

# LONG TERM GENERATION EXPANSION PLAN -2018 - 2037 CONSULTATIVE MEETING

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# FOCUSED AREAS

1. Uninterrupted supply of electricity to consumers at affordable price to sustain country's economic growth while due consideration given to energy security and environmental impacts.
  - ❖ Proportion of fuel mix in the thermal plant
  - ❖ Addition of renewable energy other than Major Hydro
  - ❖ Least economical cost of generation with taking correct border prices for all type of fuels
  - ❖ System stability

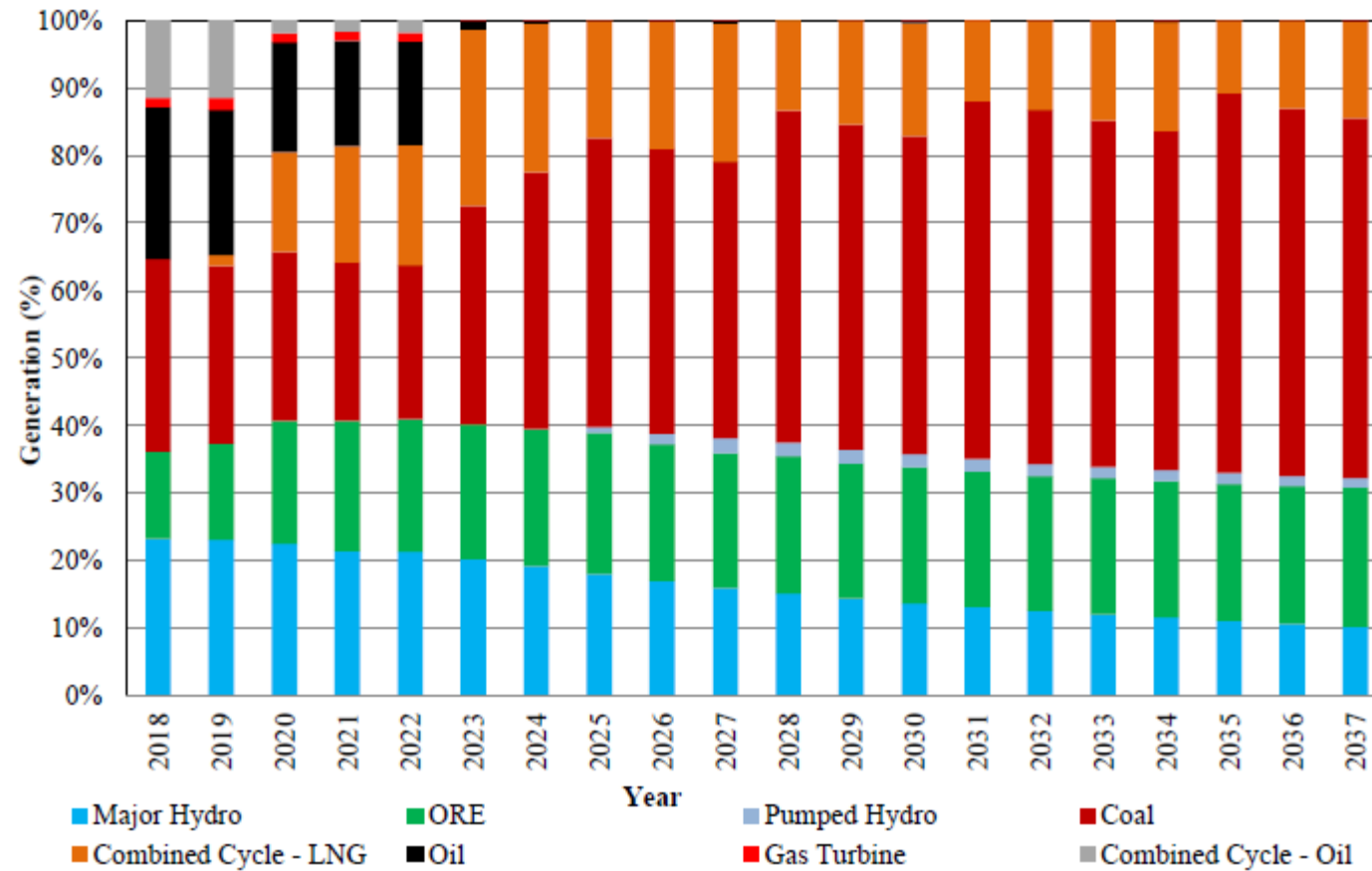
## Results of Generation Expansion Planning Studies 2018-2037

Future coal power development limited to 1800 MW

YEAR	RENEWABLE ADDITIONS		THERMAL ADDITIONS		THERMAL RETIREMENTS	LOLP %
2018	Mini Hydro Biomass	15 MW 5 MW	Solar 160 MW	100 MW Furnace Oil fired Power Plant * 70 MW Furnace Oil fired Power Plant * 150 MW Furnace Oil fired Power Plant *	8x6.13 MW Asia Power	1.245
2019	Major Hydro Mini Hydro Solar	120 MW 15 MW 95 MW	(Uma Oya HPP) Wind 50 MW Biomass 5 MW	2x35 MW Gas Turbine 1x300 MW Natural Gas fired Combined Cycle Power Plant – Western Region*	-	0.220
2020	Major Hydro Wind Mini Hydro Solar	35 MW 15 MW 100 MW 105 MW	(Broadlands HPP) (Thalpitigala HPP) (Mannar Wind Park) Wind 120 MW Biomass 5 MW	1x35 MW Gas Turbine	6x5 MW Northern Power	0.237
2021	Mini Hydro Solar	10 MW 55 MW	Wind 75 MW Biomass 5 MW	1x300 MW Natural Gas fired Combined Cycle Power Plant – Western Region	4x17 MW Kelanitissa Gas Turbines	0.107
2022	Major Hydro Mini Hydro Solar	31 MW 20 MW 20 MW 10 MW 6 MW	(Moragolla HPP) (Seethawaka HPP) (Gin Ganga HPP) Wind 50 MW Biomass 5 MW			0.237
2023	Mini Hydro Solar	10 MW 55 MW	Wind 60 MW Biomass 5 MW	1x300 MW New Coal Power Plant (Change to Super critical will be evaluated) 163 MW Combined Cycle Power Plant (KPS-2) *	115 MW Gas Turbine** 4x9 MW Sapugaskanda Diesel Ext.** 163 MW Sojitz Kelanitissa Combined Cycle Plant *	0.205
2024	Mini Hydro Solar	10 MW 55 MW	Wind 45 MW Biomass 5 MW	1x300 MW New Coal Power Plant (Change to Super critical will be evaluated)	4x18 MW Sapugaskanda Diesel	0.145
2025	Major Hydro Mini Hydro Solar	200 MW 10 MW 104 MW	(Pumped Storage Power Plant) Wind 85 MW Biomass 5 MW	-	4x9 MW Sapugaskanda Diesel Ext. 4x15 MW CEB Barge Power Plant	0.192
2026	Major Hydro Mini Hydro Biomass	200 MW 10 MW 5 MW	(Pumped Storage Power Plant) Solar 55 MW	1x300 MW Natural Gas fired Combined Cycle Power Plant – Southern Region	-	0.022
2027	Major Hydro Mini Hydro Solar	200 MW 10 MW 54 MW	(Pumped Storage Power Plant) Wind 25 MW Biomass 5 MW	1x300 MW Natural Gas fired Combined Cycle Power Plant – Southern Region	-	0.002
2028	Mini Hydro Solar	10 MW 105 MW	Wind 45 MW Biomass 5 MW	-	-	0.009

2028	Mini Hydro Solar	10 MW 105 MW	Wind Biomass	45 MW 5 MW	-	-	0.009
2029	Mini Hydro Solar	10 MW 54 MW	Wind Biomass	25 MW 5 MW	1x600 MW New Supercritical Coal Power Plant	-	0.002
2030	Mini Hydro Solar	10 MW 55 MW	Wind Biomass	70 MW 5 MW	-	-	0.006
2031	Mini Hydro Solar	10 MW 54 MW	Wind Biomass	35 MW 5 MW	-	-	0.025
2032	Mini Hydro Solar	10 MW 55 MW	Wind	45 MW	1x600 MW New Supercritical Coal Power Plant	-	0.005
2033	Mini Hydro Solar	10 MW 54 MW	Wind Biomass	70 MW 5 MW	1x300 MW Natural Gas fired Combined Cycle Power Plant - Western Region	165 MW Combined Cycle Plant (KPS) 163 MW Combined Cycle Plant (KPS-2)	0.025
2034	Mini Hydro Solar	10 MW 55 MW	Wind	70 MW	-	-	0.113
2035	Mini Hydro Solar	10 MW 54 MW	Wind Biomass	70 MW 5 MW	1x300 MW Natural Gas fired Combined Cycle Power Plant -Western Region 1x300 MW Natural Gas fired Combined Cycle Power Plant - Southern Region	300MW West Coast Combined Cycle Power Plant	0.067
2036	Mini Hydro Solar	10 MW 55 MW	Wind	95 MW	1x300 MW Natural Gas fired Combined Cycle Power Plant -Southern Region	-	0.066
2037	Mini Hydro Solar	10 MW 104 MW	Wind Biomass	70 MW 5 MW	-	-	0.259
Total PV Cost up to year 2037, USD 14,894.64 million (LKR 2,217.51 billion)**							

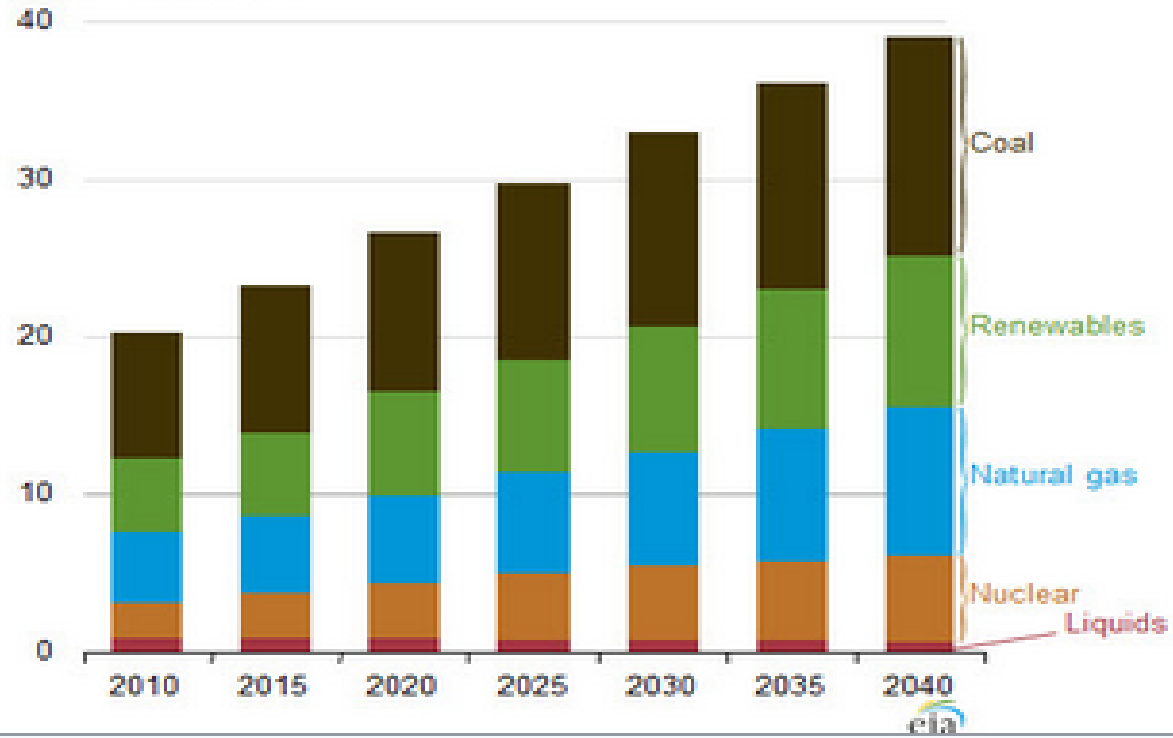
Please refer Page A7-23 for General Notes



*Figure 7.5 – Percentage Share of Energy Mix over next 20 years in Base Case*

**Figure 83. World net electricity generation by fuel, 2010-2040**

trillion kilowatthours



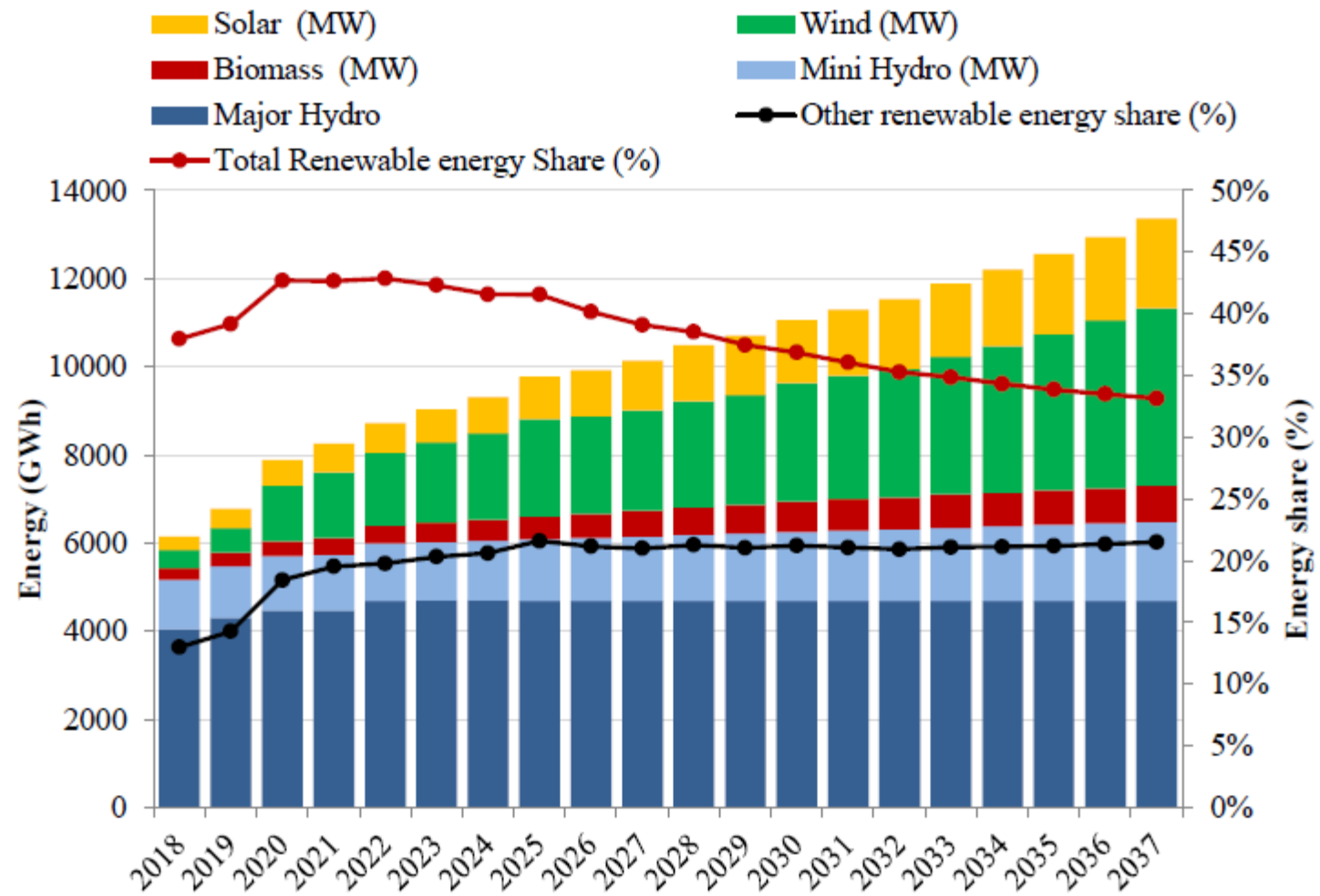
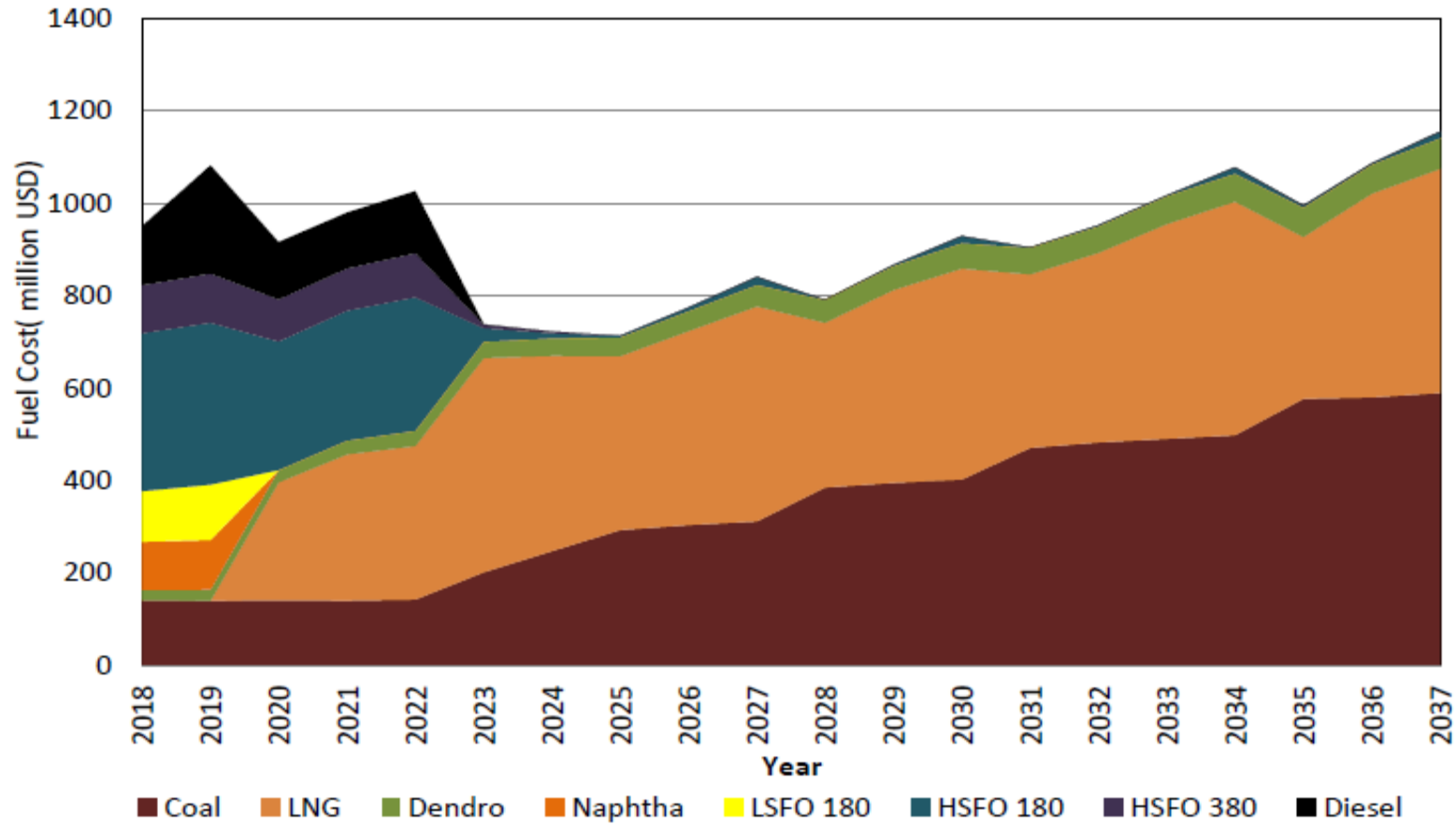


Figure 5.3: Energy Contribution of Renewable Energy Sources and Energy Share for Next 20 Years



*Figure 7.9- Expected Variation of Fuel Cost of Base Case*



# Options considered

Construction of pump storage plant to manage peak demand and high efficient operation of thermal plant

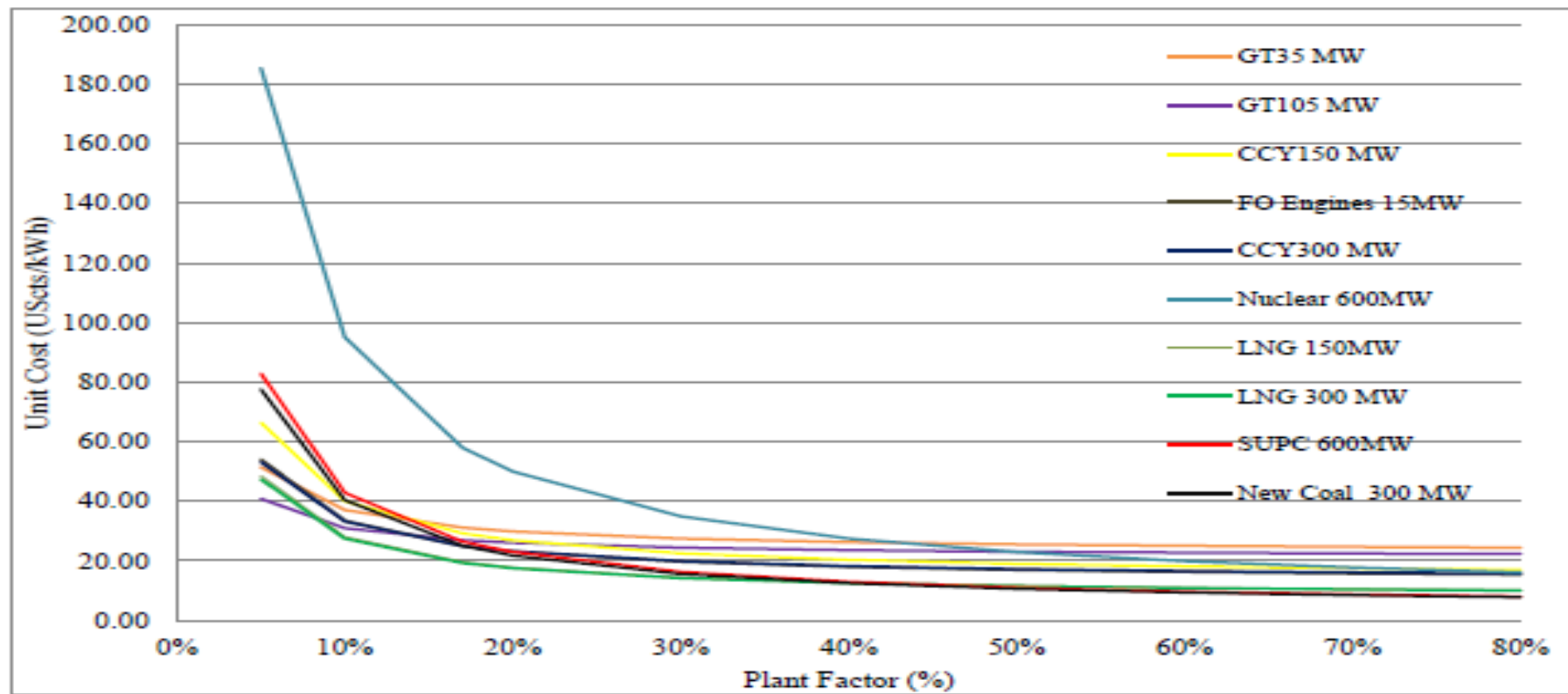
- ✓ When number of coal plants increases the outage of these plant will also increases for statutory maintenance etc. and couple of plant may be remained shut down always. Have you considered this situation.
- ✓ Alternatives such as charging vehicle batteries could be considered instead of pump storage plant
- ✓ World market prices of LPG also competitive with LNG presently. Should be taken attention in this respect as well.
- ✓ Energy conservation and demand side management

*Table 4.6 - Specific Cost of Candidate Thermal Plants in US\$Cts/kWh (LKR/kWh)*

Plant \ Plant Factor	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
35MW Gas Turbine	33.55 (49.94)	28.12 (41.87)	26.31 (39.18)	25.41 (37.83)	24.87 (37.02)	24.51 (36.49)	24.25 (36.10)	24.06 (35.81)
105MW Gas Turbine	28.60 (42.58)	24.88 (37.04)	23.64 (35.19)	23.02 (34.27)	22.64 (33.71)	22.40 (33.34)	22.22 (33.08)	22.09 (32.88)
150MW Combined Cycle Plant Auto Diesel	34.25 (50.99)	24.02 (35.77)	20.62 (30.69)	18.91 (28.16)	17.89 (26.63)	17.21 (25.62)	16.72 (24.89)	16.36 (24.35)
300MW Combined Cycle Plant Auto Diesel	27.33 (40.69)	20.30 (30.22)	17.96 (26.73)	16.79 (24.99)	16.08 (23.94)	15.61 (23.25)	15.28 (22.75)	15.03 (22.37)
150MW Combined Cycle Plant Natural Gas	21.96 (32.69)	14.78 (22.00)	12.39 (18.44)	11.19 (16.66)	10.47 (15.59)	9.99 (14.88)	9.65 (14.37)	9.39 (13.99)
300MW Combined Cycle Plant Natural Gas	21.64 (35.21)	14.62 (21.77)	12.29 (18.29)	11.12 (16.55)	10.42 (15.51)	9.95 (14.81)	9.62 (14.32)	9.37 (13.94)
300MW High Efficient Coal Plant	30.99 (46.13)	17.11 (25.47)	12.48 (18.59)	10.17 (15.14)	8.78 (13.08)	7.86 (11.70)	7.20 (10.72)	6.70 (9.98)
600MW Super Critical Coal Plant	32.82 (48.83)	17.93 (26.68)	12.97 (19.30)	10.49 (15.61)	9.00 (13.39)	8.01 (11.91)	7.30 (10.86)	6.77 (10.07)
600MW Nuclear Plant	69.08 (102.84)	37.00 (55.08)	26.31 (39.16)	20.96 (31.20)	17.75 (26.43)	15.61 (23.24)	14.09 (20.97)	12.94 (19.26)
15MW Reciprocating Engines	28.89 (43.02)	20.89 (31.11)	18.23 (27.14)	16.89 (25.15)	16.09 (23.96)	15.56 (23.17)	15.18 (22.60)	14.89 (22.17)
5MW Dendro Plant	36.36 (54.13)	24.38 (36.30)	20.39 (30.35)	18.39 (27.38)	17.19 (25.60)	16.40 (24.41)	15.83 (23.56)	15.40 (22.92)

Note: 1 US\$ = LKR 148.88

#### A7.1.4 Screening Curves of the Generation Options at 15% Discount Rate



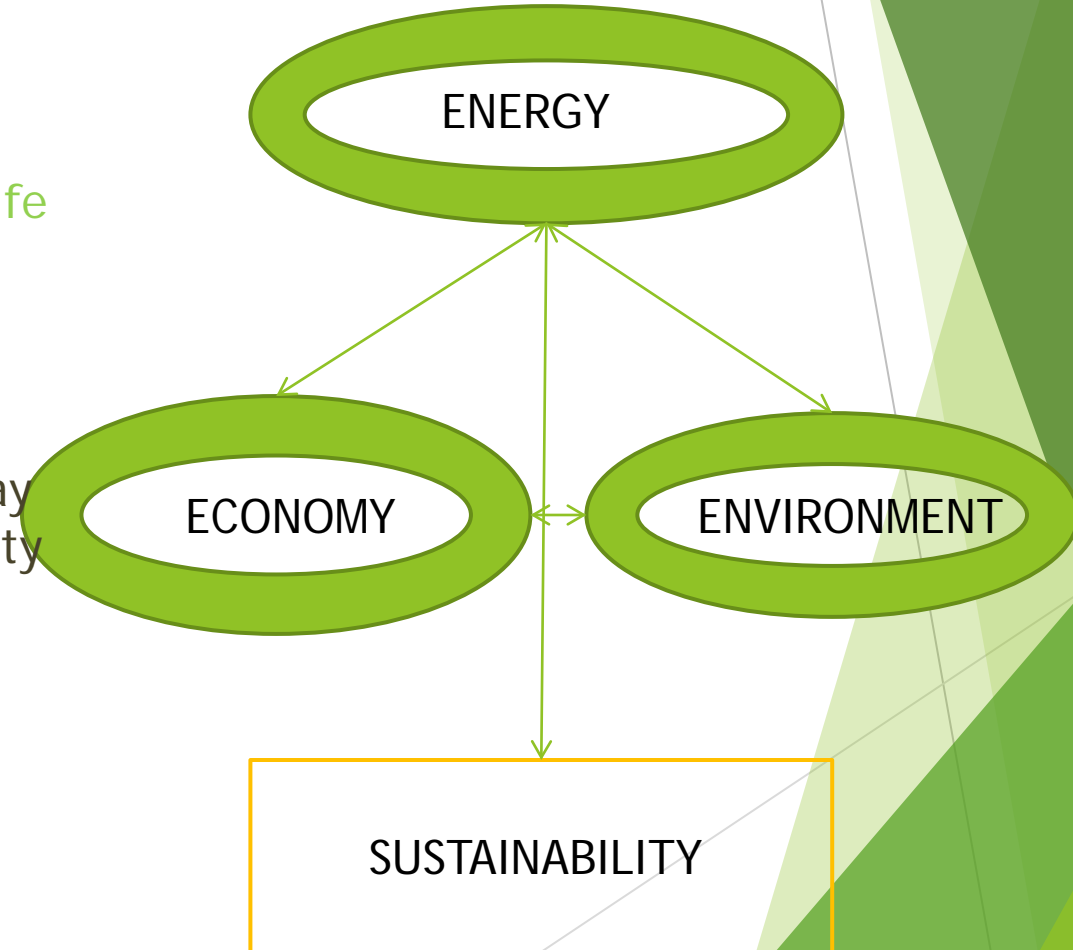
# REFINERY PROFIT MARGIN

Year		2011		2012		2013		2014		2015	
Product	SOREM Yield per 100 crude bbl	price / bbl	value of products USD	price / bbl	value of products USD	price / bbl	value of products USD	price / bbl	value of products USD	price / bbl	value of products USD
LPG	3.6	101.00	363.60	104.00	374.40	103.00	370.80	92.50	333.00	48.60	174.96
Gas 92	18.5	121.30	2,244.10	121.20	2,242.20	118.96	2,200.81	112.67	2,084.30	70.03	1,295.60
Gas 95	5	124.17	620.84	123.10	615.50	122.39	611.97	115.00	575.01	72.28	361.40
Kero	11	128.98	1,418.73	128.40	1,412.40	124.90	1,373.91	114.92	1,264.14	69.60	765.58
Diesel	0	127.73	-	132.20	-	125.60	-	115.72	-	68.07	-
Die S	55.3	128.70	7,116.97	133.10	7,360.43	127.27	7,037.75	116.22	6,427.10	69.28	3,831.14
Bitumen	1.8	107.00	192.60	110.00	198.00	107.00	192.60	98.00	176.40	52.00	93.60
<b>Total value of product</b>			<b>11,956.84</b>		<b>12,202.93</b>		<b>11,787.84</b>		<b>10,859.95</b>		<b>6,522.28</b>
Cost for Crude		106.43	10,642.79	109.22	10,921.54	105.55	10,555.46	96.81	9,680.63	51.05	5,104.92
<b>Gross margin</b>			<b>1,314.05</b>		<b>1,281.39</b>		<b>1,232.38</b>		<b>1,179.33</b>		<b>1,417.36</b>
less: O&M @2%			212.86		218.43		211.11		193.61		102.10
<b>Net margin per 100 bbl</b>			<b>1,101.19</b>		<b>1,062.96</b>		<b>1,021.27</b>		<b>985.72</b>		<b>1,315.26</b>
Net margin per 1bbl			11.01		10.63		10.21		9.86		13.15
Net margin per day (100,000 bbl)			1,101,192.17		1,062,957.50		1,021,273.25		985,715.92		1,315,261.67
<b>Net margin per year (3,500,000 bbl)</b>			<b>385,417,258.33</b>		<b>372,035,125.00</b>		<b>357,445,637.50</b>		<b>345,000,570.83</b>		<b>460,341,583.33</b>

# ENERGY

## KEY ISSUES IN TODAY'S ENERGY SECTOR DISCUSSIONS

- ❖ Economic development - Quality of life
- ❖ Environmental Impacts - Global warming, climate change
- ❖ Sustainability - meet the present day needs without compromising the ability to meet future generations needs



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