10. Economic and Financial Analysis

10. Economic and Financial Analysis

10.1. Construction Cost

The construction cost for the Sihanoukville Combined Cycle Power Plant is estimated to be 100.2 Million for Stage 1 and 74.6 Million for Stage 2 as shown in Table 10.1-1 and cost breakdown are shown in Table 10.1-2 and Table 10.1-3.

Table 10.1-1 Summary of Construction Cost

(Million US$)

Stage	F/C Portion	L/C Portion	Total
Stage 1	83.6	16.6	100.2
Stage 2	65.4	9.3	74.6
Total	149.0	25.9	174.8

Note: The estimate construction cost is as of 2001 price level and the associated T/L is exclusive.
The total is not matched due to the round off.

The construction costs were estimated on the following basis:

Cost estimates for equipment and materials, which are deemed to be fabricated and imported from foreign countries, are based on international competitive market prices with referring to actual contract or bidding prices for a similar combined cycle power plant. Basically most of the mechanical and electrical equipment are assumed to be imported.

Cost of materials, which are available in Cambodia, are estimated on the basis of the data collected during the study.

The labor costs for erection works for equipment are estimated on the basis of reference costs in neighboring countries, but the labor costs for civil and architectural works are based on the cost in actual projects in Cambodia.

Construction cost includes the costs for access road, oil fuel pipeline from Sokimex Oil

Terminal to the plant, improvement of regional road and bridges from Sihanoukville port to the plant and temporary relocation works for road and railroad nearby the plant site.

Land acquisition cost

Land acquisition cost is estimated based on the unit land cost which was given by the Sihanoukville Municipality, i.e. 2.3 US$ per square meter. The required area is estimated 32 ha.

Resettlement fee

At present only four households exist in the plant site area. However, for estimates of resettlement fee, the number of households are estimated 10, and unit resettlement fee is estimated 3,000 US$ with referring to the cost used in the transmission project in Cambodia.

Cost of mine survey

The cost of mine survey is estimated by using the unit cost which was given by CMAC, i.e. 0.6 $/m^2. This unit cost is that for an actual mine sweeping work (named “Level 3”) which is carried out by CMAC in response to the governmental institution’s request.

Table 10.1-2 Estimate of Construction Cost (as of 2001)

(unit :1,000 US$)

	Stage-1			Stage-2		
	F/C	L/C	Total	F/C	L/C	Total
Mechanical	44,290	3,330	47,620	41,100	3,090	44,190
Electrical	19,250	1,230	20,480	14,610	930	15,540
Civil Works	5,450	6,650	12,100	2,520	3,090	5,610
Building & Structure	3,400	1,830	5,230	1,570	850	2,420
Spare Parts & Others	6,720	0	6,720	3,470	0	3,470
Subtotal	**79,110**	**13,040**	**92,150**	**63,270**	**7,960**	**71,230**
Training	100	0	100	50	0	50
Owner's Administration Fee (3%, 2%)	0	2,600	2,600	0	1,300	1,300
Engineering Consultant Fee (5%, 3%)	4,390	0	4,390	2,040	0	2,040
Land Acquisition	0	740	740	0	0	0
Resettlement & Compensation	0	30	30	0	0	0
Mine Survey	0	190	190	0	0	0
Subtotal	**4,490**	**3,560**	**8,050**	**2,090**	**1,300**	**3,390**
Grand Total	**83,600**	**16,600**	**100,200**	**65,360**	**9,260**	**74,620**

Note : Mechanical, Electrical, Civil Works, Building & Structure, and Spare Parts & Others include Physical Contingency of 5 %.

	F/C	L/C	Total
Associated Transmission Line (Site ~ Kampot)	8,640	2,160	10,800

Table 10.1-3 Breakdown of Construction Cost

Unit: 1000 US$

	Item	Stage 1		Stage 2		Total
		Quantity	Cost	Quantity	Cost	
Mechanical	Gas turbine and associated equipment	3	22000	3	22000	44000
	Steam turbine and associated equipment	1	6500	1	6500	13000
	HRSG and associated equipment	3	6600	3	6600	13200
	Fuel gas supply system	L.S.	570	L.S.	570	1140
	Fuel oil storage and supply system	L.S.	580	L.S.	580	1160
	Cooling water system	L.S.	1200	L.S.	1200	2400
	Plant pipings	L.S.	1800	L.S.	1600	3400
	Water treatment system	L.S.	840	L.S.	420	1260
	Wastewater treatment & incineration	L.S.	400	L.S.	50	450
	Fire prevention and protection system	L.S.	1200	L.S.	500	1700
	Emergency diesel generator	1	130	-	0	130
	Crane, mobile equipment incl. fire engine	L.S.	1700	L.S.	500	2200
	Other mechanical equipment	L.S.	830	L.S.	570	1400
	Stacks	1	1000	1	1000	2000
	Subtotal		**45350**		**42090**	**87440**
Electrical	Control and instrumentation	L.S.	7700	L.S.	6500	14200
	Plant electrical equipment	L.S.	8900	L.S.	7600	16500
	In-plant substation	L.S.	2900	L.S.	700	3600
	Subtotal		**19500**		**14800**	**34300**
Civil and Structural Works	Land formation	L.S.	430	L.S.	0	430
	River diversion	L.S.	420	L.S.	0	420
	Equipment foundation and Others	L.S.	2160	L.S.	1640	3800
	Water storage tank proper	L.S.	500	L.S.	500	1000
	Wastewater treatment facilities	L.S.	300	L.S.	100	400
	In-plant road	L.S.	910	L.S.	0	910
	Drainage system	L.S.	1580	L.S.	0	1580
	Cooling water pipe & system	L.S.	3100	L.S.	3100	6200
	Access road	L.S.	110	L.S.	0	110
	Improvement of regional road & bridge	L.S.	310	L.S.	0	310
	Temporary works (relocation of road/railroad)	L.S.	1700	L.S.	0	1700
	Power house	1	3600	Extension	2300	5900
	Administration building	1	900	-	0	900
	Other miscellaneous buildings	L.S.	450	-	0	450
	Security fencing, plantation, etc.	L.S.	30	-	0	30
	Subtotal		**16500**		**7640**	**24140**
Spare Parts and Others	Spare parts		4000		3000	7000
	Special tools and workshop machines		1500		0	1500
	Laboratory equipment		600		0	600
	Consumables		300		300	600
	Subtotal		**6400**		**3300**	**9700**
	Grand Total of Construction Works		**87750**		**67830**	**155580**
Miscellaneous Expense	Training	L.S.	100	L.S.	50	150
	Owner's administration fee	3 %	2600	2 %	1300	3900
	Engineering consultant fee	5 %	4388	3 %	2035	6423
	Fhysical contingency (5%)	5 %	4388	5 %	3392	7780
	Land acquisition cost (2.3 $/m^2)	32 ha	736	0	0	736
	Resettlement fee (3,000 $/one)	10 houses	30	0	0	30
	Mine survey cost (0.6 $/m^2)	32 ha	192	0	0	192
	Subtotal		**12434**		**6777**	**19211**
Total Project Cost			**100,184**		**74,607**	**174,791**

10.2. Economic Analysis

10.2.1. Objective

Economic analysis is carried out to verify the economic validity of the implementation of project from the viewpoint of the whole Cambodian economy.

10.2.2. Methodology of Economic Analysis

The Sihanoukville Combined Cycle Power Plant is proposed currently to meet the future power demand. If the project is not implemented, the implementation of an alternative power plant, of which installed capacity is equivalent to the project, shall be required to attain the same objective.

Therefore, the economic validity of the project can be measured in a way of cost comparison between the project and the alternative power plant.
Concerning the cost comparison, “With - Without” method is commonly used in the economic analysis for the power sector. “With” means the proposed project (Sihanoukville Combined Cycle Power Plant) and “Without” means the alternative project (such as diesel power plant etc.).

10.2.3. Judgment of Economic Validity

The economic validity of the project is verified by using the following economic parameters:

(1) Economic Internal Rate of Return (EIRR)

The EIRR can be defined as the rate of discount, which equalizes the discounted gross benefits with the discounted gross costs. It can be explained mathematically as follows:

$$\sum_{k=1}^{n} \frac{B_k}{(1+i)^k} = \sum_{k=1}^{n} \frac{C_k}{(1+i)^k}$$

Where; B_k : benefit for year k

C_k : cost for year k

i : discount rate

An EIRR of 10% ~ 12 % is set as the hurdle rate normally by the World Bank and Asian Development Bank and applied to a power sector in the developing countries. Therefore, if EIRR derived from the above calculation exceed the hurdle rate, the economic validity of the project is verified. Otherwise, additional support data, such as social impact, which cannot be counted in the monetary term, will be required to implement the project.

(2) Net Present Value (NPV)

The NPV is the most straightforward discounted cash flow measure of the project worth. It is simply the present value of the cash flow stream, i.e. the net present value of benefit less the net present value of cost. NPV can be expressed by the following formula:

$$NPV = \sum_{k=1}^{n} \frac{B_k - C_k}{(1+r)^k}$$

Where; r : hurdle rate

The project having positive NPV is acceptable economically.

(3) Benefit – Cost Ratio (B/C)

The benefit-cost ratio is computed on the basis of discounting the benefit and cost streams to their present values. It can be expressed as follows:

$$B/C = \frac{NPV \text{ of Benefit}}{NPV \text{ of Cost}} = \frac{\sum_{k=1}^{n} \frac{Bk}{(1+r)^k}}{\sum_{k=1}^{n} \frac{Ck}{(1+k)^k}}$$

If B/C ratio exceeds 1.0, the project is acceptable economically (1.2 is often used actually).

10.2.4. General conditions for Economic Analysis

The following conditions are applied to the economic analysis.

(1) The commencement of commercial operation for Stage 1 and Stage 2 is assumed to be September 1, 2006 and September 1, 2008 respectively based on the optimum power development program in Section 2.2. and expected project implementation schedule in Chapter 9.

(2) Annual capacity factors are set as shown in Table 10.2-1 based on the results of optimum power development program in Section 2.2.

Table 10.2-1 Capacity Factors of Sihanoukville C.C. Power Plant

Stage	2006	2007	2008	2009	2010	2011	2012 ~
Stage 1	0.24	0.75	0.55	0.63	0.67	0.70	0.50
Stage 2	-	-	0.18	0.63	0.67	0.70	0.50

(3) The project cost expressed in US$ term is assumed to be economic price (border price) because the construction will be carried out based on the international competitive bid.

(4) The price escalation[3] (inflation), subsidies, duties and taxes are excluded in the economic analysis because those taxes and duties are regarded merely as the domestic transfer of capital.

(5) Engineering and Administration fees are excluded from the project cost in order to keep the same cost level as that of alternative thermal plant.

(6) The kW value adjustment of the alternative thermal power plant is calculated by using the following equation:

[3] Escalations are sometimes taken into account when the fuel price escalations are envisaged to be different by fuel type such as oil vs. coal.

$$\text{kW value} = \frac{(1-\frac{T1}{365})(1-T2)(1-T3)(1-T4)}{(1-\frac{A1}{365})(1-A2)(1-A3)(1-A4)}$$

Where; T1 = Scheduled maintenance days of proposed project (days)

T2 = Forced outage rate of proposed project (decimal)

T3 = Station use of proposed project (decimal)

T4 = Transmission and distribution lines loss of proposed project (decimal)

A1 = Scheduled maintenance days of alternative thermal plant (days)

A2 = Forced outage rate of alternative thermal plant (decimal)

A3 = Station use of alternative thermal plant (decimal)

A4 = Transmission and distribution lines loss of alternative thermal plant (decimal)

(7) The kWh value adjustment of the alternative thermal plant is also calculated by using the following formula:

$$\text{kWh Value} = \frac{(1-T3)(1-T4)}{(1-A3)(1-A4)}$$

In the above formulas, transmission and distribution lines loss can be negligible in the economic analysis because the both losses are the same.

(8) The transmission line cost can be negligible in the economic analysis for the same reason as item (7) above.

10.2.5. Fuel and Fuel Price

CIF prices (Cost, insurance and freight) are used for oil fuels because the all oil fuels in Cambodia are imported from overseas at the moment.
The average CIF prices of diesel oil and heavy oil are used based on the actual CIF price record provided by EDC as shown in Section 3.1.

Concerning the natural gas, of which exploring is expected in future; the estimated exploring cost is envisaged to be higher than the world market and to be consumed in the domestic due to the less efficiency of the gas reserve. The natural gas price is es-

timated 4 $/MMBTU at power plant site including the markup provisionally.

Table 10.2-2 Fuel Prices for Economic Analysis

Fuel Type	Fuel Price (CIF Price)	Remarks
Diesel Oil *1)	237 $/MT	Average from 1996 Nov. ~ 2001. July
Heavy Fuel Oil *2)	154 $/MT	Average from 1996 Nov.~ 2001. August
Natural Gas	4.0 $/MMBTU	Engineer's assumptions (L.H.V. base) 3.5 $/MMBTU and 4.5 $/MMBTU are also testified in the economic analysis.

Source: *1) and *2) EDC

Fuel price escalation is not considered in the economic analysis because the same escalation rate will be applicable to all fuels.

10.2.6. Fuel Shift

Since some fuel types seem to be applicable to the project at the moment, the following fuel scenarios are considered in the economic analysis.

(1) Natural Gas will be used for whole period of 20-years economic lifetime from the beginning (**Base Case**).

(2) Diesel Oil will be used for the first 5 years and Natural Gas will be used for the next 15 years.

(3) Diesel Oil will be used for the first 10 years and Natural Gas will be used for the next 10 years.

(4) Diesel Oil will be used for whole period of 20-years economic lifetime from the beginning.

In line with the fuel shift for the above items (2), (3) and (4) , the cost of additional gas treatment system of 1.2 Million US$ for all stages is also considered.

10.2.7. Project Characteristics and Conditions

The project characteristics, which were revealed in the course of the study, and assumed condition, are summarized in Table 10.2-3.

Table 10.2-3 Project Characteristics and Assumed Conditions

Items	Value	Unit	Remarks
Installed capacity	180	MW	90 MW × 2 stages
Capacity Factor (Average 54%)		%	2006 2007 2008 2009 2010 2011 2012 ~ ST-1 24 75 55 63 67 70 50 ST-2 - - 18 63 67 70 50
Construction cost	164.4	M. $	Excluding Engineering and Administration Fees
Scheduled maintenance days	49	Days	For kW and kWh adjustments use only
Forced outage rate	8.0	%	
Station use	2.8	%	
Fixed O/M cost	20.0	$/kW-year	
Natural Gas			
Fuel price	4.0	$/MMBTU	LHV base, domestic price including markup
Heat rate	6,829	BTU/kWh	
Fuel cost	27.32	$/MWh	
Variable O/M	1.0	$/MWh	
Diesel Oil			
Fuel price	6.02	$/MMBTU	LHV base, CIF Price for Diesel :237 $/ton
Heat rate	7,030	BTU/kWh	
Fuel cost	42.32	$/MWh	
Variable O/M	2.5	$/MWh	
Construction period	2	Years	Disbursement schedule are 40 % and 60 %.
Construction start	2004, 2006		2-staged construction
Operation start	2006, 2008		Each operation of 90 MW
Economic life time	20	Years	

10.2.8. Alternative Thermal Power Plant

A diesel power plant with equivalent capacity to the project is set as an alternative thermal power plant in view of current supply system in Cambodia.

Table 10.2-4 shows the plant properties to be used as the representative of equivalent diesel power plant.

Table 10.2-4 Characteristics of Alternative Diesel and Assumed Conditions

Items	Value	Unit	Remarks
Installed capacity	197.8	MW	98.9 MW x 2 stages, (Middle Speed)
Annual generation		GWh	2006 2007 2008 2009 2010 2011 2012~ ST-1 192.8 602.4 441.8 506.1 538.2 562.3 401.7 ST-2 - - 144.5 506.1 538.2 562.3 401.7
Construction cost	271.0	M.US$	Excluding Engineering and Administration Fees
Scheduled maintenance days	28	days	
Forced outage rate	20	%	
Station use	4.6	%	
Fixed O/M cost	21.0	$/kW-year	
Variable O/M cost	3.0	$/MWh	
Fuel Price	3.99	$/MMBTU	LHV base, CIF Price for HFO: 154.0 $/ton
Heat rate	7,888	BTU/kWh	HFO
Fuel cost	31.49	$/MWh	HFO
Construction period	2	years	Disbursement schedules are 50 % and 50 %.
Construction start	2004, 2006		2-staged construction
Operation start	2006, 2008		Each operation of 90 MW
Economic life time	20	years	
kW Adjustment	1.099		
kWh Adjustment	1.019		

10.2.9. Calculation Cases and Results

(1) Calculation Cases

10 calculation cases, with combination of fuel conversion scenario and natural gas price, are conducted as shown in Table 10.2-5.
Case Nos. 100s, 200s and 300s are focusing on the timing of natural gas fuel availability and Case No. 400 represents the case of diesel oil for the whole economic life time to understand the economic advantage of the natural gas.
Concerning the natural gas price, 4.0, 3.5 and 4.5 $/MMBTU are assumed.

(2) Calculation Results

Table 10.2-5 also presents the results of economic analysis. Typical cases (Case No. 100, 300, and 400) are demonstrated in Attachments 3.1 to 3.3
The economic indices show the excellent economic performance of the project except the Case No. 400 because the construction cost of the project is cheaper than that of the alternative diesel power plant and the natural gas fuel cost is also cheaper than the heavy fuel oil.

Concerning Case No. 400, EIRR of 3.81 % indicates that the Net Present Value of Cost becomes lower than the Net Present Value of Benefit on condition that the discount rate is bigger than 3.81 % (B - C becomes negative if the discount rate is less than 3.81%).

“B – C” of Case 100 shows about 4 times and B/C of Case 100 also presents 30% more in comparison Case 400.

Table 10.2-5 Calculation Cases and Summary of Results

1. Calculation Cases

	Se.No.	1	2	3	4	5	6	7	8	9	10
	Case No.	100	110	120	200	210	220	300	310	320	400
A	***Fuel Conversion Scenario***										
	(1) Natural Gas for full 20 years	◎	○	○							
	(2) Diesel Oil 5 years + NG 15 years				○	○	○				
	(3) Diesel Oil 10 years + NG 10 years							○	○	○	
	(4) Diesel Oil for full 20 years										○
B	***Natural Gas Fuel Price***										
	(1) 4.0 US$/MMBTU	◎			○			○			
	(2) 3.5 US$/MMBTU		○			○			○		
	(3) 4.5 US$/MMBTU			○			○			○	
C	***Diesel Oil Price (CIF)***										
	(1) 237 US$/ton				○	○	○	○	○	○	○

Note: ◎means Base Case.

2. Calculation Results

Economic Internal Rate of Return (EIRR)	%	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	3.81*1
Net Present Value of Cost	M.US$	249.3	233.7	264.2	276.3	266.5	285.5	299.0	294.1	303.6	321.7
Net Present Value of Benefit	M.US$	345.0	345.0	345.0	345.0	345.0	345.0	345.0	345.0	345.0	345.0
B - C	M.US$	95.7	111.3	80.8	68.7	78.5	59.5	46	50.9	41.4	23.3
B/C		1.38	1.48	1.31	1.25	1.29	1.21	1.15	1.17	1.14	1.07

Note: Net Present Value as of 2001 is discounted value with 10 % discount rate.

N.A means EIRR>100 %

*1: For the Case No. 400, B-C becomes positive on condition that the discount rate is higher than 3.81 %, unless B-C becomes negative.

10.3. Financial Analysis

10.3.1. Objective

Financial analysis is carried out to verify the financial feasibility of the project from the viewpoint of the project owner and lenders. Therefore, market prices, which include taxes & duties, and subsidiaries, are used in the analysis.

Financial analysis is conducted in US$ term because US$ currency is prevalent in Cambodia[4] as well as Cambodian Riel.

10.3.2. Methodology and Definition of Financial Analysis

The financial Internal Rate of Return (FIRR) is the most commonly used measure in financial analysis. FIRR consists of Project Internal Rate of Return (Project IRR) and Return on Equity (ROE) according to the source of fund. Project IRR presents the expected rate of return on investment, which is fully prepared by own finance. On the other hands, ROE presents the expected rate of return on equity portion. Therefore, the former indicator does not depend on the financial (loan) conditions and presents the financial characteristic of the project itself. The latter indicator presents the financial improvement of the project by means of imposing the external fund sources. According to World Bank Discussion Papers[5], it is said that power developers normally require at least 20 to 30 % of ROE.

Debt Service Coverage Ratio (DSCR) is one of the financial indices and the Bankers are generally most concerned on this factor. According to the World Bank data, DSCR exceeding 1.5 times is recommended. The DSCR is calculated by using the following equation:

$$DSCR = \frac{Net\ Sales\ Revenue}{(Capital\ Repayment + Interest\ Payment)}$$

Where, Net Sales Revenue = Sales Revenue – Operation Cost – Profit Tax

The financial levelised production cost (LPC) is generally compared with the power

[4] Invoice of power tariff is made in Cambodian Riel and payment is allowed to be done by Riel or US$ term for an example.

[5] "Submission and Analysis of Proposals for Private Generation Project in Developing Countries", 1994

tariff. The financial levelised production cost is derived from the following formula:

$$LPC = \frac{\text{NPV of Total Cost with 10 \% Discount Rate}}{\text{NPV of Salable Energy with 10\% Discount Rate}}$$

10.3.3. Annual Generation and Salable Energy

(1) Annual Generation

Annual generation energies can be calculated by the capacity factor, which is resulted from the optimum power development program in Section 2.2.

The capacity factors are set as shown in Table 10.3-1 as well as the economic analysis.

The average capacity factor for the economic lifetime of 20 years is estimated to be 54%.

Table 10.3-1 Capacity Factors of Sihanoukville C.C. Power Plant

Stage	2006	2007	2008	2009	2010	2011	2012 ~
Stage 1	0.24	0.75	0.55	0.63	0.67	0.70	0.50
Stage 2	-	-	0.18	0.63	0.67	0.70	0.50

Note: Annual generation energy for 2007 results in 591.3 GWh (= 90 MW × 0.75 × 8,760 hrs × 0.001)

(2) Station Use and Transmission Loss

The station use is assumed to be 2.8 % as well as economic analysis.

The transmission line loss is assumed as follows:

- Project Site ~ Takeo : 1.7 % (220 kV × 2 circuits)
- Project Site ~ Phnom Penh : 2.7 % (220 kV × 2 circuits)
- Chau Doc ~ Phnom Penh : 4 % for peak period and 2 % for shoulder period[6]

The distribution loss in Phnom Penh is set at 13.0%[7] based on the EDC's projec-

[6] "Feasibility Study for the First Transmission Link between Phnom Penh and the Southern Region of Cambodia, Project Review", page 57, April 2001.

[7] According to EDC's information in November 2001, the distribution loss in Phnom Penh around year 2006, EDC projects 12% ~ 14%.

tion and the total loss from the project site to consumer's end is assumed to be 15.7% provisionally.

(3) Salable Energy

Based on the above assumptions, the salable energy becomes as follows:

$$\begin{aligned} \textit{Salable Energy} &= \textit{Generation Energy} \times (1 - \textit{Station Use}) \times (1 - \textit{T/L loss}) \\ &= \textit{Generation Energy} \times (1\text{-}0.028) \times (1\text{-}\ 0.157) \\ &= 0.8194 \times \textit{Generation Energy} \end{aligned}$$

10.3.4. Construction Cost

The construction cost consists of the construction of the project and the construction of transmission line from Kampot to the project site (about 83 km). The construction cost of the transmission line from Phnom Penh to Takeo is assumed to be born by the World Bank's Project and from Takeo to Kampot is also assumed to be born by the German Grant.

The construction cost of the project is estimated by two currencies portion for Stage 1 and Stage 2 respectively.

Table 10.3-2 Estimated Construction Cost (M.US$)

Stage No	F/C Portion (M.US$)		L/C Portion (M.US$)		Total	
	Before Escalation	After Escalation	Before Escalation	After Escalation	Before Escalation	After Escalation
Stage 1 90 MW	83.6	92.2	16.6	18.2	100.2	110.4
Stage 2 90 MW	65.4	75.5	9.3	10.6	74.6	86.1
Subtotal	149.0	167.7	25.9	28.8	174.8	196.5
220 kVA × 2 lines	8.6	9.4	2.2	2.4	10.8	11.8
Total	157.6	177.1	28.0	31.2	185.6	208.3

Note: The above costs exclude duties & taxes, IDC and other financial fees.
The total is not matched due to round off.

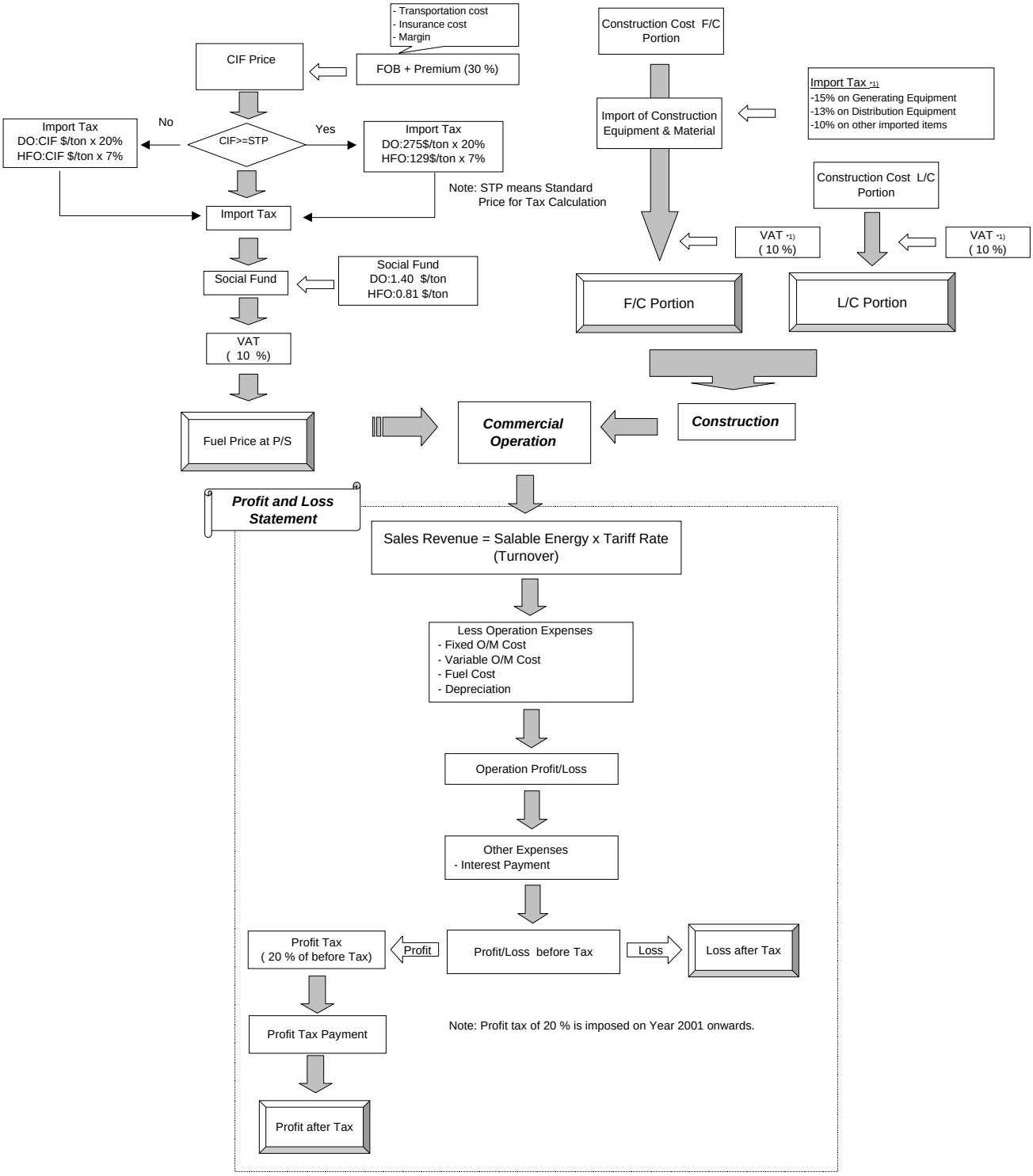
The price escalation of 2.4 % per annum is considered referring to the ADB Report[8].

[8] "Provincial Power Supply Project", Asian Development Bank, November 2000, page 17.

10.3.5. Taxes and Duties imposed on Project

Fig. 10.3-1 presents the taxes and duties imposed on the project. Taxes and duties, which will be incurred during the construction period, are regarded as the investment capital of the Royal Government of Cambodia.

Value Added Tax of 10 % is imposed on Foreign and Local Currencies Portion.



Note) VAT of 10 % is imposed on Local and Foreign costs excluding Consultant Services

*1) Source: Asian Development Bank "Provincial Power Supply Project", Appendix-5, page1

Fig.10.3-1 Taxes and Duties on Project

10.3.6. Power Tariff Forecast

The average power tariff as of 2000 is 554 Riel/kWh[9] (or 14.57 ¢/kWh) and the power tariff rate is shown in Attachment 1.5.

The future power tariff is assumed based on EDC Report, ADB Project Report[10] and the World Bank Project Report[11], which are shown in Tables 10.3-3 and 10.3-4.

Table 10.3-3 Future Power Tariff Scenario (Riel/kWh)

	2001	2002	2003	2004	2005	2006	2007
ADB *1)	652	700	752	728	730	746	778
EDC *2)	608	613	620	628	636	646	656

*1) ADB "Provincial Power Supply Project", November 2000, Appendix-9, Page 4, Table A9.1

*2) EDC Report, page 14

Table 10.3-4 Exchange Rate Forecast (Riel/$) and Power Tariff Forecast (¢/kWh)

	2001	2002	2003	2004	2005	2006	2007
Exc. Rate *3)	3,971	4,149	4,335	4,530	4,734	4,946	5,169
EDC	15.31	14.79	14.31	13.86	13.44	13.06	12.68
ADB *4)	16.42	16.87	17.35	16.07	15.42	15.08	15.05
World Bank *5)	16.1	16.1	16.1	14.5	13.8	13.4	12.5

*3) EDC Report, page 14

*4) ¢/kWh for ADB portion is calculated by using the above exchange rate.

*5) World Bank "Project Overview Report", Page 58, Table 7

Note: Exchange Rate against US$ is assumed to be devaluated 4.5 % annually by EDC.

Based on the above forecast, the average power tariff from the year 2006 onwards is assumed to be 13.0 ¢/kWh.

However, the average power tariff consists of the following cost. Therefore, the power tariff contributing to the project finance is the power tariff less indirect cost.

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[9] "Prepared and Analyses Study, EDC's Strategic Planning for Year 2001, 2002 and 2003 within Planning until 2010 ", Page 14, EDC, November 2000

[10] "Report and Recommendation of the President to the Board of Directors on a Proposed Loan to the Kingdom of Cambodia for the Provincial Power Supply Project" , November 2000

[11] "The World Bank Cambodia Rural Electrification and Transmission Project (PHRD TF025765) Feasibility Study Report for the Transmission Link between Phnom Penh and the Southern Region of Cambodia, Project Overview", April 2001

- Direct operation costs (Fuel cost, Fixed O/M and Variable O/M costs)
- Power purchase cost from IPP
- Maintenance cost of transmission and distribution lines
- Overhead cost

Table 10.3-5 data shows the cost related to the power generation of EDC Phnom Penh Operations from 1997 to 1999.

Table 10.3-5 Cost Related to Power Generation in Phnom Penh Operation (Million Riel)

FY Year	1997	1998	1999
1. Cost Related to Power Generation *1)			
Fuel			
Diesel Oil	32,255	46,806	23,822
Fuel Oil	5,541	-	10,046
Light Oil & Materials	1,585	1,593	2,429
IPP Purchase	33,133	58,061	73,693
Depreciation	7,780	13,741	11,656
Wages and Salaries	196	818	1,176
Subtotal	80,490	121,019	122,822
2. Total Expenditure *2)			
Cost of Sales	74,782	109,918	131,708
Operating Expenses	14,829	40,539	13,776
Cost of Sales + Operating Expenses	89,611	150,457	145,484
Direct Cost Ratio (1/2)	90.32%	80.43%	84.42%

*1) Source: Finance and Accounting Department of EDC, September 2001
*2) Source: EDC Annual Report 1998, November ,1999, and Finance and Accounting Dpt of EDC, September 2001.

Since the Operating Expenses in 1998 include the provision of bad debt, the direct cost ratio is estimated by the average of 1997 and 1999 as follows:

$$\text{Direct Cost Ratio} = \frac{(80{,}490 + 122{,}822)}{(89{,}611 + 145{,}484)} = 86.48\% = 85\,\%$$

Therefore, power tariff contributing to the project is set at 11.05 ¢/kWh (13 ¢/kWh × 85% = 11.05).

10.3.7. Fixed and Variable O/M Cost

(1) Fixed O/M Cost

Fixed O/M cost mainly consists of machine repair cost and wage & salaries of the operation staffs. According to EDC Report, EDC planned the staff costs for the year 1999 as shown in Table 10.3-6.

Table 10.3-6 EDC Staff Cost in PHN's for 1999

(Unit: 1,000 US$)

1. Salaries	1,446
2. Social Insurance Charge	232
3. Advantage in kind	63
4. Bonus	176
Total Staff Cost	1,917

Source: "EDC Annual Report 1998, Table 4-8", Feb. 1999

Since the total staffs in PHN's as of December 31, 2000 were 1,295 personnel, the average manpower cost per annum is estimated to be 1,480 US$ per capita per year provisionally.

On the other hand, proposed staffs for the commercial operation are 151 personnel for the two stages. Considering the other related fixed costs, the fixed O/M cost is assumed as follows:

(a) Stage 1 : Total Fixed O/M cost = 3.62 Million US$ (40.22 $/kW-year)

- Personal Expenses : 1,480 $/capita × 118 person = 0.17 Million US$
- Maintenance cost : 3 % of Plant Cost (ST1) = 101.4 Million US$ × 3% = 3.04 Million US$
- Insurance etc. : 0.4 % of Plant Cost (ST1) = 101.4 Million US$ × 0.4% = 0.41 Million US$

(b) Stage 2 : Total Fixed O/M cost = 2.85 Million US$ (31.67 $/kW-year)

- Personal Expenses : 1,480 $/capita × 33 person = 0.05 Million US$
- Maintenance cost : 3 % of Plant Cost (ST2) = 82.2 Million US$ × 3 % = 2.47 Million US$
- Insurance etc. : 0.4 % of Plant Cost (ST2) = 82.2 Million US$ × 0.4 % = 0.33 Million US$

Note : Plant Cost defined here consists of Mechanical Works, Electrical Works, Civil and Structural Works and Spare Parts.

Since the fixed O/M cost for the associated transmission line is normally 1.0 % of the investment cost, the fixed O/M cost for the transmission line becomes 0.1 Million US$ (= 11.8 Million US$ × 1 %) and be paid by Stage 1.

(2) Variable O/M Cost

Variable O/M cost is estimated to be 1.0 $/MWh for natural gas-fired and 2.5 $/MWh for diesel oil-fired respectively referring to the similar plants in the developing countries in the South-east Asia.

10.3.8. Fuel Cost and Fuel Shift

The fuels applicable to the project are assumed to be diesel oil and natural gas.

(1) Fuel Cost

The fuel prices used in the financial analysis are market prices including the taxes and duties.

Taxes and duties shown in Table 10.3-7 are considered in the financial analysis.

The import tax for diesel oil is calculated by the standard price of 275 $/ton basis.

Table 10.3-7 Taxes and Duties on Fuel

Fuel Type	Import Tax	Social Fund	VAT
Diesel Oil	20 %	1.40 $/ton	10 %
Natural Gas	None *1)	1.40 $/ton	10 %

Note: Taxes and duties for natural gas are assumed values.
*1) Natural Gas is assumed to be domestic product.

The fuel cost before taxes and duties are set at 237 $/ton (CIF Price) for diesel oil and 4.0 $/MMBTU (L.H.V. base) for natural gas. Annual escalation of 2 % is estimated for diesel oil and 0 % for natural gas from the year 2001 onwards.

(2) Fuel Shift

As mentioned in the economic analysis, natural gas is expected to be exploited in Cambodia in future. The timing of fuel shift is assumed as follows as well as economic analysis.

(a) Natural Gas will be used for whole period of 20-years economic lifetime from the beginning (**Base Case**).

(b) Diesel Oil will be used for the first 5 years and Natural Gas will be used for the next 15 years.

(c) Diesel Oil will be used for the first 10 years and Natural Gas will be used for the next 10 years.

(d) Diesel Oil will be used for whole period of 20-years economic lifetime from the beginning.

In line with the fuel shift, the cost of additional gas treatment system of 1.2 Million US$ for all stages is also considered.

10.3.9. Depreciation Method

Depreciation method applied to EDC at the moment is accelerated depreciation method, of which ratios varied from 0 % to 20 % based on the categories as shown in Table 10.3-8.

Table 10.3-8 Percent of Annual Depreciation

Categories	Percents
Land	0 %
Land Improvement	20 %
Administration Building	3 %
Production Building	11 %
Substation	4 %
Generator	11 %
Other Equipment	11 %
Network Equipment	4 %
Vehicle	15 %
Office Furniture	10 %

Source: Finance and Accounting Department of EDC, September 2001

All project cost, including the land acquisition and resettlement, is assumed to be subject to the depreciation and the average percents of depreciation is also assumed to be 11 % based on the above table.

10.3.10. Implementation Method

The following two implementation methods for Sihanoukville C.C. Project are considered.

(1) Option 1 : EDC will implement the project by using official loan.

(2) Option 2 : The private investor will implement the project by his own finance and loans, and sell the power to EDC based on the Power Purchase Agreement (BOT).

10.3.11. Finance Arrangement

(1) Finance Sources

The official finance sources such as the Japan Bank for International Cooperation (JBIC) and the Asian Development Bank, are the most prospective finance sources for the project in case of Option 1.

For Option 2, the combination of Oversea Investment Loan (OIL) and the commercial bank seems to be applicable.

(2) Loan Conditions and Finance Arrangement

The typical loan conditions offered by official finance sources and commercial banks are as follows:

(a) JBIC Loan (Yen Loan)

JBIC will finance the 100 % of the foreign currency portion or the maximum 85% of the total project cost.

JBIC loan cannot be applicable to the duties and taxes.

Since Cambodia belongs to the LLDC (Least Less-Developed Country), RGC (The Royal Government of Cambodia) will be able to borrow the required fund for the project on the following conditions in case of the standard loan.

- Interest rate of 1.0 %
- Amortization of 30 years including grace period of 10 years (maximum)

(b) ADB Loan (US$ Loan)

ADB will finance the 100 % of the foreign currency portion or approximately 90 % of the total project cost including the Interest During Construction (IDC) based on the “Provincial Power Supply Project”, which was financed by ADB. ADB loan also cannot be applicable to the duties and taxes.

The standard loan condition (Special Drawing Right) based on the above project seems to be as follows:

- Interest rate of 1 % for during the grace period

- Interest of 1.5 % per annum thereafter
- Amortization of 32 years including grace period of 8 years.

(c) Overseas Investment Loan (OIL)

OIL is applicable to the IPP Project, if the Japanese investors are involved in the IPP. OIL is assumed to finance 60% of the total debt. Other conditions for US$ Loan are assumed as follows:

- Interest rate per annum = LIBOR + 1.0 % (LIBOR: London Interbank Offered Rate)
- Amortization of 15 years including grace period of 5 years

(d) Subsidiary Loan

The Loan Agreement will be made between the Banker and the Borrower for the above a) and b) loans. The Ministry of Economy and Finance (MEF), Cambodia is the representative of the Borrower.

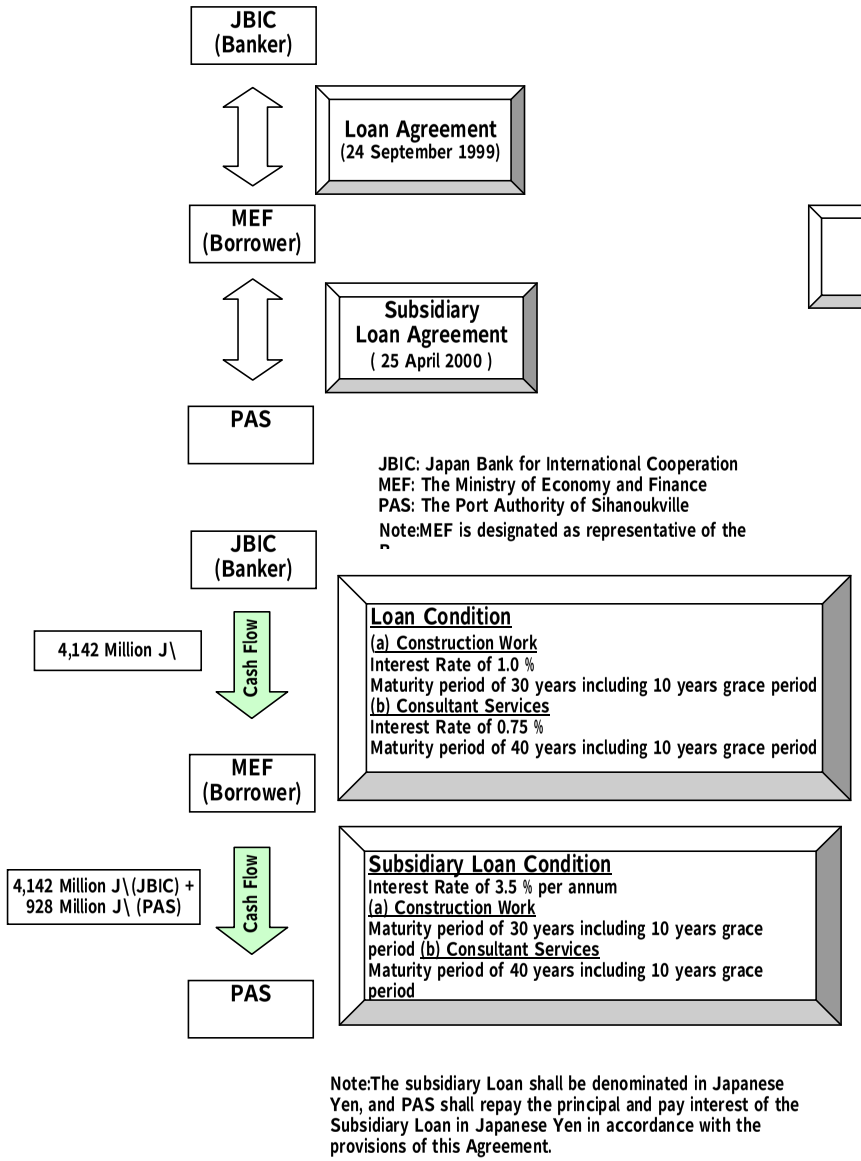
Besides the above Loan Agreement, MEF will re-lend the loan and the RGC portion to the executing agency (EDC) under the Subsidiary Loan Agreement.

Fig. 10.3-2 demonstrates the examples of Loan Agreement and Subsidiary Loan Agreement, which seems to be applicable to the “Sihanoukville Combined Cycle Project”.

Therefore, the financial feasibility of the Project is studied by using the above Subsidiary Loan Agreement.

Subsidiary Loan-1 is the case when the 85% of total project cost is borrowed from an official finance source (Source-A), and Subsidiary Loan-2 is the case when the 90% of total project cost including IDC is borrowed from an official finance source (Source-B).

Case-1 Japan Bank for International Cooperation
"Sihanoukville Port Urgent Rehabilitation Project"



Case-2 Asian Development Bank
"Provincial Power Supply Project"

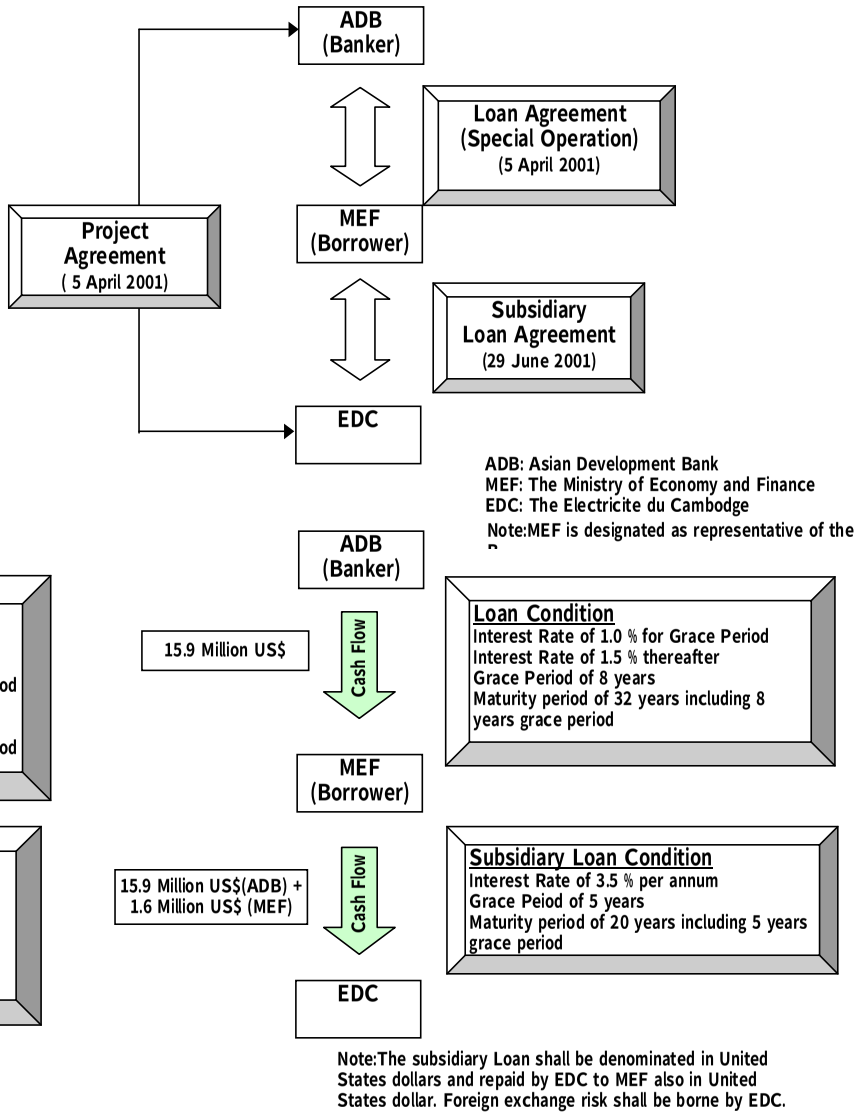


Fig.10.3-2 Loan Agreement and Subsidiary Loan Agreement

10.3.12. Calculation Conditions

Based on the above considerations, the calculation conditions in the financial analysis are summarized in Table 10.3-9.

Table 10.3-9 Sihanoukville C.C. Project Calculation Conditions

Items	*EDC Project*	*IPP Project (BOT)*
Installed Capacity	90 MW × 2 stages = 180 MW	
Annual Capacity Factor (Average 54%)	2006 2007 2008 2009 2010 2011 2012~ ST-1 24% 75% 55% 63% 67% 70% 50% ST-2 - - 18% 63% 67% 70% 50%	
Station Use	2.8 %	
T/L and Distribution Loss	15.7%	0% (Sales at P/S exit)
Salable Energy	Generation Energy × 81.94%	Generation Energy × 97.2%
Construction Cost for Stage 1 F/C L/C inc. duties and taxes Total (inc. T/L)	After escalation 101.6 Million US$ 45.3 Million US$ 146.9 Million US$	Import tax will be exempted.[*1)] 101.6 Million US$ 31.9 Million US$ 133.5 Million US$
Construction Cost for Stage 2 F/C L/C inc. duties and taxes Total (inc. T/L)	After Escalation 75.5 Million US$ 29.5 Million US$ 105.0 Million US$	Import tax will be exempted.[*1)] 75.5 Million US$ 18.8 Million US$ 94.3 Million US$
Escalation L/C F/C	2.4 % per annum 2.4 % per annum	
Disbursement Schedule Stage 1 Stage 2	2004 2005 2006 2007 2008 22.8% 50.3% 26.9% - - - - 22.2% 51.3% 26.5%	
Finance Planning Financial Source Interest Rate (=IDC) Commitment Fee Grace Period Repayment Period Loan Limit Top Front Fee Finance Source Interest rate (=IDC) Commitment Fee Front End Fee Grace Period Repayment Period Loan Limitation	 Subsidiary Loan - 1 3.5 % per annum - 8 years 23 years including grace period 100 % of F/C or 85 % of the project cost - Subsidiary Loan - 2 3.5 % per annum - - 8 years 23 years inc. 5 years grace period 100 % of F/C or 90 % of the construction cost inc. IDC	 OIL US$ Loan LIBOR+1 % *2) (3.46 + 1 = 4.46) 0.25 % of remaining loan 5 years 15 years 60 % of debt portion 1.0 % of loan amount Bank Syndicate Loan LIBOR+2.5 %(3.46 + 2.5=5.96) 0.5 % 1.25 % of loan amount 5 years 15 years including grace period None
Equity : Debt	-	30 % : 70 %
Economic Life Time	20 years	

Items	*EDC Project*	*IPP Project (BOT)*
Depreciation Method	Accelerated method with 11 % for 20-years economic lifetime	
Power Tariff as of 2006 excluding maintenance cost of T/L, D/S and overhead	11.05 ¢/kWh	¢/kWh for PPA PPA: Power Purchase Agreement
Operation Cost Fixed O/M Cost Variable O/M Cost Fuel Cost	ST-1: 40.2 $/kW-year (inc. T/L: 41.5) ST-2: 31.7 $/kW-year Natural Gas : 1.0 $/MWh Diesel Oil : 2.5 $/MWh Natural Gas : 30.27 $/MWh Diesel Oil : 58.28 $/MWh	
Tax and Duties Profit Tax	20%	9 % with 8 years Tax Holiday *1)
Commencement of Operation	Stage 1: 2006 Sep.1 Stage 2: 2008 Sep.1	
Discount Rate	10 %	
Exchange Rate	1 US$ = 4000 Riel as of 2001	

Note : *1) Power Purchase Agreement between Leader Universal Holdings Berhad Delcom Services SDN BHD INTERCORE INC. and EDC, Appendix K, page 94.

*2) LIBOR is 3.46 % as of October, 2001 (Source: www.bankrate.com/brm/news/biz/ratechart.asp)

10.3.13. Calculation Cases and Calculation Results

(1) Calculation Cases

Based on the above considerations, 27 cases as summarized in Table 10.3-10 are conducted.

(a) Case numbers of 1000s are the cases that the project is implemented by Subsidiary Loan-1.

(b) Case numbers of 2000s are the cases that the project is implemented by Subsidiary Loan-2.

(c) Case numbers of 3000s are the case that the project is implemented by IPP and the power tariff for PPA, which satisfies the ROE of 20%, is calculated.

Power selling to EDC is assumed at power station outlet.

(d) Case numbers of 4000s are focusing on generation cost excluding VAT and Profit Tax to compare the power purchase cost from Vietnam and IPP1. And distribution loss is also excluded for the comparison basis.

In association with the above implementation methods, Table 10.3-11 shows the summary of the total project cost including all costs.

(2) Calculation Results

Table 10.3-10 also shows the calculation results of the financial analysis and Case No. 1000, Case No. 2000, Case No. 3000, and Case No. 4000 are demonstrated in Attachments 3.4 to 3.7.

(a) Project IRR

If the natural gas is used for the full economic lifetime or put into the operation before the 5th year, the project IRR of 10% is expected. On the other hand, if the diesel oil is used for the full economic life time, the project IRR cannot be calculated and the financial attractiveness will be eliminated.

Therefore, from the viewpoint of the project EIRR, the financial attractiveness will be expected on condition that the natural gas becomes available before the 5 years from the commencement of commercial operation.

(b) ROE & DSCR

As shown in Table 10.3-11, since EDC bears IDC portion only under the Subsidiary Loan Agreement, ROE presents the good performance for any cases. However, in view of DSCR, the minimum DSCR becomes less than 1.0 or negative if diesel oil is fired more than 10 years during the operation period. The DSCR less than 1.0 means that EDC has to borrow the additional loan for the interest payment and principal repayment due to shortage of own cash.

Therefore, the implementation of the project will be accepted by the Lenders if the natural gas is warranted to be put into the operation before the 5th year from the commencement of the commercial operation, unless the implementation will not be accepted.

(c) Levelised Production Cost

At the priced of natural gas of 4.0 $/MMBTU, levelised production cost including taxes and duties under the effective power tariff of 11.05 ¢/kWh varies from 7.84 ¢/kWh to 9.45 ¢/kWh for the cases that the natural gas will be put into the project within the first 5 years during the operation period and 10.96 ¢/kWh to 12.85 ¢/kWh if natural gas is put into the project on 11th

year or not put into the project. If the natural gas is available from the beginning of the operation, levelised production cost can be expected to be 30% less in comparison with the case that the natural gas is put into the operation on 11th year.

(d) IPP Project

In case of the IPP project, the hurdle rate for the financial feasibility is set at 20 % of ROE. To achieve the ROE more than 20 %, the power tariff selling to EDC (at P/S exit) requires from 7.70 ¢/kWh to 9.85 ¢/kWh under the condition that natural gas is put into within 5 years and its price is 4.0 $/ MMBTU.

These selling prices will be equivalent to 9.13 ¢/kWh to 11.68 ¢/kWh at consumer's end level taken into account of T/L and D/L loss of 15.7%.

EDC has to purchase at more expensive cost than that of EDC implementation because the selling price to EDC at consumer's end is higher than the levelised production cost for the case of EDC.

If the diesel oil is used for the full operation period, the selling price of 14.39 ¢/kWh to EDC exceeds the expected power tariff of 13.00 ¢/kWh and cannot be accepted by EDC.

(e) Production Cost without Taxes

- Comparison with the current purchase tariff from IPP1

  Attachment 1.3 shows the current EDC's operation status. EDC purchases the power from IPP1. in Phnom Penh Operations at 8.94 ¢/kWh (1997) to 10.95 ¢/kWh (2000) based on the PPA. The above purchase prices do not include the duties and taxes, because EDC bears duties and taxes imposed on fuel, of which fuel is used by IPP1s, instead of IPP1.

  The levelised production cost for Case No. 4000 is excluded duties and taxes, and profit tax to keep the same cost level with the current purchase tariff from IPP1.

  The levelised production cost of the project of 5.78 ¢/kWh is clearly lower than the current purchase tariff from IPP1.

- Comparison with the power import from Vietnam

The Royal Government of Cambodia and the Government of Social Republic of Viet Nam made an Agreement on Power Sector Cooperation in June, 1999. Based on the agreement, MIME (Ministry of Industry, Mines and Energy) and MOI (Ministry of Industry, Viet Nam) entered into Power Trade Agreement describing the power trade from Vietnam to Cambodia. According to Power Purchase Agreement signed on July 24, 2000 based on the above agreement, the conditions on the power purchase from Vietnam are set as follows:

a. Commencement of power purchase : year 2003[12]
b. Source of supply : Thot Not substation via Chau Doc
c. Interconnecting point : Border between Cambodia and Vietnam
d. Metering point : Chau Doc substation
e. Supply capacity : 80 MW between 2003 to 2005
: 200 MW after year 2005
f. Power tariff effectiveness : 5 years
g. Currency in payment : US$

Table 10.3-12 Power Purchase Prices from Vietnam

Dry Season (November ~ June 30)	Peak hours	(18:00 ~ 22:00)	8.50 ¢ /kWh
	Normal hours	(4:00 ~ 18:00)	6.25 ¢ /kWh
	Off-peak hours	(22:00 ~ 4:00)	4.50 ¢ /kWh
Wet Season (July ~ October 31)	Peak hours	(18:00 ~ 22:00)	8.00 ¢ /kWh
	Normal hours	(4:00 ~ 18:00)	6.00 ¢ /kWh
	Off-peak hours	(22:00 ~ 4:00)	3.00 ¢ /kWh

The average purchase price at the border is estimated to be about 6.0 ¢/kWh[13].

If the purchase price of 6.0 ¢/kWh at the border price converts to the

[12] As mentioned in Section 2.4, available import year seems to be delayed.

[13] Dry Season = (8.5 x 4 + 6.25 x 14 + 4.5 x 6)/24 = 6.2, Rainy Season = (8.0 x 4 + 6.0 x 14 + 3.0 x 6)/24 = 5.6, whole year = (6.2 x 8 + 5.6 x 4)/12 = 6.0

equivalent prices at Takeo and at Phnom Penh taking into consideration of transmission line loss, the above border price will be as shown in Table 10.3-13 in comparison with the levelised production costs of Case No. 4000 and 4100.

Table 10.3-13 Comparison of Purchase Price and LPC

	Power Purchase From Vietnam	Levelised Production Cost (LPC)
At Phnom Penh	6.0 /(1-0.02) = 6.12 ¢/kWh	5.78 ¢/kWh (No. 4000)
At Takeo	6.0 /(1-0.01) =6.06 ¢/kWh	5.73 ¢/kWh (No. 4100)

Note) T/L loss from Chau Doc to Phnom Penh and to Takeo is assumed to be 2.0 % and 1.0 % respectively as mentioned before.

Based on the above comparison, it is expected that if the natural gas, of which exploring cost is 4.0 $/MMBTU, will be put into the operation from the commencement of the commercial operation, production cost of the project will be less than the purchase price from Vietnam.

Further more, if the Shihanoukville Industrial Zone is realized in future[14], the project will be more advantageous in virtue of its location.

[14] According to ADB information, the improvement of Sihanoukville Air Port from the domestic air port to the international air port is under negotiation between RGC and Bangkok Airways to induce the overseas investors.

Table 10.3-10 Calculation Cases and Results for Financial Analysis

1. Calculation Cases

	Se.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	Case No.	1000	1010	1020	1100	1110	1120	1200	1210	1220	1300	1400	2000	2010	2020	2100	2110	2120	2300	3000	3010	3020	3100	3110	3120	3300	4000	4100
A.	***Finance Sources***																											
	(1) Subsidiary Loan -1	◎	○	○	○	○	○	○	○	○	○	○															○	○
	(2) Subsidiary Loan -2												○	○	○	○	○	○	○									
	(3) OIL + Bank Syndicate Loan																			○	○	○	○	○	○	○		
B	***Implementation Method***																											
	(1) Implemented by EDC	◎	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○								○	○
	(2) IPP																			○	○	○	○	○	○	○		
C	***Fuel Conversion Scenario***																											
	(1) Natural Gas for full 20 years	◎	○	○								○	○	○	○					○	○	○					○	○
	(2) Diesel 5 years + NG 15 years				○	○	○									○	○	○					○	○	○			
	(3) Diesel 10 years + NG 10 years							○	○	○																		
	(4) Diesel Oil for full 20 years										○								○							○		
D	***Natural Gas Price (inc. Taxes)***																											
	(1) 4.43 US$/MMBTU	◎			○			○				○	○			○				○			○				○	○
	(2) 3.88 US$/MMBTU		○			○			○					○			○				○			○				
	(3) 4.98 US$/MMBTU			○			○			○					○			○				○			○			
E	***Diesel Oil Price (inc. Taxes)***																											
	(1) 326.54 US$/ton										○								○							○		
F	***T/L from Kampot to Site***																											
	(1) Including T/L (11.8 M.US$)	◎	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	(2) Excluding T/L											○																
G	***Power consumption at***																											
	(1) Phnom Penh	◎	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
	(2) Takeo																											○
H	***Value Added Tax & Profit Tax***																											
	(1) No VAT																										○	○
	(2) No Profit Tax																										○	○

Note: ◎means base case.

2. Calculation Results

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1 Project IRR (%)																											
Stage-1	11.6	12.7	10.5	6.6	7.1	5.9	3.0	3.4	2.6	N.A.	13.2	11.6	12.7	10.5	6.6	7.1	5.9	N.A.	8.9	9.0	8.9	10.0	10.1	10.0	8.0	20.7	21.0
Stage-2	16.5	17.7	15.2	12.1	12.8	11.2	7.1	7.5	6.5	N.A.	16.5	16.5	17.7	15.2	12.1	12.8	11.2	N.A.	14.1	14.1	14.2	16.9	17.1	16.7	12.3	27.6	28.0
Stage-1 & Stage-2	13.5	14.5	12.3	8.7	9.4	8.1	4.8	5.2	4.3	N.A.	14.5	13.5	14.5	12.3	8.7	9.4	8.1	N.A.	10.9	11.0	10.9	12.6	12.8	12.5	9.6	23.0	23.4
2 Return on Equity (%)																											
Stage-1	210	224	197	46	48	43	1	4	-2	N.A.	237	210	224	196	45	47	43	N.A.	15.0	15.0	14.9	14.7	14.7	14.8	15.0	309	313
Stage-2	244	258	230	91	94	88	33	35	31	N.A.	244	245	258	230	91	94	88	N.A.	29.4	29.4	29.5	30.2	30.3	30.2	29.2	337	342
Stage-1 & Stage-2	213	226	199	59	61	57	14	16	11	N.A.	238	213	226	199	59	61	56	N.A.	20.0	20.0	20.0	19.9	19.9	20.0	20.1	310	314
3 Min. Debt Service Coverage Ratio																											
Stage-1	1.0	1.1	0.9	1.0	1.1	0.9	0.1	0.1	0.1	-0.6	1.1	1.0	1.1	0.9	1.0	1.1	0.9	-0.6	1.0	1.0	1.0	0.6	0.5	0.7	0.9	1.8	1.8
Stage-2	1.5	1.6	1.4	1.5	1.6	1.4	0.2	0.2	0.2	-0.9	1.5	1.5	1.6	1.3	1.5	1.6	1.3	-0.9	1.5	1.5	1.5	2.3	2.4	2.2	1.2	2.6	2.7
Stage-1 & Stage-2	1.5	1.6	1.4	1.1	1.1	1.1	0.1	0.1	0.1	-0.9	1.5	1.5	1.6	1.3	1.1	1.1	1.1	-0.9	1.2	1.2	1.2	1.0	0.9	1.1	1.1	2.4	2.4
4 Levelised Production Cost (¢/kWh)																											
Stage-1	8.12	7.77	8.49	10.07	9.90	10.28	11.44	11.36	11.55	13.04	7.90	8.15	7.79	8.53	10.10	9.92	10.31	13.08	7.26	6.89	7.66	9.14	8.94	9.34	11.86	6.09	6.02
Stage-2	7.48	7.12	7.84	8.65	8.39	8.91	10.34	10.21	10.48	12.59	7.48	7.49	7.13	7.86	8.66	8.41	8.94	12.61	6.34	5.96	6.73	7.52	7.25	7.80	11.25	5.40	5.34
Stage-1 & Stage-2	7.84	7.48	8.20	9.45	9.24	9.67	10.96	10.86	11.08	12.85	7.72	7.86	7.50	8.23	9.47	9.26	9.71	12.88	6.86	6.48	7.25	8.43	8.20	8.66	11.59	5.78	5.73
Power Tariff for PPA (¢/kWh) at P/S exit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.70	7.32	8.09	9.85	9.68	10.04	12.13	-	-

Table 10.3-11 Total Project Cost and Finance Arrangement for Sihanoukville Combined Cycle Project

1. Subsidiary Loan - 1 (Unit :Million US$)

	Stage-1			Stage-2			Stage-1 & Stage-2		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
Construction Cost	79.9	16.0	95.9	62.4	8.8	71.2	142.3	24.8	167.1
Physical Contingency	3.8	0.6	4.4	3.0	0.4	3.4	6.8	1.0	7.8
Price Contingency	8.5	1.6	10.1	10.1	1.4	11.5	18.6	3.0	21.6
Duties and Taxes	0.0	24.7	24.7	0.0	18.9	18.9	0.0	43.6	43.6
IDC by EDC	7.6	0.0	7.6	5.4	0.0	5.4	13.0	0.0	13.0
Associated T/L	9.4	2.4	11.8	0.0	0.0	0.0	9.4	2.4	11.8
Total	109.2	45.3	154.5	80.9	29.5	110.4	190.1	74.8	264.9

	Stage-1		Stage-2		Stage-1 & Stage-2	
	Amount	Portion	Amount	Portion	Amount	Portion
Official Finance Source-A	122.2	79.1%	86.1	78.0%	208.3	78.6%
RGC	24.7	16.0%	18.9	17.1%	43.6	16.5%
EDC	7.6	4.9%	5.4	4.9%	13	4.9%
Total	154.5	100.0%	110.4	100.0%	264.9	100.0%

2. Subsidiary Loan - 2 (Unit :Million US$)

	Stage-1			Stage-2			Stage-1 & Stage-2		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
Construction Cost inc.IDC	81.7	16.0	97.7	63.7	8.8	72.5	145.4	24.8	170.2
Physical Contingency	3.8	0.6	4.4	3.0	0.4	3.4	6.8	1.0	7.8
Price Contingency	8.5	1.6	10.1	10.1	1.4	11.5	18.6	3.0	21.6
Duties and Taxes	0.0	24.7	24.7	0.0	18.9	18.9	0.0	43.6	43.6
IDC by EDC	7.6	0.0	7.6	5.4	0.0	5.4	13.0	0.0	13.0
Associated T/L	9.4	2.4	11.8	0.0	0.0	0.0	9.4	2.4	11.8
Total	111.0	45.3	156.3	82.2	29.5	111.7	193.2	74.8	268.0

	Stage-1		Stage-2		Stage-1 & Stage-2	
	Amount	Portion	Amount	Portion	Amount	Portion
Official Finance Source - B	124.0	79.3%	87.4	78.2%	211.4	78.9%
RGC	24.7	15.8%	18.9	16.9%	43.6	16.3%
EDC	7.6	4.9%	5.4	4.8%	13.0	4.9%
Total	156.3	100.0%	111.7	100.0%	268.0	100.0%

3. Overseas Investment Loan + Bank Syndicate Loan (Unit :Million US$)

	Stage-1			Stage-2			Stage-1 & Stage-2		
	F/C	L/C	Total	F/C	L/C	Total	F/C	L/C	Total
Construction Cost	79.9	16.0	95.9	62.4	8.8	71.2	142.3	24.8	167.1
Physical Contingency	3.8	0.6	4.4	3.0	0.4	3.4	6.8	1.0	7.8
Price Contingency	8.5	1.6	10.1	10.1	1.4	11.5	18.6	3.0	21.6
Duties and Taxes	0.0	11.3	11.3	0.0	8.2	8.2	0.0	19.5	19.5
IDC & Financial Fee	8.9	0.0	8.9	6.2	0.0	6.2	15.1	0.0	15.1
Associated T/L	9.4	2.4	11.8	0.0	0.0	0.0	9.4	2.4	11.8
Total	110.5	31.9	142.4	81.7	18.8	100.5	192.2	50.7	242.9

	Stage-1		Stage-2		Stage-1 & Stage-2	
	Amount	Portion	Amount	Portion	Amount	Portion
Overseas Investment Loan	59.9	42.1%	42.2	42.0%	102.1	42.0%
Bank Syndicate Loan	39.8	27.9%	28.1	28.0%	67.9	28.0%
IPP Own Finance	42.7	30.0%	30.2	30.0%	72.9	30.0%
Total	142.4	100.0%	100.5	100.0%	242.9	100.0%

10.4. Conclusion

In the course of the economic and financial analyses, the following conclusions are induced under the current assumed conditions.

(1) Total project cost including the duties and taxes, IDC and other financial fees, and the associated transmission line from the Site to Kampot is anticipated to be 155 Million US$ for Stage 1 and 110 Million US$ for Stage 2 respectively.

(2) If the natural gas is put into the operation before the 5th year from the commencement of the commercial operation, the good economic and financial performances are expected. On the other hand, if the diesel oil is fired during the full operation period, the economic and financial feasibility of the project will not be expected.

(3) Especially, if the natural gas is available from the beginning of the commercial operation, production cost of the project will be much lower than the current purchase price from IPP1 and be less expensive than the power purchase from Vietnam in future.

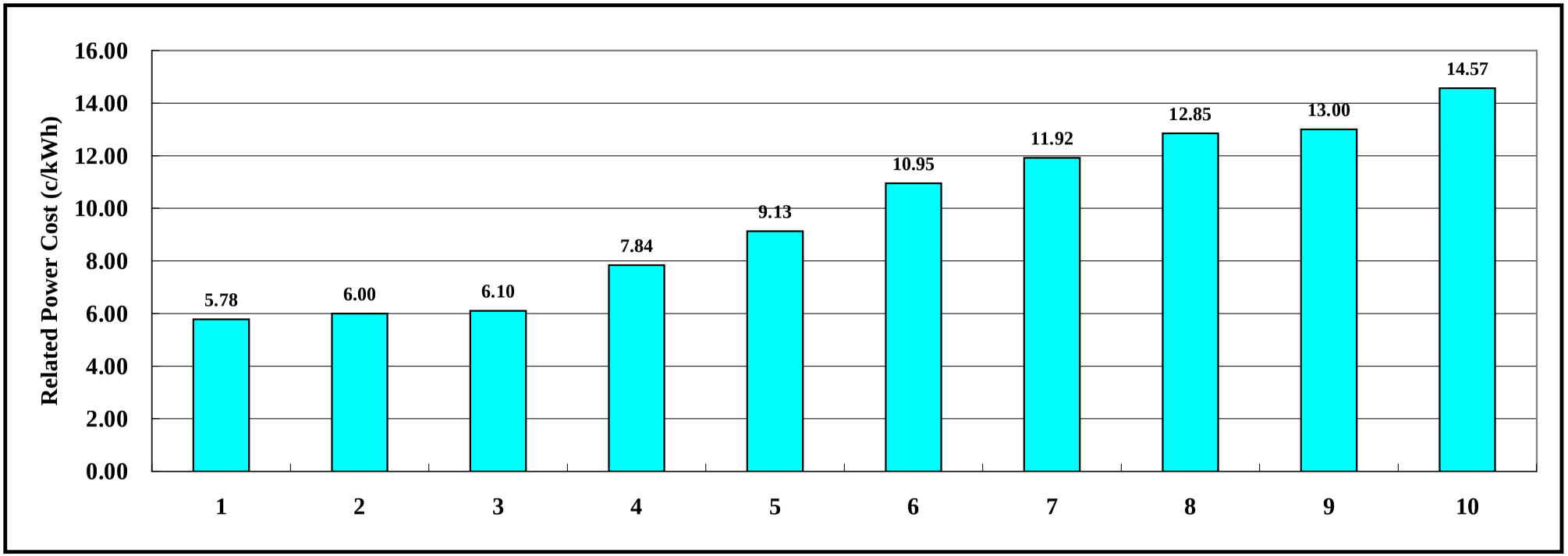
(4) Natural Gas price of 4.0 $/MMBTU seems to be rather conservative in comparison with the current world market prices[15]. Therefore, if the natural gas price is available at less than 4.0 $/MMBTU, more economic and financial attractiveness will be expected.

(5) Based on the above considerations, Fig.10.4-1 presents the various power costs related to the EDC activities and results of financial analysis. As shown in Fig.10.4-1, Sihanoukville C.C. power plant with natural gas firing for full 20 years operation period presents the lowest cost among the each cost level and is expected to contribute to reduction of future power tariff of EDC remarkably.

(6) The only issue to be overcome by EDC in order to implement the project seems to be financial problem. As shown in Attachment 1.4, the current management of

[15] According to "2001 World Development Indicators, World Bank", the average price of natural gas from the year 1998 to 2000 is 2.72 US$/MMBTU at Europe and 2.81 US$/MMBTU in US.

EDC has been suffering from a deficit since 1997. Under the current financial situation of EDC, it seems to be difficult to bear the IDC, even though the EDC occupies only 5 % of the total project cost. Since Sihanoukville Combined Cycle Project requires the huge investment amounted to be around 265 Million US$ and is the first big project for EDC, the improvement of the EDC management will be desirable until the implementation of the project.



	1	2	3	4	5	6	7	8	9	10
Power Cost Items	Levelised Production Cost for Sihanoukville C.C NG for 20 years	Average Import Power Tariff from Vietnam	Average Import Power Tariff from Vietnam	Levelised Production Cost for Sihanoukville C.C NG for 20 years	Power Purchase Price from Sihanoukville C.C NG for 20 years by IPP	Power Purchase Price from IPP-1 in 2000	Production Cost of EDC (PHN's) in 1999 inc. Power Purchase from IPP-1	Levelised Production Cost for Sihanoukville C.C DO for 20 years	Assumed Power Tariff from 2006 onwards	Average Power Tariff in 2000
Taxes	W/O Taxes	W/O Taxes	W/O Taxes	W/ Taxes	W/O Import Duties	W/O Import Duties	W/ Taxes	W/ Taxes	W/O VAT	W/O VAT
Cost at	Entrance at Phnom Penh	Border between Vitnam and Cambodia	Entrance at Phnom Penh	Consumer's end in Phnom Penh	Consumer's end in Phnom Penh	IPP-1 P/S Exit	Consumer's end in Phnom Penh	Consumer's end in Phnom Penh	Consumer's end in Phnom Penh	Consumer's end in Phnom Penh

Fig.10.4-1 Comparison of Related Power Cost