

APPENDIX 4-7-2

Cost estimation of Phu Yen East site

Total Project Cost Estimated for Phu Yen East PSPP site

Cost Items	Unit	Unit price (USD)	Phu Yen East (1,200MW)	
			Quantity	Cost
I Construction Cost				
1.1 Preparatory Works				
Operation Roads in area	km	360,000	14.0	5,040,000
Construction Roads in area	km	280,000	5.0	1,400,000
Roads to Project Area	km	570,000	7.3	4,161,000
Bridge	m ²	2,015	2,300	4,634,500
Base camp	%	5.0		761,775
Construction power supply	km	42,718	7.3	311,845
Others	%	5.0		815,456
Total				17,125,000
1.2 Civil Work				
1) Site installation	%	5.0		12,425,900
2) Temporary river diversion				
#	m ³	42.4	33,810	1,433,544
#	%	15.0		215,032
#	m ³	116.5	3,220	375,066
#	t	790.0	322	254,380
#	m ³	1.9	6,000	11,160
#	m ³	4.5	24,000	107,040
#	%	10.0		239,622
Sub Total				2,636,000
3) Upper Dam/Reservoir				
#	m ³	2.5	240,000	600,000
#	m ³	6.0	4,560,000	27,268,800
#	m ³	4.8	1,824,000	8,773,440
#	m ³	11.6	1,824,000	21,213,120
#	m ³	94.0	4,000	376,000
#	t	700.0	400	280,000
Asphalt pavement, flat	m ²	65.3	152,000	9,925,600
Asphalt pavement, slope	m ²	192.6	165,000	31,779,000
Excavation, tunnel (drainage)	m ³	42.4	45,136	1,913,763
Tunnel supporting work	%	15.0		287,065
Concrete, lining	m ³	116.5	16,444	1,915,372
Re-bar, tunnel	t	790.0	1,644	1,299,059
#	%	5.0		5,281,561
Sub Total				110,913,000
4) Lower Dam/Reservoir				
#	m ³	2.5	4,500	11,250
#	m ³	6.0	85,500	511,290
#	m ³	82.0	200,000	16,400,000
#	m ³	94.0	20,000	1,880,000
#	t	700.0	2,000	1,400,000
#	m	29.9	3,400	101,660
#	m	67.9	24,300	1,649,970
#	m ²	2,000.0	1,140	2,280,000
#	%	5.0		1,211,709
Sub Total				25,446,000
5) Power intake				
Excavation, common	m ³	2.5	1,700	4,250
Excavation, rock	m ³	6.0	32,300	193,154
Excavation, tunnel	m ³	42.4	1,110	47,064
Tunnel, shaft supporting work	%	15.0		7,060
Concrete, structure	m ³	94.0	5,100	479,400
Concrete, tunnel	m ³	116.5	370	43,098
Re-bar, open	t	700.0	510	357,000
Re-bar, tunnel	t	790.0	37	29,230
Others	%	10.0		116,026
Sub Total				1,276,000

Total Project Cost Estimated for Phu Yen East PSPP site

Cost Items	Unit	Unit price (USD)	Phu Yen East (1,200MW)	
			Quantity	Cost
6) Penstock				
Excavation, common	m ³	2.5	1,000	2,500
Excavation, rock	m ³	6.0	3,000	17,940
Excavation, tunnel	m ³	42.4	27,082	1,148,258
Excavation, inclined shaft	m ³	62.0	55,517	3,442,066
Tunnel supporting work	%	15.0		688,549
Concrete, backfill, tunnel	m ³	186.5	3,000	559,380
Concrete, backfill, shaft	m ³	192.2	25,159	4,835,559
Re-bar, tunnel	t	790.0	300	237,000
Re-bar, shaft	t	790.0	2,516	1,987,561
Others	%	10.0		1,291,881
Sub Total				14,211,000
7) Powerhouse and switchyard				
Excavation, common	m ³	2.5	2,100	5,250
Excavation, rock	m ³	6.0	39,900	238,602
Excavation, tunnel	m ³	42.4	31,700	1,344,080
Tunnel supporting work	%	10.0		134,408
Excavation, cavern	m ³	34.9	185,000	6,456,500
Cavern supporting work	%	15.0		968,475
Concrete, structure, open	m ³	94.0	1,050	98,700
Concrete, structure, cavern	m ³	116.5	74,000	8,619,520
Re-bar, open	t	700.0	52.5	36,750
Re-bar, cavern	t	790.0	11,100	8,769,000
Others	%	10.0		2,667,129
Sub Total				29,338,000
8) Surge tank (tailrace)				
Excavation, tunnel	m ³	42.4	60,000	2,544,000
Excavation, shaft	m ³	78.0	52,060	4,060,680
Tunnel supporting work	%	15.0		990,702
Concrete, lining	m ³	161.9	9,040	1,463,576
Re-bar	t	790.0	904	714,160
Others	%	10.0		977,312
Sub Total				10,750,000
9) Tailrace				
Excavation, tunnel	m ³	42.4	146,810	6,224,744
Tunnel supporting work	%	15.0		933,712
Concrete, lining, tunnel	m ³	116.5	45,790	5,333,619
Re-bar, tunnel	t	790.0	9,158	7,234,820
Work adit	m ³	42.4	25,000	1,060,000
Others (Work adits etc.)	%	10.0		2,078,689
Sub Total				22,866,000
10) Power outlet				
Excavation, common	m ³	2.5	926.5	2,316
Excavation, rock	m ³	6.0	17,604	105,269
Excavation, tunnel	m ³	42.4	1,110	47,064
Excavation, shaft	m ³	62.0	2,490	154,380
Tunnel, shaft supporting work	%	15.0		30,217
Concrete, structure	m ³	94.0	4,475	420,650
Concrete, tunnel	m ³	116.5	950	110,656
Concrete, shaft	m ³	161.9	150	24,282
Re-bar, open	t	700.0	224	156,625
Re-bar, tunnel	t	790.0	48	37,525
Re-bar, shaft	t	790.0	15	11,850
Others	%	10.0		110,083
Sub Total				1,211,000

Total Project Cost Estimated for Phu Yen East PSPP site

Cost Items	Unit	Unit price (USD)	Phu Yen East (1,200MW)	
			Quantity	Cost
11) Main Tunnels				
Excavation, tunnel	m ³	42.4	216,000	9,158,400
Excavation, shaft	m ³	62.0	4,000	248,000
Tunnel, shaft supporting work	%	15.0		1,410,960
Concrete, tunnel	m ³	116.5	93,510	10,891,987
Re-bar, tunnel	t	790.0	4,675	3,693,625
Others	%	10.0		2,540,297
Sub Total				27,943,000
Total				
				259,016,000
1.3 Hydromechanical Works				
Penstock	t	3,500	8,600	30,100,000
Bifercation	t	4,000	300	1,200,000
Draft	t	3,500	650	2,275,000
Draft gate	t	4,000	450	1,800,000
Outlet gate	t	4,000	450	1,800,000
Others	%	16.0		5,948,000
Total				43,123,000
1.4 Hydroelectrical Works				
1) Generating equipment/Transformer	LS			256,310,000
Total Cost of Construction Works				
				575,574,000
II Engineering Service	%	7.5		43,168,000
III Administration Expense	%	0.5		2,878,000
IV Land compensation and Resettlement				
4.1 Resettlement				
1) Land compensation and Resettlement		32,363	74	2,394,825
2) Other compensations	%	10.0		239,483
4.2 Others				
Others	%	10.0		263,431
Total				2,898,000
V Tax (VAT 10%)	%	10.0		29,943,000
VI Physical Contingency	%	10.0		65,446,000
Total Project Cost (USD)				
				719,907,000
Construction Unit Cost (USD/kW)				
				600

APPENDIX 4-7-3

Calculation of FIRR for Phu Yen East site

Computation of FIRR for Phu Yen East Project (at consumer's end)

(Power Tariff of USc 12cents /kWh)

Pumping energy ; Coal Case

(Unit: US\$ million)

No.	Year	Capital costs Total	O&M costs	Pumping costs	Total costs	Saleable energy (GWh)	Power rate (USc/kWh)	Financial revenue	Selling& general expenses	Resources tax & VAT	Current surplus	B - C
1		1.5			1.5							(1.5)
2		2.5			2.5							(2.5)
3		3.4			3.4							(3.4)
4		35.1			35.1							(35.1)
5		79.5			79.5							(79.5)
6		147.5			147.5							(147.5)
7		118.9			118.9							(118.9)
8		225.3			225.3							(225.3)
9		164.3			164.3							(164.3)
10		20.4			20.4							(20.4)
11		1.1			1.1							(1.1)
12	1		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
13	2		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
14	3		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
15	4		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
16	5		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
17	6		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
18	7		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
19	8		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
20	9		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
21	10		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
22	11		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
23	12		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
24	13		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
25	14		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
26	15		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
27	16		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
28	17		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
29	18		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
30	19		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
31	20		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
32	21		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
33	22		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
34	23		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
35	24		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
36	25		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
37	26		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
38	27		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
39	28		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
40	29		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
41	30		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
42	31		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
43	32		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
44	33		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
45	34		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
46	35		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
47	36		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
48	37		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
49	38		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
50	39		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
51	40		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
52	41	256.3	5.6	20.2	282.1	0	12.0	0.0	0.0	0.0	0.0	(282.1)
53	42		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
54	43		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
55	44		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
56	45		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
57	46		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
58	47		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
59	48		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
60	49		5.6	20.2	25.8	960	12.0	115.2	9.6	13.8	91.8	66.0
61	50	(228.9)	5.6	20.2	(203.1)	960	12.0	115.2	9.6	13.8	91.8	294.8
FIRR=												6.1%

Computation of FIRR for Phu Yen East Project (at consumer's end)

(Power Tariff of USc 12cents /kWh)

Pumping energy ; Hydropower

(Unit: US\$ million)

No.	Year	Capital costs Total	O&M costs	Pumping costs	Total costs	Saleable energy (GWh)	Power rate (USc/kWh)	Financial revenue	Selling& general expenses	Resources tax & VAT	Current surplus	B - C
1		1.5			1.5							(1.5)
2		2.5			2.5							(2.5)
3		3.4			3.4							(3.4)
4		35.1			35.1							(35.1)
5		79.5			79.5							(79.5)
6		147.5			147.5							(147.5)
7		118.9			118.9							(118.9)
8		225.3			225.3							(225.3)
9		164.3			164.3							(164.3)
10		20.4			20.4							(20.4)
11		1.1			1.1							(1.1)
12	1		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
13	2		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
14	3		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
15	4		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
16	5		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
17	6		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
18	7		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
19	8		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
20	9		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
21	10		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
22	11		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
23	12		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
24	13		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
25	14		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
26	15		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
27	16		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
28	17		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
29	18		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
30	19		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
31	20		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
32	21		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
33	22		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
34	23		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
35	24		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
36	25		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
37	26		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
38	27		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
39	28		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
40	29		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
41	30		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
42	31		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
43	32		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
44	33		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
45	34		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
46	35		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
47	36		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
48	37		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
49	38		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
50	39		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
51	40		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
52	41	256.3	5.6	0.0	261.9	0	12.0	0.0	0.0	0.0	0.0	(261.9)
53	42		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
54	43		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
55	44		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
56	45		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
57	46		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
58	47		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
59	48		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
60	49		5.6	0.0	5.6	960	12.0	115.2	9.6	13.8	91.8	86.2
61	50	(228.9)	5.6	0.0	(223.3)	960	12.0	115.2	9.6	13.8	91.8	315.0

FIRR=

7.8%