Cogeneration Feasibility Studies

Vy Consult will engineer the best cogeneration configuration that suits your facility's present and future requirement. With this, the facility owner can have peace of mind that the selected cogeneration system is the best technical and economic option for the plant.

Vy Consult has the ability to perform very detailed feasibility studies for cogeneration projects. A cogeneration feasibility study is divided into

- Technical and
- Commercial/operating

State of the art heat balance modeling software such as ***GTPRO, GTMASTER*** and ***PEACE*** are used to model the performance of the cogeneration plant.

Vy Consult has developed in-house software that models with great depth the operations of the plant and the financial returns expected. Feasibility studies conducted based on simplistic assumptions will give favourable results. We take into account or approximate the real world conditions in our feasibility studies and engineering such as :

- *Actual Load Profile*
- *GTG Degradation*
- *GTG Down Time*
- *Analysis with Single and Multiple GTGs*
- *Part Load Operation*
- *Sensitivity Analysis*
- *Non-biased and Independent Evaluation*

- *Actual Load Profile*

  The actual load profile of the facility is considered along with the prediction of the annual growth in utility demand based on discussions with the facility owners. Facilities usually run at a lower load on the weekends and this load profile is also taken into consideration.

- *GTG Degradation*

  Degradation effects on the turbo machinery is considered. These effects are normally ignored.

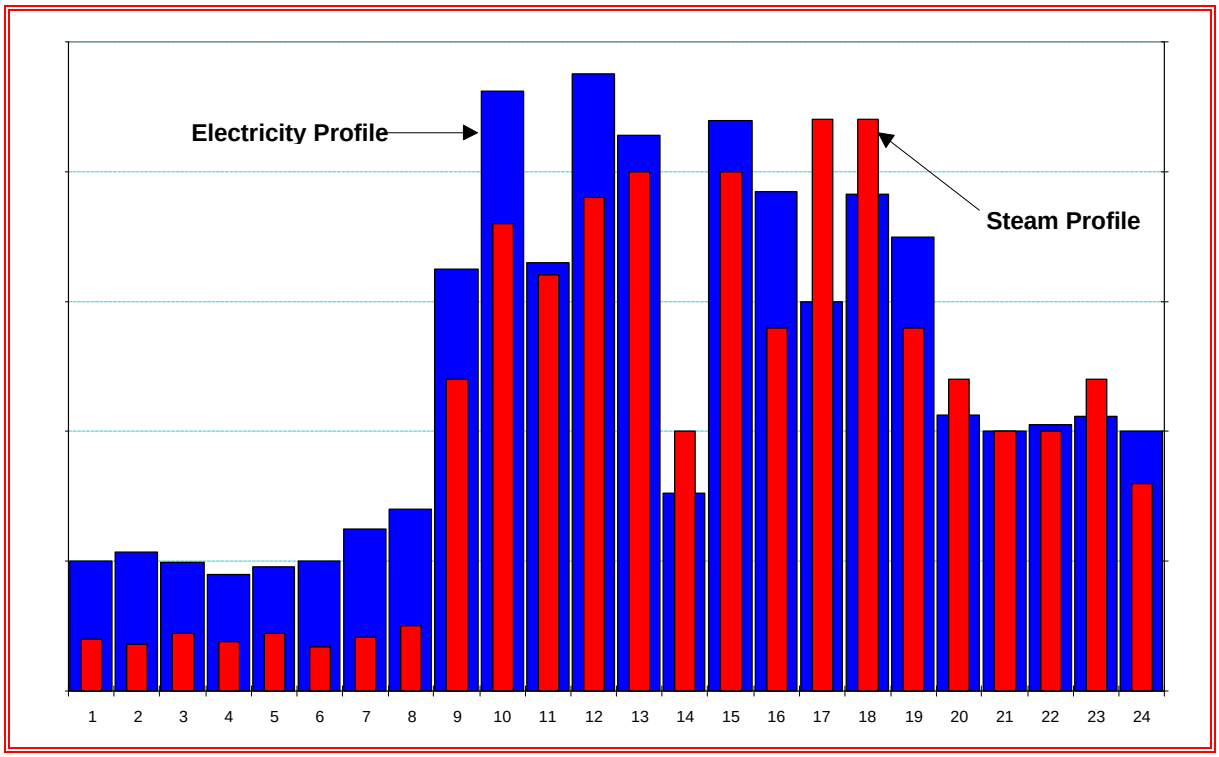

Figure 1 : Actual load profile chart from the facility is used for a feasibility study

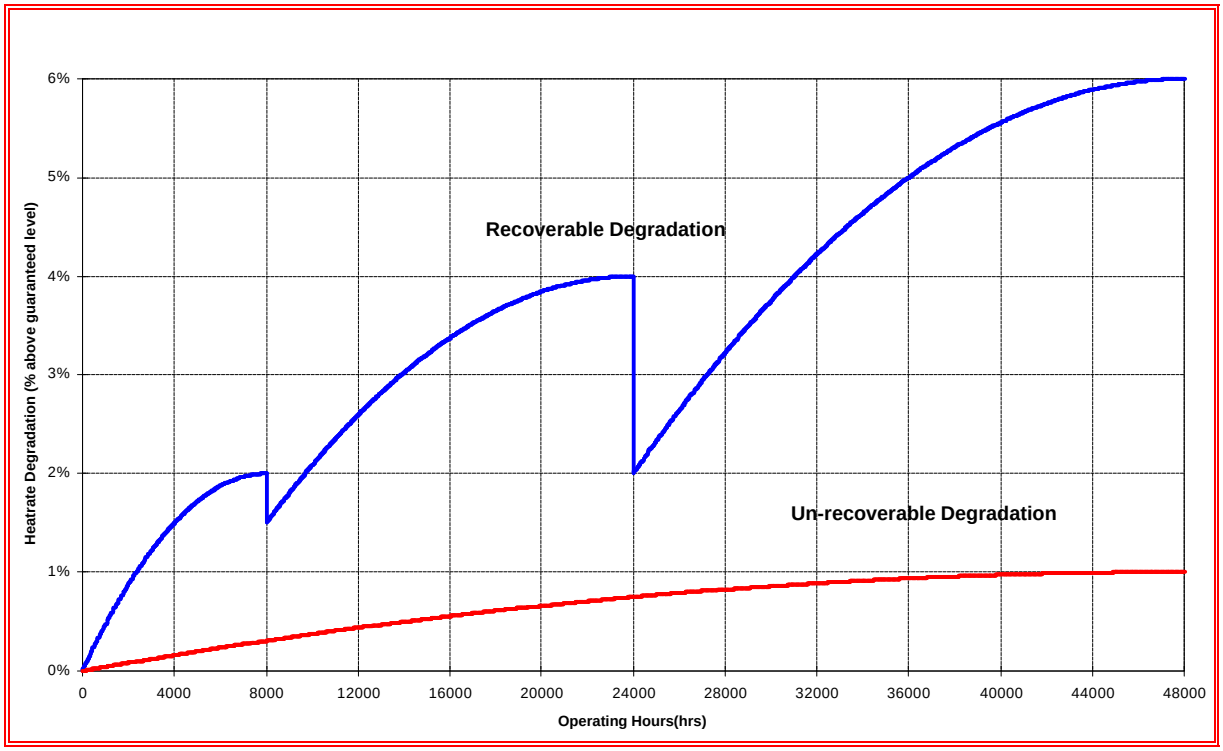

Figure 2 : Heatrate degradation curve for a gas turbine generator

- *GTG Down Time*

  Turbo-machinery down time is considered

- *Analysis with Single and Multiple GTGs*

  The economic feasibility of utilizing multiple smaller sized GTGs against using a single larger GTG is considered.

  This is a complex analysis when combined with actual load profiles. This is because for analysis of multiple machines, some machines are shut down when there is not enough demand to increase the overall plant efficiency.

  The next figure shows the plant heatrate at part load using 4 x Solar Mars, 1 x Frame 6, 1 X ABB GTX 100. The chart shows that the high efficiency GTX 100 has a higher efficiency until about 55% after which the 2 x Solar Mars would run at a higher efficiency. The Frame 6 GTG has a higher efficiency compared to the 4 x Solar Mars up to a plant load of 80%. The Frame 6 and the GTX 100 cost 60% and 65% of the 4 x Solar Mars. Multiple machines provide added reliability while larger machines reduce capital investment.

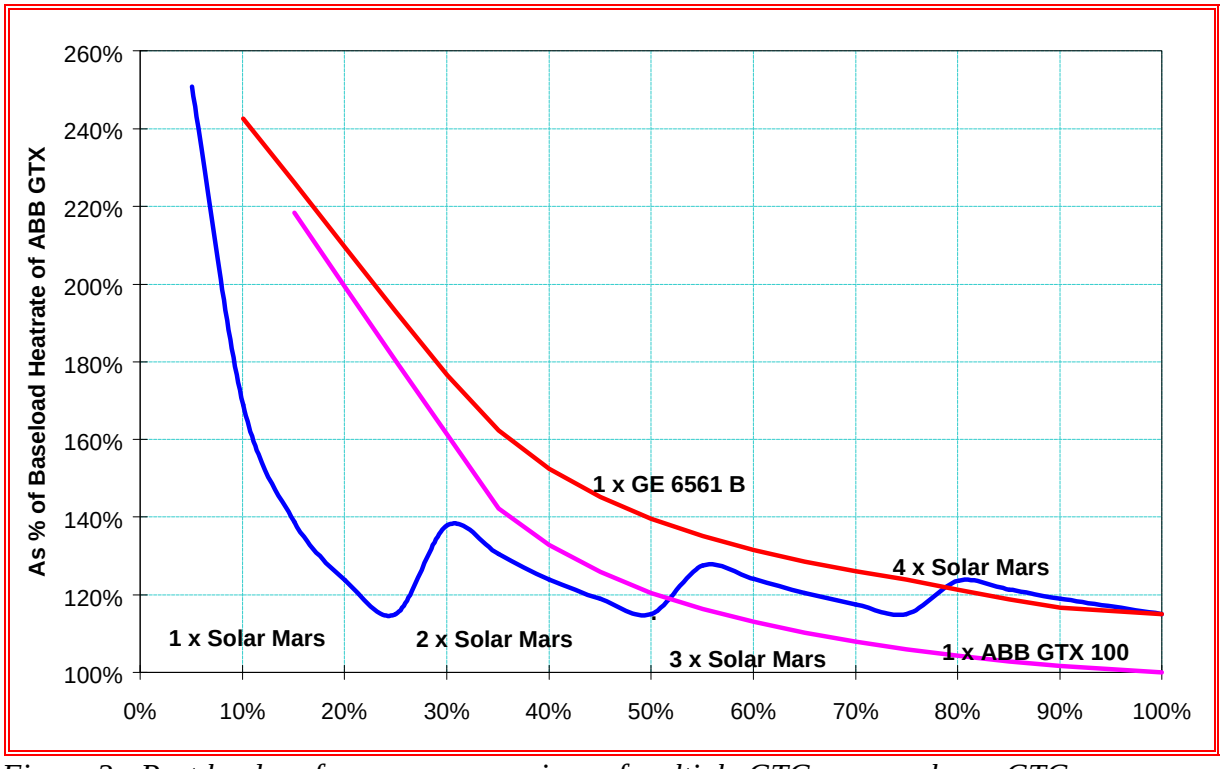

Figure 3 : Part load performance comparison of multiple GTGs vs. one large GTG

- *Part Load Operation*

  Considering part-load operation of the GTGs and other plant equipment. This is important as part load efficiencies are much lower than that of base-load and this is rarely considered in a feasibility analysis. Certain configurations may be economically attractive only if it is run at base-load.

Part-load analysis is very rarely conducted due to the complex and complicated behaviour of power generating efficiency when running at part load.

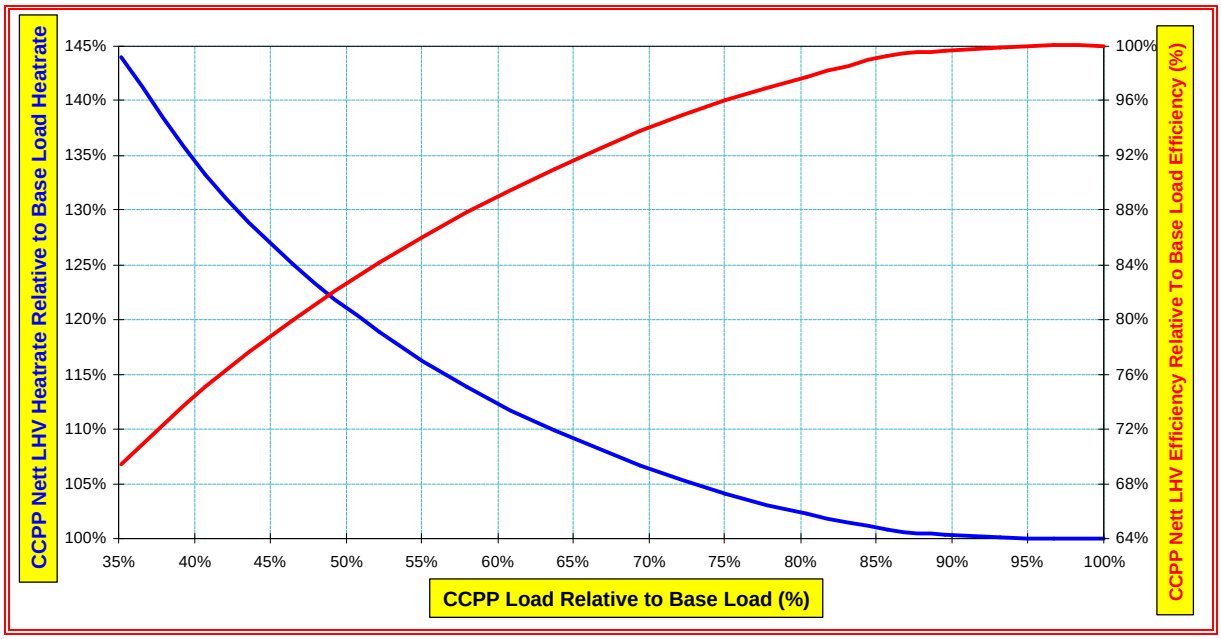

Figure 4 : Part load electrical efficiency of a condensing/extraction CCPP

- *Sensitivity Analysis*

  Detailed sensitivity analysis is conducted so that the facility owner is aware of the risks involved in the project. An example is how the Internal Rate of Return (IRR) be impacted if the gas cost is varied or what debt/equity ratio would yield the desired returns. Sensitivity analysis is of paramount importance because a cogeneration system yields attractive returns at one scenario may not be the best option if the variables change.

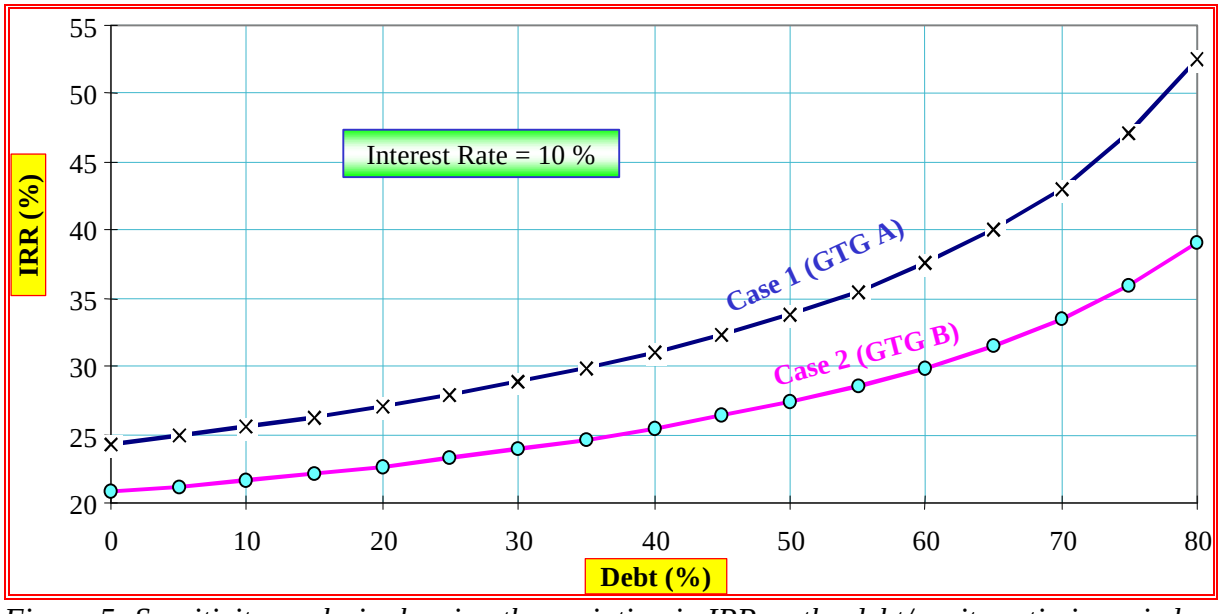

Figure 5 :Sensitivity analysis showing the variation in IRR as the debt/equity ratio is varied.

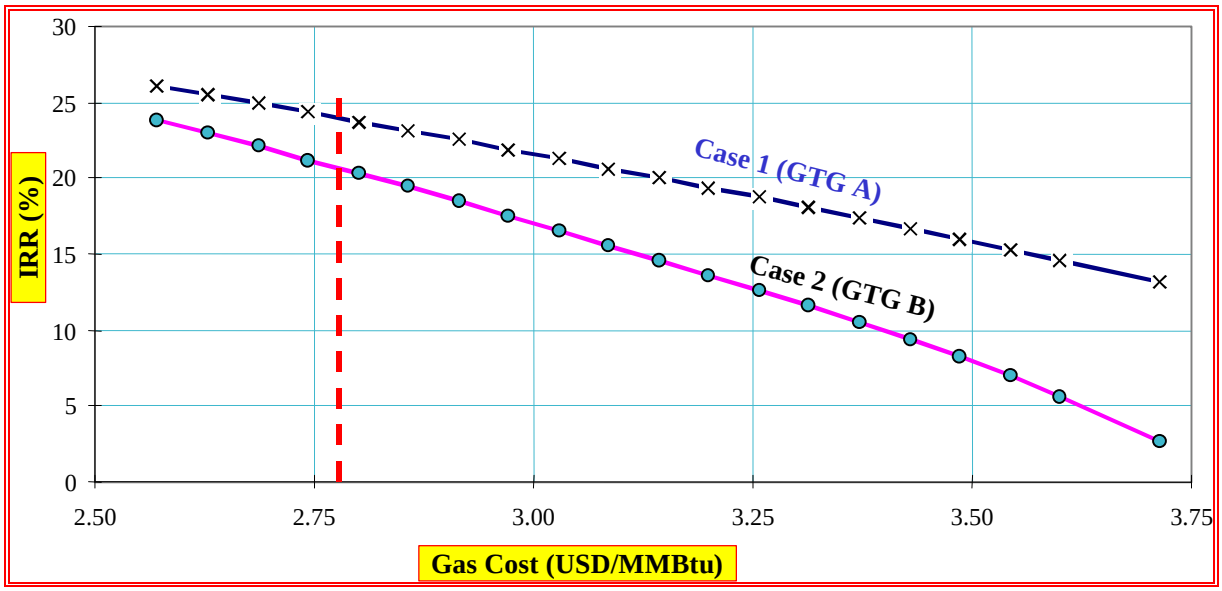

Figure 6 : Sensitivity analysis showing how variation in the gas cost affects two cogeneration plants. The steeper gradient for Case 2 shows that it is greatly affected by an increase in gas cost and as such, if the owner should be aware of the risks involved if this plant is opted for.

- *Non-biased and Independent Evaluation*

Vy Consult acts independently and does not favour any manufacturer or contractor. As such the feasibility study is non-bias and considers all possible cogeneration configurations that are available to the facility owner. There are so many options available to a facility owner that without a detailed analysis, one would never know the merits of one configurations over another.

Examples of the options available for a cogeneration configuration include :

– GTGs from GE, Allison, Solar, Allied Signal, ABB, EGT, Kawasaki and others available from our database of over 164 GTGs.
– Use of inlet air chilling to boost power output and efficiency. If this option is used, would it be more favourable to use absorption chillers or electric chillers.
– Use of extraction, backpressure or condensing steam turbines.
– Selection of best HRSG configuration. This includes selection of single or dual pressure systems, option to supply steam to the deaerator from the process steam or to have an integral boiler supplying steam to the deaerator.
– Use of duct firing to provide flexibility in power generation (if a steam turbine is in use) or steam generation.

There are many options available and the cogeneration configuration that best suits the client's technical requirements as well as yield the most favourable economic return is recommended. **With so many options and choices available, this recommendation can only be made if a thorough Techno-Economic Analysis is conducted.**

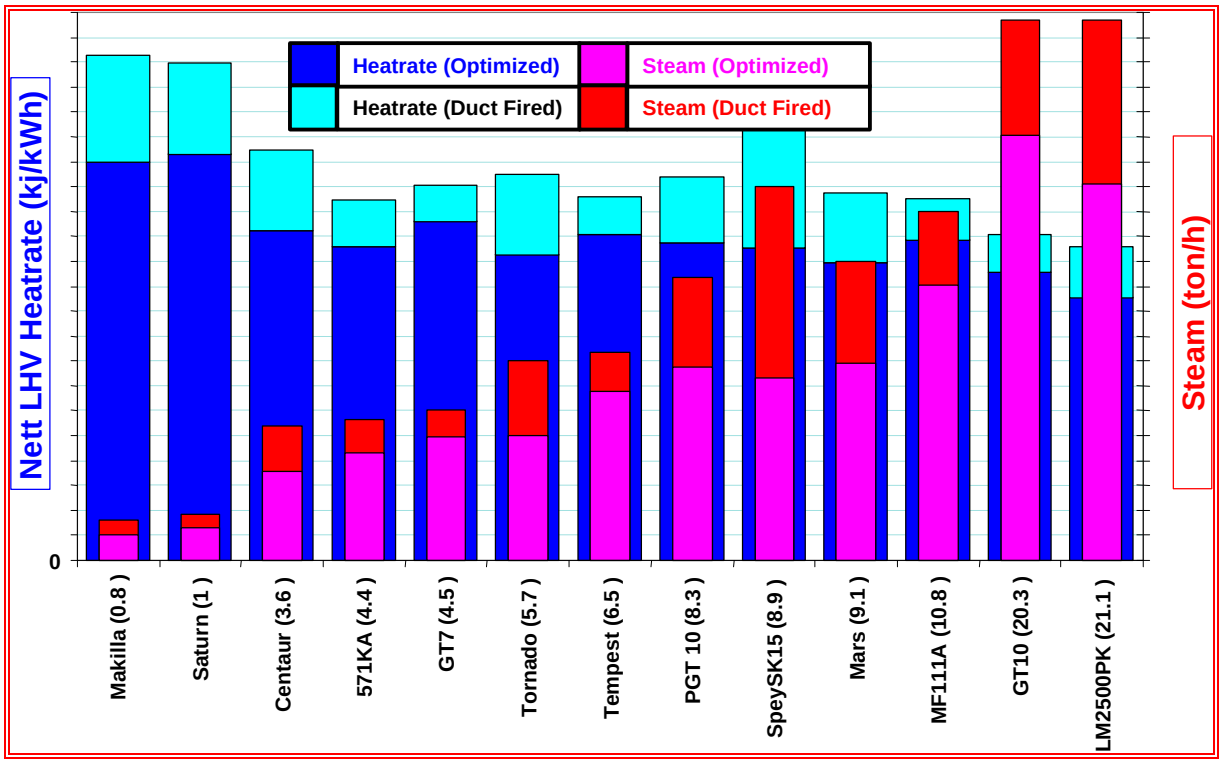

Figure 7 :Performance parameters for various cogeneration systems with power < 25MW

- Electrical Interconnection and paralleling Studies.

Loadflow and shortcircuit analysis shall be carried out to ensure that the suitable equipment ratings are specified correctly in the pre-engineering design. This would ensure that cogeneration plant system operation considerations for steady state and transient conditions would be considered at the design stage. Through a detailed study, a firm design concept can be established at the very early stage.