A Caterpillar® publication for Power Professionals FALL 2021

RUNREADY™

SAFE HAVEN

BACKED BY CAT® POWER, NEW COMMUNITY CENTER SERVES MANY NEEDS

LINING UP RIGHT

Critical elements come together for campus standby power project

A CLEAN SLATE

Airport microgrid is key to sustainable approach

CAT®

To a Sustainable Future

Caterpillar is at the forefront of the energy transition, integrating renewable power with smart energy storage and conventional diesel or gas-fueled power generation.

This issue features a story about a solar-powered microgrid backed by a Cat® G3412 gas generator set at the Chattanooga Metropolitan Airport.

Microgrid systems provide:

- Increased energy efficiency with no reliance on the grid and optimal total cost of ownership.
- Smart Microgrids mean efficient power that can be produced where and when it's needed without transmission lines and transformer losses.
- A high-performance, scalable system designed and built using standardized building blocks that are easy and quick to install, even in challenging environments.

This issue also features a state-of-the art community center that is backed by Cat G3512 gas generator sets. With reliable power at the ready, the YMCA Piscataway Community Center serves as both an evacuation site in a disaster, as well as housing the town's Office of Emergency Management.

On page 8, another example of sustainability is the new power plant at Snowbird, a destination ski resort in Utah. The new custom-designed cogeneration facility features three synchronized and paralleled Cat gas generator sets, including two Cat G3520H units, as well as a single Cat G3512H generator set.

The cogeneration facility is the latest in a series of sustainability initiatives undertaken by Snowbird, which include ridesharing, mine reclamation, native species revegetation, watershed rehabilitation, electric vehicle charging stations, energy-efficient bulbs, composting, heater upgrades, glass recycling and planting trees for season passes sold.

Meanwhile in Seattle, a team-based approach headed up by the local Cat dealer helped deliver and sequence a complex generator installation, which was no small feat given that it occurred during the most challenging period of the COVID-19 pandemic.

We are always on the lookout for innovative customer application stories. Please contact us to share your story: JohnR@HighVelocityCommunications.com

DID YOU KNOW?

Old Betsy

Before being donated to the Smithsonian Institution, Caterpillar's first diesel engine prototype, "Old Betsy," built in 1933, was restored and put through a rigorous series of emissions tests in 1973. Thanks to a forward-thinking design, Old Betsy came very close to meeting 1973 emissions standards 40 years after it was built.

TUNEL MULATOS

As part of the fourth-generation highways currently being built in Colombia, South America, the Mulatos Tunnel (Tunel Mulatos) is being constructed as part of a portion of highway called Pacifico 2, which will connect the Department of Antioquia with the Coffee Triangle and the southwest of the country.

With a length of 1.5 miles and two vehicular passages, it constitutes a milestone of Colombian engineering. Its location, in the rocky massif between the Mulatos and the Cauca Rivers, makes it the most critical segment of the project.

With more than 50 years of combined experience in civil works, the tunnel lining was awarded to Consorcio Suroeste, formed by two large construction companies in Colombia: Latinco S.A. and Estyma S.A.

Tunel Mulatos is an essential part of the Enlace Pacífico 2 road project. The route covers 60 miles between La Pintada - Primavera (Caldas) and La Pintada - Bolombolo (Venice), and will connect Medellín with the Eje Cafetero and with the Pacific Coast.

When the work is completed, the travel time between Cali and Medellín for a five-axle truck will be reduced from 15 to 8 hours, and a private vehicle will be able to make the journey in five hours.

For the project, the construction consortium needed a 2.7 MW standby power genset. Last year, Cat® dealer Gecolsa delivered a Cat C175-16 diesel generator to the site. It is the first unit of its kind in Columbia.

To deliver the genset, Gecolsa overcame several challenges:

- The road was not completely finished, therefore, the equipment transport to the final destination was difficult.
- Due to the generator size, Gecolsa needed a specialized group of people in order to install it in the final room.

"Gecolsa achieved startup of this unit last March, and our customer is satisfied with our support and good work," said Jhonatan A. Franco Rodriguez, a coordinating engineer with Gecolsa.

CONTENTS

IN THE SPOTLIGHT:

FEATURES

RunReady™ is published by High Velocity Communications Inc. on behalf of your Cat® Dealer. Publisher, Tim O'Brien • Editorial Director, John Rondy • Senior Art Director, Eric Valk • Director of Client Services, Kelly Pemper. Every attempt has been made to ensure specifications are accurate. Because specifications are subject to change without notice, check with us, your Cat Dealer, for the latest equipment information. Some photography provided courtesy of Caterpillar Inc. High Velocity Communications Inc., 1720 Dolphin Drive, Suite D, Waukesha, WI 53186-1489. Phone (262) 544-6600. Please submit address corrections and changes via e-mail to: Kelly@HighVelocityCommunications.com. **Volume 12 Number 3**.

SAFE HAVEN

BACKED BY CAT® POWER, NEW COMMUNITY CENTER SERVES MANY NEEDS

First established in 1666, Piscataway, New Jersey is one of the oldest settlements in the U.S.

Located 40 miles southwest of Midtown Manhattan, Piscataway is a township of nearly 61,000 people. As the home of Rutgers University's Busch and Livingston main campuses, SHI Stadium and a significant portion of Robert Wood Johnson Medical School, the township has advanced academic and research facilities. Commercial businesses include a vibrant life sciences sector, information technology and data centers, transportation logistics, and a wide variety of other commercial and industrial companies.

In 2019, *Money* magazine ranked Piscataway in its Top 100 Best Places to Live in America—the fourth time Piscataway was featured on the list.

About 20 years ago, town leaders envisioned a new community center that would bring people together from all walks of life. The goal was not only to provide an outlet for recreation, but also a focal point for community support and safety.

That goal was realized last year with the opening of the YMCA Piscataway Community Center (YPCC). The 83,000 square-foot, state-of-the-art facility features an aquatic center with three pools, a fitness center and group exercise studios. There is also a training/coaching office, a gymnasium with 202 bleacher seats, child watch room, dance and art studios, café and a teen center.

The second floor consists of an indoor track above a full-sized basketball court. There is an outdoor water park open during the summer months with a pirate theme that has two open flume water slides, two spray cannons, a deck geyser and a large super splash bucket connected to the ship's bow surrounded by hose sprayers and arches. Outdoor seating is also available for families to enjoy.

"This is definitely a state-of-the-art facility," says senior facility director Muhammed Derti. "From the lighting controls, to the generators, to the pool systems, the mechanicals and even the flooring—everything we have here is basically brand-new technology and materials."

A place of refuge

As the design of the building was contemplated, Superstorm Sandy hit New Jersey in October 2012, leaving many people without power for five days or more, recalls Mayor Brian Wahler, who is now in his 21st year in office.

"It dawned on us and our emergency

Continued on page 6

CUSTOMER PROFILE

YMCA Piscataway Community Center

Location: Piscataway, N.J.

Application: Standby power

Cat® Equipment: G3512 gas gensets (2), Master Control Panel

management community that we needed an official evacuation site for the town," Wahler says. "So, what was envisioned as a place to bring people together for exercise and other activities morphed into a place for people to seek refuge during times of crisis.

"And one of the big components of that was, if you're going to send people here, we needed to have a reliable backup energy source to keep the power on," Wahler continues. "So, at that point, we started looking into designing the building as if everything was going to be powered by backup generators when there is a grid power outage."

Based on specifications from its engineering consultant, the township chose two Cat® G3512 gas-fueled generator sets and controls supplied by Cat dealer Foley Power Systems as standby power for the new community center. The decision to utilize natural gas instead of diesel-powered gensets was influenced by the experience with Sandy, when diesel fuel could not be delivered to many locations in the wake of the massive storm.

"The great thing about having natural gas is you don't have to have a service contract with a diesel company," Derti says. "If there's a storm and they run out of fuel or the roads are blocked, they can't get diesel fuel to you.

"By having natural gas, it's already in the building, so you know you're never going to run out of fuel," Derti says. "We can literally run the generators for the entire week, and they will keep running. You don't have to worry about the delivery guy getting here with fuel. With natural gas, it's a dependable supply of fuel to the generator."

Beyond major weather events, New Jersey is subject to brownouts and other interruptions from the utility grid. With backup power at the ready, the community center doesn't miss a beat.

"Having the doors open and keeping the lights on and everything maintained with no power outages is key," Derti says. "If someone's exercising, nothing shuts down. When we have our summer camp programs and the kids are using the facility and we have a power outage or a thunderstorm, everyone stays comfortable in this facility. And our members can also swim and use the pools as well. So we never shut down."

"What was envisioned as a place to bring people together for exercise and other activities morphed into a place for people to seek refuge during times of crisis."

BRIAN WAHLER, Mayor, Piscataway Township

Evacuation center

Piscataway officials decided to locate the Office of Emergency Management (OEM) within the new community center, further cementing the building's role as a safe haven.

"By having natural gas, it's already in the building, so you know you're never going to run out of fuel—it's a dependable supply of energy to the generator. We can literally run the generators for the entire week, and they will keep running. You don't have to worry about the delivery guy getting here with fuel."

MUHAMMED DERTI, Senior Facility Director, YMCA Piscataway Community Center

The OEM offices housed within the YPCC will serve as a command and control center in an emergency for Piscataway Township. And the entire building will serve as an official evacuation site.

"That's why we thought that the Office of Emergency Management should be housed in this building," Wahler says. "So we don't have to worry about power going down in an emergency. It'll be a base of operations. The office is near the side entrance, so staff can come and go without interrupting other activities in the building."

For added security, the YPCC has approximately 90 television screens and more than 100 security cameras throughout the building.

In early September, the remnants of Hurricane Ida caused a tremendous amount of rain in central New Jersey, which led to extensive flooding throughout the region. As part of a coordinated emergency response, the township's community center was opened as a shelter.

Thus far, officials from communities throughout the state of New Jersey have toured the model facility as they contemplate building their own community centers.

"One of the things that I strongly suggest is that they have an emergency management component, because in a time of crisis it's all hands on deck—even at a community center," Wahler says.

"It's not just our experience with Sandy, we went through Hurricanes Floyd, Irene, and Sandy," Wahler adds. "The lesson was that we need to have a redundant power supply for our government buildings, pumping stations, intersections—things that the average person does not think about. But we as officials have the responsibility to think about it because those are items that make cities and towns operate safely and efficiently.

"And when it goes down without power, chaos can ensue very easily," Wahler continues. "And that's why it was incumbent upon us to make sure that we have a redundant source of power backing up our primary systems to give our emergency management officials and volunteers peace of mind."

The YPCC was designed with sustainability in mind, says Kyle Strohman, executive director of the YMCA Piscataway Community Center. (The YMCA operates the facility for the town.)

"People depend on trustworthy power sources to be able to go about their daily lives," Strohman says. "Regardless of what's happening outside, they can come here and charge their electric vehicles, connect with WiFi, hold their meetings, and plug in their smart devices—all of these things that we tend to take for granted. We now have the ability to provide that for our community of 8,000 members."

Fast starting

The Cat G3512 generator sets were chosen because it was the only natural gas genset that could comply with all specifications including the necessary 1000 kW power output, and have the ability to start and accept load within 10 seconds per NFPA 110, according to Joe Hendershot, a principal with Associated Technology, Inc., who specified the genset for Piscataway.

"The selection criteria dictated that the community center install generators that start and energize emergency load within 10 seconds," Hendershot says, adding that the gensets are set up in an N+1 configuration.

"The Cat G3512 gas gensets have the capability to start within that timeframe, plus the EMCP 4.4 generator controllers manage paralleling and load management sequences of operations, and there is a remote touchscreen Master Control Panel (MCP) for viewing and control located in the adjacent electrical room.

"Mayor Wahler agreed that fueling with natural gas had unique advantages compared to other options such as diesel," Hendershot says. "So that was a deciding factor in selecting gas-fueled generator sets as the backup power source."

The generators were selected with critical grade silencers and sound attenuated enclosures to meet requisite noise ordinances.

"These two generators are so quiet that you actually don't need to wear headphones," Derti says. "We have houses right behind us, and they never complain about the noise when they're running. The only thing you'll hear is the exhaust flap when it kicks on."

Derti appreciates the ease of use of the standby power system.

"I can look at what the generators are doing from a touchscreen in my office," he says. "I can literally turn on the generator and run it from my office. The setup is just user friendly."

SNOWBIRD POWER

REVOLUTIONARY for the SKI INDUSTRY

A new cogeneration facility anchored by three Cat® gas generator sets is the latest in a series of major sustainability initiatives undertaken by Snowbird, a premier ski resort and alpine destination in Utah.

Housed in a new 8,700 square-foot building reinforced to withstand harsh winter conditions, Cat dealer Wheeler Power Systems designed and installed the new custom-designed cogeneration facility that features three synchronized and paralleled Cat gas generator sets, including two Cat G3520H units, as well as a single Cat G3512H generator set.

Commissioned in July, the 5.3 MW system also includes new switchgear, high-efficiency boilers, heat exchangers, pumps, control valves, and electronic controls for balance of plant components. The new Snowbird Power Systems facility enables the resort to make its own power, and then recycle the waste heat created from power production to warm its buildings and water rather than using new energy sources.

The new cogeneration plant replaces a 1.9 MW system installed in 1986 that was powered by three Cat G399 gas generator sets. Operating 24 hours a day, seven days a week year-round, the generator sets logged nearly 300,000 hours of service, far exceeding their expected operational lives of 120,000 hours.

"Caterpillar cogeneration technology supported by Wheeler Power Systems proved its value for Snowbird over the long haul, and we are poised to deliver the same superior level of performance with the new system," said Bart Meyers, general manager in Caterpillar's Electric Power Division.

The integrated system provides electricity for key operations at the resort, including the Aerial Tram and chairlifts. It also powers guest spaces throughout the resort, including The Cliff Lodge, The Inn, The Lodge at Snowbird, and Iron Blosam Lodge, as well as the Snowbird Center and Creekside Café & Grill. In all, the system can supply up to 90 percent of the resort's energy requirements during the busy winter season and up to 100 percent of its energy needs in the summer.

The cogeneration facility is the latest in a series of major sustainability initiatives undertaken by Snowbird, which include ridesharing, mine reclamation, native species revegetation, watershed rehabilitation, electric vehicle charging stations, energy-efficient bulbs, composting, heater upgrades, glass recycling and planting trees for season passes sold.

"Here at Snowbird, we are committed to being responsible stewards of our outdoor spaces that bring us so much joy year-round," said Snowbird president and general manager Dave Fields.

The new plant reduces carbon dioxide emissions and cuts the resort's carbon footprint in half.

"Replacing our original cogeneration facility with a new plant that leverages the expertise and technologies from Caterpillar is a part of that commitment," Fields said. "This new cutting-edge system will not only enhance the safety and experience of our guests, but also allow us to become more efficient with how we use energy at Snowbird."

"Here at Snowbird, we are committed to being responsible stewards of our outdoor spaces that bring us so much joy year-round."

LINING UP RIGHT

CRITICAL ELEMENTS COME TOGETHER FOR CAMPUS STANDBY POWER PROJECT

Constructed in 2017, the West Campus Utility Plant at the University of Washington (UW) provides chilled water and emergency power to the Health Sciences and other research facilities of the UW Seattle campus. The addition of the new utility plant was necessary to increase both chilled water capacity and to meet the growing emergency power demand of the campus.

Because a majority of the operations on a campus with 49,000 students are focused around research and incorporating education through research, the Campus Energy, Utilities and Operations (CEUO) department is responsible for providing uninterruptible and reliable emergency power and chilled water to all UW facilities. This includes the University of Washington Medical Center and the campus police station located next door.

The West Campus Utility Plant (WCUP) provides 4,500 tons of chiller capacity and eight megawatts (MW) of emergency electrical power, and is expandable to 10,500 tons of chiller capacity and 12 MW of emergency power without modification to the building. Underground diesel fuel storage and 1,800 lineal feet of 22" chilled water pipe in existing utility tunnels was also included in the project.

In addition to providing utilities to critical parts of the campus, the 15,000-sq. ft. building also serves as a gateway of sorts to the southwest area of the campus.

In 2019, CEUO leadership sought to add another standby generator set to the existing lineup of three Cat® 3516C diesel generator sets housed in enclosures on the roof of the two-story building. The $2 million allocated for the addition of a fourth standby genset had to cover the cost of not only procurement, but also engineering and installation.

As an added design/engineering challenge, the plant required that the existing Cat Switchgear which controls the backup generators remain fully operational during the installation phase.

Another challenge involved lifting the generator onto the roof of the building with a crane in a dense urban environment. And finally, the bulk of the project took place during the COVID-19 pandemic, which posed additional challenges with scheduling and permitting.

Going to the source

Finding a way to fit the entire project within the budgeted amount was accomplished through cooperative purchasing. Faced with budget constraints, plant manager Ryan Trickett worked with a procurement specialist at the university who was most familiar with cooperative purchasing.

CUSTOMER PROFILE

University of Washington

Location: West Campus Utility Plant, Seattle, Wash.

Application: Emergency power

Cat® Equipment: 3516C diesel gensets (4), Switchgear,160V 60Hz - 3 phase 3 wire

Aleksondra Jordan, a senior procurement and sourcing specialist with UW Facilities, recommended Sourcewell, a national organization that helps governmental, educational, and nonprofit agencies operate more efficiently through a variety of solutions. Sourcewell saves time and money by

Continued on page 10

combining the buying power of more than 50,000 governmental, educational, and nonprofit organizations.

"Sourcewell is a very useful tool that we use a lot here at UW, and it really turned out to be what made this project possible in the timeline that we needed with a product that we wanted," Jordan said. "It saved us time. We didn't have to do multiple bids or do a posting. We were able to easily read through the quote, and it included materials and installation. It really covered the entire project that we needed done here at our West Campus Utility Plant."

Going this route enabled Trickett to procure necessary equipment for the project in a highly efficient manner.

"Sourcewell provides some pretty good discounts on the equipment itself, but the big cost savings for us was the amount of time and effort it would have required to manage getting the project off the ground," Trickett said. "And that's a huge cost savings. Plus, it gave us the confidence that we were getting exactly what we wanted for this facility.

"We also saved on contractor markup because we didn't buy the genset through the electrical contractor," Trickett said. "We saved roughly another 10 to 15 percent on the cost of that unit alone because we bought it essentially customer-direct."

Since the Cat dealer was also the installing contractor, Campus Energy Utility and Operations was able to purchase customer-direct without the risk of an equipment coordination or delivery schedule mishap.

A team approach

Beyond cost considerations, the project required a complex planning and design process to ensure that all the utilities remained operational, and that backup power was still accessible in the event of an outage.

"The number one challenge we had was making sure that at all levels of the project—from the procurement stage all the way to final commissioning—that everybody understood this is a fully operational emergency power plant," Trickett said.

"At all times, we provide emergency power or backup power to the campus, whether the generators are running or not," Trickett said. "We're providing chilled water service year-round for critical process needs we have on campus, so it was very important that the team understood the project needed to be done in such a way that at no time during installation was that service compromised."

In a unique arrangement, Cat dealer N C Power Systems acted as the general contractor, which facilitated a team approach that led to a favorable outcome. Constant communication between the dealer, staff at the WCUP plant and the electrical contractor was essential, Trickett said.

"When we met with the team at N C Power to talk about the scope of the project, early on, we had the discussion about the critical nature of this plant, that Caterpillar switchgear was already here, and that my need as an owner was to have a very streamlined and efficient turnkey project that would meet the schedule and the budget."

Based on those discussions, N C Power Systems took on the role of general contractor and vetted the selection of OEG, Inc. as the electrical contractor.

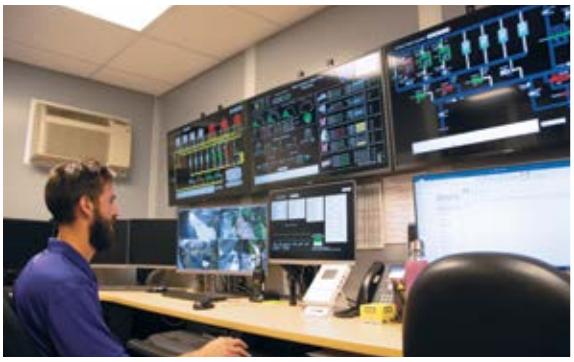
"From the very beginning they were asking us detailed questions directly, such as, "What do you think about cable routing? What about cable sizes? ... things like that," Trickett said. "So, it was a very flat communication structure where it really felt like we were one family, one team with a shared mission to accomplish."

For Jesse Reyer, a vice president with OEG, the bottom line was to avoid causing any loss of power during the project.

"For us it became a much larger scale project than what we would do as a traditional electrical contractor," Reyer said. "And the more we looked into it, we thought that this is a pretty exciting project and we can figure this out.

"We knew that whatever we did, we could cause no shutdowns," Reyer continues. "We also have the campus police station right next door and

West Campus Utility Plant



a church on the other side of it. So we had to play really nice with the neighbors. We had three different crane picks out here hoisting materials, and then our large crane hoisted the generator onto the roof.

"So, we had to navigate all of that with the neighbors here and get the appropriate street use permits, and all of this occurred during the pandemic. It was a matter of reaching out and trying to get people engaged at a time when everybody was working remotely. In the past, some of those things would take a day or two and now they're taking literally weeks to overcome. Probably our biggest challenges were the logistics and coordination with the other parties involved."

Based on the aggressive timeline, OEG pushed ahead with gaining electrical permits and documenting its work through third-party inspections. A week before the generator was installed, Reyer finally received a call from the City of Seattle, which was ready to conduct a pre-intake appointment—a process that normally occurs at the start of the project. Fortunately, the city expedited the construction permit because OEG had done everything right and documented it through inspections.

The lift came off without a hitch in December, and thanks to careful planning, no shutdowns occurred. The new Cat genset received final commissioning in March.

"In conjunction with N C Power Systems, we delivered a very good project, and most importantly, we had a happy client at the end of the day," Reyer said. "I believe we met all of their expectations—we didn't drop the ball."

"Having that trust and reliablity with the local dealer is very important to us and we know we can count on them."

RYAN TRICKETT, Plant Manager, University of Washington

Reliability factor

The selection of a Cat generator set to supplement the other three units was based on a history of other Cat units performing well elsewhere on campus, according to Mark Kirschenbaum, assistant director of Campus Utilities.

Before he started with the UW in 1995, there was an existing 6 MW Cat diesel generator installation at the central UW Power Plant.

"Everything was performing exactly the way it was meant to, so when it came time to expand, there was really no question that we wanted to maintain the same look and feel, so we pushed for and got permission for two more Caterpillar gensets. It's now a 10-megawatt plant that's been running successfully since 2004."

Five years ago, as part of the buildout of the West Campus Utility Plant, Cat diesel generators were the preferred choice, Kirschenbaum said.

"Why would we want a different brand of gensets? We were familiar with the 3516 series. They perform exactly the way we want them to, and they are relatively low maintenance."

In his previous job, Kirschenbaum worked as a chief engineer on diesel-powered ships.

"I remember those little Cat generators always did their job," he said. "I was used to much bigger engines, but coming to work here at the power plant, I immediately gravitated to the diesel generator room. It was like, 'Oh yeah, this is what I'm familiar with.' The Cat engines are bulletproof—they run. What more can you ask for? I saw no reason to change that, so we kept going with them. "

N C Power Systems handles all of the scheduled maintenance on the gensets, and performs any needed repairs.

"Given the type of systems and equipment that we run, we are expected to be operational at all times," Trickett says. "So it's very important to us to have a dealer like N C Power Systems who is responsive to all of our needs, and is timely with regard to corrective items as well as meeting the schedule for preventative maintenance items.

"Having that trust and reliability with the local dealer is very important to us, and we know we can count on them."

A **CLEAN** SLATE

AIRPORT MICROGRID IS KEY TO SUSTAINABLE APPROACH

Over the past 40 years, Chattanooga has transformed itself from one of the most polluted cities in the nation to one of the cleanest. As a cornerstone of the community, the Chattanooga Metropolitan Airport Authority (CMAA) shares the city's vision for sustainability.

A decade ago, the airport pledged to reduce its environmental footprint and started small by initiating sustainable practices both on the airfield and within the commercial terminal. Over time, the airport has incorporated this green philosophy into larger projects including a solar farm and LEED designed facilities.

Lighting was one of the first initiatives that the airport tackled. Old incandescent lights on the airfield were systematically replaced with more energy efficient LEDs as part of each taxiway construction project.

Lighting on the exterior of the terminal building was upgraded from metal-halide to compact florescent lights. On the interior of the terminal, lighting was changed to compact florescent lights, and time, motion and light detectors were installed to ensure that lights were only used when needed.

With these simple changes, the Chattanooga Airport reduced its electric consumption by one full megawatt each year over the first five years.

The CMAA has evaluated day-to-day operations and made conscious decisions to focus on sustainability in areas like green cleaning products, green pest control, green landscaping practices and recycling programs. All of these efforts minimize the pollution of air and water and leave a cleaner community for neighbors to enjoy.

The airport maintains many acres of asphalt on the airfield to support its aviation partners. All asphalt that is removed during reconstruction projects is recycled and reused to produce aggregate for new asphalt at the airport.

In 2018, the airport began restoring the pavement with an environmentally safe product instead of traditional coal tar. The new product significantly extends the life of the pavement while protecting water quality.

When the airport began the West Airfield Corporate Aviation Campus, a hill stood on the property and had to be removed before construction could start. Instead of trucking the dirt from the hill off the airport, the airport used the dirt as fill in an area of the airfield that was low and unusable. This served as the foundation, literally, of the airport's solar farm. The low-lying, 9.5-acre area that was once unusable is now the site of the 2.73 megawatt solar farm.

"We've done a lot of things to go green," says airport planner Jack McAfee. "When we built the fixed base operator (FBO), it was the first LEED Platinum certified FBO in the country. Several of our hangars are LEED certified."

LEED is an internationally recognized green building certification system which essentially provides building owners a method to identify and implement energy efficient ways to design, construct and operate their buildings.

"We actually bought a number of car dealership properties that were just all concrete surfaces, and we razed them," McAfee says. "We made it back into green space, and we don't see flooding anymore, which protects neighborhoods that used to be impacted by flooding from stormwater runoff."

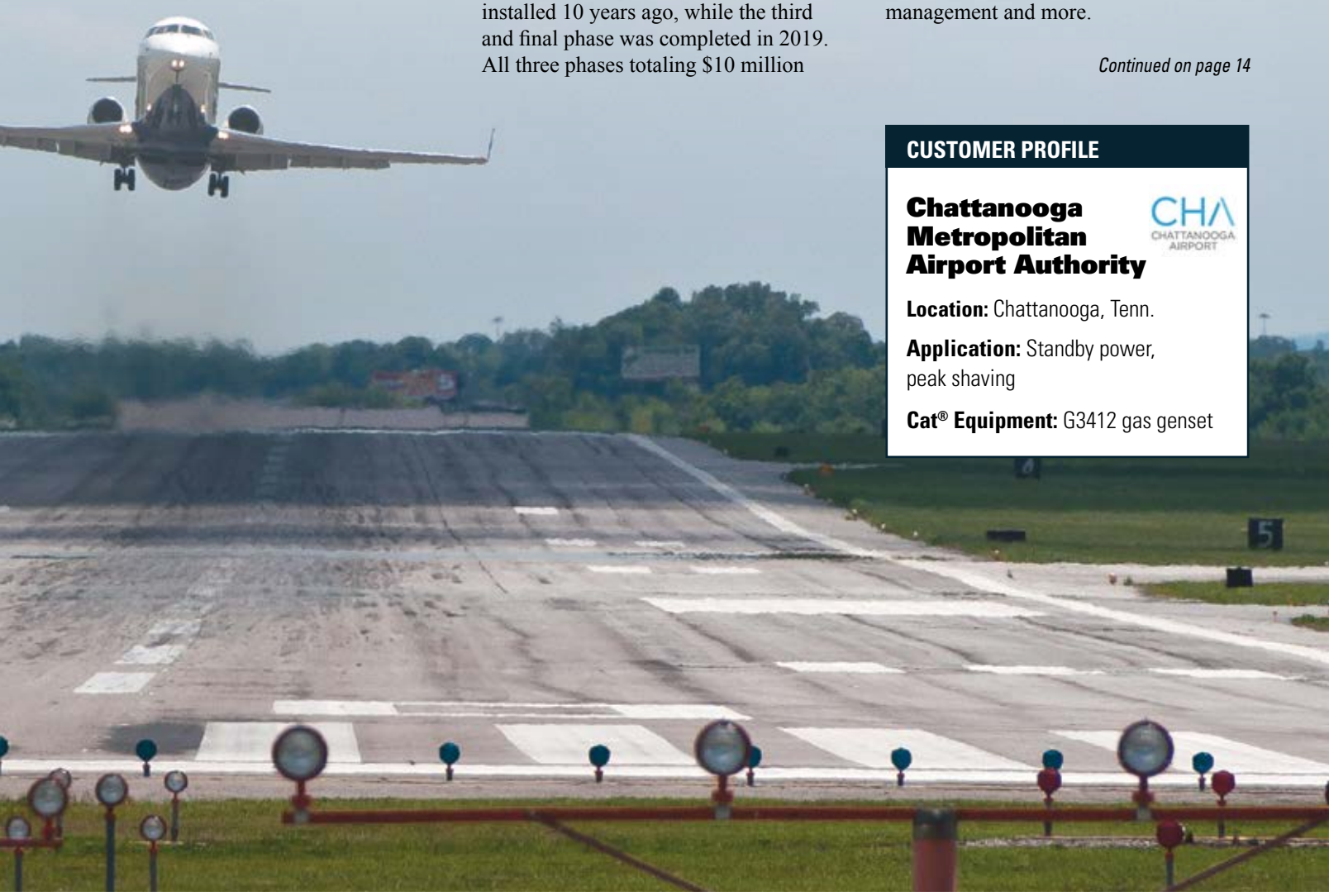
Advanced microgrid project

The solar farm is connected to a microgrid that includes energy storage, a Cat® G3412 gas-fueled generator set, and a control system that dictates when to run on stored energy and when to start the Cat genset for supplemental power. The first of three solar arrays was installed 10 years ago, while the third and final phase was completed in 2019. All three phases totaling $10 million were covered by a grant from the Federal Aviation Administration, with the airport authority contributing 10 percent of the total.

The airport owns and maintains the solar arrays, while the local electric and fiber optic utility—EPB of Chattanooga—owns the battery and the generator, and oversees operation of the microgrid.

About 10 years ago, EPB deployed one of the nation's most advanced smart grids for the Chattanooga area utilizing a community-wide fiber optic network as the communications backbone for the highly automated electric distribution system. Pairing the airport's microgrid with the community smart grid has allowed the research partnership to test new and more dynamic ways of utilizing the equipment for resilience, demand management and more.

Continued on page 14



CUSTOMER PROFILE

Chattanooga Metropolitan Airport Authority

Location: Chattanooga, Tenn.

Application: Standby power, peak shaving

Cat® Equipment: G3412 gas genset

Another partner in the project is the University of Tennessee, which designed the microgrid controller. The microgrid started as a research project between EPB and the University of Tennessee and was funded by the Department of Energy's Advanced Research Project Agency – Energy (ARPA-E).

"One of the things that they wanted to try to understand a little bit better is integrating different types of generation—of the solar and the battery and now the natural gas generator—and seeing how all those elements would work together," says Jim Glass, senior manager for Smart Grid development at EPB.

The microgrid supplies power to the runway lights and other navigation aids at the airport, McAfee says. Because it is tied into the local utility's distribution system, the microgrid also provides energy to an adjacent neighborhood.

"The main research aspect was developing a flexible boundary capability that allows the micro grid to interact dynamically with our community's smart grid," Glass says. "Normally a microgrid has one interconnect point to the utility and you open that and the microgrid operates independently. But since we are tying into our overall distribution system, we actually have three or four different points that could connect to the utility.

"And if there's no utility power available, the microgrid has the ability to expand or contract to serve as many customers as possible with the generation resources that are available," Glass says.

The microgrid runs in parallel with EPB's smart grid distribution system, or can operate in island mode when grid power is lost.

"Having this solar farm connected to a microgrid is important, because when we had a power failure out here previously, all of our navigational aids would go offline and that would cause air traffic to have to be rerouted if it was during low visibility conditions," McAfee says.

"Now if we lose power out here, the microgrid kicks on. With a gas generator it can go forever."

JACK McAFEE, Airport Planner,
Chattanooga Metropolitan Aiport Authority

"Now if we lose power out here, the microgrid kicks on. If EPB can't find an immediate resolution, this microgrid will power these navigational aids almost immediately."

Achieving net zero

Essentially, the microgrid solar PV covers 100 percent of the airport's electric utility bill. Energy that is generated from the photovoltaic solar panels is sold back to the Tennessee Valley Authority (TVA), and that amount is credited by EPB toward the airport's utility bill.

"Our main runway is between the terminal and the solar farm, and it would be cost prohibitive to bore underneath the runway and lay cable to power the terminal," McAfee says. "We found it was much more economical to just generate the power and sell it back to the grid.

"After the third phase was put in, we're at net zero. The amount that we sell to the grid is about the exact same as what we require for power at the main terminal."

While the solar cells provide essentially all of the power to the microgrid, they can't generate electrons when the sun doesn't shine. In order to ensure continuous power, the microgrid is backed by the Cat G3412 genset, which was commissioned in October 2020.

"With a gas generator, it can go forever," McAfee says. "We have some battery powered operations over here as well, and that'll power us for about two hours."

The generator is maintained by technicians from the local Cat dealer, Stowers Machinery.

"For EPB, it was important to have a stable generation resource," Glass says. "The solar obviously doesn't work at night or on a cloudy day, and the battery has got limited duration. So the generator gives us a little bit more stability in running the microgrid."

Additionally, the Cat generator is called on to run during times of peak demand on the grid. This practice known as peak shaving is controlled by a SCADA system, and helps EPB save on demand charges, which helps lower energy bills for its customers. EPB also tests the generator each month.

Altogether, the Cat genset is estimated to run just under 100 hours, annually. The choice of installing a gas-fueled generator set versus diesel was an easy one, Glass says.

"Part of it was convenience—there's no refueling," he says. "And the other important aspect is the perceived emissions. Natural gas is just a cleaner fuel, and we don't have to worry about smoke issues or anything like that."

The project represents a culmination of a partnership between the airport, EPB and the University of Tennessee—one which required working together in coordinated fashion to achieve the end result.

"We have a fantastic relationship with EPB," McAfee says. "They helped us get this project on line. And essentially any type of program we're doing related to power or solar, EPB has been right there as a partner."

SOLAR FARM

The solar farm is a staple in the Chattanooga Airport's green initiative. The three-phase project launched in 2011, expanded in the summer of 2013, and was completed in the spring of 2019. Each phase added nearly a megawatt of power, for a combined total of 2.73 megawatts.

The solar farm is located on the southwest corner of the airfield in an area unusable for aviation purposes. But it is the perfect location for a solar farm.

Phase I: A 1.0 megawatt solar array, consists of 3,948 solar panels with 60 cells each, generating 255 watts per panel.

Phase II: A 1.1 megawatt solar array, consists of 3,542 panels with 72 cells each, generating 310 watts per panel.

Phase III: A 641 kilowatt solar array, consists of 1,886 panels with 72 cells each, generating 340 watts per panel.

The three phases together produce approximately 100 percent of the energy consumed by the airport.

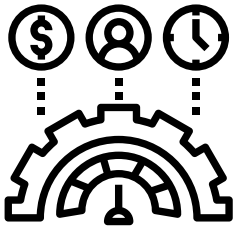
The solar farm was funded through a Federal Aviation Administration (FAA) Voluntary Airport Low Emission (VALE) Grant. VALE Grants are air quality grants issued to airports that are in non-attainment or maintenance areas. In 2010, Chattanooga was in a non-attainment area for Particulate Matter 2.5, making it eligible at the time for air quality grant funding.

COME TO THE POWER EXPERTS

Production needs reliable power.

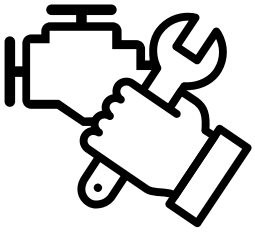
Come to the experts for the efficient, cost-effective, reliable power you need. From backup systems to solutions that provide power to your operations 24/7, our experts will deliver to your specific power requirements. With the widest portfolio of power products in the industry, Caterpillar power systems and solutions:

Meet the highest standards for reliability and performance



Are optimized for operational efficiency, cost effectiveness, and longevity

Can be configured to include low-carbon alternatives to diesel, supporting sustainable operations



Stay ready to run with tailored service agreements to optimize solution integrity and performance, avoiding unplanned outages

Learn more at www.cat.com/powergeneration

FOLLOW CAT® ELECTRIC POWER

CAT®
LET'S DO THE WORK.™