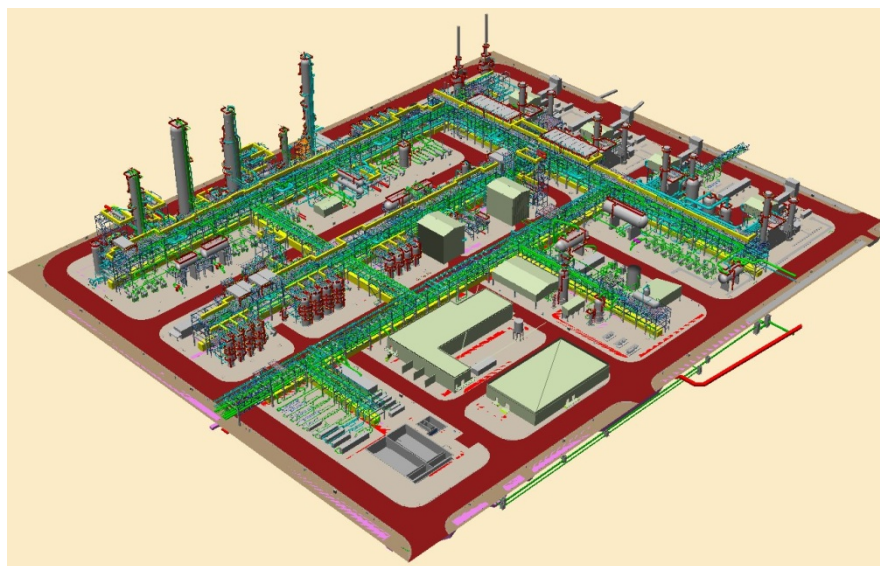
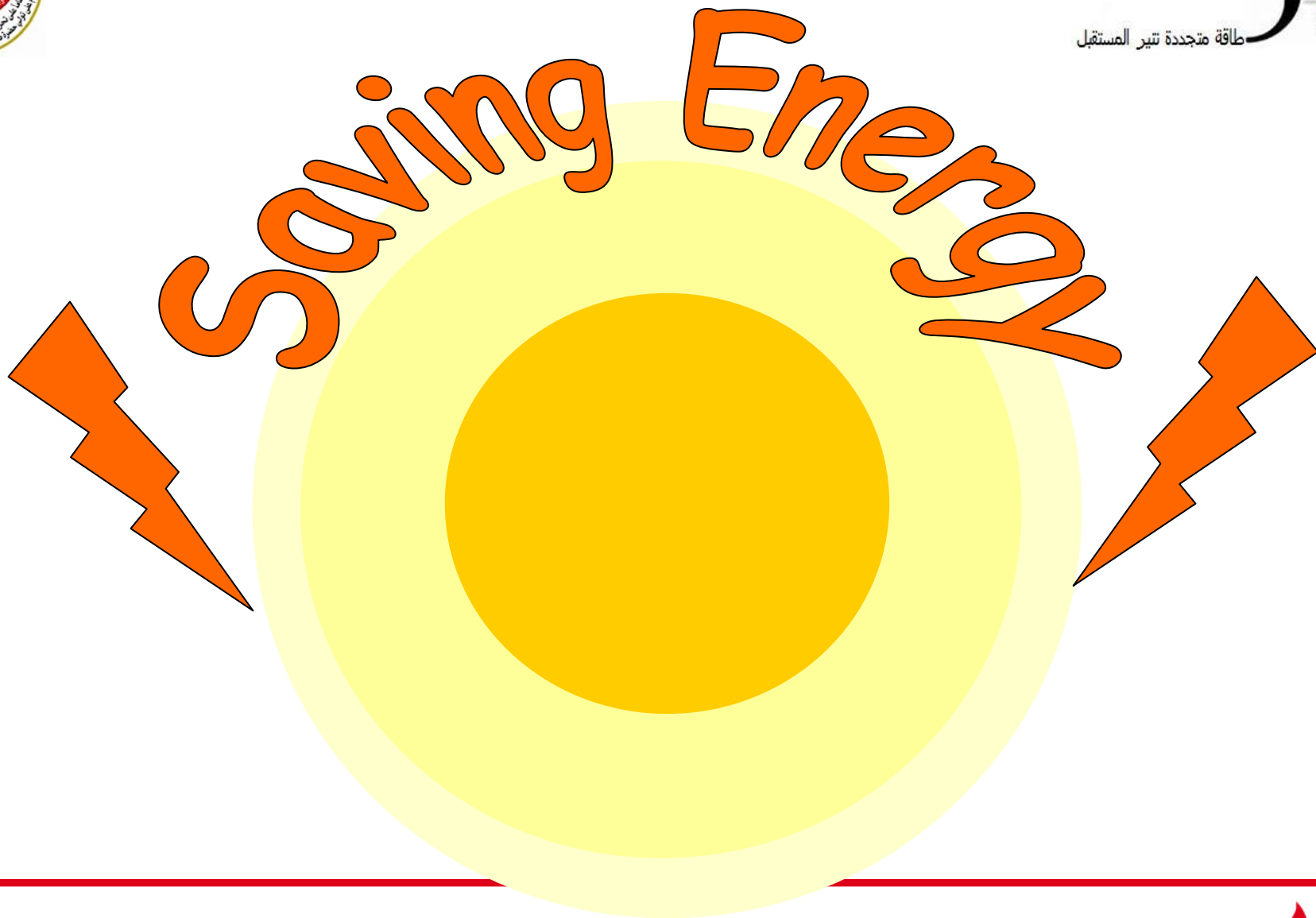
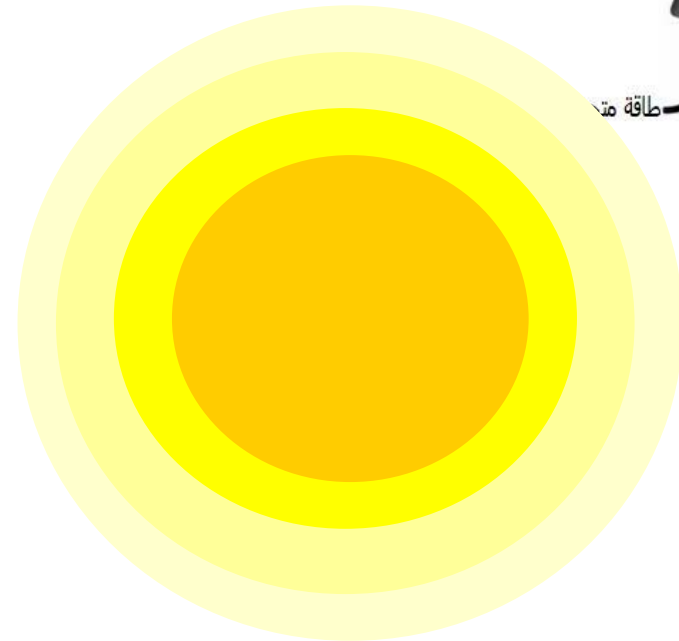


ENERGY OPTIMIZATION IN THE MAA GAS PROCESSING FACILITIES



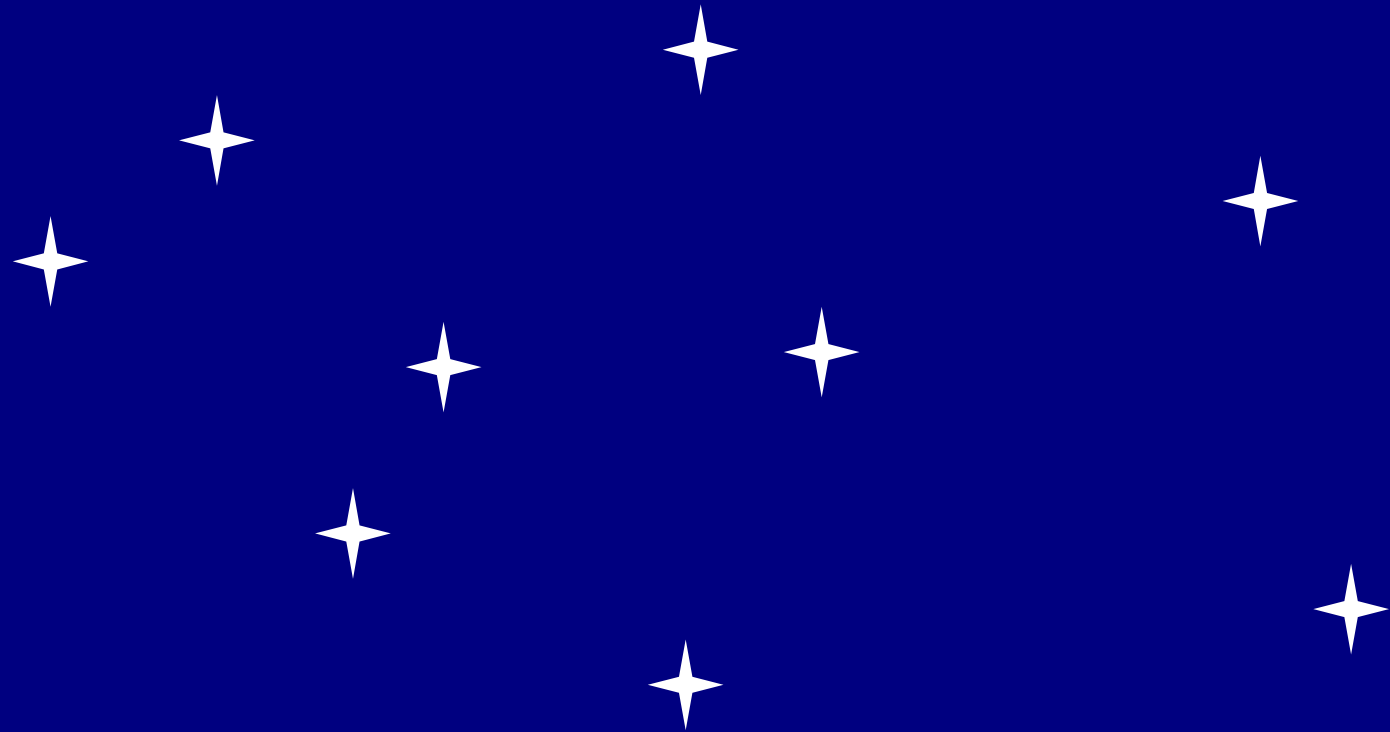
**ABDULLAH AJMI , K.S.SABAPATHI, MUSAALAM AL MOWAIZRI,
SHAIMA AL AMEEN
PROCESS ENGINEERING
MINA AL-AHMADI REFINERY, KNPC**



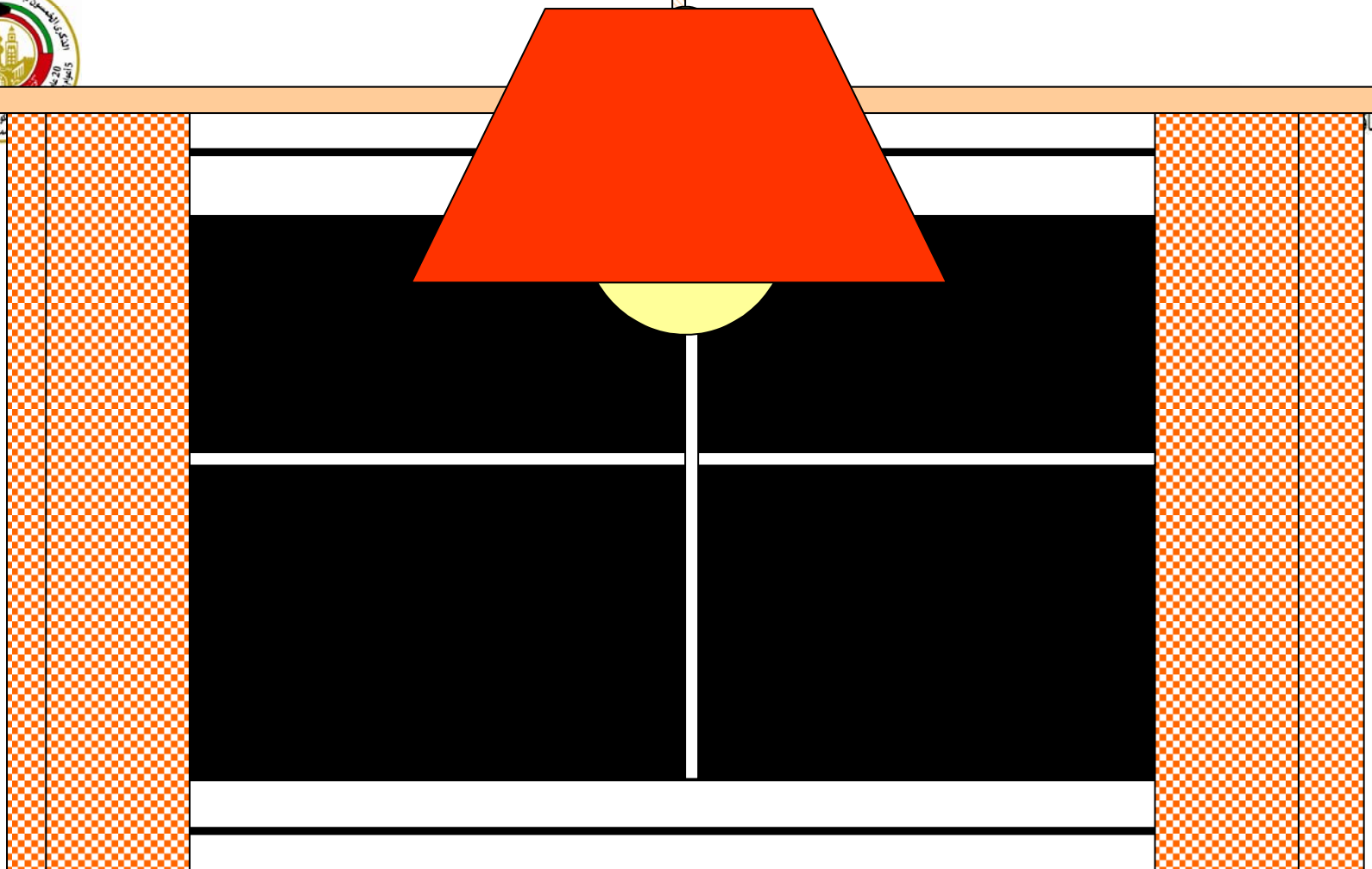


The sun warms us and gives us light during the day.





At night, and during the colder months, we need light and warmth from other sources...



You can turn off the lights when you don't need them!

Suggest that the grown ups who do the shopping buy energy saving light bulbs.





Ask an adult to turn the heating down / cooling up a notch ...

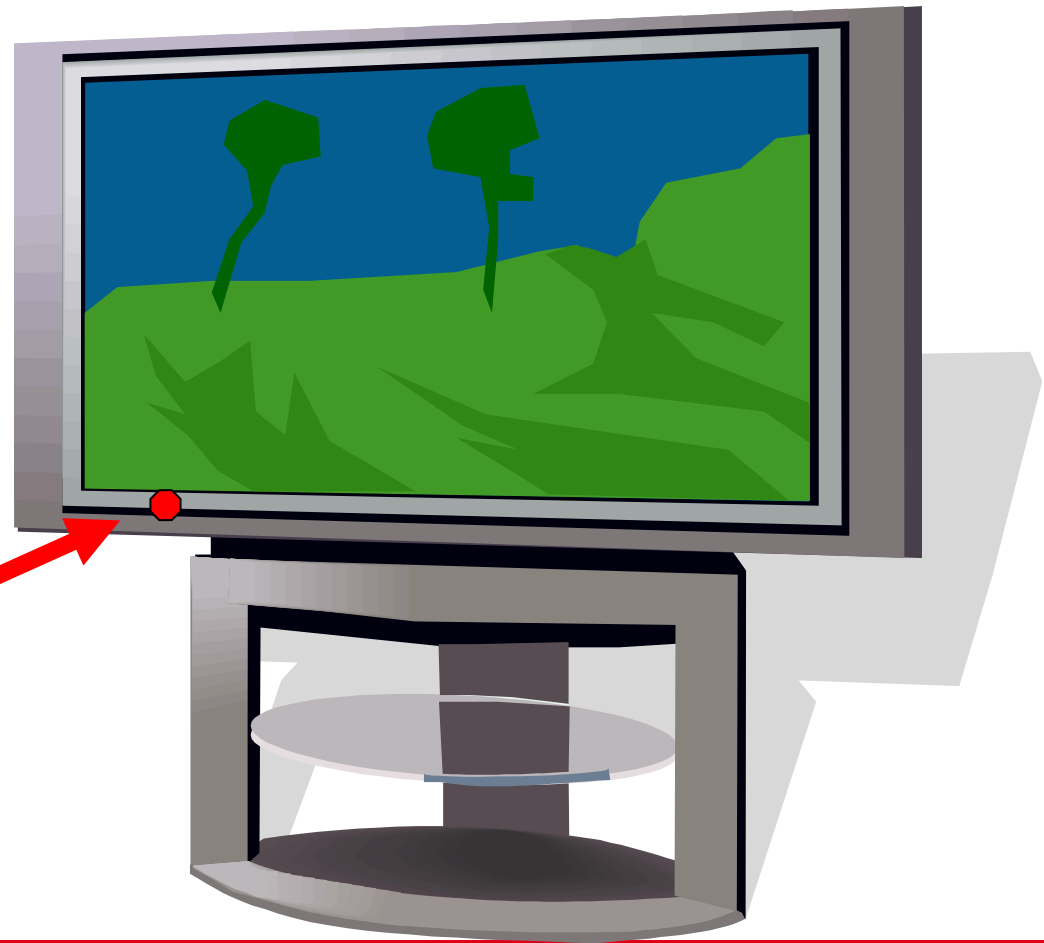
طاقة متجددة تثير المستقبل





Switch off! Don't leave it on standby!

طاقة متجددة تثير المستقبل



If you can see a light like this when the TV is off, it is using almost as much energy as if it was on!

There's lots you can do
to help the World!





Each house we might save small amount of ranging 0.2~1 KWHR , However from Gas plant we have saved 15000 KWHR . Which is about equivalent of about 15000~75000 house.

Therefore all industrial units which consumes energy should concentrate and implement energy conservation efforts .



OUTLINE

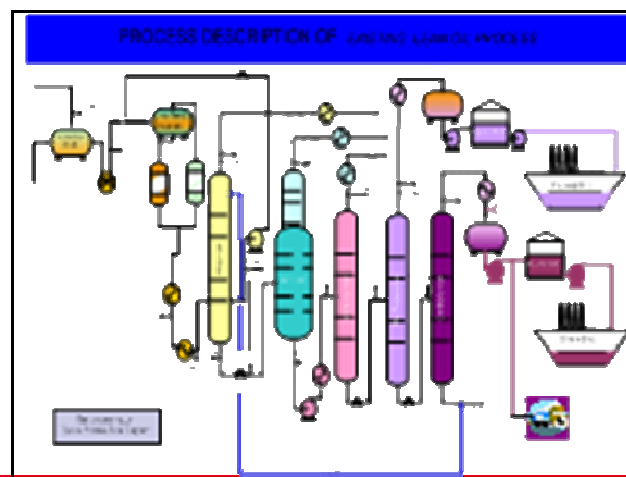


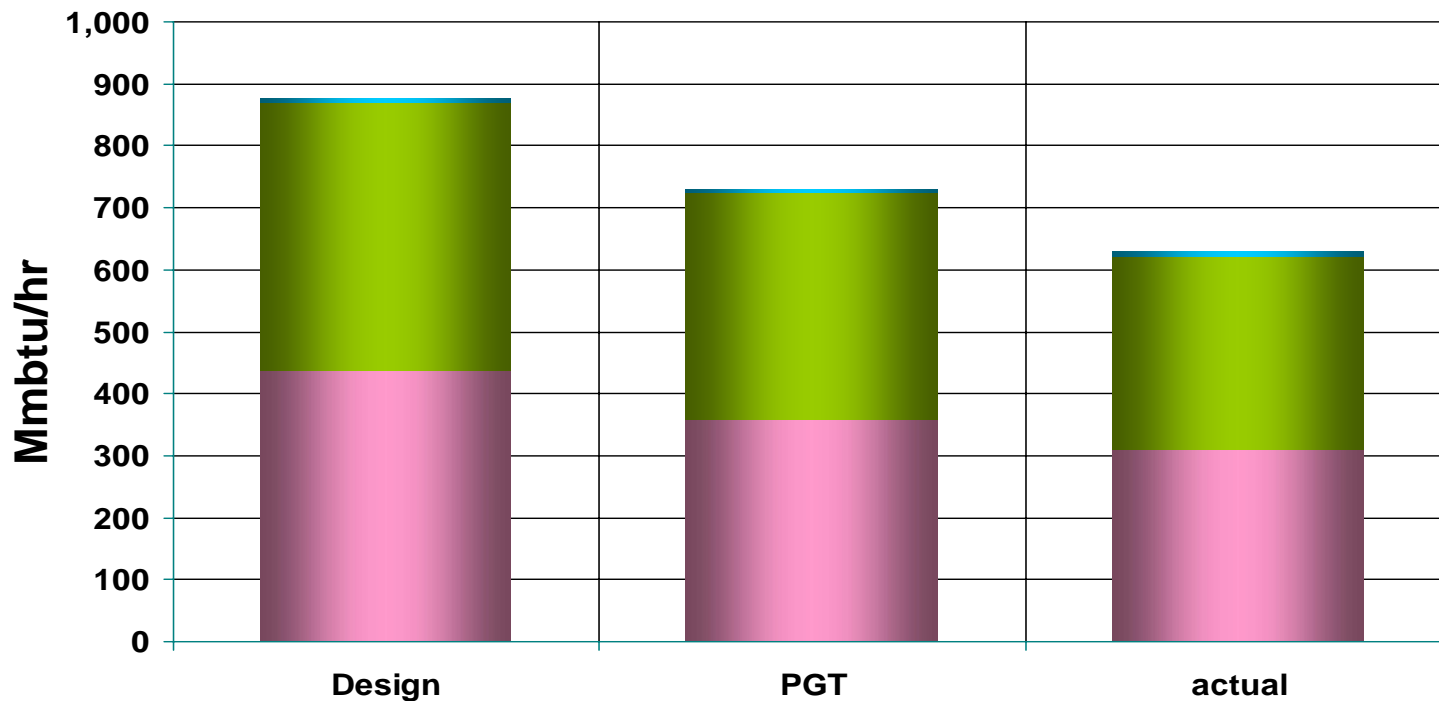
- Gas Processing
- Gas Plant Energy requirement
- Operational changes.
- Improvement with New Hardware Modification
- Ideas considered in new Projects.



GAS PROCESSING

- Associate gas production/processing can range from simple to complex operations.
- The separation of components by absorption, adsorption, refrigeration or cryogenics from a stream of natural gas for the purpose of making saleable liquid products and for treating the residue gas to meet the required specifications.





		Design	PGT	Actual
Steam	MMBTU/HR	432	360	335
Fuel gas	MMBTU/HR	437	365	317
Power	MMBTU/HR	6.8	5	7
Total	MMBTU/HR	875.8	730	659



MAA have taken all the efforts and carried out various modifications and activities to reduce the energy consumption. With these modifications the overall energy consumption is reduced from 730 MMBTU/HR during PGT to actual 659 MMBTU/HR .

We could achieve this in spite of the fact that Fired heater convection coils are dirty and to be cleaned in the next TA.

Some of the major activities are presented in the following slides :



ACTIVITIES

A. Operational changes

1. Improve vacuum
2. Extraction of Steam 2 MW
3. Reduction in pressure 24 MMBTU/HR

B. Improvement with Modifications

1. BFW heaters 14 MMBTU/HR/TRAIN
2. APC in Gas plant 4.3 MMBTU/HR/TRAIN

C. Ideas considered in the New Projects

1. Regen Gas cooling/ heating . 29.5+13.9 MMBTU/HR
2. Integration Compressor discharge used for reboiling . 36.88 MMBTU/HR
3. Integration NGL Pre heat 19.52 MMBTU/HR
4. VSD drive in offsite. 6.8 MMBTU/HR (2MW)
5. Fin fan cooler management 0.7 MMBTU/HR(.2 MW)
6. Use steam reboiler instead fired heater .
7. Installation of Air preheaters . (91% FROM 84%) 90 MMBTU/HR



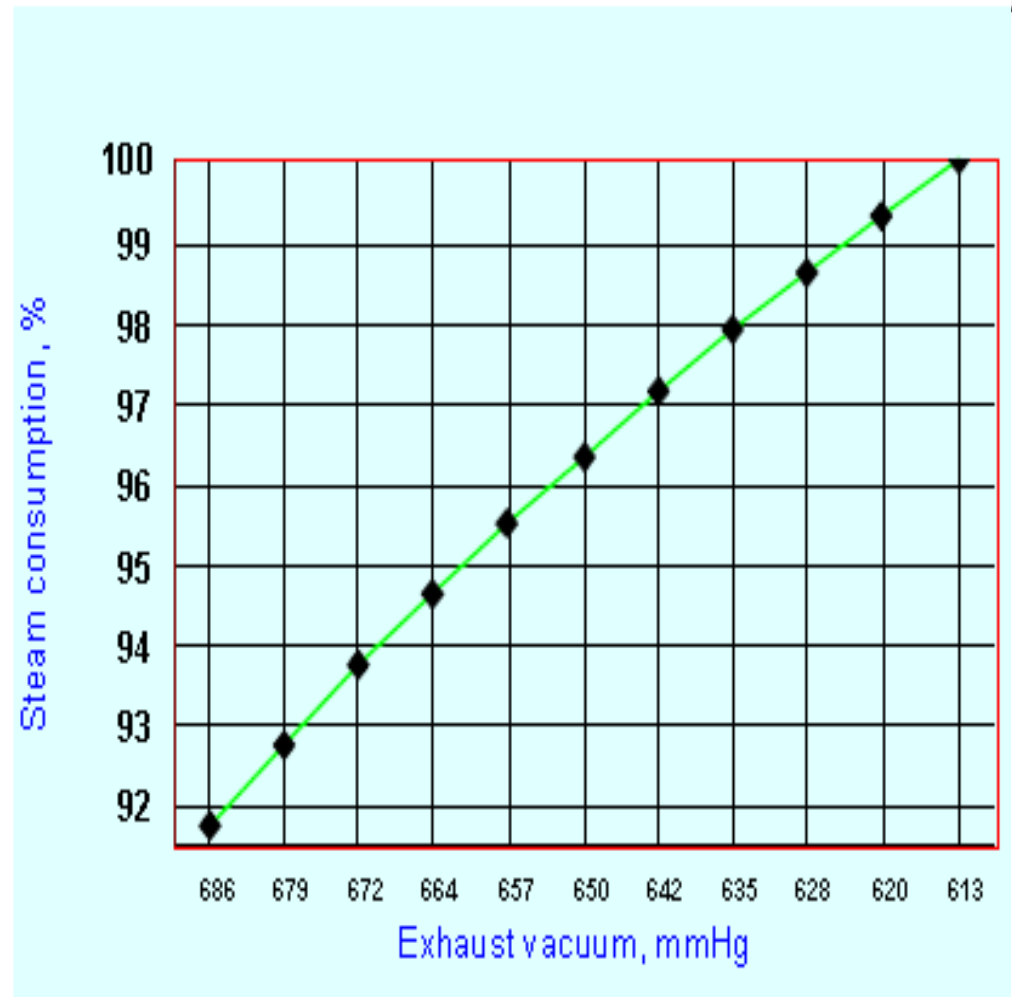


A.1 EFFECT OF EXHAUST VACUUM



Lower vacuum, increases the steam consumption in the turbine, Exhaust pressure lower than the specified will reduce the steam consumption and improves the turbine efficiency. Similarly exhaust vacuum lower than the specified, will lower the turbine efficiency and reduces the steam consumption.

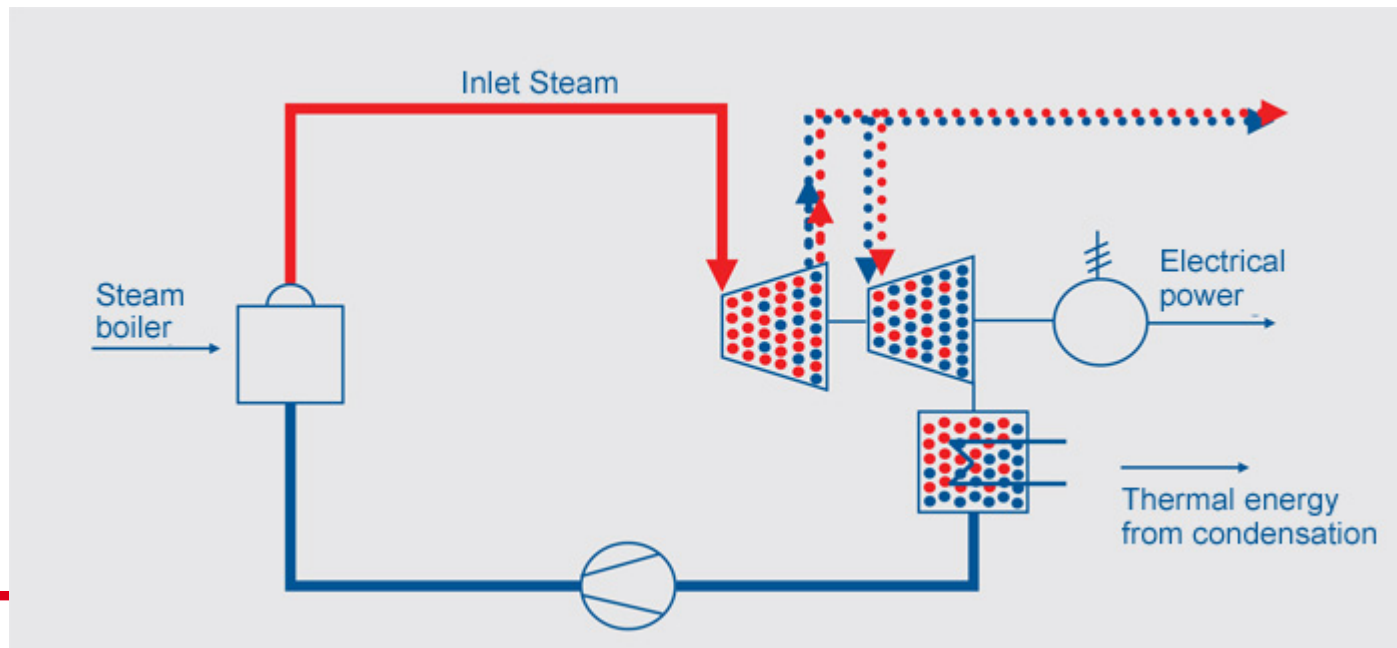
The vacuum on 4KT-101 condensers was 532 mmHg (-0.7 kg/cm²,) compare to a design figure of 653 mmhg (-0.86 kg/cm²,) MAA putting all the efforts to improve the vacuum. Improving the vacuum is expected to reduce the steam consumption by about 3 t/hr equivalent of 9 MMBTU/hr.



A.2 EXTRACTION OF STEAM

Most of the loss in the steam system happen in the condenser , huge amount of heat is removed by cooling water . Withdrawing the steam at the medium pressure and use it for process use increases the efficiency since loss at the condenser is minimized. Original provision of extracting MP steam was not utilized and we are planning to utilize the same.

MP steam can be extracted this will save about 2 MW power.



A.3 DE BUTANISER PRESSURE REDUCTION

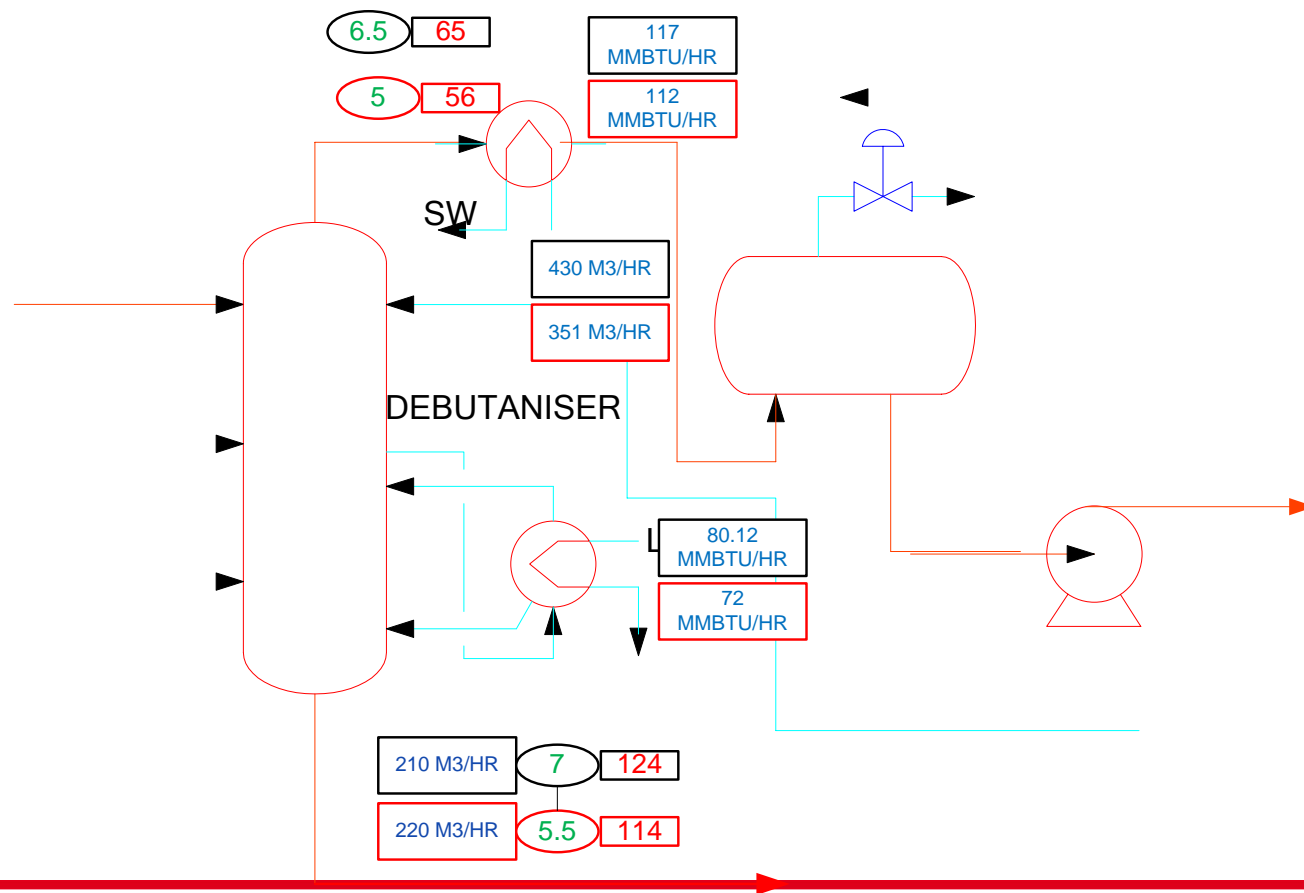
Normally tower design pressure are fixed based on the maximum cooling water temperature. Reduction in the operating pressure will improve the following **with out affecting the product speciation and column flooding:**

- Column bottom temperature will reduce and this will in turn reduce the temperature entering the KNG cooler. This will reduce the considerable energy loss.
- Volatility coefficient (separation efficiency) is higher at lower pressure. This will improve the separation and reduces the reflux and energy consumption.

The debutaniser pressure was reduced from 6.5 bar to 5bar. Net reduction in the Fuel gas is about 1 MMSCFD because of the pressure reduction. Savings realized due to the pressure reduction is about 24 MMBTU/HR .



DEBUTANISER BEFORE AND AFTER PRESSURE REDUCTION



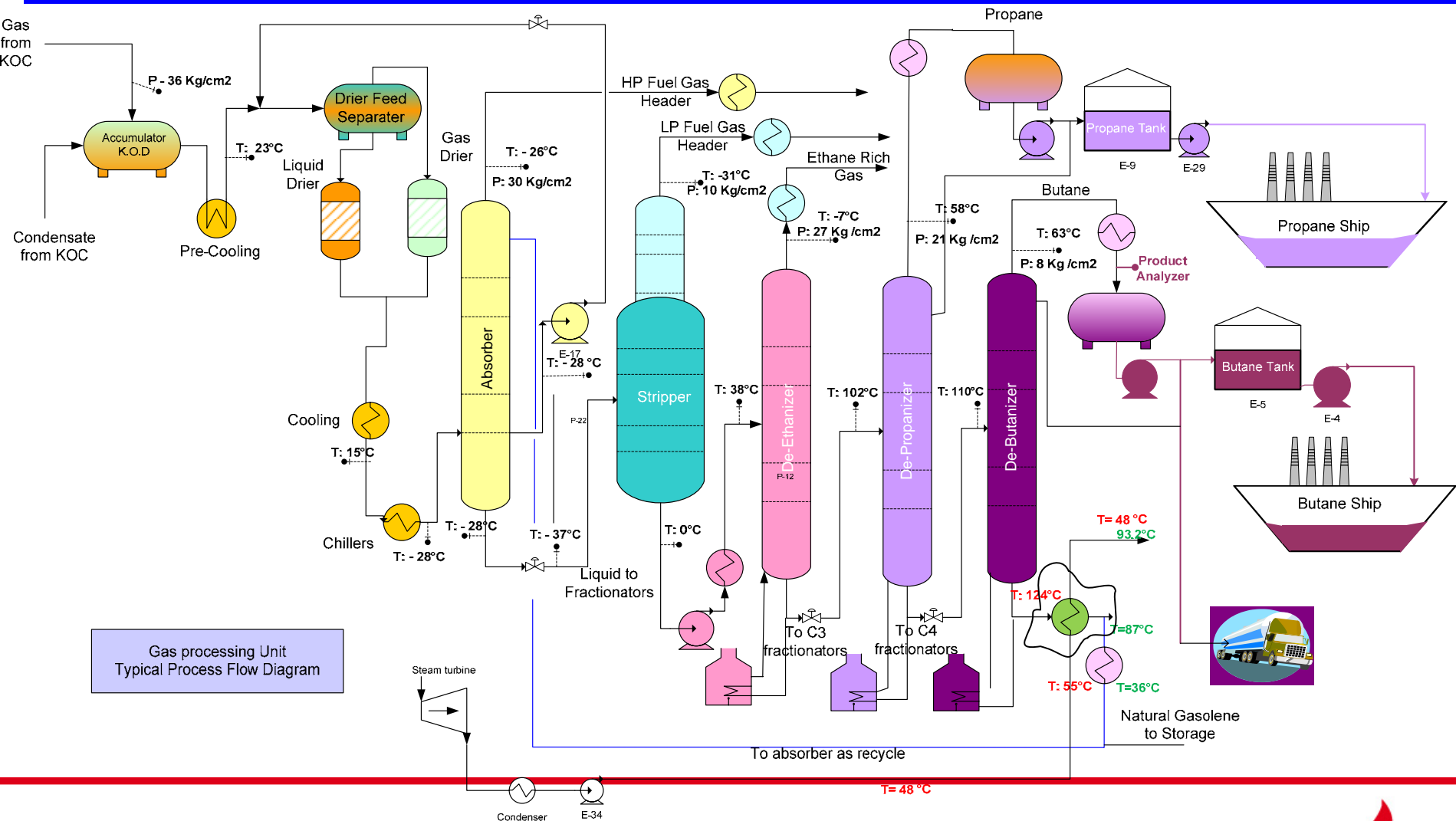


B.1 BFW EXCHANGER



- As a part of energy conservation activities and reduce emissions, Process has studied energy loss in the gas plant. It was found that KNG is cooled by sea water from 110 Deg C. About 19 MMBTU/HR of heat was lost to sea water which could be potentially utilized.
- Further investigation revealed that condensate from 4K001 compressor is around 54 Deg c. The same is heated by steam in the de-aerator. It was found that KNG heat can be recovered by condensate. Accordingly the scheme was issued and hazoped and implemented.
- This has increased condensate return temp and resulted in energy saving of about 14 MMBTU/HR /Train.

PROCESS DESCRIPTION OF EXISTING LEAN OIL PROCESS







B.2 APC IN FRACTIONATORS IN TRAINS



- As you are aware, an APC scheme in the Debutaniser of Train - II has been identified, designed, configured and implemented completely by in-house efforts. The scheme reduces the reflux and in turn fuel gas requirement in order to maintain the required product quality set by an operator.
- Data analysis shows a significantly improved control performance for the implemented scheme. Furthermore, due to the decrease in the reflux flow (which in turn reduces the fuel gas consumption) and an increase in on spec butane production, a tangible benefit of 4.2 MMBTU/HR/Train was achieved.



C.1 HEAT INTEGRATION DEBUTANISER REBOILER & COMPRESSOR DISCHARGE

During the compression process fluid heated to high temperature.
This normally cooled by air .

On the other hand, Gas plant fractionators needs high amount of heat for re-boiling at relatively low temperature .

Feed Gas Compressor discharge has to be cooled and fractionator bottom has to be heated. These are two integrated and saving about 36.88 MMBTU/HR .

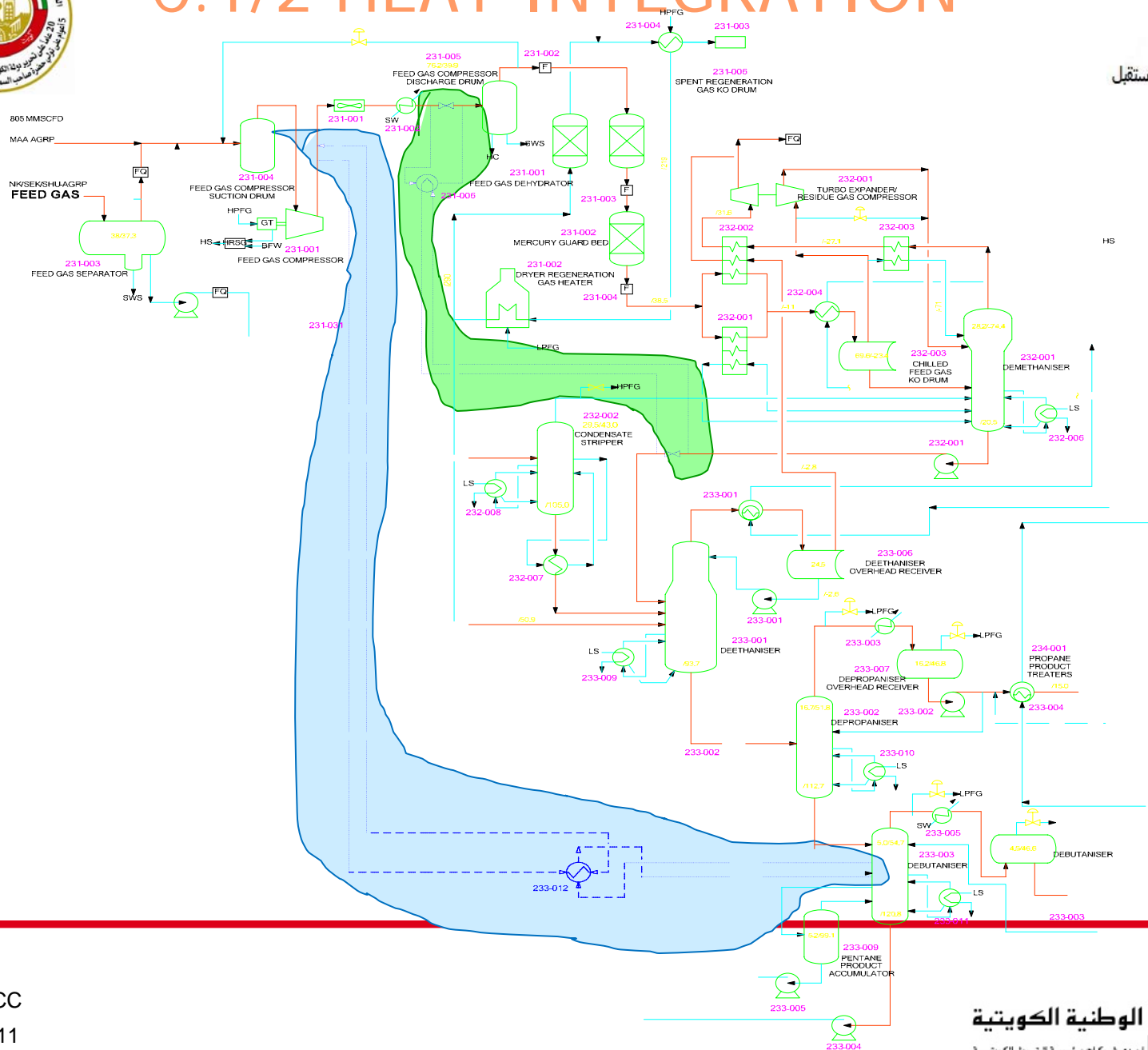
C2 NGL FEED WITH DE-ETHANISER FEED

Feed Gas Sub-cooler exchanger, E-231-006A/B, that will heat Raw NGL and cool the Feed Gas to a temperature of approximately 86 °F (30 °C). This reduced the reboiler load of de-ethaniser and reduce the at the drier 19.52 MMBTU/HR





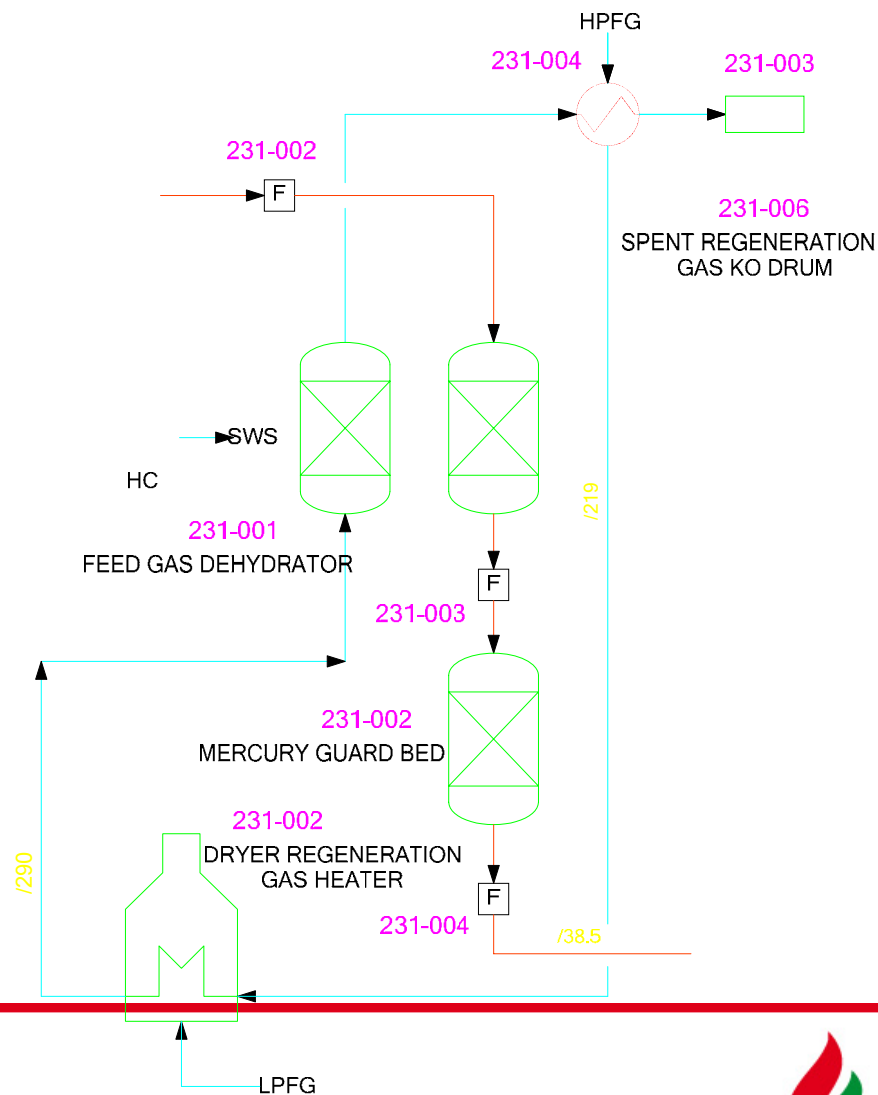
C.1/2 HEAT INTEGRATION





C.3 REGENERATION GAS HEAT RECOVERY

Normally Gas used for regeneration gas is cooled by air . KNPC has identified that this heat can be recovered . Accordingly Dryer Regeneration Gas Preheater, E-231-004 A/B, is installed to recover the heat 426.4 °F (219.1 °C) and then to the Dryer Regeneration Gas Heater, H-231-002, where it is heated to a temperature of 590 ° F (310 ° C). This has resulted savings about 29.5 MMBTU/HR for Drier system +13.9 MMBTU/HR for the treater system.



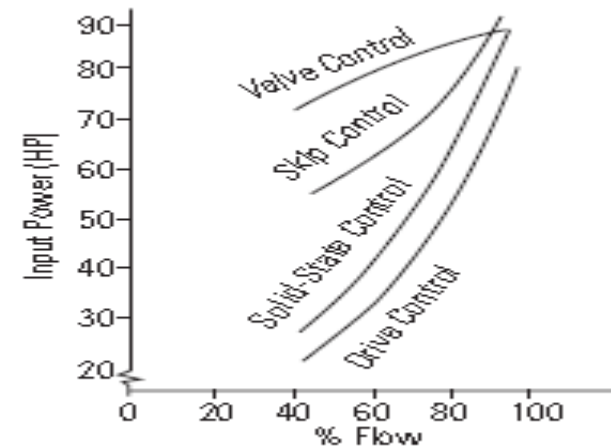
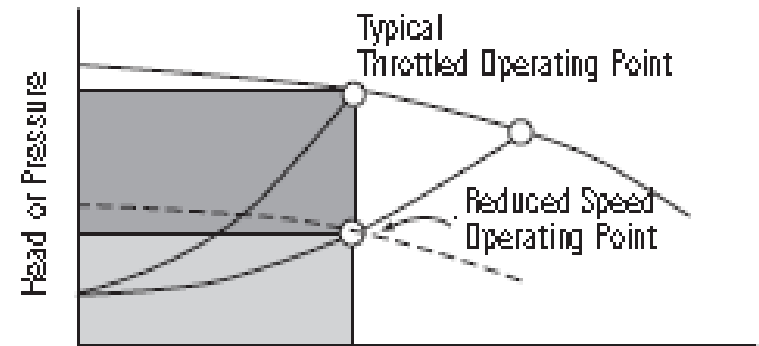


C.4 VSD MOTORS

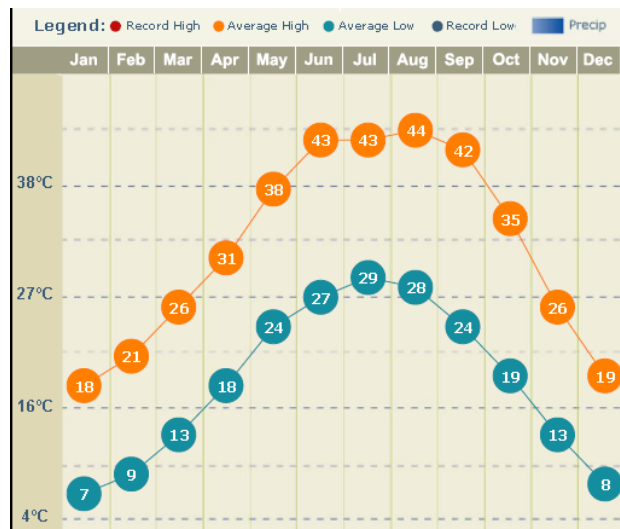
Normally control valve is used to control the flow. This method is efficient for the plants operates close 100%. At lower capacity this most inefficient way. Variable speed is most optimum solution for this issue. The motor will consume only 25% as much power at 63% speed compared to 100% speed.

AC motor-driven applications that do not require full speed can save energy by controlling the motor with a variable speed drive instead of control valve.

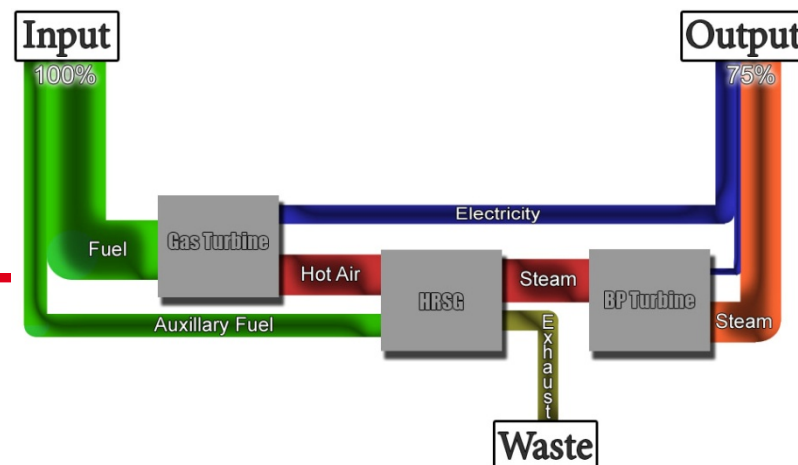
Propane and butane pumps has to operate for circulation and loading services with 1000 m³/hr and 400 m³/hr this can be achieved by reducing the speed to around 50 %. Loading rates is also varying based on customers requirement. Therefore VSD is installed in loading system to save energy.



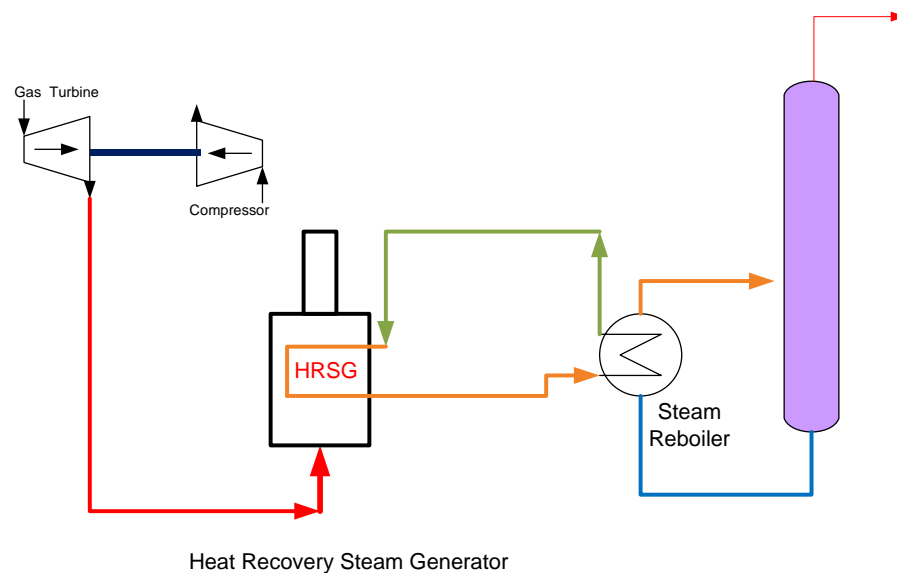
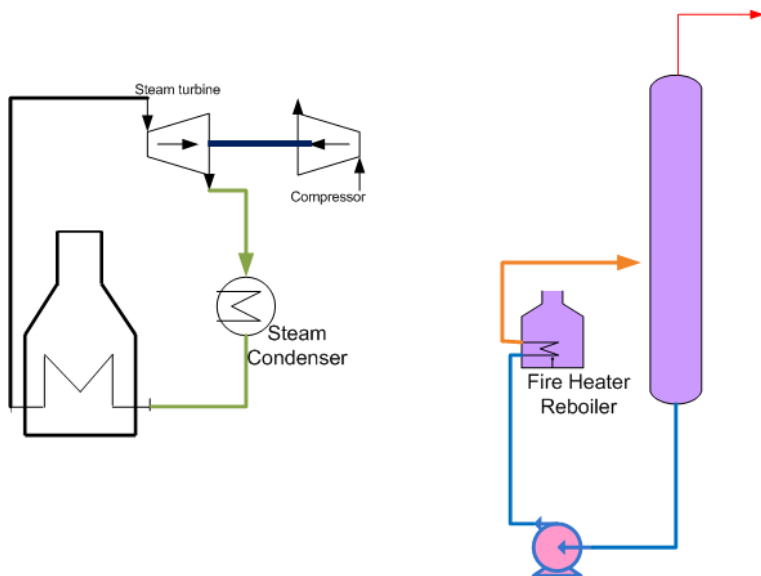
Air coolers are designed for a maximum ambient temp of 54°C in Kuwait. Number of Fin Fan coolers are designed based on this temperature. However Kuwait Ambient temperature varies as follows .



Therefore all the coolers are not required all the time . It is possible to switch off many of the cooler most of the time . Automatic control was installed to switch off the fin fans. This will save considerable energy about 200 KW .

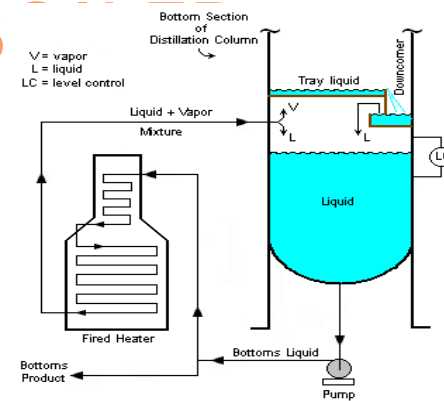
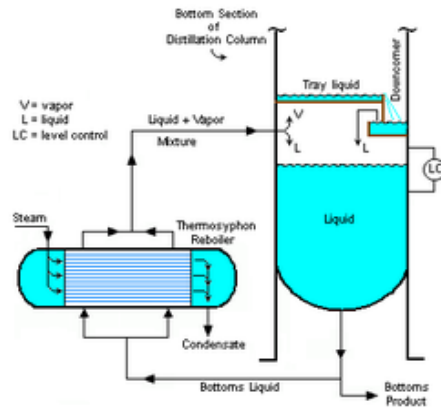


C5. BOILER & FIRE HEATER REBOILER VS GT & STEAM REBOILER



	MMBTU/HR	%
POWER	388	21.1%
STEAM	567	30.8%
LOSS	888	48.2%
TOTAL	1843	100%

	MMBTU/HR	%
POWER	388	33.6%
STEAM	567	49.1%
LOSS	200	17.3%
TOTAL	1155	100%



There are many types of thermosyphon reboilers. They may be vertical or horizontal and they may also be once-through or recirculating. Some fluids being reboiled may be temperature-sensitive and, for example, subject to polymerization by contact with high temperature heat transfer tube walls. In such cases, it is best to have a high liquid recirculation rate to avoid having high tube wall temperatures which would cause polymerization and, hence, fouling of the tubes.

Fired heaters (furnaces) may be used as a distillation column reboiler. A pump is required to circulate the column bottoms through the heat transfer tubes in the furnace's convection and radiant sections. The heat source for the fired heater reboiler may be either fuel gas or fuel oil.

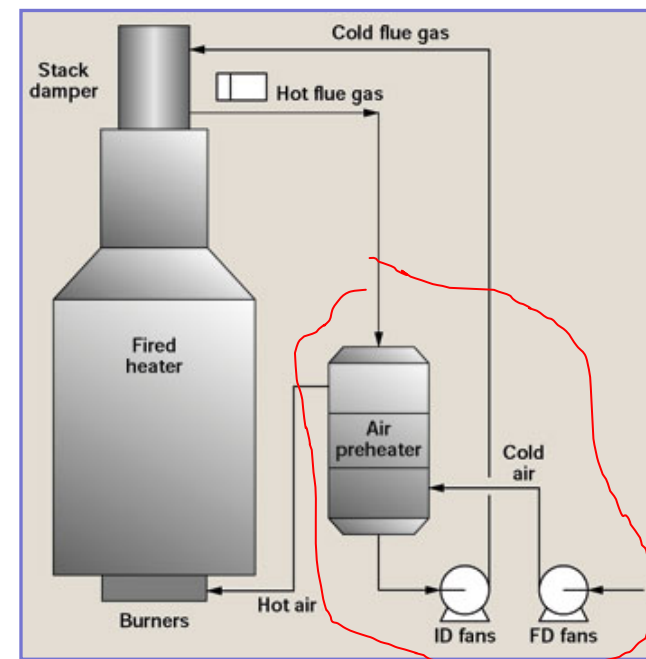
C.7 AIR PREHEATER AT EXITING GAS PLANT

De-Ethaniser/Propaniser/Butaniser reboilers of each train are not equipped with air pre heaters .

The stack outlet temperature is 390 – 400°C which can be reduced to 180°C by installing Air Pre-heater.

Due to this the efficiency of furnaces expected to increase from 86% to 91%.

The expected energy saving will be 30X3 MMBTU/HR for the nine heaters . We are facing problem in retrofitting these preheating in the existing location .



Existing Gas Plant

New Gas Plant

Operational Changes	MMBTU/HR	Hardware Changes	MMBTU/HR	All Changes	
Improve vacuum	9	BFW heaters	14	Regen Gas cooling/heating.	29.5 13.9
Extraction of Steam	6	APC in Gas plant	4.3	Compressor discharge used for reboiling	36.88
Reduction in pressure	24			NGL Pre heat	19.52
		Total	18.3	VSD drive in offsite.	7
		Air preheater	30	Fin fan cooler management	.7
Total	39	Total	87.3	Total	107.5
				Use steam Reboiler instead fired heater.	700*



THANK YOU

