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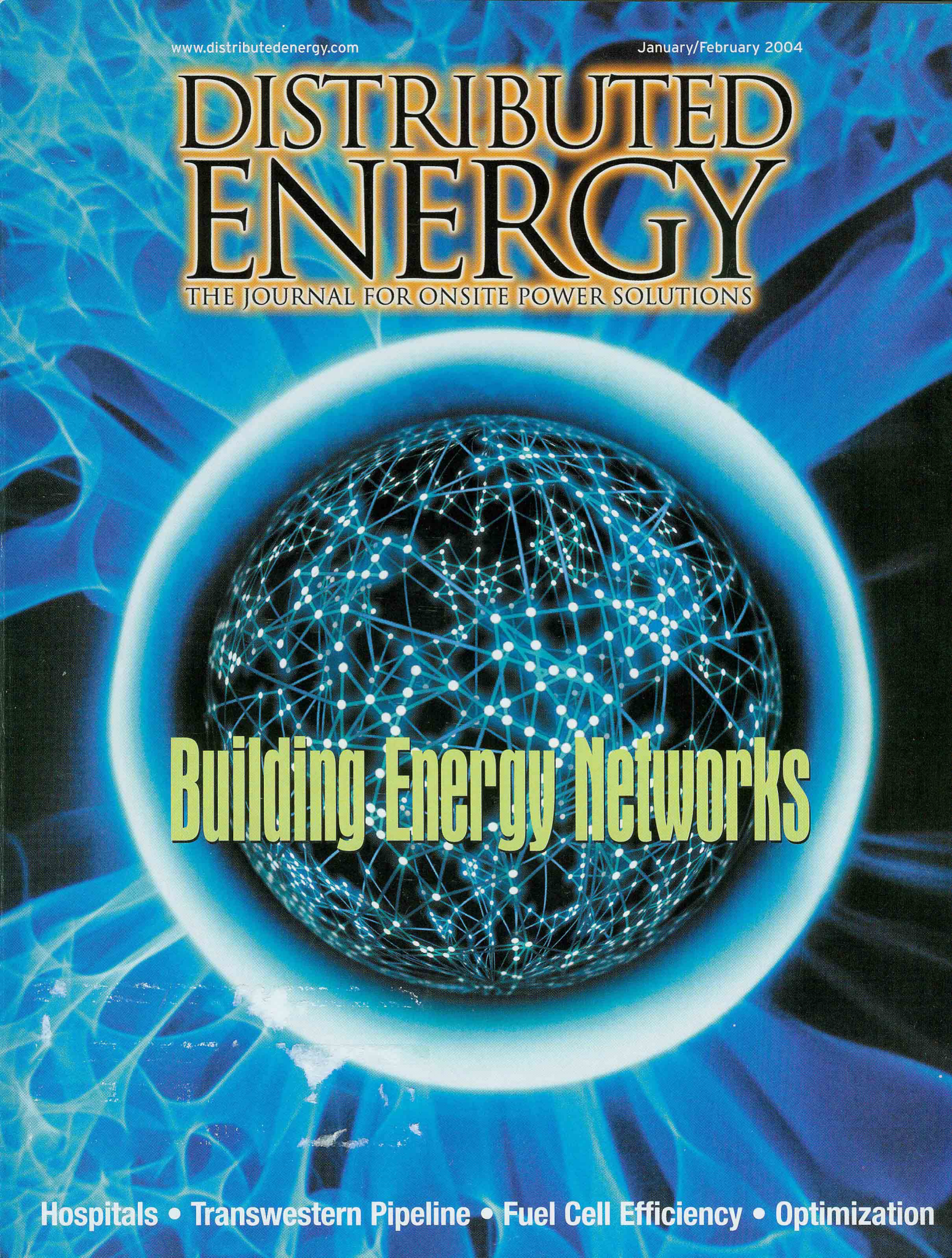

Building Energy Networks

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CJ CÓRDOVA

Packaged Systems Pave the Way to Up-Front Cost Savings

In the November/December issue's column, I profiled major types of onsite power generation and related equipment. In this issue, I'm very pleased to introduce guest columnist ***Ronald Fiskum, distributed-energy resources (DER) program manager at the United States Department of Energy****, to describe DOE's initiative with industry partners to combine individual pieces of equipment into prepackaged systems for buildings. Fiskum, who oversees this initiative along with other DER programs, encourages you to visit* WWW.EERE.ENERGY.GOV/DER/BCHP_PACKAGED.HTML *to learn more or to contact him directly at* ronald.fiskum@ee.doe.gov *or 202/586-9154.*

Traditionally, energy customers interested in installing onsite generation and combined heat and power (CHP) systems hire engineering firms to combine individual components into a unit designed to serve their specific needs. Depending on application size and complexity, business as usual means that hundreds of hours of up-front engineering and design work might be required, with multiple weeks or months needed for installation and start-up.

Custom-engineered systems feature highly efficient fuel use, reduced energy costs, and improved power reliability, among other advantages. However, a shorter, less costly, and simpler route to achieving these benefits in buildings is evolving: packaged CHP systems, also called *integrated energy systems* (IES). Equipment manufacturer teams, along with DOE and Oak Ridge National Laboratory (ORNL), are collaborating to improve and standardize IES by packaging formerly separate components into one streamlined unit at the factory. These systems, which leave the factory ready for use in a variety of buildings, feature power generation units matched with heat recovery and thermally activated technologies in optimal configurations. The smaller-scale systems can even be delivered on a single skid.

What's in It for Me?

"DOE's goal is to accelerate the market introduction of packaged IES that offer customers lower up-front costs and less complicated and time-consuming installations," notes Phillip Fairchild, who leads the CHP group at ORNL. "The industry teams that DOE is supporting through ORNL are prematching components and tailoring them to function together in the most efficient manner possible." In fact, the teams are designing IES to provide buildings with systems that closely match their energy loads. Examples of facilities with loads that can be served efficiently by an IES include hotels and motels, hospitals and other healthcare facilities, schools and universities, supermarkets, and other commercial or institutional buildings.

The advantages that an IES offers customers over a conventional system include the following:

One-Stop Shopping—You don't need to specify separate pieces of equipment, deal with multiple manufacturers, and hire someone to string components together for you and make them work. Manufacturers have anticipated your needs and partnered to pair and optimize the performance of selected components.

Capital Costs Cut Significantly—Pre-engineering results in standardized off-the-shelf packages that cost less.

Installation Time Reduced by Up to Two-Thirds—Manufacturer teams are striving to come as close to "plug-and-play" as possible so a system can be dropped in, plugged in, and turned on in minimal time.

Simpler Control Systems—Instead of separate controls on each piece of equipment, you get a streamlined control system. There is no need to master multiple complicated control systems and ensure that each is successfully integrated with existing building controls. You may even be able to simplify the operation of existing controls with the packaged system.

Greater Adaptability—The modular packages are adaptable to various capacity requirements and space limitations. There is no need to custom engineer; a system suited to your facility's needs can be configured easily.

Building Systems Simplified—All of the packaged systems being developed feature exhaust-fired absorption chillers/heaters that eliminate the need for steam/hot-water generation equipment at your site.

Replicable System Designs—Got more than one facility with energy needs? Packaged systems are suitable for multiple applications across facilities.

How Do Integrated Energy Systems Work?

A key to realizing the full potential of IES lies in energy-use optimization. Central to this component are computer-based controls that link and simplify equipment and/or building system operations from the facility-engineering point of view while optimizing equipment operation from the energy-use point of view.

"In their ultimate form, online supervisory controls can optimize both supply- and demand-side energy options on a real-time, campuswide basis," notes Steve Gabel, project manager at Honeywell. "On a smaller scale, integrated systems controls offer a streamlined approach to making different pieces of equipment work together in the most efficient and cost-effective manner possible."

Who Is Packaging CHP Components?

Here are short summaries of what each ORNL-sponsored industry team is accomplishing, along with contacts who can answer your questions in greater detail.

Smaller Systems

UNITED TECHNOLOGIES

United Technologies partnered with Capstone Microturbine and Carrier Corporation to develop systems that power air conditioning with waste heat from microturbines, maximizing fuel efficiency and energy cost savings. The team recently introduced the PureComfort Solution, featuring four Capstone 60-kW microturbines coupled with a Carrier 110-ton, double-effect, direct-fired absorption chiller. The team is fast-tracking preparations for a test facility. It also analyzes factors that influence market success by developing a screening tool and optimizing the modular system to achieve significant savings.

Project Contacts: Tom Rosfjord, Ph.D., United Technologies Research Corporation, 860/610-7418, *rosfjord@utrc.utc.com*; Tom Coulbourn, national accounts manager, UTC Power, 804/353-5327, *tom.coulbourn@utcfuelcells.com*

CAPSTONE TURBINE CORPORATION

Capstone Turbine is developing and integrating packaged CHP systems driven by its ultralow-emission 30- and 60-kW microturbines in arrays of up to 20 microturbine-driven systems. The team is focusing on (1) creating packages that provide optimal energy savings for small turbine-based integrated systems; (2) improving end-user power quality, capital and operating costs, and reliability; and (3) providing the best value for clean, onsite cooling, heating, and power generation.

Project Contact: Steve Gillette, director of CHP business development, 818/734-5472, *sgillette@capstoneturbine.com*

NISOURCE ENERGY TECHNOLOGIES

NiSource Energy Technologies and Rahmat Shoureshi, controls consultant, are developing, integrating, and packaging an energy system that optimizes facility energy usage by combining multiple 60-kW microturbines with absorption chillers/heaters in packaged systems. The project builds on a successful hotel installation in Chesterton, IN, to develop future applications in other industries with high water-heating needs. The system optimizes energy options for a facility's specific energy-use patterns, including space heating, thermal load from hot-water heating, and swimming pool and spa heating.

Project Contact: Robert Kramer, chief scientist, 219/647-5500, *rakramer@nisource.com*

INGERSOLL-RAND

Ingersoll-Rand Energy Systems and IR Hussman teamed with Energy Concept Company and Advanced Mechanical Technology Inc. to combine CHP components into a package ideal for supermarket applications. The system, which can supply 70–100 kW, provides steady, grid-independent, microturbine-based power integrated with an ammonia-water absorption refrigeration system on a single skid serving applications to -20°F. The team is focusing on meeting the challenges posed by the need to aggregate supermarkets' typically small, dispersed refrigeration loads and on creating standard product suitable for store designs that vary widely.

Project Contact: Jim Kesseli, advanced technology director, 603/430-7116, *jim_kesseli@irco.com.*

Larger Systems

GAS TECHNOLOGY INSTITUTE

The Gas Technology Institute, Waukesha, Trane, Ballard Engineering Inc., Charles Equipment Company, and the University of Illinois at Chicago teamed to develop and demonstrate reciprocating engine generators ranging from 290 to 770 kW matched with absorption chillers (e.g., 90 RT) to optimize performance. The resulting modularized plug-and-play IES are easily adaptable to various requirements for electricity, hot water, and chilled water. The team is using market analysis to guide development of this system to expedite commercialization.

Project Contact: John Kelly, distributed-energy group director, 847/768-0665, *john.kelly@gastechnology.org*

BURNS & MCDONNELL

Burns & McDonnell has teamed with Broad USA, Solar Turbines, and Austin Energy, a municipal utility, to develop a modular system that integrates a 5-MW turbine generator with an advanced waste heat-fired, 2,500-RT absorption cooling to provide energy to an Austin Energy microgrid to a high-tech industrial park. Costs will be reduced because chilled water is used for air conditioning, increasing fuel-use efficiency from 33% to 70–80%. The modular design is adaptable to various capacity, space, and grid interconnection requirements.

Project Contacts: Ed Mardiat, director of CHP development, 816/822-3344, *emardiat@burnsmcd.com*; Rod Schwass, program manager, 816/822-4213, *rschwass@burnsmcd.com*

HONEYWELL LABS

Honeywell Labs has teamed with Broad USA, Chelsea Group, and I.C. Thomasson to develop reference designs to improve economics and simplify installation. Honeywell Energy Services is installing a prototype system at the 82nd Central Heating Plant at the Ft. Bragg military base in North Carolina. The 82nd plant, one of 14 central plants on the base, serves a large number of barracks and other buildings with steam for heating and domestic hot water, in addition to chilled water for cooling. The prototype IES features a 5-MW turbine generator integrated with a 1,000-ton Broad USA absorption chiller that uses waste heat from the turbine and/or natural gas to meet air-conditioning needs. The absorption chiller will be used to displace the cooling load of an existing 800-ton electric centrifugal chiller. Turbine waste heat will also be used to produce steam. A supervisory control system will optimize energy supply. Packaged systems with supervisory controls can be a key component in maximizing the cost-effectiveness of a site's energy choices, health, and safety.

Project Contacts: Steve Gabel, project manager, Honeywell, 612/951-7555, *steve.gabel@honeywell.com*; John Wimberly, president, I.C. Thomasson, 615/346-3400, *jwimberly@icthomasson.com.*

CHP for Buildings Integration Test Center

In addition to the equipment manufacturer teams, DOE is sponsoring equipment integration testing through the CHP Integration Test Center at the University of Maryland. The center is housed in a 52,700-ft.^{2} office building at the edge of the University of Maryland campus. The 200-employee administration building is an ideal test site because it represents a typical commercial building, with a total power demand of 300 kW and a requirement for 60 RT of cooling capacity.

The center is testing two different IES, both of which supply actual building needs. To take an exciting online tour of this facility and the two systems, please visit WWW.CHPB.NET/VTOUR/INDEX.HTML. DE