Eastern Seaboard Development Plan
Map Ta Phut Port Project (1) – (3)
Map Ta Phut Industrial/Urban Complex Construction Project

1. Project Summary and Japan's ODA Loan

(1) Background: Conventionally, Thai industry had focused on light industrial fields, but the government of Thailand attempted to promote the first large scale petro-chemical industrial project in Thailand as a part of the Eastern Seaboard Development Plan. Specifically, the Map Ta Phut area in Rayong Province, where the natural gas pipeline from the Gulf of Thailand landed, was to be developed as a heavy-chemical industrial district. Thus, construction was being pursued of an industrial complex to support location of heavy-chemical industry and an industrial port for filling shipping demands of the industrial complex.

(2) Objectives: Promoting location of heavy-chemical industry in the Map Ta Phut area and accommodating the growing transport demand of the industry

(3) Project Scope: Construction of the Map Ta Phut Port (one multipurpose berth and two berths dedicated for liquid cargo) and the Map Ta Phut Industrial/Urban Complex (380.8 ha). The ODA loan covered the full amount of foreign currency portion for construction. For both projects, IEAT has expanded the facilities sequentially after completion of the work portion covered by the ODA loan.

(4) Borrower/Executing Agency: Both are the Industrial Estate Authority of Thailand (IEAT) (Guarantor: Kingdom of Thailand)

(5) Outline of the Loan Agreement:

	Port Project			Industrial/Urban Complex Project
	Phase (1)	Phase (2)	Phase (3)	
Loan Amount Loan Disbursed Amount	¥ 5,611 million ¥ 3,112 million	¥ 16,045 million ¥ 3,017 million	¥ 3,395 million ¥ 2,267 million	¥ 3,207 million ¥ 1,415 million
Date of Exchange of Notes Date of Loan Agreement	July 1984 September 1984	September 1985 October 1985	September 1991 September 1991	September 1985 October 1985
Loan Conditions Interest Rate Repayment Period (Grace Period)	 3.5% 30 years (10 years)	 3.5% 30 years (10 years)	 3.0% 25 years (7 years)	 3.5% 30 years (10 years)
Final Disbursement Date	March 1995	September 1993	February 1997	October 1991

Note: Three loan agreements were concluded corersponding to the scope of project (dredging and landfill, other construction work, and equipment procurement) for the Port Project.

2. Analysis and Evaluation

(1) Project Scope (See Appendix 1 for more detailed discussion): Map Ta Phut Port Project was halted for two years and three months in line with temporary suspension of Eastern Seaboard Development Plan because of review of the Government of Thailand on the foreign loan borrowing plan. At the time of restart, the scope of project was modified by stopping construction of the fertilizer berth, by adding construction of the liquid berth, etc. on the basis of change of situation during the suspension. These changes are considered reasonable because they were closely geared to changes in development of industries to be located in this complex. Concerning the Map Ta Phut Industrial/Urban Complex, slight adjustment was made to the scale of each facility after examination in the detailed design. To meet the increase in the number of enterprises coming into the complex, IEAT is expanding the complex facilities (424 ha) even after the completion of the work portion covered by the ODA loan (380.8 ha).

(2) Implementation Schedule: The construction of Map Ta Phut Port was delayed about three years from the original plan due to temporary suspension of Eastern Seaboard Development Plan and subsequent reconsideration of the project scope. The time required for the construction becomes rather shortened, however. Concerning equipment (port cargo handling equipment, etc.), procurement was delayed from more one year to two years depending on items due to delay in the selection of contractors, but the time required for procurement and installation were approximately as planned. About two-year delay observed in the Map Ta Phut Industrial/Urban Complex is also attributed to temporary suspension of Eastern Seaboard Development Plan.

(3) Project Cost: Construction costs (in bahts) for both Map Ta Phut Port and Complex were actually about 50 - 60% of those of the original plan due to heated competition for contract award. The equipment procurement costs (in bahts) for the port were actually more than 60% of that of the original plan as a result of bidding.

Comparison of Original Plan and Actual

Item	Plan	Actual
①Project Scope		
- Port Project		
1. West breakwater/Shore Protection	1,550 m/7,550 m	1,560 m/5,033 m
2. Dredging, landfill	12.8 million m^3	6.9 million m^3
3. Berths	Dedicated for fertilizer (2) / multipurpose (1) /anchoring place for small vessels (1)	Dedicated to liquid cargoes (2) / multipurpose (1) /anchoring place for small vessels (1)
4. On-Land Facilities	Road, pavement, buildings, etc.	Road, pavement, buildings, etc.
5. Navigation Aids	1 set	1 set
6. Equipment Procurement (vessels/gantry crane)	7 vessels/2 cranes	7 vessels/2 cranes
7. Consulting Services	677 M/M	687 M/M
- Industrial/Urban Complex Project		
1. Ground Leveling (industrial complex/urban area)	380.8 ha/40 ha	380.8 ha/40 ha
2. Water Facilities		
Purification Plant	10,000 m^3 per day	5,100 m^3 per day

Wastewater Treatment Facilities (for industry/for city)	4,000 m^3 per day／2,400 m^3 per day	4,000 m^3 per day／2,400 m^3 per day
3. Other Facilities	Road, drainage ditches, etc.	Road, drainage ditches, etc.
4. Consulting Services	175 M/M	124 M/M

②Implementation Schedule		
- Port Project		
1. Construction Works (commencement to completion)	May 1986 to December 1988	November 1989 to February 1992
2. Equipment Procurement	May 1992 to May 1993	June 1993 to December 1994
3. Consulting Service (Construction Works/Equipment Procurement)	May 1985 to December 1988／ May 1992 to May 1993	November 1989 to December 1994 (Continuation of the same consultant)
- Industrial/Urban Complex		
1. Construction Works (commencement to completion)	April 1986 to March 1988	December 1987 to May 1990
2. Consulting Services	June 1985 to March 1988	December 1987 to May 1990
③ Project Cost		
- Port Project		
1. Construction Works		
Foreign currency	¥21,656 million	¥6,129 million
Local currency	1,155 million bahts	764 million bahts
Total	3,535 million bahts (¥32,167 million)	1,989 million bahts (¥9,949 million)
Exchange Rate	1 baht = ¥9.1	1 baht = ¥5.0
2. Equipment Procurement		
Foreign currency	¥3,395 million	¥2,267 million
Local currency	286 million bahts	54 million bahts
Total	927 million bahts (¥4,912 million)	607 million bahts (¥2,488 million)
Exchange Rate	1 baht = ¥5.3	1 baht = ¥4.1
- Industrial/Urban Complex		
Foreign currency	¥3,207 million	¥1,415 million
Local currency	638 million bahts	269 million bahts
Total	991 million bahts (¥9,015 million)	517 million bahts (¥2,948 million)
Exchange Rate	1 baht = ¥9.1	1 baht = ¥5.7

(5) Project Implementation Scheme: The executing agency is Industrial Estate Authority of Thailand (IEAT) for both projects. Though it did not have prior experience of constructing ports, IEAT completed construction works without substantial delay other than the effects of suspension of Eastern Seaboard Development Plan; its performance can be appreciated.

(6) Operations and Maintenance: In this industrial port, operation of the berths and anchorage place of small vessels are commissioned to three private enterprises selected from competitive bidding. As regards the industrial complex, operations and maintenance of the water supply facility, wastewater treatment facility, and drainage ditches are commissioned to a private enterprise. Other facilities including roads are under control of IEAT. In addition, careful measures are taken by IEAT by holding a regular monthly meeting participated by representatives of enterprises in the complex to discuss problems in terms of operations and maintenance.

(7) Operational Performance (See Appendix 2 for more detailed discussion): The multipurpose berth of the Map Ta Phut Port is handling general cargoes for export and import by enterprises in the complex while the liquid berth handles petro-chemical related cargoes of these enterprises. In addition, there are berths operated independently by these enterprises, apart from above public berths. The berth utilization is shown below.

(in 1,000 tons, %)

Year	1992	1993	1994	1995	1996	1997	1998*
Multi-purpose berth (berth occupancy ratio: %)**	103 15%	254 20%	553 60%	1,116 80%	1,501 80%	1,840 80%	1,555 70%
Liquid berth (Berth occupancy ratio of Berth I: %) (that of Berth II : %)	28 0% 3%	104 2% 10%	190 2% 15%	731 6% 35%	1,232 25% 42%	2,314 35% 45%	1,900 38% 44%

Sources: documents of IEAT, TTT, TPT

*: Estimated by multiplying the achievement up to May 1998 by 12/5.

**: The occupancy of multipurpose berth is the approximation based on oral reports from TPT due to limited data.

The number of enterprises and employees of the Map Ta Phut Industrial/Urban Complex grew steadily as shown in the table below. Facilities of this complex were expanded by IEAT to meet the growing demand and to provide these enterprises with adequate public services. The wastewater treatment facility for the urban area is not used because the number of occupants in this area is less than planned.

Year	1991	1992	1993	1994	1995	1996	1997	1998
Number of enterprises (operating)	14	17	24	27	31	34	46	48
Number of Employees*	3,248	3,731	4,435	5,172	6,725	8,891	12,814	13,464

Sources: IEAT

* Excluding construction workers.

(7) Management Performance of IEAT (See Appendix 3 for more detailed discussion): IEAT, compared to its business scale, has earned sizable profits every year (ratio of recurring profit to sales in 1995 - 1997: 30% - 34%), and its management performance can be said to be favorable. As the income has increased greatly from the land lease and various services to enterprises along with increase in the number of enterprises in this industrial complex, the operation revenue grew by 1.5 times from 1,158 million bahts in 1995 to 1,811 million bahts in 1997.

(8) Projects Effects and Impacts

(i)Quantitative Effects

(a) Cargo Handling Amount of the Map Ta Phut Port: Demand generated was approximately equivalent to the estimation in the appraisal for general cargoes while exceeding substantially that estimated for liquid cargoes. This port can be said to well manage these demands and to support development of the heavy chemical industry in this complex.

(b) Number of Enterprises in the Map Ta Phut Industrial/Urban Complex: As of 1998, the number of enterprises in this complex amounted to 48 and all of land available for industrial usage

(5.030 rai or about 800 ha) was contracted. Petro-chemical and related enterprises account for the largest share in the occupants.

(c) Creation of Employment by the Map Ta Phut Industrial/Urban Complex: There are at present 13,464 employees, so that the employment creation effect was far above the level projected in the appraisal (9,800).

(d) Financial Internal Rate of Return: FIRR of Map Ta Phut Port and Complex is 4.5% and 13.1% respectively.

(ii) Qualitative Effects

(a) Development of the Heavy Chemical Industry, Mainly the Petro-chemical Industry: The construction of the Map Ta Phut Industry/Urban Complex was intended to develop the heavy-chemical industry using natural gas from the Gulf of Thailand. This complex achieved substantial development mostly in the petro-chemical industry. It may be said that this project contributed greatly to the development of the petro-chemical industry of Thailand.

(b) Industrialization of the Eastern Seaboard: From 1991 to 1996, the real GDP per capita of Thailand achieved an annual average growth rate of 6.6%. The same index of Eastern Seaboard and Rayong Province where this project is located exceeded the national average substantially, achieving annual average growth rates of 11.7% and 15.4% respectively.

3. Lessons Learned (See Appendix 4 for more detailed discussion)

(1)Flexible changes of plan to meet variation in economic situations and demands must be accepted positively as long as such changes are necessary to achieve the project objective and ensure its effects and impacts. In particular, the projects related to industry promotion tend to be governed by changes in economic situation and trends of individual industries. It is advisable that the borrower country, the executing agency, and JBIC perform continuous monitoring of these projects in the implementation stage and determine whether a change of situation is so significant that the original plan needs modification.

(2)It is suggested that the support to the central secondary treatment facilities of domestic wastewater be implemented according to the priority based on understanding of the overall condition of this sector of the country concerned (for example, the support must be started where people are already concentrated and the flow of sewage is assured, such as a metropolitan area or existing local cities).

Project Scope

Map Ta Phut Port

The Government of Thailand had suspended temporarily the Eastern Seaboard Development Plan for the purpose of reviewing the overseas borrowing plan. In line with this action, this project was suspended temporarily for two years and three months from November 1985 to January 1988. Because of changes in the situation during the suspension period, the scope of this project was reviewed.

① Halting the construction of the fertilizer berths

Construction of the fertilizer plant of the National Fertilizer Co., Ltd. (hereinafter called, "NFC"), which was planned within the Map Ta Phut Industrial/Urban Complex, was postponed. Accordingly, construction was abandoned for two berths dedicated to fertilizer and planned to handle related cargoes of the plant. Along with this, dredging of the zone in the vicinity of these berths was excluded from the project scopes.

Though originally scheduled for construction with the ODA loan (the loan agreement concluded in 1982), the board of directors of NFC decided to hold up this fertilizer plant project for the time being in 1988. The ODA loan was terminated without disbursement in 1992 when the validity period for the effectiveness of the loan agreement and disbursement came to an end.

Later on, the fertilizer plant construction project was resumed in line with restructuring of the project of NFC, with the plant including dedicated berths constructed through raising of private funds. The plant started operation in May 1998. Halt of construction of the fertilizer plant using the ODA loan was judged to be reasonable because it was a consequence of review of the project in several stages on the basis of changes in the international market conditions of fertilizer. It was therefore unavoidable that construction of berths for fertilizer was excluded from the project scope.

② Additional construction of the liquid berths

During appraisal of the 12th ODA loan, the berths dedicated to petro-chemical liquid cargoes was planned for stage 2 and not included in the scope of ODA loan. The plan was to handle the liquid cargo in multipurpose and fertilizer berths for the time being and to develop the dedicated liquid cargo berths when the handling amount increases in the future.

By 1988 when this project was resumed, however, construction of the first-phase petro-chemical complex (located in the Map Ta Phut Industrial/Urban Complex) went into full gear. This is a joint venture of the Petroleum Authority of Thailand (PTT) and private enterprise, called NPC-1. Moreover, the second-phase petro-chemical complex (NPC-2) which is another joint venture of the government and private sector was being realized. As the quantity of liquid cargo related to petro-chemistry was expected to grow rapidly, two berths dedicated to liquid cargo were to be covered additionally by the ODA loan. In this event, JBIC thoroughly analyzed the justification of additional scope through field surveys and representative offices' work, verifying the operating conditions and petro-chemical cargo demand forecast for petro-chemical plants. Finally, JBIC confirmed the feasibility of addition after holding discussions with IEAT several times.

Practically, liquid cargo berths were utilized at an appropriate level (35 - 40% in terms of the berth occupancy ratio) while congestion (80% in terms of the berth occupancy ratio, the same year) was observed with multipurpose berths. Namely, handling of petro-chemical liquid cargo might suffer substantial inconvenience if liquid cargo berths were not available. It may therefore be concluded that addition of liquid cargo berths was a right decision.

③ Halting the landfill on the east side and shore protection of the landfill

The industrial landfill (5.9 million m^3) planned for construction on the east side of sea lane and the eastern shore protection (2.5 km) were excluded from the scope of ODA loan. This decision was made because the vessel-overhauling industry to be located in this landfill was held up.

Later on, oil refineries, etc. decided to enter this landfill and IEAT constructed the landfill independently. In spite of the original plan, construction of the eastern breakwater out of the scope of the ODA loan was not made because the eastern landfill was constructed while being extended long in the offshore direction in response to the request of oil refineries and no breakwater became necessary any more.

④ Additional construction of the land facilities

Land facilities including roads, water services, and buildings was excluded from the scope of 12th ODA loan during appraisal in consideration of the overall fund ceiling of the 12th loan. It was expected that these facilities would be included, as Package 2, in the scope of the 13th ODA loan in the next year. After suspension of the Eastern Seaboard Development Plan, these facilities were additionally included in the scope of the 12th ODA loan because of the urgent necessity to develop port facilities including those on land.

Map Ta Phut Industrial/Urban Complex

As a result of review through detailed design after appraisal of the 12th ODA loan, minor modifications were made to the road length and facility scale. The capacity of water purification plant was originally planned with 10,000 m^3/day, which was then modified to the two-stage development plan according to the trend of establishment of enterprises in the complex. The first facility with the capacity of 5,100 m^3/day alone was developed under the ODA loan. For the industrial wastewater treatment plant, the capacity was originally planned to be 4,000 m^3/day. Similarly to the case of purification plant, the two-stage development plan was employed according to the trend of establishment of enterprises in the complex. In consequence, the civil works (aeration tanks, etc.) compatible with the flowrate of 4,000 m^3/day were covered by the ODA loan. For equipment such as pumps, etc., the capacity portion compatible with 2,400 m^3/day (a capacity required for the time being) was covered by the ODA loan.

The industrial/urban complex project covered by the ODA loan was for development of the infrastructure of a location where the first-phase petro-chemical complex related enterprises and fertilizer plant were planned. Later on, as the second-phase petro-chemical complex was constructed, development of this industrial complex was expanded beyond the scope of ODA loan. Now, IEAT expands individual facilities beyond the scope of ODA loan projects along with increase in number of enterprises.

Operational Performance

(1) Map Ta Phut Port

Table 1 shows trends of the cargo handling amount and berth occupancy ratio of Map Ta Phut port. The total cargo handling amount of public berths (one multipurpose and two liquid cargo berths) covered by this project ran up to 4,154 thousand tons in 1997. Apart from them, there are private berths developed in the industrial port and utilized actively in these years.

Table 1 Annual cargo handling amount and berth occupancy ratio (in 1,000 tons, %)

	1992	1993	1994	1995	1996	1997	1998*
Multipurpose berth	103	254	553	1,116	1,501	1,840	1,555
(Berth occupancy ratio: %) **	15%	20%	60%	80%	80%	80%	70%
Fluid berth	28	104	190	731	1,232	2,314	1,900
(Berth 1 occupancy ratio: %)	0%	2%	2%	6%	25%	35%	38%
(Berth 2 occupancy ratio: %)	3%	10%	15%	35%	42%	45%	44%
RRC's berth	-	-	-	199	4,367	5,094	3,120
STAR's berth	-	-	-	-	3,630	6,725	7,838
NFC's fertilizer berth	-	-	-	-	-	260	406

Souce: IEAT, TTT, and TPT data

*: Estimated by multiplying the past data up to May 1998, by 12/5.

**: Due to restricted availability of data, the occupancy ratio of multipurpose berth was the approximation based on interviews with TPT officials.

According to the original plan at the time of appraisal of the 12th ODA loan, the general cargo handling amount with the multipurpose berth was estimated to be 320 thousand tons annually up to 1989 and annual 1,960 thousand tons over the medium term depending on the growth of demand in 1990 and onward. Actually, the handling amount increased favorably since operation start in 1992, reaching the amount level equivalent to the original estimation in 1997. In consequence, the berth occupancy ratio increased substantially (the appropriate berth occupancy ratio is said to be generally 40 - 65%), causing extended offshore waiting and complaints from cargo owners. In order to cope with this situation, IEAT is said to plan construction of the additional public berth in the new landfill currently under construction on the east side. But this plan is not yet put into practical shape.

At the time of appraisal of the 12th ODA loan, the handling amount of petro-chemical liquid cargo was estimated to be annual 147 thousand tons up to 1989 and annual 187 thousand tons in 1990 and onward. In line with flourishing petro-chemical industry in the Map Ta Phut district, the handling amount increased far beyond the expectation, reaching 2,314 thousand tons annually in 1997. As a result, the berth occupancy ratio rose to 38% and 43% respectively for each of two berths, as of May 1998.

In the case of public berths (multipurpose and liquid cargo) developed under ODA loan, the handling amount was nearly as estimated initially for general cargoes and exceeded substantially the initial estimation for liquid cargoes, as described above. Therefore, Map Ta Phut Port has coped well with the cargo handling demand from the industrial complex, supporting thereby the growth of heavy chemical industry in this complex in terms of transportation.

(2) Map Ta Phut Industrial/Urban Complex

Table 2 shows the evolution of number of enterprises, number of employees, and leased area of this complex. As of the present, the 5,030 rai (about 800 ha) area is totally contracted for the industrial zone. Note that the ODA loan covered development of a total of 2,380 rai industrial complex including ① enterprises related to the first-phase petro-chemical complex, ② a fertilizer plant of NFC, and ③ blocks for medium to small enterprises. In the Map Ta Phut Industrial/Urban Complex, 5,030 rai exceeding the portion covered by ODA loan has already been developed, with a total of 48 enterprises having entered.

Table 2 Changes of number of enterprises, number of employees, and leased area of the complex

		1991	1992	1993	1994	1995	1996	1997	1998
No. of enterprises (operating)		14	17	24	27	31	34	46	48
No. of employees (excluding construction workers)		3,248	3,731	4,435	5,172	6,725	8,891	12,814	13,464
Leased area (rai)	Industrial	3,227	4,134	4,605	4,739	4,895	4,895	4,973	5,023
	Housing	178	178	178	178	231	243	243	270

Source: IEAT

Of the urban area (2,000 rai) in the neighborhood of the Map Ta Phut Industrial/Urban Complex, 250 rai covered by the ODA loan was completely leased. Other portions are not yet utilized. According to IEAT, less tenants in public houses constructed by NHA (National Housing Authority) and thus sluggish housing development in the neighboring area of the complex may be due to following reasons. Namely, ① the housing development project of NHA delayed and was too late for location of the plant and ② the house construction cost rose excessively during delay, pushing up the house rent. Accordingly, many workers of this complex commute to the work from nearby cities (Ban Chang and Rayong), instead of living within the urban area. IEAT plans to redevelop the vacant housing lots for the industrial land for medium to small enterprises in the future.

Table 3 shows the utilization state of facilities in this complex. All facilities other than the sewage treatment plant for the urban area are operating properly. Demand prediction at appraisal of the 12th ODA loan was based on demands from ① enterprises related to the first-phase petro-chemical complex, ② fertilizer plant of NFC, and ③ medium to small enterprises. As described above, the number of enterprises has increased to exceed the expectation, and IEAT has expanded the capacity of certain facilities independently.

Table 3 Actual utilization of facilities in the Map Ta Phut Industrial /Urban Complex

		1991	1992	1993	1994	1995	1996	1997	1998*
Water supply ($\times 1000m^3$)	Raw water	6,055	3,072	9,266	11,074	18,084	29,726	38,366	43,800
	City water	171	436	1,001	1,205	2,086	2,845	2,880	2,880
Sewage treatment ($\times 1000m^3$)	Industrial	0	83	290	330	215	285	562	450
	Urban	0	0	0	0	0	0	0	0
Max. power demand (MW)		133	136	244	357	375	430	402	383
Solid waste treatment: (ton)		18,294	20,556	22,840	25,099	27,282	29,355	31,028	32,850

Source: IEAT

*: The value for 1998 was estimated by multiplying the result up to October by 12/10. Solid waste treatment covers treatment by Map Ta Phut City.

Raw water is supplied to a large plant with an independent water purification facility. In response to increase in the number of enterprises in the complex, the raw water supply is growing annually, reaching 38,366 thousand m^3 annually (4,634 m^3/hour on average) in 1997. As an JBIC-financed project, the raw water transmission system with a capacity of 4,000 m^3/hour was developed. IEAT has already undertaken expansion of its installed capacity to meet growing demand of enterprises in the complex for raw water.

Treated water supply to enterprises without any water purification facility was also increasing; 2,880 thousand m^3 annually (7,890 m^3/day on average) in 1997. As an JBIC-financed project, the water purification plant with a capacity of 5,100 m^3/day was developed. To accommodate the increasing demand for treated water of the enterprises in the complex, IEAT has already increased its installed capacity.

Wastewater to be treated from enterprises in the medium to small enterprise zone called a "supporting industry zone" is increasing gradually, reaching 562 thousand m^3 (1,540 m^3/day on average) in 1997. JBIC-financed projects include the civil engineering work of aeration tanks, etc. to achieve wastewater treatment of 4,000 m^3/day and procurement of equipment (pumps, etc.) to cope with treatment of 2,400 m^3/day required for the time being. The amount of wastewater to be treated is well within the range compatible with the sewage treatment facility.

The sewage treatment facility for the urban area (capacity 2,400 m^3/day for assumed 3,050 households) is currently not used. IEAT explains that the population of the urban area[1] is too small to produce enough wastewater to operate the facility economically and that there is no contractor who dares to conclude contract for operation[2]. In Thailand, it was as late as 1994 that the first wastewater treatment plant was constructed by BMA even for Bangkok[3] and treatment of domestic wastewater including the concentrated secondary treatment in the plant is fairly under way[4]. In local cities, due to financial constraints and lack of experienced engineers of the local authorities which is the maintaining and operating entities, the wastewater treatment plant are not operated smoothly in many cases. Against such a background, the current situation of Map Ta Phut is not unusual.

Inclusion of construction of a sewage treatment plant in the new urban area development plan from the beginning may be viewed as a positive highly-motivated efforts to improve the situation in Thailand where treatment of domestic wastewater had not made much progress[5]. However, the urban area of Map Ta Phut is a new town developed along with a new industrial complex and its development possibility was unknown. It may be inevitable that the resultant situation of not utilizing the sewage treatment facility occurred because of small population inflow into the area[6]. The lesson we can obtain from this

---

[1] The current population of the urban area is 3,102. The estimated amount of untreated wastewater is 520 m^3/day. (IEAT data)

[2] IEAT has a basic policy of privatizing water purification and wastewater treatment facilities and is not engaged in maintenance and administration by itself. It is said that full cost recovery in operation and maintenance of a sewage treatment facility in the urban area of Map Ta Phut may result in higher charges per household because of small population of this area. Note that only two local authorities (Pattaya and Pathon) collect wastewater charges in Thailand. (Wastewater charges are not collected even in Bangkok.)

[3] Even when the sewage treatment plant for housing complex constructed by NHA in Bangkok is added, the percent of population with sewers of Bangkok is as low as about 3%.

[4] In Thailand, the human waste treatment system with septic tanks is disseminated throughout individual households.

[5] The first full-scale sewage treatment plant of Thailand was constructed in Pattaya in 1986. Inclusion of the sewage treatment plant for urban area during planning of this project was an ambitious plan in advance of other local cities.

[6] When the sewage treatment facility for urban area of Map Ta Phut is to be operated with small burden on

experience may be that the sewage treatment plant must be constructed only when the potential of generation of wastewater is assured from the careful review. Specifically, in the case of this project, it might be desirable that the timing for construction of the sewage treatment plant should be studied at the time of housing development in the urban area, separating it from construction of the Map Ta Phut Industrial/Urban Complex (financed by the ODA loan)[7]. For the JBIC-financed domestic wastewater treatment in the future, it is essential to determine the timing of construction of the sewage treatment plant for the new urban area. It may also be desirable to put an emphasis on the support of sewage treatment facilities in existing cities that have been already developed with dense population (cities where generation of wastewater is assured).

A landfill with a capacity of 50,000 m^3 was constructed with the ODA loan to dispose of solid wastes (general wastes). This site was already full and is closed now. Accordingly, general wastes from the Map Ta Phut Industrial/Urban Complex are currently collected and disposed of by the authority of Map Ta Phut City. On the other hand, industrial wastes including harmful substances are collected and disposed of by GENCO located in the neighborhood of the complex.

As discussed above, all facilities of the Map Ta Phut Industrial/Urban Complex developed with the ODA loan, excluding the sewage treatment facility for the urban area, are underlying structures to support production of various plants by meeting the demands of enterprises for various public services in the complex. It may be said that these facilities have contributed greatly to development of infrastructures for heavy chemical industry in Map Ta Phut.

---

beneficiaries, the governmental subsidy is necessary. Considering that only two local authorities are collecting wastewater charges in Thailand, it is highly possible that the operation here may rely totally on the governmental subsidy. In addition, the population of the area is small, so that it may be uneconomical to force operation of the treatment facility.

[7] The capacity of this sewage treatment plant was later expanded by IEAT. However, considering the current situation where the facility is not yet utilized because of reasons described above, such expansion may be considered an inappropriate investment.

Management Performance of IEAT

IEAT enjoys a satisfactory management performance with larger profit (ratio of recurring income to sales being 27 - 35% for 1992 - 1997) every year for its business scale. On the basis of increase in the number of enterprises in the industrial complex including this project, the income from land lease or various services for enterprises has grown substantially. Consequently, the operating income increased by more than twice from 761 million bahts in 1992 to 1,811 million bahts in 1997. The revenue from operation of Map Ta Phut Industrial Port has occupied a certain percentage in these years. Considering the IEAT's operating income of only 67 million bahts in 1983 when the 11th ODA loan appraisal was made, the growth rate was considerable.

Table 2.-1 Financial Statement (in million bahts)

	1992	1993	1994	1995	1996	1997
Current assets	2,196	1,464	2,022	1,921	2,023	2,436
Cash / deposit	729	982	1,419	1,064	1,057	1,090
Fixed assets	6,540	7,716	7,837	8,109	8,628	8,885
Land / building / equipment	6,467	5,129	5,338	4,399	4,808	5,098
Landfill	-	1,399	1,399	1,399	1,399	1,399
Leased assets	-	1,103	1,068	2,284	2,342	2,297
Current liability	988	742	1,167	634	1,030	759
Fixed liability	4,127	4,859	4,127	4,343	3,387	5,145
Other liability	727	499	1210	1,429	1,370	1,271
Capital	2,894	3,080	3,355	3,623	4,863	4,146
Operating revenue	761	831	946	1,158	1,552	1,811
Income from land lease	251	391	382	425	462	534
Income from services	-	166	265	451	783	859
Income from port	-	31	56	111	152	226
Operating expenses	385	451	541	735	982	1,160
Non-operating balance	-110	-158	-120	-30	-50	-117
Recurring income	266	222	284	393	520	534

Source: PAT annual reports of the corresponding year.

As of the field survey in November 1998, we were told that privatization of IEAT had been proposed from IEAT to the Ministry of Finance and under discussion. It may be necessary to follow the flow of discussions with care in the future.

Lessons Learned

Flexible plan change according to the change in economic state and demand must be approved positively as long as it is necessary for achievement of the project objectives and effects/impacts. In particular, projects related to industry promotion are greatly dependent on economical changes and changes in trends of individual industries. It is recommended that a borrower country and executing agency in coordination with JBIC perform continuous monitoring of these projects to find out any change in the situation or the necessity to review the project in each project implementation stage.

Map Ta Phut Port was constructed to meet export and import demands of enterprises in the Map Ta Phut Industrial/Urban Complex developed to promote heavy chemical industries. Initially, the berth development was planned, with the ODA loan, to chiefly handle cargoes of the fertilizer plant whose construction was planned in this complex. Later on, the berth development plan was modified to cope mainly with the petro-chemical cargo transport as a result of adjournment of construction of the plant in this complex as well as growth of the petro-chemical industry. In consequence, the original objective of compliance with the transport demand of the complex was achieved with apparent effects and impacts.

The Map Ta Phut Industrial/Urban Complex was an ambitious project to attract the heavy chemical industry, an unprecedented new industry in Thailand. Considering the difficulty of a development issue of promoting a new industry, this complex may be considered to involve careful review of the project plan while checking changes in the economic state. Review of local industries through careful study and change of the industrial port project to meet the traffic demand of the complex, with resultant demonstration of the effects and impacts, may be a good practice which should be referred to in the future.

In particular, the project related to promoting of the industry is greatly dependent on changes in the economic state and trends of individual industries. Continuous monitoring is therefore essential for any change in the situation and the necessity of project review in each project implementation stage. If the plan must be changed to achieve the objectives and to demonstrate the effects and impacts, it is vital to approve such change positively and flexibly as in the case of the Map Ta Phut Port.

Concerning support to the concentrated secondary treatment facility for domestic wastewater, careful examination should be done for the timing of construction in case of a new urban are development, and the priority of assistance in this sector should be also placed on metropolitan and existing local cities that require improvement of the living environment due to considerable development and concentration of the population. In this case, it is essential to understand the overall state of the wastewater treatment sector of a country concerned.

The Map Ta Phut Industrial/Urban Complex Project included the domestic wastewater treatment facility for the new urban area in its neighborhood. This was not put into operation because of small population of the area. Since the possibility of development of the new urban area is difficult to predict, it may have

been desirable that construction of this facility should be considered in line with housing development of the area while separating it from construction of the complex (financed by the ODA loan). Careful examination should be done for the timing of construction of sewage treatment facilities in case of a new urban are development. It may be also desirable to put the priority on support of the sewage treatment facility of existing urban areas where the development has proceeded considerably and the population is concentrated.

Generally, in developing countries, treatment of domestic wastewater is addressed only after development of other public services (electricity, water supply, etc.). Also, it is often the case that the concentrated secondary treatment of domestic wastewater is handled only when the primary treatment with a simplified septic tank is disseminated to a certain extent. Accordingly, support to construction of concentrated treatment facility should be made at the right timing appropriate to the development stage of a country and city concerned, beginning with the existing urban area where the population is concentrated. Besides, the sewage treatment facility is mostly operated and maintained by the local government and its deficient financial resource or organization capacity may cause failure of smooth operation. It may also be important to pay attention to the organization capacity when selecting the cities to be supported.