Trigeneration saves energy, produces free heat and reduces CO_2 emissions

-What could possibly go wrong?

8 November 2011

Nalin Wickramasinghe

Trigeneration is a great idea...

- Simultaneous generation of electricity and thermal energy – HW & CHW
- Achieve up to 80% efficiency vs. 30% from conventional grid
- Using natural gas reduces carbon emissions from 1060 to 550 kg/MWh (in NSW)
- NABERS uplift in the range 1-2 stars
- Green Star uplift – especially when 6 Stars is the objective
- Can be configured for standby/backup operation

Typical Project Development Process

- Site energy analysis – electrical and thermal data used to model & size optimal plant for max capacity utilization
- Assessment of electrical network connection – substation configurations, fault current issues etc
- Site evaluation: plant location in relation to switchboards, thermal reticulation, natural gas connection
- Authority approvals – Ausgrid, EPA
- Gas network capacity – confirmation & costs from Jemena
- Long term gas commodity contract – pricing & escalation, volumes & restrictions

Potential Pitfalls in Development Process

- Sizing errors – plants should operate at >80% capacity min 75 hrs/week for commercial payback.
  - Sizing to peak load will not achieve this
  - Results in part-year operation or de-rated operation
  - Reduced operation leads to not achieving NABERS target
  - De-rated operation – high maintenance costs
  - Base Building/Tenancy – uncertainty of Tenant take-up
  - Erroneous assumptions on exporting energy to grid
- Electrical network connection issues
  - Typically lack of attention to fault current at design stage results in expensive solutions to remedy
  - Impractical design based on island-mode off grid operation
- Natural Gas connection
  - Potential network augmentation costs could be significant – blow the business case
  - Especially with greenfields sites – need to confirm with Jemena early on

Potential Pitfalls in Development Process – *contd…*

- **EPA approvals – oxides of nitrogen (NOx)**
  - **Depending on engine size will require SCR – NSW & QLD**
  - **Cost needs to be modelled**
  - **Sometimes SCR utilized unnecessarily**
- **Long term gas commodity contract – pricing & escalation, volumes & restrictions**
  - **Inaccurate gas usage forecast – under use will still have take-or-pay which will further impact business case**
  - **Daily over-run charges can similarly incur heavy penalties**
  - **Important to make accurate volume estimates**
  - **This is often an issue if plant has been oversized resulting in under-operation and reduced gas usage volume**

In summary…

- Trigen is a great idea with significant energy efficiency and environmental benefits
- Not as straightforward as it may appear
- The challenges are not all technical – there are commercial/ regulatory issues as well
- Lack of attention to key points has resulted in “bad press” at times