

## Successful Implementation – Energy Conservation Measure

<b>Measure</b>
Change of start up procedure of gas turbine change over during plant in operation.
<b>Equipment</b>
<b>Industry / Sector</b>
M/s Oswal Chemical & Fertilizers Limited, Shahajahanpur
<b>Year of Implementation</b>
2001
<b>Cost Benefit Analysis</b>
<input type="checkbox"/> Type of Measure : No investment
<input type="checkbox"/> Annual Energy Saving : 508.2mkcal/ year
<input type="checkbox"/> Actual Cost Saving : Rs.10.22 lacs/ year
<input type="checkbox"/> Actual Investment : NA
<input type="checkbox"/> Payback : NA
<b>Implementation Highlights</b>
<p>Implementation has resulted in</p> <ul style="list-style-type: none"> <li>▪ The natural gas consumption was reduced significantly.</li> <li>▪ At the time of change over if there is shortage in supply of natural gas from GAIL (Now-a-days it is a common problem encountered i.e. shortage in natural gas supply). If the supply of natural gas is in boundaries, to maintain the same load of the plant the alternative fuel naphtha is to be used which is almost four times costlier to natural gas.* If the natural gas supply is very low then we have to cut down the load on ammonia plant till the change over process completes.</li> <li>▪ *Ultimately results in urea production</li> <li>▪ *Reduction in ammonia production</li> <li>▪ *Since the load on the mega equipments such as synthesis gas compressor, process air compressor (in ammonia plant), CO<sub>2</sub> compressors, may come to surge point so that anti surge valves may open and increases energy consumption (*indicates in case acute shortage of natural gas during these changeovers)</li> <li>▪ *Apart from the above said points as the gas turbine is on full speed no load the problems if any can be identified and can be attended without disturbing the running plant, since the gas turbine is a very critical equipment with respect to plant operations</li> </ul>

- **M/S OSWAL CHEMICALS&FERTILISERS LIMITED, SHAHJANPUR**, is a natural gas based nitrogenous fertiliser plant having a capacity of 2250 tpd urea & 1350 tpd of ammonia. In off sites plant two service boilers of 100te/hr capacity at 112 Ksc and 515 deg centigrade. It also has two Gas turbine generators, at a rating of 20.8 mw at 11kv along with heat recovery steam generators apart from other utilities. Turn over of the company is around 1000 crores.

### Summary

During cold start ups high temp flew gases are not required so that the GAS TURBINE full speed no load or sufficient to meet the requirements till the connected HRSG achieves the rated parameters. We are achieving by this conservation of natural resource which are very limited in India.

### Background

As mentioned above we are having two Gas Turbines for power to meet the power requirement of the complex. Out of these two only one turbine runs as the total power requirement is 13.5-14.5Mw. If any problem is anticipated in the running gas turbine/hrsg the gas turbine will be changed over from the one which is running to stand by one.

**Existing operating procedure:** As per this as soon as the gas turbine achieved *full speed no load* the gas is synchronised with the running gas turbine by keeping load on the just started around 4.0 mw till HRSG comes into line. As it is cold start up the HRSG comes into existing steam grid in 5.5 to 6hrs.[as per cold start up procedure].After the HRSG comes into grid the gas turbine is loaded and the other which is to be stopped will be unloaded and the breaker is opened. The HRSG which is connected with the unloaded gas turbine got-off and finally gas turbine got-off.

**Changed operating procedure:** As we cannot heat up HRSG suddenly during cold start up and the start up curve must be followed, due to this divert damper (the device which divert the flue gases towards HRSG) must be opened in a regulated way irrespective of GTG exhaust temperature, that is why GTG exhaust temperature doesn't make any difference at this stage. The exhaust temperature of gas turbine is around 270 - 280 ° C depending upon the variables such as ambient temperature, inlet guide vane etc. At 3.5-4 MW load the exhaust temperature will be 330-340 ° C, depending upon the above said parameters .As the complex load is fixed i.e. around 13.5-14.5 MW the load will be shared by both the gas turbines as the incoming gas turbine was kept at 3.5-4 MW, the remaining load would be on the other turbine. As the load on the out going turbine was reduced by the above said load, the exhaust temperature of the out going turbine will be reduced by 60 - 70 ° C .As the load is reduced on gas turbine to maintain the same steam load on HRSG the supplementary firing is to be increased by 800 sm<sup>3</sup>, the gas consumption of GTG at full speed no load is at 2400 sm<sup>3</sup> and at 3.5-4MW it is around 3400 sm<sup>3</sup>, the total additional gas which we were giving previously was around 2200 sm<sup>3</sup> more ,so the amount of gas saved after adopting this procedure was around 2200 sm<sup>3</sup> per hour and the same was saved .the HRSG is cold start up time is 5.5-6 hours . the total gas saving in this case is around 12100 sm<sup>3</sup> .after the HRSG is ready to take on grid (i.e. approximately after 5.5 hours), the incoming GTG is synchronised with outgoing one and the electrical load is transferred from

the incoming to the outgoing one by monitoring the generator and turbine parameters (total time duration for this process is 15-20 minutes). The calorific value of NG as taken 8400 kcal per sm<sup>3</sup>

### Principle

Any equipment which is idle i.e. at atmospheric pressure and temperature cannot be pressurized/heated up suddenly. Particularly in case of steam generators, apart from some normal procedures we have to take some extra precautions since these are fired type vessels and operates at very high temperature and pressure that is why each and every steam generator is having its own cold start up curve according to their ratings and configurations.

### Details of techno-economics:

Particulars	Actual energy savings
Energy consumption before modified start up	<b>341.88 mkCal per start up</b>
Energy saving	<b>101.64 mkCal per start up</b>
Percentage of reduction	<b>30%</b>
Annual savings in terms of energy (assuming five start ups in a year)	<b>508.2 mkCal</b>
Annual savings in monetary terms	<b>Rs 2.72 lakhs in terms of natural gas and Rs 7.74 lakhs in terms naptha</b>
Investment required	<b>Nil</b>

### Implementation issues

The procedure which was adopted during commissioning was followed. At a later date after discussions with the concerned people Mr. N.K. Agarwal (Manager off-sites), Mr. A.K. Chauhan (Assistant Manager off- sites) and other operating personnel the matter was put forwarded to top management and the same was accepted.

(The matter was also discussed with BHEL-GE service personnel as the supplier of gas turbine is M/S BHEL, They have clarified that there was no problem in running GTG at full speed no load for eight hours or even more)

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