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## Inverter-Based System

### OPENING NEW DOORS FOR COGENERATION

#### Tecogen Offers New Technology In 100 kW Package

**THE BENEFITS OF COMBINED HEAT AND POWER (CHP)** are well understood. Energy users generate electric power on site, and use the substantial byproduct heat from electric generation. A recent introduction by Tecogen, a well-established provider of self-generation and engine-driven chiller products, offers significant additional efficiency and flexibility for this market.

#### Advantages of Parallel Operation

In some situations, industrial energy users choose to generate all of their required site electric power independent of the electric utility, or perhaps with a normally open interconnection that is used infrequently. However a much more common scenario is "parallel generation", with owner generation supplying part of the site electric needs, with the balance made up by utility-supplied energy. In cases where the customer has surplus site-generated power, it can also be sold back to the serving utility under agreed-upon payment terms.

In these parallel generation systems, it is essential that in the case of a utility outage, the on-site generation be positively prevented from back-feeding onto the utility lines. Under the rules established by state utility regulatory commissions, utilities also have strict standards for acceptable characteristics of power from interconnected CHP systems.

In the past, owners of CHP equipment met the utility interconnection standards either by using a synchronous generator or an induction generator. The synchronous system requires complex and expensive protection systems to separate it from the grid in the case of an outage. Further, when it is operating it generates significant levels of fault current that can overload utility system protective relays. The induction generator uses grid power to stabilize output frequency and automatically shuts down in the case of a utility outage. However with induction generators, owners lose the advantage of having an on-site backup power system in the case of a utility outage.

#### New Approach Solves Interconnection Challenge

A product recently introduced by Tecogen is designed to solve these problems. The 100 kW INV-100 by Tecogen features a power-inverter between the generator and the grid. These units can separate from the grid and continue to generate power in the case of a grid power failure. Two of the major challenges for CHP are met.

Because of the inverter base, the engine can run at varying speeds while continuing a 60-hertz output. This means that units can more precisely follow electric load or heat load requirements while staying near the engine's "sweet spot."

#### Allows Multiple Units on Circuit

The product control software incorporates a power balancing algorithm developed at the University of Wisconsin and licensed through the Wisconsin Alumni Research Foundation (WARF). Equipped with this feature, multiple units can align with each other on a common subcircuit, even islanded from the main grid. All the units work together, even at varying unit speeds.

Bob Panora, CEO of Tecogen, gives credit to many sources for the success of the INV-100 design. For instance, the Energy Solutions Center and its member utility, National Grid, are supporting two long-term data acquisition efforts designed to be a showcase for interested customers. One installation is at a food processing plant and another is at a large apartment complex. Both are located in Brooklyn NY, and receive gas service from National Grid. Joe Rende from National Grid notes, "National Grid fully supports products like Tecogen that provide unique energy solutions to help meet our customer's needs. This prod-

uct helps our customers to reduce both energy costs and greenhouse emissions. This makes for a very compelling business case." Panora gives credit to the California Energy Commission and Southern California Gas Company for their financial backing. He also recognizes the important role played by the WARF power-balancing algorithm.

#### Broad Cross-section of Market

Today the INV-100 is fully commercial, with over 50 units in operation or scheduled for delivery. Users include schools and universities, manufacturing plants, office and retail buildings, and multi-family residential buildings. According to Jeffrey Glick, East Coast Sales Manager for Tecogen, "These units have struck a chord with a broad cross-section of customers in North America and even overseas. They appreciate that the electric utilities are supportive of this type of CHP, rather than opposing interconnection."

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This hotel installation of the INV-100 supplies building power, domestic hot water, and standby generation in case of a utility outage. Photo courtesy Tecogen.

