

## CHAPTER VII

### COST PERFORMANCE ANALYSIS

In this study the cost performance analysis is measured in cost/electricity unit (Baht/kWh) which is consist of three main costs that is Production Cost, Environment Cost and Social Cost so total cost will be form in this award formula from (1)

$$\text{Total Cost} = \text{Production Cost} + \text{Environment Cost} + \text{Social Cost}$$

From the formula (1) , the details of production cost , environmental cost and social cost will be describes as following

#### 7.1 Production Cost

Production Cost of electricity include investment cost, fuel cost , Operation and Maintenance Cost (O&M) so production cost will form be in this formula (from feasibility study)

Production Cost =

$$\text{Investment Cost} + \text{Fuel Cost} + \text{Operation and Maintenance Cost} + \text{Energy Fund} + \text{Insurance}$$

(2)

In the feasibility formula

$$\text{Investment Cost} = \text{Plant Cost} + \text{Transmission Cost} + \text{Import Duty \& Taxes} + \text{Escalation} + \text{Energy Fund} + \text{IDC} + \text{Front End-Fee} + \text{Commitment Fee} \quad (3)$$

Production cost will be calculated in unit Baht/kwh as shown in the case study

**Case study : New Natural Gas Combined Cycle capacity 900 MW operate in 2012**

Plant Capacity	900	MW
Average Efficiency	50.5	%
Net Plant Heat Rate	6,750	Btu / Kwh
Average Plant Factor	85.5	%
Plant life time	25	year
Project cost		
Power plant	22,573	Million Baht
Transmission	179	Million Baht
Operation & Maintenance+ Admin Cost		
Fix O&M cost	0.110	Baht / kwh
Variable O&M cost	0.015	Baht / kwh
Insurance	0.75	% of power plant
Depreciation (Straight Line Method )		
Power plant (22,573/25)	902.92	Million Baht per year
Transmission (179/25)	7.16	Million Baht per year
Debt : Equity Ratio	75 : 25	
Interest Rate	6.5	% per year
Loan Repayment period	10	Year

Front End Fee	1.5	%
Commitment Fee	0.375	% per year
Discount rate (WACC of Firm)	7.7	%
Exchange rate	31	Baht/USD
Energy Fund		
During Construction	50,000	Baht per MW per year
Operation	0.01	Baht per kwh

From (2)

$$\text{Production Cost} = \text{Investment Cost} + \text{Fuel Cost} + \text{O\&M Cost} + \text{Energy Fund} + \text{Insurance} \quad (2)$$

$$\text{Investment Cost} = \text{Plant Cost} + \text{Transmission Cost} + \text{Import Duty \& Taxes} + \text{Escalation} + \text{Energy Fund} + \text{IDC} + \text{Front End-Fee} + \text{Commitment Fee} \quad (3)$$

#### Investment Cost

Plant Cost	19,577.00	Million Baht
Transmission Cost	152.10	Million Baht
Import Duty & Taxes	214.10	Million Baht
Escalation	736.00	Million Baht
Energy Fund	131.00	Million Baht
IDC	1,597.10	Million Baht
Front End-Fee	256.00	Million Baht
Commitment Fee	<u>89.70</u>	Million Baht
 Total Project Cost	 <b><u>22,753.00</u></b>	 Million Baht

Table 7-1 Fuel cost of Natural Gas

Year	2012	2013	2014	2015	2016	2017	2018	2019
(baht/MMbtu)	274.74	280.24	285.84	291.56	297.17	304.52	310.47	316.06
Year	2020	2021	2022	2023	2024	2025	2026	2027
(baht/MMbtu)	320.97	328.31	331.47	334.62	337.77	340.92	344.06	347.22
Year	2028	2029	2030					
(baht/MMbtu)	350.72	353.83	357.37					

#### Operation & Maintenance+ Admin Cost

Fix O&M cost	0.110	Baht / kwh
Variable O&M cost	0.015	Baht / kwh
<b>Energy Fund</b>	0.01	Baht / kwh
<b>Insurance</b>	0.75	% of Power plant

#### Enviromental Cost

Dry Low NOx	510,000,000	Baht
CEMS	450,000,000	Baht
Water Treatment Plant	420,000,000	Baht
Silencer	<u>280,000,000</u>	Baht
<b>Total</b>	<u>1,660,000,000</u>	Baht

Social Cost total = 1,140,000,000 Baht

The Result of Natural gas Combined Cycle is

Table 7-2 Production cost

Year	2012	2013	2014	2015	2016	2017	2018
Production cost(Baht/kwh)	2.75	2.9	3.06	3.215	3.37	3.53	3.68
Year	2019	2020	2021	2022	2023	2024	2025
Production cost(Baht/kwh)	3.84	4.02	4.175	4.335	4.49	4.65	4.8
Year	2026	2027	2028	2029	2030		
Production cost(Baht/kwh)	4.96	5.11	5.265	5.415	5.565		

Environmental cost = 0.22 Baht/kwh

Social cost = 0.0375 Baht/ kwh

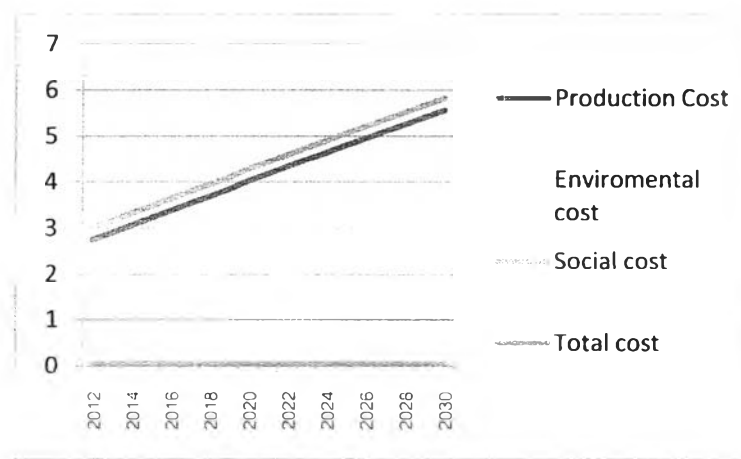


Figure 7-1 Natural gas combined cycle cost

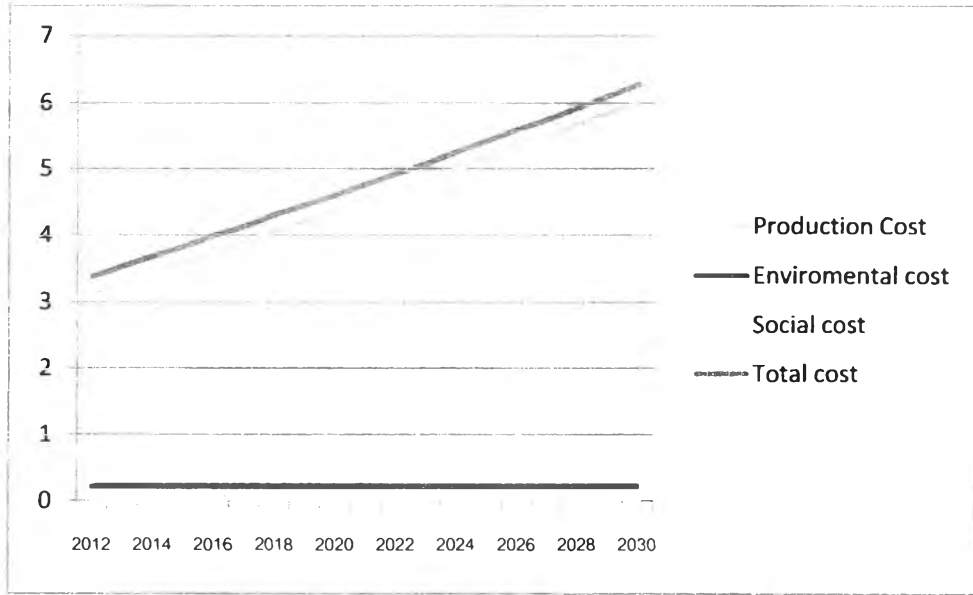


Figure 7-2 Natural gas LNG combined cycle cost

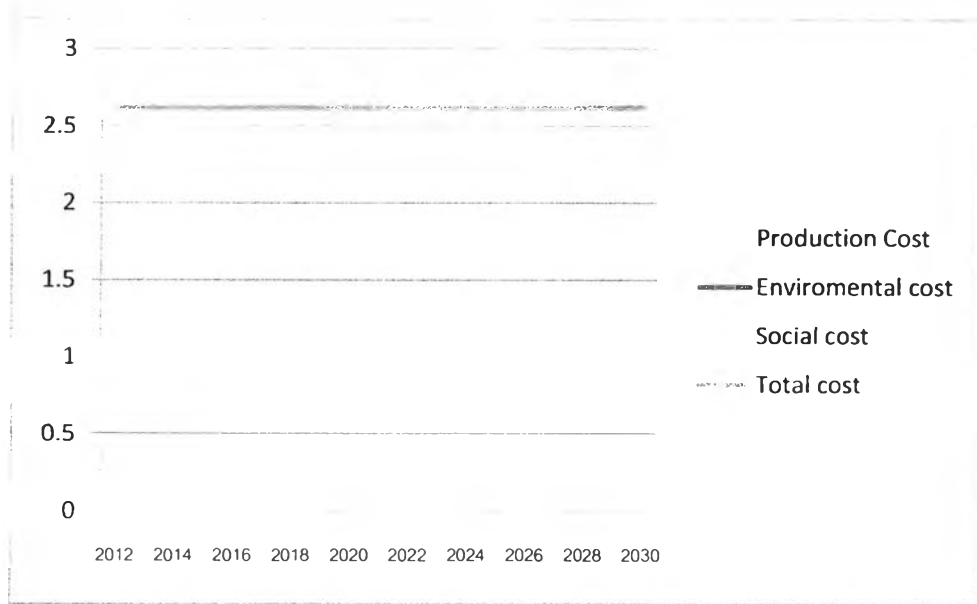


Figure 7-3 Hydro power plant cost

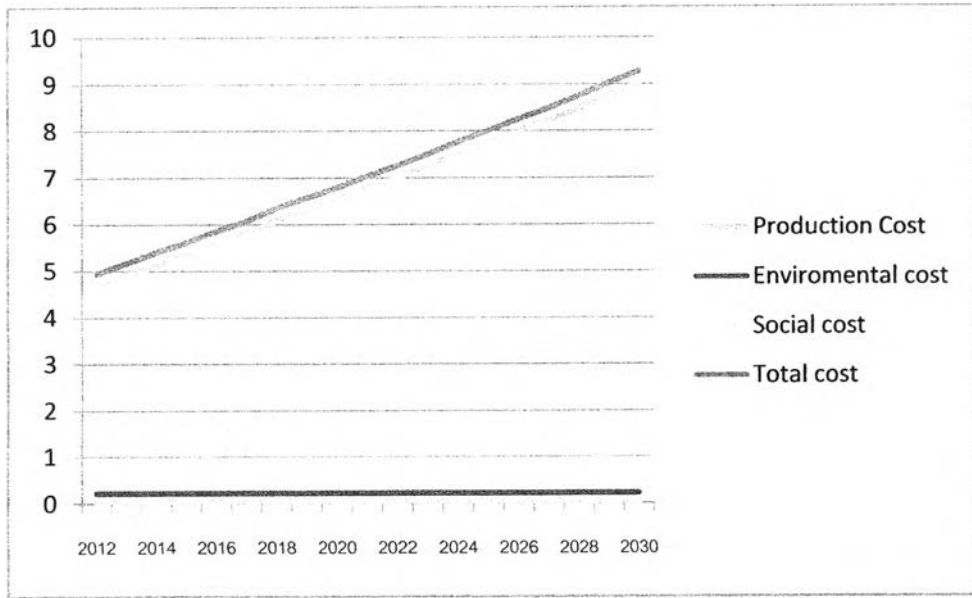


Figure 7-4 Heavy Oil Power plant cost

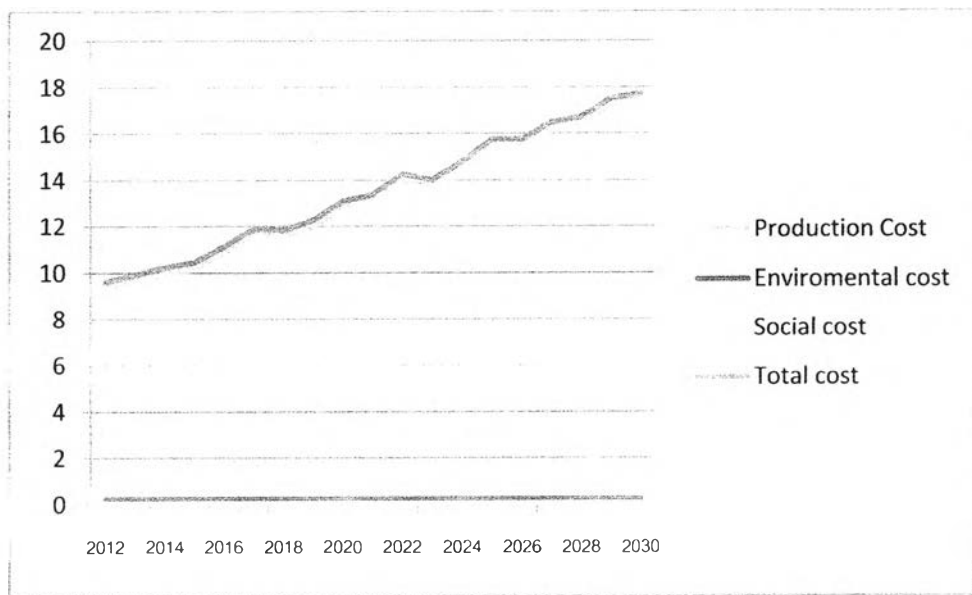


Figure 7-5 Diesel Power plant cost

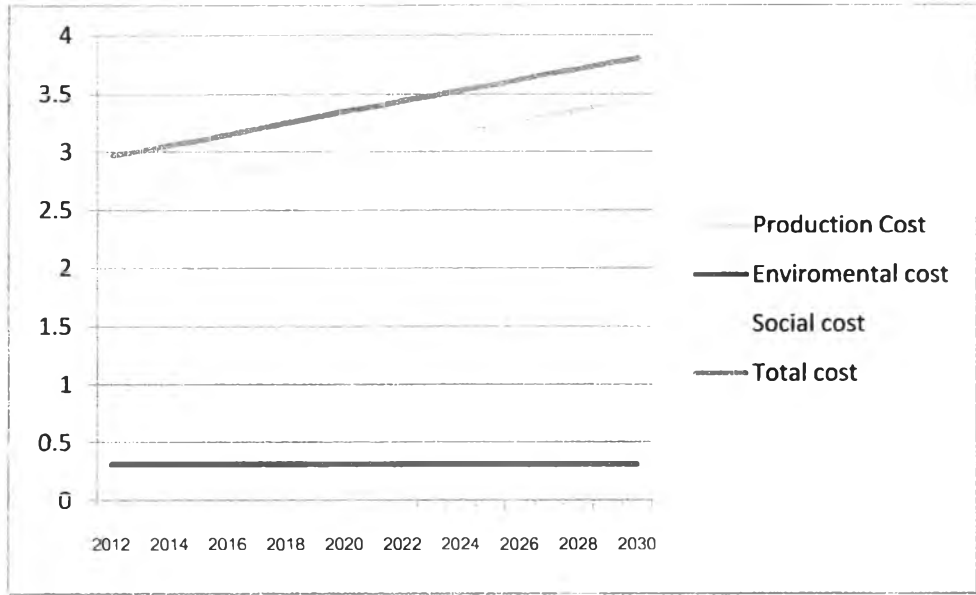


Figure 7-6 Coal power plant cost

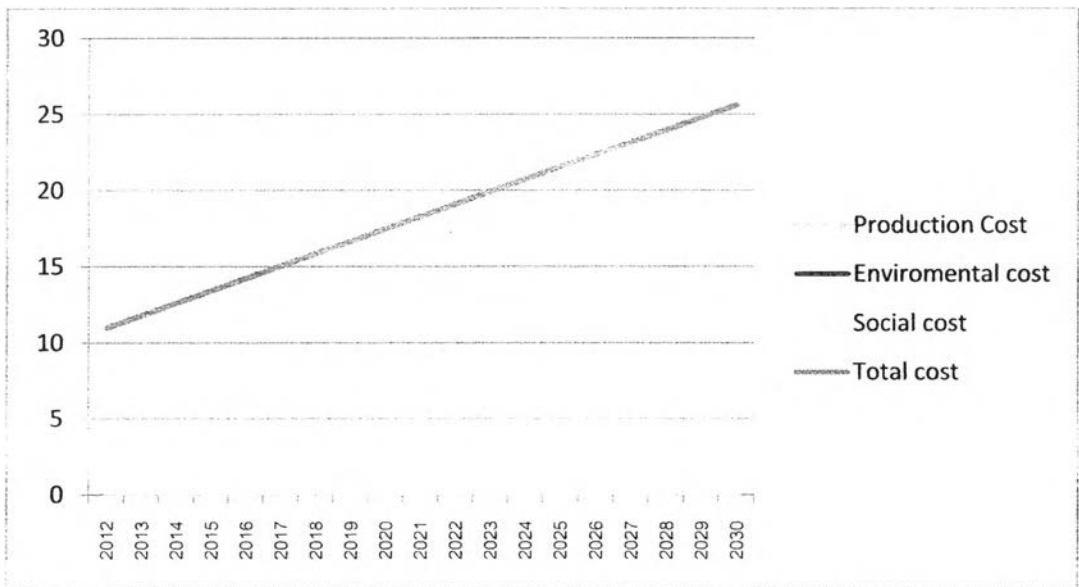


Figure 7-7 Renewable power plant cost



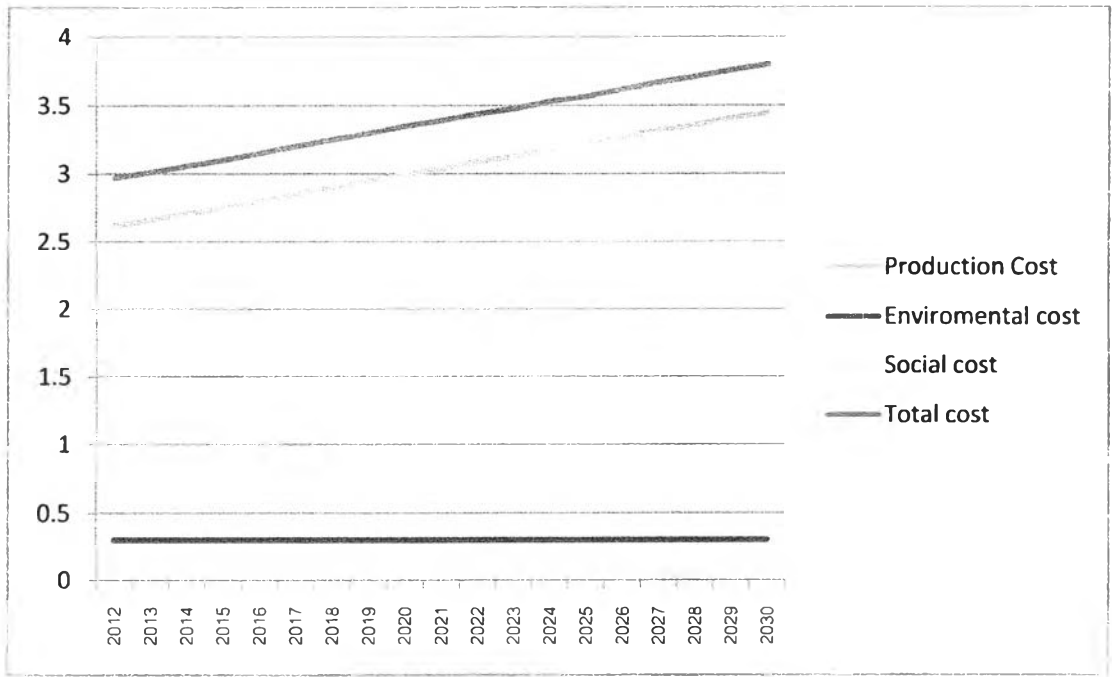


Figure 7-8 Nuclear power plant cost

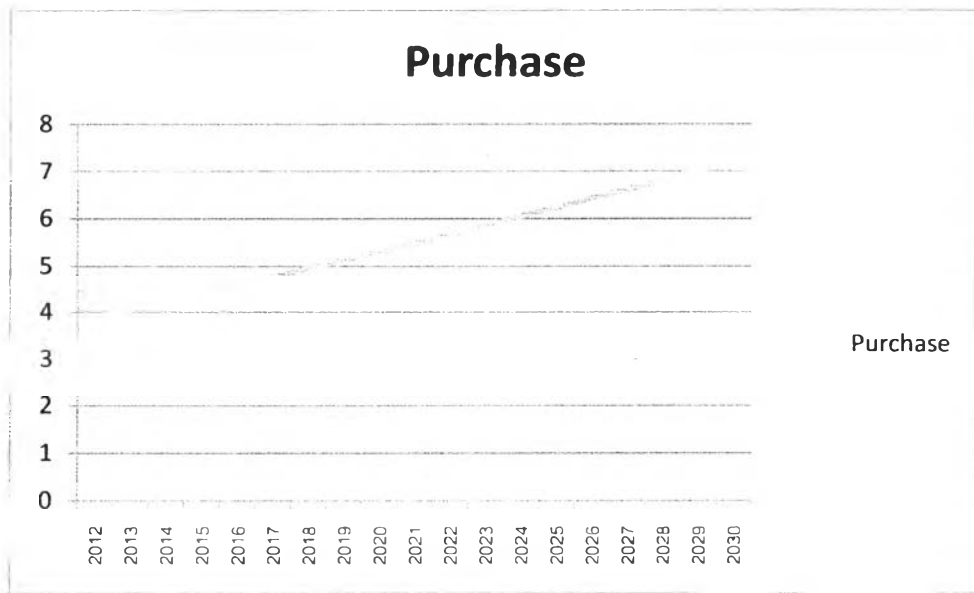


Figure 7-9 Electric Purchase cost

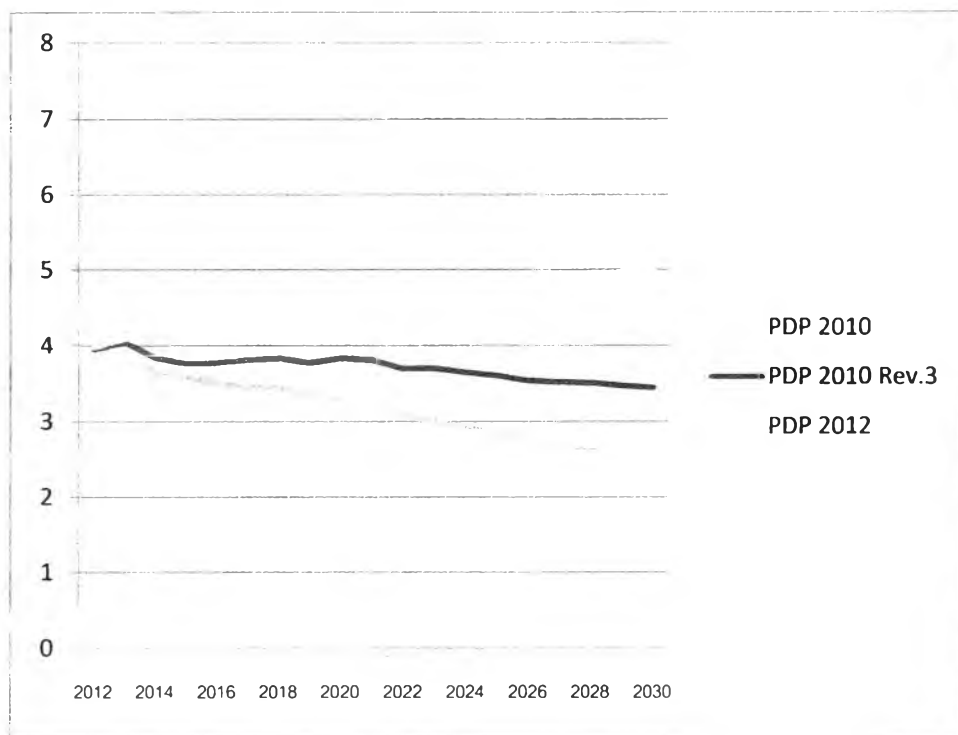


Figure 7-10 Average electricity production cost of each PDP.