Non Implemented Case Study– Energy Conservation Measure

Measure
Improvement in vapor absorption chiller operation by improving the quality of steam
Equipment
Vapor absorption chiller
Industry / Sector
Bulk drugs
Year of Implementation
Implemented during 1996 but failed, recommended for replacement
Cost Benefit Analysis
‹› Type of Measure: Medium term
‹› Annual Energy Savings: 13.80 KL of HSD
‹› Actual cost savings: Rs.1.30 lakh
‹› Actual investment : Rs. 2.00 lakh
‹› Payback: 1.5 year
Implementation Highlights
▱ Implemented but failed ▱ During the energy audit study, it was suggested to improve the distribution network. After improving the distribution network the problem remained without much of improvement and no significant savings were noticed. ▱ Post implementation review indicated that actual problem lied in the boiler hence the measure failed to yield the energy savings. ▱ The plant has non-IBR boilers, which are inefficient in giving high quality steam resulted in poor performance of the vapor absorption unit. ▱ Plant decided to stop the boiler operation and take the steam from other boilers whenever there is lean load on the other boilers, since the investment is high.

Summary	Improvement of steam quality and distribution will improve the energy efficiency of vapor absorption chiller

Background

Plant has one double effect vapor absorption unit VAU of rated capacity 180 TR to meet the air conditioning load of the plant. During the DEA study it was observed VAU was generating 110 TR. One non-IBR boiler is used to generate the steam required by VAU.

The specific steam consumption of VAU was estimated at 5.65 kg/TR as against normal consumption of 3.7 kg/TR. The high steam consumption was due to low steam pressure at VAU.

The actual steam pressure at VAU was 3.3 kg/cm^2 while at the boiler it was 8.0 kg/cm^2 and the required pressure for VAU was 8.0 kg/cm^2. Hence high-pressure drop in the line was observed in the distribution line.

Audit team suspected the condensate in the line and generation of wet steam in the boiler causing high pressure drop and hence suggested installing a steam trap in the distribution line to reduce the pressure drop which will improve the performance of the VAU.

The plant personnel have installed steam trap in the distribution line. Not much of improvement was found.

Year of implementation	: End of 1996
Time taken to implement	: 3 days
Investment incurred	: Rs.5000

During the post audit review detailed analysis was made to pin point the factors contributing for lower performance of the VAU. The analysis revealed that there is a mismatch of the system rated capacities of VAU and steam boiler. The VAU requires steam (3.75 kg/TR at a pressure of 8.0 kg/cm^2) of 666 kg/h to generate 180 TR. The total steam required will be of 720 kg/h after considering line losses of 8%.

The rated capacity of the boiler connected to the VAU is 600 kg/h at 15.0 kg/cm^2. After considering the line losses of 8% the steam (dry and wet) supplied to the VAU is only 550 kg/hr provided boiler is generating steam at the rated capacity. In actual practice normally such very small capacity boilers will generate steam of dryness fraction of ↑ 0.9.

The actual dry steam supplied to the VAU is 490 kg/h after considering the dryness fraction of 0.9. The TR generated with 490 kg/h of steam is maximum of 130 TR. In actual practice the TR generation is 110.

Scope for further improvement :

It is recommended to discuss with boiler supplier and VAU supplier to clarify and check the rated and operating capacities of the equipment. The improvement in TR generation can be achieved either by replacing the boiler with higher capacity on or connect the header of the to the main steam header.

Techno-economics:

HSD savings	: 13.80 kl/year
Cost savings	: Rs 1.31 lakh/year
Investment required	: Rs 2.00 lakh exchange offer
Payback period	: 1.5 years

Principle

Steam quality (dryness fraction) plays vital role on steam utilization aspects. Higher the dryness fraction more steam economy can be envisaged.

Lower the dryness fraction high condensation in the lines will take place there by results in more distribution loss. The condensation of steam will also results in water hammer, poor heat transfer co-efficient, etc.