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GHG Project Case Study

The UTC Power PureComfort™ CCHP System: Meeting the Demand for Low Carbon-Generation Technologies

Rising energy prices, the increasing demand for high-quality, reliable power, and concerns about the climate impacts of energy consumption offer businesses new opportunities to take advantage of low-carbon, on-site, distributed-generation (DG) technologies. Companies that apply DG technologies to their operations can save money as well as reduce greenhouse gas (GHG) emissions. Meanwhile, this new DG market provides profitable new business opportunities for companies that produce and sell high-efficiency, on-site generation products.

By providing low-carbon products such as the PureComfort™ combined cooling, heating and power system, UTC Power (UTC), a subsidiary of United Technologies Corporation, is creating value and achieving positive environmental outcomes by influencing its customers' energy use.

Distributed Generation as an Energy Alternative

UTC's power systems offer the benefits of DG, which is the production of electricity, and in some cases cooling and/or heat (so called "combined cooling, heating and power" or "CCHP"), at several locations across an electric grid rather than at a single, centralized location. Environmentally-responsible on-site power can be supplied by renewable technologies like solar photovoltaic panels and wind turbines or from high-efficiency fuel cells, microturbines and technologically advanced natural gas-fueled reciprocating engines. For businesses and homeowners, having on-site DG can have several economic and environmental advantages, such as

- High-quality, reliable electricity to protect against power outages that can compromise critical operations.
- Immediate positive cash flow from energy savings depending on the price of fuel.
- Lower peak electricity demand, which can significantly reduce electric rates for large commercial and industrial operations.
- More efficient use of energy from certain DG technologies as well as from combined heat and power use.
- Lower GHG emissions, depending on DG technology and fuel.
- Scalability, because most DG technologies are modular and can be adjusted to fit any power requirement.

In addition to the internal benefits of DG technologies, they have greater overall benefits compared with centralized power production. Because centralized power systems lose as much as two-thirds of their total energy through conversion and transmission losses, distributed generation can substantially cut these losses by producing electrical power on-site. These efficiency gains also have positive environmental benefits by reducing the quantity of fossil fuels required for the same level of service throughout the electric grid. In turn, these

DG technologies have the potential to lower emissions of GHGs and conventional pollutants.

In addition to the environmental benefits of reducing energy consumption, a facility can benefit financially by incorporating distributed generation into its energy management plan. Besides greater reliability and peak-shaving benefits, when DG electricity production exceeds internal demand, the power can in many cases be sold back to the utility grid, creating additional revenue. Currently, 40 states and the District of Columbia allow for some form of net metering in which consumers of electric power can sell excess power back to the grid. Through peak shaving and net metering, DG can also improve the local utility grid's performance by relieving transmission congestion and reducing demand on the overall system. This can shrink the local utility's environmental footprint by reducing demand during peak-load events, which typically occur during the hottest days of summer when electric generators are running at full capacity and smog-forming pollutants are most potent.

Note that state and local regulations apply to DG installations. Just as net-metering rules vary by both state and utility provider, the rules governing the interconnection of new power systems to the utility grid, emission requirements, and installation permits also may differ in their stringency and application. The federal government and several states also provide incentives for DG installations, such as rebates, grants, and tax exemptions. Accordingly, these requirements and incentives should be taken into account when considering a DG project.

UTC Power and the PureComfort™ CCHP System

The PureComfort™ combined cooling, heating and power system is an example of how UTC is finding value in new low-carbon market opportunities. The modular design of the PureComfort™ system allows customers to scale the system to meet their specific energy needs while increasing the reliability of their power supply and improving their overall environmental performance.

The PureComfort™ system consists of a double-effect absorption chiller/heater driven by exhaust from either a reciprocating engine or microturbines. The system provides scalable, on-site electrical power and its thermal energy supplies heating and/or cooling. The reliable power of the PureComfort™ system improves overall energy efficiency by avoiding the losses associated with purchasing power through the electrical grid while insulating on-site operations from utility outages. If grid electricity is lost, the PureComfort™ system, when configured for grid-independent operation, can provide heat and power without interruption. The heat and electricity generated by the system is often cheaper than that supplied by the local utility, although financial performance is contingent on the cost of natural gas and electricity from the grid.

Compared with power from the electrical grid, the PureComfort™ system is highly efficient. According to UTC Power, at an ambient temperature of 59°F, the system can be as high as 91 percent efficient when electrical and cooling outputs are considered together. Even at low and high ambient temperatures of 32 and 95°F, UTC claims that the system can be as efficient as 68 percent to 80 percent. This high efficiency leads to both environmental and economic benefits. Because the prime movers are fueled with natural gas, they emit fewer smog-forming pollutants and GHGs than a similar-size, diesel-fired system. This feature is especially important to both on-site power systems located in highly populated areas and companies with voluntary or mandatory GHG reduction commitments. Indeed, because of its exceptional environmental performance, UTC Power has found that it is relatively

easy to obtain the necessary air permits for the PureComfort™ system compared with the permits for diesel-fired backup units. The total reduction of emissions varies depending on the fuel mix of the local utility and the ambient conditions in which the heating and chilling unit operates.

Economically, the benefits associated with the PureComfort™ system make good business sense. Project paybacks differ geographically in accordance with the particular state, local and utility policies, as well as from variations in grid electricity and natural gas costs. With this in mind, one system installed in California's PG&E region had a simple payback time of 1.5 years, with savings stemming from the lower demand for electricity from the grid where the system was utilized for 5,000 hours of power and cooling and 3,000 hours of power and heating in one year. Another system installed in New York's ConEdison region produced a longer but still reasonable payback of 4.1 years.

The primary market niche for the PureComfort™ system is customers that have facilities using the heating and chilling outputs year-round and to which power reliability is a concern. Such customers include hotels, supermarkets, big-box retailers, data centers, hospitals, and schools.

If energy and environmental trends continue in the same direction as in the last few years, more customers will be interested in buying systems like the PureComfort™ combined cooling, heating and power system. As DG technologies move into the mainstream, pioneers like UTC Power will be well-positioned to capture market share as they meet the increasing demand for high-efficiency, low-carbon power. Customers will also be able to capture the considerable benefits of these technologies and realize lower costs, greater value, and lower climate impacts.