Chapter 3 Electric Power Industry and Others in Iran

3.1 Introduction

Chapter 2 of the Final Report of the Master Plan Study described the socio-economic situations in Iran in the extents enough to understand the contents of the Report. This Chapter 3 of the Follow-up of the Master Plan Study gives notable changes in Iran in three years. Cited references are mainly 1) Basic information collection project in Iran by JICA in March 2002, and 2) Statistical Yearbook 2001/2002 in the home pages of Statistical Center of Iran. Other information and references collected during the follow-up study are also used for preparation of this report.

Iran has the second largest population and economic activities within the Middle East and the second largest production of crude oil in OPEC, and the second largest deposit of natural gas in the world. However, the revolution and the war with Iraqi, Asian economic crisis, fluctuation of oil prices have affected economics of Iran in decades. Meanwhile from March 2000, the Third 5 Years Development Plan was started to mainly direct towards improvement of the economic foundations and social administrative structure. (Presidential Speech on 20 March 2000).

The JICA Team found on the first day of the Study surprisingly that the conversion rate of Rial to Dollar was the same to the September 1999 as written in the Master Plan Report. The conversion rate had been revised from the fixed rate of Rls.3000 per \$1 to the floating system in August 1998. Currently high oil price may make economy of Iran to be stable.

Also the JICA Team found that existences of Korea and China were enlarged in Iran. The Iran Air Tehran flights via Beijin from and to Japan were loaded with many people related with Korea and China. The first word to the JICA Team from taxi drivers was almost all 'Are you Korean?' Tehran subways were in operation with the cooperation of China and reportedly construction of an additional subway line would be awarded to China. The JICA Team saw many visitors from other than Asia. Iran started production of airplanes with the cooperation of Rumania (Newspaper on Nov. 16) and Rumania proposed to solve air pollution caused by mobile sources in Tehran (Newspaper Dec. 2). Also Italy expressed its desire to solve environmental issue in Iran. The JICA Team saw TVs in English, French and German in three cities visited.

Air pollution in Tehran seemed severer than the one in 3 years ago. On Nov. 19, CO

concentration was over the hazardous condition and an alert warning was alarmed in the city. The municipality of Tehran announced to introduce 1500 buses that would use natural gas of less emission of CO than current diesel fuel and also to give cars entering regulated districts of Tehran an obligation to be inspected their emissions. Cars in Tehran were running around neglecting common rules. According to the Yearbook 2001/2002, cars in Iran increased by 68% in three years from 1998. The province of Tehran has 17% population of the nation, although it has 145,186 cars: 46% of the nation in 2000.

3.2 Policy and Economics

The Third 5 Years Development Plan expects numerically an annual economic growth rate of 6% and an annual increment of employment to be 760,000 people. Major strategies are the gradual conversion to the market-oriented economy and the reduction of dependency on oil revenue. The following are major objectives of the Plan:

- Job creation and elimination of joblessness
- Guarantee of economic safety and establishment of reliance on investment and production
- Renewal of budget system and reduction of oil revenue on governmental budget
- Independence on planning of financial policy and application of indirect financial policy
- Privatization of economic activity, public involvement in social services, and reduction of governmental involvement in economic activity
- Balancing of national finance and promotion of non-oil products

The following 11 items are cited as basic policies to be implemented.

- ① Institutional and financial reformation
- 2 Restructuring of national enterprises
- ③ Elimination of monopolies and facilitation of competitiveness
- ④ Reduction of governmental subsidies and reformation of social security system
- ⑤ Increment of employment
- 6 Revision of tax and budget system
- ⑦ Conservation of locally independent revenue sources
- (8) Improvement of banking and exchange systems
- (9) Establishment of financial system
- 10 Intensification of scientific and technological research and development
- (1) Attention to Environmental preservation

There are several basic policies continuing from the second 5 year Plan. It is remarkable to have the environmental preservation as one of the basic policies, among several ones continuing from the Second 5 Years Plan.

The Second 5 Years Plan achieved 3.1% growth of the gross domestic product (GDP) annually, instead of targeted 5.1% reportedly. However, in the middle of the Third 5 Years Plan, the Management and Planning Organization announced that the annual GDP growth would be 6.4% instead of 6% planned (Newspaper Nov. 24, 2002).

The Iranian GDP-Market price was equivalent to around US\$ 80 billion in 2000 (Statistical Yearbook 2001/2002) that was equal to US\$ 1257 of the GDP/capita by using the population in 2000 to be 63,663,942. The population was given in the report of Statistical Center of Iran.

3.3 Electric Sector

The chapter 3 of the Final Report of the Master Plan Study gave details of the electric sector in Iran. Added below are developments in three years after the Master Plan Study, cited from "Electric Power Industry in Iran 1967-2000" published by Tavanir and MOE, and the Yearbook 2001/2002.

There was no major change in the organization of MOE from the one in 1999. The detailed Tavanir organization is attached as Appendix A.3-1. The organization of the Power Sector has been changing into an independent economical enterprise. Organizations related with environmental controls in MOE had been rearranged slightly as described in Article 4.3 of Chapter 4 later.

Table 3.1 indicates electric power consumption by various sectors. In the table, "commercial" includes public services and "others" does uses for agriculture. The total consumption was doubled in these 10 years. The most increment was for the Industry sector.

Table 3.2 shows annual changes of installed capacities with generation methods. Current installed power plants are listed in Appendix A.3-2. Table 3.3 is for annually generated powers by generation methods. "Gas Turbine" in two tables includes combined cycle generation method.

Voor	Decidential	Commoraial	Inductry	Othora	Total (CWb)
real	Residential	Commercial	Industry	Others	Total (Gwn)
1990	17,344	11,930	10,220	5,613	45,107
1991	19,128	13,609	10,637	5,801	49,175
1992	19,509	14,004	13,262	5,531	52,306
1993	22,143	14,984	15,572	5,415	58,114
1994	22,473	13,747	20,470	6,935	63,625
1995	23,374	13,858	21,390	7,232	65,854
1996	23,993	14,217	22,925	8,920	70,055
1997	26,523	14,887	23,661	8,287	73,358
1998	28,686	15,561	24,140	9,259	77,646
1999	29,754	16,189	26,504	12,209	84,656
2000	31,266	17,262	28,937	12,901	90,366

Table 3.1	Power	Consum	ption	in	Sectors
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 Table 3.2
 Installed Capacity of Electric Generation

Year	Hydraulic	Steam	Gas Turbine	Diesel	Total (MW)
1990	1,953	8,086	3,940	824	14,803
1991	1,953	8,086	3,940	869	14,848
1992	1,953	8,710	4,794	856	16,313
1993	1,953	9,513	5,934	812	18,212
1994	1,953	10,742	7,007	758	20,460
1995	1,953	11,557	7,746	658	21,914
1996	1,969	11,621	8,168	662	22,420
1997	1,999	11,685	8,896	677	23,257
1998	1,999	12,400	9,422	616	24,437
1999	1,999	13,115	9,565	593	25,272
2000	1,999	13,764	10,036	574	26,373

Table 3.2 indicated that the 52% of the total electricity were generated by the steam power plants and no expansion of the hydraulic plant was recorded. However, the newspaper on Nov. 19 reported Karoun No. 3 Hydraulic Unit (Rated 2000MW) is close to completion with 25% remaining construction. After its completion, the capacity of electricity generation by the hydraulic method will almost be doubled.

Table 3.3 concludes total 96.5% of electricity is generated by steam and gas turbine methods.

Year	Hydraulic	Steam	Gas Turbine	Diesel	Total (GWh)
1990	6,083	38,836	8,723	1,254	54,896
1991	7,056	41,947	9,463	1,244	59,710
1992	9,330	42,362	10,866	1,224	63,782
1993	9,823	48,166	12,419	927	71,335
1994	7,445	53,376	15,402	863	77,086
1995	7,275	55,901	16,145	723	80,044
1996	7,376	62,364	15,475	610	85,825
1997	6,908	65,628	19,298	475	92,309
1998	7,015	63,988	26,486	373	97,862
1999	4,943	70,689	31,156	419	107,207
2000	3,650	78,332	33,365	361	115,708

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3.4 Electricity Generation and Fuel

Table 3.4 tabulates the annual fuel consumption in power plants under MOE. Table 3.3 indicated that increment of power generation by gas turbine method including combined cycles is remarkable. Here in Table 3.4, it is also remarkable to see the increment of natural gas consumption in the power industry.

Table 3.4	Annual Fuel	Consumption and	Total Energy in	Power Plants
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	Diesel Oil1000m ³	Fuel Oil 1000m ³	Natural Gas 10 ⁶ m ³	Total 10 ⁹ kcal ¹
1990	1,143	4,810	8,316	135,951
1991	965	5,144	9,099	144,964
1992	1,103	4,853	9,858	150,718
1993	1,973	5,786	11,501	171,398
1994	1,151	5,887	12,541	182,866
1995	1,411	6,700	13,234	194,577
1996	1,014	7,446	13,443	205,737
1997	1,161	7,038	15,604	240,381
1998	796	4,870	19,403	232,677
1999	1,073	5,946	21,234	248,179
2000	1,283	6,492	22,883	271,082

By assuming heat of combustion of each fuel as diesel oil to be 13,000,000kcal/m³, fuel oil to be 10,320,000kcal/m³, natural gas to be 8,680kcal/m³, the power industry generates electricity 6% from diesel oil, 24% from fuel oil and 70% from natural gas in 2000.

¹ Traditional units as given in the reference cited.

Figure 3.1 illustrates annual production amounts of natural gas (Yearbook 2000). In 1999, the amount supplied to the National Iranian Gas Company was $58,729 \times 10^6 \text{m}^3$, and that injected to oil field was $24,729 \times 10^6 \text{m}^3$. The National Iranian Gas Company supplies gas for power generation and for residential use, etc. Table 3.4 tells that the power plants consumed about 36% of the net supply. More natural gas will be consumed in the power plants by their conversion from fuel oil and the increasing popularity of the gas turbine generation method.





Figure 3.2 shows annual change of crude oil production, processing and export amounts in Iran. Iran produced $1,533 \times 10^6$ barrels in 2001 and exported a half and process domestically a half of its production.





Year

Table 3.5 tabulates daily amounts of oil products (Yearbook 2000/2001 and 2001/2002). Although there was no data revealed product distributions in 2000, the daily productions of total products are almost equal in 2000 and in 2001. By assuming the amount of fuel oil production is equal to that in 2001 and assuming 300 days operation in one year, annual production of fuel oil in Iran would be $24 \times 10^6 \text{m}^3$ in Iran in 2000. As the consumed amount of fuel oil in the power plants was $6.492 \times 10^6 \text{m}^3$ (Table 3.4) in 2000, about 27% of all fuel oil produced in Iran was burnt for power generation. The percentage will be reduced by more conversion to natural gas in the power sector.

	1995	1996	1997	1998	1999	2000	2001
LPG	7,594	7,341	7,783	7,638	8,900		8,298
Gasoline	28,293	28,321	29,331	30,369	29,700		37,128
Kerosene	23,703	25,220	25,467	26,076	25,300		27,160
Gas Oil	55,700	57,869	61,646	59,785	58,400		70,879
Fuel Oil	64,933	68,649	76,710	57,258	66,300		80,152
Aviation Fuel	2,300	2,322	2,908				3,098
Lubricant	1,409	1,097	1,361				1,221
Asphalt	6,678	7,592	7,520				8,284
Others	6,828	8,213	8,757				10,382
Total	197,438	206,624	221,483	234,407	247,460	245,808	245,891

Table 3.5Daily Production of Oil Products (m³/Day)