market to bring down cost through the economies of scale. However, solar energy can be used in the form of thermal energy such as solar water heater that can be installed for hotels and hospitals. It can also be used in the promotion of solar dryers for factories in the vegetable/food drying industry to reduce fuel oil or electricity consumption.

Also, there are large number of locations amenable to using wind energy for power generation. India has proven capability in the field of wind energy, with its installed capacity of 900 MW, second only to the United States. This capability needs to be shared with other countries in the region where there is potential for tapping wind energy. India is the only country in the region to have an exclusive Ministry for Renewable Energy Development, which has launched a large and ambitious programme on renewable energy. Till 2001, the contribution of renewable energy to total power generation capacity in India was 3430 MW. The estimated potential is said to be over 100,000 MW.

BIMSTEC countries could coordinate the training programs on New and Renewable Energy Technologies, demonstration program on Bio-mass gasifiers, tidal and wind energy utilization for energy conservation. Sharing of experiences in the field of tapping renewable non-conventional energy among member countries is one of the most promising activities for energy cooperation.

3. Energy Situation in Myanmar

Myanmar has considerable indigenous primary energy potential, which could meet domestic demand in long term if properly managed. As of December 2005, the remaining recoverable proven onshore/offshore oil and gas reserves were estimated at 15,220.27 million barrel (mmb) and 93.23 trillion cubic feet (tcf) respectively, while the future discovery potential onshore and offshore is estimated at 7,000 tcf of gas[6].

The total coal resources in place are estimated at about 711 million tons in 2005. There are 15 coal deposits that have been identified in Myanmar so far. The Kalewa coal deposit was first discovered in 1886 and it had adequate reserve to offer reasonable prospect for development as an energy base. However, only one coal powered-plant in Myanmar was recently constructed at Tikyit of Shan State in 2005.

In renewable energy, Myanmar has an abundance of potential hydropower resources, with a theoretical power potential of over 108,000 Megawatts (MW) and 366,000 Gigawatt-hour (GWh) per year of average energy in its river systems which drain the four main basins of Ayeyarwaddy, Chindwin, Thanlwin and Sittaung. This potential compares to the present development of 575 MW of installed capacity in 2005, which represents merely one half of one percent of the country's theoretical potential.

Two major offshore natural gas fields are now being developed by two international consortia. The Yadana field, with about 6 trillion cubic feet of natural gas, has been developed by a consortium led by Total. It produces about 600 million cubic feet per day of gas for export to Thailand. The Yetagun field, which was discovered by Texaco, but developed by a consortium led by Petronas Carigali (formerly operated by Premier Oil), produces about 400 million cubic feet per day of gas for export to Thailand.

As a result of these developments, natural gas has become Myanmar's largest export earner, annually bringing in between US$350 million and US$400 million in hard currency earnings.

Table 4: Energy Resources in Myanmar

No.	Description	Potential Reserve	Identified Reserve
1	Crude Oil (*Offshore & Onshore*)	15220.27 MMBBL	207.179 MMBBL
2	Natural Gas	93. 698 TCF	12.617 TCF
3	Coal	711 MMT	310 MMT
4	Hydro	108,000 MW	39,720 MW
5	Geothermal	93 Hot Spring	
6	Biomass	50.8 % of total land area covered with forest (344,234 km^2)	
7	Wind	365.1 TWH per year	
8	Solar Power	51973.8 TWH per year	
9	Oil Shale	5850 MMBBL	

Source: Ministry of Energy, Myanmar Government.

In Myanmar, biomass energy constitutes for major portion of primary energy consumption and it is about 65% of total energy consumption in 2004/2005, according to Ministry of Energy.[7] However, crude oil stand after biomass in energy consumption and it accounts for 15% of total energy consumption in the same year. The total use of primary energy in 2004/05 was 13.09 million toe (or about 250,000 barrels of oil equivalent per day). Total per capita consumption of energy was only 0.92 tons of oil equivalent (toe)/year in 2000, which was one of the lowest levels of energy consumption in the developing world.[8] In 2004/05 total per capita consumption of energy at 0.84 toe was even lower.

The Table 5 summarizes primary energy consumption by type. Oil supplies slightly over 50 percent of commercial energy consumption in 1999/2000, followed by natural gas with about 30 percent. Hydroelectricity normally accounts for about 10 percent of consumption but in 2004/05 its contribution had increased to 20 percent; coal which normally accounts for just 1.0 percent of commercial energy consumption came to constitute 4 percent of the total commercial energy consumption.

Table 5: Commercial and Primary Energy Consumption by Type

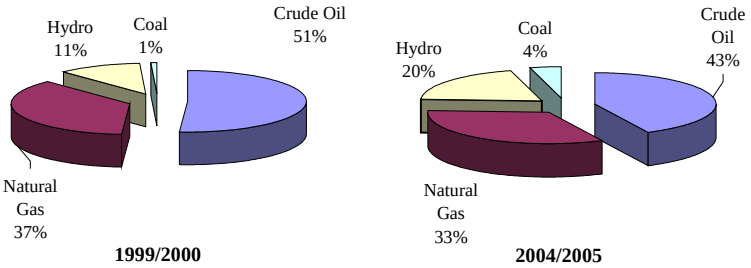
(Thousand TOE)

Type	1999-00	2000-01	2001-02	2002-03	2003-04	2004-05
Crude Oil	1820	1983	1991	1924	1924	1957
Natural Gas	1311	1205	1033	1264	1428	1508
Hydro	399	728	772	742	788	904
Coal	32	83	71	76	123	196
Sub-total	3562	3999	3867	4006	4263	4565
Biomass	7769	7825	8036	8249	8615	8526
Grand TOTAL	11331	11824	11903	12255	12878	13091
Population(million)	48.1	50.13	51.14	52.17	53.22	54.30
Per capita commercial energy consumption	**0.74**	**0.79**	**0.76**	**0.76**	**0.80**	**0.84**

Notes:
Toe = tons of oil equivalent
Note: conversion factors are as follows:
1 barrel of crude oil = 0. 1379 toe
1,000 cubic meters of natural gas = 0.8122 toe
1 metric ton of coal = 0.550 toe
1,000 kilowatt hours of electricity = 0.2312 toe
Source: Ministry of Energy, Myanmar Government.

The changes in the energy-mix in the consumption of commercial energy can more clearly be seen in Figure 1.

Figure 1: Consumption of Commercial Energy



Crude Oil

In relative terms, the consumption of crude oil has gone down from 51 percent to 43 percent. But, in absolute terms, it has increased from 1820 thousand toe in 1999/2000 to 1957 thousand toe in 2004/05 (Table 5).[9] There are two counteracting forces pulling in opposite directions for this development. The largest energy consumption in Myanmar is household followed by industrial and transport (See Figure A1 in Appendix). Myanmar, as an international consultant put it, is an energy paradox referring to excessive use of energy by households for domestic use as compared to industrial establishment. Commercial energy now supplies 36 percent of total energy requirement, but firewood still accounts for 64 percent. Household use of energy is not as sensitive to price changes as other uses, and hence the impact of recent changes in energy prices is not as much as one would expect. On the other hand, recent changes in fuel and electricity prices have been so drastic (in the manner shock therapy) that it cannot fail to have some significant impact.

Natural Gas

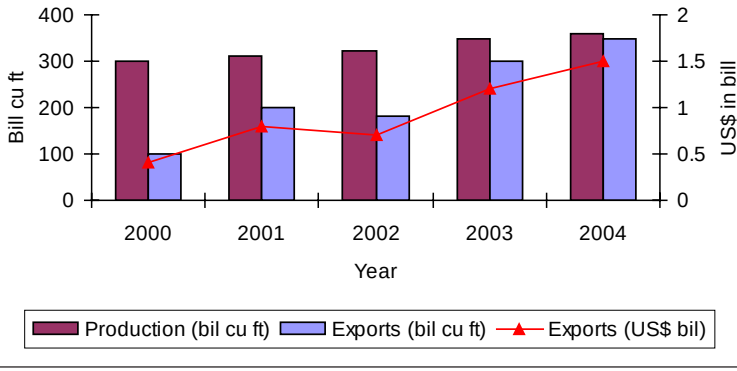
Although the consumption of natural gas has gone down in relative terms, in absolute terms it too has increased markedly from 1311 thousand toe in 1999/2000 to 1508 thousand toe in 2004/05. According

to the Ministry of Energy, yearly onshore production of natural gas is about 52 million cubic feet (2004/05), which is about the same level as it was in 2000/01.[10] The produced gas is transmitted to gas turbines, fertilizer plants, methanol plant, LPG plant, cement factories and other industries by pipelines. However, for electricity generation, reliance on independent diesel generators is the rule rather than the exception in Myanmar's urban centers and nascent manufacturing sector.

Since 2004 the government has been promoting the use of natural gas as an alternative fuel. There are more than 20 natural gas stations opened throughout Yangon and other major towns including Mandalay. Government subsidizes in selling of natural gas especially for public transport such as city bus. To date, over 5000 vehicles changed to CNG used engines.[11] According to official estimates, the average savings of fuel per day works out to about 13, 872 gallons of motor gasoline and 37,704 gallons of high speed diesel. This, it is hoped, will cushion the effect of price rise in petroleum products. So far however, the free market prices of petroleum and diesel continue to soar above international price levels.

As indicated earlier, the bulk of natural gas production is exported to Thailand (see Figure 2). Indeed, gas has become a major export earner for Myanmar accounting for over 30 percent of its yearly export earnings. The value of gas exports now clearly surpasses that of

Figure 2: Natural Gas Production and Exports



Myanmar's traditional export commodities such as beans and pulses, teak and rice.

Electricity

Two main sources of electric power generation in Myanmar are hydel and gas with the former overtaking the latter by 2004/2005, which is development in the right direction. The two together generated nearly 88 percent of the total electric power generation of 8128 million kilowatt-hours (kWh) in 2004/05.

The main source of electric power supply in Myanmar is the Myanmar Electric Power Enterprise (MEPE), a state monopoly under the Ministry of Power. It is responsible for power generation, transmission, and distribution. Table 6 shows electric power installation, generation and sales (consumption).

Since 2002/03 installed capacity as well as electric power generation has increased significantly. This is chiefly due to extension of gas power generation plants, adoption of high technology in steam power generation (by recycling waste heat) and construction of mini-hydropower plants in addition to diesel generators. As a result, per capita electricity consumption has also increased markedly from 60.4 kilowatt hours (kWh) in 1999/2000 to 119.75 kWh in 2004/05.[12] Unfortunately however, the rural community is still poorly served with the electrification rate for the whole country at a stagnant 15 percent as indicated earlier.

As in most developing countries, power system losses between the power station and the customer due to aging or unsatisfactory equipment and pilferage continue to be high at about 33 percent or one-third of total power generated. That is huge.[13] But, encouragingly, *al-beit* inexplicably, it had gone down to some 20 per cent in 2002/03; only to increase again to about 27 percent in 2005/06[14].

Although the installed capacity has increased significantly from about 1171 megawatts in 2000/01 to 1775 megawatts in 2004/05 shortage of electricity, unstable voltage, and frequent blackouts are

Table 6: Electric Power Installation, Generation and Consumption

Year	Installed Capacity (Megawatts)	Units Generated (Million kWh)	Units Sold (Million kWh)			
			General	Industrial	Others	Total
2000/01	1171	5117.64	1361.02	1295.43	611.45(1747.8)	3267.94
2001/02	1160	4688.98	1244.70	1147.90	96.80(1549.6)	3040.90
2002/03	1190	5067.95	1430.90	1417.00	636.20(1076.5)	3484.10
2003/04	1336	5988.50	2043.10	1870.90	983.20	4897.20
2004/05	1775	8128.34	2670.60	2644.70	1187.40	6502.70

Source: CSO, Statistical Yearbook, 2003; Selected Monthly Economic Indicators, November 2005.
Note: Figures in parenthesis show unit loss.

still a common occurrence, indicating that demand by far still outstripped supply. This means that the development of the manufacturing sector will continue to be hampered by lack of electricity.

Since 1994 MEPE had been discussing with several interested parties (both local and foreign) for private participation in various areas of the power sector. However, the low tariffs in local currency and the small amount of consumers in foreign currency at that time prevented any meaningful developments. Since then however, MEPE had raised electricity tariffs several times; culminating finally in an increase from 0.50 kyat per unit (of 1 kilowatt-hour) in 1994 to the present level of 25 kyats per unit. As a result, private participation in the power sector came to take place. Box 1 has further details on this.

Box 1: Private Sector Participation

In early 1994 the permission of Private Sector to participate or jointly implement in Government activities was introduced also in the power sector. Since then MEPE had been discusslng with several interested parties both local and foreign for private participation In various areas of the power sector. However, the low tariffs in local currency and the small amount of consumers in foreign currency have been a draw-back to the commercialization process. With the promotion of the tourist industry, mining industry and the current trend of foreign investments in various sectors, an increase in the number of consumers in foreign currency is expected in the near future.The tariff was increased in September 1994 for the first time in 40 years. It was raised fivefold from Kyat 0.50 to 2.5 Kyat per unit (of 1 kilowatt-hour) for domestic users and 3 Kyats per unit for commercial and industrial users. Tariff in foreign currency_ for foreigners, foreign and export oriented companies is 0.08 US$ kWh.Even after this increase, the tariff in local currency is well below the commercial. rates needed to make power generation profitable. Recently the tariff has been further raised from K 2.50/kWh to K25/kWh for commercial and industrial

Box 1 continued

Box 1 continued

consumers and for domestic above 200 units per month. Pursuant to the increase in tariff, many of the local and foreign companies have discussed with eagerness for private participation in the power generation sector. For the time-being only the following local companies are involved for investments in the power sector. (a) The Present status of private participation in power sector is as follows : The following Power Projects have been permitted to respective local companies for implementation on BOOT(Built-Own-Operate-Transfer) Basis. (1) 2 x 6 MW coal-fired power station at Tachileik Township, Western Shan State will be developed by Golden Triangle Co., Ltd. (2) 2 x 12 MW Hydra Power Station at Myitkyina and Waing Maw Township, Kachin State will be developed by Bu Ga Co., Ltd. (b) For the following Hydropower Projects located in Sittaung valley, the discussions for joint implementation with interested local companies and Myanma Electric Power-Enterprise are underway. (1) 20 MW Yenwe Hydropower Project, Nyaunglebin Township, Bago Division. (2) 66 MW Phyu I lydropower project Phyu Township, Bago Ulvision. (3) 60 MW Kun Chaung Hydropower Phyu Township, Bago Division.

Source: ASEAN Centre for Energy, 2004

Coal

As we have seen, Myanmar has ample reserves of coal. Therefore, it was most appropriate that coal mining was opened up for private participation early on through the Myanmar Mine Laws of 1995. As a result, coal production began to increase steadily and according to official figures reached a peak of 51,033 tons in 2000/2001 (Statistical Yearbook 2001, CSO). [15], Most of the coals are being produced at Kalewa and Namma, two state-owned coal mines. The other coalfields are very remotely located, and, at present, lack the infrastructure to transport the coal to major consuming centers cheaply. The main uses of coal at present are for small scale power generation, mineral processing industries, and sponge iron production, in almost equal proportions.

Renewable Energy

Bowing to the new tradition (it would seem) or following popular trend, homage must be paid to the activities concerning the development of renewable energy. In a recent energy ministers meeting in Lao PDR on July 27, ASEAN called for more investment and to raise the region's capacity in renewable energy such as bio-fuels and hydropower alternatives to oil. In a joint statement the ministers said "reliable, adequate and affordable energy supplies are essential for strong and sustainable economic growth and competitiveness".[16] Indeed, it has been known for quite some time that governments of developing countries should, over the long run, consider the development of renewable energy in order to sustain economic growth.[17]

What Myanmar's U Myint Oo (chief research officer, Myanma Oil and Gas Enterprise) said at the same meeting is therefore of great interest. According to him, "Myanmar hoped to replace all of its 40,000 barrels per day (bpd) conventional oil product imports with physic nut oil within a few years"[18].

To date, Myanmar's renewable energy activities in cooperation with regional organizations are as follows:

- BIMSTEC – Demonstration project using biomas gasifier system (Kokke village, Myingyan).
- ACMECS – Workshop on biofuel cooperation in ACMECS (12th September 2005, Yangon).
- ASEAN+3 – New & Renewable Energies Program 2005 (The Executive Seminar, 12-14th September, 2005, Japan).

Community Size Biogas plant established by Ministry of Science and Technology (MOST) between 2003 and 2005 are shown in Table 7.

As we can see efforts are being made to introduce new and renewable sources of energy. But so far they have failed to make a dent towards fulfilling the energy requirements of the rural communities; and much remains to be done in terms of research,

Table 7: Community Size Biogas Plant Established by MOST (2003 – 2005)

Sr	State/Division	Nos. of Biogas Plant	Total installed (KW)
1.	Mandalay Division	89	801
2.	Sagaing Division	12	108
3.	Magway Division	3	27
4.	Northern Shan State	1	9
	Total	105	945

Source: U Thein Lwin, "Why Renewable Energy", 2005.

experimentation, and cost-benefit studies. Box 2 provides a quick snap on biogas in developing world.

Box 2: Biogas in the Developing World

The demand for electricity at the village level has led to the use of biogas in the developing world, particularly in China an India. Biogas is produced in a digester where organic material is fermented to produce electricity, and the residue from the digester can be used as fertilizer. For example, cattle dung mixed with water can produce a mix of methane and carbon dioxide. The gas, after passing through a condensation trap, can be mixed with diesel fuel to operate a generator. The electricity produced can be used to pump out underground water, to light up village homes and streets, and in cooking. Smaller family sized digesters are more common, and in China, about 4.6 million such digesters are estimated to be in use, especially in the south. In India, the number is smaller but growing (World Resources Institute, 1994). Bigger community-sized digesters are more economical but require village level organization which is not always available. The biogas system is environment-friendly. It is inexpensive, clean, produce hardly any pollution, and provides employment for the local people. If there is enough demand for the electricity, it is also an economically viable project. The number of biogas digesters looks likely to increase steadily in the developing world and biogas has the potential to become a significant source of energy in the villages of the developing countries. This is an example of an innovative measure meeting the demands of development without causing significant environmental degradation and at an affordable cost.

Source: Avijit Gupta and Mukul G. Asher. Environment and the Developing World, 1998

Energy policy

The Ministry of Energy (MOE) of the Union of Myanmar claims to be meticulously pursuing the following energy policy:

- To maintain the status of energy independence,
- To save non-renewable energy for future energy sufficiency of the nation, (or to promote wider use of new and renewable sources of energy),
- To promote efficient utilization of energy and impress on energy conservation, (or to promote energy efficiency and conservation),
- To prevent deforestation caused by excessive use of fuel wood and charcoal (or to promote use of alternative fuels in households).

In addition, in recent years five more policy objectives came to be included.[19] They are:

- To supply fuel oil, urea and fertilizer to industrial, agricultural and other sectors of the economy:
- To enhance foreign exchange earnings through exports of surplus oil, natural gas and petroleum products;
- To promote regional cooperation;
- To use modern methods and to promote human resource development of nationals in the energy sector;
- To stockpile fuel oil systematically for national security and economic stability.

Apart from the above, departmental reports rarely mention measures to be taken for the achievement of the policy objectives such as tariff rationalization, full cost recovery, reduction and removal of subsidies and cross-subsidies, setting up of independent regulatory mechanism, corporatization and privatization of state-owned utilities, and so on.

Nonetheless, privatization efforts mentioned earlier and increases in the electricity tariffs and fuel prices over the last couple of years can be seen as developments in the right direction. In particular, fuel price hikes since the early 1980s can be seen as reduction and removal of subsidies (Table 8).

Table 8: Domestic Fuel Prices

Sr. No.	Date	Motor Gasoline (kyat/gallon)	High Speed Diesel (kyat/gallon)
1.	23-8-1976	3.50	2.50
2	24-7-1982	3.60	2.60
3	20-10-1988	16.00	10.50
4	4-8-1994	25.00	20.00
5	20-7-1997	180.00	160.00
6	20-10-2005	1,500.00	1,500.00

Source: Authors.

However, rationing of motor gasoline is still in place. It is to be hoped that once the process of rationalizing prices and achieving full-cost recovery are fully in place, rationing system could be dismantled. Note that rationalization of prices and full-cost recovery are the keys to regional cooperation based on economic considerations.

It is also unfortunate that "reduction of poverty" is not mentioned among the policy objectives of the government, even though some 85 percent of the population is still deprived of access to electricity.[20] This means that energy resources required for reducing poverty is not set aside and instead included as part of "surplus energy" available for export. It is not right to leave the poor mired in "energy-poverty" vicious circle. While it may not be economically feasible to provide conventional sources of energy to people living in remote villages, provision of non-conventional energy sources (e.g. biogas plants, biomass utilization, etc.) would be an appropriate option in such areas.

On a more positive note however, "promoting regional cooperation" came to be included among the policy objectives, a matter to which we now turn.

4. Myanmar's Potential and Prospects for Energy Cooperation

Myanmar, with naturally endowed primary energy resources, has immense potential for the cooperation in energy sector especially with BIMSTEC member countries. As we have seen, Myanmar's export

of gas from both Yadana and Yetagun to Thailand is an example of success in energy cooperation in this region for mutual benefit. With the finding of natural gas in Myanmar offshore at Shwe prospect in Block A-1, other member countries especially India have an opportunity for energy sector development. At the present moment, British engineering firm Genesis Engineering is studying the feasibility of potential several gas pipeline routes from Myanmar to India and Thailand for consortium led by Daewoo International, operator of Block A-1. The feasibility study is expected to be completed by mid 2006.

In addition, Indian engineering firm is reportedly studying the gas pipeline routes in India to tap the gas from that field as well. It is believed that India is primarily studying onshore pipeline without passing Bangladesh. India may use this proposed pipeline not only to tap Myanmar gas but also to bring its eastern gas to major market area.

A feasibility study is currently being carried out for the development of hydropower project at 1,200 MW Tamanthi Hydroelectric Project on Chindwin River for power export to India. India's state owned NHPC is working on it with the cooperation of Myanmar Ministry of Electric Power. Another two hydropower projects for energy cooperation between India and Myanmar are 500 MW Manipur (Kalewa) and 150 MW Homalin Project.

Table 9: Myanmar Hydropower Projects for BIMSTEC Energy Cooperation

No.	Projects	MW	Neighbouring Country
1.	Hutgyi	600	Thailand
2.	Tasang (Thanlwin)	7110	Thailand
3.	Tanintharyi	600	Thailand
4.	Nam Kok	150	Thailand
5.	Ywathi (Thanlwin)	3500	Thailand
6.	Lemro	600	Bangladesh
7.	Mi Chaung	200	Bangladesh
8.	Tamanthi	1200	India
9.	Manipur (Kalewa)	500	India
10.	Homalin	150	India

With abundant hydropower potential, Myanmar is currently studying the project feasibility of 5 and 2 hydropower projects for Thailand and Bangladesh respectively. All these project sites are located near border areas and thus provide the cooperation opportunity for regional development.

As of early 2006, India's Oil and Natural Gas Corporation (ONGC) has a 20 percent stake in Myanmar's offshore Block A-a and A-3, while the Gas Authority of India Ltd. (GAIL) held 10 percent stake in both projects. India's oil company ESSAR entered Production Sharing Contract (PSC) during 2005 for oil and gas exploration of onshore block L and offshore block M-2. PTTEPI of Thailand signed 5 PSC contracts for exploration of offshore block M-3, M-4, M-7, M-9 and M-11.

Currently, only 5 offshore oil and gas blocks (namely A-5, A-6, A-7, M-1 and M-8) are left for regional cooperation in energy sector. Moreover, demarcation process is underway for deep water oil and gas blocks for inviting foreign direct investment.

There is also an opportunity for BIMSTEC countries in the exploration of commercial scale hydropower for regional energy sector cooperation. Such projects, being capital intensive, are by their very nature need huge initial investments. Under present circumstances, Myanmar is unlikely to receive any assistance from the West or indeed international organizations for materializing these potentials. Therefore, Myanmar should open prospective hydropower projects to local and regional private sectors for Independent Power Provider (IPP) in order to achieve targeted objectives in the shorter term. In short, creation of better investment climate is essential for proper energy sector development in Myanmar.

Then again, technologically more advanced BIMSTEC member countries, such as India, Thailand and Bangladesh on the other hand, have ample opportunity to provide Myanmar with technical assistance.

5. BIMSTEC-Japan Cooperation

Japan's involvement with BIMSTEC countries except Thailand has been very limited. This is true of trade as of investment. The reasons, as Professor Ebashi pointed out, was because the three BIMSTEC countries, Myanmar, India and Bangladesh "adopted the closed door, socialistic economic policy in their early stage of development and cautious in utilizing the benefits of international trade for their economic reconstruction" (Ebashi, 2005). Other reasons include: dominating presence of inefficient state economic enterprises; extensive government restrictions which limits free competition and economic activities of private enterprises; lack of infrastructure and labor problems especially in India, Bangladesh and Sri Lanka.

But, as Professor Ebashi mentioned further, there have been some positive changes for the better in recent years. For instance, since 1991 India has been implementing economic reforms, liberalization and de-regulation and rapid expansion following them could attract Japanese investments especially because of the so called concern on "China Risk". As for Myanmar, although there was a set back in its reform efforts since the Asian economic crisis in 1997, likely establishment of "Special Economic Zone (Industrial Development Zone)" – mainly for Chinese enterprises at Thilawa on the outskirts of Yangon – in the near future may become a turning point which changes Myanmar's investment environment drastically.

According to Professor Ebashi, promotion of Japanese Direct Investment in BIMSTEC countries, especially in infrastructure (such as power, communication and transportation), is the best way for realizing closer economic relations between Japan and BIMSTEC countries as well as promoting better ties among BIMSTEC countries.

Indeed, promotion of foreign direct investment (FDI) in general will not only enhance the development of BIMSTEC countries but will also make BIMSTEC a more attractive place for greater inflow of FDI.

But, in order to attain this objective, BIMSTEC countries will need to put their act together, to coordinate much better, not only in the filed of energy but also in transport, trade, communication, tourism and so on.

6. Conclusion

Any kind of cooperation needs goodwill. We sometimes tend to forget that. On the other hand, goodwill is merely a necessary but not a sufficient condition. Meaningful and lasting economic cooperation between nations must be based on economic considerations and national interests rather than on goodwill alone. This applies to cooperation amongst BIMSTEC member countries as between BIMSTEC and Japan.

As mentioned at the very outset of this paper, the two projects which were identified for cooperation in the energy sector in BIMSTEC are:

- The energy infrastructure development (natural gas) project, and
- The development of new and renewable sources of energy project.

The concept of trans-BIMSTEC gas pipeline(s) was further endorsed at the first BIMSTEC Energy Ministers' conference held in 2005. A joint statement issued after the meeting said that it "would further enhance the objective of providing the region with a secure supply of energy and would contribute to the social and economic development of member countries". In addition, "the meeting had also agreed on a plan to establish an electricity grid connecting the grouping's members" (*The Myanmar Times*, October 10-16, 2005).

Sadly however, not much progress seems to have been made either as regards energy infrastructure development or regarding the development of new and renewable energy, except on a bilateral basis and especially between Myanmar and Thailand, and to a lesser extent between Myanmar and India. Lack of progress is by no means due to lack of opportunities. As we have seen in the foregoing analysis, there are ample opportunities for regional cooperation, not only in the production and utilization of natural gas but also in hydroelectricity; and in the development of new and renewable sources of energy.

There is much scope for regional cooperation among BIMSTEC countries. To recapitulate very briefly from the Myanmar perspective:

- There are still a number of offshore oil and gas blocks left for regional cooperation in energy sector.
- There is also an opportunity for regional countries in the exploration of commercial scale hydropower for regional energy sector cooperation.
- Training and capacity building especially in the field of renewable energy also offer much scope for regional cooperation. Establishment of common training facilities may be useful.
- Sharing of laboratory and testing facilities and research findings for BIMSTEC countries which geographically are interconnected may be cost-effective. In particular, sharing of research findings with regard to the efficacy of Myanmar's plan to replace all of its conventional oil product imports with physic nut oil will be useful.
- Cost-benefit analysis regarding the establishment of petrochemical complex in Myanmar (if an appropriate regional partner could be found) will be particularly useful as it would create employment opportunity for local community as well as much needed industrial development.

BIMSTEC member countries can get together in some of the above mentioned areas, there can be no doubt that Japan will be too willing to lend a helping hand.

Endnotes

1 The papers are by Abdur Rob Khan, ABM Ziaur Rahman, Mahfuz Kabir and Sharif M Hossain, "BIMSTEC-Japan Cooperation in Energy Sector:Vision and Task Ahead" presented at the 1st International Conference on Towards BIMSTEC-Japan Comprehensive Economic Cooperation: Vision and Task Ahead, 16-17 December 2005: Kolkata, India; and ABM Ziaur Rahman, Mahfuz Kabir and Sharif M Hossain, "BIMSTEC-Japan Cooperation in Energy Sector: Bangladesh Perspective" presented at the Dhaka Dialogue, 8-9 July 2006: Dhaka, Bangladesh.

2 For example, in Myanmar, biomass energy constitutes for major portion of primary energy consumption and it is about 65% of total energy consumption in 2004/2005, according to Ministry of Energy.

3 In relative terms, that is, as a proportion of GDP, Myanmar's industrial sector at about 12% of its GDP is the least developed amongst BIMSTEC countries.

4 As reported in Myanmar Times (August 7-13, 2006) India has abandoned

plans to build a gas pipeline across Bangladesh to import A1 offshore gas field in Myanmar.

5 *RIS* Policy Briefs, No. 8 December 2003.

6 Ministry of Energy

7 As compared to the consumption proportion of some 81 percent in 1988/89 it is a significant improvement.

8 Country Economic Report MYANMAR, Asian Development Bank, 2001

9 However, this is still below the peak of 2,841 thousand toe reached earlier in 1999/2000.

10 Ministry of Energy, "Objectives and Plan Implementation of the Ministry of Energy" March 2006 (in Myanmar Language).

11 As far as city bus fares are concerned, they have more than doubled because the capital cost of converting diesel engines to CNG engines had to be recouped. Monthly bus fares from Yangon to Ywarthargyi and back which used to cost kyats 3000 before now costs kyats 8,000.

12 It is however still very low as compared to 307 kWh in India or 1,382 kWh in Thailand in 1999/2000 (ADB, Country Economic Report: Myanmar, December 2001).

13 It is not known as to how much of the unit loss is due to poor equipment and how much to pilferages. Should the former be the main cause of unit loss economic, cost-benefit analysis to evaluate and select energy-conserving and –producing options may be worthwhile.

14 As reported in The Mirror, (30-7-2006), electric power generated in 2005/06 was 6064.16 million kWh out of which 4431.06 million kWh was consumed indicating unit loss of 1633.10 million kWh or 27 percent of total power generated..

15 Previously, the total coal production in Myanmar reached a peak of 43,500 tons in 1984/85 but since then has dropped to 30,980 tons in 1994/95.

16 *The Myanmar Times*, August 7-13, 2006.

17 For example, see Scott Sklar, "Renewable energy: A Key to Sustainable Development," in Guertin, Gray, and Bailly eds., Energy Technology Cooperation for Sustainable Development. Latham, M.D: University Press of America, 1993.

18 Ibid, p.11.

19 "Objectives and Plan Implementation of the Ministry of Energy" March 2006 (in Myanmar Language).

20 For example, ADB 2000 Review of the energy sector in the region recommended focusing on the revised operational priorities which included "reducing poverty in the region"

References

Asian Development Bank. *Country Economic Report MYANMAR*, Manila 2001

ADB 1981. *Role of the Bank in the Energy Sector in the Region*. Working Paper No. 2-81, Manila.

ADB. *The Bank's Policy Initiatives in the Energy Sector.* Manila, 1995.

ADB . *Energy 2000: Review of Energy Policy*. Manila, 2000.

Central Statistical Organization: *Report of 1997 Household Income and Expenditure Survey (1999)*

Avijit Gupta and Mukul G. Asher. *Environment and the Developing World*, John Wiley & Sons, New York, 1998

Energy Information Administration, *International Energy Outlook 2005*

Khan, Abdur Rob, ABM Ziaur Rahman, Mahfuz Kabir and Sharif M. Hossain. "BIMSTEC-Japan Cooperation in Energy Sector, Vision and the Tasks Ahead". Paper presented at the 1st International Conference on Towards BIMSTEC-Japan Comprehensive Economic Cooperation: Vision and Tasks Ahead, 16-17 December 2005: Kolkata, India.

Kyaw Aye. "Energy Cooperation Among the BIMST-EC Countries", *BIISS Jourenal,* 24(4): 453-482, 2003.

Masahiko Ebashi. "Deepening BIMSTEC-Japan Economic Relations: Tasks Ahead". Paper presented at *Towards BIMSTEC-Japan Comprehensive Economic Cooperation,* 16-17 December 2005, Kolkata, India.

Ministry of Energy (MOE). Yangon, Myanmar.

Ministry of Energy. "Objectives and Plan Implementation of the Ministry of Energy" Yangon, Myanmar. March 2006 (in Myanmar Language).

Research and Information System for Developing Countries (RIS). *RIS Policy Briefs,* No. 8 December 2003.

The Myanmar Times, various issues.

Thein Lwin,U. *"Why Renewable Energy", 2005.*

UNDP(a): United Nations Development Programme, *Energy for Sustainable Development in Asia and the Pacific Region: Challenges and Lessons from UNDP projects*, New York, 2004.

UNDP(b): United Nations Development Programme, *The Sustainable Difference: Energy and Environment to achieve the MDGs,* Energy and Environment Bureau for Development Policy, UNDP, New York, 2004.

World Bank. *Myanmar: Energy Sector Investment and Policy Review Study,* Report No. 10394 –BA, 1992

Appendix 1: Consumption of Commercial Energy, 1995/96~1999/2000

No.	Item	Unit	1995/96	1996/97	1997/98	1998/99	1999/2000
1	Crude Oil	('000 toe)	1,536	1,651	1,899	2,280	2,841
2	Natural Gas	('000 toe)	1,236	1,340	1,448	1,396	1,320
3	Coal	('000 toe)	18	17	12	25	19
4	Hydroelectricity	('000 toe)	369	375	404	219	222
	Total	**('000 toe)**	**3,159**	**3,383**	**3,763**	**3,920**	**4,402**
5	Population	Million	44.7	45.6	46.4	47.2	48.1
6	Per Capita Primary Energy Consumption	Toe	0.071	0.074	0.081	0.083	0.092

toe = tons of oil equivalent

Source: *Country Economic Report MYANMAR*, Asian Development Bank, 2001

Appendix 2: Electric Power Installation, Generation and Consumption, 1989/90-1998/99

Year	Installed Capacity (Megawatts)	Generation (Million kWh)	Consumption (Million kWh)	Consumers (000 No.)	Electrification Twns	Vils
1989/90	793	2494.44	1572.65	624	304	788
1992/93	807	3006.60	1831.46	741	314	933
1995/96	982	3762.33	2262.37	826	320	1015
1998/99	1055	4579.29	2848.02	920	323	1104

Source: CSO, Statistical Yearbook, 1997 and 2000.

Appendix 3: Electricity Generation and Sales, 1995/96-1999/2000

Year	1995/96	1996/97	1997/98	1998/99	1999/2000
Generation (GWh)	3,763	4,130	4,550	4,139	4,568
Sales (GWh)	2,262	2,434	2,676	2,716	2,899
Station Use	63	98	139	140	101
Losses (%)	38.2	38.7	38.1	31.0	33.5

Source: CSO, Statistical Yearbook, 2003.

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Centre for Studies in International Relations and Development
P 534 Raja Basanta Roy Road
Kolkata 700029, India
Phone: +91-33-2463 7322
Fax: + 91-33-2463 7322
Email: membersecretary@csird.org.in;
csirdindia@yahoo.co.in
Websites: http://www.csird.org.in;
http://www.bntt.org