

## **6.1 Industrial Infrastructure/Industry Location Survey Existing Condition of Industrial Infrastructure Buildup/Industry Location**

### **(1) Existing Condition of Industrial Infrastructure Sector**

#### **1) Energy Sector**

The energy sector (especially oil and gas) is one of the important sectors for Myanmar to earn foreign currencies. Since 1887, Myanmar (formerly Burma) has been known to the world as an oil-producing country. Since the middle of the 1990s, however, its inland oil/gas production has been decreasing. The survey has showed us that Myanmar has turned out to be a net oil-importing country since the middle of the 1990s. This fact is possibly a critical factor for Myanmar to map out an economic plan in the future.

#### **Energy Demand/Supply Balance:**

As shown in Figure 6-10 and Figure 6-12, Myanmar has an energy consumption of 0.3 tons per capita (when converted to oil in its energy sector as a whole). That is, it is one of the lowest energy-consuming countries in the world. What should be noted here, is the fact that Myanmar has an electric power share of less than 2% of its total energy consumption (11.33 million tons) while getting 80% of its energy from natural sources, such as firewood and charcoal. According to the findings in a survey made by the Statistics Bureau in 1997, only 37% of the households were supplied with electric power. (Electrification reached 71.6% in urban areas but only 17.7% in rural areas). Since around 1997, the electric power shortage has become serious due to a decrease in hydropower generation, which arose from greater water needs, in addition to gas shortages. Consequently, power failures have started to occur frequently. Planned and sudden power failures have precluded shops, small and medium-sized enterprises, hotels, etc. from managing their business without possessing a private generator. Under such circumstances, small-sized generators have increasingly begun to be imported. In 2000, the hydropower generating capacity recovered normalcy, with water levels rising in dams. As a result, the power shortage phenomenon has slightly improved. With its power demand and supply already completely out of balance, Myanmar has not yet resolved its power failure problem to date. It is unlikely that the power shortage issue could ever be resolved without increasing its supply in a great measure.

**Table 6-4 Energy Balance, 1999 (One Million Oil Ton Equivalent)**

	Oil	Gas	Coal	Power	Miscellaneous*	Total
Production	0.50	1.52	0.02	0.16	10.60	12.60
Import	1.30	0.00	0.00	0.00	0.00	1.30
Export	0.02	0.00	0.00	0.00	0.00	0.02
Supply	1.78	1.52	0.02	0.16	10.60	14.06
Loss	-0.28	-1.10	0.00	-0.28	-1.45	-3.11
Transformation Output		-	-	0.36	-	0.36
Final Consumption	1.50	0.42	0.02	0.24	9.15	11.33

\* Main firewood, charcoal, crops tailings, etc.

Source: Energy Data Associates.

As was already referred to, it may be pointed out that the decrease in domestic oil and gas production is one of the reasons for the recent significant power shortages.

**Table 6-5 Energy and Electric Power Trends: 1985-1999**

	85	92	93	94	95	96	97	98	99	2/9
Cru. Oil 1,000Bl	10.0	5.4	5.2	5.0	4.3	3.8	3.6	3.4	3.5	0.67
N. Gas	35.5	31.3	38.7	48.3	54.0	58.6	63.5	69.9	57.9	1.85
Adjust				37.2	31.3	28.2	26.8	25.3	26.0	0.83
E. Pow.	684	807	809	837	982	1,033	1,042	1,055	1,196	1.48
Adjust								805	846	1.05
Pow. Ge.	2.12	3.01	3.39	3.63	3.76	4.13	4.46	4.58	5.02	1.67
Adjust								3.48	3.56	1.18

Note: Crude Oil in (Million Barrel), N. Gas in (Billion Cu. ft.), Electric Power Capacity in (Mega Watts -- MW), E. Power Generation in (Billion KW/h).

Source: Central Statistical Organization and JICA Study Team

Crude oil production in Myanmar has been declining in the past ten years. In 1985, the crude oil production was 10 million barrels per year but continued to decline and in 1992 the oil production declined to 5.4 million barrels and by 1999 the production further declined to 3.5 million barrels as shown in Table 6-5.

On the other hand, natural gas production has increased mainly due to offshore gas production in Yadana and Yatagone fields. Gas production increased from 31.3 billion Cu. ft. in 1992 to 57.9 billion Cu. ft. in 1999 (85% increase). However, the natural gas production

on land has been declining just as crude oil production declined because most of the natural gas is produced as associated gas (that is gas jointly produced with crude oil). Adjusted gas production on land alone is estimated to decline at the same rate as the decline of crude oil: in 1999 it was 26 billion Cu. ft. (17% decline from 1992).

100% of the offshore gas has been exported to Thailand; therefore, the increased gas production is not available for domestic use. The gas pipeline from the Yadana and Yangon area has been planned to bring a 25% production-sharing portion of natural gas to the Yangon area; however, the pipeline project was not implemented up to now creating a shortage of natural gas in Myanmar. In particular, about 500 MW of electric power generators are using natural gas as their main fuel and the shortage of natural gas is also seriously reducing the electric power generation capacity. It is urgent for Myanmar to build the delayed gas pipeline from the Yadana and Yatagone gas fields to the Yangon area so that existing electric power generators can start operating fully.

**Table 6-6 Energy Production, Consumption and Net Import: 1998/9**

	Production 1 Mill. T Oil Eq.	Consumption 1 Mill. T Oil Eq.	Per-Capita Consumption*	Net Import
Myanmar	12.4	13.6 (2.0%)	307 (0.5%)	9
Thailand	39.3	68.9 (7.9%)	1,153 (6.4%)	43
China	1,020	1,031 (3.8%)	830 (2.4%)	1
Vietnam	42.7	33.7 (3.0%)	440 (0.9%)	-27
Philippines	17.8	38.3 (3.7%)	526 (1.4%)	53
Indonesia	211.5	123.1 (4.7%)	604 (2.9%)	-72
Malaysia	74.9	43.6 (7.9%)	1,967 (5.1%)	-72

Per-Capita Com: 1 Kg Oil Equiv.

Source: World Development Indicator: 2001

As was mentioned earlier, Myanmar was a net exporter of energy until the middle of the 1990s, however, due to the increasing demand for energy and declining production of onshore oil/gas production in the past several years (as shown in Table 6-6), Myanmar was already a net importer of energy in 1998. In 1998, 9 million tons equivalent of energy (mainly crude oil and finished oil products) was imported, which is 3% of the nation's total energy consumption. Other Asian countries such as Indonesia, Malaysia and Vietnam are net exporters of energy but Thailand and Philippines are net importers. Considering the limited foreign currency reserve and limited exporting capacity, Myanmar must either increase its domestic oil/gas exploration to step-up production or increase its export capacity in all possible sectors such as agriculture, tourism and manufacturing.

The export of offshore gas to Thailand started in 1998 and the export volume has increased in recent years. According to the latest information, the volume of gas exported to Thailand increased drastically from the year 2000 and further jumped in 2001.

**Table. 6-7 Export of Natural Gas to Thailand (Million Cubic feet)**

	1998/9	1999/2000 (GR)	2000/2001 (GR)	2001/2002* (GR)
Export of Gas	954	6,527 (6.8)	65,359 (10.0)	173,365 (2.7)
Value (Mil. Kyat)	4.9	31.2 (6.4)	1,110.5 (35.5)	3,059.6 (2.8)
US\$ (Million)				US\$ 600

April-December 2001 (9 months)

Source: elected Monthly Economic Indicators Central Statistical Organization

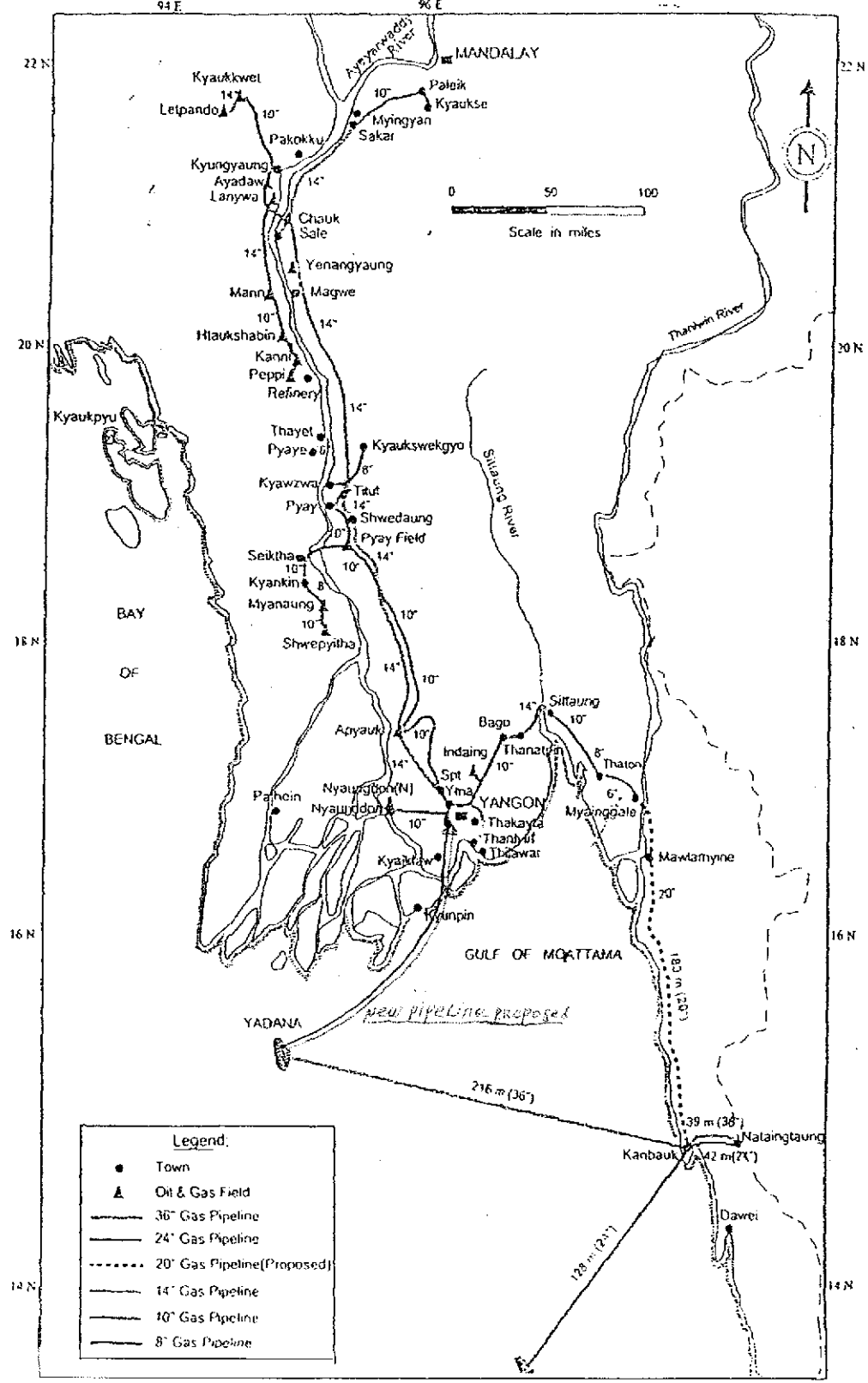
The value of natural gas export jumped by 35 times (1,110 Million Kyat) from 1999 to 2000 and further jumped by 2.8 times (3,059 Million Kyat: US\$600 million) from 2000 to 2001. This drastic increase of natural gas exports is one of the bright spots for the Myanmar economy in recent years and likely to help the shortage of foreign currency slightly.

Should gas production and export increase further, Myanmar may return to a net exporter of energy again and be able to develop its economy by investing into badly needed infrastructure and other sectors.

#### **Energy Sector-related Organizations:**

In the energy sector, Myanmar has three state-owned enterprises (SOE) under the Ministry of Energy. Myanmar Oil and Gas Enterprise (MOGE) undertakes the production of oil and gas and transport via pipeline. Myanmar Petrochemical Enterprise (MPE) covers the production of oil refining and petrochemical products. And Myanmar Petroleum Products enterprise (MEPE) is in charge of selling petroleum products. In Myanmar, the oil/gas industry is a business monopolized by the government. Nevertheless, the offshore gas production could not only be developed with the capabilities of MOGE either technically or financially. This development, therefore, has proceeded within a production-sharing scheme with foreign capital participation. To date, Myanmar has succeeded in commercializing gas in two locations; Yadana and Yatagone; with their production totally exported to Thailand via a pipeline.

Figure 6-18 Gas Pipe Lines in Myanmar



Source: Central Statistical Organization

i) MOGE

The most important facilities relating to MOGE are its gas pipelines. 70% of the electric power consumed in Myanmar is generated with gas. A gas pipeline has been laid out from Yangon to Mandalay along the Ayeyarwady River (Refer to Figure 6-18) beyond Bago to the east of Yangon. Furthermore, the pipeline connects with Thaton, where there is a cement plant. In 2001, a new pipeline was constructed near Thaton to the north of Dawei where pipelines from Yadana and Yatagone are joined together. In 1995, it was planned to construct a submarine gas pipeline from the Yadana gas field to the suburbs of Yangon, however, to this day, the project has been suspended. Once the Yadana pipeline is finished, 25% of gas production in Yadana is scheduled to be supplied to Myanmar. This will lead to an increase in volume of the gas supplied to fertilizer and power plants, which are stronghold gas users. Hence, this would partially help solve the current energy/power shortage. Considering that domestically available gas is running short, it is urgently called upon to construct this submarine pipeline from Yadana. It is desired to propose that the pipeline be constructed as soon as possible and be given a high priority

ii) MPE

MEP has three oil refineries operating methanol, fertilizer and LPG plants to produce petroleum products. The three oil refineries are: 1) Thanlyin Refinery (30, 000bbl d), 2) Chauk Refinery (6300bbl · d), and 3) Mann Refinery (25000bbl · d). However, their total oil production capacity of 60 thousand barrels a day is insufficient to fully supply even the current low domestic demand. Consequently, Myanmar has recently been importing petroleum products from Malaysia and Singapore. From the viewpoint of either energy security or cost, it is necessary for Myanmar to construct a full-scale oil refinery. MPE has already worked out a construction plan, which remains far from implementation due to difficulties in raising the funds required. From a medium-term point of view, it is necessary to construct a new oil refinery.

**Table 6-8 Oil Related Production by MPE: (000 Gal)**

	Motor Spirit	Diesel Oil	Gas Oil	Furnace Oil	Aviation Turbine	Kerosene
1995/6	65,133	116,564	4,250	27,429	17,523	234
1996/7	53,204	91,451	3,308	24,476	14,382	282
1997/8	77,738	123,096	4,302	28,602	15,724	235
1998/9	81,802	119,147	4,636	30,475	14,055	41
1999/2000	82,006	116,128	5,613	33,738	16,162	38
2000/01	80,597	112,595	6,119	20,333	17,910	186

Source: Selected Monthly Economic Indicators, Central Statistical Organization

MEP has primitive facilities installed 20 to 30 years ago, which have not been modernized to date. Since 1995, therefore, MEP has had an almost unchanged production. During that period, however, the demand for petroleum products grew tremendously in Myanmar, which led to an increase in imports of petroleum products.

### iii) MEPE

MEPE is in charge of selling petroleum products. It has gas stations all over the nation, oil storage facilities, oil tankers and oil tank lorries developing its sales activities on a monopolistic basis. The gas stations constructed more than 30 years ago are old and small in small number (approximately 20 locations in Yangon). With petroleum products running short, 6 gallons of gasoline is sold to car owners twice a week at a very low price of approximately 1,080 Kyat (at a market price of approximately US\$0.04 per liter). If more than 6 gallons should be required, however, gasoline is unavailable at that price and will have to be purchased at US\$0.22 per liter, equivalent to four times the official distribution price from an oil importer or on the black market. It is said that state-owned enterprises are purchasing petroleum products at lower prices than market ones. Petroleum product pricing and the market are uncertain and, therefore, transactions are being conducted daily on the black market

## 2) Existing Conditions of the Electric Power Sector

Myanmar's economy has been growing smoothly since 1989 when it partially shifted into a market economy for the first time. Electric power supply, however, has failed to keep up with the growing demand. At present, Myanmar has an electric power plant capacity of 1,192 megawatts only (in 1998). And the nation has a per-capita power consumption of 64 kilowatt-hours a year, which remains the lowest level in the world.

**Table 6-9 Electric Power Generating Capacity**

	1994	1995	1996	1997	1998	1999/2000
Electric Power (Mkwh)	3,632	3,762	4,130	4,445	4,579	5,024
Gas	1,852	2,061	2,049	2,503	2,848	3,515
Hydro	1,659	1,595	1,622	1,686	1,486	961
Thermal	79	62	59	213	226	504
Diesel	42	43	40	43	46	45
Electric Power Installation (MW)	837	982	1,033	1,042	1,055	1,196

Source: Statistical Yearbook 2000, Central Statistical Organization

Myanmar's electric power supply is characterized by domestically produced gas generated power, occupying 70% of its total power generating equipment (in 1999). Most of the latest power plants in the country are using gas to generate electric power. The rest is generated hydroelectrically (19%), thermoelectrically (10%) and with diesel (0.9%).

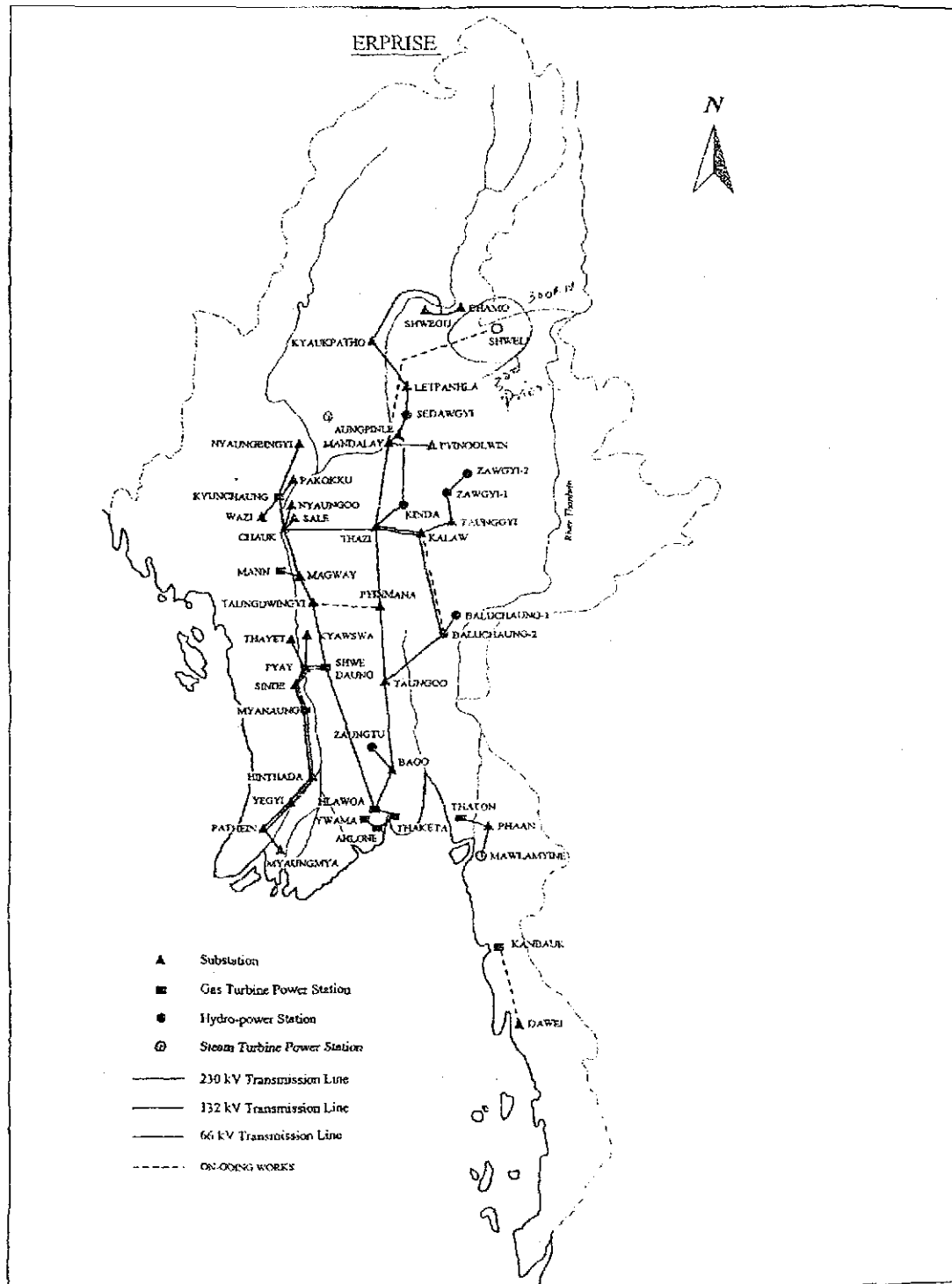
To obtain development funds and foreign currencies, Myanmar has not allowed the power plant capacity to keep up with the demand. As a result, power failures have occurred frequently since the middle of the 1990s. As a result, shopowners, hotel owners and medium- and small-sized enterprise owners have been driven into a situation where they have no alternative but to acquire small-sized generators. Thus, they are forced to spend a lot of funds and energy on securing electricity in the event of power failure.

The electric power shortage is unlikely to be dissolved with ease. Presently, it has become necessary to start up an urgent action plan so that an efficiency improvement program can be implemented for the old thermo electrical (gas) power plants, including the gas power generation fueled by the Yadana and Yatagone gas fields, whose implementation program has been delayed.

A number of short-term programs were mapped out from 1998 to 2000, of which, however, only two thermoelectric projects, Ahlone Steam (50MW) and Hlawga Steam (50MW), and one hydroelectric project, Zawgyi II, have been implemented. All other projects have been deferred for lack of funds. The big three projects, the Kyaiktaw gas power generating project (300Mw), the Ywama gas project (300Mw) and the Delta Offshore gas project (200 Mw), have not been implemented yet. The Paunglaung project and three other hydroelectric power generation projects have seen part of their tunnel construction work started, with funds raised from Japanese enterprises. Nevertheless, these hydroelectric power plants have also been delayed in their construction completion.



Figure 6-19 Myanmar Electric Power Enterprise National Grid System



Source: Central Statistical Organization

**Medium- and Long-term Demand Projections:**

The medium- and long-term electric power demand in Myanmar has been forecast by MEPE (1995), ECFA (1997) and MEPE (2001) so far. According to ECFA's forecasts as shown in Table 6-11, Myanmar will require a base-case power plant capacity to generate 1,787MW in 2005, and 2,984MW in 2010. MEPE is considered to have a current operational power plant capacity of approximately 1000MW, which may well be considered to run short by at least 20% to 30% as compared with the demand.

**MEPE's Power Supply Plan:**

- i) Building large-sized new combined power plants, using offshore gas (from Yadana and Yatagone gas fields),
- ii) Improving old existing gas power plants and converting them to new equipment, using inland gas in current use and offshore gas,
- iii) Thermoelectric power plants, using the residual oil available in oil refineries (especially from the inland Mann Oil Refinery),
- iv) Small- and medium-sized hydroelectric power plants,
- v) Large-sized hydroelectric power plants, and
- vi) Building export-oriented large hydroelectric power plants by making effective use of the private sector (either partially or totally).

From a medium- to long-term point of view, there is a strong possibility that Myanmar may explore hydroelectric power generation. Theoretical potential is estimated at 108,000 MW and the economic potential at 30,000MW.

**Future Plan:**

Myanmar has been significantly affected by its failure to implement any of the gas power plant projects, i.e. Kyaiktaw (300MW), Ywama (300MW) and Delta Offshore Block 1 (200MW), and all full-scale power projects from 1997 to 2000.

For power supply strategies, Myanmar should on a short-term basis promote gas and thermoelectric power generation and small hydroelectric power generation. On a medium- and long-term basis, a large-sized hydroelectric power plant project should be adopted.

It is expected that future power generating facilities will be developed possibly in the following priority order:

- i) Urgent power generating projects (projects to supply to an integral cluster of industrial complexes and/or industrial zones with diesel and gas generators),
- ii) Improving the efficiency of existing gas thermoelectric power plants and the working ratio of gas power plants by constructing a gas pipeline from Yadana gas field in earlier stages,

- iii) Newly constructing gas power plants (projects already planned),
- iv) Building small-scale hydroelectric power plants,
- v) Building medium- and large-sized hydroelectric power plants (for domestic consumption), and
- vi) Export-oriented hydroelectric power plants along the border with Thailand.

For hydroelectric power generating potentials, in particular, projects of high economic viability have only reached 30,000 MW. From a medium- and long-term point of view, the environment ought to be scarcely depleted (without reducing tropical rain forests due to their significant falls). Besides, there are a number of areas where small-sized dams may be located. These natural conditions in Myanmar are more favorable than in any other countries. The natural gas produced within its own territory is expected to increase in great measure from now on and to become the foundation of Myanmar's power supply together with hydroelectric power. As part of a solution to the electric power problem, the Japanese Government temporarily suspended a non-reimbursable cooperation amount of US\$3 billion to improve the Baluchaung Power Plant. This year, however, this cooperation has restarted.

#### **Urgent Power Development Program: 2001-2005**

The electric power shortage that had turned out to be a significant social problem caused the Myanmar Government to start up an urgent power development plan in 2001. As shown in Table 6-10 below, Myanmar is expected to have an electric power demand of 1,338MW on a base-case basis up to 2005. Even on a high-growth case basis, it is also envisaged that the power demand will be 1,433MW. In reality, however, there is strong possibility that the electric power demand in Myanmar has already exceeded 1,500MW, considering that the economic boom at the beginning of the 1990s accelerated the introduction of electrical appliances in housing developments.

**Table 6-10 Current 5-Year Plan: 2001-2005 Demand Forecast for Electric Power: 2001-2005**

Year	Low Growth	Base Case	High Growth
2000(Base Year)	890MW	890MW	890MW
2001-02	952MW	966MW	979MW
2002-03	1,019MW	1,048MW	1,077MW
2003-04	1,090MW (7.0%)	1,137MW (8.5%)	1,185MW (10.0%)
2004-05	1,167MW	1,233MW	1,303MW
2005-06	1,248MW	1,338MW	1,433MW

Source: Ministry of Electric Power: Department of Planning

The urgent plan announced in 2001 projected a demand of 1400MW. A specific power project, however, has specified to develop a 2300MW power plant. The project has been supported by a development fund so far, however, is up to a quarter of the proposed power plant capacity of 2,200MW (currently only 3 projects are to be implemented by March 2002). Unless new fund providers appear in the future, it will be difficult to implement all these projects.

**Table 6-11 5-Years Plan: 2001-2005 Detail Projects**

Year of Compl	Projects	Capacity (MW)	Estimated Cost (Million US\$)
2002-03	Thapanzeik (Hy)	30	36
2002-03	Paunglaung (Hy)	280	336
2002-03	Mandalay (GT)	30	18
2003-04	Mone (Hy)	75	90
2003-04	Yenwe (Hy)	25	30
2003-04	Kabaung (Hy)	30	36
2003-04	Mann CC	20	40
2003-04	Swedaung CC	25	50
2003-04	Kyunchaung CC	25	50
2003-04	Tigyit (Coal Fired)	120	96
2004-05	Pyu (Hy)	65	78
2004-05	Shweli (Hy)	300	360
2004-05	Kun (Hy)	60	72
2005-06	Thaukyegat (Hy)	150	180
2005-06	Bawgata (Hy)	160	192
2005-06	Shwekyin (Hy)	120	144
2005-06	Yeywa (Hy)	700	840
2005-06	Tigyit (Coal Fired 2nd Stage)	120	96
Total	18 Projects	2,235 MW	2,744 Million US\$

Source: Ministry of Electric Power

**Table 6-12 Transmission, Substation and Distribution Expansion Plan: 2001-2005**

Type	Number of Projects	Estimated Cost (M US\$)
Transmission and Substation	35	387.46
Distribution Expansion	Yangon, Mandalay and Other	856.9
Total		1,244.36 Million US\$

Source: Ministry of Electric Power

According to a cost projection concerning power projects as a whole, the total of power plants and transmission cables would amount to US\$3,988 million, which would remain an unrealistic figure under the current fund shortage while ODA is substantially unavailable.

#### **Future Power Demand:**

Myanmar's per-capita power consumption remains at a low level similarly to the energy case.

**Table 6-13 Electric Power Consumption Per Capita (Kwh : 1993)**

	Myanmar	Thailand	China	Vietnam	Philippines	Malaysia	Asia/P
Kwh	64	1,345	746	232	451	2,554	787
	1.0	21.0	11.7	3.6	7.0	39.9	12.3

Source: World Bank 2001 World Development Indicators

In Myanmar, electric power was consumed at a rate of 64Kwh per capita only in 1999 and 2000. This per-capita power consumption was only equivalent to one-twentieth of that of Thailand and one-seventh of that of Vietnam. And it is equivalent to one-twelfth of the mean per-capita power consumption in Asia. This low level of power consumption also demonstrates how difficult it is to resolve the power shortage in Myanmar. Even with the electric power supply increased, there is a strong possibility that power shortages may continue indefinitely since demand is increasing never-endingly. As a solution to the problem, it would be necessary to enhance power-generating equipment with enough capacity to exceed possible increase in demand, with funds raised from the private sector and abroad. From a short-term point of view, it is necessary to supply electric power intensively to those regions and/or industries where electric power is essentially required.

#### **Power Generating Organization/Management:**

Regarding the electric power sector in Myanmar, one bureau in the Ministry of Energy (MOE) was separated into an independent ministry named Ministry of Electric Power (MOEP) in 1997. To undertake the practical business ranging from power generation to sales, Myanmar Electric Power Enterprise (MEPE) is acting as a state-owned company with a monopolistic right over the nation. The power rates at which electricity is supplied to the people in Myanmar are internationally held very low, or 25 Kyat (market price of US\$0.03) per Kwh. Nevertheless, it is sold to foreign capital and full-scale private companies at US\$0.08 per Kwh. Similarly to the case of other energies, lower power rates apply to state-owned companies and military facilities.

Consequently, these low power rates plus the effects of recent power shortages have resulted in MEPE operations falling into the red .

**Table 6-14 Electric Power Sector Operation (Revenue and Cost, Surplus/Loss) in Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenue	928.1	2,771.1	3,227.5	3,450.8	3,599.6	19,680.8
Cost	726.8	2,599.8	2,721.6	3,120.7	4,976.9	20,614.1
Surp/Loss	+201.8	+171.3	+505.9	+330.1	-1,377.3	-933.3
% to Rev	+21.7%	+6.2%	+15.7%	+9.6%	-38.3%	-4.7%

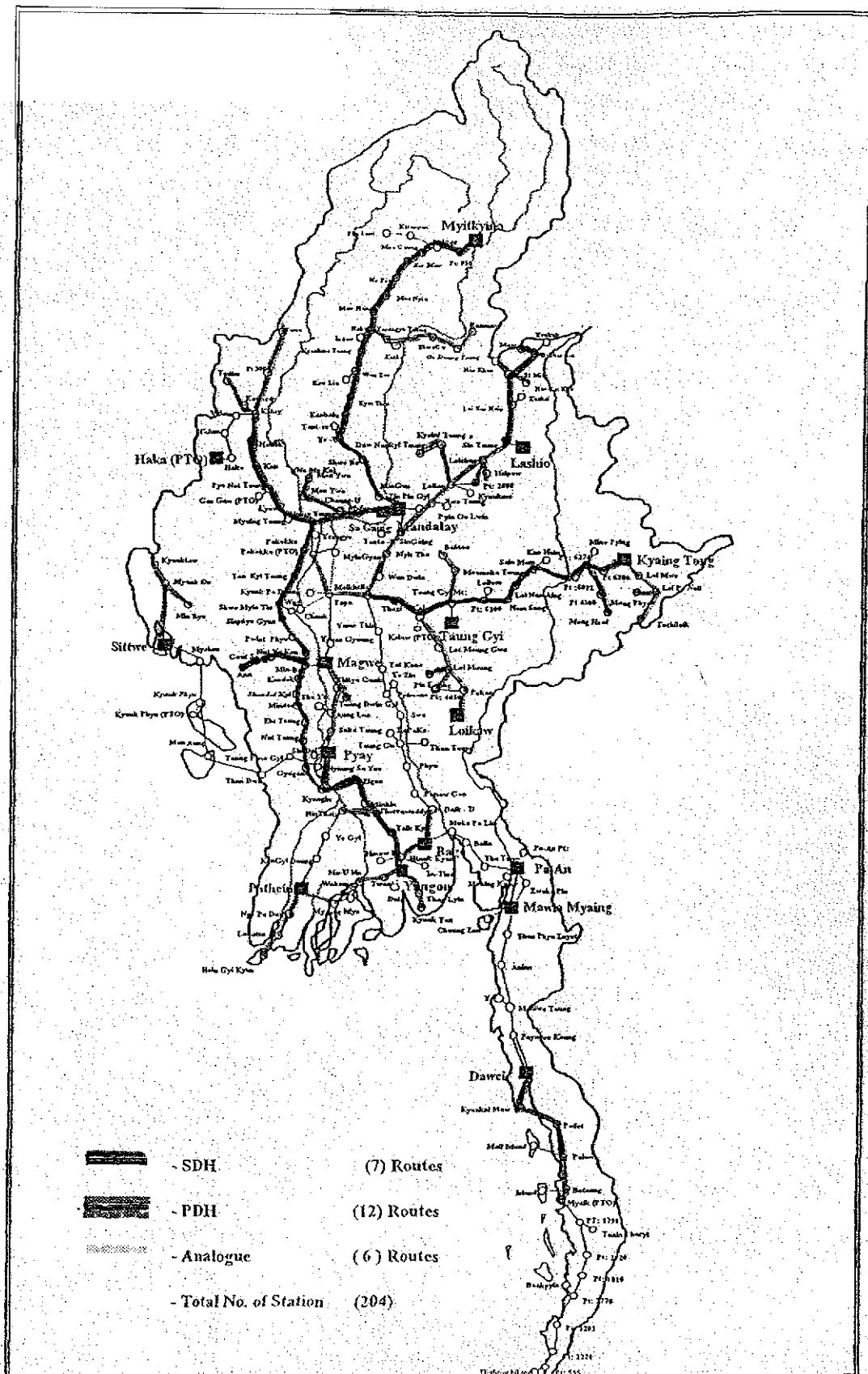
Source: Ministry of Electric Power

As shown in Table 6-14, MEPE was in the black until around 1997 when power failures had rarely taken place, Myanmar had its economy in a favorable condition and the Kyat remained at a high foreign exchange rate. Since 1998, however, MEPE has run into significant deficit, or loss-making operation (with deficit amounting to 38% of the revenue).

### 3) Communication Sector

An efficient and inexpensive communication sector is essential not only to consumers and development of the economy, but also to development of the industry, tourism and commodity distribution and service sectors. Myanmar, however, has lagged behind in popularizing and modernizing its telephone network. In 1999, only 260,000 telephone sets were installed over the whole nation. Mobile phones have remained expensive relative to earnings, showing a low popularization rate limited to foreigners and high-income Myanmar citizens mainly in Yangon and Mandalay.

Figure 6-20 Route Map For Myanmar Microwave System



Source: Central Statistical Organization

**Table 6-15 No of Telephone Installed in Myanmar in (1000)**

	1985	1992	1993	1994	95	96	97	98	99	9/92
Tele No	59	110	129	147	170	199	225	241	261	2.34

Source: Central Statistical Organization

As is shown in Table 6-16, IT-related services in Myanmar have low popularity compared to the situation in other ASEAN member countries partly due to governmental control. IT services are enjoyed by foreign capitals and a limited number of private enterprises only. In order to promote the invitation of foreign capital into Myanmar from now on, it is urgently necessary to popularize communications in general and liberalize IT-related operations, including the Internet (especially e-mail communications). To this end, liberalization of the communication industry and the introduction of market principles should start being studied promptly, with consideration given to the status quo of monopolistic high pricing.

**Table 6-16 Telecommunication and IT Related Data (1999)**

	Fixed Tele. Per 1000	Mobile Per 1000	Cost Per 3 Minit	Fax Per 1000	No Of Comp.Mil	Internet Host10	Internet No Mil
Myanmar	6	0.1	0.48	0.1	0.01	0	0.01
Thailand	86	38	0.08	2.5	8.9	0.01	0.1
China	86	34	0.01	1.6	12.2	0.69	8.9
Vietnam	27	4	0.08	0.4	?	?	?
Philippines	39	38	0.006	?	16.9	2.21	0.5
Indonesia	27	135	0.01	0.9	9.1	1.15	0.9
Malaysia	203	137	0.02	8.1	68.7	27.6	1.5
Asia/Pac	82	47	0.03	1.5	17.0	3.96	3.98

Source: World Development Indicator WB:2001

Myanmar has lagged behind significantly in popularizing its communication/IT-related infrastructure. Its telephone popularization rate has remained at one-fourteenth of the average in Asian countries. And it belongs to a group of countries where telephone costs are the highest of all Asian nations, or 16 times higher than the Asian average. Likewise, mobile phones have been popularized at one-four-hundredth to five-hundredth. Myanmar has also lagged behind in IT-related operations far more than that. Its computer/Internet popularization rate has not reached one-several hundredth of the average in other Asian countries.



### Communication Sector Organization/Management:

Myanmar Post and Telecommunication Enterprise (MPTE), which is part of the Ministry of Transport, has been monopolizing the post and communication sector all over the nation. Telephone rates are set at 4 Kyat locally and 20 Kyat remotely on a per-call basis, remaining at an internationally reasonable level. In Myanmar, however, international telephone rates are charged at US\$4.5 per 3 minutes from Myanmar to Japan and at US\$7.5, being very high from an international point of view. MPTE, which is a monopolistic enterprise without any competitor, has set service rates at the highest level in the world. As a result, their operation has continued to keep the balance in the black for the past twenty years while enjoying a high level of profitability compared to oil-related state-owned enterprises (with a profit margin of approximately 12% in 1999).

**Table 6-17 Telecommunication Sector Operation (Revenue and Cost, Surplus/Loss)**

**in Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenue	255.9	1834.5	2256.2	3401.7	4248.0	5668.0
Cost	130.9	1527.8	2066.6	2403.2	3558.9	4491.2
Surp/Loss	+125.0	+306.7	+189.6	+998.5	+689.1	+676.8
% to Rev	+48.8%	+16.7%	+8.4%	+29.4%	+16.2%	+11.9%

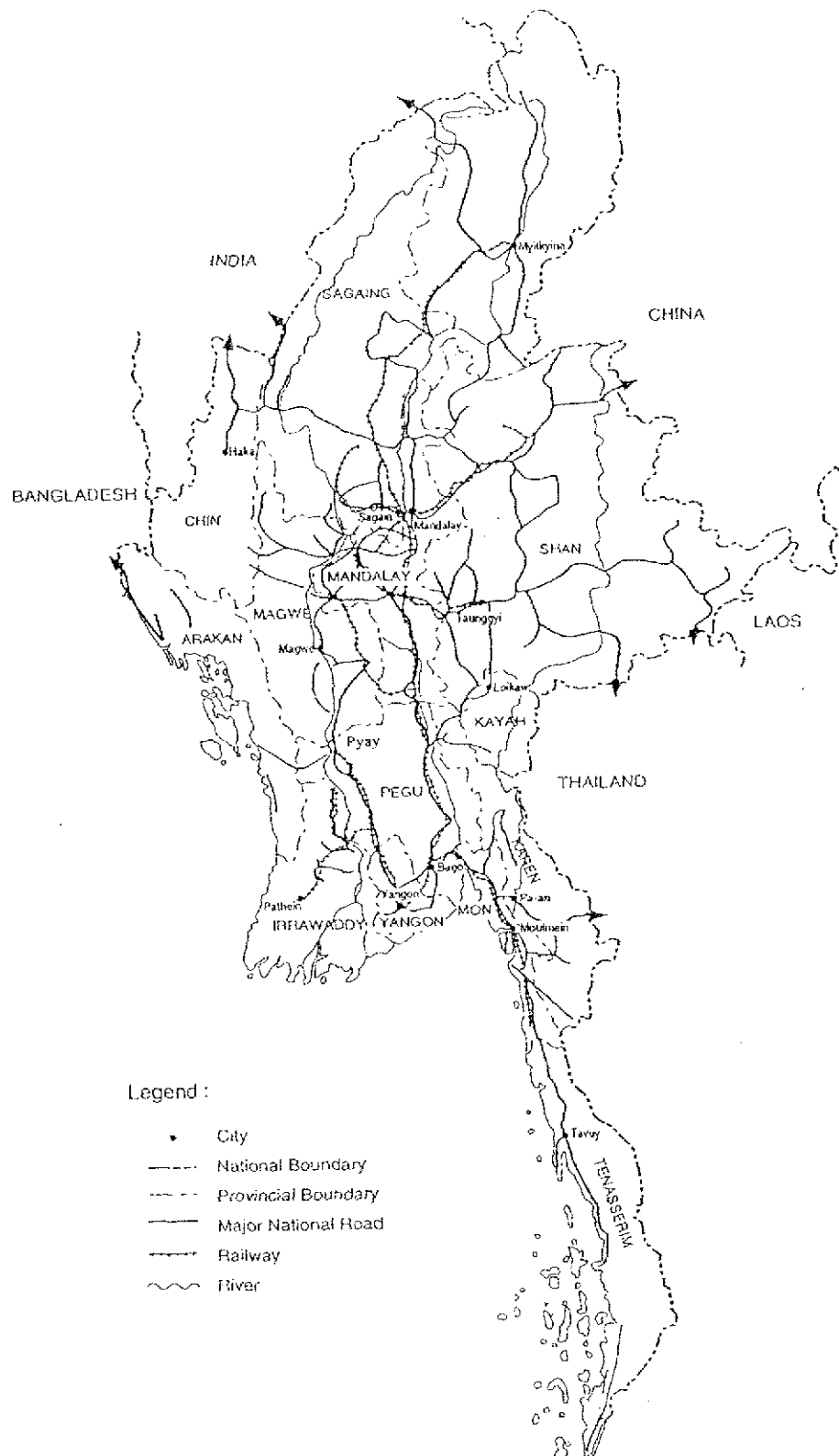
Source: Statistical Yearbook 2000

#### 4) Transport Sector

##### i) Filed-proven Transport Services

In Myanmar, since transition to the market economy in 1989, the traffic/transport sector is one of the industries where privatization has made great progress especially with its infrastructure. In 1994, the state-owned transport sector occupied a market share of more than 80%. At present, however, that market share has dropped to 12% or 13% mainly in railway and aircraft. In the meantime, private enterprises mainly in road, water and air transport sectors have come to participate in privatization, contributing to a growth of the private sector's share in Myanmar's transport market. Nevertheless, a full-scale investment has not been made for a long period of time. It may be safely said, therefore, that the transport industry in this country involves a lot of problems both quantitative and qualitative, with its equipment getting old-fashioned.

**Figure 6-21 Infrastructure Network in Myanmar**



Source: Central Statistical Organization

Judging by the projection statistics for 1992/1993 to 1999/2000 (up to the latest statistics published currently), the total number of passengers decreased from 236 million persons to 131 million (a 44% decrease) during the period. Especially, road transportation showed a remarkable decline. Although the cause of this decline has remained unclear, counterparts have commented there are possibilities that the bus transport services transferred to the private sector may have leaked out of the statistics and that bus users may have decreased, coupled with a rapid growth of the private motor vehicle population which started around the middle of 1990. In the meantime, Myanmar continued to enjoy GDP growth at a mean annual rate of 5% or 6% throughout that period. No growth of people movement might well be considered unnatural. There are high possibilities, therefore, that counterparts may have pointed out factors correctly.

By individual transport means, the passenger sector has decreased its market share (by 38%) and yielded the top market share to the railway transport sector (44%) in 1999.

The inland waterway has also shown a decrease in the number of passengers but not so remarkably as seen in the road transportation.

**Table 6-18 Passenger Transportation (1,000 persons)**

Mode	1992/3	1993/4	1994/5	1995/6	1996	1997/8	1998	1999
Rail	56,511	56,260	53,362	53,928	55,283	54,318	57,365	58,179
Airline	438	513	612	637	598	430	386	410
Waterway	39,185	36,003	26,582	24,979	23,404	21,221	23,486	22,599
Road Transp	139,877	119,956	113,168	115,179	107,310	88,223	64,866	50,247
Total	236,011	212,732	193,724	194,153	186,595	164,192	146,103	131,435

Source: Statistic Year Book: 2000

In the cargo transportation sector, water transport is ranked at the top, occupying a market share of 43.7%, followed by the railway at 40.5%. The road cargo transport still had a low market share of 15.7% although it has been growing gradually. The air transport has occupied an extremely low market share of 0.02% only. The railway cargo transport has leveled off while both water and road transport have been showing a gradual growth. Especially in Myanmar, there is a 6,000 kilometers long water transport course mainly composed of the Ayeyarwady River. And it is highly likely to function as a major transport means in the future, too. The water transport in Myanmar has potential for growth in the future when progress will be made in building up and improving ships, harbors and canals.

**Table 6-19 Cargo Transportation (1,000 Ton Km)**

Mode	1992/3	1993/4	1994/5	1995/6	1996/7	1997/8	1998/9	1999/0
Rail	3,130	3,268	3,297	3,112	3,165	3,063	3,304	3,389
Airline	2	2	2	2	3	3	3	2
Water	2,963	3,172	3,193	3,176	3,509	3,400	3,729	3,653
Road	963	1,115	1,169	1,352	1,302	1,394	1,269	1,315
Total	7,058	7,557	7,661	7,642	7,979	7,860	8,305	8,359

Source: Central Statistical Organization

These facts unlike other countries tell us that inland water transport is critical for Myanmar mainly along the Ayeyarwady River, which flows through the delta region from the north to the south of the country. There is a heavy traffic of 5,000-ton class ships up to Bhamo inland, 1,600 kilometers near the boundary of the People's Republic of China (300Km up to the boundary), and the inland waterway has an extension that reaches 6,600 kilometers. In the rainy season, 5,000-ton class vessels can reach Mandalay inland for 1,000 kilometers. This water transport, however, involves the problem that it is difficult to avail in the dry season. The Water Canal Bureau and Navy have cherished an inland water transport development plan to allow 5,000-ton class ships to be put in service throughout the year, with a few low dams constructed at several locations while building up the waterway. Similarly to the Mississippi River, Five Major Lakes and the Lawrence River in Canada, and the Rhine and Danube Rivers in Europe, it is highly likely that inland ships may transport far more crops, ores, heavy commodities, containers and the likes by way of the inland waterway in the future. The fact that inland waterways played an important role in transporting cargoes even in North America and Europe where railways, roads and airways were not developed shows a high probability of influencing the future industry location in Myanmar. It is, therefore, necessary to map our economic programs with full understandings about the inland waterways, especially when working out an industry location plan.

**Table 6-20 Transportation System Facility in Myanmar**

	Transportation Mode	Unit	Km	Total
1	Road · Union Road · Main Road · Local Road	(Km)	3,945 19,250 7,466	30,661
2	Railway · Double Truck · Single Truck	(Km)	408 3,245	3,563
3	Inland Waterways	(Km)	6,600	6,600
4	Ports · Main Yangon Ports · Other Ports	(No)	2 8	10
5	Airport · International · Regional	(No)	7 55	62

Source: Central Statistical Organization

ii) Road/Bridge

According to statistics in 1998, Myanmar had a total road extension of 30,661 kilometers. Paved roads, however, are limited to between Yangon and Mandalay and from Mandalay to the border with the People's Republic of China (constructed with an aid of both fund and technology from the PRC). Most of the rest of the roads (88%) have remained unpaved. In the rainy season, some unpaved roads hinder traffic. Over the Ayeyarwady River that separates the country into two, there was only one old bridge (constructed during the colony days), which connected Mandalay with Sagaing Prefecture. Another bridge, however, which connects the city of Pyay with Rakhine Prefecture was constructed by the Ministry of Public Works at its own expense last year. Additionally, in 1992 a bridge connecting the Yangon River with the Thilawa area was completed under non-reimbursable cooperation by the People's Republic of China.

**The roads are classified as follows:**

- a) National routes under the jurisdiction of the Ministry of Public Works (PW)  
(24,225Km), and
- b) Local roads under the jurisdiction of Territorial District Committees (TDC)  
(6,436Km).

The road network is arranged in harmony with the networks of railways, rivers and airways, reflecting the topographical features peculiar to Myanmar. The road network has its routes concentrated around two big cities, with a national route located at the center of the network, communicating the country's capital, Yangon, with Mandalay, the second largest city in the central region. Local roads have been constructed and built up with the labor offered by the nation's inhabitants. This system is such that stones are crushed and laid over the road.

This, however, has improved a significant portion of local roads.

**Table 6-21 Road Length and Paved Share: 1999 (%)**

	Myanmar	Thailand	China	Vietnam	Philippine	Indonesia	Malaysia	Asia/P
T.Road 1000 Km	28.2	64.6	1,526	93.2	199.9	386.0	65.0	-
Paved (%)	12.2	97.5	-	25.1	19.8	46.3	75.8	45.4
Car/1000	2	106	8	-	31	25	200	35

Source: World Development Indicators: 2001

Paved roads, however, have only reached 12.2%, lagging far behind in comparison with other Asian countries. Since the infrastructure funds available to the Government are limited, the Myanmar administration has started to construct parts of road between Mandalay and Yangon, using private sector's funds since last year. Under the current circumstances, however, it is difficult to predict to what extent the road construction will make progress in the future, with private sector funds.

### iii) Railway

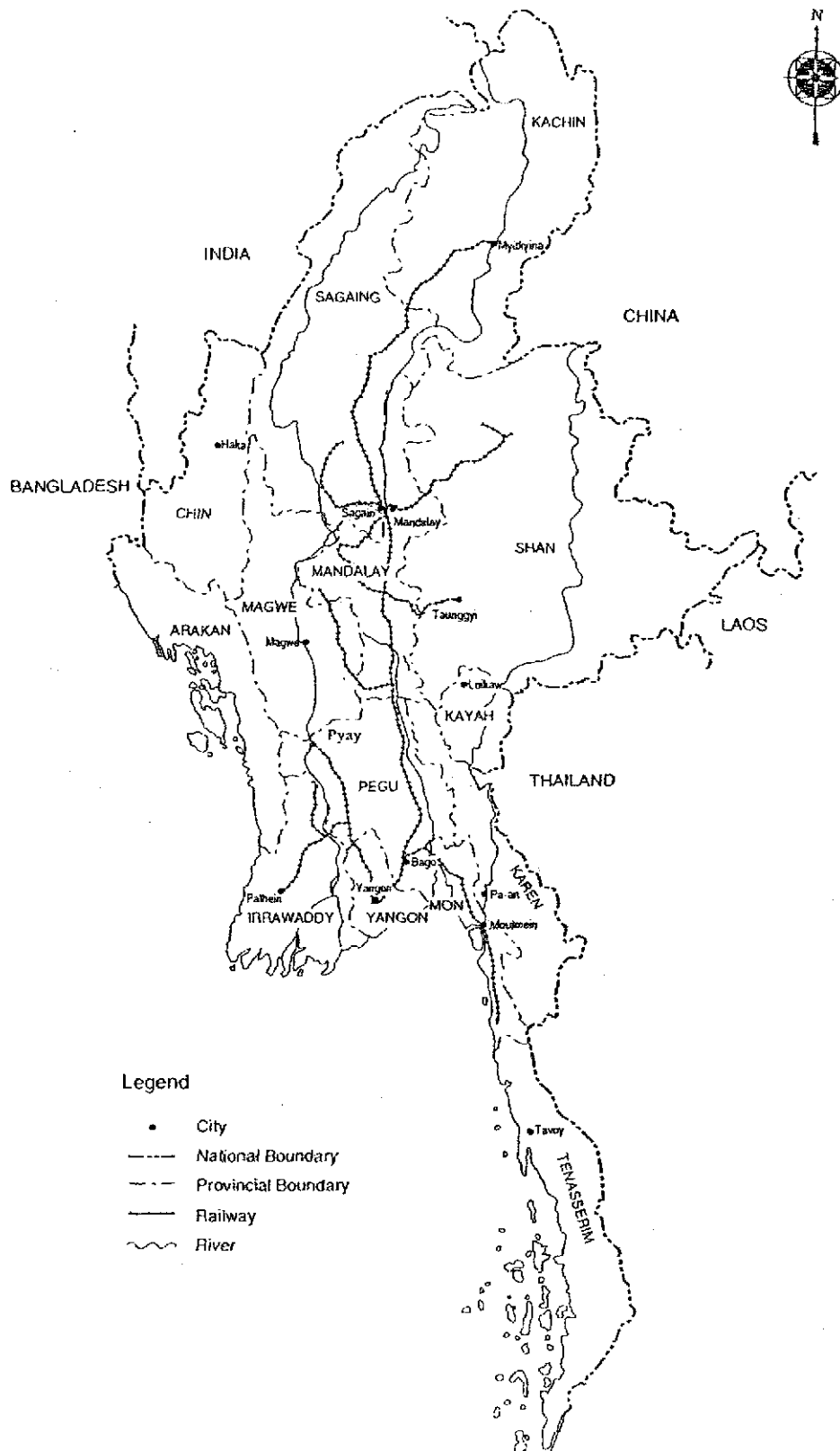
#### **History/Outline**

Since the second half of the 19th century, railway transport has turned out to be the most important traffic means for Myanmar. In 1877, the first railway in Myanmar was put into service between Yangon and Biei. In 1896, it was extended to Mandalay. At present, the north-south trunk line has intercommunicated principal cities, with several branch lines extended from the east to the west. The railway in Myanmar has a total extension of 3,888 kilometers, all subject to the narrow meter gage.

#### **Problems Involved in the Railway**

The railway transport sector has had both passenger and cargo services level off for the past five years (1992 to 1997). During that period, the railway transport demand has not increased although the economy has grown at 5% or 6%. In the most critical span of Yangon to Mandalay, all of the road, water and air transport services have turned out to be competitors for the railway. A complete set of comprehensive countermeasures is required for the railway to survive.

**Figure 6-22 Myanmar Railways Network System**



Source: Central Statistical Organization

- a) The tracks still use wood: Owing to an unsatisfactory repair, the railway permits trains to run at a mean vehicular speed of 35 to 40 kilometers per hour. This slow speed is a major problem in the system.
- b) Interlocked signals have been provided in 43% of the existing (131) stations. Since they have not been maintained properly, however, signaling often fails to function under unfavorable weather conditions, if any. An increase in railway speed essentially requires modernizing the signaling system.
- c) Cars: Myanmar owns 311 locomotives, of which 48 are equipped with an electro-diesel engine and 129 with an hydro-diesel engine while keeping 43 locomotives still out of use. Half the freight car population and 70% of passenger cars have been used for 45 years or more. It is a big challenge to modernize the railway cars, including the locomotives.
- d) Service: The railway in Myanmar was managed as a state-owned entity in the past. Similarly to the railway in other countries, it may be safely said that the sector was conducted as a load-like business in carrying passengers. With roads, airways and waterways privatized, competition has begun to be improved in rendering services. In the future, it is important not only to modernize the railway equipment and materials but also to improve services so that the railway can survive.

For future development strategies, it is necessary for the railway to increase speeds while improving services as well. Increase in service speeds would require modernizing all of the equipment, materials, tracks, signaling and locomotives. With funds running short, it is impossible to make a significant investment. From a short-term point of view, therefore, it is necessary to make the railway competitive against another traffic modes while trying to increase the speed and improve the services through a review of the scheme, a rationalization of train services and an improvement of administration/management.

From a medium-term point of view, a development plan is now in progress across the border between Thailand and Myanmar, extending the railway up to Tavoy located at 200 kilometers to the west of Bangkok. In the future, the connection is to be extended to Kanchanaburi in Thailand, where it is to be connected to the Thai railway.

#### Railway Sector's Organization/Management:

The railway in Myanmar is monopolistically managed by Myanmar Railways Enterprise (MRE) as a state-owned business entity under the Ministry of Transport.



**Table 6-22 Railways Sector Operation (Revenue and Cost, surplus/loss) in Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenue	564.2	2,777.1	3,234.0	5,324.3	6,456.1	6,408.0
Cost	475.9	2,580.5	2,797.1	4,359.8	6,591.1	6,606.5
Surp/Loss	+88.3	+436.9	+436.9	+964.5	-135.0	-198.5
% to Rev	+15.7%	+15.7%	+13.5%	+18.1%	-2.1%	-3.1%

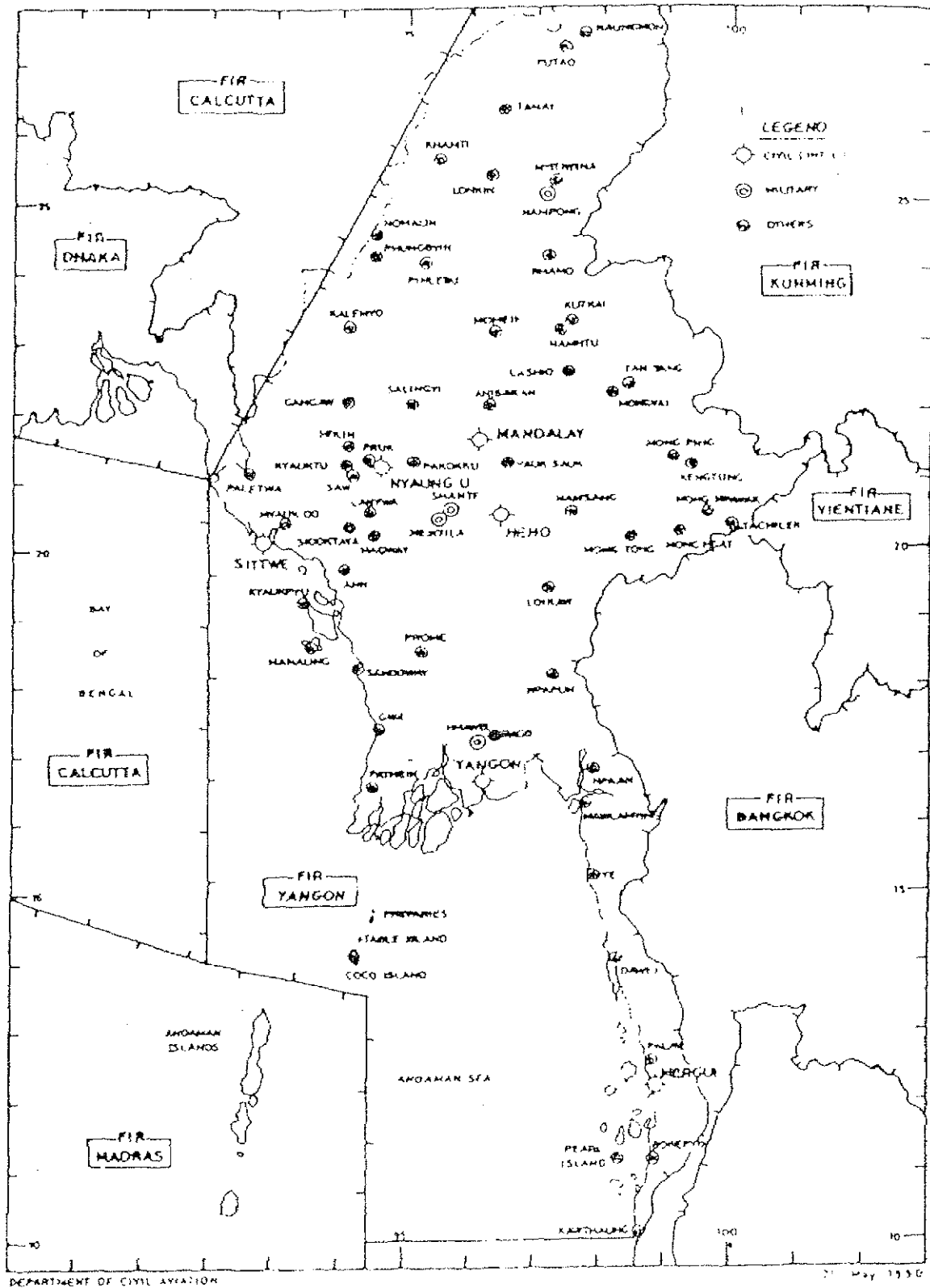
Source: Statistical Yearbook 2000

As shown in Table 6-22, the railway was in the black until 1997. Since 1998, however, it has been in the red.

iv) Airport/Air Service:

The Department of Civil Aviation, an organization subordinate to the Ministry of Transport, has control over the entirety of the services in Myanmar's airports and airlines. Since 1989, when the Myanmar Government adopted a liberalization policy, economic activities, such as foreign investments, trade, tourism, etc. have begun to be activated, and coupled with such trends, international and domestic airline services have been additionally available while new routes have been opened. As a result, a rapid increase has been seen in both air cargo and passengers. In 1992, there were 20,000 tourists only; the number rapidly grew to 250,000 in 1996 and 290,000 in 1998. Recognizing that the airport is an important gateway to attract tourism and investors, the Myanmar Government placed emphasis on the construction of Yangon Airport in the capital city and of Mandalay Airport in the tourism base or second largest city in the country.

Figure 6-23 Airports in Myanmar



Source: Central Statistical Organization

a) Yangon Airport

Yangon Airport, which is being constructed under a loan from the OECF, had its construction project suspended after Myanmar's political confusion in 1988. The Japanese Government, however, restarted the airport construction in 1999. As a result, the airport terminal and the aviation control equipment have been improved. Only one runway of 2,400 meters (extended to 3,300 meters), however, makes it difficult for large-sized airplanes, such as jumbo jets or the likes, to be put into service. At present, airplanes up to the Airbus class can land and take off at the airport. Now, 187 flights/week are available, of which 70 belong to international airlines, while 10 airlines (Bangladesh, Biman, Silk Air, Thai Airways International, Malaysia Airlines System, Pakistan International Airways, China Airlines, Air China, India Airlines, Uni Air and Druk Airline) have extended their services into Yangon. From Japan, All Nippon Airways increased services between Kansai International Airport and Yangon by one flight a week. With low passenger occupancy, however, this flight was discontinued in 2000.

Until 1999, 940,000 passengers used airline services in Myanmar, of whom 520,000 were aboard international airlines. Those passengers who use Yangon Airport grew at an annual rate of approximately 2% from 1990 to 1999. Almost 100% of international airline passengers have been using Yangon Airport, which functions as the most important entrance to Myanmar for the time being.

b) Mandalay Airport

Mandalay International Airport No. 2 located in the second largest city of Myanmar was completed in 2000 as a modern airport that has a full-scale runway, second longest in the world or 4,200 meters long. Its terminals and aviation control equipment were constructed under financial support from Thailand's Thai Import-Export Bank amounting to US\$150 million. A modern eight-lane road has been completed up to the city of Mandalay distant by 30 kilometers from the airport, requiring less than 30 minutes to commute there. It is located near Pagan famous for its Buddhism temples and to the Tachilek plateau, too. It has the potential to become the entrance of tourists to the central region of Myanmar. There are few arrivals and departures to and from Mandalay International Airport, whose use is being now awaited. At present, however, investments in Myanmar have remained sluggish since the economic crisis in the region. In 1999, the number of passengers using Mandalay Airport amounted to 324,000 persons, all of who were domestic because no international airline has extended services there.

c) Bago-New Yangon International Airport

Since 1994, a long runway with the same extension as in Mandalay has been

progressively constructed at Bago, located 35 kilometers away in the suburbs of Yangon. In April 2001, construction of an airport terminal was started under funding by a Korean enterprise. Once the new Yangon Airport is completed, it will become a full-scale airport large enough for Jumbo jets to land and take off. Two or three years are scheduled for completion of the new Yangon International Airport.

### **Airline Industry**

Presently, there are four airline companies in Myanmar. Myanmar Airways is state-owned, covering 21 cities within the territory. In 1993, a joint venture with a Singaporean private enterprise (shared at 50,4% by the Myanmar Government) was established to incorporate Myanmar Airways International, currently covering seven international lines. In addition, Air Mandalay is operating domestic airlines mainly between Yangon and Mandalay under a joint venture of Myanmar Airway with a Singaporean private enterprise. Yangon Airways started as a private enterprise in 1997, currently operating domestic airlines. In 1999, the domestic airline market shares were broken down into Myanmar Airways at 56%, Yangon Airways at 24% and Air Mandalay at 20%. In 1999, the three companies operating domestic airlines had a total of 686,000 passengers.

### **Airport Issues and Development Strategies:**

Myanmar has a broad national territory. To promote the modernization of industries from now on, it is essential to modernize the aviation sector. To date, Yangon and Mandalay Airports have been modernized; it will be necessary in the future to modernize another 5 international and 57 local airports. Especially, it will be important to modernize airports in sightseeing areas such as: Pagan, kyaupyu, alongside the Bay of Bengal, and Dawei, close to the border with Thailand. Airports other than Yangon and Mandalay both recently or about to be modernized are equipped with a road or aviation security systems problematical in terms of both performance and reliability. It is urgently necessary to improve the old-fashioned equipment and facilities so that aviation safety will improve. These issues have often caused local airline services to be suspended, lacking in reliability.

**Table 6-23 Air Transportation: Passengers, Cargo and No of Aircraft: 1999**

	No of Aircraft Dep. 1000	Passengers Carried, 1000 ton	Air Cargo Million Ton-Km
Myanmar	11	537	6
Thailand	95	15,951	1,671
China	93	5,188	1,139
Vietnam	29	2,600	99
Philippines	36	5,004	241
Indonesia	135	8,047	362
Malaysia	165	14,985	1,425
Asia/Pacific	1,350	136,788	-

Source: World Development Indicator: 2001

An international comparison relating to airports tells us that Myanmar has significantly lagged behind other infrastructure sectors. In order to achieve the level prevailing in ASEAN member countries under Vision 2020, it will also be necessary to make a lot of investments in the airport/aviation sector.

#### v) Harbor and Inland Water Transport

Myanmar has ten harbors, The Yangon Port (river harbor) is the most important as a cargo front entrance through which 90% or more of the international cargoes are passing. In Thilawa, located 20 kilometers to the south of Yangon Port, a harbor with ten berths was developed in 1999 with an investment made by a Singaporean enterprise (on a BOT basis). In the area located on the backgrounds of this port, a 2000-hectare coastal complex is to be developed. Modern cranes are being installed so that the port can be expected to become a crucial substitute port to Yangon Port.

Among the local ports and harbors occupying 10%, Kawthaung is the largest, located on the south border with Thailand, where marine products and consumer goods are traded with Thailand (estimated takeover: approx. 500 thousand tones a year). In other ports and harbors, cargoes are being handled at a low level: 10,000 tons a year at Kyaupyu, Thandwe and Pathein, about 50 thousand tons at Sittwe, Maliwun and Myeik, and 50 thousand tons a year in Dawei on the east coast.

The most critical problem for ports and harbors in Myanmar is the fact that both Yangon and Thilawa Ports only permit 10,000 to 12,000 ton class ships to enter. And they cannot pass Yangon Port without waiting for a favorable tide. This is one of the factors causing Myanmar to lose international competitiveness of domestic products, while requiring both cost and time. That is, neither port is satisfactory as a modern port or harbor. Besides, Yangon River is narrow in width and will be filled up with ships entering and departing once the port cargo volume reaches 20 million tons a year. It will be necessary to construct a port facing the ocean. At present, one can envisage the construction of ports to the west and east of Yangon.

#### **Inland Water Transport:**

In Myanmar, inland water transport has been used as a traditional traffic means. Even now, it still plays an important role in handling (a maximum of) 42% of cargo haulage. The waterway is laid out along the Ayeyarwady River, with a navigable watercourse extension reaching 6,600 kilometers. Bhamo at 300 kilometers of the border with the People's Republic of China is located 1,600 kilometers upstream of the river mouth. Nevertheless, it has sufficient water depth to allow a 1-meter deep ship to navigate throughout the year. In the rainy season, the water gets deeper, thereby allowing a 5000DWT class vessel to navigate up

to Mandalay. The problem is a drastic variation of the water depth between dry and winter seasons. As a result, periodic transport services are unavailable in the river. The coastal services are managed by the Inland Water Transport Enterprise, a state-owned company, and a private company. The state-owned enterprise, however, is unable to purchase ships due to lack of budgetary appropriations. Consequently, an increasing number of private enterprises have made inroads in the industry section where the privatization level is most advanced. The most serious problem is the fact the Waterway Department, which must maintain and control the inland waterways, is not in a position to maintain and control them properly. Corrective action needs to be taken urgently, considering that the waterway maintenance/control is a service essential to safety and indispensable for the largest possible number of ships to circulate.

## **6.2 Industrial Location and Industrial Estate Program in Myanmar**

### **(1) Historical Industrial Location Trends and Development of Industrial Estates**

- 1) Until the opening of the Myanmar's economy in 1988, Myanmar was isolated and followed a socialist economic system for nearly three decades. Therefore, most of industry was nationalized and belonged to the government as state-owned enterprises (SOE), which were located in many sites mostly in the Yangon to Mandalay corridor.
- 2) The private sector was limited to relatively small food processing, traditional artifacts, household and agricultural tools, textiles and repair services located in the urban area mixed with shops and housing until 1988.
- 3) Since 1988, liberalization measures and new regulations were introduced to achieve a significant industrial investment and production by persuading private sector participation and foreign investment (FDI). In 1988, the Union of Myanmar Foreign Investment Law was enacted and followed by the Private Industrial Enterprises Law in 1990 and the Cottage Industries Promotion Law in the following year (1991).
- 4) In order to accommodate the increasing number of private industries, the first industrial estate was built under the supervision of National Industrial Promotion Committee (NIPC) in 1992. Then, Myanmar Industrial Development Committee (MIDC) was established in 1995 for promoting industrial development and taking strong measures to develop more industrial estates in the whole country for the purpose of accommodating the private sector (mainly SMEs ).
- 5) So far 19 such industrial estates supported by MIDC were developed and another 10 industrial estates were developed by the Department of Human Settlement and Housing Development (DHSHD) of the Ministry of Construction. Furthermore,

several new IE (9) are currently under a DHSHD implementation process. The Ministries of Industry 1 and 2 have also started to develop their own industrial estates and started to relocate their new factories.

- 6) MIDC's Central Committee intends to have more industrial estates developed nationwide together with the private industry under MIDC supervision. Under the current MIDC policy, the private industry seems to have no choice but to locate in industrial estates.
- 7) Industrial estates have been quickly developed in the past 10 years from zero to about 30 (4,000 Ha) accommodating the rapidly growing private industry. Since the industrial estate sites are the only place to locate private manufacturing industries in Myanmar now, an expansion in number and improvement of quality plus diversification to meet various needs of industries are needed in the future.

## (2) Existing Conditions of Industrial Estates

The Industrial Estate (IE) concept is relatively new to Myanmar. The first IE was developed merely 10 years ago and by now 28 IEs have been developed and 9 new IEs are under construction. Additionally, the Ministries 1 and 2 have started developing their own industrial estates for SOEs.

### 1) Yangon Area

Yangon Area provides the most favorable conditions for industry due to its proximity to key infrastructure such as port, airport, railway and highways plus the best supply of both skilled and unskilled workers. The first industrial estate in Yangon was started from Dagon (South), and now up to 7 industrial estates have been completed (2,676 Ha) with 9 additional industrial estates under implementation (1,952 Ha).

The DHSHD was a leading organization for the development of all industrial estates in the Yangon Area and there are three approaches to industrial estate implementation:

- i) Implementation by DHSHD: 5 are completed and 3 are under implementation,
- ii) Joint implementation with private sector: 6 are under implementation, and
- iii) Joint implementation with foreign companies: 2 are completed, 1 by Japan and another by Korea.

**Table 6-24 Industrial Estate in the Yangon Area: 1992-2002**

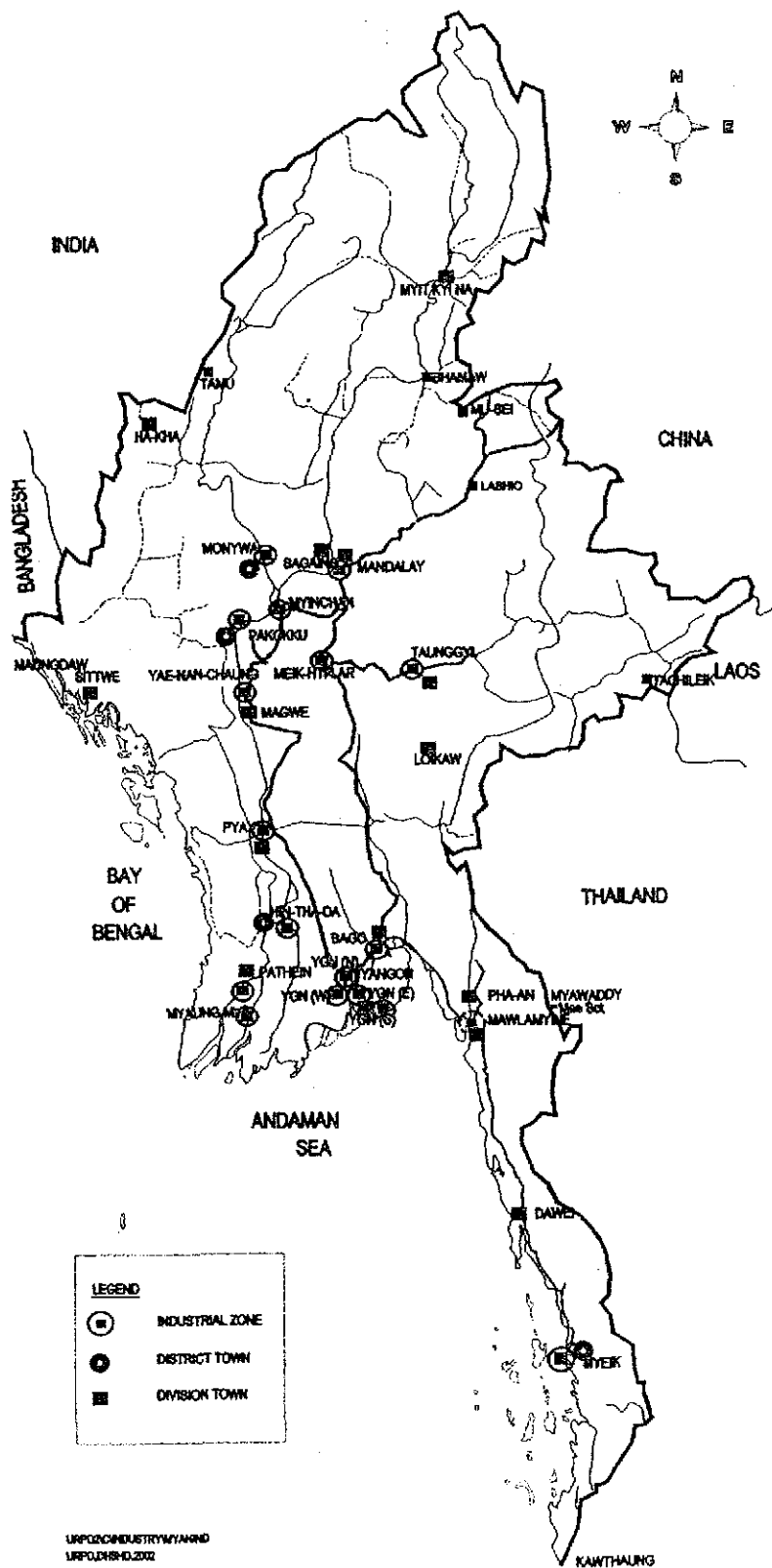
	Completed (1999)	Under Construction	Total
DHSHD Alone	5	3	8
DHSHD and Private	0	6	6
DHSHD and Foreign	2	0	2
Total Area (Ha)	7 ( 2,676 Ha)	9 (1,952 Ha)	16(4,78Ha)

Source: DHSHD

Yangon is by far attracting the largest number of industrial estates indicating that the Yangon area is the most popular industrial location in Myanmar. Especially now, the private participation is welcomed by the Government and 6 new industrial estates are under construction in a JV between the DHSHD and the private sector. The total area is likely to reach nearly 5,000 hectares, which is likely to be sufficient for the near future as far as the land area is concerned. However, the quality of industrial estates still needs to be improved.

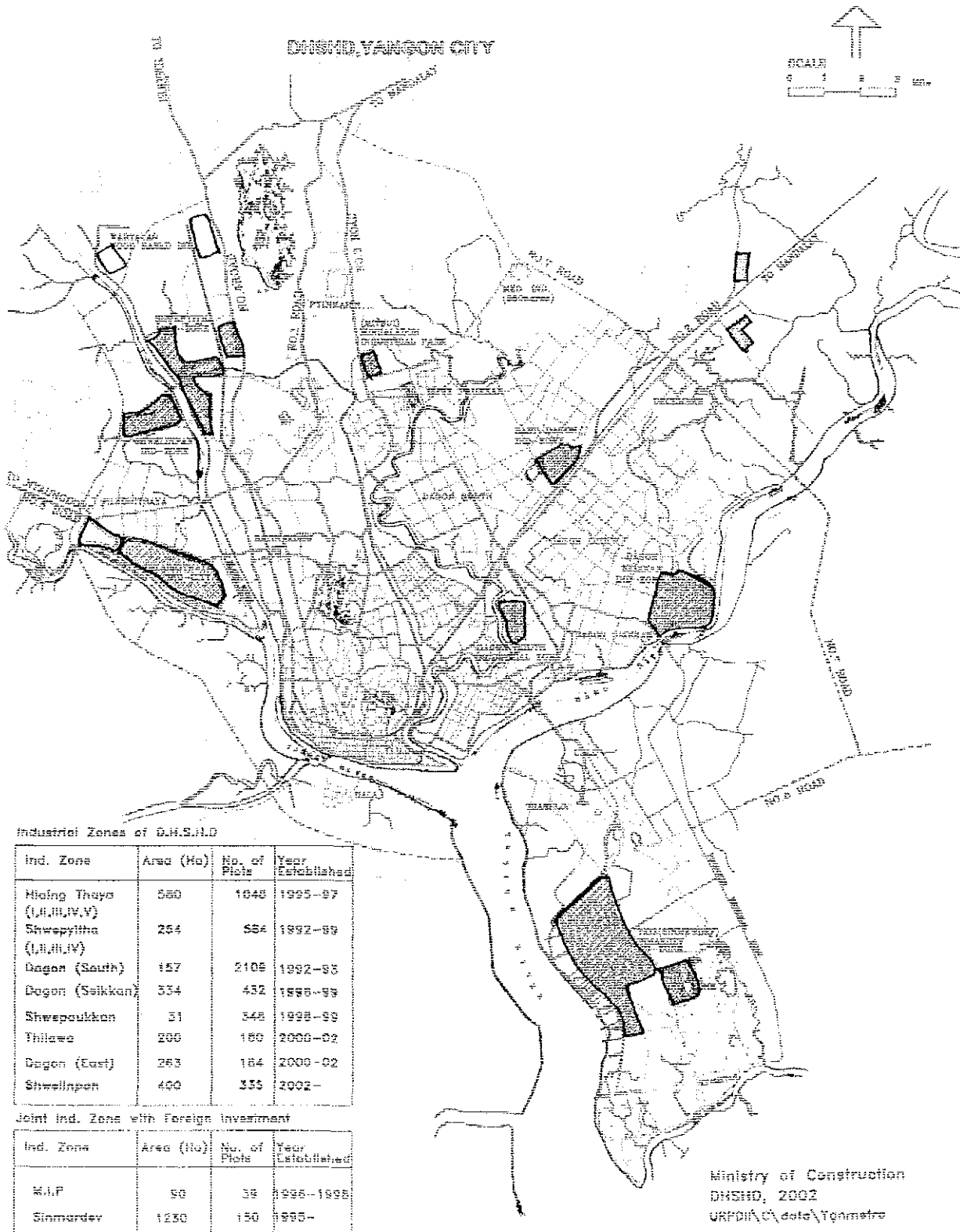


Figure 6-24 Industrial Zones in Myanmar



Source: Central Statistical Organization

Figure 6-25 Location Map of Industrial Zones



Source: Department of Human Settlement, Housing Development

Table 6-25 Industrial Zones under MIDC

Sr. No.	MIDC Industrial Zone	State/ Division	Name of Zone	Year of Establishment	Area (acre)	No. of Industries
1	Yangon East District	Yangon Division	(a) South Dagon Industrial Zone-1	1992	475.354	128
			(b) South Dagon Industrial Zone-2	1992	203.784	525
			(c ) South Dagon Industrial Zone-3	1995	35.280	371
			(d) North Okkalapa	1999	109.789	115
			(e) South Okkalapa	1999	25.000	98
			(f) Shwe Paukkan	1992	94.640	72
			(g) Yangon Industrial park	1998	404.000	30
			(h) Mingaladon Industrial Park	1992	180.000	10
			(i) Thakayta	1999	200.000	82
			(j) Dagon Seikkan	2000	1208.695	24
2	Yangon West District	Yangon Division	Yangon West District Industrial Zones		191.000	-
3	Yangon North District	Yangon Division	(a) Hlaing Thayar Zones 1,2,3,4,5	1995	986.540	216
			(b) Shwe Pyithar Zones 1,2,3,4	1990	306.976	101
4	Yangon South District	Yangon Division	Yangon South District Industrial Zones		191.000	1075
5	Mandalay	Mandalay Division	(a) Industrial Zone-1	1990	809.510	661
			(b) Industrial Zone-2	1997	137.000	333

Sr. No.	MIDC Industrial Zone	State/ Division	Name of Zone	Year of Establishment	Area (acre)	No. of Industries
6	Myingyan	Mandalay Division	Myingyan Industrial Zone		163.590	306
7	Meiktila	Mandalay Division	Meiktila Industrial Zone	1997	385.450	81
8	Monywa	Sagaing Division	Yenangyaung Industrial Zone	1992	296.700	490
9	Yenangyaung	Magwe Division	Yenangyaung Industrial Zone	1998	98.810	137
10	Pakokku	Magwe Division	Pakokku Industrial Zone		321.000	448
11	Bago	Bago Division	Bago Industrial Zone		191.000	35
12	Pyay	Bago Division	Bago Industrial Zone	1992	68.000	124
13	Patheingyi	Patheingyi Division	Patheingyi Industrial Zone	1993	191.000	326
14	Myaungmya	Ayeyar-Wady Division	Myaungmya Industrial Zone	1993	101.650	58
15	Hinthada	Ayeyar-Wady Division	Hinthada Industrial Zone		191.000	482
16	Myeik		Myeik Industrial Zone		191.000	153
17	Yangon	Southern Shan State	Aye Tharyar Industrial Zone	1999	287.000	342
18	Mawlamyine		Mawlamyine Industrial Zone		162.400	326
19	<b>Total</b>				<b>7058.000</b>	<b>7467</b>

Established By Department of Human Settlement Housing Development (DHSDH)

Assumptions: 2, 4, 11, 13, 15, 16 are assumed to be 191 Acre.

Source: DHSDH

## 2) Regional Industrial Estates (Outside of the Yangon Area)

- i) Mandalay is the second largest urban area and accommodates three industrial estates with a total area of 1,495 Acre (745 Ha). 1,381 factories are located in these three industrial estates. The types of industries in the Mandalay industrial estates are mainly automobile re-construction workshops (300), woodworks and food processing.
- ii) Other regional IEs are located in 11 different provinces and several regional industrial estates are under consideration (shown in the Appendix 1). These regional industrial estates are mainly accommodating local SMEs and cottage industries such as food processing, woodwork, agricultural tool making and tool repair shops.

### iii) Ministry of Industry Industrial Zones

Since the year 2000, the Ministries of Industry 1 and 2 are developing relatively large-scale industrial estates to accommodate their own SOE factories. This is a new approach by the Ministries 1 and 2. Previously each factory was located separately outside of an industrial zone or estate. Currently two new industrial estates (zones) are been developed and still new factories are under construction in those zones.

Brief information on the two industrial zones is given below:

#### A. The Ministry of Industry 1 Industrial Estate:

- a) Area estimated 400 Ha.
- b) Starting year: 2001
- c) Type of factories: 12 factories shown below:

Sewing machines, shoe factory, marble factory, fire trucks factory, agro machinery factory, bicycle factory, plastic factory, blanket factory, garment factory, cement factory and knitwear factory

#### B. The Ministry of Industry 2 Industrial Estate

- a) Area 150 Hectar
- b) Starting year: 1998
- c) Type of Factory:

Motor spare parts, agro machinery factory, multipurpose diesel engine factory and HT cable factory are located in the Ministry 1 industrial estate.

It seems that the Ministries 1 and 2 are together implementing 20 new industrial projects currently and foot-free SOE industries. These projects are likely to be located in industrial zones since it is easier to provide necessary supporting infrastructure and also easier to provide services as well.

## 3) Total Industrial Estates in Myanmar

Based on our estimation shown in Table 6-26, the total land area is 8,158 Acre (3,700 Hectare), which is distributed rather evenly with 49% in the Yangon Area, 21% in Mandalay

and 30% in the regions. The total number of factories in the industrial estates is 7,527 and also they are evenly distributed as 43% in the Yangon Area, 18% in Mandalay and the remaining 41% in the regions. However, the large majority of workers by far reside in the Yangon area (83%) followed by the regions (10%) and Mandalay (7%) due to the difference in the size and level of manufacturing.

**Table 6-26 Number, Factory and Worker in Industrial Estates in Myanmar 2002**

	No Area*(Acre)			No of Factory		No of Worker	
	Shear (%)			Shear (%)		Shear (%)	
Yangon Area	13	3,463	49%	3,190	43%	510,400	83%
Mandalay	3	1,495	21%	1,381	18%	41,430	7%
Region	11	2,100	30%	3,079	41%	61,580	10%
Total (MIDC)	27	7,058	100%	7,492	100%	620,910	100%
Ministries land2	2	1,100		35		n.a.	
Grand Total	29	8,158		7,527		n.a.	

Note\*: 5 new industrial estates are included in this Table.

Source: DHSHD, MIDA and Estimated by Consultant:

Assumptions: About 160 workers in the Yangon area, 30 workers in the Mandalay area and 20 workers in the regions based on several samples.

Factories located in the Yangon area are larger, much more modern and sophisticated compared to Mandalay and the regions. Especially, the regional industries are mostly food processing, woodwork, repair services and tool making and the size of industry is relatively small (SMEs) or even cottage industry level.

Locating manufacturing industry in industrial estates has been practiced in all Asian countries and China for the past two decades very successfully. Finally Myanmar is following a similar path to the other Asian countries to locate its industries in industrial estates and we expect this tendency to be further strengthened in the future because the MIDC is trying to force private industries to move into industrial estates. Actually the MIDC policy is a good policy since it will reduce cost of providing industrial infrastructure and it is likely to speed up the industrial development process if the standards of industrial estates are kept at a high level, attractive enough to investors. Also more importantly, attracting industries in industrial estates makes environmental control casier in the future instead of individual spreading.

### (3) Myanmar's Industrial Estate Development Major Problems

Myanmar has successfully developed nearly 30 industrial estates from nothing in just a

decade. However, legal status is completely lacking and the quality of industrial estates is not good enough to support healthy industrial development.

The key problems are as follows:

- Poor and lacking physical facilities and services
- Lack of legal status for industrial estates and locating factories
- Lack of autonomous authority for managing industrial estates
- Limited types of industrial estates to meet the needs of the private sector

#### 1) Poor and Lacking Physical Facilities and Services

Unfortunately all of the IEs are faced with electric power shortages and nearly all factories are required to purchase their own generator in order to operate. Compared with most of the industrial estates in Asian countries and China, the facilities and services available in Myanmar's industrial estates are very low and sometimes even missing. Shortages of electric power supply are not the only infrastructure service problem but also other facilities and services are missing or in limited supply, such as water treatment facilities and communication facilities, especially in the regional industrial estates. Also internal roads, drainage, administration offices are normally in poor condition compared with the other Asian industrial estates.

Forwarding service, banking, insurance, post and courier services and other supporting services are in most cases missing. In a large number of industrial estates the land was divided with minimum access roads, water supply (not all of them have a common water supply system), power supply (frequent blackouts) and a small office for management purposes. Quite often, various commercial facilities, which support located factories, do not exist or are in limited numbers. The best industrial estate in Myanmar is the Mingaladon IE developed jointly by a Japanese company and DHSDD. All basic physical facilities such as water supply, wastewater treatment plant, drainage, electric power and telephone lines and the administration office with supporting staffs are available. Mingaladon IE is the only industrial estate equipped with a wastewater treatment system. However, even in the Mingaladon industrial estate, the electric power supply is not sufficient, and other commonly available services are missing due to the limited number of industries located in the vicinity.

#### 2) Lack of Legal Laws and Regulations for Industrial Estates

So far, no laws and regulations have been established for industrial estate in Myanmar unlike in other countries in Asia and China. Because of this lack of laws and regulations, these industrial estates must follow the Ministry of Industry 1 Directives and Standing Orders and local development committees' laws and regulations. These three regulators tend to create

*frequent changes in rules and regulations and interventions in the factories operating in the industrial estates. All other countries in Asia and China have already independent laws and regulations for industrial estates, which tend to provide a stable favorable condition for operating industrial estates and factories located in these estates.*

### 3) Lack of Autonomous Authority for Managing Industrial Estates

In Myanmar, each industrial estate has a small managing staff (one or two persons, often part-timers) but there is no central organization to formulate a policy and manage the industrial estates. In other Asian countries, a strong autonomous authority manages the industrial estates. For Example, the Industrial Estate Authority of Thailand (IEAT) manages all the industrial estates in Thailand; while in the Philippines, the Philippines Economic Development Zone Authority (PEDZ) manages industrial estates. Either Prime Ministers or Presidents head these authorities, and key ministers are members of the managing boards. Since the development of industrial estates is the most effective tool to promote both domestic and foreign direct investment, nearly all Asian countries have given top priority to develop and manage industrial estates nationwide, which provides a one-stop-window service allowing inventors to get all necessary government permits from the authority. Also because of the various infrastructures, services and amenities needed for successful industrial estates, the authority needs an efficient and strong coordinating capacity. At the moment, the management organization is too weak and unable to manage, coordinate and promote investment in Myanmar.

### 4) Limited Types of Industrial Estates to Meet the Needs of the Private Sector

All countries have developed various types of industrial estates in order to promote various industries such as Special Economic Zones (SEZs), Export Processing Zones (EPZs), Technical Promotion Zones (TPZs), Heavy Industry Zones and General Industrial Zones (GIZs) or mixes of a few functions. It is important to select the best types of industrial estate functions to meet the needs of each region. In Myanmar, the industrial estates developed so far are only of one type; mixed industrial estates catering mainly to SMEs for both export-oriented and domestic-oriented purposes. In the future, specialized industrial estates are badly needed to support the special requirements of various industries.

### (4) Experiences of Industrial Estates Development in Asia and China

The industrial estate concept was started to mainly accommodate foreign direct investment (FDI) in Asia. Manufacturing production facilities have gradually been shifting from industrial countries to developing countries starting from Korea and Taiwan in the 1960s,



ASEAN countries from the 1980s, China and Vietnam from the 1990s. The speed of this industrial shift especially accelerated from the middle of the 1980s due to the rapid globalization and the collapse of the Socialist system. In order to accommodate large numbers of manufacturing industries in Asian developing countries, the use of Special Economic Zones (SEZs) became normal practice.

The SEZ system is necessary and is the best system for developing countries because normally the infrastructure, business services and legal systems were not good enough for the modern manufacturing industry to operate smoothly. Improving a whole nation's infrastructure, other services and legal system is a greater task that takes a long time to be brought to international standards; however, developing limited small areas of SEZs can be developed in a short time and at a small cost. Nearly every country in Asia has adopted the SEZ system and successfully attracted FDI.

#### 1) Types of SEZs used and Number Developed in Asia and China

##### i) Free Processing Zones (FPZs)

- Export Processing Zones (EPZs) mainly processing export-oriented manufacturing products: Cavite's EPZ in the Philippines, Posen's EPZ in Korea and Lat Crabbing in Thailand.
- General Industrial Estates (GEEs) processing local materials and/or import-substitution products:
- Combined EPZs and GEEs for domestic oriented industries. Many ASEAN industrial estates are of this type.

##### ii) Free Trade Zones (FTZs)

- Duty and other taxes are zero or reduced within the FTZ area and used for expansion of trade with surrounding countries or regions. For example: Panama's FTA, Abdudabi's FTZ, and several FTZs build by China along its borders with Russia and Kazakhstan.

##### iii) Special Economic Zones (SEZs)

- SEZs combine all of the above functions as well as allowing a wider range of economic activities under tax-free and/or flexible conditions. The type of activities include manufacturing, trading, finance, tourism and even agriculture. Normally large areas (a few sq. Kms to 500 sq. Kms). For example: 4 SEZs in China, the Cubic Bay SEZ in Philippines, and Batam Island SEZ in Indonesia and Langkawi Island SEZ in Malaysia.

In Asia, the SEZ concept had been widely used to attract foreign direct investment (FDI)

very successfully. Especially after the Plaza Agreement in 1985, the number of SEZs in Asia increased rapidly, and infrastructure, services and legal conditions have improved significantly. 80-90% of the FDI and local industrial investment in Asia have been attracted by SEZs. A rough estimation of the SEZ and FDI ratio is given below:

**Table 6-27 SEZ and FDI in Asian Countries (1986-1997: in Million US\$)**

Country	No of SEZs	Amount of FDI
1. China	120	398,390
2. Indonesia	93	111,086
3. Thailand	35	66,475
4. Malaysia	32	36,630
5. Philippines	35	8,314
6. Vietnam	30	27,311
Total	325	548,206

Source: Estimated by Japan Development Institute (JDI)

China was the most successful country to use the SEZ concept as a tool to attract FDI first and later on even domestic investment. China in the past 20 years, developed 120 SEZs starting from just 4 SEZs in the early 1980s, it attracted US\$ 398 billion of FDI during the 1986 to 1997 period alone. Indonesia was a latecomer and seriously started developing high quality SEZs from 1989 and in a short time; Indonesia successfully developed 93 SEZs and attracted US\$ 111 billion of FDI. Followed by Thailand (35 SEZs with US\$ 66 billion), Malaysia (32 SEZs with US\$ 36 billion) and even Vietnam joined the trend and developed SEZs in the early 1990s and quickly attracted FDI (30 SEZs with US\$ 27 billion).

#### (5) Myanmar's Future Industrial Estate Program (MEDZ Program)

Since the existing industrial estates are not high quality estates and lack necessary legal frameworks and regulations as well as many essential facilities services, the Myanmar Government has been studying a more high quality and attractive industrial estate program in 2000 assisted by Japanese experts dispatched by the Japan Overseas Development Cooperation (JODC). A special committee was formed on the Myanmar side headed by Minister in charge and 5 committee members were selected from key infrastructure related ministries.

The study recommended that Myanmar develop 44 high class and attractive industrial estates in various categories (Large Special Economic Zone Type, SME Industrial Zone Export-Oriented and Import-Substitution Oriented or Mixed One), Free-Trade Zones near the borders, Tourism Promotion Zone, and Resource based Zone). Since these industrial zones

are trying to promote Myanmar's economic development, they decided to call these industrial estates Myanmar Economic Zones (MEZs), which is the same concept as the Philippines Economic Zones (PEZs) in Philippines.

**Table 6-28 Proposed Myanmar Economic Zones (MEZs) Program: 2000-2020**

	Existing	New	Total Area (Ha)
1. Large MEZs	1	5	12,000
2. SME MEZs	18	2	3,000
3. Trade MEZs	0	5	500
4. Tourism MEZs	0	3	1,500
5. Resource MEZs	0	10	500
Total	19	25	17,500

Source: Implementation Study for Myanmar Economic Zone Development from JODC

The Myanmar Economic Zone (MEZ) Program was intended to break through the current "Vicious Cycle" by quickly providing an attractive environment for investors both domestic and FDI in various sectors, sizes and locations. The MEZ Program was intended to revitalize the Myanmar economy in the shortest time at a minimum cost by concentrating the necessary infrastructure to several MEZ areas. This method has been widely used in Asia and China, and Myanmar is also likely to benefit from this largely proven successful method.

Economic progress will take place only if new investments are made, especially Foreign Direct Investment (FDI), which is one of the key elements to shaping up economic development in the whole world. FDI is also likely to bring many benefits to the country such as new products, new jobs, new technologies and new management skills.

#### (6) Usefulness and Effectiveness of the Proposed MEZ Plan

Because of the poor infrastructure (especially electric power and telecommunication services), various regulations hindering normal business operations (such as import and export regulations and multiple foreign exchanges), and weak services related to international business operation, the investment environment in Myanmar is not attractive to most foreign and domestic investors. Therefore, Myanmar should start its MEZ program immediately, creating highly attractive MEZs so that the country can attract more FDI, in spite of the current difficult conditions.

The best place to develop MEZs is within the Yangon area, especially utilizing existing industrial estates such as Thilawa, Hlaing Thaya, Mingaladon and a few on-going industrial estates. Upgrading the existing industrial estates to internationally accepted standards will be the best solution for this time. For the short-term, export-oriented MEZs should be given

priority. Later, a shift to more import-substitution oriented MEZs or mixed MEZs should take place.

#### (7) Expected Merit and Requirements of the MEZ Program

The obvious merit of the MEZ is clear. Myanmar would be able to attract more FDI and domestic investments even under the current difficult situation. The MEZ Program combined to an emergency power supply program should improve the situation drastically. The proposed MEZ program should improve Myanmar's investment environment significantly in a short time (say less than one year) and probably enable the nation to break through its current economic "vicious cycle".

##### 1) Necessary Facilities and Functions for Successful MEZs

In view of the existing limitations of international level infrastructure, services and legal status, the proposed MEZs should include the following functions and facilities:

- i) All of basic infrastructure: electric power, telecommunications, water supply and wastewater treatment facilities,
- ii) Basic services, banking, post office, DHL, insurance, forwarding services, in the commercial zones within the MEZs or in nearby locations,
- iii) Training centers for workers within the MEZs,
- iv) Custom office services and forwarding services, and
- v) MEZ administration offices and maintenance services functioning as one-stop windows for various permits.

##### 2) Possible Impact of the Short Term MEZ Program (2002-2005) in Myanmar:

- i) Type of Industries: light industries: garments, footwear and shoes, toys, machinery and electronics parts production in the early stage.
- ii) A MEZ converting 5 existing industrial estates (200 Hectares each) could attract 1,000 factories with an average of 500 workers: 500,000 workers after 5 years.
- iii) Expected FDI is US\$ 25 billion over 5 years assuming a US\$ 25 million investment in each factory.
- iv) Labor value added: Assuming US\$ 500 per year per worker, the value added will be US\$ 250 Million/Y.
- v) Plus supporting service industries and spillover effects are likely to indirectly create 100,000 new jobs, which may create an additional income of US\$ 50 million.
- vi) The total impact is: 600,000 new jobs, which represent a value added for Myanmar of US\$ 300 million.

We expect that once the economic development starts with the introduction of the MEZs

and exports start to increase, it will allow Myanmar to earn more badly needed foreign currency. Thus, the real wages are likely to increase to the current Chinese or Vietnamese level (US\$ 1,000 to US\$ 1,500 per worker per year) within 5 to 10 years. Within 5 years, due to higher wages, the value added is likely to increase to US\$ 600 Million from just 5 MEZs.

Myanmar is likely to benefit from a maximum annual income of US\$ 600 Million and 600,000 new jobs within 5 years and Myanmar may be able to increase its number of MEZs in the future, one by one. Assuming the experience of other ASEAN countries, Myanmar may be able to develop about 50 MEZs within 20 years. In the future, Myanmar workers' value added is likely to increase as manufacturing upgrades to assembly and processing industries.

### 3) Possible Impact of the Long Term MEZ Program: 2002-2020

Assuming that 50 SEZs will be developed successfully in the next 20 years, we expect the following results:

- i) Number of workers per SEZ to be 80,000: 3 Million Jobs.
- ii) Total value added: Assuming value added per one labor at US\$ 4,000 by 2020, the value added generated by the labor increase should be US\$ 120 Billion.

### (8) Necessary Conditions for Successful Myanmar MEZ Programs

- 1) Within the MEZs, separate business rules and regulations shall be applied specified by the MEZ directives, which should be as competitive as any other SEZs practiced in China and other Asian countries.
- 2) Land ownership/leasing regulations: Internationally competitive legal status and pricing. At least 50 years' leasing with extension options should be provided and land leases should be transferred to other buyers so that land can be used by collaterals for receiving loans.
- 3) Simplified permits for construction and operation of factories within MEZ areas. One-stop window system should be given to the MEZ Authority for the overall administration and management just as in other SEZs in Asian countries.
- 4) High quality infrastructure services: Under the current condition, MEZs need to have their own power generation system. Other facilities such as water supply, telecommunication service, wastewater treatment facilities shall be installed if not available.
- 5) High quality supporting services and living conditions within and surrounding areas. Banking, insurance, forwarding agencies should be located within or nearby the MEZs. Housing, amenities, shopping facilities should be available within commuting distance. In the case of the Yangon area, most of these necessary functions and services are likely to be available.

- 6) Investment Promotion: By both Government (MIC) and the MEZ Authority.  
Active promotions for attracting investors to MEZs are very important and nearly all of the agencies managing SEZs should actively promote investments.
- 7) Consideration of Environment: Minimizing the impact on the environment is becoming one of the most important factors nowadays. Environmental care is very important especially for foreign companies since, under international conventions, they must follow international environmental regulations even when operating in the developing countries.
- 8) Manpower skill training and upgrading: Since required skills in modern manufacturing industries are rapidly changing and continuous training to upgrade skills is necessary, skill training centers within the MEZs may be helpful to keep up with the changing technology. These types of training centers can be built with ODA funding.
- 9) Strong government commitment and support for the MEZ and willingness to continuously create competitive conditions by improving any shortcomings and problems. This is necessary since every one is competing against each other under the current market economy. In the end, the government desire to succeed is the key factor since the development of MEZs will require a strong political will to solve many problems and face the many obstacles that are related to the MEZ program.

(9) Necessary Actions for Materialization of MEZs in Myanmar

- 1) Prepare the MEZ Directive: the Philippines Economic Zone Development Authority (PEZA) Act is one of the best SEZ laws and we recommend Myanmar to use it as a base. We understand that the enactment of laws will take at least two to three years in Myanmar, however, we recommend that for the MEZ program, (Directives from MIC), should be considered because MIC can issue MEZ Directives authorized and supported by the Trade Committee and the SPDC Cabinet.
- 2) Establishment of the MEZ authority: This could tentatively be called the Myanmar Economic Zone Authority (MEZA), that will plan, develop and manage all of the META's in Myanmar. Already the Department of Housing and Urban Planning has been working on industrial estate planning and development. Myanmar may upgrade the Department to the MEZA.
- 3) Identify suitable sites among several existing and ongoing industrial estates within the Yangon Area between Thilawa and Yangon City or within a 20 to 30km area.
- 4) Identify possible joint venture partners locally and outside for MEZ projects. If possible, the MEZ should be financed by private investment as much as possible since private MEZs (with the MEZA Authority) are likely to provide better services

and attract more investors especially for FDI.

### **6.3 Infrastructure and Industrial Location: Key Issues and Problems**

#### **(1) Inherited General Historical Problems**

The infrastructure sector in Myanmar inherited and suffers old and inadequate infrastructure, fleets and facilities in addition to the highly centralized institutional and management system from the previous socialist government in the 1960's. The major reasons for the inadequate infrastructure stem from: (i) a shortage of investment capital resulting in the inability to finance needed projects; (ii) low revenues resulting from a system of irrational pricing which bears little relation to cost, (iii) a low level of taxation creating a chronic shortage of the capital investment and operating budget (causing a shortage of inputs, fuel, foreign exchange and spare parts); (iv) lack of market incentives to stimulate competition, spur output, and contain costs; and (v) a weak and highly centralized administration system creating weak or ineffective policies, planning and monitoring. We will discuss some of the above problems in more detail below.

#### **(2) Inherited Inadequate Infrastructure and Shortage of Infrastructure Facilities**

In Myanmar, infrastructure facilities are relatively old and inadequate in general due to limited infrastructure investment for many decades since the Second World War. After partial opening of its economy since 1988, new investment in infrastructure has been taking place in the past decade. In spite of the best efforts of the Myanmar government to improve the infrastructure, the inadequacy and shortage of infrastructure still exists and has been creating a serious problem for the healthy economic growth and the preservation of the well-being of its citizens.

After the opening of its economy, a few infrastructure sectors, especially in hotels, international ports (the Yangon Area) and airports (Mandalay and Yangon), have been improved significantly in the past several years. It was a good decision to improve these facilities since the sudden increase in foreign visitors and trade caused a severe shortage of these facilities in the early 1990's. Now these infrastructures are improved and even over supplied due to the slowdown of foreign visitors and trades.

As shown in Table 6-29, the infrastructure capacity and services have grown in several sectors above the real GDP growth such as the number of hotel rooms (increased by 5.9 times between 1992 to 1999), followed by international shipping (by 3.5 times), coastal shipping (by 2 times) and telephone (2.3 times). However, in some sectors, the capacity and/or services have declined during the same period, for example, the number of railway wagons (only 55% of 1992), the number of air cargoes (90% of 1992), and the remaining sectors have grown below the real GDP growth, which indicates worsening of the supply capacity.

**Table 6-29 Infrastructure Facility and Services Trends: 1985-1999**

Sector	85	92	93	94	95	96	97	98	99	2/99
Electrical	684	807	809	837	982	1033	1042	1055	1196	1.48
Po. MW										
Tele No	59	110	129	147	170	199	225	241	261	2.34
P.1000										
RoadMi	13.5	14.1	14.2	15.4	15.7	16.1	16.7	17.3	17.5	1.24
No Veh	52.5	60.6	65.5	47.6	65.1	69.9	75.5	76.7	85.5	1.41
Rail Mil	2767	3047	3102	3102	3305	3427	2845	3789	3798	1.25
Wago N	893	635	668	692	389	333	329	366	352	0.55
Pas. Mil	2.08	3.10	3.21	2.90	2.82	2.73	2.49	2.53	2.61	0.84
Ship.In	1.59	2.12	2.88	3.70	3.79	4.69	3.40	6.82	7.49	3.53
Coast.S	499	349	442	468	302	288	537	589	719	2.06
Inl P.M	418	603	617	528	536	491	434	470	454	0.75
AirNoFl	1476	1338	1363	1290	509	466	350	327	314	0.23
SchedFl	1129	939	753	900	368	359	268	292	300	0.32
Air Car	12	10	10	10	13	13	12	12	9	0.9
F.Visito	3.6	4.4	9.0	13.2	17.0	31.0	33.0	34.6	30.9	7.0
N Hotel	-	184	309	351	308	805	1003	1030	1089	5.91
No IE	0	1	1	3	5	10	15	18	19	19.0
Irrig.La	2.62	2.74	3.30	3.84	4.34	3.85	3.93	4.18	4.55	1.66
POP	37.1	42.3	43.1	43.9	44.7	45.6	46.4	47.2	48.1	1.14
GDP	56.0	54.8	58.1	62.4	66.7	71.0	75.1	79.5	88.1	1.61

Source: Statistical Yearbook 2000

As a result of the efforts by the government, the infrastructure sector facilities have been expanded and improved significantly in quality, especially in the area related to gateways (such as airports, ports and hotels) in the 1990's, however, other infrastructure sectors such as electric power, energy (oil/gas), telecommunication, transport (especially in railway and inland shipping) are still faced by continuous problems of old and inadequate infrastructure facilities, fleets and equipment due to the rapid increase in demand and the shortage of investment capital and operation budget. The electric power sector is especially in a critical condition creating a bottleneck for the entire economic growth and seriously affecting the well-being of the citizens y by frequent and long blackouts.



### Comparison with ASEAN and China:

These inadequate infrastructure facilities of Myanmar are also evident when we compare them with those of the neighboring countries in Asia as shown in Table 6-30.

**Table 6-30 Comparison of Infrastructure in Asia 1999**

	Energy Com Per Pop. Kg Oil Equiv.	Electric power Per Pop. Kwh	Telephone No Per 1000	Paved Road Km Per 1 Million Pop.	Air Passenger Per Pop.
China	830 (2.7)	746 (11.1)	86 (14.3)	243 (3.2)	0.045 (4.1)
Indonesia	604 (2.0)	320 (5.0)	29 (4.8)	776 (10.2)	0.039 (3.5)
Malaysia	1,967 (6.4)	2,554 (4.0)	203 (33.8)	2,200 (29.0)	0.661 (60)
Philippines	562 (1.7)	451 (7.0)	39 (6.5)	533 (7.0)	0.067 (6.1)
Thailand	1,153 (3.8)	1,345 (21.0)	86 (8.6)	1,046 (13.8)	0.267 (24)
Vietnam	440 (1.4)	232 (3.6)	27 (4.5)	302 (4.0)	0.061 (5.5)
Myanmar	307 (1.0)	64 (1.0)	6 (1.0)	76 (1.0)	0.011 (1.0)
ASEAN Ave.	761 (2.5)	705 (11.0)	51 (8.6)	785 (10.3)	0.124 (11.3)

( ) is compared with Myanmar

Source: 2001 World Bank: World Development Indicators

The infrastructure facilities in Myanmar are about 1/ 10th of the ASEAN average and 1/ 20th of Thailand. The most critical sector of Myanmar, the electric power sector is 1 /11th of the ASEAN average and 1/21th of Thailand. It is clear that if Myanmar is going to catch up with the current ASEAN level of per capita GDP, Myanmar must improve its infrastructure in nearly all sectors by an average of 11 times over at least.

It is difficult to assess the shortage of infrastructure qualitatively and quantitatively in a precise manner due to limited information, however, based on the international comparisons and discussions with government officers in charge, we may say that except for a few sectors such as hotels, international ports and international airports, other infrastructure facilities, fleets and equipment are inadequate and short of supply for a healthy economic growth, and in particular, the following sectors need to improve quickly:

- 1) Electric power
- 2) Telecommunications (including IT facilities)
- 3) Energy, especially natural gas pipeline
- 4) Railway
- 5) High quality industrial estate (Myanmar Economic Zone: MEZ)

In order for Myanmar's per capita income to catch up to the current level of Thailand (US\$2,000) by 2020, Myanmar must develop at least 50 high quality MEZs, and existing 30 industrial estates are not good enough to attract investors, both domestic and foreign.

### (3) Weak and Ineffective Centralized Institution and Management System

Based on the interviews and discussions with various infrastructure ministries and state owned enterprises (SOE), we find that the current institutional and management system is neither adequate nor suitable in the rapidly changing infrastructure sector. The current institutional and management system has been inherited from the socialist government in the past decades and has not adjusted to the new environment yet.

In most countries in the world, ministries mainly formulate policies, strategies and long-term plans of the infrastructure sector, but no longer directly operate agencies. In Myanmar, the ministries are still directly controlling all state-owned enterprises (SOE) covering every aspect, such as the annual operation budget, capital investment, pricing and wages and even personnel assignment. The ministries are just like the headquarters of SOEs. This highly centralized and inflexible institutional and management system has been inherited from the socialist government in the 1960's and seems to have remained unchanged until now even after the partial opening of the Myanmar economy in 1988. Urgent reforms of this highly centralized institutional and management system should be carried out because Myanmar is only one of a few countries (Myanmar and North Korea) keeping the old/socialist system.

The major problems of the current institutional and management system are:

#### 1) Weak policy and planning formulation capability

The ministries are supposed to formulate appropriate policies, plans and strategies in addition to performing monitoring and coordination among various sectors. However, as the ministries must control all SOEs that belong thereto in nearly every aspect, they are too busy for day-to-day operating problems and are not able to pay attention to long-term policies, strategies and planning.

#### 2) Weak or No Incentive and Cost Saving Effort by SOEs

The SOE budget is not independent and is based on the annual budget set by the ministries, and revenues are pooled into the government account. Therefore, there is no incentive for SOEs to reduce cost and try new innovative ideas for operation. Under the current system, profit or loss from the operation of SOEs will not affect the managers or workers. Thus, there are no incentives to improve operations.

#### 3) Weak or No Competition in the Sector

Under the current institutional system, many sectors, such as energy, electric power, telecommunication, railways, ports, airports and industrial estates, are still kept under state monopoly. Other sectors such as airlines, public transport (buses and trucks) and inland shipping are partially open to the private sector, and limited competition among them exists,

however, SOEs still fill the dominant role in each sector. Under the current system, competition in infrastructure sectors is weak or nonexistent due to the monopoly power, and reform of the system is required.

#### (4) Shortage of Investment Capital and Operating Budget

There are several reasons for the chronic shortage of investment capital, and among these, the following items are critical;

- A shortage of domestic capital due to the low revenues and taxation and inefficient operation
- Limited external capital investment due to limited ODA, FDI and OOF
- Limited private participation due to lack of BOT/BOO legal framework

This shortage of investment is the biggest problem for the entire infrastructure sector. We will briefly examine the above items in the following paragraphs:

##### 1) Shortage and Limited Domestic Capital Budget and Operating Profit/Loss

One of the reasons for the inadequate and insufficient infrastructure is a small investment capital due to a shortage of domestic revenues and foreign currencies.

**Table 6-31 Infrastructure Capital Investment (Constant Price: 1985/86) In Million Kyat**

	85/86	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	99/00
E. Power	659.8	234.0	147.7	94.3	126.4	148.4	213.4	278.5	152.9	156.3
Transport	456.0	83.5	21.8	25.2	32.8	55.4	136.4	102.1	46.6	43.5
Railways	199.6	158.2	162.4	130.5	241.5	387.9	543.2	433.5	235.5	239.7
Telecom	92.4	129.2	41.9	39.5	46.7	84.4	90.7	81.4	60.9	56.9
G. Total	4,298	1,123	811	544	744	1,016	1,287	1,209	922	861

Transport: Oversea Shipping, Inland Water Shipping, Port Authority, Myanmar Shipyards and Myanmar Airways

Source: Statistic Year Book 2000

As shown in Table 6-31, the capital investment (at the constant price of 1985/86) in infrastructure in the 1990's is much less than during the period of 1985/86. For example, the electric power sector investment in 1990/91 was only 35% of the capital investment of 1985/86 and even less in 1992/93 (only 14% of 1985/86). The total capital investment of four major infrastructure sectors in 1992/93 was only 26% of that in 1985/86. Although the capital investment in recent years, especially in electric power, started to increase from 1995/96, it is still too small an amount to keep up with the rapidly increasing demand. Much lower investment capital was probably due to smaller foreign assistance (ODA) in the 1990's

compared with that of the 1980's. It is clear that the level of the capital investment for infrastructure has remained low probably due to limited income generated by infrastructure operation by SOEs and taxes collected by the government.

## 2) Operating Revenues and Loss/Profit by Selected Infrastructure Sector

The operating revenues for the entire SOEs has been below the cost of operation for over two decades, and the loss has been increasing in recent years, especially since 1996/97. After 1996/97, the loss has been above 10% of the annual budget, and in the year 1998/99 it reached 27.8%. This situation has been affecting the availability of long-term investment capital for the infrastructure.

**Table 6-32 All Infrastructure Sector Operation Rev and Cost, Surplus/Loss: In Mil Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenues	22,335.0	87,185.1	108,555.0	184,921.2	22,155.5	315,141.7
Cost	22,503.3	91,624.6	119,936.5	214,639.7	309,587.1	365,695.2
Surp/Loss	- 168.3	- 4439.5	- 11,381.5	- 29,718.5	- 67,431.6	- 50,553.5
% to Rev	-0.08%	-5.1%	-10.5%	-16.1%	-27.8%	-16.0%

Source: Statistical Yearbook 2000

The Table 6-33 to Table 6-36 have shown the annual operation revenues, cost and loss/profit for the four key infrastructure sectors: electric power, transport (covering land, inland shipping, overseas shipping, airlines, ports and airports), railways and telecommunication.

**Table 6-33 Electric Power Sector Operation (Revenues and Cost, Surplus/Loss) In Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenues	928.1	2,771.1	3,227.5	3,450.8	3,599.6	19,680.8
Cost	726.8	2,599.8	2,721.6	3,120.7	4,976.9	20,614.1
Surp/Loss	+201.8	+171.3	+505.9	+330.1	-1,377.3	-933.3
% to Rev	+21.7%	+6.2%	+15.7%	+9.6%	-38.3%	-4.7%

Source: Statistical Yearbook 2000

The electric power sector has been profitable until 1997/98, but since 1998/99 the annual operation has suffered a big loss. The loss in 1998/99 particularly increased suddenly to 38% of the revenues.

**Table 6-34 Transport Sector Operation (Revenues and Cost, Surplus/Loss) In Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenues	827.7	2,362.6	3,202.1	3,445.9	5,455.3	5,029.7
Cost	759.8	2,006.9	2,519.8	3,759.6	5,297.7	5,482.3
Surp/Loss	+67.9	+682.3	+682.3	-313.7	+157.6	-452.6
% to Rev	+8.2%	+28.9%	+21.4%	-9.1%	+2.9%	-9.0%

Source: Statistical Yearbook 2000

The transportation sector had been profitable until 1996/97 with relatively high margins (29% in 1995/96 and 21% in 1996/97), but from 1997/98 it started losing money and recovered a little in 1998/99, but again the loss increased to 9% in 1999/2000.

**Table 6-35 Railway Sector Operation (Revenues and Cost, Surplus/Loss) In Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenues	564.2	2,777.1	3,234.0	5,324.3	6,456.1	6,408.0
Cost	475.9	2,580.5	2,797.1	4,359.8	6,591.1	6,606.5
Surp/Loss	+88.3	+436.9	+436.9	+964.5	-135.0	-198.5
% to Rev	+15.7%	+15.7%	+13.5%	+18.1%	-2.1%	-3.1%

Source: Statistical Yearbook 2000

The railway sector is also showing a similar pattern. From 1998/99, the railway sector started losing money although the loss is relatively small compared with the electric power and transportation sectors.

**Table 6-36 Telecommunications Sector Operation (Revenues and Cost, Surplus/Loss)**

**In Million Kyat**

	85/86	95/96	96/97	97/98	98/99	99/00
Revenues	255.9	1,834.5	2,256.2	3,401.7	4,248.0	5,668.0
Cost	130.9	1,527.8	2,066.6	2,403.2	3,558.9	4,491.2
Surp/Loss	+125.0	+306.7	+189.6	+998.5	+689.1	+676.8
% to Rev	+48.8%	+16.7%	+8.4%	+29.4%	+16.2%	+11.9%

Source: Statistical Yearbook 2000

The telecommunications sector was the only exception, i.e. it has been constantly making profits. Probably the continuous profit by the telecommunications sector is due to the monopoly power given to it and the ability to maintain high telephone charges, especially in the case of international calls, which are by far highest among Asian countries, and perhaps in the world as well.

**Table 6-37 Comparison of Telecommunication Charge of Asian Countries 1999 in US\$**

	Myanmar	China	Indonesia	Malaysia	Philippines	Thailand
Local	0.48	0.12	0.01	0.02	0.01	0.08
International	26.86	2.90	7.71	2.80	4.80	2.50

Note: Charge is based on 3 minutes.

Source: World Bank World Development Indicators 2001

As is clearly shown in Table 6-37, Myanmar telephone charges are the highest in Asian countries for both local and international calls. A local call is 48 times as high as that of Indonesia and Philippines. The international call charge is also the highest and about 10 times as high as that of China, Malaysia and Thailand. It is clear that the higher charge due to monopoly is the main reason for continuous profit made by the Myanmar telecommunications sector. Since communication is so important for modern industry/business and even for the well being of citizen's daily lives, reducing telephone charges and increasing the number of telephones is an urgent task.

#### i) Limited External Capital (ODA and FDI)

Another reason for the limited capital investment in infrastructure is the limited amount of external capital inflow. Myanmar is receiving only limited external foreign aids, FDI and (OOF)/bank loan in the infrastructure sector mainly due to the economic sanctions which have been imposed by the US and EU since 1989.

In 1999, Myanmar received only 1/8th, 1/13th and 1/14th of the total capital inflow of Vietnam, Philippines and Thailand, respectively. The main reason for this very low capital inflow to Myanmar is the economic sanctions enforced by the Western nations, which result in limited ODA, FDI and private bank loans.

**Table 6-38 External Capital Flow from Outside (In Million US\$)**

Country	FDI		ODA(Net)		Net Private		Total	
Year	1990	1999	1990	1999	1990	1999	1990	1999
China	590	9,221	3,225	2,324	2,098	11,851	5,913	23,396
Indonesia	1,093	-2,745	1,639	2,206	1,872	1,813	4,604	1,274
Malaysia	2,333	1,552	66	143	770	3,247	3,169	4,942
Myanmar	161	216	161	73	153	203	474	492
Philippines	530	573	1,057	690	639	4,915	2,226	6,178
Thailand	2,444	6,213	578	1,003	4,399	2,471	7,421	6,987
Vietnam	16	1,609	891	1,421	16	828	923	3,858

Source: 2001 World Development Indicators

The total capital flow to Myanmar did not increase between 1990 and 1999 and remained almost at the same level (1.04 times). However, China, Vietnam and Philippines increased the total capital flow by 4.18, 3.98 and 2.78 times from 1990 to 1999, respectively. On the other hand, Indonesia and Thailand received less total capital due to the Asian financial crisis that started from 1997. The achievement of Vietnam and China is impressive during the period from 1990 to 1999 as it increased by 4 times, and it is a good lesson for Myanmar to follow in the Vision 2020 plan. Based on the comparison of Myanmar and ASEAN countries, Myanmar may be able to increase the total capital inflow substantially by changing the external environment, and it is essential for improving the infrastructure sector just as other developing countries have been doing so.

#### ii) Limited Participation of the Private Sector in Capital Formation

The third possible reason for the shortage of investment capital in the infrastructure sector is the limited participation of the private sector.

Private participation in infrastructure development for Myanmar is relatively new and limited in number. The best-known BOT scheme is the Thilawa Port project costing US\$120 million. Other transportation projects are:

- a) Airline JVs, such as Mandalay Air Line;
- b) Inland shipping: Several inland-shipping companies have been operating various internal shipping routes;
- c) Mandalay-Yangon Highways: 4 blocks were under construction by domestic contractors under the BOT scheme;
- d) Kanchanaburi to Dawei highway by Thailand private consortium: A basic agreement was made;
- e) Two industrial estates: Two projects were implemented by foreign companies under the joint venture scheme with the Myanmar government in the middle of 1990's; and
- f) Domestic Industrial estate projects: 5 domestic private investors have started developing small industrial estates in the Yangon area since 2001.

The total private investment in infrastructure in the past 10 years seems to be around US\$500 million.

#### Experience of the Asian Countries Concerning Private Participation in the Infrastructure Sector

Since the 1980's, the private sector has become an important player for capital formation. The average share of the private sector in the gross domestic fixed capital in ASEAN countries is around 66% (66.5% in 1990 and 66.1% in 1999). Even in China, the private sector share increased from 33.8% in 1990 to 45.9% in 1999. The private sector

became an important investor even in the infrastructure sector in recent years as the BOT/BOO scheme was introduced in the early 1980's.

**Table 6-39 Private Fixed Investment: % of Gross Domestic Fixed Investment (%)**

	1990	1999
China	33.8	45.9
Indonesia	67.5	77.0
Malaysia	64.5	65.4
Philippines	81.8	76.0
Thailand	84.8	66.2
Average	66.5	66.1

Source: 2001 World Development Indicators

#### Private Investment in Key Infrastructure Sub-Sector in Asia and China

In order to assess the actual infrastructure investment in Asia and China, we selected four major infrastructure sectors as shown below in Table 6-40.

**Table 6-40 Investment in Infrastructure Projects with Private Participation: In Million US\$**

	Telecom		Energy		Transport		Water Sup.		Total	
	90-94	95-99	90-94	95-99	90-94	95-99	90-94	95-99	90-94	95-99
China	0	5,970	5,448	12,922	5,821	9,651	43	605	11,312	29,148
Indonesia	1,119	7,245	352	9,747	709	2,223	4	872	2,184	20,087
Malaysia	2,010	4,380	5,663	1,611	2,769	8,196	3,977	1,056	14,419	15,243
Philippines	592	5,138	4,502	6,998	0	3,006	0	5,820	5,094	20,962
Thailand	3,664	4,035	675	4,945	696	1,700	0	239	5,035	10,919
Myanmar*									200	300
Total	7,385	26,768	16,640	31,458	9,995	24,776	4,024	8,592	38,044	96,359

Source: 2001 World Development Indicators \* for Myanmar estimated by Consultant.

Among key infrastructure sectors, the energy sector has been favorable for private investment in the form of BOO and BOT since the 1980's, and private sector investment has become important for the telecommunication sector and transportation sector as well. From the late 1990's, private investment started even in the water supply sector as well. The private participation in China between 1995 and 1999 reached US\$29 billion, followed by Philippines (US\$21 billion), Indonesia (US\$20 billion), Malaysia (US\$15 billion) and Thailand (US\$11 billion). In the same period (1995-99), total private investment in the 5 countries together



reached US\$96 billion.

Compared with the ASEAN countries and China, Myanmar is well behind in attracting private investment in the infrastructure sector. The average private participation of US\$20 billion during the period of 1995-99 in the Asian countries is 80 times as high as that of Myanmar. It is urgent to immediately improve the investment environment for private participation in the infrastructure sector.

- Summary of Problems in Shortage of Investment Capital

The major reason for limited private investment in infrastructure in Myanmar is lack of a private investment-related legal system such as BOT/BOO regulations

Myanmar should try to improve the investment environment for private investment in the infrastructure sector by taking certain actions:

- a) BOT/BOO legal framework must be passed to ensure the investors' confidence.
- b) Foreign currency transfer and free import and export activities for these BOT/BOO projects must be guaranteed so that free economic activities can be carried out.
- c) The external relationship must also be improved so that economic sanctions will be eliminated and high economic growth promoted.
- d) Foreign exchange policy needs to be adjusted to guarantee the free and fair infrastructure and fair charges for the investors.

(5) Irrational and Multiple Pricing Mechanism

Under the current pricing decision mechanism, the ministries and directives given by the higher authority basically control pricing of each of goods and services in each infrastructure sector. For pricing decisions, the market mechanism is not functioning well and is not reflecting real cost. And the current system is slow to adjust to the changes in the market environment. As a result, the current pricing bears no relation to costs, inefficiencies are shielded, patterns of demand become distorted, and wrong signals emerge for investment. The prices of (1) energy, (2) electric power, (3) telephone, (4) air fares, (5) railways, (6) land transport and (7) inland shipping are controlled by government directive, and in most cases, the prices are not uniform but multiple pricing is used. For example, the current electric power charge for the domestic private sector is 25 Kyat per 1 Kwh and US\$0.88 US for foreign companies. In addition, SOEs are given even lower prices in some cases. For the electric power sector there are three or four different price levels, and the same pricing is practiced in other infrastructure sectors. In general, the pricing of the infrastructure is not related to true economic cost or international market prices, since prices are not determined by the economic cost of services nor does they reflect the market demand. As a result, prices can be higher or extremely lower compared with the true economic cost of services or products.

Oil price and electric power cost are below the economic cost (or the international market cost) and the telecommunication pricing is well above the production cost or internationally accepted prices.

(6) Major Problems of the Industrial Estates Program

In order to achieve the Vision 2020 goal, the infrastructure sector must not only increase capital investment but also undertake reforms in the institutional and management system as well.

In brief, we may conclude that:

- 1) Infrastructure in Myanmar has inherited old and inadequate infrastructure from the previous socialist government in the 1960's;
- 2) The current per capita infrastructure facilities level is very low at about 1/11th of the ASEAN average and about 1/20th of that in Thailand;
- 3) The inadequate infrastructure level stemmed from very limited capital investment in infrastructure, and the investment level of the 1990's was below the level of 1985/86. The current investment level is about 1/XX of that in the ASEAN countries and 1/ZZ of that in Thailand. (GCF);
- 4) In Myanmar, low capital investment stemmed from:
  - a) Low level of domestic investment capital generated internally;
  - b) Low level of private participation in infrastructure; and
  - c) Low level of external investment and foreign aids; and

Highly centralized and inefficient organization and management system. The infrastructure sector is still highly centralized and directly controlled by the ministries and is a legacy from the socialist government in the 1960's.

The problems arising from the current organization are:

- 1) Weak and/or ineffective policy, planning and strategy formulation;
- 2) Ineffective operation and continuous loss from the operation;
- 3) Irrational pricing system: The pricing system does not reflect true economic costs nor does it reflect international market costs;
- 4) No market incentives or cost saving efforts by operators due to the budget are given, and revenues are pooled to the government account that is not independent, resulting in limited incentives for SOE managers and workers; and
- 5) Weak or no competition by suppliers due to the monopoly or quasi-monopoly supply system.

**Table 6-41 Fixed Capital Formation and GDP Growth: 1990-1999**

	GCF % of GDP (90)	GCF % of GDP (99)	GCF 1999 US\$Billion	GDP Growth 80-90(%)	GDP Growth 90-99(%)
China	35	37	362.4	10.1	10.7
Indonesia	29	18	22.5	6.1	4.7
Malaysia	32	22	16.9	5.3	7.3
Philippines	24	19	14.8	1.0	3.2
Thailand	41	21	25.4	7.6	4.7
Vietnam	13	25	7.2	4.6	8.1
Myanmar	13	11	1.5*	0.6	6.3
ASEAN Av.	31.5	20	20.0	5.0	5.0

Source: World Bank World Development Indicators 2000

\* Estimated Based on Assumption of \$300 PCI in 1999.

## **6.4 Infrastructure Sector Reforms and Infrastructure Development Strategies for Vision 2020**

### **(1) Vision 2020 Goal and Target (Basic Conditions and Assumptions)**

The economic goal for Vision 2020 is to catch up to the ASEAN 2000 Economic Level (PCI of \$2,000) by 2020. The goal of the infrastructure sector is to support the economic growth of Myanmar with a view to achieving Vision 2020 in the most efficient way by reducing various problems. Based on the goal of Vision 2020, the industrial employment level by 2020 is likely to be 5.5 million, which indicates that 4.0 million new jobs must be created by the industry sector. In order to achieve Vision 2020, the infrastructure sector must increase facilities, fleets, and equipment by at least 11 times to reach the US\$2,000 PCI level by 2020. For example, the electric power capacity must be expanded from 1,100MW to 28,000 MW generating capacity by 2020 and the investment cost is estimated at US\$30 billion. The total estimated investment cost of the infrastructure sector is around US\$146 billion (see Table 6-42) at least and it may be higher.

**Table 6-42 GCF Requirement: 2000-2020 for the Industrial Vision Achievement (US\$ Billion)**

	2000	2005	2010	2020	Cumulative
GCF Requirement	US\$1.6 (242 BiKyat)	US\$ 11.7	US\$ 21.8	US\$ 40.4	US\$436
Inf. Capital Investment	US\$0.5	US\$1.95	US\$7.26	US\$13.5	US\$146

Source: Estimated by Consultant.

Assumptions: Infrastructure Capital Investment is 30% of the Gross Capital Formation.

## (2) Infrastructure Development Strategies for Achieving Vision 2020

### 1) MEZ Program for the Year 2002-2020

The basic strategy is to develop 50 high grade MEZs by 2020 in the most attractive locations and to develop supporting infrastructure around the MEZs with high priority. In this way, the necessary infrastructure will be minimized and the maximum income and production can be generated. This method of building attractive economic zones of various types to attract both domestic and foreign investment has been used in ASEAN countries and China with great success.

We propose the Myanmar Economic Zone (MEZ) Plan as shown below. This is the plan proposed in October 2000 by the joint working group between the Myanmar MEZ Committee and the Japanese Group supported by JODC with some modifications.

The large-scale MEZs are reduced from 5 to 4 but the MEZs for small and medium enterprises (SME) and resource-based MEZs are increased by 18 and 7 respectively. The basic rationale is that Myanmar needs more labor-intensive export-oriented industries and resource-based industries in the coming 10 years. For the future, Myanmar may consider attracting high-tech-based industry (electronics and precision parts) in both Yangon and Mandalay areas (2 sites) just like China and Thailand have successfully introduced in some industrial estates. Thus, we added 2 such high-tech MEZs.

**Table 6-43 Proposed Myanmar Economic Zone (MEZ) Program: 2000-2020 Target:**

	Existing	New	Total Area (Ha)
1. Large MEZ	1	4	10,000
2. SME (EPZ and GIZ)	18	18	7,200
3. Trade MEZ	0	5	500
4. Tourism MEZ	0	3	1,500
5. Resource MEZ	0	17	2,550
6. High-tech MEZ	0	2	400
Total	19	50	22,150

Source: Implementation Study for Myanmar Economic Zone Development by JODC

The time frame of the MEZ plan is shown in Table 6-43. We recommend that improvement of existing industrial estates first be carried out in order to speed up the development and to reduce the investment cost. For the first 5 years, we recommend the upgrading of 5 existing industrial estates to the internationally acceptable EPZs, which are commonly practiced in all of the ASEAN countries and China. We also recommend that one

pilot project for the free trade based MEZ should start at the Chinese or Thailand border area, followed by the tourism based MEZ in one of the tourist cities of Pagan, Mandalay, Taunggyi, Sittwe and Andaman Sea Islands. We further recommend that one or two resource-based (fisheries, agricultural or timber resource-based) MEZs should be developed.

**Table 6-44 Proposed Myanmar Economic Zone (MEZ) Program: 2000-2020 Target:**

	2005	2010	2020
1. Large MEZ	1 (Up Grade 1)	2	4
2. SME (EPZ and GIZ)	18 (Up Grade 5)	25	36
3. Trade MEZ	1	3	5
4. Tourism MEZ	1	2	3
5. Resource MEZ	2	7	17
6. High-tech MEZ	0	1	2
Total	22	40	50

Source: Implementation Study for Myanmar Economic Zone Development by JODC Adjusted by Consultant

For the medium term (2006-2010), SME-based MEZs, resource-based, trade-based and tourism-based MEZs should continue to be expanded and by the end of the medium term period, one high-tech-based MEZ can be introduced at Mandalay or Yangon fully utilizing the newly developed international airports.

For the long term (2011-2020), large scale MEZs with new deep-sea ports in either South or East of Yangon can be developed. Large scale MEZs can also be developed at the Bengal and Andaman Sea areas together with neighboring countries as new gateways.

#### **Possible Benefit from the MEZ Program (2005-2020)**

Based on our assumptions, the proposed 50 MEZs are likely to create 3.0 million new industrial jobs and are likely to generate income of US\$500 million by 2005, US\$1.5 billion by 2010 and US\$9.0 billion by 2020.

**Table 6-45 Future MEZ Target: 2005-2020**

	2005	2010	Total
MEZ	5	20	50
Employment	0.5 Million	1.0 Million	3.0 Million
Value Added	US\$250 Million	US\$1.5 Billion	US\$9 Billion
Net Value/Work	US\$500	US\$1,500	US\$3,000

Source: Estimated by Consultant

## **2) Implementation Steps**

- i) Start from Emergency Program: Bottlenecks Solving Plan
  - a) Five MEZs (export-oriented: EPZ) in the Yangon Area (converting existing IEs)
  - b) Dry port at Mandalay (assisting exporters and if Mandalay has demands for EPZ, it can be upgraded to EPZ )
  - c) Emergency power generation project (barge power plants and/or diesel power to EPZ sites (assisting existing industries and attracting new investors)
- ii) Primary focus on the first 5 MEZs and gradual expansion to the remaining 50 MEZs and implementation of supporting infrastructure in order to minimize the investment cost and to maximize the benefit.
- iii) Taking advantage of the physical comparative advantages of Myanmar for the development of the infrastructure and economy.
- iv) Taking advantage of regional integration and cooperation with neighboring countries (China, India and Thailand), especially in the first stage when the large external resources are not available.

### (3) Comparative Advantages of Physical Characteristics for Infrastructure Development

Myanmar has many comparative advantages in its natural endowments as shown below and should maximize such advantages for the development of infrastructure and industries. We consider that the following 7 items are particularly positive features of Myanmar, which can be used to develop competitive industries and infrastructure in the coming 20 years.

- 1) Strategic location: Myanmar is bordered with 5 countries and is connected to the dynamic economy of the ASEAN, China and India and Bangladesh. Utilizing these advantages, Myanmar has the potential to become a transportation hub in the Asian region.
- 2) Good potential deep-sea ports: Myanmar faces the Bay of Bengal and Indian Ocean and there are seven potential deep-sea port sites which have been identified: two in the Bay of Bengal area, South and East Yangon, and three on the Andaman Sea coast. Developing these deep-sea ports in the future, Myanmar will have several gateways for not only itself but also for China and Thailand.
- 3) Largest hydropower potential in Asia: (30,000 MW economically feasible power potential). Myanmar is endowed with the largest hydropower potential in Asia and less than 2% is so far developed. Myanmar may become an exporter of electric power to neighboring countries in the future if Myanmar is able to develop the full potential just as Laos has become an exporter of electric power.
- 4) 6,000 km of navigable canals and river channels: The Ayeyawaday River can be controlled by 4 or 5 dikes, which will provide (a) navigation of ships, (b) irrigation of the dry zone

for agricultural purposes, and (c) hydro power generation. (Three in one project: navigation, irrigation and power generation) .

- 5) Large dry zone for future irrigated land: Large agricultural zones in the central region are short of water in the dry season and it is not possible to grow agricultural products there but this land can be converted to a fertile agricultural zone by the irrigation system. Then, Myanmar has a chance to become a food basket of Asia.
- 6) Good tropical sea resort sites: In the Bay of Bengal and Andaman Sea areas, Myanmar may be able to develop a few good international sea resorts just like other ASEAN countries did. At the moment, the number of visitors to Myanmar is only 250,000 or so, but by developing attractive tropical resorts combined with attractive cultural and historical tourist sites, Myanmar may be able to attract 2 to 3 million tourists. (Thailand in 2001 had 10 million visitors).
- 7) A good air transport hub location (Mandalay and Bago): Myanmar has the potential to attract more airlines because of the strategic location between the Far East and the Middle East. Two first class runways (4.2 km long) are already built (Mandalay) or underway (Bago New Yangon Airport).

#### (4) Advantage of Regional Integration and Cooperation Projects (Proposed and Potential)

Myanmar is also located in the middle of the dynamic economies of the ASEAN, China and India/Bangladesh, and several regional integration and cooperation plans are proposed. Some plans are already implemented. Myanmar should take advantage of its strategic location to materialize as many regional integration projects and regional cooperation projects as possible. It should do so, especially in the immediate future, since available financial resources are limited due to the economic sanctions.

So far about 10 such projects have been either proposed or discussed as shown below.

The Mekong Sub-regional Committee coordinated by the Asian Development Bank (ADB) proposed the first three projects. The Asian Highway connecting to India and Bangladesh has been supported by the ESCAP/UNDP for many years and it seems ready to implement the Asian Highway concept. Especially with respect to the Highway, neighboring countries have been actively working with Myanmar and providing assistance to improve the existing road network. China has been working to improve the Muse to Mandalay corridor, India now agreed to improve the road network this year, and Thailand also agreed to implement the part of the road connecting MS to Yangon. Working with these three countries, the regional integration networks can be improved significantly within several years. This type of cooperation with neighboring countries is very important for Myanmar, especially in the early period when large-scale outside assistance is not available.

- 1) Asian Highway networks connecting the ASEAN countries, China and India.
- 2) Asian railway network connecting the ASEAN countries and China.
- 3) Asian telecommunication network for the ASEAN countries and China
- 4) Energy and transport corridor with China and the ASEAN countries.
- 5) Asian hydro power generation (30,000 MW) and transmission network
- 6) Internal waterway crossing the country (6,000 km): 3 in 1 project: transportation, irrigation and power generation with China.
- 7) Asian food basket: rice, other cereal, beans etc. the ASEAN countries and China
- 8) Asian air transport hub at Mandalay and Bago with the ASEAN countries and China
- 9) Regional integration gateways (Thailand Border and China) across the Pacific and Indian Ocean.
- 10) Free Trade Zone (FTZ) development in the key locations (5-6 locations)

Other projects such as the energy corridor with China, energy power with Thailand, gateway projects with Thailand and ETZ at the border projects with China, India and Thailand can be implemented in the near future to benefit both sides. Regarding the ADB projects, ADB decided to open its office in Yangon in the next year for preparation of these projects and others.

#### (5) Long Term Infrastructure Development Concept and Strategies for Myanmar

Taking into account all the characteristics and advantages and disadvantages (i.e., limited financial resources), we consider that the following infrastructure development strategies seem to be the best for Myanmar.

##### Step 1: First 5 Years: Emergency Plan

In this period, the major bottleneck sectors are (1) electric power, (2) energy, especially gas, and (3) telecommunications. Furthermore, we add high quality industrial estates to the list of short supplies.

Therefore, these infrastructures (especially electric power) and the 5 high quality MEZs should be given high priority. Also regional integration projects with assistance of neighboring countries should be implemented as much as possible. Land transportation, especially between Yangon and Mandalay, is the main transportation corridor, and the upgrading project (4 blocks) has already been started by special private participation. This Yangon-Mandalay corridor upgrading project should be continued and should be completed as soon as possible.

##### Step 2: Next 5 Years Medium Term Plan (2006-2010)

Regional road networks connecting to provinces should be implemented by making



easier access and providing less costly transportation networks.

The three capital-intensive infrastructures (electric power, telecommunications, and energy) must be improved continuously to keep up with the rapidly growing demand.

Also, new international ports may have to be developed as the total trade volume passes the critical mass of 20 to 25 million ton/year in the Yangon Area. The existing ports along the Yangon River will be congested and may reach saturation point due to the capacity of the Yangon River channel (the distance of 25 km from the open sea allows a limited number of ships). The new ports are either in the South of the Yangon River mouth or in the East of the Yangon River mouth. Since the development of new international ports will take a long time to materialize, the planning of such ports should start after the volume of trade reaches 15 to 20 million ton/year.

### Step 3: Long Term Plan (2011-2020)

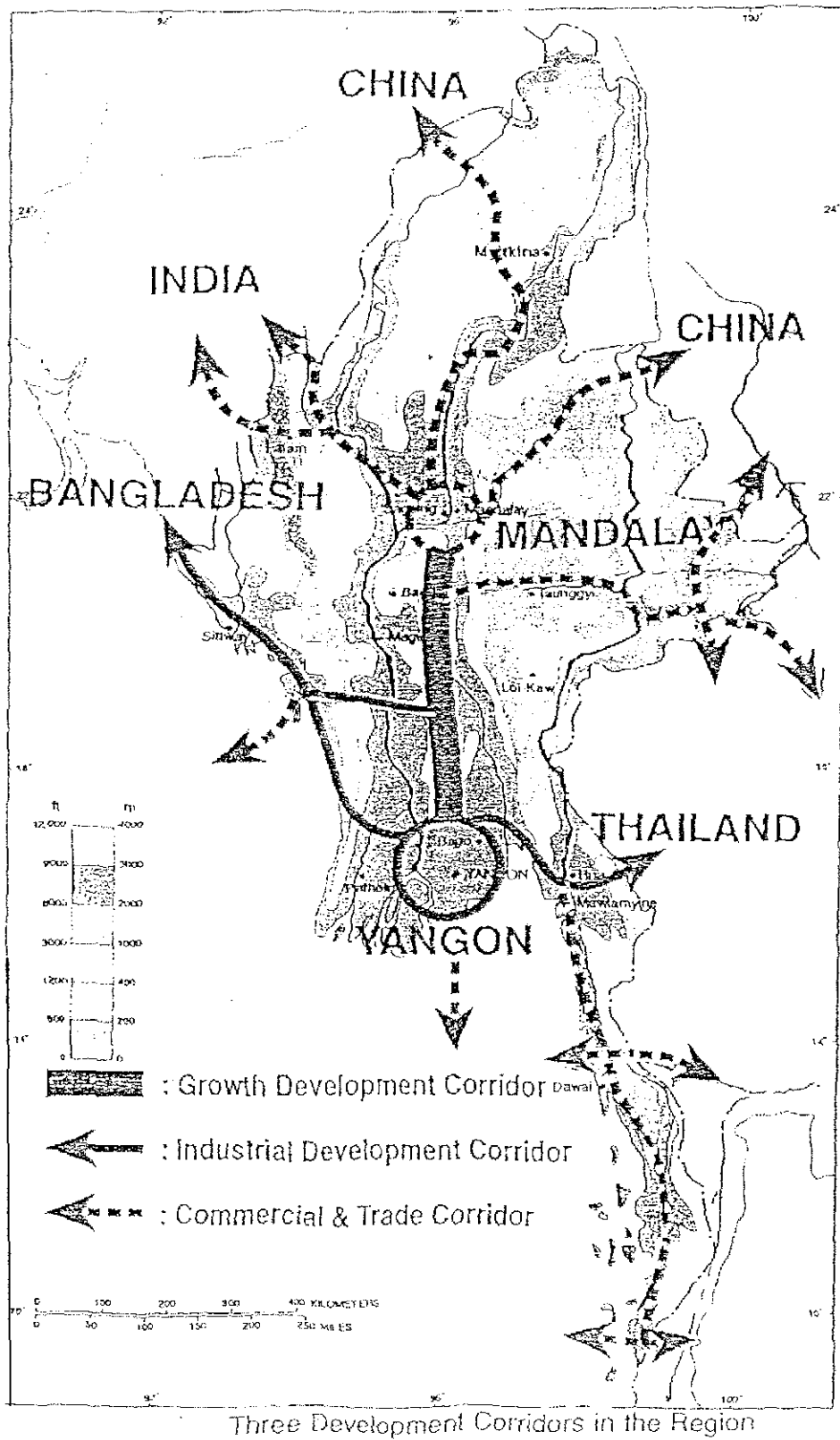
In this period, major infrastructure projects should be undertaken and completed to maximize the potential of Myanmar by connecting all neighboring countries, developing hydropower potential, and new gateways in the Bengal and Andaman Sea making Myanmar an important transportation hub in the region. By the end of Vision 2020, the following major infrastructure projects should be completed in whole or in part.

- 1) Transportation networks with the ASEAN countries, China and India and Bangladesh
- 2) Gateway major ports in the Bay of Bengal and the Andaman Sea
- 3) North-south corridor: Yangon-Mandalay by rail, highways and waterway
- 4) Asian energy networks: natural gas and oil
- 5) Asian airport hub (Mandalay and New Yangon Airport)
- 6) Asian hydro power network

The development of this major infrastructure and other infrastructure sectors to sufficient levels by 2020 will require massive investment (minimum of US\$146 billion) and the finding of financing source is the most important task for Myanmar in infrastructure sector development.

See Diagram/Figure 6-26.

Figure 6-26 Development Corridors for the Future Myanmar



Three Development Corridors in the Region

Source: JICA Study Team

(6) How to Finance Required Capital for Vision 2002-2020

As was mentioned before, finding financing sources is the most important and difficult task for the infrastructure development. The currently available investment capital for the sector is less than the investment capital available in 1985/86. Probably this is due to the limited external assistance resulting from the current economic sanctions. Examining the financing problems of Myanmar and studying other ASEAN countries' financing experience, we recommend the following four improvements/reforms:

1) Increase in Private Investment Participation

There are several projects which have been implemented or are now on-going by private investment, such as Thilawa Port and Yangon-Mandalay Road. However, Myanmar is not sufficiently attracting private investment in the infrastructure sector to assist the improvement of infrastructure. As is shown in Chapter 3, the ASEAN countries and China have improved the legal and pricing system in the infrastructure sector and have started to attract large private investment in the infrastructure sector. For example, China and Indonesia attracted about US\$40 billion investment during the period between 1990 and 1999 in four infrastructure sectors (energy, telecommunications, transportation and water supply) followed by Malaysia (US\$30 billion), Philippines (US\$26 billion) and Thailand (US\$16 billion).

Myanmar needs to enact the BOT/BOO laws and regulations in order to attract more private investment in the infrastructure sector as nearly all countries have already done so. If Myanmar enacts the BOT/BOO laws and regulations and encourages the private sector to participate in the nation building, Myanmar will be able to attract up to Thailand's level of US\$1.6 billion or Philippines' level of US\$2.3 billion per year. During the 2002 to 2020 period, if Myanmar is able to attract up to Thailand's level, the total private investment will reach US\$30 billion, and if up to the Philippines' level, it will reach US\$40 billion.

2) Increase Revenues by SOEs and Taxes from Domestic Operation

Since most SOEs in the infrastructure sector are losing money from operation, this can be improved by (a) rationalizing prices (a cost recovery policy), and (b) commercializing the operation of SOEs by giving more autonomy and an independent financial system. These actions are likely to increase efficiency of operation by SOEs and are likely to increase competition among suppliers. As a result, the infrastructure sector is likely to increase revenues and profits. Since most ASEAN countries are generating profits from the infrastructure sector (especially from energy, power, telecommunications and transportation), and if Myanmar is able to follow them, Myanmar will be able to generate sufficient profits to make the investment capital by itself. As a target, at least 30-40% of investment capital should

be generated from own profits produced internally in the future.

### 3) External Financing (FDI, ODA & OOF) and Regional Cooperation with Neighbors.

In the long run, Myanmar needs to attract external financing resources in the form of ODA, FDI and OOF/bank loans in the infrastructure. The total external capital inflow in Myanmar was only US\$0.5 million in 1999, compared with Thailand (US\$7 billion), Vietnam (US\$3.8 billion), Philippines (US\$6.2 billion) and China (US\$23 billion). Probably 30% of these external capital inflows is used for financing the infrastructure, which means that external financing for the infrastructure sector in Thailand was US\$2.1 billion, in Vietnam US\$1.1 billion, in the Philippines US\$1.9 billion, and in China US\$7.0 billion in 1999. That indicates that Myanmar is able to increase by at least 4 times if international relations are normalized just like Vietnam did in the middle of 1990's.

As a target, Myanmar should try to attract external investment capital of at least Vietnam's level (the total of US\$4 billion per year and US\$1.1 billion for the infrastructure) and hopefully attract Thailand's level of US\$2.1 billion per year for the infrastructure. As far as the timing of increasing the external financing is concerned, it is better to start as soon as possible since the need of investment capital for Myanmar is large.

### (7) Required Reforms in Infrastructure Sector to Improve the Infrastructure Sector

Myanmar inherited old and inadequate infrastructure and has been trying to improve the old & inadequate infrastructure in the past decade but is still faced by serious bottlenecks and various institutional and management problems. Myanmar's organization and management system is still highly centralized and it is an inflexible system inherited from the socialist government in the past. Ministries directly supervise and basically control all operation units (SOEs) in the infrastructure sector. The policy formulation and operation is mixed and not separated, and most sectors are still subject to state monopoly or dominated by the state organizations. Under these conditions many problems are surfacing in various areas shown in Chapter 3 and can be summarized as follows:

- 1) Infrastructure in Myanmar is old and inadequate infrastructure inherited from the previous socialist government from the 1960's.
- 2) The current per capita infrastructure facilities level is very low and about 1/11<sup>th</sup> of the ASEAN average and about 1/20<sup>th</sup> of Thailand.
- 3) The inadequate infrastructure level stemmed from the very limited capital investment in infrastructure, and the investment level of the 1990's was less than the level of 1985/86 and the current investment level is about 1/11<sup>th</sup> of the ASEAN average and 1/20<sup>th</sup> of Thailand.
- 4) In Myanmar, low capital investment stemmed from the following:

- i) Low level of domestic investment capital generated from operation;
- ii) Low level of private participation in infrastructure; and
- iii) Low level of external investment and foreign aids.

**5) Highly centralized and inefficient organization and management system**

The infrastructure sector is still highly centralized and directly controlled by ministries and is a legacy from the socialist government in the 1960's.

The problems arising from the current organization are:

- i) Weak and/or ineffective policy, planning and strategy formulation;
- ii) Ineffective operation and continuous loss from the operation;
- iii) Irrational pricing system: The pricing system does not reflect true economic costs nor does it reflect international market costs;
- iv) No market incentives or cost saving efforts by operators due to the budget are given, and revenues are pooled to the government account that is not independent, resulting in limited incentives for SOE managers and workers; and
- v) Weak or no competition by suppliers due to the monopoly or quasi-monopoly supply system.

In order to overcome the above problems, we recommend the following solutions and reforms:

**1) Institutional and Management Reforms and Improvements**

**i) Strengthen Ministry Planning and Policy**

In order to improve the efficiency of the infrastructure sector, the government direct control should be gradually changed to a more decentralized system. Ministries should be responsible for formulating policies, long-term plans, and monitoring and coordinating various sectors and actual operation should be given to operating units.

**ii) Increase Efficiency and Cost Recovery of SOEs' Operation**

SOE should be given a more autonomous management system and independent financial management. The commercialization of the infrastructure sector should be considered in the medium term, the cost of providing infrastructure should be recovered by improving management and rationalizing pricing.

**2) Pricing Reform: Rational Pricing (Cost Recovery and Simplification)**

- i) Multiple pricing should be unified or at least simplified.

- ii) Pricing should be based on the economic cost reflecting the market cost gradually. If subsidies are needed for social reasons, the subsidies should be given as welfare subsidies in general, and subsidies for each infrastructure item should be abolished. This rationalization of pricing has been one of the major problems of socialist countries in the past, however, now nearly all socialist countries, including former Soviet Union and Eastern European countries as well as China and Vietnam, have successfully switched to the cost recovery system in recent years.

### 3) Legal Reform (BOT/BOO & MEZ) to Increase Private Participation & Promote FDI

- i) Encourage participation of the private sector in the infrastructure by passing BOT/BOO directives and regulations. A large portion of electric power, telecommunications, transportation (road/highways, bridge, ports and all of transportation services) and industrial estates can be financed by the private sector.
- ii) The MEZ Directive should be passed and the MEZ Authority established as soon as possible.

### 4) Expanding External Financial Resources in Infrastructure (ODA, FDI and OOF)

The external financial resources should be expanded as soon as possible by improving the international relations.

- i) ODA funding should be expanded.
- ii) FDI in infrastructure should be encouraged.
- iii) OOF/Bank loan for infrastructure.

## **6.5 Emergency Plan and Recommendations (2002-2005)**

### (1) Critical Current Condition of Infrastructure and Myanmar's Economy

We are in a time of global mega-competition, when globalization and market economics are spreading rapidly. Unable to make the transition from a socialist economic structure to a market economy, however, the Myanmar economy lags far behind the rest of Asia. In order to develop economically, Myanmar urgently needs to embark on structural economic reforms and develop its industrial infrastructure. Myanmar has not invested properly in infrastructure for over half a century, and almost the entire infrastructure sector is insufficient for industrialization. The level of infrastructure per capita is only one twentieth that of ASEAN countries, and there is a particularly chronic shortage of electricity, with power stoppages

almost constant. This severely adversely affects not only manufacturing, but also the economy as a whole.

The Myanmar economy and the industrial infrastructure sector are in a vicious cycle, and the cycle is worsening. The main features of this vicious cycle are as follows:

- Severe infrastructure shortages (especially of electricity and gas), which are creating a bottleneck impeding the economy as a whole.
- The Myanmar economy faces numerous problems in almost all sectors, not the least of which is an extreme shortage of foreign currency. Frequent changes to import and export regulations further damage the economy.
- Structural economic reforms including trade deregulation, unification of multiple exchange rates, privatization of state-owned enterprises (SOEs), reform of the land system, and reform of the foreign investment system will ultimately need to be implemented. However, the experience of China and other Asian countries indicates that such structural economic reforms require time. Unless Myanmar, which faces a severe shortage of foreign currency, can quickly implement plans requiring only a small investment outlay to generate foreign currency, the economy could collapse, leading to social unrest.
- Myanmar therefore needs an urgent plan to earn foreign currency in order to escape from this vicious cycle.
- Myanmar needs to adopt a strategy of medium/long-term economic reform in combination with urgent measures for progressive implementation beginning with those fields where implementation is feasible.

As shown the above, Myanmar's economy is faced with many difficulties and the infrastructure sector (especially electric power) is also confronted by serious problems. Both areas are considered to be in critical condition. Because of the current critical circumstances, foreign direct investment (FDI) and exports are declining in recent years. In our analysis, the infrastructure sector is also in a "Vicious Cycle". Therefore, for the immediate future, Myanmar needs an urgent improvement plan to get out of this condition in the shortest time.

## (2) Possible Solution for Getting out of "Vicious Cycle"

Myanmar must improve the critically bottlenecked infrastructure and, at the same time, must quickly improve the investment environment so that new investment (hopefully in export-oriented industries) can resume and FDI and exports can expand. We recommend the Emergency Plan, i.e., the Combined Emergency Electric Power Program & MEZ Plan, to jump-start in the Myanmar economy plus structure reforms for each infrastructure sector for

the medium term.

In order to escape this severe economic cycle, Myanmar needs to give priority to urgent measures pursued in parallel with medium-term structural reforms in order to achieve a radical solution to its problems. Below we put forward two proposals for urgent measures ((1) an urgent plan for the development of special economic zones, and (2) an urgent electricity supply plan), and four proposals for medium and long-term structural reform ((1) market pricing of infrastructure charges, (2) privatization of SOEs in the infrastructure sector, (3) a transition from centralized management to localized management, and (4) elimination of the present ad hoc approach to planning and adjustment).

Our concrete proposals for medium/long-term industry location and infrastructure development consist of (1) a method that enables the rapid and efficient development of infrastructure while keeping down investment costs by focusing on the development of infrastructure in and around 40 “Myanmar Economic Zones” (MEZs), and (2) the priority development in collaboration with neighboring countries of international corridor projects taking maximum advantage of Myanmar’s strategic location between ASEAN, China and India.

**Figure 6-27 Proposal on Industry Location and Infrastructure Sector  
(Urgent and Medium/Long-Term)**

1. Urgent measures (2003-4)
  - (1) Urgent MEZ development plan: Reform of two or three existing industrial zones to create internationally attractive special economic zones (called Myanmar Economic Zones (MEZs) in Myanmar) (in 1-2 years)
  - (2) Urgent electricity supply plan (to solve shortages in a target of 1-3 years)
    - 1) Supply of electricity to MEZs
    - 2) Urgent projects to provide supplies to other regions (government/private sector BOO/BOT projects)
    - 3) Urgent gas pipeline construction projects (couple of project)
    - 4) Acceleration of construction of hydroelectric power plants (couple of plants)
    - 5) Project to repair and upgrade existing power plant with Japanese aid provided by JICA



2. Proposal for medium/long-term structural reform of industry location and infrastructure development
  - (1) Market pricing of infrastructure charges (halt of stem flow of red ink)
  - (2) Switch from monopolistic SOE approach to privatization (progressive privatization starting with sectors where privatization is feasible)
  - (3) Move away from centralized, generalized management toward management by specialists based on transfer of authority to those on the ground.
  - (4) Move away from present ad hoc approach to planning and adjustment to system of planning and adjustment of industry location and infrastructure to enable balanced development of each sector and region.
3. Proposal on medium/long-term industry location and infrastructure development projects
  - (1) Establishment of 40 MEZs throughout Myanmar and concentration of infrastructure development on development of MEZs
  - (2) Active participation in international corridor projects linking ASEAN, China and West Asia (Asian Highway, railways, communications networks, harbors)

Source: JICA Study Team

### (3) Why? Emergency Infrastructure Plan: Asian Success Stories

In order to shift from a "Vicious Cycle" to a "Virtuous Cycle", a quick improvement of investment environment (physical, legal and service environment) is needed and the proposed emergency plan will improve not only infrastructure but also the overall investment environment in the shortest time by creating internationally recognized Export Processing Zones. This type of approach was very successfully carried out by Indonesia from 1989, by the Philippines from 1990 and the most of other ASEAN countries & China.

### (4) Benefit of the Plan: Limited Cost but Large Benefit

#### 1) Cost to the Government

The emergency plan is basically the improvement of the regulations and the introduction of new strategies in which the private sector will be allowed to participate in the improvement of infrastructure and investment environment. The Government role is to improve the legal and institutional aspects and actual physical improvement can be done mostly by the private sector. The Government is only expected to pass the MEZ and BOT directives and regulations

and set up the MEZ Authority. The cost to the Government will be nearly nothing or limited since the most of investment will be carried out by private sector.

## 2) Benefit from the Emergency Plan to the Nation

It is rather difficult to predict the outcome of the emergency plan in Myanmar precisely, however, based on the experience of the ASEAN courtiers and recent investors' opinions, we predict that if the emergency plan is properly implemented and improves the investment environment, Myanmar is likely to attract a substantial number of labor intensive export-oriented industries, especially garments, shoes and toy industries, in a short time.

**Table 6-46 Future MEZ Target: 2005-2020**

	2005	2010	Total
MEZ	5	20	50
Employment	0.50 Million	1.0 Million	3.0 Million
Value Added	US\$250 Million	US\$1.5 Billion	US\$9 Billion
Net Value/Work	US\$500	US\$1500	US\$3,000

Source: Estimated by Consultant

The expected employment from the 5 MEZ (EPZ) is likely to be 500,000 new jobs and they will generate US\$ 250 million at least. They may not be fully occupied by the year 2005 due to time lag but can be fully operational in 5 years or so.

## (5) Establishment of good investment environment to ensure success of urgent MEZ development plan

The establishment of an investment environment that is attractive in the eyes of investors is essential to success. Of particular importance are the following:

- Development of minimum infrastructure: electricity, communications, waterworks and sewerage services, roads, etc. (electricity in particular is of the utmost importance).
- Streamlining of process for approval of establishment of firms and construction of plants, etc.: Establishment of one-stop window, which is already taken as given in other parts of Asia. Authority for its establishment and operation should be given to the MEZ Authority (SEZ operator).
- Streamlining and acceleration of exporting or importing of machinery and materials: MEZs should be made bonded zones where containers can be freely exported or imported leaving the seal intact. Movement into and out of ports should take no more than 24 hours.

- Investors in MEZs should be offered incentives, such as tax cuts and exemptions on a par with ASEAN countries and China and permission for long-term residence.
- Contracts for land and buildings in MEZs should be for a minimum of 50 years (with additional contract renewal options), and costs set at an internationally competitive level (no more than US\$30/m<sup>2</sup> of developed land). If possible, permanent land use rights (allowing use without conferring ownership) now commonplace around the world should be provided.
- Banks (foreign banks or joint ventures) should be established in MEZs enabling currency to be freely exchanged at market exchange rates at any time.
- The movement of funds between Myanmar and other countries should be simplified. Freedom of remittance of returns on investment should also be guaranteed through banks in MEZs.
- These rules for MEZs should be specifically laid out in the MEZ directive, and investors offered a guarantee that these rules will not be changed for a minimum of 30 years.

The success of MEZs depends on eliminating the unpredictable rule changes and unclear legislation found in Myanmar in MEZs if nowhere else, providing international business systems and services, and guaranteeing to maintain them for at least 30 years. Similar methods have succeeded in China, Vietnam and, more recently, in North Korea. The failure of special economic zones in some members of the CIS and countries in Africa has been due in most instances to the failure to guarantee the above minimum level of systems and services required for international business.

#### **Figure 6-28 Pilot Projects**

- Selection of most promising existing industrial zones in the Yangon area: (1) Hlaing Thaya, (2) Dagon (East), (3) Mingaradon, (4) Thilawa, (5) Shwalinpon, etc. are possible candidates.
- Of these five, Mingaradon and Thilawa, Hlaing Thaya will be chosen as model zones for pilot projects.
  - The existing operator will be upgraded and staffed with permanent staff from the MEZ Authority, and mechanisms put in place to enable customs, banking services and international container transportation to be performed directly in and from MEZs.
- The pilot MEZs will be made to succeed, and the number of zones progressively expanded to five according to demand. If possible, an MEZ and dry port with a bonded zone will also be established in the Mandalay region, which is the location of the No. 2 industrial cluster.

Source: JICA Study Team

## (6) Evidence and Opinions of Investors

Seven Japanese garment investments to Myanmar materialized recently and a few factories started operating this year. According to investors, Myanmar is an attractive place for labor-intensive industries such as garments, shoes and toys now although there are many obstacles in Myanmar.

Main reasons are as follows:

- Labor wages are low (lower than in China at the current exchange rate) and there are relatively abundant labor resources (nearly 50 million population)
- Membership in the ASEAN and the Buddhism culture makes it an attractive place for Asian investors, especially for Japanese and Korean investors.
- Raw materials for garment industries are now largely manufactured by ASEAN countries and China, and Myanmar is close to these countries and raw materials can be imported easily and the AFTA agreement may help even further in the future.
- Major problems: (a) lack of infrastructure especially electric power; (b) transportation cost is higher and takes an extra week compared with Vietnam and China; and (c) Multiple exchange rates and many business restrictions and obstacles.
- After weighing the advantages and disadvantages, 7 Japanese garment investors have decided to invest in Myanmar and this evidence is very encouraging for the proposed plan.
- Now 4,000 garment factories are operating in Bangladesh alone and more in China and the ASEAN countries, if Myanmar is able to improve its infrastructure (especially electric power) and investment environment by introducing the EPZ concept, 10% to 20% of these factories can shift to Myanmar. These garment factories are expected to employ 500 to 2,000 workers per factory.
- Based on these opinions of Japanese investors, we are confident that Myanmar can achieve the goal set by the emergency plan of attracting 1,000 labor-intensive investments which can create additional 500,000 workers and generate at least US\$250 million net income within 5 years if the Myanmar Government takes appropriate actions mentioned above with the strong political will to succeed.
- Implementation of urgent plan for supply of electricity by IPPs and requirements for success

The urgent electricity supply plan is intended to solve the chronic electricity shortage in high-priority fields alongside MEZs. Because of the strapped state of government finances and shortage of foreign currency, we propose that the supply of electricity should be developed and operated by the private sector (IPPs), which is already common practice around the world.

There are two forms of operation of power utilities by the private sector: build-operate-transfer (BOT) for a limited period, and build-operate-own (BOO), where development and operation is permanently entrusted to the private sector. The successful implementation of BOT/BOO power projects in Myanmar depends on the following minimum conditions:

- Free pricing of electricity rates: Suppliers should be allowed to set rates at a level that covers minimum costs and also generates profits.
- Electricity rates should be changed in accordance with changes in the environment.
- Machinery, materials and fuels should be freely importable.
- It should be possible to freely remit returns on investments.
- The free exchange of the Kyat with foreign currencies should be guaranteed.
- Continued application of rules governing BOT projects should be guaranteed for a minimum of 30 years.
- As these conditions can be easily met within MEZs, we propose that electricity BOT projects should be first implemented in MEZs.

There are four methods of improving the industrial zones already operated by firms to create MEZs and introduce BOT principles into the electric power sector. These are as follows:

- Firms in MEZs invest jointly in purchasing a generator that is operated on a BOT basis (BOT partnership).
- A third party and firms in an MEZ establish a power company to supply electricity on a BOT basis (private-sector BOT project).
- The government electricity utility, the Myanmar Electric Power Enterprise (MEPE), and the private sector establish a joint venture to supply electricity on a BOT basis (public-private BOT project).
- The MEPE invests independently in supplying electricity for within an MEZ (SOE project).

The first two methods are ready being considered by private firms in existing industrial zones and by the MEPE. What is required is a decision and action on the electricity IPP law ready for concrete implementation.

**Figure 6-29 Concrete Electricity BOT/BOO Project Proposals**

- One example of a pilot BOT power project is that at the Hlaing Thaya industrial zone. Electricity demand is almost 35MW, and BOT power proposals have been put forward by several firms. All firms operate their own small generators at their own expense to make up for electricity shortages. According to a questionnaire survey of 90 firms, the average cost of private power generation is US\$0.13/kwh. All firms showed strong interest in a private-sector BOT power project.
- The planned selling cost (including profit) of electricity produced using 50MW barge generators is around US\$0.08. This would create an extremely stable power supply cheaper than that produced independently by individual firms. Private-sector electricity BOO/BOT projects have been successfully established in industrial zones in countries such as the Philippines, Indonesia, Malaysia, Thailand, China and Vietnam.

Source: JICA Study Team

(7) Radical measures to solve the power shortage problem

The above proposals for BOT/BOO projects provide an urgent means of supplying electricity in a limited number of MEZs in order to enable Myanmar to escape the present vicious economic cycle. In order to achieve a root-and-branch solution to the problem of power shortages in the entire electric power sector independently of the BOT power projects proposed for MEZs, the following methods should be considered:

1) Redesign of electricity and energy rates structure based on market principle

One of way is that electricity rates can be set in US dollar and adjusted the local currency rates every six months or so. Under the current Myanmar economic condition, due to the declining exchange rate against the foreign currency, the electric fee rates become below the production cost. The setting rates in terms of foreign currency are one of way and for power family can be adjusted by social welfare program.

2) Both electricity rates and energy rates (for oil and gas) are presently kept below global market prices found elsewhere, and SOEs are bleeding red ink. The more electricity state-owned power utilities sell, the deeper into deficit they fall, making it impossible to spare the funds to invest in new power generating facilities. It is therefore absolutely vital to adopt a pricing structure that sets electricity rates at a level that covers minimum costs and generates profits. Because of the considerable impact on people's lives of electricity and energy rates, however, prices should be gradually brought closer to market prices over a period of three to five years to avoid causing social unrest. A

mechanism should then be introduced so that rates can be subsequently revised in line with changes in energy costs and reset so as not to diverge excessively from international prices.

**Figure 6-30 Annual Deficit of the Ministry of Electric Power**

Electricity rates in Myanmar are approximately 25 Kyats/Kwh for general use and US\$0.08 (about 75 Kyats) for foreign and large firms. Electricity is supplied at even lower rates to SOEs and military installations. Let us assume that 10% of electricity is supplied at US\$0.08 and 90% is supplied at 25 Kyats. Power consumption in 1998 was M3.7 billion kW. Compared with if rates were set at the international standard (75 Kyats), the annual loss due to excessively low rates is 165 billion Kyats (US\$180 million).

Bringing electricity rates closer to market prices will increase revenues by US\$180 million, which can be used to boost power generating capacity in the future.

The sale of petroleum products below market prices likewise results in a loss, and this loss is estimated to be in excess of that for electricity. Rates for both oil and electricity should therefore be raised and the revenues thus generated used for investment in developing the energy and transport infrastructure.

Source: Ministry of Electric Power & JICA Study Team

### 3) Urgent construction of offshore gas pipeline

Almost 50% of Myanmar's power facilities are gas-fired. Recently, however, onshore gas production in Myanmar has slumped, and this has been one of the main causes of the power shortages. Offshore gas production, on the other hand, has been steadily growing, but is entirely exported to Thailand. While Myanmar's share of offshore gas production is 25%, the lack of a pipeline makes it impossible to pipe the gas into Myanmar. An offshore gas pipeline should therefore be immediately built to solve the gas shortage.

**Figure 6-31 Concrete Emergency Gas Pipeline Plan**

- (1) Construction of an undersea pipeline from the Yadana gas field to south Yangon.
- (2) The existing pipeline up to Thaton in southeast Tangon should be extended to Yangon. Policy on implementation of (2) has been reported at a recent press conference, but the reported bore of the pipeline is small. The large bore pipeline described in (1) should therefore also be built as soon as possible. Construction of these gas pipelines will enable operation at full capacity of existing gas-fired power generating facilities (currently operating at 50% capacity). It will also enable the introduction of new 300MW gas-fired power generating facilities (which can be built rapidly).

Source: Ministry of Energy & JICA Study Team

#### 4) Establishment of BOT power projects outside MEZs

Although we propose the urgent establishment of BOT power projects at two or three MEZs around Yangon, BOT power projects should also be more widely adopted where possible in other fields and regions outside the MEZs in the Yangon area. There is particularly high potential for a BOT power project to provide power for the Monywa copper mine, and BOT power projects principally for rural industrial zones, tourist areas such as Lake Inya, and the fishery center in the Myeik region.

#### 5) Spread of small-scale power generation in provincial cities and rural communities

At 25%, the electricity penetration rate in Myanmar's provinces is extremely low, and most regions in the provinces are without electricity. In some of these regions, electricity could be generated for only a small investment by small hydroelectric facilities, wind turbines and biomass. In these regions, the rural power development should be pursued by the Government and private sector independently of the large-scale generation of power transmitted by power transmission lines. Promoting the spread of electricity in the provinces will encourage the spread of telecommunications and the development of education and culture, and stimulate economic activity.

### (8) Proposal of an urgent action plan for MEZs

#### 1) Areas for urgent MEZ establishment

- The candidate model zone for urgent MEZ establishment are Mingaradon , Thilawa and Thlain Thaya.

#### 2) Major MEZ capabilities/functions and simplification of trade work

Basically, the MEZA office in the MEZ would perform all requisite licensing and approval work by proxy.

Examples of work performed by the MEZA by proxy.

- Corporate registration
- Licensing of operations in the MEZ
- Approval of employment
- Export/import licensing and registration (or special exemption from requirements)
- Customs clearance procedures
- Contracting for use of electrical power, waterworks, sewerage, etc.



The centralized performance of this licensing and approval work would simplify trade business, as shown in the figure below. To this end, a special directive (MEZ Directive) must be prepared in the concerned ministries (of Commerce, Finance, Nos. 1 & 2 Industry, Agriculture and Irrigation, Forestry and others) upon adjustment with legislation related to registration, export/import work, customs clearance, and quarantine.

## 6.6 Rural Electrification Sector

### (1) Present Conditions of Rural Electrification in Myanmar

The power sector in Myanmar is administrated by the Ministry of Electric Power (MOEP), under which are three organizations: the Department of Electric Power (DOEP) responsible for policy making; the Department of Hydroelectric Power (DHP) responsible for investigations, designing and implementation of hydropower projects; and Myanma Electric Power Enterprise (MEPE) responsible for operation and maintenance of hydro and thermal power stations, construction and maintenance of transmission and distribution networks, and management of electricity business such as tariff collection and so forth. MEPE implements and manages the interconnected and isolated power grids. Although electrification ratio of the urban area amounts to 97 %, that of the rural area having 13,792 Village Tracts remains at 7.6 %. The performance of the power sector has shown a steady progress since 1988 to 2000 as shown below:

**Table 6-47 Power Sector and Rural Electrification**

Items	1988/89	2000/01	Remarks
Nos. of customers	600,000	1,030,000	Annual growth rate at 4.6 %
Nos. of Townships electrified	287	323	All the Townships electrified by 1996.
Nos. of Village Tracts electrified	749	1,117	8.1 % of the 13,792 VTs electrified by 2000/01 (village electrification ratio).
Generating Capacity			
Hydro	707 MW	1,172 MW	Annual rate at 4.3%
Thermal around	229 MW	360 MW	3.8%
Yangon	110 MW	465 MW	12.8%
Firm Peak Output	407 MW	716 MW	Annual rate at 4.8%
Peak Power Demand	332 MW	1,005 MW	Annual rate at 9.7%
Annual Energy Generated	2,226 GWh	5,020 GWh	Annual rate at 7.0%
Annual Energy Sold	1,428 GWh	3,715 GWh	Annual rate at 8.3%
Length of 11-33-66 k V Distribution Lines	4,837 miles	7,915 miles	Annual rate at 4.2%

Source: MEPE

According to the present power tariff system implemented on 1 March 1999, the energy charge is at K2.50/kWh for general use up to 50 kWh per month. This is equivalent to about US\$0.25 per kWh that cannot recover even the running costs of power stations.

The main sources of electric power in the rural areas are, in the descending order by scale, 1) MEPE grids, 2) self supply generators of villages (diesel engines, Pico hydros, rice husk gas engines), 3) battery lighting (8 W as standard) on individual basis charged at Battery Charging Station (BCS). Most of BCS are commercially operated with the grids or diesel generators as power source. In Myanmar equipments of small hydros are manufactured in MEPE workshop as well as in private workshops as shown below:

**Table 6-48 Workshops of Small Hydros in Myanmar**

No.	Workshops	Nos. of Installations	Remarks
1.	MEPE workshop in Yangon	30	A total output at 13,548 kW, average station output at 450 kW, including equipments imported.
2.	U Khun Kyaw, Rural Development & Hydroelectric Implementation Group, Taunggyi, Shan State	33	Manufactured and installed small hydros of 5-75 kW since 1984, and accumulated adequate technology, which can be the Model for proposed VEC Schemes.
3.	U Kyaw Kyaw, U Taing Kyaw workshops, Sein Pann Industrial Co-op Ltd., Mandalay	9	Manufactured and installed five Pelton turbines of 3 kW each in Kachin State in 1983. Manufactured two Crossflow turbines of 5-10 kW in 1987. Manufacturing Francis and propeller turbines in 2002.
4.	U Paung Kyaw workshops, Sein Pann Industrial Co-op Ltd., Mandalay	30	Manufactured Pelton turbines of 5-50 kW since 1983, for Northern Shan.
5.	U Chit Hla and Sons, Aye Thar Yar Industrial Zone, Shan State	56	Manufactured Pico turbines of 5-20 kW since 1989.

Source: JICA study team for Introduction of Renewable Energies in Rural Areas in Myanmar

Numbers of solar or wind-powered BCSs in Myanmar are limited except for

some donated by the private sector. UNDP, in cooperation with the Ministry of Health, installed Vaccine Cold Storage System with solar power (SHS type) for 27 hospitals and clinics in total. UNDP, also in cooperation with the Ministry of Agriculture, installed solar pumps at 31 locations. Solar Home Systems have been partly disseminated on individual basis in Yangon Division, Bago Division, Chin State, etc. MEPE operates about 30 small hydros as well as 456 diesel generators for rural electrification of remote areas.

(2) Renewable Energy Potential and Prospects of Rural Electrification

As the local resources and technologies available for Rural Electrification in Myanmar, there are 1) abundant small hydro potential and turbine manufacturing and installation technology, 2) rice husk potential amounting to 3.5 million tones a year and the gasification technology for gas engine generator, and 3) recycling technology of batteries and presence of collection and distribution network of batteries on the commercial basis. As the small hydro potential, there are 154 sites of small hydros smaller than 10 MW and 170 MW in total potential output as identified by DHP. Also there are numerous number of Pico hydro sites of 5-20 kW and the points for installation of turbine-generator assembly of 1 kW or less, centering Shan State. Timber, rice husks, and bagasse from sugarcane are the main biomass resources. Timber of 540,000 tones is fell down annually while its 20 % are left in the forests as residue. Sawmills discharge about 30 % of the timber processed as wood chips and sawdust, which are effectively utilized as fuel of factories and homes. The wood residue left in the forest would be used as wood pellet or for gas engine generation if these can economically be collected from wide fields. Rice husks, produced at about 3.5 million tones a year, have been used as fuel for home cooking, brick burning, alcohol distillation, burning of earthenware and porcelain, litter-substitute for poultry farming, power source for rice-mills (husk gas engine), and so forth. If it is assumed that 20 % of the total husk can be used for rural electrification purpose, it has a potential of power generation at 127 MW, which can electrify, at 80 W per household, 1.6 million households and about 10 million people. Bagasse resources amount to 1.3 million tones a year. Its production is limited to 5-6 harvesting months in the dry season. Since bagasse cannot be stored for long time due to its high content of moisture, power generation fueled by bagasse is limited to the dry season. It has been used as source of heat and electric power at sugar-mills but is not suitable for rural electrification of small and isolated systems. However, since the bagasse production is concentrated to the dry season when the output of hydropower stations drops, it can augment the dry season output of hydros if bagasse

power stations are operated in parallel with the interconnected or isolated power grids of MEPE. Solar potential is abundant all over the Myanmar. Wind potential is limited to the western coasts and inland wind corridors (along Ayeyarwady River, western edge of Shan Plateau, etc.). These can be implemented only with external financial supports for their relatively high costs.

(3) Target of Rural Electrification

Since the first oil shock in 1973 when kerosene oil disappeared from the market in Myanmar, “diesel oil lamp” and “battery lighting” with 4-8 W lamps have rapidly spread countrywide. Batteries are charged at commercial stations powered by the grids or diesel generators. Although there is no statistic on the battery lighting, it is estimated 20-30 % of the rural households have such battery lighting. The rural electrification that MEPE implements by extending distribution lines from the interconnected and isolated grids aims at 24 hour supply. A small scale rural electrification to be implemented by Village Electrification Committee (VEC), etc. targets at supply for 5 hours a day (6:00 p.m. to 11:00 p.m.) to power 3 fluorescent lights of 20 W per household. The demand for rural electrification will require 700 MW for 5.8 million households if the unit demand is assumed at 120 W per household on an average of MEPE Schemes and VEC Schemes. Taking into consideration these rural electrification cannot benefit from scale merit, it may be assumed that unit construction cost including distribution lines be at around \$2,000 per kW. Then the total capital requirement for achieving the rural electrification would be in the order of \$1,400 million. It is envisaged as the minimum target of rural electrification that 166 Village Tracts with about 500,000 people be electrified for lighting purpose every year with renewable energy. This would improve the electrification ratio by 1.2 % a year. As shown below, about \$15 million will be required annually as the aggregate costs to achieve the target:

**Table 6-49 Minimum Target for Rural Electrification and Capital Requirement**

No.	Type	Capacity	House-	Price per	New VT	Annual Total		
			holds	Scheme	Electrified	House-	Popu-	Amount
			nos.	\$1,000	nos./yr	nos.	1,000	\$1,000
1	Rice husk gas engine	50 kW	500	40	140	70,000	420	5,600
2	Mini-hydro	300 kW	2,000	1,200	5	10,000	60	6,000
	Micro hydro	50 kW	400	100	15	6,000	36	1,500
3	Solar BCS	16 kWp	200	230	6	1,200	7	1,380
Total			-	-	166	87,200	523	14,480

Source: JICA study team for Introduction of Renewable Energies in Rural Areas in Myanmar

(4) Strategy for Promoting Rural Electrification

It has been proposed in the rural electrification sector for substantial improvement of the rural electrification ratio as early as possible that the following two basic approaches be taken:

- MEPE Schemes for 24 hour supply: MEPE will, from the long-term viewpoint, develop small hydros of greater than 100 kW in remote areas on one hand and will extend distribution lines from the grids on the other hand, to materialize the full scale electrification on 24 hour basis for lighting and industrial/commercial demand as well.
- VEC Schemes for lighting: The villagers are encouraged to realize the low-cost and sustainable electrification by rapid introduction of village electrification schemes with the self-help spirit for the short to medium term, utilizing the national technology and local renewable energy.

In order to improve the rural electrification ratio as early as possible, *VEC Schemes* should first, on the short to medium term, be implemented to disseminate electric lighting with the national technology and local resources. Following the lighting campaign, *MEPE Schemes* should, as part of the national socio-economic infrastructures, be extended to these households on the long-term, to facilitate the grid connection for 24 hour supply and the use of various electric appliances.

### MEPE Schemes

It is essential that MEPE continue the ongoing Generation Expansion Plan of the Interconnected Grid, which will alleviate the severe load shedding being imposed in the Grid and will also contribute to securing the power source for rural electrification by the grid extension. In addition to the Generation Expansion Plan of the Interconnected Grid, *MEPE Schemes* need implementation of the following rural electrification projects:

- To rehabilitate or augment the capacity of existing power stations of isolated systems (small hydros and diesels);
- To implement small hydros;
- To extend distribution lines from the grids.

### VEC Schemes

- To realize the lighting first, preceding the full scale electrification by the grid extension that may take even 10s of years depending on the location;
- To aim at lighting for 5 hours a day from 6:00 p.m. to 11:00 p.m.;
- To implement by villagers' self-help spirit with technical supports from MEPE.

Even when the two basic approaches above are implemented, it is foreseen some villages that lack renewable energy potential and are situated far from the grids would be left un-electrified even after 30 years.

- **Social Schemes:** It is desirable that MEPE install BCSs to charge batteries for lighting in those villages which would not be electrified by VEC Schemes and MEPE Schemes even after 30 years. Such BCSs should be powered by solar or wind power and complemented by Community Hall Lighting System of SHS type.

## (5) Necessary Measures

### Institutional Measures

- To appoint MEPE as Champion for Rural Electrification and establish Section of Rural Electrification (SRE) and attach it to the Planning Department of MEPE;
- To officially recognize Village Schemes;
- To establish and manage Rural Electrification Fund (REF) and Performance Bond System (PBS) (PBS is to encourage villagers on decision making for implementing *VEC Schemes*);

- To implement Capacity Building for construction, operation and management of rural electrification projects;
- To finance *Social Schemes*.

#### Applicable Energy Sources for Rural Electrification by Region

A framework for preliminary selection of form of renewable energy for electrification of a village in certain region is given below:

- Small hydros are most suitable in the Shan Plateau, Chin State, and so forth.
- Biomass gas engines are suitable countrywide wherever there are excess rice husks or wood chips/sawdust available at a low cost being situated nearby rice-mills or sawmills.
- In the remote mountainous areas, Pico hydro is suitable if there is potential and if not solar-powered BCS may be applied. Subject to financial capacity, SHS could also be implemented elsewhere.
- Wind-powered BCS may be employed where local wind potential exists.

**Table 6-50 Framework for Preliminary Selection of Form of Renewable Energy**

No.	Region	MEPE		Agency for RE			
		Extension of Distribution Lines from National/ Local Grids	Small & mini-hydro P > 100 kW 51-10,000 kW	Micro-hydro P < 50 kW 0.5-50 kW	Solar BCS 0.05-3 kW	Wind BCS 0.05-3 kW	Biomass gas engine 10-100 kW
1	Mountain Regions	★	★★★★★	★★★★★	★	★★	★★★★★ with rice husk or sawdust
2	Delta and Paddy Cultivating Regions	★	-	★ on irrigation channel	★	★ where wind prevails	★★★★★ with rice husk
3	Coastal Regions	★	★★	★★	★	★★	★★★★★ with rice husk or sawdust
4	Remote and hardly accessible areas	-	★★	★★★	★★★★★	★★	★★★★★ with rice husk
5	Urban Areas including Suburbs	★★★★★	-	-	-	-	-

Legend:   This pattern means out of scope of the current study.

★ to ★★★★★ Shows level of potential for implementation.

Biogas may be useful for lighting and cooking in those households in the border areas which are scattered in wide areas and, therefore, favor such individual system as for own home use rather than the distribution line-connected RE system.

Source: JICA study team for Introduction of Renewable Energies in Rural Areas in Myanmar