

CONCLUSION

The study shows that Value Chain analysis is an effective approach to identify and address the critical bottlenecks which can be prioritized to enhance the value chain.

7.1 Value Chain process

The study of Value Chain (VC) is based on process analysis. Value chain is a sequence of activities that a firm performs to deliver a valuable product or service to the market. The activities are performed in a sequence and are interconnected. The activities are performed in a sequence and are interconnected. The activities are performed in a sequence and are interconnected.

Improving the efficiency of the Value Chain is a key objective of the study. The study aims to identify the critical bottlenecks in the Value Chain and to propose effective solutions to address them.

Table 7.1 Value Chain process analysis

Process name	Value added	Cost	Time	Quality	Flexibility	Scalability	Reliability	Customer satisfaction
Raw material procurement	High	Low	Low	High	High	High	High	High
Production process	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Quality control	Low	High	High	Low	Low	Low	Low	Low
Logistics and distribution	High	Low	Low	High	High	High	High	High
Customer service	High	Low	Low	High	High	High	High	High
Product development	High	Low	Low	High	High	High	High	High
Marketing and sales	High	Low	Low	High	High	High	High	High
Customer feedback	High	Low	Low	High	High	High	High	High
Product innovation	High	Low	Low	High	High	High	High	High
Customer loyalty	High	Low	Low	High	High	High	High	High
Product expansion	High	Low	Low	High	High	High	High	High
Customer retention	High	Low	Low	High	High	High	High	High
Product diversification	High	Low	Low	High	High	High	High	High
Customer engagement	High	Low	Low	High	High	High	High	High
Product differentiation	High	Low	Low	High	High	High	High	High
Customer acquisition	High	Low	Low	High	High	High	High	High
Product lifecycle	High	Low	Low	High	High	High	High	High
Customer segmentation	High	Low	Low	High	High	High	High	High
Product positioning	High	Low	Low	High	High	High	High	High
Customer targeting	High	Low	Low	High	High	High	High	High
Product promotion	High	Low	Low	High	High	High	High	High
Customer relationship	High	Low	Low	High	High	High	High	High
Product branding	High	Low	Low	High	High	High	High	High
Customer experience	High	Low	Low	High	High	High	High	High
Product packaging	High	Low	Low	High	High	High	High	High
Customer support	High	Low	Low	High	High	High	High	High
Product pricing	High	Low	Low	High	High	High	High	High
Customer loyalty program	High	Low	Low	High	High	High	High	High
Product distribution	High	Low	Low	High	High	High	High	High
Customer feedback loop	High	Low	Low	High	High	High	High	High
Product innovation pipeline	High	Low	Low	High	High	High	High	High
Customer engagement strategy	High	Low	Low	High	High	High	High	High
Product differentiation strategy	High	Low	Low	High	High	High	High	High
Customer acquisition strategy	High	Low	Low	High	High	High	High	High
Product lifecycle management	High	Low	Low	High	High	High	High	High
Customer segmentation strategy	High	Low	Low	High	High	High	High	High
Product positioning strategy	High	Low	Low	High	High	High	High	High
Customer targeting strategy	High	Low	Low	High	High	High	High	High
Product promotion strategy	High	Low	Low	High	High	High	High	High
Customer relationship strategy	High	Low	Low	High	High	High	High	High
Product branding strategy	High	Low	Low	High	High	High	High	High
Customer experience strategy	High	Low	Low	High	High	High	High	High
Product packaging strategy	High	Low	Low	High	High	High	High	High
Customer support strategy	High	Low	Low	High	High	High	High	High
Product pricing strategy	High	Low	Low	High	High	High	High	High
Customer loyalty program strategy	High	Low	Low	High	High	High	High	High
Product distribution strategy	High	Low	Low	High	High	High	High	High
Customer feedback loop strategy	High	Low	Low	High	High	High	High	High
Product innovation pipeline strategy	High	Low	Low	High	High	High	High	High
Customer engagement strategy	High	Low	Low	High	High	High	High	High
Product differentiation strategy	High	Low	Low	High	High	High	High	High
Customer acquisition strategy	High	Low	Low	High	High	High	High	High
Product lifecycle management strategy	High	Low	Low	High	High	High	High	High
Customer segmentation strategy	High	Low	Low	High	High	High	High	High
Product positioning strategy	High	Low	Low	High	High	High	High	High
Customer targeting strategy	High	Low	Low	High	High	High	High	High
Product promotion strategy	High	Low	Low	High	High	High	High	High
Customer relationship strategy	High	Low	Low	High	High	High	High	High
Product branding strategy	High	Low	Low	High	High	High	High	High
Customer experience strategy	High	Low	Low	High	High	High	High	High
Product packaging strategy	High	Low	Low	High	High	High	High	High
Customer support strategy	High	Low	Low	High	High	High	High	High
Product pricing strategy	High	Low	Low	High	High	High	High	High
Customer loyalty program strategy	High	Low	Low	High	High	High	High	High
Product distribution strategy	High	Low	Low	High	High	High	High	High
Customer feedback loop strategy	High	Low	Low	High	High	High	High	High
Product innovation pipeline strategy	High	Low	Low	High	High	High	High	High

CHAPTER 7

7 CONCLUSION

This topic covers viable CDM projects as per the existing approved CDM methodologies. Further this gives suggestions which can be potentially included in energy and CDM policy.

7.1 Viable CDM projects

The state of the art of the CDM in thermal power sector in Sri Lanka shows that there is huge potential for climate change mitigation opportunities. Sri Lanka is one of the few leading countries, who have used technology transfer via the CDM projects. The experience of CDM could help Sri Lanka become one leader in CDM in the future.

Furthermore, the economic growth of Sri Lanka and its energy demand forecast provide for a huge potential for possible CDM projects. The CDM projects will offer an accelerated market penetration and extra revenue to investors.

Table 13: Viable CDM projects in Sri Lanka

Power plant	the construction and operation of a supercritical coal fired power plant (ACM0013)	Use of waste heat/gas to generate steam/power/mechanical energy (ACM0012/AMS)	switch from coal and/or petroleum fuels to natural gas in an existing power plant for electricity generation with an operation history of at least three years using the baseline coal and/or petroleum fuel (AMS II B)	Convert single gas turbine to combined cycle using waste heat of gas turbine (ACM0007)	improve the efficiency of fossil fuel generating units that supply an electricity or thermal system by reducing energy or fuel consumption (AMS II B/)	construction and operation of a new natural gas fired grid-connected electricity generation plant (AM0029)	implement rehabilitation and/or energy efficiency improvement measures in an existing fossil fuel fired power plant for electricity generation (AM0061)	steam turbines and gas turbines are retrofitted with component(s) of improved design for energy efficiency improvements in an existing fossil fuel power plant (AM0062)
<i>Independent Power Producers (BOOT contracts)</i>								
Lakdhanavi diesel engine		Y			Y			
Asia Power Ltd diesel engine		Y			Y			
Barge Mounted		Y			Y			
Ace Power - Matara		Y			Y			
Ace Powe - Horana		Y			Y			
AES Kelanitissa		Y	Y		Y			
Heladhanavi		Y			Y			
Ace Ambilipitiya		Y			Y			
Kerawalapitiya combined cycle		Y	Y		Y			
EXPANSION PLAN ADDITIONS (in sequence)								
Gas turbine						Y		

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ANNEXES

Annex 1.

Input values to the levelized cost comparison of subcritical and supercritical

Assumptions	Units	Subcritical	Supercritical
Project Size	MW	600	600
Project Cost	Million USD	900	1200
Cost Per MW	USD Million/MW	1.5	2.00
Debt	%	75.00%	75.00%
Equity	%	25.00%	25.00%
Rate of Interest on loan Capital	%	12.00%	12.00%
Rate of Interest on Working Capital	%	10.00%	10.00%
Return on Equity	%	0.00%	0.00%
Loan Repayment Period	Years	20	20
Depreciation	%	4.00%	4.00%
O&M Cost (Fixed)	Mill USD/MW	0.0132	0.0132
O&M Cost (Variable)	USD/MWh	0.00	0.00
Escalation	%	5.37%	5.37%
Insurance	% of Capital Cost	1.00%	1.00%
Maintenance Spares	% of Capital Cost	1.00%	1.00%
Plant Life	Years	25	25
PLF	%	85%	85%
Auxiliary Consumption	%	7.50%	7.50%
GCV	kCal/Kg	6345.60	6345.60
SHR	kCal/kWh	2450	2450
Price Per Tonne (USD)	USD/MT	80.00	80.00
Fuel Price Escalation %	%	4.00%	4.00%
CER price	USD/CER		15
Annual CERs generation	million CERs		1.6

Annex 2

Levelised cost of the 600 MW subcritical coal power plant

Description	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV
Working Capital																									
O&M Expenses (mUSD)	1.41	1.44	1.48	1.52	1.56	1.61	1.65	1.70	1.75	1.80	1.86	1.92	1.98	2.05	2.12	2.19	2.27	2.35	2.44	2.53	2.62	2.73	2.83	2.94	3.06
Maintenance Spares (mUSD)	9.00	9.54	10.11	10.72	11.36	12.04	12.77	13.53	14.34	15.21	16.12	17.08	18.11	19.20	20.35	21.57	22.86	24.23	25.69	27.23	28.86	30.60	32.43	34.38	36.44
Fixed Cost																									
Interest on Loan Capital (mUSD)	81.00	78.95	72.90	68.85	64.80	60.75	56.70	52.65	48.60	44.55	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50	40.50
Depreciation (m USD)	36.00	34.56	33.18	31.85	30.58	29.35	28.18	27.05	25.97	24.93	23.93	22.98	22.06	21.18	20.33	19.52	18.73	17.99	17.27	16.58	15.91	15.28	14.66	14.08	13.51
Loan outstanding (m USD)	641.25	607.50	573.75	540.00	506.25	472.50	438.75	405.00	371.25	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50	337.50
O&M Expenses (Fixed) (mUSD)	7.90	8.33	8.77	9.24	9.74	10.26	10.81	11.40	12.01	12.65	13.33	14.05	14.80	15.60	16.43	17.32	18.25	19.23	20.26	21.35	22.49	23.70	24.97	26.32	27.73
Insurance (mUSD)	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
Total O & M Expenses (mUSD)	18.90	17.33	17.77	18.24	18.74	19.26	19.81	20.40	21.01	21.65	22.33	23.05	23.80	24.60	25.43	26.32	27.25	28.23	29.26	30.35	31.49	32.70	33.97	35.32	36.73
Interest on Working Capital (mUSD)	4.17	3.36	3.31	3.25	3.21	3.16	3.12	3.08	3.04	3.00	2.97	3.01	3.06	3.10	3.15	3.21	3.26	3.33	3.39	3.46	3.54	3.62	3.70	3.79	3.88
Tax	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Annual Fixed Cost (mUSD)	138.07	132.20	127.16	122.20	117.32	112.53	107.81	103.17	98.62	94.14	89.74	89.54	89.42	89.37	89.42	89.54	89.75	90.04	90.42	90.88	91.44	92.09	92.84	93.68	94.63
Fixed Cost/Unit (USD/kWh)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Working for Fuel Cost																									
GCV kCal/kg	8345.60																								
Gross SHR (kCal/kWh)	2450																								
Coal Consumption/yr (T)	1724914	*****	1724914	1724914	1724914	*****	1724914	*****	1724914	1724914	1724914	1724914	*****	1724914	1724914	1724914	*****	1724914	1724914	1724914	1724914	1724914	1724914	1724914	
Price Per Tonne (USD)	80.00	81.44	82.94	84.50	86.11	87.80	89.55	91.37	93.27	95.24	97.29	99.42	101.64	103.94	106.34	108.83	111.43	114.12	116.93	119.85	122.88	126.04	129.32	132.73	136.28
Escalation %	4.00%	1.04																							
Annual Fuel Cost (USD Million) -Variable 46%	62.10	63.21	64.38	65.59	66.84	68.15	69.51	70.93	72.40	73.93	75.52	77.17	78.89	80.68	82.54	84.48	86.49	88.58	90.76	93.03	95.38	97.83	100.38	103.03	105.78
Annual Fuel Cost (USD Million) - Fixed 65%	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90	75.90
Total Fuel Cost (USD Million)	137.99	139.11	140.27	141.48	142.74	144.05	145.41	146.82	148.29	149.82	151.41	153.07	154.79	156.58	158.44	160.37	162.39	164.48	166.66	168.92	171.28	173.73	176.27	178.92	181.68
Fuel Cost/Unit (USD/kWh)	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Units Generated in year (MU)	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6
Auxiliary Consumption (MUs)	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07
Net Exportable Units (MUs)	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53
Unit Cost (USD / kWh)	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07
	1.00	0.96	0.81	0.73	0.64	0.55	0.53	0.48	0.43	0.39	0.35	0.31	0.28	0.25	0.23	0.21	0.19	0.17	0.15	0.13	0.11	0.10	0.09	0.08	0.08
	11.1%	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Levelized Cost for sub critical coal PP	0.063	USD/kWh																							

Annex 3

Levelised cost of the 600 MW supercritical coal power plant without CER revenue

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV
Working Capital Calculations																									
O&M Expenses for one month (mUSD)	1.66	1.69	1.73	1.77	1.81	1.86	1.90	1.95	2.00	2.05	2.11	2.17	2.23	2.30	2.37	2.44	2.52	2.60	2.69	2.78	2.87	2.96	3.08	3.19	3.31
Maintenance Spares (mUSD)	12.00	12.72	13.46	14.29	15.15	16.06	17.02	18.04	19.13	20.27	21.49	22.78	24.15	25.60	27.13	28.76	30.46	32.31	34.25	36.31	38.49	40.79	43.24	45.84	48.59
Fixed Cost Calculations																									
Interest on Loan Capital (mUSD)	108.00	102.60	97.20	91.80	86.40	81.00	75.60	70.20	64.80	59.40	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Depreciation (mUSD)	46.00	46.08	44.24	42.47	40.77	39.14	37.57	36.07	34.63	33.24	31.91	30.64	29.41	28.23	27.10	26.02	24.98	23.98	23.02	22.10	21.22	20.37	19.55	18.77	18.02
Loan outstanding (mUSD)	855.00	810.00	765.00	720.00	675.00	630.00	585.00	540.00	495.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00	450.00
O&M Expenses (Fixed) (mUSD)	7.90	8.33	8.77	9.24	9.74	10.26	10.81	11.40	12.01	12.65	13.33	14.05	14.80	15.60	16.43	17.32	18.25	19.23	20.20	21.35	22.49	23.70	24.97	26.32	27.73
Insurance (USD Million)	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Total O & M Expenses (mUSD)	19.90	20.33	20.77	21.24	21.74	22.26	22.81	23.40	24.01	24.65	25.33	26.05	26.80	27.60	28.43	29.32	30.25	31.23	32.20	33.35	34.49	35.70	36.97	38.32	39.73
Interest on Working Capital (mUSD)	5.00	3.91	3.83	3.75	3.67	3.60	3.52	3.46	3.39	3.33	3.27	3.31	3.34	3.39	3.43	3.49	3.54	3.60	3.66	3.73	3.81	3.89	3.97	4.06	4.15
Annual Fixed Cost (mUSD)	180.90	172.92	166.04	159.26	152.58	146.00	139.51	133.12	126.82	120.62	114.51	113.99	113.50	113.22	112.97	112.82	112.77	112.81	112.94	113.18	113.52	113.95	114.50	115.15	115.90
Fixed Cost/Unit (USD/kWh)	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Working for Fuel Cost																									
GCV kCal/Kg	6345.60																								
Gross SHR (tCal/kWh)	2050																								
Coal Consumption/year (Ton)	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336
Price Per Tonne (USD)	80.00	81.44	82.94	84.50	86.11	87.80	89.55	91.37	93.27	95.24	97.29	99.42	101.64	103.94	106.34	108.83	111.43	114.12	116.93	119.85	122.88	126.04	129.32	132.73	136.28
Escalation %	4.00%	1.04%																							
Annual Fuel Cost (mUSD) - Variable 48%	52.21	53.15	54.13	55.15	56.20	57.30	58.45	59.64	60.87	62.16	63.50	64.89	66.33	67.84	69.40	71.03	72.72	74.46	76.21	78.02	80.20	82.20	84.40	86.83	88.94
Annual Fuel Cost (mUSD) - Fixed 52%	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81	63.81
Total Fuel Cost (mUSD)	116.03	116.97	117.94	118.96	120.02	121.12	122.26	123.45	124.69	125.97	127.31	128.70	130.15	131.65	133.22	134.85	136.54	138.30	140.13	142.03	144.01	146.07	148.21	150.44	152.76
Fuel Cost/Unit (USD/kWh)	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04
Units Generated in year (MUs)	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6
Auxiliary Consumption (MUs)	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07
Transformation Losses (MUs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Exportable Units (MUs)	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53
Unit Cost (USD / kWh)	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07
	11.1%	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.07
Levelised Cost for super critical coal power plant without CERs		0.065																							

Annex 4

Levelised cost of the 600 MW supercritical coal power plant with CER revenue

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV
Working Capital Calculations																									
O&M Expenses for one month (mUSD)	1.68	1.68	1.73	1.77	1.81	1.86	1.90	1.95	2.00	2.05	2.11	2.17	2.23	2.30	2.37	2.44	2.52	2.60	2.69	2.78	2.87	2.98	3.08	3.19	3.31
Maintenance Spares (mUSD)	12.00	12.72	13.48	14.29	15.16	16.06	17.02	18.04	19.13	20.27	21.49	22.78	24.15	25.60	27.13	28.76	30.48	32.31	34.25	36.31	38.49	40.79	43.24	45.84	48.59
Fixed Cost Calculations																									
Interest on Loan Capital (mUSD)	106.00	107.00	97.50	91.89	86.40	81.00	76.00	70.20	64.00	59.40	54.00	51.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00	54.00
Depreciation (mUSD)	48.00	48.00	44.24	42.47	40.77	39.14	37.57	35.97	34.03	33.24	31.91	30.04	29.41	28.23	27.10	26.02	24.98	23.98	23.02	22.10	21.22	20.37	19.55	18.77	18.02
Loan outstanding (mUSD)	850.00	810.00	765.00	720.00	678.00	639.00	595.00	540.00	495.00	450.00	400.00	350.00	300.00	250.00	200.00	150.00	100.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
O&M Expenses (Fixed) (mUSD)	7.90	8.33	8.77	9.24	9.74	10.29	10.81	11.40	12.01	12.05	13.33	14.05	14.80	15.60	16.43	17.32	18.25	19.23	20.26	21.35	22.49	23.70	24.97	26.32	27.73
Insurance (mUSD)	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00	12.00
Total O & M Expenses (mUSD)	19.90	20.33	20.77	21.24	21.74	22.29	22.81	23.40	24.01	24.05	25.33	26.05	26.80	27.60	28.43	29.32	30.25	31.23	32.28	33.35	34.49	35.70	36.97	38.32	39.73
Interest on Working Capital (mUSD)	6.00	6.01	6.83	7.76	8.69	9.60	10.52	11.40	12.33	13.33	14.37	15.40	16.43	17.43	18.43	19.43	20.43	21.43	22.43	23.43	24.43	25.43	26.43	27.43	28.43
Annual Fixed Cost (mUSD)	160.90	172.92	169.04	159.29	152.60	149.09	139.51	133.12	126.82	120.82	114.51	113.99	113.56	113.22	112.97	112.82	112.77	112.81	112.94	113.18	113.52	113.95	114.50	115.15	115.90
Fixed Cost/Unit (USD/MWh)	0.64	0.64	0.64	0.64	0.64	0.64	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
Working for Fuel Cost																									
CO ₂ Emissions (t/year)	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64	6345.64
CO ₂ Emissions (t/year) (CER)	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336	1450336
Price Per Tonne (USD)	85.64	81.44	82.64	84.64	85.11	87.89	88.55	91.37	93.27	95.24	97.29	99.42	101.64	103.94	106.34	108.83	111.43	114.12	116.93	119.85	122.88	126.04	129.32	132.73	136.28
Annual Fuel Cost (mUSD) - Variable 45%	52.21	63.15	64.13	66.15	66.29	67.39	68.49	69.64	69.81	67.16	63.50	64.89	66.33	67.84	69.40	71.03	72.72	74.48	76.31	78.22	80.20	82.28	84.40	86.63	88.94
Annual Fuel Cost (mUSD) - Fixed 55%	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81	64.81
Annual CER Revenue (mUSD)	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19	24.19
Total Fuel Cost (mUSD)	62.13	62.57	62.94	64.56	66.01	67.12	68.26	69.45	69.69	66.69	63.31	64.70	66.15	67.65	69.22	70.85	72.54	74.30	76.13	78.03	80.01	82.07	84.21	86.44	88.76
Fuel Cost/Unit (USD/MWh)	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Units Generated in year (MWh)	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6	4467.6
Available Capacity (MWh)	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07	335.07
Transmission Losses (MWh)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Generation (MWh)	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53	4132.53
Unit Cost (USD/MWh)	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61
Levelised Cost for supercritical coal power plant (USD/MWh)	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17

Annex 5
Levelised cost of the 600 MW LNG power plant without CER revenue

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV	
Working Capital Calculations																										
O&M Expenses for one month (mUSD)	1.21	1.25	1.28	1.32	1.37	1.41	1.45	1.50	1.55	1.61	1.66	1.72	1.79	1.85	1.92	2.00	2.07	2.16	2.24	2.33	2.43	2.53	2.63	2.75	2.86	
Maintenance Spares (mUSD)	6.64	7.04	7.46	7.91	8.38	8.89	9.42	9.98	10.56	11.22	11.89	12.60	13.36	14.16	15.01	15.91	16.87	17.88	18.95	20.09	21.30	22.57	23.93	25.36	26.88	
Fixed Cost Calculations																										
Interest on Loan Capital (mUSD)	59.76	58.77	53.78	50.80	47.81	44.82	41.83	38.84	35.86	32.87	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88
Depreciation (mUSD)	26.56	25.50	24.48	23.50	22.56	21.66	20.79	19.96	19.16	18.39	17.66	16.95	16.27	15.62	15.00	14.40	13.82	13.27	12.74	12.23	11.74	11.27	10.82	10.39	9.97	
Loan outstanding (mUSD)	473.10	448.20	423.30	398.40	373.50	348.60	323.70	298.80	273.90	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00
O&M Expenses (Fixed) (mUSD)	7.90	8.33	8.77	9.24	9.74	10.26	10.81	11.40	12.01	12.65	13.33	14.05	14.80	15.60	16.43	17.32	18.25	19.23	20.26	21.35	22.49	23.70	24.97	26.32	27.73	
Insurance (mUSD)	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	
Total O & M Expenses (mUSD)	14.54	14.97	15.41	15.88	16.38	16.90	17.45	18.04	18.65	19.29	19.97	20.69	21.44	22.24	23.07	23.96	24.89	25.87	26.90	27.99	29.13	30.34	31.61	32.96	34.37	
Interest on Working Capital (mUSD)	8.87	8.17	8.24	8.31	8.39	8.48	8.57	8.67	8.77	8.89	9.01	9.19	9.38	9.58	9.79	10.00	10.23	10.47	10.71	10.97	11.24	11.53	11.82	12.13	12.45	
Annual Fixed Cost (mUSD)	109.53	105.41	101.91	98.49	95.14	91.86	88.64	85.51	82.44	79.44	76.52	76.71	76.98	77.32	77.74	78.24	78.82	79.48	80.23	81.07	82.00	83.02	84.14	85.35	86.67	
Fixed Cost/Unit (USD/kWh)	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
Working for Fuel Cost																										
GCV kCal/Kg	8345.60																									
Gross SHR (kCal/kWh)	1721																									
Coal Consumption/year (Ton)	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524
Price Per Tonne (USD)	768.00	781.82	796.20	811.15	826.70	842.88	859.69	877.19	895.38	914.30	933.97	954.44	975.72	997.85	1020.87	1044.81	1069.70	1095.59	1122.52	1150.53	1179.65	1209.94	1241.44	1274.21	1308.28	
Escalation %	4.00%	1.040																								
Annual Fuel Cost (mUSD) - Variable 45%	379.30	386.13	393.23	400.62	408.30	416.28	424.59	433.23	442.21	451.56	461.28	471.38	481.89	492.82	504.19	516.01	528.31	541.10	554.40	568.23	582.61	597.57	613.13	629.31	646.14	
Annual Fuel Cost (mUSD) - Fixed 55%	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	
Total Fuel Cost (mUSD)	842.90	849.73	856.83	864.21	871.89	879.88	888.18	896.82	905.81	915.15	924.87	934.98	945.49	956.42	967.79	979.61	991.90	1004.69	1017.99	1031.82	1046.21	1061.17	1076.73	1092.91	1109.73	
Fuel Cost/Unit (USD/kWh)	0.23	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.27	0.27	0.28	0.28	0.28	0.29	0.29	0.30	
Units Generated in year (MU)	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	
Auxiliary Consumption (MUs)	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	
Transformation Losses (MUs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Net Exportable Units (MUs)	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	
Unit Cost (USD / kWh)	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.31	0.31	0.31	0.32	
	1.00	0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35	0.31	0.28	0.25	0.23	0.21	0.19	0.17	0.15	0.14	0.12	0.11	0.10	0.09	0.08	
	11.1%	0.25	0.23	0.21	0.19	0.17	0.15	0.14	0.13	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03	
Levelized Cost for LNG power plant without CERs	0.266	USD/kWh																								

Annex 6 : Levelised cost of the 600 MW LNG power plant with CER revenue

Years	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV	XXV
Working Capital Calculations																									
O&M Expenses for one month (mUSD)	1.21	1.25	1.28	1.32	1.37	1.41	1.45	1.50	1.55	1.61	1.66	1.72	1.79	1.85	1.92	2.00	2.07	2.16	2.24	2.33	2.43	2.53	2.63	2.75	2.86
Maintenance Spares (mUSD)	6.64	7.04	7.46	7.91	8.38	8.89	9.42	9.98	10.56	11.22	11.89	12.60	13.36	14.16	15.01	15.91	16.87	17.88	18.95	20.09	21.30	22.57	23.93	25.36	26.88
Fixed Cost Calculations																									
Interest on Loan Capital (mUSD)	59.76	56.77	53.78	50.80	47.81	44.82	41.83	38.84	35.86	32.87	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88	29.88
Depreciation (mUSD)	26.58	25.50	24.48	23.50	22.56	21.66	20.79	19.96	19.16	18.39	17.66	16.95	16.27	15.62	15.00	14.40	13.82	13.27	12.74	12.23	11.74	11.27	10.82	10.39	9.97
Loan outstanding (mUSD)	473.10	448.20	423.30	398.40	373.50	348.60	323.70	298.80	273.90	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00	249.00
O&M Expenses (Fixed) (mUSD)	7.90	8.33	8.77	9.24	9.74	10.26	10.81	11.40	12.01	12.65	13.33	14.05	14.80	15.60	16.43	17.32	18.25	19.23	20.26	21.35	22.49	23.70	24.97	26.32	27.73
Insurance (mUSD)	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64	6.64
Total O & M Expenses (mUSD)	14.54	14.97	15.41	15.88	16.38	16.90	17.45	18.04	18.65	19.29	19.97	20.69	21.44	22.24	23.07	23.96	24.89	25.87	26.90	27.99	29.13	30.34	31.61	32.96	34.37
Interest on Working Capital (mUSD)	8.67	8.17	8.24	8.31	8.39	8.48	8.57	8.67	8.77	8.89	9.01	9.19	9.36	9.58	9.79	10.00	10.23	10.47	10.71	10.97	11.24	11.53	11.82	12.13	12.45
Annual Fixed Cost (mUSD)	109.53	105.41	101.91	98.49	95.14	91.86	88.64	85.51	82.44	79.44	76.52	76.71	76.98	77.32	77.74	78.24	78.82	79.48	80.23	81.07	82.00	83.02	84.14	85.35	86.67
Fixed Cost/Unit (USD/kWh)	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Working for Fuel Cost																									
GCV kCal/Kg	6345.60																								
Gross SHR (kCal/kWh)	1721																								
Coal Consumption/year (Ton)	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524	1097524
Price Per Tonne (USD)	768.00	781.82	796.20	811.15	826.70	842.88	859.69	877.19	895.38	914.30	933.97	954.44	975.72	997.85	1020.87	1044.81	1069.70	1095.59	1122.52	1150.53	1179.65	1209.94	1241.44	1274.21	1308.28
Escalation %	4.00%	1.040																							
Annual Fuel Cost (mUSD) - Variable 45%	379.30	386.13	393.23	400.62	408.30	416.28	424.59	433.23	442.21	451.56	461.28	471.38	481.89	492.82	504.19	516.01	528.31	541.10	554.40	568.23	582.61	597.57	613.13	629.31	646.14
Annual Fuel Cost (mUSD) - Fixed 55%	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59	463.59
Annual CER Revenue (mUSD)	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33	12.33
Total Fuel Cost (mUSD)	830.57	837.40	844.50	851.88	859.56	867.55	875.85	884.49	893.48	902.82	912.54	922.65	933.16	944.09	955.46	967.28	979.57	992.38	1005.66	1019.49	1033.88	1048.84	1064.40	1080.58	1097.40
Fuel Cost/Unit (USD/kWh)	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.28	0.28	0.29	0.29
Units Generated in year (MU)	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12	4047.12
Auxiliary Consumption (MUs)	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53	303.53
Transformation Losses (MUs)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Exportable Units (MUs)	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59	3743.59
Unit Cost (USD / kWh)	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.31	0.31	0.32
	1.00	0.90	0.81	0.73	0.66	0.59	0.53	0.48	0.43	0.39	0.35	0.31	0.28	0.25	0.23	0.21	0.19	0.17	0.15	0.14	0.12	0.11	0.10	0.09	0.08
	11.13	0.25	0.23	0.20	0.19	0.17	0.15	0.14	0.12	0.11	0.10	0.09	0.08	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.03	0.03	0.03
Levelised Cost for LNG power plant with CERs		0.263																							
			USD/kWh																						

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