Application of VSD for Boiler Feed Pump
Successful Case Study

In one of the food processing industry having steam boiler based co-generation system, plant had a problem to start boiler feed pump on the DG set and other electrical related problems. This paper presents how the plant had over come this problem by installing Variable Speed Drive (VSD) to the boiler feed pump in addition to huge energy and savings. The paper also gives the details of actual energy and cost savings realized.

Brief description of the site

In one of the food process industries, the main source of electricity is through co-generation plant and supply from grid through 33 kV supply. Both these sources are synchronized. The co-generation plant meets the demand of steam and power required by the process passing high pressure steam through a back pressure turbine. Plant has two DG sets of 750 kVA and 250 kVA.

During the plant normal operations the entire electricity demand is met by the co-generation plant unscheduled outage co-generation unit, the plant draws the power grid and from 750 kVA DG. How ever since the plant is located in rural region there were frequent shutdown of power supply from grid. The duration of non availability of power exceed more than 10 hours per day. In view of this plant has to depend on its own co-generation plant and DG sets.

Many a times when the co-generation plant has to be started, the grid supply was not available and the co-generation auxiliaries such as boiler feed water pumps, fans, etc has be started on DG sets. Hence when ever boiler feed pump is started current on DG set, due to high starting current, the voltage of DG set reduces drastically and the DG trips and plant has to wait till the grid supply is resumed to start the captive power plant as a result production was affected.

Detailed energy audit of the plant has carried out in this plant to identify the energy savings measures and over come the problems.

Analysis and Findings

During the audit study the DG sets, co-generation plant auxiliary loads were studied in detail to arrive appropriate solution. The salient features of the analysis are:

- Boiler feed pump of co-generation plant has a rated flow of 41000 kg/h and heat 92 kg/cm^2. The major co-generation auxiliary loads are boiler feed water pump (BFP) of 200 kW and loaded to 145-150 kW.
- The auxiliaries such as FD, ID fans, condenser, cooling tower fans, etc. amounts to a total load of 350 kW.
- During the grid power interruption, in order to start co-generation plant all the auxiliaries has to be taken on DG set, till it starts power generation and taking over all the loads. This problem of taking up of BFP on DG set was due to high starting current, which cause DG set to trip due to under voltage.
- The steam generation of the plant is varied depending up on the process requirement since most of the unit processes are of batch type hence the BFP out put is varied.
- At 85% of boiler loading (which is normal operating load) the feed pump discharge control valve position was at 50% opening. Pump discharge pressure (before the control valve) is higher by 30% than the after valve pressure. The schematic diagram is depicted below:
- The pressure drop across the control valve is 16 kg/cm^2 which is very high

Recommendation

In order to over come the start up problems of cogeneration plant on DG sets and to obtain energy savings in boiler feed pump, as the boiler fed pump is being throttled and % valve opening is varied, application of Variable Speed Drive to the boiler feed pump was suggested by the TERI team with following objectives.

- To have low starting current of the BFP motor so that DG set can take load without tripping.
- To save energy by avoiding the throttling operation of control valve.

Action initiated by the plant

Plant had installed VFD on boiler feed pump at a total installation cost of Rs 10.0 lakh. After installation of VSD throttling control valve was avoided. Now the plant is not facing problem is stating co-generation plant auxiliaries on DG set.

Feed back was obtained from the plant, which indicated that now plant the start up problems were avoided resulting high smooth operation of plant without loss of production. In addition, there were considerable energy and cost savings.

Actual savings achieved

Measured parameters during the audit period (before installation of VSD):

Boiler feed pump rating: 41 TPH, 92 kg/cm^2.

Motor capacity: 200 kW

Operating discharge at full load: 36 TPH

Operating pressure at control valve inlet: 95 kg/cm^2.

Operating pressure at control valve outlet: 70/72 kg/cm^2.

Measured load on boiler feed pump: 147 kW.

Energy consumption of BFW (6000 hrs); 8.82 lakh kWh/ annum

Savings after installation of VSD

Energy consumption of BFW: 6.72 lakh kWh / annum

Annual Energy savings: 2.1 lakh kWh.

Annual cost savings: 11.55 lakh.

Cost of implementation: Rs. 10.0 lakh

Simple payback period: 11 months.

Conclusion:

It can be seen that in this particular case, installation of VSD is not only resulted in energy and cost savings but also avoided operational problems of the plant.

Reference book:

IEEMA Journal
May 2005