GAIL Pata

1.0 Introduction: GAIL Pata

GAIL, Pata is a wholly owned unit of GAIL (India) Limited. It is geographically located in between Kanpur and Etawah by the main railway line from Kanpur to Delhi. This complex is a grass-root, energy intensive, integrated gas based Petrochemical Plant having end product as Polymer (comprises of HDPE & LLDPE), Liquefied Petroleum gas and Propane etc. The sales turnover of this complex is Rs. 1836 crores in the year of 2003-2004.

Gail, Pata works with a global focus to create and strengthen significant global presence to pursue strategic, attractive opportunities that leverage company's capabilities while effectively manages business risk. Our mission is to accelerate and optimize the effective & economic use of natural gas and its fractions to the benefit of national economy. This complex has acquired both ISO 9000 and 14000 certificates in 2002. It has also acquired several prestigious awards like British Safety Council's Sword of Honor, OISD safety award etc. It has also initiated TQM.

2.0 Process Description & Process Flow Diagram

2.1 Gas Sweetening Unit:

The gas from the HVJ pipeline contains about 5 to 6 % CO2 by volume which interferes with C2-C3 recovery in GPU where deep cryogenic conditions are involved. In view of this it is necessary to remove CO2 from the feed gas down to 50 PPM level. The sour feed gas enters the bottom of the absorber where it contacts counter currently with the descending lean solution. The acid gas component in the gas is absorbed by the solvent and the sweet gas leaves from the top of the absorber. The reach solvent solution loaded with acid components is drawn from the absorber bottom and flashed in to the flash drum to recover dissolved heavy hydrocarbons. The flashed rich solution is then fed to the regenerator through a lean/rich exchanger. In the regenerator the acid components are stripped off by the reboiled vapour generated through the regenerator reboiler and the solvent is recovered as lean solvent which is recycled as absorber top.

2.2 C2-C3 Extraction Unit

The sweetened gas is compressed and cooled in feed gas cooler to separate moisture. This gas is then passed through molecular sieve dryer for drying the gas further. The dehydrated gas is next cooled in three stages. In the first stage, the gas is cooled by de-methaniser bottom reboiler, chillier 1 and side rebolier. The liquid produced is separated in separator I. In the second stage, gas is sent to chillier 2 for further cooling and the liquid produced is separated in separator II. In the third stage, the gas is expanded in an expander to cool down to 100oC. The cold gas is then fed to de-methaniser column for recovery of ethane (C2) and propane (C3). Liquids produced in separator I and separator II are also fed to this column for distillation. The liquid from bottom of the de-methaniser column is pumped to C2 and C3 storage. The gases from the top of the de-methaniser column are cooled down in condenser and the condensate is separated in reflux drum and pumped back to the column. The vapour from the reflux drum is expanded in the de-methaniser overhead gas expander compressor to result in temperature reduction in the plant to -117o C. The cold gas is utilized in the process. A part of the exit gas from intermediate stage of the exit gas compressor is used for molecular sieve regeneration, recompressed and recycled back to HVJ pipeline**.**

2.3 Gas Cracker Unit (GCU)

In gas cracking unit, the feed C2/C3 is cracked in hollow furnace tubes at high temperature in the presence of steam. The furnace output is cooled in quench tower by direct water quench and the cooled gas is sent to cracked gas compressor (CGC) for pressure boost up. The cracked gas is scrubbed for carbon dioxide using caustic wash and then sent for dehydration in molecular sieve dryers. The dry gas is next passed on to de-methanizer section where all gases other than methane and hydrogen are condensed into liquid.

Uncondensed methane and hydrogen mixture from the de-methaniser is expanded to achieve the low temperature required for hydrocarbon separation. Methane is recycled back to fuel gas system, while hydrogen is used for the production of pure H2, which is required for hydrogenation reaction terminator. The liquid from de-methaniser is sent to de-ethaniser, which splits up the feed to ethane and ethylene products at the top and the heavier at the bottom. The ethane-ethylene mix from de-ethaniser top is processed for removal of acetylene and is thereafter sent to ethylene column for further separation. In the etheylene column, the ethane-ethylene mixture is separated into ethylene product at the top and ethane at the bottom which is again recycled back to furance for cracking. The heavier bottoms from deethaniser is fed to de-propaniser which separates the propane-propylene mixture at the top and all the heavier fractions at the bottom. The propanepropylene mixtures are separated in the propylene column where by-product propylene goes as the top product and propane is obtained at the bottom. This propane is again recycled back to furnace for production of ethylene and propylene. The heavy fraction from de-propaniser bottom is fed to the debutanizer, which separates the feed into C4 mix byproduct at the top and gasoline byproduct at the bottom.

2.4 High density polyethylene plant (HDPE)

The high-density polyethylene plant (HDPE) uses the slurry process for making polyethylene (PE). The process consists of feeding ethylene to reactors containing catalyst, hydrogen and propylene or butene-1 alongwith hexane for making tailor made PE product to suit customer application requirements. The slurry from reactors (polymerizers) is fed to centrifuge where the solvent hexane gets separated from the polymer powder. This powder is next fed to a dryer for drying. The dry powder is fed to an extruder to get pellets of required size, which are subsequently bagged for shipment. The recovered hexane from centrifuge and dryer is sent to hexane recovery section, where the hexane is stripped to yield byproduct low polymer. The stripped hexane is next dehydrated for removal of moisture and recycled back for reuse.

2.5 Linear Low Density Polyethylene / High Density Polyethylene (LLDPE / HDPE) Swing Plant.

The process in linear low-density polyethylene/high density polyethylene (LLDPE/HDPE) swing plant utilizes solution phase reaction system for polyethylene manufacture. Solvent cyclohexane and co-monomer butene-1 are pumped to absorber-cooler where ethylene is fed to form reactor feed solution. The reactor operates at high pressure and temperature to yield PE. The control of the properties of the polymer is normally achieved by varying the feed quantity and injection of catalysts and hydrogen. The catalysts presented in the solution in excess is next deactivated by deactivator addition. The solution is then preheated before passing through an adsorber for the removal of the deactivated catalysts. The adsorbed material is depressurized in two stages, at intermediate pressure separator (IPS) and low-pressure separator (LPS) for flashing off of unreacted ethylene, solvent and co-monomers, which are recycled for recovery. The polymer melt from LPS is next passed through extruder to form pellets which is steam stripped, dried, blended and bagged for dispatch. The recycle vapour stream from IPS and LPS is fed to low boiler (LB) column to yield unrecovered ethylene, co-monomer, extra product and cyclohexane as bottom product. The solvent stream from LB column is then fed to high boiler (HB) column from where recycle solvent is available as top product and high boilers (low molecular weight polymers) as the bottom product. The ethylene stream from LB column is sent to the ethylene column from where ethylene vapour obtained from the top is recycled back to cracker for recovery. The bottom product from ethylene column is sent to the co-monomer column from where pure co-monomer is obtained as top product and solvent is recovered as bottom product. The bottom product from the HB column is sent to the RB column from where low molecular weight polymer is taken out as grease.

2.6 Butene - 1 plant

The process in Butene-1 plant involves dimerisation of ethylene into butene- 1. It is used as co-monomer in LLDPE/HDPE swing plant. Feed ethylene along-with recycled ethylene is fed to the reactor where reaction is takes place in presence of catalyst and butene-1 is produced. The reactor outputs are vaporized in steam exchangers and sent to flash drum. Liquid from flash drum is taken to catalyst waste removal section for waste catalyst recovery. The vapour from flash drum is sent through cooler to surge drum and liquid separated in surge drum is taken to recycle column. Vapour ethylene from recycle column is recycled back to reactor, while liquid from the bottom of recycle column is fed to butene-1 column. The product butene-1 is available from the top of the butene-1 column while heavier hydrocarbons are available as by-product from the bottom of the same column.

2.7 Liquid Petroleum Gas (LPG) plant:

Liquid hydrocarbon from gas processing unit (GPU) is fed to LPG plant C2-C3 distillation column to have C2-C3 as top product and propane (C3) and heavier hydrocarbons as bottom withdrawal. This bottom liquid is fed to propane recovery column where top product is propane and bottom withdrawal is C3 and heavier hydrocarbons. This bottom hydrocarbon mixture is then fed to LPG column to have LPG (C3/C4) as top product and natural gasoline (NGL) as bottom product. NGL comprises pentane (C5) and heavier hydrocarbons (C6 and above) which can be termed as special boiling point solvent (SBPS). Based on the demand/supply scenario of propane, the propane column is used for the production of pentane and SBPS by fractionating NGL, which is available as bottom product of LPG column. The SBPS column can be reverted back to propane column whenever propane production is required.

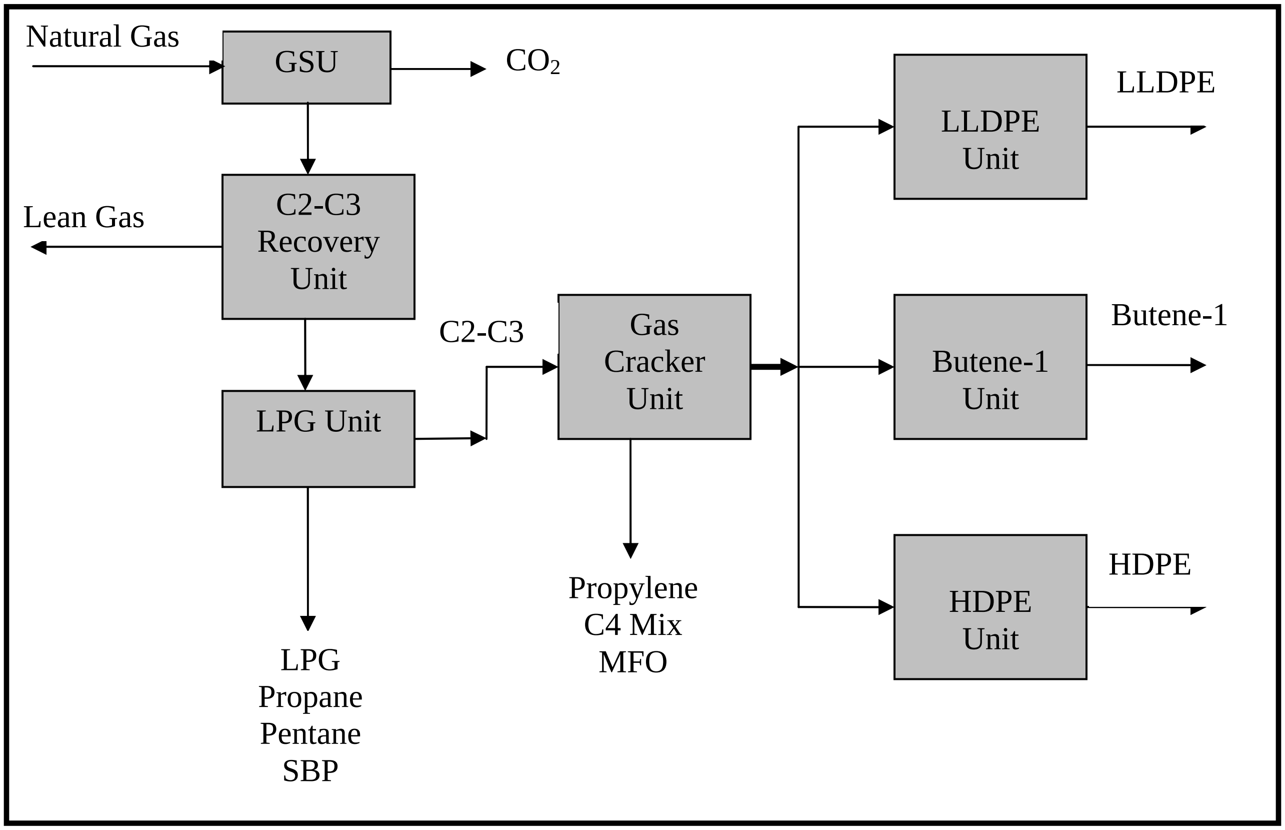
2.8 Utilities

The utilities requirement for the GAIL, PATA include power, raw water, steam, cooling water, DM water, fire water, plant air, instrument air, and nitrogen. The solid/semisolid wastes are also generated from various utility units viz. DM water plant (spent Cation/Anion samples), Nitrogen plant (spent alumina balls and spent molecular sieve).

2.9 Wastewater Treatment Plant

A number of effluent streams are generated from various sources viz, process waste stream (GSU, GPU, GCU, HDPE, LLDPE units), spent caustic waste stream, cooling water blowdown, DM plant effluent, boiler blowdown and sanitary waste stream. The total quantity of wastewater generated from the above mentioned sources amounts to 150 m3/hr. M/s GAIL have installed a combined wastewater treatment plant (WWTP) for the treatment of these effluents. Apart from this a substantial quantity of storm water is also generated during monsoon season and gets mixed up with the plant effluent. To handle this additional quantity of wastewater during monsoon, and to prevent the shock loading to various units of WWTP, M/s GAIL have installed two surge ponds where the incoming effluent is stored and released at controlled rate to the WWTP. The major units of WWTP are Grit Chamber, Oil Separator, Equalization Tank, Neutralization Tank, Flocculation Tank, Biotower, Aeration tank, Clarifier, and Sludge Thickener. The treated effluent is discharged to Sengar River.

Process Flow Diagram

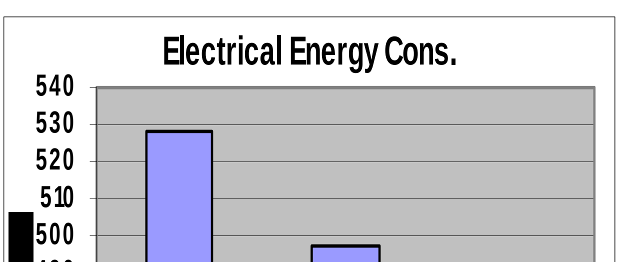


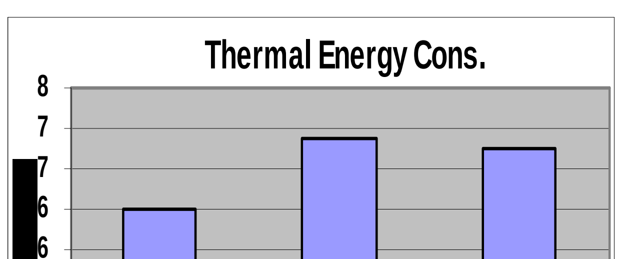
3.0 Energy Consumption Profile

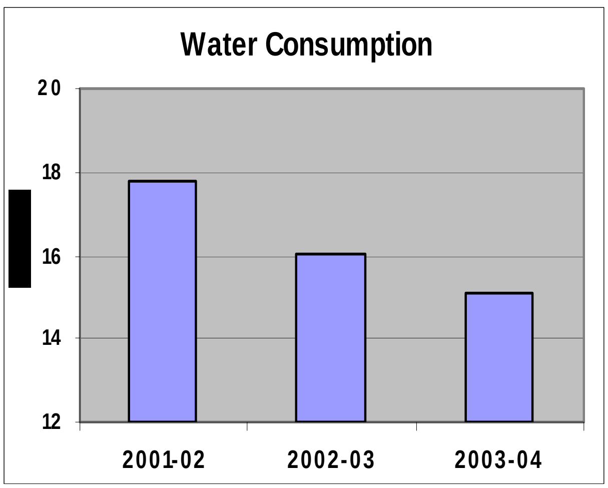
Year	Prod. MT	Energy Consumption		Specific Energy Consumption	
		Lakhs kWh	MKCals	kWh/ Tonne	MkCal/ Tonne
2001-2002	503,361	2658.18	3033661.66	528.09	6.03
2002-2003	585,612	2912.09	4033065.50	497.27	6.89
2003-2004	553305	2607.07	3730609.20	471.18	6.74

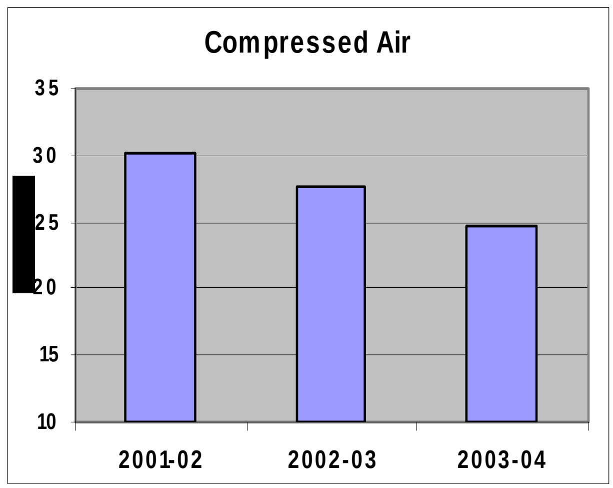
Above production is considered for Polymer + LPG + Propane

Year	Product	kWh/ Tonne	% reduction over 2001-2002	MkCal/ Tonne	% Reduction over 2001-2002
2001-2002	Polymer+ LPG+ Propane	528.09	--	6.03	--
2002-2003		497.27	5.83	6.89	-14.27
2003-2004		471.18	10.78	6.74	-11.87









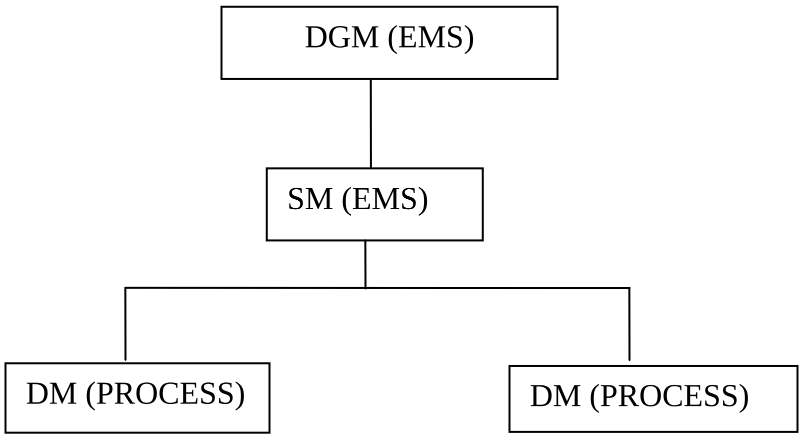
4.0 Energy Conservation commitment, Policy and set up

GAIL, Pata is involved in petrochemical sector. It consumes natural gas as raw material. It also has calorific value of its own. Same is with the all the production intermediaries. Apart from that it also requires conventional energy forms like Thermal and Electricity. GAIL, Pata is always endeavoring to lessen specific consumption values. A target is always set regarding this at the beginning of the year itself. Then this target is met with both applying some engineering and also raising the production. The actual specific consumption figure is compared with the target values on weekly basis.
Energy Conservation week is celebrated every year. A poster and slogan competition on energy saving and in-house seminar is conducted. The importance of energy conservation is also emphasized through various forums like Quality circle and TQM.

5.0 Energy management Policy

GAIL Pata is committed to efficient and optimal use of energy resources in all its applications and services through effective energy management with focus on productivity, cost effectiveness, environment and a better tomorrow.

6.0 Energy conservation Cell structure



7.0 Energy Conservation measures, schemes & Savings at GAIL, Pata from 2001 – 2004

7.1 Energy Conservation measures & Saving for year 2003-04

7.1.1 Description:

- **Power savings: Specific_efforts have been made in this year to reduce the Electrical energy consumption, by stopping motors by monitoring the process requirement / process parameters, judicious utilization of lighting power in Plants, replacing the existing chokes of tube lights with electronic ballasts etc.**

- **Inspection of steam traps and rectification: A massive (250 numbers) replacement of the faulty steam traps have been carried out. This replacement and rectification of the steam trap jobs are being carried out with a specific focus to arrest steam losses (of at least 6 MT/hr.)**

- **<u>Replacement of defective insulation:</u> Heat loss through defective insulation has been reduced by replacing the same. Especially the insulation of the pent house of the boiler UB#2 has been replaced (where we were earlier losing thermal energy).**

- **<u>Change in pulley size of Fans:</u> Ventilation air fans are provided to cool Gas Turbine enclosure. It was observed that motor RPM was on higher side resulted in frequent tripping of fan. Fan / motor maintenance expenditure was also on higher side. By replacing new pulley of large diameter towards fan side solves the problem. The current reduced from 140 to 90 ampere resulted in saving of nearly 20 lacs per annum.**

7.1.2 Table:

Descriptions	**Power (kwh)**	**Gas (scm)**	**Savings(Rs. Lakhs)**
Power saving (compared to base year)	13,833,075	NA	622.5
Inspection of steam traps & rectification	NA	15,048,000	792.0
UB-2 insulation job	NA	58,968	2.2
Change in pulley size of all six nos. of ventilation air fan of gas turbine	483,780	NA	19.3
Total	**14,316,855**	**15,106,968**	**1,436.0**

7.2 Energy Conservation & Savings at GAIL, Pata from 2002 - 2003

S. No	Detailed description of the Project	Calculations [1]	Net Annual Savings, in Rs. Lakhs / [*] Remarks
1	**ENERGY SAVING BY REPLACEMENT OF OBSOLETE VFD & MOTOR AT HDPE PLANT:** M/s JSW, Japan supplied HDPE extruder system at GAIL, Pata .The gear pump of the system was having variable frequency drive (VFD) & motor of obsolete technology, which was supplied by M/s Ansaldo, Italia. The VFD panel was working on GTO technology and motor was having dual winding i.e. two Δ winding in parallel to deliver full load torque. It was felt essential to phase out the obsolete equipment / technology due to non-availability of spares as well as for energy saving. Apart from the availability of new system in place of problematic/ obsolete system, we have implemented new ABB system, which is an energy efficient one **(August 2002).**	The power savings, based on same plant load and the same grade (RAFIA) as observed during August, 2002 (projected annual basis) is as follows: **<u>OLD ANSALDO SYSTEM</u>:** • Energy consumed by main system (TRANSFOR + VFD + MOTOR) =347 KW • Energy consumed by cooling system = 4.5 KW • Total Energy consumed annually = KW x Hrs x days of the year x per unit rate = (347+4.5) x 24 x 330 x 4 = Rs.111.35 lakhs **<u>NEW ABB SYSTEM</u>:** • Energy consumed by main system (TRANSF+ VFD + MOTOR) = 292 KW • Energy consumed by cooling system = 2.2 KW • Total Energy consumed annually = KW x Hrs x days of the year x per unit rate = (292+2.2) x 24 x 330 x 4 = Rs. 93.20 lakhs	**ANNUAL ENERGY SAVINGS** = Rs.(111.35–93.2) = **Rs. 18.15 lakhs** [3] [*] The new system was taken in line in the month of August 2002 and resulted in power savings (equivalent to Rs. 11.55 lakhs) since then during the year.
2	**ROUTING OF C2/C3 VAPOURS FROM FUEL GAS / FLARE GAS HEADER TO PROCESS UNIT:** Vapors Generated in C2/C3 Spheres (due to	Projected Annual Savings: • Total C2/C3 Vapors per day is 60 MT [2] • Balance days of the year = 210 • Cost of C2/C3 saved due to process	**SAVINGS PER ANNUM** = 60*330*10,000 **= Rs. 1980 lacs** [3] [*] The new system was commissioned

	loss of insulation) were initially a part of mixed to Fuel gas & part routed to Flare. As the situation called for, it is diverted to Gas Cracker Plant as C2/C3 feed for ethylene production as a part of Process modification **(September 2002).**	modification=60*330*10,000= Rs. 1980 lacs.	in the month of September 2002 and resulted in C2/C3 savings (equivalent to Rs. 1260 lakhs) since then during the year.
3	**STOPPING OF ONE NO. ETHYLENE SUPPLY PUMP :** Three Pumps are running for Supply of Ethylene to Polymer Plants. Each pump capacity is 25 MT/Hr. after analysis these Pumps, it was observed that passing of minimum control valve and it was closed & kept the minimum flow main header. Thereby stopped the third Ethylene supply Pump **(October 2002).**	• The Power rating of one ethylene Pump = 44 KW • Total annual Savings = 44*24*330*4 = Rs. 13.9 Lakhs.	**SAVINGS PER ANNUM** = 44*24*330*4 = **Rs. 13.9 Lacs** *(3)* **(*)** The new system was commissioned in the month of October 2002 and resulted in power savings (equivalent to Rs. 7.6 lakhs) since then during the year.
4	**STOPPING OF ONE NO. COOLING WATER CIRCULATION PUMP :** An Audit has been carried out on the cooling water circuit to find out the possibilities of optimization. On analysis, it has been found that CW flow to some of the major Heat Exchangers have been at full rate, gives rise to increase in the circulation rate. This CW is throttled to give only the required ΔT across the process / CW streams **(November 2002).**	• Power rating of one CW circulation pump = 596 KW • Total annual Savings = 596*24*330*4 = Rs.188.8 Lakhs	**SAVINGS PER ANNUM** =596*24*330*4=**Rs.188.8 Lacs** *(3)* **(*)** The pump was stopped during the month of November 2002 and resulted in power savings (equivalent to Rs. 78.7 lakhs) since then during the year.
5	**INTERNAL ENERGY AUDIT TEAM CARRIED OUT INSPECTION OF STEAM TRAPS & RECTIFICATION DONE (January 2003)**	• Number of steam traps identified for rectification / maintenance : 128 • Estimated steam Leakages: 4.6 TPH	**SAVINGS PER ANNUM** = (500 Rs./Te*128*4.6*330*24) = **Rs. 183 Lakhs** **(*)** Rectification done Subsequently. Savings achieved since January 2003 is Rs. 32.7 Lakhs)

6	**POWER SAVINGS (COMPARED TO BASE YEAR 2001-02)**	• Specific Power import per production (Polymer+ LPG+ Propane) for year 2001-02 = 70.37 Kwh/MT • Specific Power import per production (Polymer+ LPG+ Propane) for year 2002-03 [(4)] = 62.68 Kwh/MT	**SAVINGS PER ANNUM** = (70.37-62.68)*584935*4 = **Rs. 179.9 Lakhs**

Notes:

(1) Average Power for year 2002-03= Rs. 4 per KWh

(2) Approximate cost C2/C3 vapors is estimated as Rs. 10,000 per MT

(3) Operating days are considered 330 for payback estimations

(4) Production of polymers:291115 MT & LPG+ Propane is 293820 MT during the year 2002-03

7.4 Energy Savings at GAIL, Pata from 2001 to 2002

S. No	Detailed description of the Project	Calculations	Net Annual Savings, in Rs. Lakhs / [(*)] Remarks
1	**FUEL GAS SAVINGS (COMPARED TO BASE Year 2000-01)**	**<u>During 2001-02:</u>** SPECIFIC FUEL GAS CONSUMPTION PER MT OF POLYMER+LPG PRODUCED =626.4 SCM/MT TOTAL POLYMER & LPG PRODUCTION =502761 MT **<u>During 2000-01:</u>** SPECIFIC FUEL GAS CONSUMPTION PER MT OF POLYMER+LPG PRODUCED =883.2 SCM/MT TOTAL POLYMER & LPG PRODUCTION =362675 MT	**MONETARY BENEFIT** [(2)] = (883.2-626.4)X 502761 X 3.873/1E07 = **Rs. 5000 Lakhs** [(*)] The above saving was achieved on account of: • Operational Improvements • Higher Capacity Utilization • Higher Equipment Availability • Minimizing Losses.
2	**POWER SAVING (COMPARED TO BASE Year 2000-01)**	• Specific Power Import (2001-02) = 70.37 KWH/MT of (POLYMER+LPG) • Specific Power Import (2000-01) =	**MONETARY BENEFIT** [(1)] = (164.6-70.37) X 502761 MT X RS.5.14/KWH= **Rs. 2435 Lakhs** [(*)] The above Saving was achieved

		164.6 KWH/MT of (POLYMER+LPG)	on account of higher internal generation
3	**TWO NUMBER STEAM TURBINE DRIVES FOR PUMPS TAKEN IN LINE INSTEAD OF MOTOR DRIVES IN LPG PLANT**	• RATED CAPACITY OF THE TWO MOTORS = 93.6 KW ***(1)***	**MONETARY BENEFIT** ***(1)*** = 93.6 KW X 8000 hrs. X RS. 5.14/KWH**= Rs. 38. 5 lakhs.** ***(This savings was already included at Sr. No 2)***
4	**SAVING OF ENERGY IN LIGHTING SYSTEM.**		
4(a)	**INSTALLATION OF TIMERS IN TRANSFORMER & EXTRUDER AREA:** The lights of transformer yard (approx,-100 nos) & HDPE Extruder building area were on during day time due to common distribution board of internal & external fixtures. All internal & external circuits were segregated by re-distribution & laying new wiring. Subsequently the clock timer was provided for external fixtures. Henceforth the timer shall regulate lighting On/Off and save electrical energy.	• THE RATING OF ONE TUBE LIGHTS =40 WATT • EXTRA GLOWING OF TUBE LIGHT =12 HRS PER DAY	**MONETARY BENEFIT** ***(1)*** =100 NOS X 40 WATT X 12HRS X 365 DAYS X RS 5.14/KWH= **Rs. 0.9 lakhs.**
4(b)	**TABLE TENNIS ROOM & BADMINTON COURT:** The 500 watt halogen fixtures were replaced with bimetal halide 150 watt fixtures	• NO OF FITTINGS = 28 • FIXTURES GLOWING 4 HRS/DAY • NO OF DAYS GLOWING = 300 (ASSUMED)	**MONETARY BENEFIT** ***(1)*** = 28 X (0.5-0.150) X 4HRS X 300 DAYS X RS. 5.14/ KWH **= Rs. 0.60 Lakhs**

Notes:

(1) ***Actual Power import Cost (2001-02) is Rs. 5.14 per Kwh (Including all Charges like Penalty, Minimum Contract Demand)***

(2) ***Fuel Gas Cost @ RS.3873 /1000 SCM***

The total saving in terms of rupees is a whopping 110crores with an investment of meager 1.0 crore. Water consumption has been reduced to almost half. There is a reduction of 10.78% in specific electrical energy consumption.

8.0 Energy Conservation plans & Targets

Energy Conservation measures (planned)	Anticipated Saving			Estimated Investment	Simple Payback period	Project Commencement & Completion year
	Quantum (KWh)	Lac K. Cal	Rs. Lacs	Rs. Lacs	Months	
Flare Gas Recovery System	154527907	1328940	652	1072	24-30	2005-06
Installation of pressure reducing valves or transvector nozzles on the compressed air line at the service air points.	198676	1709	9.93	1.5	1-2	2004-05
Replacement of under loaded motors with appropriate/smaller capacity spare motors	203400	1749	10.17	Nominal	Immediate	2004-05
Installation of variable frequency drive on the cooling water make up pump	224500	1931	11.22	3.5	3-4	2004-05
Installation of automatic temperature controller on cooling tower fans of CT-1	64320	553	3.21	0.6	2-3	2004-05
Replacement of conventional tube lights with energy efficiency tube lights	258075	2219	12.9	21	19-20	2004-06
Replacement conventional HPSV, HPMV lamps with low loss electronics ballasts	214600	1846	10.73	28.86	32-33	2004-06
Repair the MOV of FD Fan used in UB-1	612500	50133	24.5	1	<1	2004-05
Regular maintenance of Steam Traps and stopping steam leakages	1475000	120729	59	15	3	2004-06
Reduction in heat losses with improved insulation near the GCU battery limit	297500	24350	11.9	0.2	Immediate	2004-05
Replacement of PRDS-1 with back pressure turbines	15480000	116724	774	300	38082	2004-06

9.0 Environment and safety

9.1 Environment

GAIL, Pata is committed to the protection of the environment by prevention of pollution and continual improvement in the Environmental Performance. The company has successfully installed Environmental management System and got the certification of ISO 14001 in the year of 2002.

The process of implementation was initiated in 2001 during which following efforts were undertaken and on going efforts are continuously on as per the Environmental Policy:

- **Minimize generation of waste.**
- **Conservation of resources.**
- **Recycling & re-use.**

The company, from its incipience, has integrated Effluent Treatment Plant (ETP) and a Sewage Treatment Plant (STP) for wastewater from plants and other means. It is monitored continuously as per UP Pollution Control Board (UPPCB) norms. The company has minimized the wastage of natural resources by use of recycled STP treated water for Gardening.

9.2 Safety

Industrial Safety is an essential & integral part of every operation at GAIL, Pata. GAIL Recently our plant is recommended for OHSAS-18001 by M/s TUV. Along with OHSAS-18001, we are also going for ISRS which is under implementation phase. Pata has received the prestigious International Safety Award, "**The Sword of Honor**" and "**National Safety Award**" both from the British Safety Council, London. Apart from these Gail, Pata has bagged several national awards like "**Greentech Gold Award**" from GreenTech Foundation, "Shrestha Suraksha Puraskar" from National Safety Council, Mumbai. Objective of our safety dept. is to ensure and attain a target to achieve Zero accident Rate.

Each plant is having its own Safety Committee. This committee is headed by the Plant in charge in the rank of DGM. Over that there is a central safety committee, headed by Executive Director (In charge of the whole complex). The safety committee meeting is being held religiously at regular intervals. All the recommendations of the committee are mandatory addressed within the desired time frame. Safety audits are being carried out both by internal and the external parties at regular interval. An award is in vogue to report the near miss accident

A dedicated Fire and safety department is patrolling the plant on continual basis ensuring strict implementation of the safety norms, use of personal protective equipments. Several measures have been taken for the increase of awareness among people regarding safety such as Observing safety week, Availability of MSDS on line, distribution of pocket safety book, mandatory training on safety once a year for every one , Mock drill etc.

The accident rate in GAIL, Pata is zero in 2003-2004.

Year 2003-2004 Achievements in Energy Savings

1 **Power savings**: Specific_efforts have been made in this year to reduce the Electrical energy consumption, by stopping motors by monitoring the process requirement / process parameters, judicious utilization of lighting power in Plants, replacing the existing chokes of tube lights with electronic ballasts etc.

2 **Inspection of steam traps and rectification**: A massive (250 numbers) replacement of the faulty steam traps have been carried out. This replacement and rectification of the steam trap jobs are being carried out with a specific focus to arrest steam losses (of at least 6 MT/hr.)

3 **Replacement of defective insulation**: Heat loss through defective insulation has been reduced by replacing the same. Especially the insulation of the pent house of the boiler UB#2 has been replaced (where we were earlier losing thermal energy).

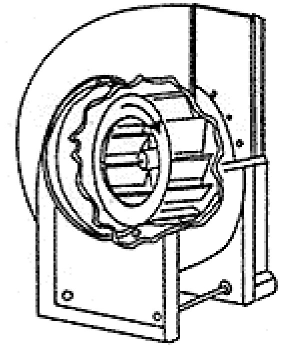
4 **Change in pulley size of Fans**: Ventilation air fans are provided to cool Gas Turbine enclosure. It was observed that motor RPM was on higher side resulted in frequent tripping of fan. Fan / motor maintenance expenditure was also on higher side. By replacing new pulley of large diameter towards fan side solves the problem. The current reduced from 140 to 90 ampere resulted in saving of nearly 20 lacs per annum (**detailed with financial analysis is provided as soft copy as PPT file**).

Detailed Break up is as per table below

Discriptions	**power(kwh)**	**gas(scm)**	**savings(Rs. Lakhs)**
Power saving (compared to base year)	#REF!	NA	#REF!
Inspection of steam traps & rectification	NA	#REF!	#REF!
UB-2 insulation job	NA	#REF!	#REF!
Change in pully size of all six nos. of ventilation air fan of gas turbine	#REF!	#REF!	#REF!
Total	**#REF!**	**#REF!**	**#REF!**

ENERGY SAVING SOLUTION FOR

CHRONIC HIGH AMPERAGE PROBLEM IN VENTILATION AIR FANS OF GAS TURBINES



SYSTEM DESCRIPTION

6 NOS. FANS ARE INSTALLED 3 EACH IN TWO FRAME-V GAS TURBINES AT GPU.

FUNCTION IS TO COOL THE TURBINE ENCLOSURE ~ AMB+40 DEG C.

MOTOR DRIVEN CENTRIFUGAL FANS.

BELT DRIVE

SPB SECTION PULLEY

TAKING SUCTION FROM TURBINE INLET DUCT THRU'

VARIABLE SUCTION DAMPER.

GRAVITY TYPE OUTLET DAMPER.

•**FANS SUPPLIED WITH GAS TURBINE PACAKGE BY M/S BHEL.**

OEM OF FAN : M/S C. DOCTOR

TECHNICAL DETAILS OF INSTALLED FANS

MAKE: C-DOCTOR & COMPANY PVT. LTD.
MODEL: 445 SWSI
POWER RATING: 90 KW
FLOW RATE: 36750 CFM
MAX AMPS: 148 AMPS
RPM OF MOTOR: 1480
DESIGN RPM OF FAN: 1520
TYPE OF BELTS: V-BELT,SPB-4250(Section: 16.3X13mm)
NO. OF BELTS: 6

PROBLEM DESCRIPTION & OBSERVATIONS

- HIGH AMPEARAGE PROBLEM SINCE COMMISSIONING.
- DRAWING ~ 140 AMPS AGAINST FULL LOAD CURRENT 148 AMPS.
- FOR KEEPING THE CURRENT WITH IN LIMIT INLET DAMPER REQUIRED TO BE REGULATED ~ 20%- 50 %.
- FREQUENT TRIPPING ON HIGH AMPS.
- INSUFFICIENT AIR FOR ENCLOSURE COOLING.
- UNRELIABLE PERFORMANCE
- CONSUMING HIGH ENERGY.

ASSOCIATED MAINTENANCE PROBLEMS

- **REPEATED MAINTENANCE. CHRONIC PROBLEM**
- **FREQUENT SLIPPING OF BELTS.**
- **SMOOTHENING OF PULLEY GROOVES**
- **STUCKING UP OF INLET DAMPERS LEADING TO FAILURE OF DAMPER LINKS.**
- **DUE TO DAMPER LINK FAILURE BEARING HOUSING CRACKING & DAMAGE TO IMPELLER.**

IMPROVEMENT ACTIONS

- SUSPECTED FOR MAL-FUNCTIONING OF INLET DAMPERS.
- DAMPER OVERHAULING DONE DURING AUG'2001 & MAY 2003 S/D.
- OVERHAULING OF ALL FANS DONE IN AUG'03- DEC'03.
- BETTER REGULATION OF INLET DAMPER AFTER OVERHAULING.
- CURRENT ACHIEVED IN THE RANGE 125-135 A.
- IMPROVED RELIABILITY.
- AFTER PROLONGED RUN & DUE TO FREQUENT DAMPER OPN PROBLEMS RE- SURFACED.

ROOT CAUSE ANALYSIS

- PROBLEM WAS RE-LOOKED FROM FLOW ANGLE.
- IF 100% ILNET DAMPER OPENING IS ACHIEVED CHANCES OF DAMAGE TO LINKS REDUCED.
- SUSPECTED FOR MISMATCH OF FAN & MOTOR.
- DURING PROJECT STAGE BHEL MIGHT HAVE SUPPLIED STANDARD AVAILABLE FAN & AVAILABLE MOTOR WITH AN INLET DAMPER.
- FANS INSTALLED FOR OTHER GAS TURBINES AT VIJAIPUR/LAKWA LPG PLANTS (FR#3 & Fr#1) ARE OPERATING WITH FULL OPEN INLET DAMPER.

- AS WITH DESIGN RPM ONLY 20%TO 50% DAMPER OPENING COULD BE ACHIEVED. DESIGN RPM OF FAN MAY BE BROUGHT DOWN TO HAVE 100% DAMPER OPENING.

- INTERCHANGED MOTOR & FAN PULLEYS IN ONE FAN ON EXPERIMENTAL BASIS.

PERFORMANCE

PARAMETER	BEFORE MODIFICATION	AFTER MODIFICATION
FAN RPM	1520	1355
AMPEARAGE	130- 140 AMPS	80-90AMPS
TURBINE ENCL. TEMP	50-80 DEG CELCIUS	50-60 DEG CELSIUS
VIBRATION	-	No Significant Change Observed
INLET DAMPER POSITION	PARTIAL 20%- 50%	FULL OPEN

POWER SAVING

- **POWER SAVING FROM ONE FAN**

= √3xVxΔIxCosφ

= √3x415X50x.85

= 30549 Watt per Hr

= 30.549 KW Per Hr

Daily Power Saving = 733 KWHr

Annual Power Saving = 241890 KWHr

ANNUAL POWER SAVING FROM BOTH FANS

= 483780 KWHr

ANNUAL MONETARY SAVINGS

- **MONETARY SAVING FROM ONE FAN DUE TO POWER SAVING = Rs 966240.00**

  FROM BOTH FANS = Rs 1932480.00

- **EXPECTED MONETARY SAVING BY LESSER CONSUMPTION OF SPARES = Rs 60000.00**

- **EXPECTED MONETARY SAVING BY REDUCED MAINTENANCE = Rs 5000.00**

- **TOTAL SAVING = Rs 1997480.00~20 LAKH**

CONCLUSION

- ACHIEVED LOW TURB. ENCL. TEMP - 15 % ↓
- IMPROVED MECHANICAL PERFORMANCE.
- REDUCTION IN NOISE ↓
- REDUCTION IN POWER CONSUMED- 35.67 %
- EXPECTED FOR LESS BELT CONSUMPTION AS PER BELT LOAD REDUCED. ↓
- EXPECTED LESS SPARES CONSUMPTION.

- PERFORMANCE OBSERVED IN ONE FAN , FOUND OK.
- MODIFICATION CARRIED OUT IN ALL FANS.
- POWER SAVING PER FAN PER YR ~ 241890 KWHr
- AS ONE FAN PER GT IS RUNNING ANNUAL POWER SAVING EXPECTED ~ 483780 KWHr
- LESS SUCTION DAMPER FAILURE.
- ANNUAL MONETARY SAVING – Rs 1997480.00

Thank You

गेल (इंडिया) लिमिटेड
पाता

ऊर्जा नीति

गेल पाता प्रभावी ऊर्जा प्रबंधन के साथ उत्पादकता, लागत प्रभावकारिता, पर्यावरण और बेहतर भविष्य पर ध्यान केन्द्रित करते हुए अपने सभी अनुप्रयोगों और सेवाओं के लिए ऊर्जा संसाधनों के दक्ष और सर्वोत्तम उपयोग हेतु प्रतिबद्ध है।

(अनिल कुमार फोतेदार)
कार्यकारी निदेशक एवं प्रभारी अधिकारी

GAIL (India) Limited
PATA

ENERGY POLICY

GAIL Pata is committed to efficient and optimal use of energy resources in all its applications and services through effective energy management with focus on productivity, cost effectiveness, environment and a better tomorrow.

(A. K. Fotedar)
Executive Director & OIC