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Energy PARTNERS

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Survey Results:

Strong response to premiere newsletter issue; high interest in water heating.

The results of the* Energy Partners *readership survey indicate your growing interest in energy monitoring, microgeneration and surge protection. However the overwhelming surprise of the survey was that the two categories of greatest interest (jointly comprising 28% of requests for more information) were Tankless Water Heating and Water Heater Boosters.

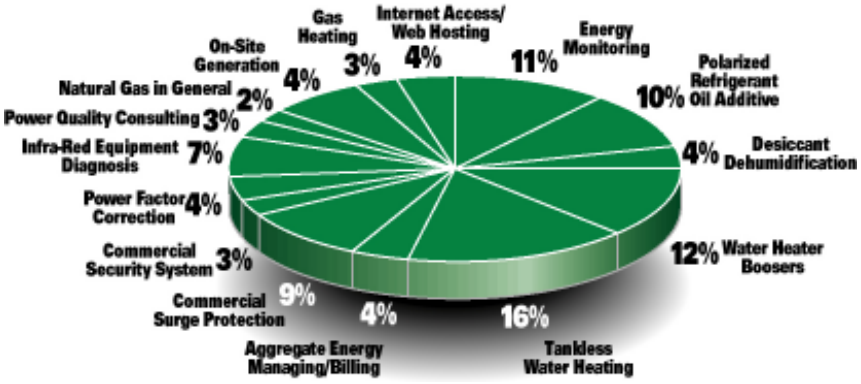
Water heating alternatives

At the national level, tankless water heating and water heater boosters are enjoying increased demand, with their primary targets typically being hotel/motels, restaurants and hospitals—obviously industries with considerable dish/clothes-washing applications. According to your responses, however, interest in water heating efficiency and alternatives is expressed across a broader spectrum of small business settings. Although not typical of the demand for these specific innovations, your responses are consistent with your strong interest in energy efficiency.

Newsletter is preferred channel

Your responses also indicate that you prefer to receive more information on these technologies/trends through the newsletter (81%), rather than through direct contact (19%). Therefore, *Energy Partners* will now be even more dedicated to addressing your expressed interests in detail.

Your Topics of Interest



Insight Into On-Site Generation

As deregulation takes shape across the nation, many electricity users and providers are reviewing methods of procuring and generating energy. One opportunity being considered is ***distributed generation*** (DG), also called on-site generation, which allows electricity to be generated at or near the location where it will be used.

DG is the integrated or stand-alone production of energy that benefits specific customers, the electrical system, or both.

Some forms of distributed generation are currently available, such as reciprocating engines, combustion turbines, and diesel generating sets. In most cases these technologies are used for "peak shaving" and back-up generation. The most promising distributed generation technologies, such as fuel cells and microturbines, have economic challenges, but technology is anticipated to evolve within the next five years which will make these options economically feasible on a commercial scale.

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Distributed Generation (Continued from page 1)

Combustion Turbines (CTs) are generating devices that use a direct mixture of air and fuel to produce energy. Combustion turbines exhibit efficiency and emissions ratings similar to reciprocating engines, and have been in commercial use for many years.

New technology may result in a turbine that can easily be used for back-up power or peak generation. Turbines have the greatest potential in an industrial setting, but may also be applicable in a commercial setting. The real advantage of CTs is seen when their heat is recovered for such practical uses as space heating or water heating.

The use of combustion turbines in the residential segment is unlikely due to the size of turbines, noise, and siting restrictions.

Fuel cells employ an electro-chemical process that converts fuel energy to electricity through flameless oxidation.

Fuel cells are similar to batteries in that they create an electric current when chemical reactions release electrons at one electrode and absorb them at another. The difference is that the electrodes of a battery provide the "fuel" and oxidizer, and so are consumed by the chemical reactions. In a fuel cell, gaseous fuel (such as hydrogen, natural gas, or methanol) and oxygen flow through porous electrodes—which are not consumed, and therefore do not need to be "recharged." Because fuel cells skip the combustion process, the conversion is much more efficient than a steam-fired boiler and much cleaner—the main emissions from a fuel cell are water vapor, carbon dioxide, and trace amounts of carbon monoxide.

Fuel cells are usually named according to the type of electrolyte (the substance which provides conductivity) they use. Four major kinds of fuel cells are now being actively developed:

- phosphoric acid fuel cells (PAFCs), the most highly developed, with major demonstration plants in operation
- photon exchange membrane (PEM), currently being tested in residential and automotive applications
- molten carbonate fuel cells (MCFCs), the most efficient fuel cell design, now entering the demonstration phase of development
- solid oxide fuel cells (SOFCs), still in the experimental stage.

Each technology is expected to find its niche eventually: PAFCs have advantages for cycling duty; PEMs have quick start-up capability and will probably be found in automotive and residential applications; MCFCs will probably be used for baseload operation; and SOFC units could be attractive for small installations if fundamental technology development issues are resolved.

Though fuel cells are currently expensive and available on a limited basis, they may still be attractive in specific applications, such as remote locations or for premium power. Upon commercialization (anticipated by 2003), a residential fuel cell is expected to retail for $3,000 to $5,000. At these prices, fuel cells can generate electricity at seven to 10 cents per kilowatt hour, depending on the fuel costs in a given market. According to H. Frank Gibbard, CEO of H Power, prices of his company's systems are expected to drop below $3000 within four to five years.

Microturbines, often called pint-size power plants, are on-site generators that are appropriate for many applications. These turbines evolved from industrial, automotive, and aerospace applications, and are smaller and simpler to operate than those used in central-station power plants. Microturbines are generally 25 to 250 kW. They may be operated in a simple cycle, but are more efficient if exhaust heat is used for process heating in a cogeneration cycle.

Only a limited number of commercial models are available today, but manufacturers—sensing their potential application in a restructured retail energy market—are rushing to develop new models. Microturbines are available in small-scale increments, suited to modest-sized commercial cogeneration applications because of their heat and exhaust output characteristics. Declining costs are expected to accompany increased market volume.

Photovoltaic (PV) technology, or solar power, is based on semiconductors, which convert light into direct electric current. Systems may be mounted on the ground or roof, and are not limited to areas that are consistently sunny. PV systems have few, if any, moving parts and create no pollution.

In order for the PV market in industrialized countries to be successful, the cost of PVs must decrease from the current price of approximately $4 per peak watt to $1.50 per peak watt. Decreasing the cost of PV production is a Catch-22; there is not enough demand to achieve an economy of scale, and until the price decreases, demand is not likely to increase.

Technology Efficiencies

	Installed Capital Cost ($/kW)	Operating Cost (¢/kwh)	Thermal Efficiency (%)
Centralized Power Plant – conventional coal	900 - 1100	Varies	30
Combustion Turbine Generators – simple cycle	250 - 350	Varies	35
Combustion Turbine Generators – combined cycle	400 - 600	Varies	60
Combustion Engine Generator set	260 - 1000	Varies	30 - 40
Fuel cell – Phosphoric Acid	2400 - 3300	7 - 10	40 - 45
Fuel cell – PEM	1300 - 1900	7 - 10	40 - 45
Fuel cell – Carbonate	Unknown	Unknown	50 - 55
Fuel cell – Solid Oxide	Unknown	Unknown	45 - 70
Microturbine/turbogenerator	350/kW	3.5 - 6.4	Varies
Photovoltaic system *(fuel is free)*	2200 - 3000	0	10 - 20

Source: Frost & Sullivan, NA Distributed Generation System Markets, 1-4 - 1-5 and EPRI (taken from Exnet, Distributed Power Conference Proceedings, Oct. 7, 1998), Sonat Power Systems, (taken from Exnet, Distributed Power Conference Proceedings, Oct. 7, 1998)

Deregulation Update

- As of September 1, 1999, 21 states had enacted restructuring legislation.
- Twenty-seven states have either Commission or Legislative investigation underway.
- As of May 31, 1999, the California Public Utility Commission reports that about 1.3% of the state's consumers had switched electricity providers. About half switched to "green" power — electricity generated from environmentally acceptable methods, such as wind, solar and geothermal.
- In Colorado, a task force to address retail competition reported that five public hearings have been held to date with one additional public hearing scheduled. Thus far, opponents of restructuring outnumber proponents on the basis that Colorado currently enjoys low electric rates, and the opponents fear prices would increase with competition. The task force was scheduled to make its report to the General Assembly by November 1, 1999.
- In May 1999, the Louisiana Public Service Commission staff presented a report on restructuring, recommending a slow approach. The report was skeptical of the benefits to residential customers, fearing that restructuring might increase prices. The report recommends that no action be taken now toward retail competition.
- In Maine, retail competition is scheduled to begin in March 2000. Standard service prices will be set through a bid process, rather than a predetermined procedure as in other states.

Power Talk: new technologies/ commercial applications

Infrared Diagnostics

Infrared cameras capture multi-colored images that indicate minuscule temperature variations in just about any object you can think of. Thermography is used in an astounding number of ways in commercial and industrial applications for diagnosing maintenance problems before they become serious.

For example, infrared imaging can...

- pinpoint high-resistance connections and other trouble spots in electrical equipment that could lead to failure of critical parts.
- diagnose mechanical defects in bearings, motors, pumps, and other components.
- highlight stresses in metallurgical applications.
- analyze a building's heat loss or heat gain, and the performance of insulation.

If your business needs infrared imaging regularly, you can buy the necessary equipment for between $10,000 and $30,000, including digital image storage, and become certified in thermography. If you'll need the service only once or twice a year, at most, you may prefer to consult a certified thermographer in your area. For a referral, get in touch with the ***Energy Partners*** editor (see contact information on page 4).

Tankless Water Heaters and Water Heater Boosters

Many businesses have a critical need for instant hot water–170° or 180°F right out of the faucet. In particular, hotels, motels, foodservice operations, and health care facilities need hot water for washing dishes, doing laundry, and sanitizing/ sterilizing equipment.

Because a conventional, storage-type water heater constantly loses heat energy through its tank walls and plumbing fittings, new water heating technologies offer significant savings for these types of business and others.

The two "hottest" products on the water heating market today are water heater boosters (which are fitted into existing hot water systems) and tankless water heaters (which replace hot water tanks).

Benefits of both, at a glance:

- The hot water provided is affordable and immediate, saving time and costs.
- The water's high temperature aids compliance with sanitary regulations for dishwashing water—reducing or eliminating the expense of sanitizing chemicals.
- Dishes are nearly spotless in the pre-wash/rinse stage.
- Rinsing dishes with 170°F water leaves them virtually dry, reducing or eliminating the safety hazard of spilled water on the floor from dishes emerging from the rinse.

Water Heater Boosters

One way to virtually eliminate standby losses in an existing tank storage system is to install a water heater booster, which allows the tank's thermostat to be adjusted to about room temperature. When a hot water faucet is turned on, the booster activates automatically—heating the water the rest of the way to the desired temperature continuously until the flow stops.

Water heater boosters work with any type of storage system—gas, oil, or electric. They greatly increase the life of the tank and its heating elements due to lower operating temperatures. And the booster unit can continue to deliver a usable amount of hot water even if the tank is depleted, so you're never totally out of hot water.

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Energy Partners is published quarterly by the Market Management Department of LG&E Energy. The purpose of this publication is to inform the commercial customers of LG&E and KU on current affairs of the energy industry, and to heighten awareness of efficiency-based trends and products available to commercial customers.

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Power Talk *(Continued from page 3)*

Tankless Water Heaters

The difference between tankless water heaters and the conventional variety is the difference between hot water *on demand* versus hot water *on hand.*

As the name implies, a tankless water heater does not keep a supply of water heated for later use. Instead, it turns on when a hot water faucet is opened, making hot water instantly and continuously for as long as necessary—so you'll never run out of hot water. Gas and electric models are available, and both offer potential energy savings compared with their conventional counterparts.

The number of units needed for any application depends on how much hot water is used. Although it may require several electric units to equal the output of a single gas unit, there are other factors to weigh; a gas unit may cost $600 or more, while electrics are in the range of $125 to $200 each—not including installation.

For additional information on water heater boosters and tankless water heaters, contact Christopher Whelan by telephone at (502) 627-2422, or by sending e-mail to *christopher.whelan@lgeenergy.com.*

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