SGIP Combined Heat and Power Performance Investigation
Report Highlights

Navigant Consulting, April 1, 2010

The full report can be found at the California Public Utilities Commission Self-Generation Incentive Program website: http://www.cpuc.ca.gov/PUC/energy/DistGen/sgip/.

The Self-Generation Incentive Program (SGIP) Combined Heat and Power (CHP) Performance Investigation sought to characterize the observed performance degradation in SGIP CHP systems identified in the eighth-year impact evaluation¹ which found that the average capacity factor of these systems decreased by approximately 30 percentage points from the first to the sixth year. Performance decline and related metrics were determined for natural gas fired fuel cells, microturbines, internal combustion (IC) engines, and gas turbines from metered hourly system output data for 208 participating sites across California from 2002 through 2008.² Phone interviews with representatives from 43 sites³ were used to enhance findings.

**Key findings.** Based on the data available for metered SGIP systems, it was observed that:

- There is a 5.9% average annual decrease in capacity factor across all technology types:
  - Due primarily to increases in time spent not operating (as a percentage of all hours, 8.2% increase per year). Increases were in long duration (greater than three days) off events.
  - Secondarily due to reductions in output level during on times (2.5% decrease in load level, relative to rated capacity, per year).

- Decreases in electrical efficiency (0.4% per year, relative to fuel input) and thermal heat recovery (1.8% per year, relative to fuel input) occurred over time.

- Controlling for the cost to produce on-site electricity, on average, system aging results in a 4.3% annual reduction in capacity factor.

- On average, each increase of one cent per kWh in on-site electricity production cost reduces capacity factor by 1.2%.

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² Additional SGIP CHP systems were not metered and are not included in this analysis. This analysis was intended to review metered data as means of investigating observed declines in capacity factor over time. There has been no indication by the program administrators that metered sites are not representative of the SGIP CHP system population as a whole.

³ Thirty-nine unique host customers were interviewed. Four of these host customers had two incented systems each in the interview sample.
The interviews with CHP host customers revealed that:
» Unexpected levels of maintenance and economic complexity have dampened participant satisfaction.
» CHP systems are technically complex, requiring expertise for both scheduled and unscheduled maintenance to keep a system running.
» CHP systems are economically complex. Fuel costs, use for recoverable heat, unpredictable demand changes, maintenance costs, maintenance contract costs, and costs to litigate deficient maintenance service must all be considered on an ongoing basis.
» For many sites, system performance and economics did not live up to what was proposed to them. Fifty-three percent would not install a system again if they were making the decision now.
  – However, host experience with fuel cells is a notable exception. While all seven of the host customers interviewed experienced technical problems with their systems, six of the seven were satisfied with the performance of their systems and five of the seven said that they would install a CHP system if faced with the decision today. Interviews revealed that fuel cell hosts often received risk mitigating contractual arrangements with manufacturers and developers, and that their systems received adequate maintenance to keep the system running.
» The economic viability of a CHP system is integrally related to the “spark spread,” or the difference between natural gas and electricity prices; the spark spread during the last decade has not fulfilled many CHP system owners’ expectations.

Recommendations. The SGIP and the PAs can support long-term CHP operation in the following ways:

1. Institute measures to mitigate the uncertainties of CHP system operation. Long-term favorable gas rates, reduced electric demand charges, and a requirement for long-term maintenance contracts and product warrantees can help mitigate operational and economic uncertainties.
2. Undertake activities to bring existing but non-functioning systems back online. These activities might include subsidizing new, longer-term maintenance contracts, offering favorable, long-term gas contracts, and providing engineering resources to identify and correct operational issues.

Customers can support long-term system performance by ensuring that their maintenance contracts and power purchase agreements contain the appropriate terms and safeguards.