

Non Implemented Case Study– Energy Conservation Measure

Measure
Waste heat recovery for DG sets by generating the steam for a vapor absorption unit
Equipment
Diesel Generation sets
Industry / Sector
Glass
Year of Implementation
-
Cost Benefit Analysis
⦿ Type of Measure: High investment
⦿ Annual Energy Savings: 10.65 lakh kWh
⦿ Actual cost savings: Rs.47.9 lakh
⦿ Actual investment : Rs. 95.00 lakhs
⦿ Payback: 2 years
Implementation Highlights
<ul style="list-style-type: none"> ☞ The measure is not implemented for many reasons. ☞ High initial investment. ☞ The interruptions in power supply will lead to huge production loss and associated losses. Plant personnel have the feeling that if waste heat recovery unit is installed it may case more interruptions in power supply. ☞ The installation of equipment requires sufficient down time of DG sets (which are operated continuously) which is not possible during the production of the plant. The plant is stopped once in three or four years. ☞ The plant also feels that no expertise or exposure in the proposed system is available with in the plant since it calls for different technology. ☞ The capital requirement is very high and the decision has to be taken at the higher level. ☞ The installation of the waste heat recovery system requires approval from the supplier of the DG set since it is under the annual maintenance contract. There was no favorable reply from the DG set supplier

Summary

Installation of waste heat recovery system in Diesel Generator set exhaust gases will results in partial heat recovery by generating steam which can be used in vapor absorption chiller.

Background

The plant has 2 X 3 MW Diesel generator set to meet the power requirement of entire plant and one is operated while another is kept as standby. The normal load of the plant on the DG set is about 2.2 –2.4 MW.

It is known that about 30% of the input heat energy to the DG set is exhausted through the exhaust gases.

Plant also has 360 TR of refrigeration system (using centrifugal compressor) of which about 180-200 TR is generated for the production applications.

In view of exhaust heat available in the DG set and requirement refrigeration load in the process, waste heat can be recovered by generating steam. The steam can be used to generate refrigeration effect by installing the vapor absorption system.

To implement this measure one waste heat recovery boiler (WHRB) to generate steam and vapor absorption chiller (VAC) to generate chilled water are required. The present chiller load can be transferred to the vapor absorption chiller. The analysis is as follows

Techno-economics:

Installed capacity of the DG set : 3000 kW

Present average load : 2200 kW

Simultaneously the plant was implementing various energy conservation measures. The saving potential of these measures was estimated at 200 kW. The waste heat recovery potential is estimated after considering the impact of various energy conservation measures.

Expected average load : 2000 kW

Estimated quantity of steam generation : 1000 kg/h

Steam generating pressure : 10 kg/cm²g

Cooling capacity can be obtained : 225 TR

The values of quantity of steam generation from WHRB and the cooling capacity of VAC was obtained from the calculations and again confirmed by the suppliers of such systems. (It was also confirmed that additional 200 TR could also be generated if the heat rejection from jacket cooling is also harnessed)

Present TR requirement	: 200 TR
Power consumption in present chiller	: 148 kW
Average operating hours	: 7200 per year
Annual power savings	: 10.65 lakh kWh
Annual cost savings	: Rs. 47.9 lakh
Investment required	: Rs.90.00 lakh
Payback period	: 2.3 years

Principle

- ☞ Waste heat is available in many forms and grades. It can be recovered by installing waste heat recovery boiler (WHRB) conveniently to the exhaust of equipment (DG sets, furnace, kilns, etc)
- ☞ Almost all WHRBs are similar to conventional boilers but mostly with out first radiant heat transfer tubes. These are generally designed for low gas entry temperatures than conventional boilers hence results in larger in size
- ☞ Normally the exhaust temperature should be above 400°C for effective generation of steam
- ☞ The major benefit apart from the fuel savings are 100% depreciation in the first year of the operation
- ☞ Another feature is, now a days the WHRBs are available with supplementary firing system to enhance the reliability in the operation
- ☞ The major factor to be considered during the installation of WHRB is increase in the back pressure on the DG set and how this is addressed during the operation of the implemented measure