

Heavy Water Plant Hazira

(i) UNIT PROFILE

Heavy Water Plant (HWP), Hazira has been setup by the Heavy Water Board (HWB), Department of Atomic Energy (DAE), Government of India at Hazira, near Surat, Gujarat State. The Plant is designed to produce 110 MTPA of heavy water using synthesis gas as the feed stock. Operation and maintenance of the plant is entrusted to M/S. KRISHAK BHARATI COOPERATIVE LIMITED (KRIBHCO). M /s. KRIBHCO is one of the premier fertilizer (Urea) manufacturers of India having its corporate office at NOIDA. The HWP is integrated with the ammonia –urea complex of M/S KRIBHCO.

Commercial production from HWP, Hazira began in January 1991. The plant has been producing consistently since then. The total capital cost in setting up the plant and township is Rs. 230 crores. The total number of employees at HWP, Hazira is 250.

The plant is operated and maintained by M/S. KRIBHCO as per the directive of the Site In-charge of HWP, Hazira. The Site In-charge of HWP, Hazira is a senior officer of HWB, DAE, Government of India presently designated as General Manager (H).

Since it is a DAE installation, its annual reports are not made public. Therefore, it is not possible to submit the same to BEE for review.

BRIEF PROCESS DESCRIPTION

The HWP is based on the mono-thermal Ammonia-Hydrogen exchange process using synthesis gas ($3\text{H}_2 + \text{N}_2$) from Ammonia Plants of M/S. KRIBHCO as feedstock. In the process deuterium is transferred from synthesis gas to liquid ammonia at a temperature of -25°C and at a pressure of 230 kg/cm^2 in isotopic exchange towers. Deuterium concentration in feed synthesis gas is extremely low (105 – 110ppm), hence enrichment of ammonia is carried out in a number of stages through mass cascading. Deuterium rich ammonia so obtained from the cascade is then cracked into its constituents. This cracked gas is subsequently burnt with air to produce heavy water of about 50 to 60% concentration. This off grade heavy water is distilled under vacuum to produce nuclear grade heavy water (Concentration 99.83%). There are two parallel streams for extraction and enrichment of Deuterium with Ammonia crackers & common synthesis unit, final product unit and other common utilities like Water pre-treatment plant, Cooling water, Inert gas (Nitrogen) plant, Instrument air plant, Effluent treatment plant, Fire water system etc.

The isotopic exchange process is energy intensive since enrichment requires is of the order of 9000 times and handling of large quantity of feed stock. However the specific energy consumption at Hazira is lowest amongst all the Heavy Water Plants in India. India is the only country in the World where this process is successfully employed for production of Heavy Water.

(ii) Energy Consumption

Energy Consumption per unit production of major energy consuming products.

| Year | Product | Specific energy consumption | | |
|-----------|-------------|--------------------------------------|-------------------------------------|--|
| | | Electricity kWh /kg D ₂ O | Natural gas Scm/kg D ₂ O | GJ/kg of D ₂ O (electrical+thermal) |
| 2000-2001 | Heavy Water | 1501.59 | 279.4 | 30.65 |
| 2001-2002 | Heavy Water | 1201.00 | 244.6 | 25.30 |
| 2002-2003 | Heavy Water | 1123.00 | 237.4 | 24.00 |

GJ = Electrical Energy x 4.184 x 3100 + Natural Gas x 9500 x 4.184

Electrical Energy = Million kWh

Natural Gas = Gas consumed in million standard cubic meter

***Computer graphics are enclosed as Annexure-II (Page 01 to 04).**

(iii) Energy Conservation Commitment, Policy and Set up

The Heavy water production process is highly energy intensive. Energy conservation is an integral part of the production planning process. Two main energy categories in this process are electrical energy (used for compression of synthesis gas, refrigeration and running of utility machines) and thermal energy (used to crack the liquid ammonia into its constituents) in Ammonia Crackers. Cracking is achieved by burning natural gas in crackers. "CONSERVE ENERGY" is the motto of HWP, Hazira. The entire team of HWP, Hazira has been putting wholehearted efforts towards minimizing energy consumption. The annual specific energy consumption per kilogram of heavy water has reduced from 33.81 GJ/kg in 1991-92 to 24.03 GJ/kg in 2003-2004. This reduction in energy consumption of 28.93% has been possible because of the continuous operating process, monitoring and consistent campaign for energy conservation. It is felt that the achievement in energy conservation of HWP, Hazira is note-worthy and can be compared with similar Heavy Water Plants and other Chemical Plants in India. Specific energy consumption figures achieved at HWP, Hazira are the lowest among all the Heavy Water Plants in India. The achievements are significant and this may be recognized to boost the morale of HWP, Hazira.

Since commissioning of the plant, a number of energy saving schemes have been implemented in Heavy Water Plant, Hazira. Monetary saving achieved due to implementation of scheme during 10th plan are listed below.

(iv) Energy Conservation Achievements

1. Installation of Three Check valves and One No. Globe valve:

Earlier in main plant these check valves and one globe valve were offering a high pressure drop across them. It was decided to replace these check valves and globe valve with higher flow area resulting in a lower pressure drop. As a result of this the pressure drop in the loop has reduced by 12.0 kg/cm² and in terms of energy it works out to be 24.0 lacs. Kwh per annum.

2. Installation of additional Heat Exchanger in the Flue gas Path of Cracker B

In main cracker of Plant B flue gas outlet temperature was 260°C. It was decided to install an extra tube bundle to reduce the flue gas outlet temperature. This modification has resulted in reduction in flue gas outlet temperature by 80°C. this has resulted in reduction of 2.16 lacs SM³ Natural Gas per annum.

3. Replacement of some Less efficient Pumps with More efficient Pumps:

Two no. of pumps were replaced with new generation high efficiency pumps in Raw water pump house and in Effluent Treatment Plant. This has resulted in 0.8 lacs kwh per annum electrical power saving.

4. Replacement of burning unit with 24 Unit:

In the plant Heavy water is produced by burning of deuterium extracted in main plant. This activity is carried out in 18 Unit. In this unit some loss of the product occurs. To eliminate these losses this unit is being replaced with a modern technology of NH₃ Water Exchange.

5. Reduction of electrical MD:

The present electrical power demand is 20 MVA. This is being reduced to 17MVA. This will result in saving of Rupees 145.4lacs per annum.

(v) Energy Conservation Plans and Targets

| Energy Conservation Measures (Planned) | Anticipated savings In | | Approx. investment (Rs.Lakhs) | Project Commencement & Completion year |
|---|------------------------------|-----------|-------------------------------|--|
| | Energy value (specify units) | Rs. Lakhs | | |
| (1)Speed reduction of booster compressor | 24.0 lakh kWh | 213.8 | 45.0 | 2004-2005 |
| (2) Setting up of steam turbine for utilization of steam turbine for generating power & setting up of vapour refrigeration system | 160.0 lakh kWh | 1452.3 | 500.0 | 2004-2006 |
| (3) Redesign of main cracker furnace. | 8360 Mkal | 28.45 | 40.0 | 2004-2006 |

(vi) Environment and Safety

Heavy water Plant, Hazira (HAEP) maintains an environmental management system, conforming to ISO 14001 : 1996

Considering its aim of Continual Improvement and Environmental Performance following schemes have been implemented in the last three years.

1. Installation of oil skimmer to reduce oil content in effluent.

2. Phasing out of Carbon Tetra Chloride which is an Ozone depleting substance.
3. Use of liquid effluent of delay pond for Horticulture purpose, which results in decrease in the final liquid effluent discharge and also saving of precious water.
4. Increasing the height of DG set exhaust pipe to 7 meters above roof level to increase the dispersion and dilution of the emission which will decrease the air pollution in the surrounding area.
5. Additional 900 Nos. of trees has been planted at site and 200 trees in township to strengthen the existing green belt.