ORNL Investigates Benefits of Distributed Generation at Municipal Utilities

DE Offers "Win-Win" Outcomes to Customers and Utilities

Background

Over the last thirty years, a large number of studies have been conducted to characterize the benefits of Distributed Energy (DE) to system owners. These benefits typically include reduced utility expenses and the provision of back-up power. As the Department of Energy (DOE) established a broader program, however, DE benefits to other stakeholders and society in general were explored. The earliest analyses simply listed potential advantages and their beneficiaries, but the benefits identified were often poorly understood and difficult to quantify. For example, total air emission reductions benefit society at large while voltage support may benefit only electric customers located in close proximity to the DE source. Moreover, as monetary values were assigned to the identified benefits, profits to one group of stakeholders might require additional costs to other stakeholders. It was therefore necessary for broad national estimates to be supplemented with more localized studies. Since municipal utilities are actually owned by their customers, they were poised to offer opportunities for the development of a DE implementation model benefiting both customers and utilities. In addition, municipal utilities are also often motivated by energy security concerns and economic development objectives.

McMinnville Electric System's peaking power diesel generator sets

Assessments

Heber Light & Power (HLP), the municipal utility in Heber City, UT, operates a combination of advanced gas-fired generators, diesel generators, and hydro with a total capacity of 12.5 MW – about half of the local peak demand. The facility actively manages the equipment in response to market fluctuations, dispatching power from their plants when hourly market prices rise above the operating cost. As large homes with huge, peak period air conditioning requirements continue to be constructed in the region, DE capabilities have kept rates from increasing to meet peak demands.

The DE equipment also provides a reliability hedge to HLP. This allows HLP to contract for lower prices from central station plants on a unit-contingent basis and provides back-up capacity in case of outages from the transmission grid. Furthermore, since the utility is located at the end of a 138 kV transmission line, positioning a portion of the power generation close to the load improves the power quality.

In Tennessee, the McMinnville Electric System (MES) operates a block of 11 diesel generators to provide peaking power to the Tennessee Valley Authority (TVA) system and back-up power for the city of McMinnville. When operating, the 20 MW capacity of the installation provides approximately 40% of the city's total demand, and

is tied into a critical care feeder circuit serving the local hospital and jail. In contrast to the HLP system, this system is dispatched by TVA and is permitted to run a maximum of only 350 hours per year due to emissions limitations. Although MES does not actively participate in the market as HLP does, fees paid by TVA have helped the utility control costs and subsequently offer retail customers the fourth lowest rates in the TVA system. TVA does not pay for reactive power, but the diesel generators provide voltage support to other power distributors 50 miles away.

MES is also involved in DE research, hosting a collaborative effort to develop and demonstrate a reciprocating engine-generator fueled by a soybean-based, bio-diesel product. An innovative after-treatment emissions system is now being tested in efforts to reduce emissions by 80-90% as compared to a diesel-fired engine. The facility's goal is "Green Power" classification which would allow continuous operation and the potential to charge higher rates.

McMinnville Electric's new bio-diesel system

DE Benefits to Municipal Utilities

- **Cost savings for utility and customers –** At a municipal utility, there is little distinction between the utility and customer. Community members at the utility want to purchase and resell power at reasonable prices in their own neighborhoods.
- **Reduced demand charges –** The utility is charged a fee proportional to its peak load. This revenue is used by larger utilities to build coal-fired or nuclear power plants to generate enough power for peak periods. Without DE capabilities, HLP would be charged for a 25 MW peak load; however, the facility is able to generate 12.5 MW of the peak power and subsequently claims only a 15 MW peak load.
- **Reduced capital costs –** Both the HLP and McMinnville systems are low-cost – approximately $1,000/kW installed. HLP can pay off the cost of the engines in approximately 2 years when running the engines only 30% of the time because the facility profits largely during peak periods and does not operate during off-hours.
- **Improved reliability and security –** Most municipal utilities simply buy electricity at market prices and resell it to customers. Both HLP and MES are atypical in that they generate their own power, making them less grid-dependent. This is particularly important to the citizens of Heber City since the one or two transmission lines into the town can be quickly compromised by a forest fire or major snow storm.
- **Power quality –** Power quality is improved when a portion of the power generation occurs close to the load.

A comprehensive examination of DE advantages may facilitate the deployment of advanced DE technologies as they are understood in the context of the larger energy market. Furthermore, a public discussion may result in regard to who will bear the costs and who will reap the benefits of power generation alternatives.

Future Work

The ongoing study of potential DE applications at customer-owned utilities will contribute to DOE's assessment of societal DE benefits mandated in the 2005 Energy Policy Act and complement technology development efforts. For example, increased examination of the value of reactive power aligns with the expansion of research into methods of production. Similarly, improved meters and controls are being investigated for their potential role in optimizing integration of DE into utility systems.

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