Seminar on The Promotion on Energy Efficiency and Conservation (PROMEEC) for Major Industries in Southeast Asia

Progress Report on Oil Refineries Earlier Audited in Myanmar.

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1. Introduction

- The refining industry in Myanmar is driven by the demand for transportation fuels and their required specifications.
- Since petroleum is not only strategic goods for each country but also commercial ones, .the energy sector in Myanmar plays a vital role for the sustainable economic development of the state .
- In view of this, Ministry of Energy , Myanmar has made a particular emphasis on promotion of energy efficiency and conservation program by inviting rich experiences, excellent technology and know-how in accordance with Myanmar Energy Policy.

1.1 Ministry of Energy

The Ministry's office

Energy Planning Department (EPD)

Myanma Oil and Gas Enterprise (MOGE)

Myanma Petrochemical Enterprise, (MPE)

Myanma Petroleum Products Enterprise (MPPE).

The Ministry's Office

- To carry out the exploration and production of oil and gas, refining, distribution and transportation of petroleum products and manufacturing of petrochemicals.

The Energy Planning Department (EPD)

- Technical arm for the Ministry of Energy (MOE) takes the leading role in the coordination, discussion and negotiation of development programmes in the sector.

1.2 Myanmar Energy Policy.

- To maintain the status of energy independence
- To save nonrenewable energy for future energy sufficiency of our nation.
- To promote efficient utilization of energy and impress on energy conservation and
- To prevent deforestation caused by excessive use of fuel wood and charcoal.

Myanma Petrochemical Enterprise

Myanma Petrochemical Enterprise is responsible for the production of petroleum and petrochemical products from crude oil and natural gas in the country.

Myanma Petrochemical Enterprise is assigned for the followings:

a. Refining of petroleum products from crude oil and natural gas.

b. Production of petrochemicals from crude oil and natural gas.

c. Production of urea fertilizer from natural gas.

d. Export of petroleum and petrochemical products.

1.3 Myanma Petrochemical Enterprise

. (a) No (1) Refinery, Thanlyin.

(b) No (2) Refinery, Chauk.

(c) Petrochemical Complex , Thanbayakan, (Mann)

(d) No (1) Urea Fertilizer factory, Sa-le (A) & (B)

(e) No (2) Urea Fertilizer factory, Kyun-Chaung

(f) No (3) Urea Fertilizer factory, Kyawzwa

(g) Methanol Plant, Seiktha

(h) LPG Extraction Plant, Minbu

(i) LPG Skid-mounted Plant, Nyaung-Don

(j) Bitumen Plant, No(1) Refinery, Thanlyin

Petrochemical Complex (Thanbayagan)

Year built 1982

Capacity 25,000 BPSD

Contractor MHI ,JPN

2.1.2 Transportation and Processing of crude oil

***Feedstock*:**

10” pipeline from local oil field:

Mann, Htauk Shabin, Kanni

By barge Ye-Nan-Chaung, Kyauk-Kwet, Nyaung-Don, Kwai Ma and Nga-Bat-Chaung. Yetagun condensate from Yetagun offshore oil field is also processed as demand.

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Storage Tanks in Petrochemical Complex, Thanbayakan (Mann)

Process Units:

Sr.No	Unit	Capacity (BPSD)
1	Topping Unit	25,000
2	Naptha Hydro Desulphuriser	5,000
3	Reforming Unit	2,800
4	Hydrotreater	3,000
5	Delayed Coker	5,200
5	LPG Recovery	800
6	Naptha Merox	1,400
7	Fouling Water Stripper	15.2 ton/ hr.

Topping Unit
Petrochemical Complex, Thanbayakan (Mann)

Coking Unit and Topping Unit
Petrochemical Complex, Thanbayakan (Mann)

LPG Sphere Tanks
Petrochemical Complex, Thanbayakan (Mann

2.1.3 Utility Details.

- Power
- Water
- Fuel
  - -Associated Gas
  - -Home Fuel Gas
  - -Fuel Oil

3. Energy Efficiency and Conservation Activities in Mann Refinery

- Energy Audit From ECCJ Visited Mann Refinery in December 2001 and advised some recommendations for energy conservation measures.

- The Energy Management Team organized by process and maintenance engineers is executing the following activities with the top management support.

a. Operating parameters (reflux ratio, stripping steam, operation pressure, temperature, etc.) are regularly checked and monitored.

b. Excess air content in the flue gas has been measured once a week in order to improve the burning efficiency of burners. Air registers from burners and dampers for furnace are adjusted to minimum open position.

c. Rotating machines such as compressors, turbines, motors, etc. and spare parts for electrical and instruments are periodically checked and preventive maintenance are carried out for stable and steady operation.

d. Engineering staffs in the technical service department have conducted survey all energy usage to make energy trend.

e. All data related energy saving or energy conservation are collected in order of energy consumption rate.

f. Steam leakages, steam traps and insulation are regularly checked and repaired by Refinery site maintenance team.

g. Removal of dirt from condensers and heat exchangers etc. are carried out as necessary.

3.1 Improvement on Energy Conservation Activities

• As suggested by ECCJ, the action have been taking for energy efficiency and conservation matters.

•Compared to the data audited in December 2001, the improvement of operation in package boilers and furnaces for Topping Unit is as follows

Description	Type of firing	O_2		CO_2		Ex..Air	
		18-12-01	21-11-06	18-12-01	21-11-06	18-12-01	21-11-06
Furnace A, Topper	Combined Fired	9.0	6.2	5.6	6.0	67.5	36.17
Furnace B, Topper	Combined Fired	8.2	7.0	6.8	6.0	57.5	43.4
Boiler B,	Gas	6.0	4.5	8.2	7.8	35.7	23.9
Boiler C,	Oil	5.6	4.8	10.6	8.0	33.6	26.09

3.2 Improvement Result on Thermal Efficiency of Process Heater for Topping Unit

• Basis:	Flue Gas O2, A/B	6.2 / 7 %
•	CO2, A/B	6.0 / 6.0 %
•	Ex.Air	35.17 / 43.4 %
•	Flue Gas Temp.	294 / 307 ºC
•	Datum Temp.	25 ºC
• Mean heat capacity (Cpm) of CO2		8.716 kcal/ kgmolºC at 25ºC
• Mean heat capacity (Cpm) of CO2		10.003 kcal/kgmolºC at 300ºC
• Mean heat capacity (Cpm) of Air		6.949 kcal/ kgmolºC at 25ºC
• Mean heat capacity (Cpm) of Air		7.054 kcal/kgmolºC at 300ºC
• Mean heat capacity (Cpm) of N2		6.949 kcal/ kgmolºC at 25ºC
• Mean heat capacity (Cpm) of N2		7.054 kcal/kgmolºC at 300ºC

- Enthalpy Δ H (300-25) of CO2 = Δ H (300-0) - Δ H (25-0)
- = 10.003 (300-0) - 8.716 (25-0)
  = 63.25 kcal/kg
- Enthalpy Δ H (300-25) of Air = Δ H (300-0) - Δ H (25-0)
- = 7.054 (300-0) - 6.949 (25-0)
  = 66.98 kcal/kg
- Enthalpy Δ H (300-25) of N2 = Δ H (300-0) - Δ H (25-0)
- = 7.023 (300-0) - 6.96 (25-0)
  = 69.03 kcal/kg
- Stack Heat Loss (Qs) exit flue gas temp 300ºC

Component	Kg of component formed per kg of fuel	enthaply at te kcal perkg of fuel	Heat content kcal/kg fuel
CO_2	2.799	63.25	177.0367
N_2	12.889	69.03	889.7277
Air	16.898	66.98	1131.8280
	Total Heat Loss of Stack		2198.59

- Sensible heat of fuel gas at Datum temp 25ºC, fuel gas temp 50ºC
- Avg specific heat of fuel gas = 0.525 kcal/kgmolºC
- Δ Hf = mcp Δ T
- = 1 ✕ 0.525 ✕ (50-25)
- = 13.125 kcal/kg
- LHV = 11975 kcal/kg
- Ha sensible heat of air at 25ºC = 0 kcal/kg
- Hf sensible of fuel gas at 50ºC = 13.125 kcal/kg
- Total Heat Input = 11988.125kcal/kg
- Assume: Radiation heat loss (Qr), 9.33% of heat input
- Therefore Qr = 9.33 ✕ 11988.125 / 100
- = 1118.492 kcal/kg
- Total Heat loss = Qs + Qr
- = 2198.59 + 1118.492
- = 3317.082 kcal/kg
- Net Thermal Efficiency = $\frac{\text{heat output}}{\text{heat input}}$ ✕ 100
- = 72.33 %

3.3 Improvement Result on Thermal Efficiency of package Boiler B (gas fired)

- Basis: Flue Gas O2 4.5 %
- CO2 7.8 %
- Ex.air 23.9 %
- Flue Gas Temp 270ºC
- Datum Temp 30ºC

Composition of associated gas

	1	2	3	4	5	6
Component	mole %	mole fraction	M.W	Total weight (Kgs)	Net Heating Value kcal/kg	Heating value kcal
CH_4	97.68	0.9769	16	15.63	11952	186810
C_2H_6	1.82	0.0182	30.1	0.55	11352	6244
C_3H_8	0.34	0.0034	42.1	0.14	10946	1532
C_4H_{10}	0.15	0.0015	58.1	0.09	10935	984
Total	100.00	1.0000		16.41 Avg(MW)	11918	1955570

Generated Steam	20 ton/hr
Fuel gas consumption	1440 Nm3/hr
Weight of fuel gas	1054.93 kg/hr
Generated Steam for 1 kg of fuel gas	18.96 kg/kg(f)
Heat input	
a. Net heating value of fuel gas (A.G)	11918 kcal/kg
b. Sensible heat of AG (Fs)	0
AG fuel gas temp	30 ºC
Ambient temp	30 ºC
c. Sensible heat of air (Ha)	0
d. Sensible heat of boiler feed water (BFW)	
temp of boiler feed water	110 ºC

- enthalpy of BFW at 30 ºC 30.01 kcal/kg
- enthalpy of BFW at 110 ºC 110.2 kcal/kg
- Sensible heat of BFW 18.96(110.230.01)kcal/kg
- = 1520.402 kcal/kg
- Total heat input = 13599.81 kcal/kg
- Total heat loss (stack heat loss and radiation heat loss) is assumed about 21 % of heat input.
- Heat loss = 21 % ✕13599.81kcal/kg
- = 2822.07 kcal/kg
- Net Thermal Efficiency = heat out put x 100
- heat input
- =79%

Topping Unit

1. Flow Meter

	Tag No.	Design (kl/h)	18-12-01	21-11-06
Crude Oil	FRC-101	168.5	70	60
Preflashed Crude Oil	FRC-102	179.9	60	52.8
Main Fractionator Side Reflux	FRC-103	123.6	61.1	78.0
Whole Naphtha	FRC-151	39.9	13.5	11.0
Kerosene	FRC-108	33.2	6.3	5.25
Light Gas Oil	FRC-110	35.3	19.9	10.5
Heavy Gas Oil	FRC-112	25.6	10.5	14.7
Kerosene Stripping Steam	FI-107	0.474	0.189	0.500
Light Gas Oil Stripping Steam	FI-109	0.499	0.189	0.154
Heavy Gas Oil Stripping Steam	FI-111	0.351	0.224	0.080
Topped Crude Oil Stripping Steam	FI-106	1.246	0.800	0.650

2. Temperature (Fractionator and Drum)

	Tag No.	Design (kl/h)	18-12-01	21-11-06
Cruder Heater Outlet	TRC-101	374	340	345
Main Fractionator Top	TRC-102	138	125	120
Main Fractionator Kero. Draw off			175	175
Main Fractionator LGO Draw off			230	200
Main Fractionator HGO Draw off			290	285
Main Fractionator Bottom		349	305	305
Main Fractionator O/H Drum		40	28	38
Preflash Tower		171	144	128
Kerosene Stripper		184	148	135
LGO Stripper		257	225	215
HGO Stripper		307	282	285

3. Temperature (Heat exchanger)

		Tag No.	Design (kl/h)	18-12-01	21-11-06
Side Reflux	Shell Side In/Out	(HE-101)	38/86	35/86	38/88
	Tube Side In/Out	(HE-101)	157/86	150/80	130/80
Kero. H.E	Shell Side In/Out	(HE-102)	184/100	143/80	125/77
	Tube Side In/Out	(HE-102)	86/100	86/96	80/103
LGO H.E	Shell Side In/Out	(HE-103)	257/125	225/115	220/115
	Tube Side In/Out	(HE-103)	100/125	96/110	100/110
T.C H.E	Shell Side In/Out	(HE-104)	246/159	230/150	230/145
	Tube Side In/Out	(HE-104)	125/159	110/150	110/130
HGO H.E	Shell Side In/Out	(HE-105)	307/180	282/160	280/215
	Tube Side In/Out	(HE-105)	159/171	150/170	130/135

4. Pressure and Others

	Tag No.	Design (kl/h)	18-12-01	21-11-06
Main Fractionator O/H Pressure		0.95	0.6	
Main Fractionator O/H Drum Press	PRC-101	0.5	0.5	0.4
Stabilizer O/H Pressure	PRC-151		8.0	
Stabilizer O/H Drum Pressure		8.0	8.0	
Splitter O/H Pressure			Not used	
Splitter O/H Drum Pressure	PRC-171	0.7	Not used	
Crude Charge Heater Fuel Oil Rate			0.45	0.30
Fuel Oil Sp.Gr			0.8615	0.8637
Fuel Oil Temp			53	50
Fuel Gas Rate			0.37	0.37
Fuel Gas M.W (AG+HFG)			17.92	17.961
Fuel Gas Temp				50

Fuel Gas Press			3.4	4.2
Flue Gas Temp.(Stack Inlet)	A/B			294/307
Radiation Temp	A/B		606/629	582/560
Convection Wall Inside Temp	A/B		457/488	412/419
Draft Pressure Floor	A/B		-7/-7	
Convection	A/B		2/n.a	
Stack In	A/B		19/5	
Stack Out	A/B		n.a/n.a	
Damper Opening	A/B		10/15	F.C/F.C
Flue Gas O_2 %	A/B			6.2/7
CO_2 %	A/B			6/6
Excess Air %	A/B			36.17/43.4
Furnace Inside Temp			580	552
Stack Outside Temp	A/B		138/122	135/120

Technical Data on Package Boiler B

1. Flow Rate

		Design 10^3 kg/hr	18-12-01 10^3 kg/hr	21-11-06 10^3 kg/hr
Boiler Feed Water to Boiler B	FQ 1402 B	36.9	17.6	22.5
Boiler Feed Water to Boiler B	FQ 1402 C	36.9	15.8	11.25
HPsteam production of Boiler B		36	18. 9	20.1
HPsteam production of Boiler C		36	15.8	9.9
Air to Boiler B		45000	15126	17869
Air to Boiler C		45000	14783	11011
				kg/hr
Fuel oil to Boiler C		2638	1.28 kl/hr	0.83

2. Temperature

Hp steam temp.	TIC 1401C	300	290	290
Lp steam temp	TIC 1404	151	145	142
Deaerator temp		110	96-98	97
Fuel oil temp		30	32	32
Pure water temp		15	Ambient	Ambient
Boiler Feed water temp			96	97
Flue Gas Temp Outersurface	 B C		 215 200	 270 250

3. Pressure and others

	Tag.No	Design (kg/cm^2-G)	18-12-01	21-11-06
HP Steam Pressure	PI-1421	30	28	27.5
LP Steam Pressure	PI-1422	4	3.4	3.4
Deaerator Pressure	PI-1404	0.43	0.36	0.35
Draft Pressure Inside of Furnace	PI-1413 B1		30mmH_2O	10mmH_2O
Air Supplied	PI-1413 B2		80mmH_2O	19mmH_2O
Air Supplied	PI-1413 C1		70mmH_2O	<0 mmH_2O
Inside of Furnace	PI-1413 C2		>0 mmH_2O	10mmH_2O
Fuel Gas Pressure to Boiler	PIA-1431		2.7	2.6
Molecular Weight of Fuel Gas			16.49	16.49
Flue Gas O_2 %	B/C		6.0/ 5.6%	4.5/4.8%
CO_2 %	B/C		8.2/10.6%	7.8/8.0%
Excess Air %	B/C		35.7/33.6%	23.9/26.09%
	(Gas / Oil)			

BOILER WALL SURFACE TEMPERATURE

BOILER "B"

Date 19.12.2001

RIGHT SIDE

79	60.8	67.6
89.7	56.4	53.1
94.1	77.1	69.0

LEFT SIDE

42.5	48.4	44.7
41.4	47.4	70.9
65.7	67.6	55.8

BACK SIDE

157	55.6	34.1
	44.2	44.1
	71.2	45.6

Date 18.11.2006

RIGHT SIDE

42	43	40.2
42	41	39.5
65	55	45

LEFT SIDE

34.4	33.8	34.3
36	39	39
35	38	40

BACK SIDE

38.1	34.5	36.1
40	51	41
43	52	51

- **4.0 Conclusion**
- Nowadays, the trend of energy in the world is tremendously increasing as the demand for energy has been rising up.
- In order to step up the industrialization and urbanization processes and to improve people's living standard at current growth rate, all of our ASEAN countries stress our needs for more energy.
- Energy production and consumption have been increasing steadily and as a consequence, the effective and efficient utilization of energy becomes more and more evident, since the crude oil price has become up day by day.

•The action program of energy savings for the oil industry in Myanmar for the short term is being carried out under the management of Ministry of Energy.

- As the results of energy efficiency and conservation activities in Mann Refinery, the net thermal efficiency on Boiler B and Furnace for Topping Unit becomes 79%, 72.3% respectively compared to 70% and 68.68% audited in December 2001 which are considered as the base line.
- Therefore, it is found that 9 % of energy efficiency Boiler B and 3.65% of energy efficiency for Furnace of Topping Unit becomes increase.

•For sustainable economic development in our country, the long term energy saving program is an essential need such as

• Energy management training

• Introduction of new technologies

• Promotion of international energy conservation efforts

•Broader introduction of clean technology and modification program on energy efficiency and conservation, etc.

- Our organizational strategy is to upgrade and promote advanced technologies in energy sector.
- Vision is to be most efficient use of energy and to get higher performance level of production in enterprise.

- In order to do so, Ministry of Energy, Myanmar has been enhancing the cooperation with international organization for obtaining technical assistant and financial support.
- Myanmar has a chance in the contribution of the long term energy saving program, our country would be of great benefit for promotion of energy efficiency and conservation for oil industry in Myanmar.

Energy Consumption Data from the year of 2000-01 to 2005-06

Petrochemical Complex , Thanbayakan (Mann)

Myanma Petrochemical Enterprise, Ministry of Energy, Myanmar

r	Associated Gas		Home Fuel Gas		Total Fuel Consump	Power		Grand Total	Through put	MM. Kcal
	Nm3	MM. Kcal	Nm3	MM. Kcal	MM.Kcal	Kwh	MM. Kcal	MM. Kcal	IG	per ton of crude o
00-01	13,890,555	133,177	8,382,071	80,364	213,541	23,489,275	20,214	233,755	90,366,269	0.0
01-02	10,659,067	102,195	8,376,699	80,312	182,507	22,928,575	19,732	202,239	91,780,820	0.5
02-03	11,298,275	108,323	8,219,461	78,805	187,128	24,272,718	20,889	208,017	104,890,446	0.5
03-04	9,056,950	86,834	9,595,622	91,999	178,833	24,157,068	20,789	199,622	109,580,715	0.4
04-05	10,249,925	98,272	10,437,937	100,075	198,347	24,454,888	21,045	219,392	112,544,925	0.5
05-06	18,432,165	176,720	9,695,561	92,957	269,677	24,179,293	20,808	290,485	109,641,845	0.0

Thank You