Dell Children’s Medical Center of Central Texas, in Austin, is one of the first hospitals in the United States to reach for USGBC LEED Platinum certification. But that’s only the beginning. Thanks to a hybrid combined heat and power (CHP) energy system, the center generates enough electricity, chilled water and steam to serve the entire hospital—with enough spare energy to export onto the local utility grid. Not only that, but the center shares its excess thermal energy with neighboring buildings via underground piping. The plant, which opened in February 2007, has already achieved performance expectations, reaching an overall CHP system efficiency of approximately 75%.

Burns & McDonnell of Kansas City, MO, provided the design, construction and turnkey installation of the packaged hybrid CHP energy plant. The $18 million facility incorporates a Mercury 50 recuperated natural gas combustion turbine from Solar Turbines Inc, San Diego, CA. The Mercury 50 is capable of producing up to 4.5 megawatts of on-site generation at a simple heat rate efficiency of 38% and guaranteed NOx emissions of 5 parts per million without catalyst. “This is one of the only technologies available that will meet the new State of Texas emission standards without the need of a catalyst,” says Ed Maradiat, director of CHP development, Burns & McDonnell.

The waste heat from the 711°F combustion turbine exhaust is ducted through a bypass diverter valve to a heat recovery steam generator (HRSG) that produces up to 14,000 pounds per hour. The steam from the HRSG provides process steam to the hospital for heating and can also be used to produce 900 tons of chilled water, which is produced from a Trane two-stage absorption chiller.

THE HYBRID SOLUTION
The hybrid energy plant also incorporates a 1,500-ton electrical duplex centrifugal packaged chiller plant with cooling tower and condenser water pumps, a 20,000-PPH natural gas-fired, stand-by packaged boiler, primary and secondary chilled water pumps, a 1,500-kW emergency diesel engine generator and an 8,000-ton-hour chilled water storage tank with chemical treatment.

Another significant feature of the packaged hybrid CHP facility is the thermal energy storage tank, providing 8,000-ton hours of storage capacity—enough time to defer from running the electrical centrifugal chiller during the peak energy times of the day. The tank also provides redundancy and reliability during non-peak periods by allowing the stored, chilled water to be used as backup for the packaged chiller plant and the absorption chiller.

A LEED LEADER
“This is one of the first hospitals in Texas to be fully grid-independent,” says Maradiat. “And, it is the first hospital in the nation to use the efficiency provided by the CHP plant to achieve Leadership in Energy and Environmental Design (LEED) efficiency...
credits from the U.S. Green Building Council.” It is also one of the first CHP plants in Texas that generates primary power, with the grid serving as the backup supply.

Two independent electrical feeders provide redundant backup. For further redundancy, a traditional diesel backup generator addresses the remote possibility that both the utility grid connections and the combustion turbine could go down at the same time.

DISTURBANCE IN THE GRID
If a grid outage or power disturbance happens, the energy plant will disconnect from the grid without disruption of service to the hospital. When an automatic disconnect is activated by the control system, the facility transitions seamlessly into the island mode.

The project was designed to conform to the output-based emissions formula developed by the Texas Commission on Environmental Quality (TCEQ). System records show that NOx and SO2 levels are tracking significantly below TCEQ requirements.

RISK & REWARD
Burns & McDonnell secured $995,000 of Dept. of Energy cost share funding for this innovative packaged CHP plant. A portion of these funds is paying for research, performance monitoring and the documentation of results. Burns & McDonnell teamed with the University of Texas in Austin, which is performing the bulk of the research, analysis and documentation.

Austin Energy agreed to provide the balance of funding and to own and operate the hybrid CHP energy plant project. The system’s carbon emissions footprint is 40% less than the balance of Austin Energy’s power plants. This is the first commercial, on-site energy plant in the Austin Energy portfolio. The system was designed so that Austin can operate, control and monitor the plant from their central operations center across town from the hospital.

LESSONS LEARNED
The packaged plant concept for the hybrid facility is the result of lessons learned from the Dept. of Energy CHP Development Project located at the Domain Technology Business Park in Austin. This project expanded the concept beyond a packaged CHP plant to include all of the necessary components to provide full power and thermal energy requirements of the hospital. The plant is created through a packaged or modular system using standard, pre-manufactured components. The modular approach reduces the custom engineering, planning and project lead time that is standard for most CHP systems. “Integrating technologies into modular systems that include on-site power generation, heat recovery and thermally-activated technologies is intended to achieve efficiency gains not possible from designing and building an on-site system,” Mardiat says.

INDEPENDENT MONITORING
Now that the system is up and producing, the race is on to quantify and measure the effectiveness of the CHP hybrid. Austin Energy, equipment packagers, Burns & McDonnell, the Department of Energy, Oak Ridge National Laboratory and the University of Texas at Austin are all studying parts of the package. “We are working to assess the system’s performance in a manner that is accurate, transparent and verifiable,” Mardiat says.

“Our goal is to provide performance data that makes sense to professionals who may be considering a packaged CHP system but are not knowledgeable about this emerging technology. We believe it has great potential.”