

Unit Profile:

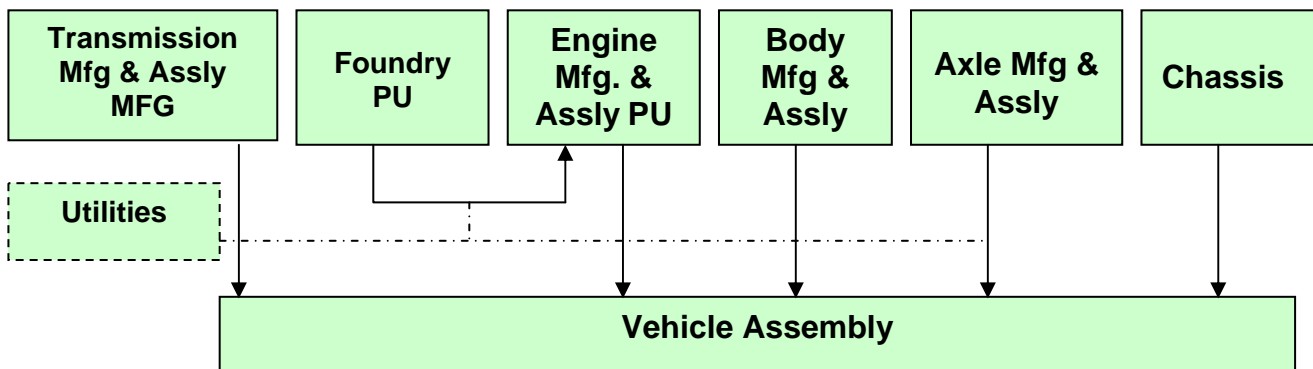
Mahindra & Mahindra Limited is the flagship company of around Rs. 8000 Crores Mahindra group, which has a significant presence in the key sectors of the Indian Economy. The company caters to the Indian & Overseas Market with a presence in Automobile, Farm Equipment, Information Technology, Trade & Finance related services and Infrastructure Development.

There are four manufacturing plants of M&M automotive sector. In Maharashtra, the plants at Mumbai and Nasik manufacture Multi-utility and Sports Utility Vehicles. Engines are produced at Igatpuri plant. Light commercial vehicles and three-wheelers are manufactured at Zaheerabad plant in Andhra Pradesh.

The Mumbai- Based M&M Auto Sector manufacturing plant at Kandivli, received the QS (Quality-system) 9000 Certificate in the year 2000. It is also ISO 14001 certified by RWTuV in the year 2002. The Mumbai plant has received the TPM excellence award from Japanese Institute of Plant Maintenance (JIPM) in the year 2003. It is also a member of the Mumbai Hazardous Waste Management Limited for the safe disposal of waste. The plant adheres to all safety standards to achieve zero accidents. M & M is the first Automobile Company to be recommended for TS 16949 certification by RWTuV in the year 2003. The Kandivli plant has also received the first place in the 'National Energy Conservation Award', for the automobile sector given by the Union Ministry of Power in 2003.

In the year 2003 -04 Automotive Sector vehicle production and sales touched an all time high. Total vehicle sales crossed the 100,000 mark for the first time.

Process Flow Chart

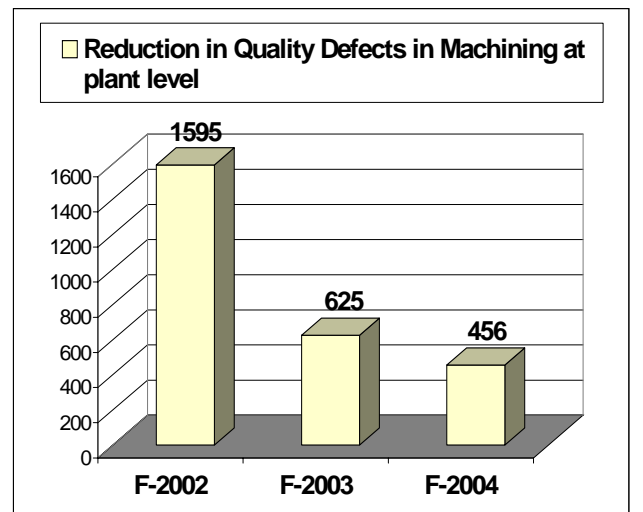
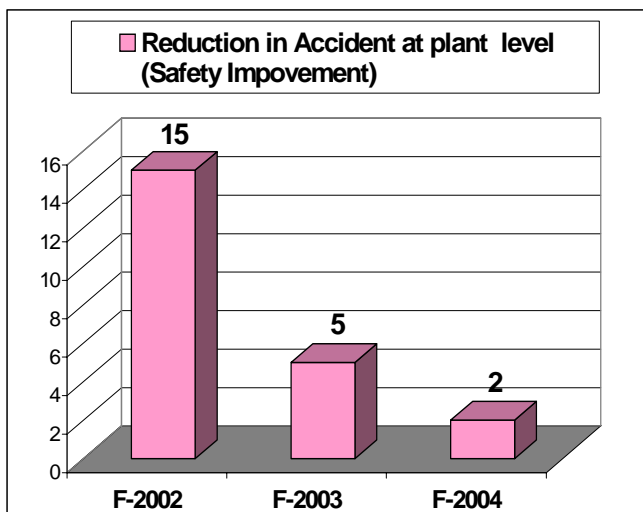
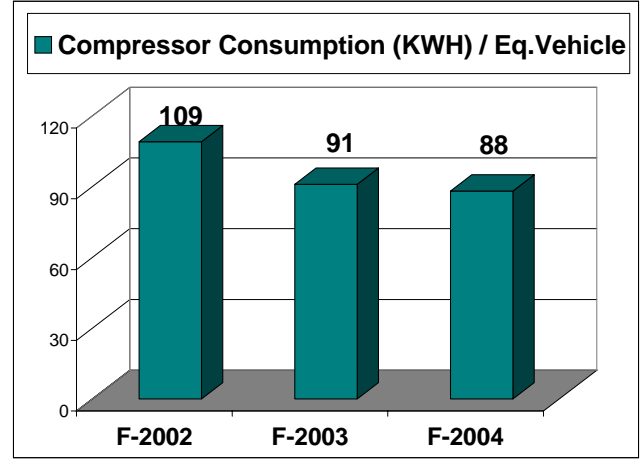
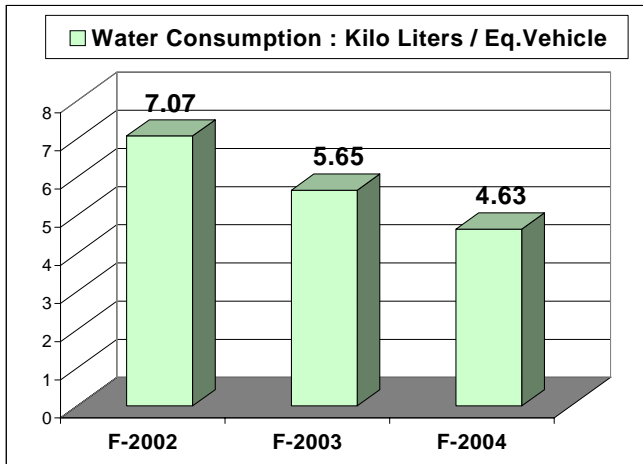
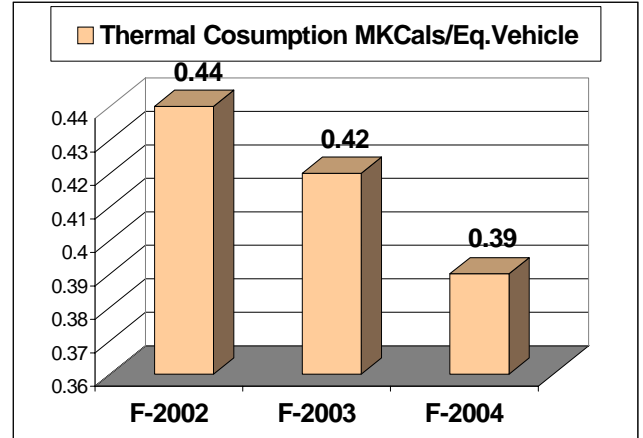
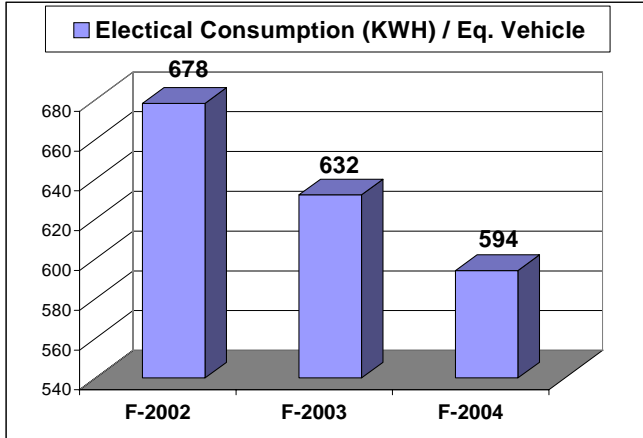


Energy Consumption:

Owing to the implementation of various energy conservation measures and Kaizens, there has been a steady decrease in Electrical and Thermal energy consumption per Eq.vehicle at M&M Kandivli Automotive plant.

DESCRIPTION	UNIT	2001-02	2002-03	2003-04
Annual Eq. Vehicle production	Nos.	37148	42508	52184
Total electrical energy consumption /annum	Lacs / kWh	255	269	310
Specific energy consumption – Electrical	Units/Eq. Vehicle	687	632	594
Total Thermal(Fuel) Consumption/annum	MKCals	16420	17784	20592
Specific energy consumption – Thermal (Fuel)	MKCals /eq. Vehicles	0.44	0.42	0.39

YEAR	ELECTRICITY		THERMAL (FUEL)	
	Consumption (kWh / Eq. Vehicle)	% reduction over 2001-02	Consumption (MKCals/ Eq. Vehicle)	% reduction over 2001 - 02
2001-02	687	-	0.44	-
2002-03	632	8%	0.42	5%
2003-04	594	14%	0.39	11%



Energy Conservation Commitment, Policy and Set Up:

Energy Saved is Energy Generated. Our energy profile consist of Electricity, Gas, Oil, Light Diesel Oil , High Speed Diesel Oil , Kerosene and Water. In-house energy conservation cell which consists of representatives of each dept. meet every month to discuss new ideas and ongoing projects. Quality, Safety & Environment issues are also discussed.

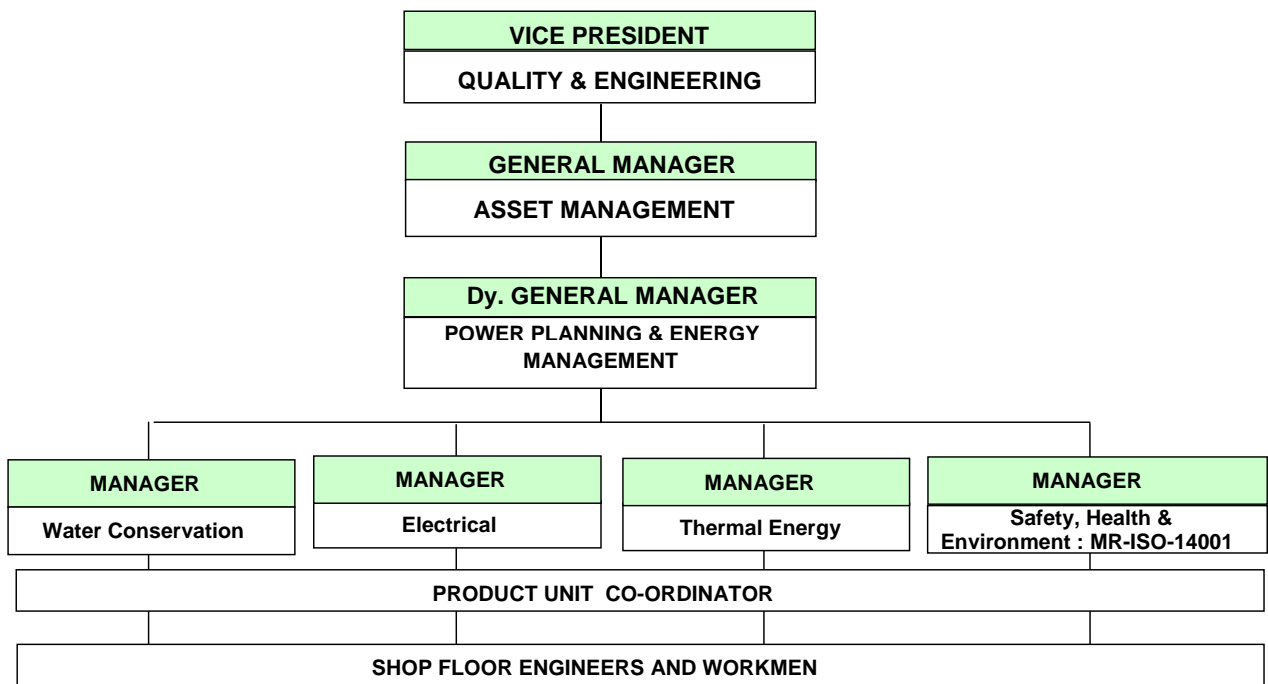
Top management plays an important role in energy conservation. Budget provisions are made exclusively for Energy Conservation projects. Each project is reviewed periodically.

Executives are sent to participate in various energy conservation seminars to explore he possibilities of new ideas like alternate sources of fuels, use of non- conventional energy. A poster and slogan competition on energy saving was conducted, In-house seminar conducted. Under TPM (Total Productive Maintenance) Methodology energy loss is given utmost importance.

ENERGY MANAGEMENT POLICY

- Promote Energy Saving and conservation of resources.
- Use of non-conventional sources of energy.
- Comply with the Energy Legislation and other regulations.
- Promote use of Energy Efficient Alternatives and use of alternate fuels.
- Communicate Energy Management Policy to all employees and encourage their involvement through training and participation.
- Create awareness among all employees for innovative ideas towards Conservation of energy.
- Minimize waste generation and promote disposal, reuse and recycling in an Environment friendly manner.
- To make an effort to reduce the cost continuously every year by adopting effective "Energy Management System"

ECON CELL STRUCTURE



Energy Conservation Plans and Targets:

Energy Conservation Measures (Planned)	Anticipated savings In Energy (Rs. lacs)	Approx. Investment (Rs. Lacs)	Project commencement & completion year
Instillation of VFD for body top coat exhaust air blowers in paint shop.	5.94	3.00	2005
Efficient Air Handling Units.	5.00	5.50	2005
Conversion of 90 kW oven in Foundry from electric to PNG.	9.00	6.00	2005
Install VFD for circulating air blower in paint drying oven	0.24	0.50	2005
Install waste heat recovery for CGC-2 furnace and preheat quench oil.	7.72	10.00	2005
Improve insulation and minimize radiation loss in red primer line.	2.73	5.00	2006
Conversion of conventional machines to CNC machines.	5.50	4.00	2006
Using Fuel cells for power & heat generation.	104.00	600.00	2006
Replace engine testing fresh air blowers with high efficiency blowers.	0.47	0.90	2006
Use of Energy Efficient motors.	9.00	7.00	2007
Effective air conditioning system by atomization using STEFA Control .	8.00	6.00	2007
Installation of wind mill as per Govt. Policy.	1000.00	800.00	2007

All other initiatives like Kaizens, Suggestion schemes, Engineering initiatives will continue.

By adopting the above energy conservation measures, M & M will be able to achieve the set target of 525 kWh / eq. vehicles and 0.36 MKCals / eq. vehicles by the year 2007

ENERGY CONSERVATION ACHIEVEMENTS

During the period 2001-2004, Mahindra & Mahindra has implemented around 300 energy saving proposals through Engineering initiatives, workmen's suggestion schemes, auditor's suggestions and TPM methodology resulting into total savings of Rs. 482 Lacs with an investment of Rs. 84 Lacs. This has resulted in a reduction of 14% in specific electrical energy consumption and 11% in specific thermal energy consumption.

Major projects implemented during the year 2003 – 2004 are listed below:

ENERGY CONSERVATION PROJECTS

1. Automatic Power Factor Controllers for reduction in maximum demand.

Investment : Rs. 2.00 Lacs

Without Automatic Power Factor Controllers

Transmission PU : Max.Demand : 873 Kva
Paint shop : Max.Demand : 623 Kva

With Power Factor Controllers

Transmission PU : Max.Demand : 737 Kva
Paint shop : Max.Demand : 585 Kva
Saving : **Rs 7.80 Lacs / Annum**



2. Energy alert system for air compressors

Investment : 3.00 Lacs

Before Installation :

Power Consumption for Month = 2.03 Lacs Kwh
Eq. Vehicle produced for Month = 3952

Avg. Units / Eq.vehicle = 51

After Installation:-

Power Consumption for Month = 2.02 Lacs Kwh
Eq. Vehicle produced for Month = 4904

Avg. Units / Eq.vehicle = 41.4

Annual Eq. Vehicles = 52184

Annual saving = Rs. 20 Lacs



3. Energy saver screw compressor.

Before Installation :

Power Consumption for Month for
Reciprocating compressors = 0.79 Lacs Kwh

After Installation:-

Power Consumption for Month for
Screw compressor = 0.60 Lacs Kwh

Annual saving = Rs. 9 Lacs



4. Turbine air ventilators in place of roof extractor

Investment : Rs. 0.18 Lacs (2 Nos Req.)

Before Installation:

Roof Extractor : Electrical Consumption : 0.11 Lacs Kwh

After Installation :

Electrical Consumption - Nil

Saving = Rs. 0.44 Lacs / Annum



5. CGC Furnace in Heat Treatment

Ceramic Fiber Insulation & Conversion- LPG to PNG

Before Conversion

LPG Consumption = 2.20 Lacs Kg / Annum
Cost of LPG = Rs. 40.74 Lacs / Annum

After Conversion

PNG Consumption = 2.45 Lacs scm / Annum
Cost of PNG = Rs. 22.05 Lacs / Annum
Saving = Rs. 18.69 Lacs / Annum

Provided Ceramic Fiber Insulation for Reduction in Heat Loss



6. Innovative Technique: Creating wealth from waste (Moulding of Bricks from Foundry Waste)

The Problem :

- Lot of waste like slag, carbon soot is generated in the foundry w factory at throw away price. The plant started using the Foundry repairing.

Bricks made from Foundry waste

The results:

Test results for the samples are encouraging and fulfilling the criteria conforming to IS codes of practice. Compared to the market rates the blocks manufactured by us will be cost effective by at least 40%.



Note: Detailed projects are included in main energy questionnaire.

Other Projects implemented during 2003-2004

- Changeover Relay for Energy Saving Gear Box for 250 watts SON street light fitting.
- Use of 28watts tubes instead of conventional 40 watts tubes.
- Replacing 60 watts M/C lamp with 11 watts lamps at Engine,Axle,Body & Transmission PU.
- Reconditioning conventional machines to CNC machines like 1651 Kirloskar Grinder, 1639 Voumard Internal Grinder, 1690 HMT Hobbing machine.
- Provided photo sensors for conveyor at Gear Carrier Machining Line in Axle PU.
- Automation of Foundry Compressor to Switch ON - OFF as per pressure requirement.
- Ceramic fibre Insulation for Muffle furnace.
- Elliminated use of Rotary Hurth Furnace in Heat Treatment.
- Use of PNG instead of LDO for second thermopac.
- Providing Core Busters for Heat Recovery in CGC-1 furnace in Heat Treatment.

- Provided Recuperator for Heat Recovery in CGC-1 Furnace in Heat Treatment.
- Eliminated use of Muffle Furnace for slot quenching operation.
- Provided electrical float valve to reduce water consumption for Municipal water tanks.
- Use of treated ETP water for gardening purpose.
- Recovery of waste packing material and selling back to vendor at Engine PU.
- Use of waste material of wind shield panel as a raw material for air deflector panel at Press Shop.
- Conversion of P4 engine with MDI 3200 engine for Forklift to reduce pollution level from 85 HSU to 35 HSU. Saving use of diesel per forklift. (Total 8 nos converted.)
- In house seminar on ' Energy Conservation' with external faculties like National Productivity Council , Atlas Copco, Enercon, Croma Engg and Thermax which was attended by participants from all plants of Auto Sector.
- Energy Conservation seminars conducted at our plants at Zaheerabad , Nashik & Igathpuri.

With the implementation of above Energy conservation measures, Plant achieved monetary saving of RS. 184 Lacs in 2003-04 which is about 12% of Total Energy Cost and overall saving of Rs.482 Lacs in last Three years with an investment of Rs.84 Lacs.

Environment & Safety:

For enhancing the Safety standard, company continued its various initiatives on Safety Awareness including Safety Audit, Risk Analysis etc.

Health Care to the employees by providing medical check-ups is organised.

Environment audits (Clause No.4.5.5) are conducted in line with our policy of good corporate citizenship and to maintain the ecological balance in and around our works.

SAFETY:

Safety Patrol Rounds in all units of auto sector are taken on monthly basis by Safety committee members to identify near miss cases. POKA YOKE (Mistake proofing) has been implemented on machines to eliminate accidents. Training & competence (Clause No.4.4.2) program's are conducted to educate and create awareness amongst the employees and the contractors. Through TPM we have achieved Zero Major Accidents at Kandivli due to various safety measures taken. Kandivli plant is adhering to all Safety standards.

HEALTH:

Medical check up campaign conducted for all the employees in all Product Units.

Health History Card are maintained by Works Doctor who is working for their better health. Yoga Classes conducted by Yoga Teacher. Workmen with heart ailment, blood pressure, diabetes have taken advantage of this program.

ENVIRONMENT:

Kandivli plants is already accredited to Internationally recognized Environmental Management System. i.e. ISO-14001. Environmental Management Program (Clause No.4.3.4) identifies projects, where improvements are achieved on continual basis using a Cross Functional Team (CFT) approach.

Hazardous Waste (M&H) Rules, 2003 compliance with Environmental Legislation and Regulation is maintained in Auto Sector. According to Ozone depleting substances rule in 2000, Kandivli plant has started converting air-conditioning equipment to environment friendly CFC free R134 gas. The plant celebrates world environment day on 5th June every year.

Membership of Mumbai Waste Management Ltd. (MWML) for Common Hazardous Waste Treatment, Storage, Disposal facility (CHWTSDF) is availed for this plant.



Title : Automatic Power Factor Controller



Power factor of an electrical network is defined as the cosine of the angle by which the apparent power (KVA) is out of phase with respect to active power (kW).

In the two part tariff system i.e. in respect of H.T. installations, the electricity board bills the consumer for energy charges and demand charges i.e. kWh and KVA respectively. The electricity board also records the power factor of the installation. Mahindra & Mahindra Kandivli plant has installed 2 Micro-Controller based Automatic Power Factor Capacitor (APFC) panels of 150 kVAR capacity each at Transmission PU and Paint shop Sub Station.. The micro controller switches individual 25kVAR capacitor banks ON – OFF depending on load to keep the peak load power factor at 0.95.

Investment : Rs. 4.00 Lacs

Without Automatic Power Factor Controllers :

Transmission PU : Max.Demand : 873 KVA

Paint shop : Max.Demand : 623 KVA

With Power Factor Controllers:

Transmission PU : Max.Demand : 737 KVA

Paint shop : Max.Demand : 585 KVA

Saving = Rs 7.80 Lacs / Annum



Mahindra Title :Energy alert system for air compressors



The EnerAIR SX Control System is installed for Energy Saving & Automation of Air Compressors at our Body PU Compressor House.

Depending on the air demand, the SX Control System automatically operates the most energy efficient sequence & combination of air compressors to meet the demand. The EnerAIR SX intelligently directs the compressors to start/stop, load/unload as per compressed air requirement.

The energy savings evaluation is carried out by comparing the specific energy consumption of the compressors “With” and “Without” SX Control System.

Energy Savings considering Specific Energy Consumption:

- Specific Energy Consumption without EnerAir SX = 51 kWh/Eq. vehicle.
- Specific Energy Consumption with EnerAir SX = 41.4 kWh/Eq. vehicle.
- % Energy Saving = $(51.0 - 41.4)/51.0 \times 100 = 18\%$
- Total equivalent vehicles for 2003-04 = 52184

Annual Energy Saving = 9.6 x 52184 = 5 Lacs kWh

Saving = Rs. 20 Lacs / Annum





Title : Installation of Energy Saver Screw Compressor



Rotary air compressors are positive displacement compressors. The most common rotary air compressor is the single stage helical or spiral lobe oil flooded screw air compressor. These compressors consist of two rotors within a casing where the rotors compress the air internally.

Because of the simple design and few wearing parts, rotary screw air compressors are easy to maintain, operate and provide very good energy saving. Rotary air compressors can be installed on any surface that will support the static weight.

At Utility Compressor House we used to operate 2 nos. of reciprocating air compressors (750+300 cfm) simultaneously before installation of 1000 cfm rotary screw compressor to meet line air pressure requirement.

Before Installation :

Motor capacity of 2 compressors run simultaneously = 240 HP

Power Consumption per Annum for Reciprocating air compressors = 9.5 Lac kWh

Operating Cost = Rs. 38 Lacs / Annum

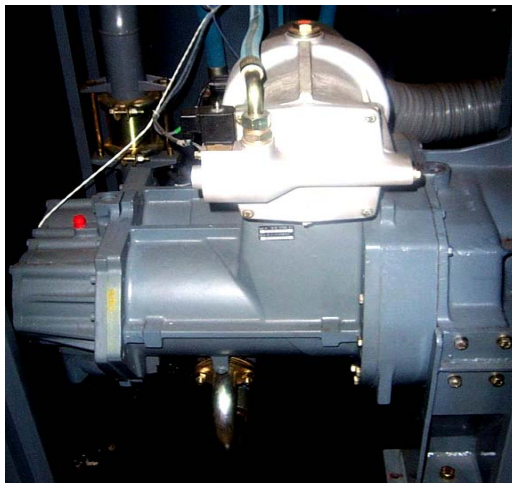
After Installation:-

Motor Capacity of 1 screw compressor = 215 HP

Power consumption per annum for screw compressor = 7.25 Lac kWh

Operating Cost = Rs 29 Lacs / Annum

Saving = Rs. 9 Lacs / Annum





Mahindra

Title : Turbine Air Ventilation System.



Roof Extractor provided for ventilation purpose is normally operated by an electrical motor.

As a technology innovation each conventional roof extractor has been replaced by two nos. of air turbine ventilator which are driven by a non-conventional energy source i.e. wind energy.

Hence resulting in motorless ventilation system causing a considerable saving in electrical energy.

Before Installation :

Roof Extractor : Electrical Consumption per Annum = 0.11 Lacs kWh

After Installation:-

Turbine Air Ventilator : Electrical Consumption : Nil

Investment : 0.18 Lacs (2 Nos.)

Saving = Rs. 0.44 Lacs / Annum



Mahindra

Title : Rx-Gas Generator Conversion (From LPG to PNG)



RX- Generator is used to generate RX Gas which is used to generate atmospheric gas required for the carburizing furnaces . It is used to prevent oxidation of parts and acts as a carburizing agent. This gas is produced by cracking mixture of air & LPG at 1015 c in presence of nickel catalyst and consists of 38% hydrogen, 38% nitrogen and 24% carbon monoxide.

Cost of Modification : Rs. 2.50 Lacs.

Before Conversion :

LPG required per day = 14.9 kg / Hr x 24 = 357.6 kg / day

Rs. 18 / Kg of LPG x 357.6 Kg. X 350 Days = **Rs. 22.52 Lacs / Annum**

After Conversion :

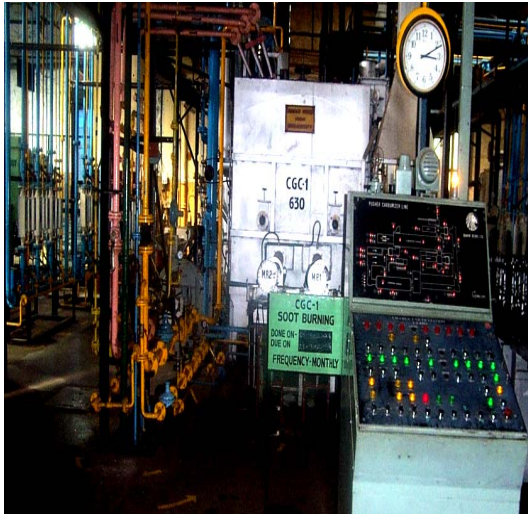
PNG required per day = 22.65 m³ / Hr x 24 = 543.6 m³ / day

Rs. 9/ M³ of PNG x 544 M³ x 350 Days = **Rs. 17.14 Lacs / Annum**

Saving = Rs. 5.36 Lacs/ Annum



Title : Continuous Gas Carborizing -1 Furnace Conversion (From-LPG to PNG) & Ceramic Fiber Insulation



Heat Treatment processes like carbonizing, Annealing, Tempering, Ammonia Nitriding etc. are carried out in Continuous Gas Carborizing Furnace 1(CGC 1) .

The various gears and shafts are heat treated to impart the hardness. The process increases the wear resistance & life of the gear box parts.

The furnace was previously running on Liquefied Petroleum Gas (LPG). With the adequate availability of Piped Natural Gas (PNG), it was decided to convert the furnace to PNG as it is a more efficient, cheaper and environment friendly fuel.

The orifice of all the burners are modified to make them suitable for PNG. The ball valves, flow valves & gas regulators are replaced.

In order to further conserve energy the furnace is provided with Ceramic Fiber Insulation and Core Busters to maintain the required temperature for longer period.

Cost of Modification : Rs. 7.25 Lacs.

Before Conversion :

Rs. 17.96 / Kg of LPG x 900 Kg. X 350 Days = Rs. 56.74 Lacs / Annum

After Conversion :

Rs. 9.14 / M3 of PNG x 1275 M3 x 350 Days = Rs. 40.80 Lacs / Annum

Saving = Rs. 15.94 Lacs / Annum





Title : Creating Wealth From Waste (Moulding Of Bricks From Foundry Waste)

The Problem :

- Asphalt road repairs are expensive, short-lived for a very simple reason that we go on adding layers of bitumen and doing patchwork without really repairing the sub-base. No wonder this patch gives way after the first showers.
- Lot of waste is generated in the foundry which is sent out of the factory at throw away price.

The Solution:

- Taking cue from the paving blocks laid by the Municipal Corporation at the major junctions in Mumbai., We decided to develop paving blocks made out of foundry scrap which can be used in lieu of conventional paving techniques for our plant roads.

The Process :

- Several Permutations & combinations for paving blocks casting were done with different constituents of material content with special emphasis maximum use of scrap material and minimum use of bought out items.
- Paving blocks were subjected to the intensive laboratory test for destructive tests.

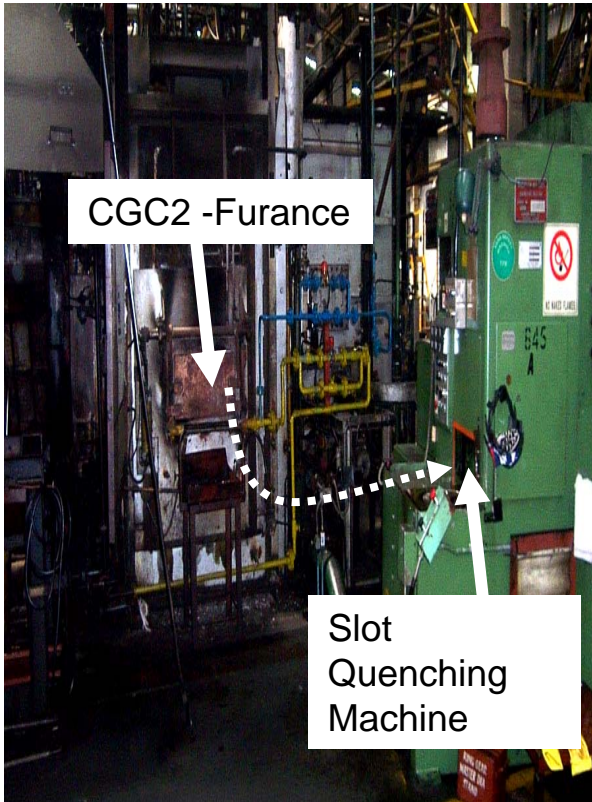
The Results:

- Test results for the samples are encouraging and fulfilling the minimum mandatory strength criteria. conforming to IS codes of practice.
- Compared to the market rates the blocks manufactured by us will be cost effective by atleast 40% .





Title : Reduction In Slot Quenching Process



The various gears and shafts are heat treated to impart the hardness in Continuous Gas Carborizing Furnace (CGC-2) located at Transmission PU Heat Treatment. Previously It used be sent to a Muffle Furnace for pre-heating before quenching operation.

By process change the pre-heating operation in muffle furnace has been eliminated.

Now the parts are directly sent for quenching operation from CGC-2 Furnace.

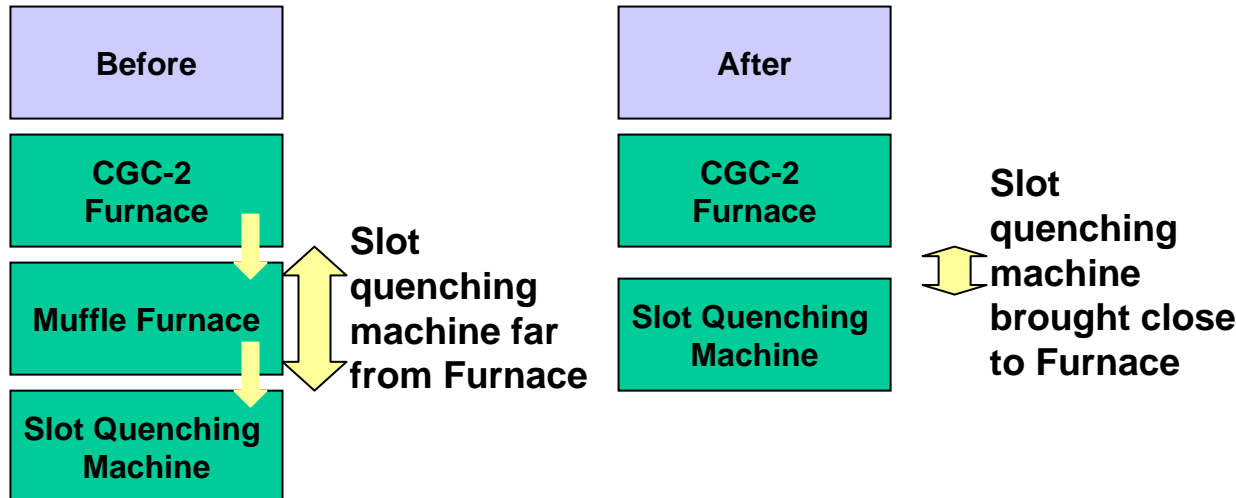
Before Process Change :

$$\text{Rs. 9.14 / M3 of PNG} \times 1733 \text{ M3} \times 300 \text{ Days} = \text{Rs. 47.52 Lacs}$$

After Process Change :

$$\text{Rs. 9.14 / M3 of PNG} \times 1164 \text{ M3} \times 300 \text{ Days} = \text{Rs. 31.92 Lacs}$$

Saving = Rs. 15.60 Lacs/ Annum





Title : Hazardous Waste Management



Mahindra & Mahindra Automotive Sector Kandivli plant has now become a registered member of **Mumbai Waste Management Limited**, for safe and secure disposal of hazardous waste.

As per regulation a separate area has been allocated for the safe storage and disposal of hazardous waste generated in the plant like paint sludge, oil immersed coolant, batteries etc.

The hazardous waste is lifted by a consented transporter of Mumbai Waste Management Limited and sent to a dedicated area at Taloja regularly.

Yearly cost of Rs. 35 Lacs is spent on the disposal of Hazardous waste keeping in view Environment and Safety aspect of the society.





Title : Recycle & Reuse of Waste Material

Before:

In Press Shop operation side panel of a vehicle is manufactured from sheet metal. The waste material generated was scraped and disposed.

After:

The waste material generated from the side panel operation is used as a raw material to manufacture Cowl Side Panel .

Reuse of waste material 370 Tons / Annum

Similarly waste management has been adopted in Engine PU , transmission PU, Axle Pu, Foundry Pu by recycling the packing material , use of corrugated boxes , plastic bins etc.

Saving of Rs. 13.82 Lacs / Annum

