Syria

Jandar Power Station Project

ReportDate: August2002
Field Survey: February, 2002

1. Project Profile and Japan's ODA Loan

Site Map：Jandar District

Site Photo：Combined Cycle Power Station

1.1 Background

Power demand in Syria showed outstanding growth, at times as high as 12.5% at maximum load on an annual average during the decade of the 1980s. The expansion of power generating facilities however, did not keep pace with the increasing power demand. There were serious power shortages in the late 1980s and power shedding was introduced at a maximum 4–5 hours per day. The expansion of the Mehardeh Thermal Power Plant (330MW) in 1988 and the Basnias Thermal Power Plant (340MW: ODA loan project) in 1989 considerably alleviated power shortage.

In spite of this, further increases in power consumption were expected with the growth in power demand and growing trends in the mining and manufacturing sectors which consumed huge mounts of electricity. A power shortage of 490MW in was expected in 1993 and a shortage of 660MW in 1995. In addition, oil, which is the major fuel for thermal power generation, occupying 80% in Syrian power generation, has been a major export product for Syria, and thus effective utilization of associated gas (natural gas) for power generation has also been considered.

1.2 Objectives

To construct a combined cycle power station (300MW×2 line) in the Jandar District, 30km south of Homs, thereby alleviating power shortages in Syria and effectively using domestically produced natural gas.

1.3 Project Scope

Major contents of the project scope are as follows:

(1) Installation of Thermal Power Facilities (300MW×2 lines)
  (a) Gas turbine: output 100MW×4 units
  (b) Gas turbine electric generator: 4 units
  (c) Heat recovery boiler: 4 units
  (d) Steam turbine: 100MW×2 units
  (e) Steam turbine electric generator: 2 units

(2) Installation of related facilities (transformers, coolant and water disposal facilities, and natural gas supply system)

(3) Construction of 210 flats to house workers

(4) Consulting services

The ODA loan covers the total amount of the foreign currency portion of the project costs. In concrete terms, this is civil works and the installation of necessary equipment and materials relating to (1)–(3) above as well as fund procurement for consulting services listed in (4).

1.4 Borrower / Executing Agency

Syrian Arab Republic／Public Establishment of Electricity for Generation and Transmission (PEEGT) (former Public Establishment of Electricity (PEE))

1.5 Outline of Loan Agreement

Loan Amount Loan Disbursed Amount	51,598 million yen 51,326 million yen
Exchange of Notes Loan Agreement	June, 1991 June, 1991
Terms and Conditions Interest Rate Repayment Period (Grace Period) Procurement	 2.9% p.a. 25 years（7 years） General untied
Final Disbursement Date	June, 1998

2. Results and Evaluation

2.1 Relevance

The objectives of this project were the enhancement of the capacity of power supply to respond to the increase in power demand in the future and also the effective use of natural gas. The Syrian Five-Year Plan for the Electric Sector (2001–2005) also advocates the construction of new power plants and the improvement of power generating capacity through the rehabilitation of existing power plants as well as the promotion of a shift from oil fuel to natural gas in order to prepare for future increases in power demand. The PEEGT also constructed the Tishreen Dam Hydroelectric Power Station (630MW), the Aleppo Thermal Power Station (1,065MW), the Al-Zara Thermal Power Station (660MW,project of Japan's ODA Loan), and the Zezoun Thermal Power Station (300MW) etc. after the construction of the Jandar Power Station. Thus, power generating capacity has been strengthened in Syria.

Furthermore, a plan to convert existing power plants from oil-fueled to gas-fueled is also being prepared. Improvement works on existing thermal power stations such as the Banias Thermal Power Station, the Al-Nasrieh Thermal Power Station, and the Tishreen Thermal Power Station (200MW) are planned. The PEEGT plans to not only enhance the power generating capacity of existing power stations but also to convert all oil-fueled power stations to gas-fueled, effectively using natural gas by the year 2010.

In addition, combined cycle power generation has superior thermal efficiency. By using natural gas, it also has less gas emission and is thus better in terms of environmental conservation than using oil. Thus, this project is still relevant.

2.2 Efficiency

2.2.1 Project Scope

Items which were modified from the original plan in the project scope are as follows. The total installed capacity increased from 600MW (gas turbine power generation 100MW×4 units, steam turbine power generation 100MW×2 units) to 700MW (gas turbine power generation 118MW×4

units, steam turbine power generation 114MW×2 units). The plan for workers' housing was downsized from a total 210 flats to 154 flats. Besides this, there were no significant modifications in the implemented plan compared with that initially planned.

2.2.2 Implementation Schedule

The initial plan estimated the period of construction at 53 months from March 1991 to July 1995 (from the commencement of the selection of consultants to the completion of project supervision by the consultants). In actual terms, the project took 72 months from March 1991 to February 1997, and was completed with a delay of 19 months. Major reasons for this delay were that it took longer than expected to select consultants and to bid with contractors, delaying the commencement of construction for 17 months, which ultimately led to the delay of the whole implementation schedule. Strictly, power plant projects like this are generally considered to be complete at the issue of the Final Acceptance Certificate by those who accept the order. But in the case of this project, the issuing procedure for the Final Acceptance Certificate was shelved after the issue of a Provisional Acceptance Certificate in May 1996. So this has been a long-standing concern between PEEGT and the contractor, but Final Acceptance Certificate was finally issued in May 2002.

2.2.3 Project Cost

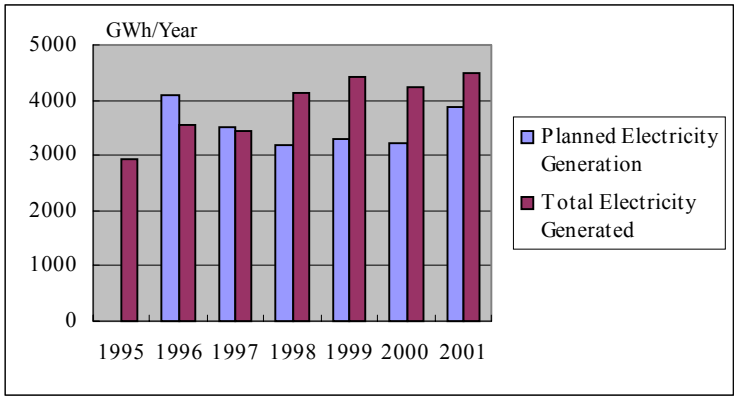
The initial plan estimated 64,935 million yen for total project costs and of this, 51,598 million yen was supposed to be covered by the ODA loan. Actual costs were within the planned budget—56,697 million yen for total costs and 51,326 million yen covered by the ODA loan.

2.3 Effectiveness

(2.3.1) Electricity Generated

The Jandar Thermal Power Station had started trial operation from 1996. It has been steadily running since then. From 1998, it has generated more electricity than planned every year. The objectives of the project have therefore been sufficiently achieved. Currently, approximately 20 % of all electricity generated by PEEGT is generated by this power station. It is functioning as a significant base load power plant in Syria.

Figure 1: Actual Power Generation at the Jandar Thermal Power Station



Source: PEEGT

(2.3.2) Other Indices of Operation Effects (Utilization Rate and Operation Rate)

Utilization and operation rates after completion underwent a smooth transition. Actual rates on average of the past three years (1999–2001) are very good: 84% for the utilization rate and 95% for the operation rate. Total thermal efficiency is fair, recording 49% (47% on a net basis). Although the operation rate slightly declined between 2000 and 2001, this was because four unit gas turbines were overhauled at that time.

Table 1: Other Indices of Operation Effects

	Completion Year (1995)	Year 2 (1996)	Year 3 (1997)	Year 4 (1998)	Year 5 (1999)	Year 6 (2000)	Year 7 (2001)
1. Utilization rate (%)	56	68	66	77	84	80	85
2. Operation rate (%)	89	93	86	97	98	94	95
3. Power sales (million S.P.)	1,736	2,076	2,015	2,363	4,504	4,286	n.a.
4. Profits (million S.P.)	0	0	0	0	0	0	0

Source: PEEGT

Although growth in the utilization rate and the operation rate increases power sales, profits derived from power sales have been zero. This is because of the particularities of the Syrian charge structure for power and the role of PEEGT as a public utility company expected to provide public services for the Jandar Power Station. That is, Syrian power tariffs are low and controlled by policy, and the sale price between PEEGT and PEDEEE is set at the price equivalent to power generation costs—structurally no profits are supposed to be generated. The managerial resources of PEEGT are thus based on the premise of a budget from the government, and profits derived from power sales are not be generated.

(2.3.3) Recalculation of the Financial Internal Return Rate (FIRR)

At appraisal, the financial internal return rate (FIRR) was expected to be 23.4 %. The premise for this is shown below. At current assessment, recalculation was not made due to the structure for the sale of power shown above, as well as the unavailability of data which uses the same premise as those of appraisal. For the problems in sustainability of this project in financial terms, see 2.5.3.

（Prerequisites）

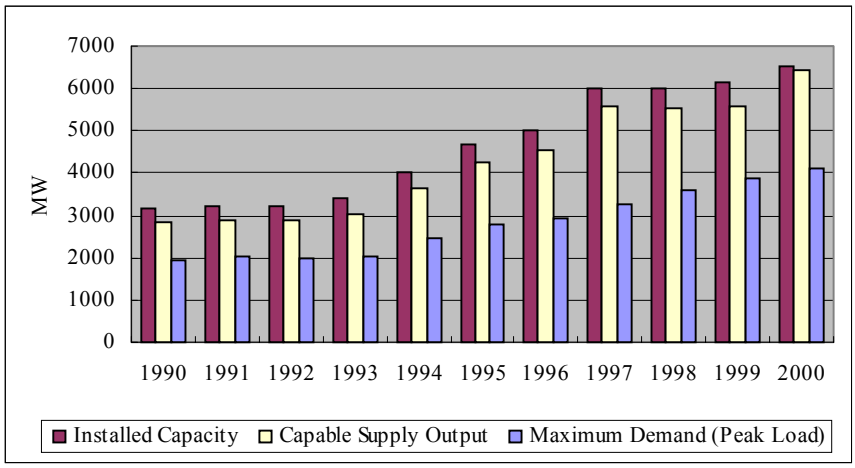
- Project Life: 25 years after starting operation
- Benefits: sales income of electricity
- Costs: total project costs, fuel expense, operation and maintenance costs

2.4 Impact

(2.4.1) Impact on the Alleviation of Power Shortages in Syria

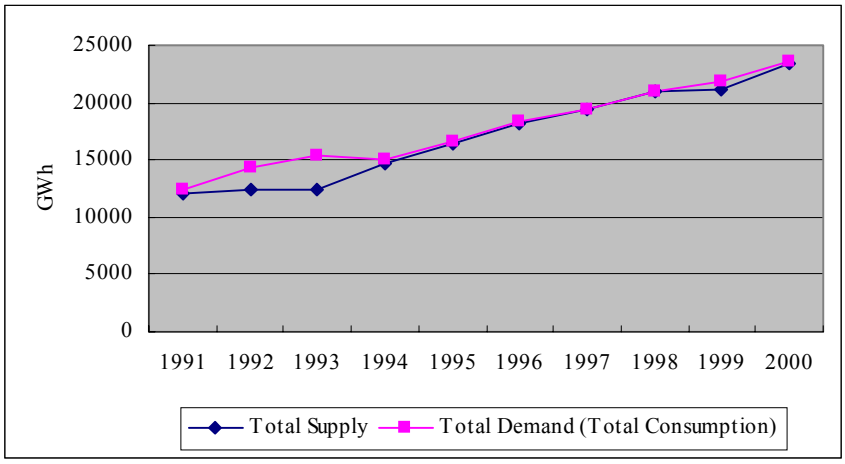
The domestic power demand after completion of this project in 1995 increased with an outstanding 8 % on an annual average (1995–2001). The enhancement of the supply capacity was accordingly made. As Figure 3 illustrates, demand and supply were well balanced after 1995.. PEEGT expects a further increase in power demand after 2002 (Figure 4). This power station, occupying the largest share in the country, at 20 %, contributed to Syrian economic development through its stable power supply.

Figure 2: Actual Performance between 1990–2000
(Installed Capacity, Electric Supply and Peak Demand)



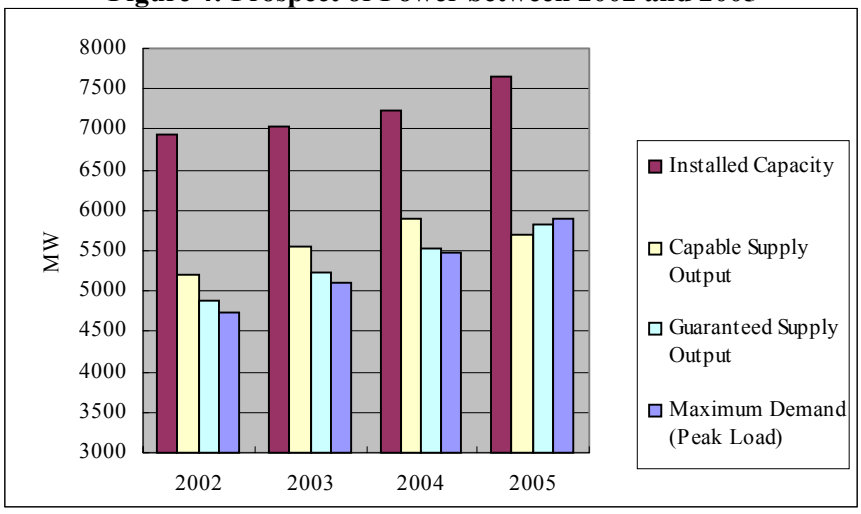
Source: PEEGT

Figure 3: Actual Performance between 1990 and 2000 (Total Supply and Total Demand)



Source: PEEGT

Figure 4: Prospect of Power between 2002 and 2005



Source: PEEGT

Table 2: Transition of Syrian Power Status (1990–2001)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1. Maximum Power Demand (MW)	1,928	2,028	1,982	2,032	2,474	2,847	2,944	3,271	3,580	3,891	4,128	4,565
1-1. Domestic Demand	1,928	2,028	2,042	2,082	2,474	2,745	2,855	3,179	3,480	3,771	3,878	4,335
1-2. Export			-60	-50	0	102	89	92	100	120	250	230
2. Installed Capacity (MW)	3,168	3,198	3,198	3,398	3,998	4,698	4,998	6,028	6,028	6,133	7,003	7,108
3. Supply Capacity (MW)	2,856	2,886	2,886	3,024	3,624	4,234	4,534	5,564	5,534	5,569	6,430	6,330
4. Generated Power (GWh/Year)	11,324	12,080	12,392	12,510	14,700	16,446	18,341	19,512	21,159	22,819	25,217	26,713
4-1. Thermal Power	9,987	10,490	10,823	10,927	12,241	13,646	14,792	15,977	17,678	20,716	22,714	24,595
4-2. Hydraulic Power	1,337	1,590	1,502	1,538	2,459	2,800	3,549	3,535	3,481	2,103	2,503	2,118
4-3. Import			67	45	0	0	0	0	0	0	0	0
5. Power Consumption at Power Stations (GWh/Year)	1,050	1,092	1,020	1,099	1,224	1,195	1,457	1,456	1,558	1,721	1,737	1,950
6. Transmitted Power (GWh/Year)	10,274	10,988	11,372	11,411	13,476	15,251	16,884	18,056	19,601	21,098	23,480	24,763
7. Power Consumption (GWh/Year)	10,274	10,988	11,372	11,411	13,476	14,602	16,208	17,463	19,003	20,572	22,725	24,053
7-1.Domestic Consumption	10,274	10,988	11,372	11,411	13,476	14,310	15,525	16,855	18,349	19,724	21,307	22,681
7-2. Export	0	0	0	0	0	292	683	608	654	848	1,418	1,372
8. Supply-Demand Gap (GWh/Year)	0	0	0	0	0	+649	+676	+593	+598	+526	+755	+710

Source: PEEGT

(2.4.2) Effective Use of Natural Gas

This project had an expected impact on the effective utilization of associated natural gas. Through this project, while it was planned that natural gas produced in the Omar District in eastern Syria should be use, simultaneously a gas pipe-line from Omar to Tichrine was. This was completed in 1992 and its branch lines were connected to the Jandar Power Station. The supply system of natural gas was thus established. As Table 3 shows, 36 % of the total natural gas consumption in Syria was made through this project (1995–2000 on average). The project has therefore contributed to the effective use of natural gas. Moreover, this effective use of associated natural gas at the Jandar Power Station has brought about a positive impact on the saving of oil which would otherwise wasted, together with the acquisition of foreign currency through the export of surplus oil created by the savings.

Table 3：Volume of Natural Gas Consumption

（Unit：Nm^3/day）

	At appraisal (1991)	(1992)	(1993)	(1994)	Year of Completion (1995)	Year 2 (1996)	Year 3 (1997)	Year 4 (1998)	Year 5 (1999)	Year 6 (2000)
Jandar Power Station	-	-	-	47 (5%)	702 (40%)	755 (36%)	737 (32%)	846 (35%)	899 (39%)	857 (35%)
Total in Syria	425	495	704	952	1,768	2,088	2,297	2,429	2,312	2,479

Source: PEEGT

(2.4.3) Impact on the Environment

The Jandar Power Plant established an environment unit within its organization and has

undertaken regular environmental impact assessments. NOx exhaust is monitored by the environment agencies of the Homs Municipal Government. Waste and sewage water drained by the power station has been checked through submission of water samples to the Ministry of Environment every three months. According to PEEGT, the environmental standard was fulfilled in all terms. Although the data on SO_2 exhaust was not disclosed, emission was very slight and has caused no critical problems. In addition, this power station was constructed in a desert area about 30 km south of Homs City. Since there was no residential area near by, noise problems did not occur.

(2.4.5) Social Impacts

The Jandar Power Station is located in a desert area about 30 km south of Homs City. It is isolated from residential areas. According to PEEGT, problems related to land acquisition and residential resettlement have not been reported.

2.5 Sustainability

2.5.1 Operation and Maintenance

PEEGT, which is the implementing agency of this project, was established in 1994 by disaggregating the former Public Establishment of Electricity (PEE) into the Public Establishment of Electricity for Generation and Transmission (PEEGT), in charge of power generation and transmission, and the Public Establishment for Distribution and Exploitation of Electrical Energy (PEDEEE), in charge of power distribution. At that time, 11 power stations possessed by PEEGT were separated and spun off into separate companies. Each power station has been managed as a public corporation, which has considerably delegated the power to manage business, budget and human resources. Currently, PEEGT is involved in the operation of power transmission, the overall planning of power generation, the management of supply, R&D, staff training, and the budget allocation and coordination of subordinated power stations. The management and operation of each power station are undertaken by each station itself. Thus, the operation and management of this project are basically carried out by the Jandar Power Station (Jandar Power Public Corporation). The total number of staff at PEEGT and PEDEEE in 2000 was 7,391 and 24,400, respectively.

2.5.2 Technical Capacity

At present, the total number of staff at the Jandar Power Station is about 500. Among them, 158 (38 engineers, 65 assistant engineers and 55 workers) are in charge of the management and operation of the power station, and 113 (49 engineers, 45 assistants and 19 workers) are in charge of maintenance. Almost all the staff undertook technical training by consultants or suppliers during the project implementation period remained at the Jandar Power Station. The overhaul of gas turbines is undertaken by local staff only. In addition, necessary regular maintenance is also carried out as appropriate. The maintenance and operation capacity of the Jandar Power Station has been fairly appreciated by suppliers. The Jandar Power Station particularly emphasizes preventive maintenance. There has been no serious failure and no accidents have happened since completion in 1995. Although the Jandar Power Station is the first and the only combined cycle power station in Syria, according to the impression given through the site survey, there were no significant problems in the technological absorption capacity or in the technical level of maintenance and operation by local staff.

2.5.3 Financial Status

Financially, 11 power stations, including Jandar, were operated as managerially and financially independent power generation companies (public corporations). Each power station (power generation company), based on a yearly plan, is supposed to apply to the government of Syria and

receive its budget from the same source through PEEGT. However, the business performance of each power stations reflects its annual budget allocation: power stations which perform better are given a higher priority to expand their budget and increased special budget for training and spare part procurement. By contrast, each power station is required to seriously tackle tasks aimed at efficient management and performance improvement.

Table 5: Budget of the Jandar Power Station

	1998		1999		2000	
	Jandar	Total*	Jandar	Total*	Jandar	Total*
Labor Costs	39,815	419,006	41,957	421,081	41,957	466,879
Raw Material Costs	965,620	4,744,059	1,143,315	6,042,803	1,143,315	6,042,377
Services	20,248	294,024	20,548	126,356	20,548	123,641
Customs and Tax	3,056,851	6,482,235	3,404,099	6,654,956	3,404,099	6,547,148
Total	4,082,534	11,939,324	4,609,919	13,245,196	4,609,919	13,180,045

Source: PEEGT

Note: Budget 'Total' is derived by adding together all budgets of the seven power generation companies (Jandar, Alsweediah, Alteem, Tishreen, Kotteineh, Banias, and Mhardeh).

The Jandar Power Station, while making an effort to improve business performance and thus ensure the necessary budget for the project, also makes an effort to arrange budget measures for spare part procurement. Contract procedures with suppliers are carried out in a well-prepared manner, while paying attention to the stock control of spare parts. In addition, by giving non-salary incentives to staff (provision of free accommodation and health care, also opportunities for overseas training), it promotes the settlement of capable staff and improves morale in order to improve performance. As a result, these efforts positively contributed to the improvement of the business performance of the Jandar Power Station. The management policy of the Jandar Power Station seems to be superior to that of the other power station companies under PEEGT in terms of credibility and efficiency.

As stated above, Syria's power tariffs are controlled under power generation costs. Wholesale prices from PEEGT to PEEDEE do not exceed power generation costs, and, moreover, power sale prices from PEDEE to consumers are lower than wholesale prices. Power generation, transmission and distribution costs, transaction costs, profits, and the gap with the power purchase price normally paid by final the customers. All of these are originally supposed to be dumped on the final price, and compensated for by government subsidies. The system loss of the whole Syrian electric power system is approximately 28 % (3 % by PEEGT and 25 % by PEDEEE). Among the 25 % loss of PEDEEE, 15 % is a technical loss and 13 % is a non-technical loss.

Electric utility is one public service. Syria has adopted the current power tariffs system in terms of business and customers' capacity for cost payment.However, in the medium to long-term, it is expected that the tariffs system will be revised to bring it closer to a commercial base in terms of sustainability. Decrease in system loss is also a task for the future.

At present, the Government of Syria is formulating a Five-Year Plan (2001–2005) for the power sector. Its major tasks are: (1) to rehabilitate and expand the existing power generating facilities by 2003 in order to improve power generation capacity and shift fuel from oil to natural gas, as well as to construct new power stations; and (2) to extend the transmission and distribution network in order to improve the quantity and quality of power services. To achieve the tasks above, the following objectives have been set.

1) To make available electric power to cover the natural growth and requirements of new economic projects.
2) The extension of current power stations, and utilization of all existing power stations and power resources, and together with the establishment of new power stations with combined cycle.
3) The economic operation of power stations, so that the return will be higher by means of the reduction of quantity and quality consumption.
4) The follow up and monitoring of routine maintenance programs for all power stations.
5) Raising the efficiency of the power system and the reduction of losses on the 230 kv, 400 kv systems.
6) Improvement of the load factor of power stations.
7) Re-structure of the tariff for the end consumer.
8) Continuation with power connection projects with Jordan and Turkey, and the beginning of new projects for connections with Iraq and Lebanon.
9) Continuation with the environmental and pollution reduction projects.
10) The training and capacity building of PEEGT and power station staff.
11) The establishment of Management and Information Systems (MIS).

Comparison of Original Plan and Actual Scope

Item	Plan	Actual
①Project Scope		
(1) Installation of Thermal Power Generating Facilities (300MW×2 Lines)	Total Electricity Generated: 600MW	Total Electricity Generated: 700MW
－Gas Turbine	Type: Single-shaft open cycle type	same as plan
	Output: 100MW	Output: 118MW
	Speed: 3,000rpm	same as plan
	4 units	same as plan
－Gas Turbine Electric Generator	4 units	same as plan
－Steam Turbine		
	Output: 100MW	Output: 114MW
	Speed: 3,000rpm	same as plan
	2 units	same as plan
－Steam Turbine Electric Generator	2 units	same as plan
－Heat Recovery Boiler		
	Type: Dual pressure type	same as plan
	4 units	
(2) Installation of Related Facilities	Main transformer	same as plan
	Unit Transformer	
	220kV switchgear	
	Emergency generator system	
	Natural gas supplying system	
	Coolant and water disposal facilities	
(3) Workers' Housing		
	200 flats (70m^2/flat)	100 flats (70m^2/flat)
	10 flats (120m^2/flat)	50 flats (100m^2/flat)
		4 villas (120m^2/villa)
(4) Consulting Services		
－Tender Evaluation	Total: 200M/M	Total: 209M/M
－Project Supervision		
②Implementation Schedule		
(1) Selection of Consultant	March, 1991～August, 1991 (6 months)	March, 1991～February, 1992 (12 months)
(2) Civil Works	December, 1991～July, 1994 (31 months)	April, 1993～June, 1995 (27 months)
(3) Installation of Gas Turbine	Completed in November, 1993	Completed in November, 1994
(4) Installation of Steam Turbine	Completed in October, 1994	Completed in August, 1995
(5) Consulting Services	September, 1991～July, 1995 (47 months)	December, 1993～February, 1997 (39 months)
(6) Total Period of Construction	March, 1991～July, 1995 (53 months)	March, 1991～February, 1997 (72 months)
③Project Cost		
Foreign Currency	51,598 million yen	51,326 million yen
Local Currency	13,337 million yen	5,371 million yen
	(1,150 million SP)	(329 million SP)
Total	64,935 million yen	56,697 million yen
ODA Loan Portion	51,598 million yen	51,326 million yen
Exchange Rate	SP1＝11.6 yen (as of December, 1990)	SP1＝16.3 yen (average of 1996)