Case Study: Verizon Communications

Cogeneration system monitoring and energy management

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Form 1653-190515

CASE STUDY: VERIZON COMMUNICATIONS

Cogeneration system monitoring and energy management

Verizon Communications, one of the largest telecommunications companies in the world, delivers voice, video, data, and other communication services to its customers over both wired and wireless connections.

To serve its customers throughout various geographic regions, Verizon provides services from its many central office switching facilities. These COs house critical electronic switching and backup power equipment for Verizon's wireline communications operations that naturally use a great deal of power when operating.

Because most electronic systems are subject to failure if left in overheated environments for long periods of time, Verizon's COs are also equipped with numerous cooling systems. These air conditioners, cooling units, and air handlers also draw very large current loads. Verizon thus requires massive amounts of reliable, high-quality power—up to 5.1 billion kWh annually—to keep its COs up and running.

Verizon recently undertook an initiative to meet these challenges by establishing a prototype "central office of the future" in Garden City, Long Island, New York. This particular central office is equipped with new distributed energy systems that provide clean, reliable, and efficient power and cooling, proactive monitoring and control of the same.

Seven fuel cells provide power to the Garden City CO.

The Garden City central office is a 292,000 sq. ft. building that serves more than 35,000 customers on Long Island. The facility makes use of waste heat from onsite generators in a cogeneration system. Cogeneration (also called combined heat and power, or CHP) is the use of power facility equipment to simultaneously generate both heat and electricity.

Verizon's "Central Office of the Future" in Garden City, Long Island

Conventional power plants release heat (created as a byproduct of electricity generation) into the environment through cooling towers, as flue gas, or by other means. Cogeneration captures this excess heat for domestic or industrial heating and cooling purposes.

In Garden City, seven fuel cells, reciprocating engines, two absorption chillers, and a heat recovery steam generator (HRSG) provide power and cooling to the facility. For example, steam byproduct is used for large air-conditioner

units through the turning of a steam turbine connected to a compressor that chills water for various air handlers.

HOW IT WORKS

During normal operation, most of the central office's 2.7 MW building load is met by a combination of a dual-fuel reciprocating engine, two diesel engines, and the fuel cells, which are electrochemical energy conversion devices similar to batteries but different in that they are designed for continuous replenishment. More precisely, fuel cells produce electricity using an external supply of fuel and oxygen as opposed to a finite amount of internal energy stored inside a battery.

Power and Cooling

The engines and fuel cells are the primary source of electricity for the telecommunications systems and the supporting equipment at the Garden City CO, while the Long Island Power Authority (LIPA) grid provides any additional power needs.

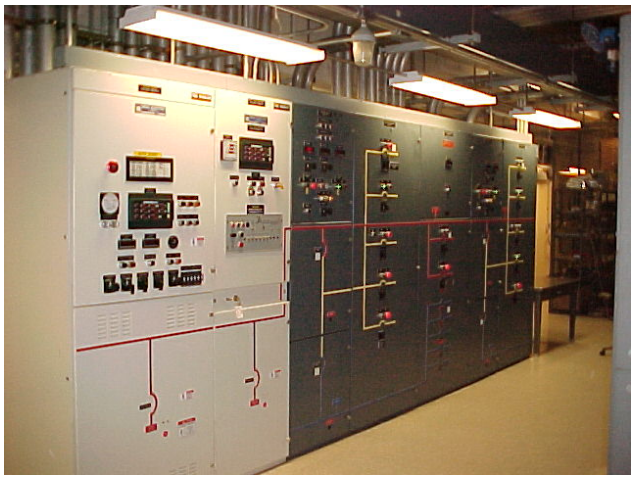
Per Verizon's agreement with the Long Island Power Authority, five of the seven fuel cells are permitted to operate during the peak summer season (June 1–September 30). All seven fuel cells are allowed to operate at all other times. They, along with the dual-fuel engine, are paralleled to the utility to reduce LIPA's supplemental power requirements to around only 100 kW of the total building load. This arrangement prevents Verizon from drawing too much power from the grid.

To guarantee the reliability of these systems and to ensure that all critical loads are being properly fed, Verizon has deployed a comprehensive monitoring system. Designed and implemented by Marine Interface (www.marineinterface.com), a supplier of hardware, software, and integration services for power-related applications, this system was expressly designed using hardware from Opto 22 and consists of a complete Ethernet-based solution.

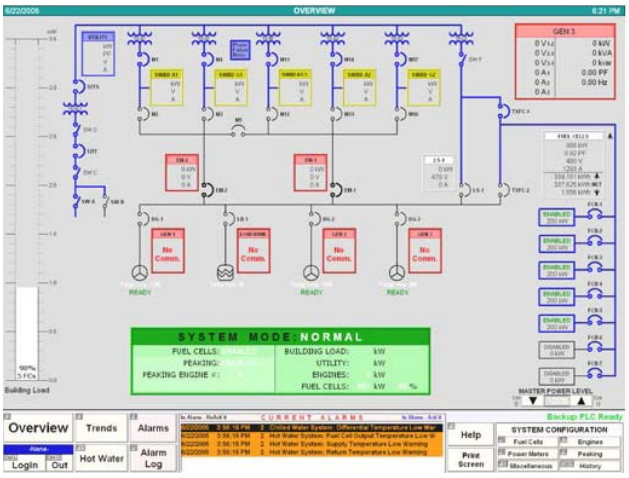
At the facility, Marine Interface installed a network of 12 Opto 22 SNAP Ultimate I/O and SNAP Simple IO units along with Opto 22 SNAP I/O mounting racks and I/O modules. These racks and various I/O modules are used to gather information from all of the site's electrical metering systems, circuit breakers, engine electronics, fuel tank systems, etc.

The Opto 22 systems make use of the many hardwired analog and digital signals as well as the serial data feeds from the electrical switchgear, metering systems, engines, control processors and fuel systems. All data is converted into Simple Network Management Protocol (SNMP) form for remote network access and monitoring.

Marine Interface programmed the Opto 22 systems to provide alarms using SNMP "trap" report-by-exception messages. These messages, along with those from all other buildings, are then dispatched to a central server (at a Verizon data center in Wantagh, NY) running Computer Associates' Unicenter software for asset management. There, everything is remotely monitored via SNMP-based



Verizon switchgear



SNMP-based software gives Verizon the ability to maintain, monitor, and troubleshoot their telecommunications infrastructure.

The Opto 22 system is used to monitor and automatically record data on the facility's various diesel, natural gas, and heating oil fuel consumptions in real time for the purpose of demonstrating compliance with mandated facility emissions limits.

viewers that graphically display system status andalarm messages.

Remote capabilities provided by this system include:

- Monitoring of circuit breaker positions, feeder loads, fuel, and relay status
- Delivery of utility power and power quality reports
- SNMP-based remote alarm notification, acknowledgement, and reset
- On/off control

But Verizon's monitoring system is also integrated into the CHP system as it recovers and utilizes heat from fuel cells, engines, and turbines to provide cooling and optimize fuel utilization. Through SNMP-based report-by-exception monitoring, the Opto 22 system manages and provides immediate notifications on the fuel cell-generated power used in parallel with the grid, as well as on the state of standby power systems. For example, switchgear housed in the central office are considered "hot spots," meaning they require significant cooling.

High-grade waste heat from the fuel cells is recovered and used by two 70-ton Thermax lithium bromide absorption chillers to cool the central office in the summer. (During the winter months, the waste heat is used to supplement that from existing boilers.) At any time, should temperatures surrounding the switches exceed a predefined threshold, Verizon supervisors receive immediate Unicenter SNMP alerts.

FINANCIAL BENEFITS & ROI

Verizon's CHP system went online in June of 2005. Since then, the facility has been operating at a rate where it produces nearly 16 million BTU (MMBTU) of useful thermal energy and 38,000 MMBTU of useful electrical energy yearly. Achieving this requires around 105,000 MMBTU of fuel, for a resulting fuel utilization efficiency of over 50 percent.

Opto 22 remote monitoring systems monitor Verizon generator sets.

Furthermore, the waste heat from the fuel cells used with the chillers allows Verizon to dramatically reduce operation of the chillers themselves and thereby realize major energy cost savings.

Also, the HRSG that reclaims waste heat from the seven fuel cells during the winter months reduces Verizon's boiler fuel usage by almost two-thirds, significantly reducing nitrous oxide (NOx) and other pollutant emissions in the process. This reduction allows the Verizon facilities to operate longer without exceeding regulatory NOx emission caps, resulting in still more cost savings.

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Verizon received performance contracts from the federal government for this project of just over $3 million, as well as a $425,000 cost-share grant from NYSERDA, the New York State Energy Research and Development Authority, which offers rebates and other incentives for businesses that initiate energy curtailment programs and significantly reduce their dependence on the grid.

THE FUTURE

Verizon hopes to replicate the success of its Garden City location at several more of its central offices. The company's ultimate goal is to provide reliable service to its customers, at reasonable prices, and with minimal environmental impact. Eventually, Verizon's Garden City

operation could serve as the model for how the company, other major carriers, and the telecommunications industry at large operate their networks.

Case study originally written in 2006.

ABOUT MARINE INTERFACE

Marine Interface specializes in providing high reliability monitoring systems for power generation and commercial marine engine systems. The company, located in East Northport, NY, is a Computer Associates technology partner. Currently Marine Interface is installing Opto 22 network-based power monitoring systems in Verizon facilities and has overall system integration responsibilities for Verizon.

ABOUT OPTO 22

Opto 22 was started in 1974 by a co-inventor of the solid-state relay (SSR), who discovered a way to make SSRs more reliable.

Opto 22 has consistently built products on open standards rather than on proprietary technologies. The company developed the red-white-yellow-black color-coding system for input/output (I/O) modules and the open Optomux® protocol, and pioneered Ethernet-based I/O.

In early 2013 Opto 22 introduced *groov* View, an easy-to-use IoT tool for developing and viewing mobile operator interfaces—mobile apps to securely monitor and control virtually any automation system or equipment.

Famous worldwide for its reliable industrial I/O, the company in 2018 introduced *groov* EPIC® (edge programmable industrial controller). EPIC has an open-source Linux® OS and provides connectivity to PLCs, software, and online services, plus data handling and visualization, in addition to real-time control.

All Opto 22 products are manufactured and supported in the U.S.A. Most solid-state SSRs and I/O modules are guaranteed for life.

The company is especially trusted for its continuing policy of providing free product support, free training, and free pre-sales engineering assistance.

For more information, visit opto22.com or contact **Opto 22 Pre-Sales Engineering**:

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