

Heavy Water Plant (Manuguru)

Unit profile:

Heavy Water Plant, Manuguru is an ISO-9001(2000) & 14001(1996) Certified Organisation, owned by Heavy Water Board, Mumbai, Department of Atomic Energy, Government of India. The plant is designed to produce 185 MT/year of Nuclear Grade Heavy Water (D₂O) with high Safety, Quality and Environment standards. The principal customer for our product in our country is M/s Nuclear Power Corporation of India Limited (NPCIL) who use our product in their pressurised heavy water based atomic power plants as a coolant and moderator. We have also exported our product to South Korea and China. HWPM meets it's power and steam demands through captive power coal based thermal cycle. HWPM contributes a lion share of 45% of the country's production based on indigenous technology.

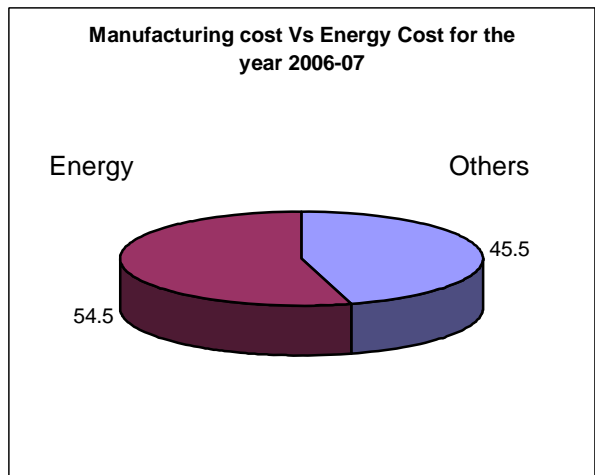
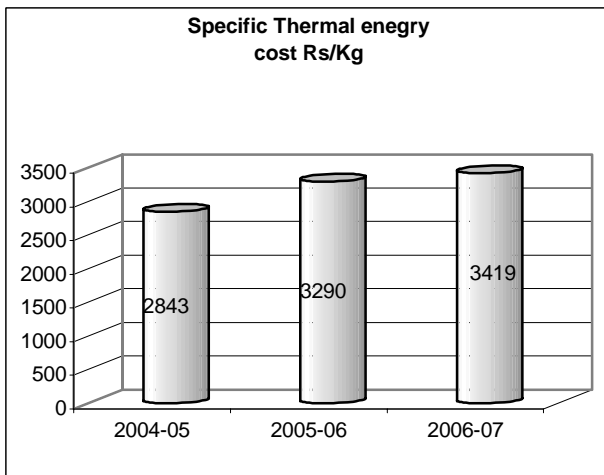
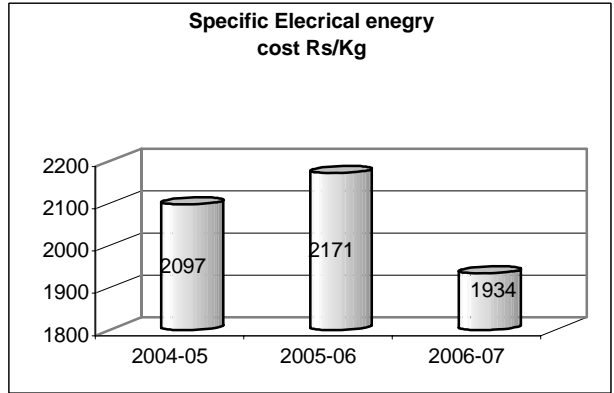
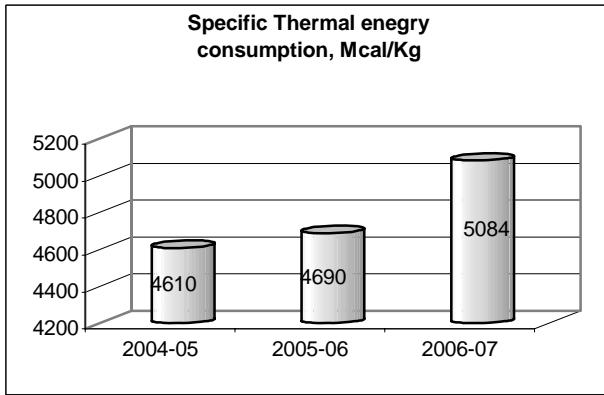
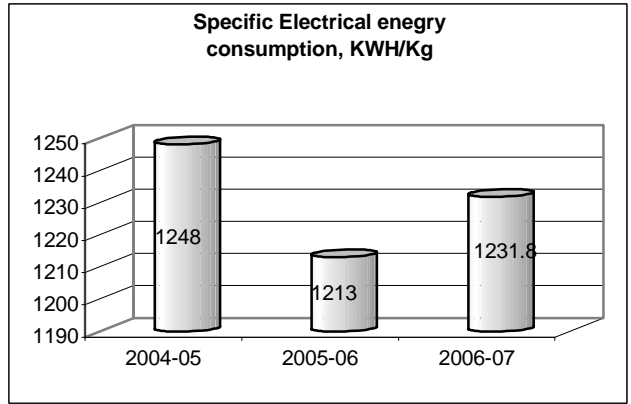
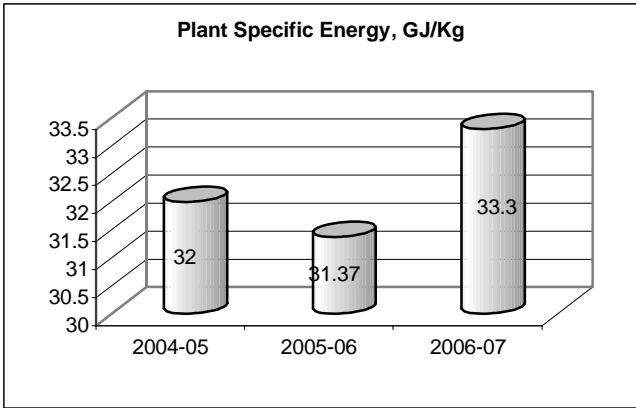
HWPM has won the "Excellent Energy Efficient Unit" award for the year 2006-07 organized by Confederation of Indian Industries (CII).

(II) Energy Consumption:

Specific Power Consumption Details	Unit	2004-2005	2005-2006	2006-2007
Annual Production (% of design)	% Design	136.25	140.37	119.69
Total Electrical Energy consumption per annum	Kwh(Lakhs)	3145.97	2363.0	2968.1
Total Thermal Energy consumption per annum	Kcal.(Million)	1161353	1099071	1125718
Total Manufacturing cost	Rs. Lakhs	13162	13926	13116
Total energy cost	Rs. Lakhs	6866.5	6963.0	7148.1
Energy cost as % of manufacturing cost	%	52.2	50.0	54.5
Specific Energy	GJ/Kg	32.0	31.37	33.3
Specific Electrical energy consumption	KWH/Kg	1248	1213.3	1231.8
Specific thermal energy consumption	Mcal./Kg	4610	4690	5084
Specific electrical energy cost	Rs./Kg	2097	2171	1934
Specific thermal energy cost	Rs./Kg	2843	3290	3419

Following are the various reasons for higher energy consumptions during the year 2006-07 inspite of actually reduced energy consumption.

- Heavy Water Plant (Manuguru) has two production streams. The major turn around (MTA) activities are normally taken up every alternate year for each process stream. During the period 2004-05, no MTA was there in any of the streams.
- Retrofit of DCS system in Unit-2 & 3 of power plant was taken up during the year 2006-07. This has resulted in higher energy consumption, due to unproductive operation.
- During 2006-07, export of power up to ~12 MW to the grid (APTRANSCO) was there which has resulted in higher heat rates of power generation.



(III) Energy conservation commitment, policy and organization set up

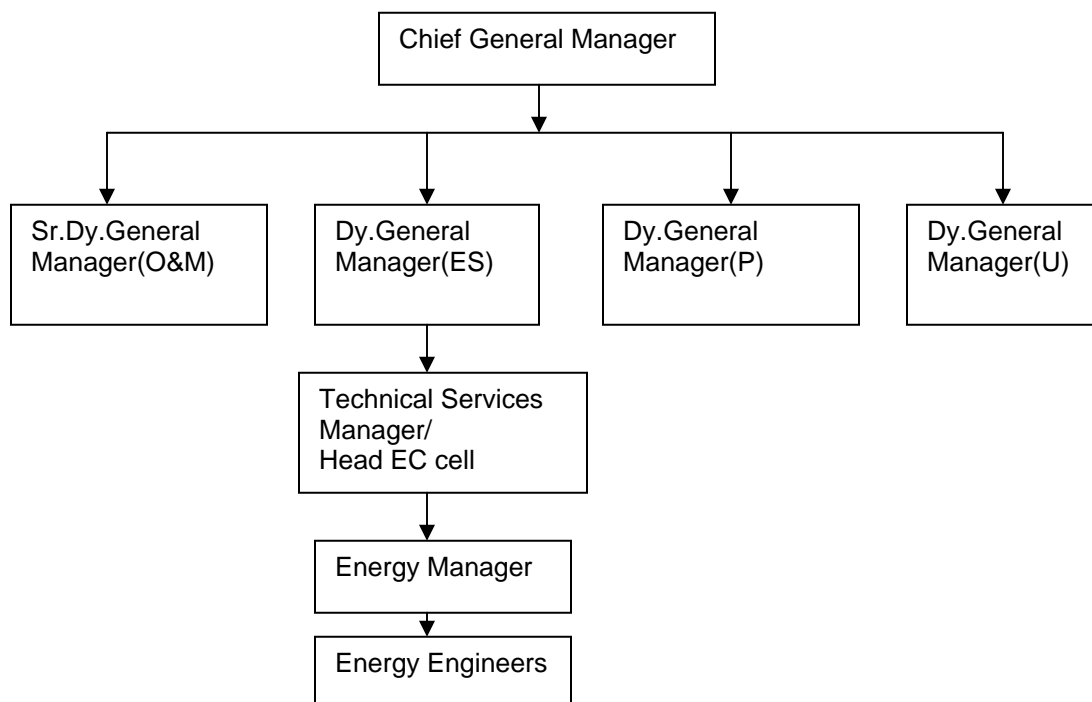
Energy Management Policy

Heavy water plant (Manuguru) is committed to well defined energy policy formulated by Heavy Water Board. The policy in our case is to pay focused attention to all aspects of plant operation and maintenance activities with a view to reduce energy consumption and also identify and implement plant modifications that can result in energy saving with specified limit on pay back period for the capital invested. The energy policy was translated into specific objectives and these objectives are given wide publicity in the plant. Matching action plans are evolved for implementation of energy objectives.

- Maximising production through highest utilization of plant equipment
- Fine tuning of operating parameters to closer to design
- Improvising on stream factor through better maintenance practices and reducing plant planned down time
- Continual Maintenance of heat exchange equipment for their highest efficiencies
- Fast track implementation of energy saving schemes
- Adoption of Re-use, re-cycle and recovery philosophy
- Hydro dynamic Study of process loops and cutting down excess design fats.
- Motivating, training and encouraging our employees to achieve the target of reducing specific energies by employee awareness programmes.
- Continuous monitoring and review of energy consumption pattern

Salient features of energy conservation cell:

Well defined organisation for energy conservation is set up with an apex committee at site comprising senior officers headed by Chief General Manager of the plant. The plant is in constant interaction with Heavy Water Board for effective implementation of policy and achieving the objectives. The committee is committed for fine tuning operations, maintenance, technology upgradation with energy efficient process and equipment, motivating and training employees in reducing specific energy consumption.



(IV) Energy Conservation achievements:

1. **Installation of smaller capacity ash slurry pump:**
Due to availability of better quality coal & reduction in steam demand over a period, ash generation is reduced. Existing pumps of high capacity were operating inefficiently, so new pumps of smaller capacity were installed which resulted in saving of ~100KW power.
2. **Export of power to grid & commissioning of new DCS system:**
Retrofit of DCS system in Unit-2 & 3 of power plant was taken up during the year 2006-07. This has resulted in higher energy consumption, due to unproductive operation. During 2006-07, export of power up to ~12 MW to the grid (APTRANSCO) was there which has resulted in higher heat rates of power generation. Though export of power to grid has negative effect on our sp. Energy consumption figures, it is done in national interest.
3. **Installation of smaller capacity cooling water pump:**
After installation of vapour Absorption refrigeration system in place of vapour compression refrigeration system to meet the refrigeration load of generation of chilled water required for the process, the cooling water requirement has increased by about 1000 m³/hr. This was forcing operation of an additional cooling water pump of capacity 4500 m³/hr, which was consuming around 750 KW of power.
A smaller capacity cooling water pump of 1200 m³/hr capacity has been installed, to meet the requirement of segregated systems, which demand higher head. And this has resulted in a net saving of 400 KW of power.
4. **Improvements in system hydraulics of chilled water pump:**
The chilled water system was having large system resistance in the overall loop. The NRVs at the discharge of the pump and flow control valves in the loop are the major areas causing large pressure drops. The head developed by these pumps was 120 m as against the actual system resistance of ~40 m for the rated flow (1500 M³/hr). A new pump of same capacity & 40 m head is installed, which has resulted in a saving of 280 KW of power. The scheme was implemented in Oct-06.
5. **Spray water for desuperheating from 4th stage of BFP:**
Spray water for de-superheating of 30-bar steam was being taken from boiler feed pump discharge header, which is at 135 bar. The quantity of water required was ~25 TPH. Actual water pressure required for de-superheating was ~60 bar.
A tapping from the 4th stage of boiler feed water pumps is taken, where the pressure available is 60 bar, which is sufficient for de-superheating. This has resulted in power saving of ~60 KW apart from saving in maintenance cost of piping & valves, which were getting eroded frequently due to huge pressure drop across the system. The scheme was implemented in Mar-07.

(V) Energy Conservation plans and targets:

Energy conservation measures planned	Expenditure in Rs lakhs	Anticipated energy savings Rs in Lakhs	Expected date of completion
Changes in inst. air system at MP/ CPP	50	60.5	2008-09
VSD for condensate extraction pump	6	10.1	2007-08
Installation of VSD for FD fans	90	47	2007-08
Aux.steam turbine	500	588	2008-09
Installation of structured packing in all the columns of both XUs and variable speed drives for A1,A2 and B2 gas boosters.	---	1165	2008-09
VFD for 12-K-105 booster	110	25.2	2007-08
Increased Heat recovery by installing additional PPX and WS Heat Exchangers.	---	770	2007-08
Installation of solar based street lights	3.5	17	2007-08
Revamp of air conditioning system	---	50	2008-09

Specific Energy consumption planned Target for the year 2005-06 & 2006-07:

Year	Electrical & thermal, GJ/Kg	Reduction over the year 2005-06
2006-07 (Base year)	33.3	-
2007 - 08	31.5	5.4%
2008 - 09	30	9.9%

Anticipated money saving at the end of 2006-07 = Rs.668 lakhs

(VI) Environment and safety**Safety :**

HWPM has a fully dedicated safety department which ensures compliance of safety measures by O&M group, authorize the jobs to be carried out strictly following the guidelines of factories act and Atomic Energy Regulatory Board norms through work permit procedures.

Safety personnel are engaged in round the clock shifts, supporting shift superintendents of the plant for all safety related requirements. HWPM has documented on-site and off-site emergency prepared plans and exercises are conducted on regular basis.

HWPM has an attached first aid and occupational health center to central control room equipped with ambulance, resuscitator equipment and required rescue and first aid medicines.

Environment**Liquid effluents:**

HWPM maintains a separate team to achieve zero leakages of water, steam, air and chemicals. A scheme of awarding best operating unit for house keeping is in force for encouraging good house keeping.

HWPM is proud of continually obtaining cess rebates initiated by AP pollution control board for compliance of statutory and legal limitations on effluents.

Air:

SPM level in flue gases is maintained below 80 mg/M³. **Heavy Water Board has the patent for flue gas conditioning through ammonia injection for control of SPM levels in stack.**

Solid:

Around 20% of fly ash generated is utilized in brick making. Balance ash is deposited in ash ponds as slurry. Dry fly ash collection & storage system is being installed after which 100% ash utilization is likely to be achieved.
