The Tulsa International Airport has been an important Oklahoma aviation hub since the 1920s, and today serves about 3 million commercial passengers a year. Getting travelers smoothly and safely through the airport and to their destinations is the topmost consideration, and having reliable electric power is a necessity.

While Tulsa’s utility outages have historically been of short duration, a recent major ice storm left the airport terminal without adequate electric power for more than eight hours and stranded thousands of passengers. Determined not to let that happen again, airport officials decided to replace the terminal’s electrical system with an updated system that could reliably and fully meet the electrical needs of the facility. During a recent major renovation of the 1960s-era terminal building, MTU Onsite Energy was the chosen supplier of a total standby power system that incorporated a unique, low-cost generator paralleling solution.

The airfield operations at Tulsa International Airport were already well protected against outages with several standby generator systems. These included FAA-owned backup generators for the control tower, instrument landing systems, runway and radar, along with airport-owned backup power for airfield lighting and limited emergency generator power for airport rescue and firefighting operations. On the passenger side, the 1960s-era main terminal building and its A and B concourses were served by a single 100 kW, natural gas-fueled generator set. With the terminal’s total electrical load at almost 4 MW, the existing set could power only critical life-safety systems such as emergency egress lighting and TSA security, as well as a portion of ticketing. During a major utility outage, there was no power for general lighting, escalators, baggage handling, food services and, most importantly, the passenger boarding bridges.

Surviving extended outages
“The airport’s primary goal for the project was to provide backup power in the event that commercial power was interrupted for an extended period of time,” said Jeff Hough, deputy director of engineering and facilities.
This 2 MW MTU Onsite Energy emergency standby generator set with associated transformers provides backup for the central plant at the airport.

“Our previous generator was capable of supporting only a very small percentage of the electrical loads for the terminal building, so when commercial power was lost, the facility was unable to support normal airline flight operations.”

Hough worked with consulting engineer Larry Gregory, P.E., with SAIC Energy, Environment & Infrastructure LLC, who designed the new standby power system for the terminal. Gregory worked, in turn, with Greg Esau, a sales engineer with United Engines, Tulsa, the local distributor for MTU Onsite Energy, to confirm that the generator sets met the specified requirements of the Airport.

“We designed a system with three separate generator installations that operate independently,” said Gregory. “A single 2 MW generator set powers the terminal’s central plant, and a 1 MW unit supplies concourse B, while concourse A requires 1.2 MW of standby generation, which we accomplished with a paralleled system.”

System includes unique paralleling design
Gregory explained that the A concourse required a larger generator than concourse B because the A concourse will support Boeing 777 wide-body aircraft in the future. Since aircraft are connected to the facility for aircraft power and air conditioning units when they are parked at the gate, those larger planes and larger loads have to be taken into consideration when planning for outages. To achieve the needed 1.2 MW of backup generation, Esau recommended that two 600 kW MTU Onsite Energy generator sets be paralleled to meet the power requirements.

“The local demand-reduction program is voluntary and allows us to participate to the maximum extent we can with our EPA-rated Tier 3 generators.”

/ / / Jeff Hough, deputy director of engineering and facilities

“First, the MTU Onsite Energy generator sets can parallel without the need for traditional paralleling switchgear, which would have made this installation prohibitively expensive. Instead, the generators are able to synchronize using their standard DGC2020 onboard generator controllers. This onboard paralleling capability was really one of the keys to MTU Onsite Energy winning the project. Second, the two 600 kW generator sets are less expensive than a single 1.2 MW generator set because they are in a popular power node. Third, by paralleling two generator sets, the system for concourse A can be more flexible. For example, in a power outage, both generators would start, synchronize and share load, but if the load is such that one generator can supply the whole concourse, the second 600 kW generator set will shut down, saving fuel. Lastly, paralleled systems enhance reliability, because if one generator fails to start, the other will likely start and assume the load.”

Another money-saving feature of all the installations is that transformers are used to step up the 480-volt power from generator sets to the terminal’s distribution voltage of 13.2 kV. Esau pointed out that while alternators that produce 13.2 kV directly are available, they are much more expensive than units using industry-standard 480-volt alternators with transformers. This was another innovative design detail that helped keep project costs low without affecting system reliability or efficiency.

When the power goes out
The airport features multiple layers of protection from power outages, including dual utility feeds, UPS systems for critical systems and now the new standby generators that will supply the total needs for the central plant, terminal and concourses.

“If both utility feeds fail, a new UPS system maintains power to critical computers and life-safety systems while the generators start,” said Gregory. “The concourses are the first to come online after a programmed delay of about 10 seconds. If the power is out for 10 seconds, it’s likely to be out longer, so that’s when the generators come on line to supply power to the concourses and main terminal. When the chiller systems in the central plant shut down because of an outage, they have to be restarted manually to prevent damage to their associated pumps. It takes the maintenance crew about 20 minutes to restore the HVAC.”
This 1 MW MTU Onsite Energy generator set provides emergency backup for the passenger terminal’s concourse B.

In a further money-saving move, the terminal building’s existing 100 kW natural gas-driven generator was relocated to the airport rescue and fire fighting station, where it now provides the total power needs of that facility.

Two paralleled 600 kW MTU Onsite Energy generator sets provide 1.2 MW of emergency power for the passenger terminal’s concourse A.

Green initiatives save energy
Hough said that the airport has instituted environmentally sound operational initiatives that have resulted in reduced energy consumption, lower operating costs and reduced usage of natural resources. New high-efficiency lighting and air-handling equipment installed during the renovation will control the growth of energy requirements now and in the future, minimizing the likelihood that the standby power system will have to be expanded anytime soon.

“The terminal renovation was driven largely by the age of the facilities,” said Hough. “Aging systems included HVAC, aging roofs, electrical systems that were fine when installed but were now at capacity and architectural finishes that had reached the end of their useful life; plus new TSA security requirements.” The result will be a more energy-efficient building with lower power requirements.

Another way the airport will save money with its new standby power system is by participating in its utility’s demand-reduction program. In exchange for a favorable electric rate, the airport agreed to run its generators during hours of seasonal high-peak demand to alleviate pressure on the local utility grid.

“The local demand-reduction program is voluntary and allows us to participate to the maximum extent we can with our EPA-rated Tier 3 generators,” said Hough. “The financial incentives are tied to the level of reduction we are able to achieve. When we use the generators to help us reduce demand, we’ll have to keep our annual run-time limits in mind. We also plan to use the demand-reduction operating times to meet our routine system-testing requirements and kill two birds with one stone.”

Hough is pleased with the new power system installation and looks forward to a more reliable facility when outages occur. “With the completion of the generator installations, the airport terminal building will now be able to continue normal operations and provide uninterrupted airline service for the city of Tulsa, whether the airport faces ice storms or any other power interruption,” he concluded.

MTU Onsite Energy is a brand of Rolls-Royce Power Systems AG. It provides diesel and gas-based power system solutions: from mission-critical to standby power to continuous power, heating and cooling. MTU Onsite Energy power systems are based on diesel engines with up to 3,400 kilowatts (kW) power output, gas engines up to 2,150 kW and gas turbines up to 50,000 kW.