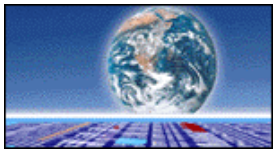
ENERGY PROSPECTS

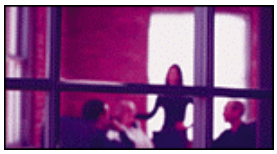
Executive Summary — Issue 2: November 1, 2002

WEB FEATURES

Domains
Indexing Key Energy Technology Web Sites



The Shadow
Shadowing Tech News on the World Wide Web



Podium
Seminars, Conferences, Tradeshows, Exhibits

NEWSTRACK

INSIDE TRACK

OPEN SESAME

PROSPECTORS

1] Showcase Examines Future of DG

If there was one overriding theme among the panelists and speakers at the recent three-day Energy Technology Showcase 2002 in Portland, Oregon, it was that regulatory and financial issues are as much a part of the weal and woe of new energy technologies and distributed generation as advances in the technologies themselves.

Day One's keynote speaker, Tom Casten, who heads the World Alliance for Decentralized Energy, set the tone for the conference with a problem statement that touched home for everyone: electricity use in the US is set to jump 43 percent in the next 20 years at the same time as the nation's transmission and distribution system is already maxed out.

In his recent study *Optimizing Future Heat and Power Generation* and in his speech, Casten drew attention to his finding that the overall capital costs needed to supply electric load growth by 2020 greatly favor increasing investments into distributed over central generation. In satisfying load growth by 2020, his bottom line is that the greater the investment in new DG, the greater the savings from not investing in both new central generation and new T&D.

Casten cited Denmark, the Netherlands and Finland as industrial economies each operating with more than 40 percent of their current generation from distributed resources. Meanwhile, US states such as California, Louisiana, New Jersey, Hawaii and Maine generate between 22 percent and 33 percent of their power with DG. But they far outpace the rest of the nation, much of which is stymied by local regulations written during a past technological era and originally designed to shield monopolies from competition.

As senior energy policy adviser to the Federal Energy Regulatory Commission, Alison Silverstein had befitting self-proclaimed maternalistic advice for both Casten and "right-sized" power guru Amory Lovins, who spoke on the final day of Showcase. With such mantras as "just because it's possible doesn't make it real," "just get over it" and "face the problems in front of you," the mother of FERC's Standard Market Design seemed to be calling for a reality check for DG.

Silverstein stressed that DG innovators and project developers should stick to underserved niche markets such as premium power and risk management against price, while avoiding "stealing customers from incumbents." Innovators and successful disruptive technologies would succeed "by leveraging the values and features that the incumbents can't offer and can't compete against." Silverstein advised developers to go where the barriers are lower already and to concentrate their resources. Above all, she lamented encroachments by DG innovators into housing, a utility market in which, she stressed, DG cannot compete. While many DG innovators do see housing as the Holy Grail, she said that only those who like their life hard would seek to displace incumbents here.

Utilities weighed in on the future of DG during numerous discussions. Pamela Lesh, vice president of federal regulatory affairs at Portland General Electric, cited two "recipes" for DG in a panel on technology and policy headed by Natural Resources Defense Council Energy Policy Director Ralph Cavanagh. The recipe for failure is most common around the US, she said, and is characterized by the same mission utilities have had for the last 100 years: sell as many kilowatt-hours as possible at the lowest possible rate; care only about today, as tomorrow is irrelevant. A further attribute of failure, she said, is the win-lose dichotomy between utilities and those who make, sell or service the new energy technologies. The recipe for success includes changing utilities' mission, developing a two-way grid and rewarding organizations for persuading customers to adopt DG.

Steve King, the plant and fuel cell field manager for PNGC Power, cited the challenges and the silver lining for DG at small rural utilities. The power dynamics for this segment have completely changed, he said. Whereas 20 years ago the motto of small utilities was "We have power, take it or leave it," today they're asking what new technologies they need to develop to avert customer flight. But he closed with a caveat: no regulation clarity, no investment.

The recipe for success includes changing utilities' mission, developing a two-way grid and rewarding organizations for persuading customers to adopt DG.

On regulatory miscues, Cavanagh cited what he called the most thoroughly discredited move in the history of modern electric regulation: the decision of the California Public Utilities Commission in 1995 to take resource portfolio management away from local utilities and turn it over to "the genius of the marketplace." Restoring this role to hometown utilities is now under way, he said. The CPUC met on October 24 to restore portfolio-management responsibilities to local utilities in California and Montana. Connected to this are performance-based incentives tied to utilities' success in substituting less costly efficiency and DG resources for more costly central generation.

Showcase attendees got a front-line status report on the long-awaited federal energy bill from Tina Kaarsberg, professional staff member for the US House of Representatives Committee on Science, Subcommittee on Energy. Of great interest to DG would be Subtitle B of the research and development section, she said, which is essentially the same in both House and Senate versions and includes $1 billion for distributed energy resources between 2002 and 2007. Biofuels and hydrogen would emerge as big winners.

Several panels brought up the problem of energy project financing and the dearth of venture capital. Anne-Marie Borbely-Bartis, an adviser to the US Department of Energy, noted the liquidity crisis in plant financing. Remaining lenders have short leashes and little familiarity with the sector. Venture capital, meanwhile, has all but fizzled out. Even in the year 2000, the energy sector's best year, it garnered only 1 percent, or $1.2 billion, of available

VC. Dan Reicher, former US assistant secretary of energy under Bill Clinton, reported that his $1.2-billion-a-year budget to advance energy efficiency, renewable energy and distributed generation would have been better spent had it been coordinated with these private funds. In closing, Reicher named biomass applications and DG networking through microgrids among today's top energy innovations.

California Power Authority Chairman David Freeman's address was a rallying cry for the energy industry to put the hurry-up on the hydrogen economy. His thesis was simple: we should not wait for the cost of fuel cells and their precious-metal catalysts to come down; internal combustion engines in modern cars can run on hydrogen today with minor modifications costing only a few thousand dollars. We should make those modifications posthaste, he said.

American drivers could keep their SUVs and 4-by-4s using the same technology as before, and the United States would be oil-independent that much sooner, Freeman said. In a global context where the US is dependent on foreign countries for more than half its oil, most of which comes from hostile governments, the urgency for fuel independence necessitates immediate steps, no matter how long projections say it will take to arrive at that goal. Even if it takes 20 years to get there, that's all the more reason to get a move on today.

One innovative idea that meshed well with Freeman's plea came from former BPA head Jack Robertson, who suggested using surplus Northwest hydro to make H_2 during off-peak hours, which would then be used to fuel retrofitted public fleet vehicles. BPA could move the H_2 over idle T&D lines to load centers at such locations as post offices and other public vehicle refueling sites. Robertson conveyed the same sense of urgency as Freeman and said a rapid shift to hydrogen could by launched by such an effort on the Columbia River. ***[Ben Gilbert and Garrett Hering]***

2] Technologies of the Future

Intercommunicating home appliances and molecular-scale occupancy sensors are among the next electrical applications in development that could set out across the so-called "valley of death" to hopeful deployment, according to experts at the Energy Technology Showcase in Portland, Oregon, October 21-23. Microgrid development, super-efficient building envelopes and a new paradigm for communications networks could also be on the horizon.

In a more efficient world, Whirlpool envisions appliances communicating with each other as part of an integrated home energy-management system that tells residents when they could save money by shedding certain loads, according to Tom Catania, Whirlpool vice president of government relations. Refrigerator magnets could alert consumers in real-time to rewards and savings or price changes. The major barrier to selling these technologies is that most rewards for shifting use to off-peak times are insignificant to consumers.

Whirlpool research indicates customers want to know how energy is being used in their homes, but they want a system to manage it only if they can see substantial savings—to the tune of 30 percent, according to Whirlpool's director of innovation and technology Marco Monacchi, who spoke at the BPA Communications and Control Conference in Stevenson, Washington, on October 25. Monacchi described the system as one that could be regulated through a simple PC interface. The right incentives must be in place, however, for consumers to view the status quo as an economic impediment. Costly home infrastructure developments are necessary to link water heaters with washing machines and computers, and without the demand signal to Whirlpool that customers want a more intelligent home system, the efficient-appliance web will be stuck in the R&D spin cycle.

The "microgrid" concept is moving toward demonstration in Vermont, according to Northern Power Systems Vice President Dan Reicher, whose company trademarked the name. The project will use NPS's overall systems-integration approach with multiple interconnected DG sources and NPS software that allows DG technologies to communicate with the grid.

In the public sector, Lawrence Berkeley National Lab has developed super-windows that perform as well as many walls in insulation tests. The challenge now will be to bring down the production cost into competition with other energy-efficient windows, according to program director Mark Levine. After a successful California Cool Roofs program in which building owners were incentivized to paint their roofs with reflective white or cream-colored materials to reflect heat and reduce indoor cooling loads, researchers are working to make existing roofing materials and colors behave as if they were white, to expand the use of reflective roofing. Levine's team also developed an aerosol duct sealer that prevents HVAC units from heating and cooling the outdoors that is being eyed by the US Department of Energy.

While carbon nanotechnology has been viewed as a possible solution to fuel cells' pricey precious-metal catalyst problem, Pacific Northwest National Labs' energy programs director Steve Hauser said nanotech research between IBM and the lab will result in

Energy Prospects is an independent news service for subscribing clients of Energy NewsData, reporting on distributed generation, new fuels, waste-to-energy, generation upgrades, combined/cooling heat and power, efficiency applications, storage and reliability, transport propulsion, integrated energy webs and green power. Report text section copyright 2002, NewsData Corporation. All rights reserved; no reprinting without permission. For subscription information, call [206] 285-4848. Telefax: [206] 281-8035. **INTERNET: www.energyprospects.com** or **www.newsdata.com**. **EDITORIAL OFFICES:** Mail: Box 900928 Queen Anne Station, Seattle, WA 98109-9228; Express delivery: 117 West Mercer Ave., Seattle, WA 98119. E-Mail: newsdata@newsdata.com. **MANAGEMENT AND STAFF:** President & Publisher -- Cyrus Noë :: Vice President & General Manager -- Brooke Dickinson :: Executive Editor -- Kari Hanson :: Managing Editor -- Katie Mulligan :: Reporters -- Garrett Hering, Ben Gilbert :: Contributing Editor -- Mark Ohrenschall :: Contributors: Lynn Francisco, Ben Tansey :: Southwest Correspondent -- Susan Whittington :: California Correspondent -- Richard Nemec :: Marketing & Technology Manager -- Daniel Sackett :: Research Assistant -- Tracy Benzen :: Proofreader -- Patty Mote

yoctotechnology, or structures on the scale of 10(-24) of a meter, by the end of the decade. Possible applications include paintable computing, or room sensors so tiny they dissolve in paint and are slapped on the walls.

At BPA's C&C conference, IBM executive Nicholas Noecker said another principal area of research is developing code to let the many DG control and intelligent metering and communications protocols to interact with utility and grid computing, a vast job if DG is to become as pervasive as many believe. The model for what Noecker called "middleware fabrics" could be almost unfathomably complex. In IBM's conception, the Internet is transformed from a network between operating systems into an operating system itself, for which IBM is developing new applications. ***[B.G.]***

More information:
Whirlpool (www.whirlpool.com)
Northern Power Systems (www.northernpower.com)
Lawrence Berkeley National Laboratory (www.lbl.gov)
Pacific Northwest National Laboratory (www.pnl.gov)
IBM (www.ibm.com)

INSIDE TRACK

3] Conference Quotes on the State of DG

The following are notable quotes from the Energy Technology Showcase conference, held October 21-23 in Portland, Oregon.

On distributed energy technology and energy efficiency:

"Have technological options outpaced institutional capabilities?" *Carl Weinberg, principal, Weinberg Associates*

"The mismatch between loads and generation has created huge amounts of inefficiency." *Pamela Lesh, vice president, federal and regulatory affairs, Portland General Electric*

"[Implementing DG] is not about the technology; it's about the barriers." *Tom Casten, CEO, Private Power LLC; chairman, World Alliance for Decentralized Economy*

"Denmark, Finland and Holland each generate more than 40 percent of their power with DG. Industrial economies can operate with such high percentages." *Casten*

"Renewables are far closer to being cost-effective than people think." *Casten*

"[The Standard Market Design] … is trying to create an energy system that is fuel neutral, technology neutral, size neutral and neutral with respect to demand, supply and storage." *Alison Silverstein, senior energy policy adviser, Federal Energy Regulatory Commission*

"The optimists say your glass is half full. The pessimists say your glass is half empty. The efficiency experts say you have twice as much glass as you really need." *Joel Gilbert, CEO, Apogee Interactive*

"We need to package technology in simple forms." *Gilbert*

"Not everyone should buy new energy technologies. There are those who shouldn't. I'm reminded of that every time I see the people ... wearing spandex." *Gilbert*

"Distributed generation competes directly with combined-cycle natural gas. DG can fundamentally disrupt peak power and combined-cycle natural gas ... . It is a competitive threat ... . DG is anything but business as usual." *Kyle Datta, president, New Energy Partners*

"The next step in energy conservation is the informed customer." *Gary Swofford, VP and COO, Puget Sound Energy*

"If implemented broadly, DER will decrease power rates for end users." *Swofford*

"We must think about new ways to build infrastructure. DG will not succeed without it." *Tina Kaarsberg, professional staff, US House of Representatives Committee on Science, Subcommittee on Energy*

"The hydrogen infrastructure will emerge in 25-30 years … if ever." *Jud Virden, deputy associate laboratory director, Battelle*

"Technological hype gets way ahead of reality." *Virden*

"New energy technologies must expect failure initially. Compact fluorescents, for example, took 20 years to make a commercial impact." *Mark Levin, director, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory*

"Distributed generation is the John Dillenger model of energy. Dillenger robbed banks because that's where the money is. You generate close to load because that's where the customer is." *Angus Duncan, executive director, Bonneville Environmental Foundation*

"The challenge to DG isn't technical. It's psychological."

"The challenge to DG isn't technical. It's psychological." *Duncan*

"The energy technology race today is as important as the space race once was." *Ron Horstman, energy services manager, Western Area Power Administration*

On energy markets and DG project financing:

"There are those who say the energy crisis of 2000-2001 will not repeat itself … don't believe it." *Dick Reiten, incoming president of the American Gas Association; CEO of Northwest Natural Gas*

"Liquefied natural gas usage in the United States will rise dramatically … . The Northwest needs to understand LNG and how it fits into its fuel mix." *Reiten*

"Natural gas is the most volatile of all commodities traded in the US." *Reiten*

"Only 1 percent of all VC in 2000 went into energy. And that was its best year ever." *Anne-Marie Borbely-Bartis, adviser, US DOE, Distributed Energy and Electric Reliability*

"Venture capital is too impatient. It does not know how to manage precommercialization" of new energy technologies. *Borbely-Bartis*

"If you make beer, you can ship it directly to the customer. If you make electricity and ship it directly to the customer, you go to jail. Energy insurgents cannot ship power to the market." *Casten*

"Successful innovators go into underserved markets." *Silverstein*

"Are distributed energy resources coming? Yes. And utilities must adapt." *Doug Oglesby, VP and general counsel, Chevron Energy Solutions*

"Utilities are excellent at delaying DER project interconnection." *Oglesby*

"Public and private funding for energy efficiency, renewable energy and distributed generation must become more coordinated." *Dan Reicher, executive vice president, Northern Power Systems; managing partner, New Energy Capital*

"Capital does not know where to go. The signals are confused." *Jack Robertson, former CEO, Bonneville Power Administration*

"We are at a tipping point. What we elect to do with energy will affect generations to come." *Jack Baker, vice president, energy/business services, Energy Northwest*

"Most of America is dialed out [on distributed energy]. But there are amazing people looking for solutions. We need to make it easier for these people to pursue their dream." *Gilbert*

"There is no venture capital … . I am concerned about companies like Capstone and Plug Power. [Innovators] are burning through their cash." *Gilbert*

"'Irrational markets can remain longer than you can remain solvent.'" *Gilbert quotes John Maynard Keynes*

On DG policy and regulation:

"What does FERC think about DG and DR? I'll tell you what we think: we're for it. Which frankly was a big shock to the rest of Washington." *Silverstein*

"The goal of the [Standard Market Design] is to create regulatory certainty to allow new investment to occur and to make it safe for venture capitalists and banks and financiers and even utilities and the merchant generators … to invest in the new technology and the new capital and the infrastructure that we desperately need." *Silverstein*

"Once we get the rules right, this county will buy the living daylights out of [new energy technologies.]" *Robertson*

"States that open up their rules to DG will be more competitive. Those that don't will force their constituents to pay for bad policy." *Casten*

"The ingredient for success of DG is to change utilities' mission … . The current regulatory framework encourages us to sell more kilowatt-hours and build more stuff. We need to rethink this." *Lesh*

"We should be careful not to waste time working on yesterday's problems." *Lesh*

"There is no way to move along the new path without involving utilities." *Ralph Cavanagh, energy program director, Natural Resources Defense Council*

"I think you should all give California credit for showing what does not work." *Cavanagh*

"There is no revolution like chaos. The weak get killed." *Robertson*

"The more rules there are, the more gaming there will be." *Kaarsberg*

"If we're going to get the hometown utility in the game, we have got to absolutely resolve together that we're going to take this wholly obsolete system of unintended bad incentives that's built into contemporary utility regulation and fix it." *Cavanagh* ***[G.H.]***

4] Cellular Rings Up FCs for Backup

Nextel Communications is one of an increasing number of telecommunications companies dialing in to fuel cells for backup power. In mid-September, the Reston, Virginia-based telecom completed demonstration of a regenerative fuel cell system co-developed by Hydrogenics and its largest stakeholder, General Motors, at a remote cellular tower in northern California.

Hydrogenics, a developer of proton-exchange-membrane fuel cell systems and fuel cell testing equipment based in Toronto, Ontario, settled on telecoms as an initial target market for its 25-KW HyUPS prototype power generator because of their critical power backup needs. As a part of testing at the Nextel site, the HyUPS provided backup power under simulated grid-failure conditions.

In April, Nextel also reached an agreement with Carlsbad, California's Metallic Power to test and evaluate the company's zinc-air fuel cell system as backup power for cellular base stations. After initially targeting power tools and landscaping equipment as primary target markets, Metallic Power has shifted its focus to backup power applications, especially for the telecommunications sector.

The 2.5-KW system uses a fuel cell stack, a fuel tank containing zinc pellets in a liquid electrolyte and an integrated regeneration module. Under full load, the unit can provide two to three hours of continuous backup.

Nuvera Fuel Cells of Cambridge, Massachusetts, is cooperating with long-distance provider Verizon to develop, test and evaluate fuel cell systems in the 5-KW range, a backup capacity used at many distributed telecom sites. As the reason for the cooperation, Verizon cited the need for high-quality power for its increasingly complex equipment.

Verizon has even bigger plans for a call-routing center on New York's Long Island that handles switching for 40,000 lines. UTC Fuel Cells will provide seven fuel cells to generate a total of 1.4 MW, making it one of the

world's largest fuel cell installations planned to date. Verizon also plans to install four natural gas reciprocating engines that will operate in parallel with the fuel cells. This will boost the generating capacity to 4.4 MW as a hybrid system. Project construction will begin before the end of the year and could take two to three years to complete.

European telecoms are also dialing in. FuelCell Energy, maker of high-temperature molten-carbonate fuel cell power plants, late last year announced the siting of a 250-KW system for backup at a Deutsche Telekom telecommunications center through its European partner, MTU Friedrichshafen.

One of the most promising advantages of fuel cells in such roles is their freedom from restrictions on duration of use. In most of California's air districts, for example, diesel generators are allowed to run only 200 hours a calendar year. Also, many telecommunications providers are finding that lead-acid batteries cannot provide the backup needs for servers under the increased demands of voice and data transfer.

In addition to backup power applications, several fuel cell manufacturers are eyeing micro fuel cells for a variety of handheld devices, including cellular phones. MTI MicroFuel Cells of Albany, New York, in early August unveiled a direct methanol micro fuel cell system designed to function as an auxiliary charger or battery extension pack. Similar to a miniature fuel cell technology developed by Motorola Labs, the system is powered by replaceable methanol fuel cartridges.

Driving the development of miniature fuel cells to a great extent is the next generation of high-bandwidth mobile technology, which will require more power than is currently available from rechargeable batteries. ***[G.H.]***

More information:
Hydrogenics (www.hydrogenics.com)
Metallic Power (www.metallicpower.com)
Nuvera Fuel Cells (www.nuvera.com)
UTC Fuel Cells (www.utcfuelcells.com)
FuelCell Energy (www.fuelcellenergy.com)
MTI MicroFuel Cells (www.mechtech.com)

5] Turbine Runs on Rocket Nozzles

A new turbine that can run on almost any quality or temperature of steam, and even compressed water, has hit the market. International Automated Systems has begun licensing its bladeless Propulsion Turbine that company executives claim produces energy so easily that geothermal wells and solar thermal steam could drive it for hydrogen production via the electrolysis of water.

The turbine forces steam through high-pressure rocket nozzles radiating at an angle from the center that drive the turbine cylinder, rather than directing steam at blades. While wet or dirty steam can slow or corrode bladed turbines, IAS claims its turbine makes expensive steam-treating equipment, or drilling for better steam sources in geothermal projects, unnecessary. The IAS turbine also doesn't lose the energy that bladed turbine systems do from released pressure in flashing and cleaning water from the steam. Steam released to atmospheric pressure comes out at full energy. IAS has also been working on ionizing the steam after it exits the nozzles to generate even more electricity.

IAS licensed the turbine last month to the Hydrogen Renewable Energy Enterprise, or THREE, a Hawaii-based renewable promoter, for all deployments statewide. THREE's president, Jack Dean, has focused his company on long-term market transition efforts to a hydrogen-based energy system. Dean has been on the hunt for mechanisms to turn a state with more than 90 percent of its energy derived from fossil fuels into a leader in hydrogen production, using local renewable sources to split water molecules.

IAS claims its turbine makes expensive steam-treating equipment unnecessary.

Last year Dean visited the IAS test site at the Roosevelt Hot Springs near Milford, Utah, run by Utah Power and CalEnergy. IAS tapped into a well that had already been drilled but could not produce enough quality steam for site developers. Turbine sizes range from 10 KW to 100 MW, and they could be run in tandem for larger plants, according to IAS President Neldon Johnson. IAS is marketing the 10-KW units as a residential distributed generation source in the form of solar thermal power plants. Johnson told *Prospects* that despite a $30,000 to $35,000 up-front cost, over 20 years the price per kilowatt-hour falls by 3.5 cents to 4 cents. Johnson also said several small municipalities in Utah have expressed interest in the 100-MW plant.

While THREE will have exclusive rights to the IAS turbine for all projects in Hawaii, the company will pay fees to IAS over 20 years, based on the amount of energy sold. ***[B.G.]***

More information:
International Automated Systems (www.iaus.com)

6] Navy's Compressed-Air Control

An integrated compressed-air management system that saves on energy bills and increases industrial productivity by preventing system breakdown has attracted the business of two Northwest naval bases, major contracts for the system's budding creator, SAV-AIR. The PL2000 monitoring and control system regulates compressor workloads and airflows much as an enterprise energy-management system would monitor electrical loads, taking information from the controllers on individual compressors and reporting it in real time to a touch-screen interface. As demand for compressed air changes, the software automatically calculates which combination of compressors can most efficiently meet the need, turning units on and off accordingly.

At 5 cents per KWh, the average industrial plant spends $35,000 on energy per year for each 100 HP of air compression, according to US Department of Energy

figures. Seventy-four percent of that energy escapes as heat loss that is too low-grade to capture and reuse. Only 18 percent of the energy used by the compressors actually delivers the air to the user, and half of that is wasted in system inefficiencies such as leaking, running too many compressors at once or storing air at unnecessarily high pressures. Most compressors have a controller attached to them, but the information is not integrated, and settings cannot be monitored or changed remotely.

While real-world results have been successful, the company had initial problems penetrating the market because many industrial plants don't recognize how much energy their systems use or how much air escapes until a comprehensive monitoring system is in place, and many are not familiar with having sophisticated process controls in their facility. Many also don't measure the productivity losses when compressed-air systems break down from mismanagement, partly because compressed-air maintenance staff and production staff are in different camps. Until recently, some customers have even been reluctant to share the results of productivity gains from a more reliable air supply because they don't want their competitors to learn the same cost-saving techniques.

Weyerhaeuser's Foster plywood plant in Sweet Home, Oregon, for example, saved 28 percent of its annual compressed-air costs—more than $34,000 in annual energy savings—but improved annual production by an additional $25,000 because more reliable air kept equipment from jamming. Similarly, a Weyerhaeuser particleboard plant reduced its annual compressed-air costs by 35 percent, or $36,000, but realized an additional productivity benefit of $24,000 with the PL2000. Payback for the SAV-AIR system from energy savings has averaged two years, and paybacks have been 40 percent faster when non-energy benefits are factored in.

The Navy contracts are significant for SAV-AIR, totaling nearly $1.2 million for both bases. Because the company is partially funded by the Northwest Energy Efficiency Alliance, SAV-AIR's mandate is to serve the Columbia River Basin. But large customers such as the Navy, with plants in multiple regions of the country, open the door for an expanded geographic base and possibly more major projects in the future. The company is also participating in the Alliance's education program on compressed-air inefficiencies, the Compressed Air Challenge. According to Alliance program evaluator Steven Scott, "awareness of compressed-air issues and cost by end users is growing along with SAV-AIR's activities."

The Alliance funding period ends in May of next year, but the company is beginning to reach a break-even point with revenues as it expands the compressed-air-management market. SAV-AIR recently developed a sequencer for compressors grouped in a single place, for smaller plants or compressed-air systems that don't need plant-wide management. Future developments may allow the SAV-AIR system to be integrated with a plant's on-site SCADA and production systems. ***[B.G.]***

More information:
SAV-AIR (www.savair.com)
Northwest Energy Efficiency Alliance (www.nwalliance.org)
Alliance Compressed Air Challenge (www.nwalliance.org/projects/projectdetail.asp?PID=57)

7] Solar Village Brightens Tucson

On a vacant lot in downtown Tucson, where urban renewal once razed history, a small village of solar-equipped stucco homes has started to bloom. The spacious porches and wood detailing on the pastel-colored homes at Armory Park del Sol might conjure up images of mansions of yesteryear, but this nifty little inner-city development is really all about the future, especially when it comes to energy efficiency.

Every home at Armory Park del Sol has a rooftop photovoltaic system, a solar water heater, high-efficiency equipment, dual-pane windows, and thermal mass masonry walls with exterior insulation.

When it is completed, Armory Park del Sol will consist of 99 single-family homes on 14 acres. Each home can generate 1 KW from the PV modules mounted on its garage. Studies performed by the NAHB Research Center of the PV system of an existing 961-square-foot home at Armory Park del Sol found it produced 945 KWh from February 13 to July 31 of this year, for an average production of 5.6 KWh per day.

Builder John Wesley Miller soon will break ground there for the construction of Arizona's first zero-energy home, in cooperation with Tucson Electric Power and Global Solar Energy. The zero-energy prototype will bring the residence-as-power-plant concept to Armory Park del Sol. According to the Department of Energy's National Renewable Energy Laboratory, a zero-energy home combines solar energy technologies with advanced energy-efficient construction. Because it can produce as much energy as it consumes, the house is considered to achieve "net zero" consumption.

To get more net-zero homes on the ground, NREL recently solicited proposals from teams willing to build them. The only grant outside California went to Miller, partnered with the NAHB Research Center. The Research Center will help design the systems for the zero-energy house and monitor how they work.

Armory Park del Sol's prototype will be able to generate about 4 KW of energy, around what the average Tucson home requires on the hottest days. When the house doesn't need the energy, the local utility gets it, and Tucson Electric's meters have no problem crediting homeowners when they return power to the grid.

Miller plans to hold the grand opening of the zero-energy home on Earth Day 2003. He's already thinking about the next step. "It's one thing to build a box that is energy efficient—the next thing is to get it to a price range where it is affordable," he said. Miller estimates the prototype will cost about $50,000 more than normal construction at the development.

Armory Park del Sol is a national demonstration project of the Partnership for Advancing Technology in

Housing, a public-private initiative to spur technological innovations to improve the affordability, quality and energy efficiency of the nation's housing. PATH chose Armory Park del Sol as a model of a sustainable community that incorporates solar and other advanced technologies. ***[Susan Whittington]***

More information:
Armory Park del Sol (www.armoryparkdelsol.com)
NAHB Research Center (www.toolbase.org)
Million Solar Roofs initiative (www.millionsolarroofs.org)
Partnership for Advancing Technology in Housing (www.pathnet.org)

8] LA Green Power Gets a Jolt

An independent performance audit released in late August by Los Angeles City Controller Laura Chick for the years 1998 to 2001 found that the Los Angeles Department of Water and Power's Public Benefits and Green Power programs—the most popular such programs in the US—failed to produce any new green power from its own resources during the program's first four years of existence. The Los Angeles City Council's Commerce, Energy and Natural Resources Committee will hold a series of hearings on the findings beginning in mid-November.

According to the report's authors from the Barrington-Wellesley Group, efforts to add green generation to LADWP's own energy mix have come up short greatly because of lack of coordination between the Green Power program and the rest of the department. City Controller Chick called on LADWP to fully integrate the Green Power program into its traditional power supply organization. "How can we expect Green Power to become a tangible resource for the city of Los Angeles if it is not fully valued, integrated and overseen within the Department?" she asked. Such integration is now forthcoming, LADWP general manager David Wiggs told *Prospects*.

The program is too heaviliy weighted toward the purchase of green tickets in lieu of developing LADWP's own generating facilities for green power, the audit found.

Among the projects singled out as poorly coordinated is the 1.5-MW landfill-gas-to-energy project at Lopez Canyon, which was dedicated in August 2001. A news release from August 16 of that year implied that the fifty 30-KW Capstone microturbines installed on-site were already operating on landfill gas that would otherwise be flared. But because of contractual issues concerning fuel delivery, these were not yet operational at the time the audit was published one year later. The switch was finally flipped at the landfill in mid-August 2002, according to Capstone spokesman Keith Field.

The program is too heaviliy weighted toward the purchase of green tickets in lieu of developing LADWP's own generating facilities for green power, the audit found. Nearly all of LADWP's new green energy comes from green tickets that support environmentally friendly alternative power at the source but that fail to provide local air-quality improvements to Los Angeles—one of the central goals of the Green Power program. Green tickets supplied 92 percent of the public utility's green power during 2000 and 2001. The remaining 8 percent came almost exclusively from wind farms in Oregon, Washington and Wyoming.

The audit also found that LADWP has spent a disproportionate amount of money on marketing and promotion of the Green Power program. Wiggs said the department has now placed a cap on such expenditures. Regardless of how much LADWP spends to operate and advertise the program, all additional costs to the department are covered by ratepayers' 3-cent-per-KWh premium and subsidies from the Public Benefits Program.

Council member Ruth Galanter, who chairs the Commerce, Energy and Natural Resources Committee, said that, more than anything, the city council wants a clear vision from LADWP for how it will expand green power production at its own facilities. Doing so has become more urgent since the passage of California's renewables portfolio standard for investor-owned utilities on September 12, which requires IOUs to generate 20 percent of their electricity with renewable power by 2017. LADWP can avoid regulation from Sacramento by executing the Green Power program's goal of investing in its own renewable power generating facilities, she said. ***[G.H.]***

More information:
Independent audit (www.ci.la.ca.us/ctr/audits/ND5735.htm)
LADWP (www.ladwp.com)

9] Wave Energy Demos Sweep NW

Producing electricity from the waves that roll endlessly off the Pacific Ocean is the focus of two demonstration ventures in the greater Pacific Northwest. Both could be operating within the next two years at up to 5 MW collective capacity.

BC Hydro's wave-power venture stems from a 2001 study on potential green energy resources for Vancouver Island. The study results led BC Hydro to announce in June 2001 a 20-MW green energy demonstration initiative for the island, selecting wind, small hydro and ocean wave energy as the most promising near-term technologies.

After a request for wave-energy proposals, BC Hydro selected Energetech Australia and United Kingdom-based Ocean Power Delivery. Both companies have signed memorandums of understanding with BC Hydro for wave-energy development.

Ocean Power's offshore floating device, the Pelamis, is a "semi-submerged, articulated machine that has several hinged joints each with a hydraulic pump inside. The relative motion of the sections due to wave action activates the pumps, which drive electric generators." OPD's Max Carcas told *Prospects* the Pelamis is designed for maximum power generation efficiency and survivability in "a fairly hostile environment" with a "very dense energy resource."

Energetech captures waves with its oscillating water-column technology, in which waves enter a fixed column structure at one end. Water pressure forces air up the column to spin a turbine, which is connected to a generator that produces electricity. Energetech uses a parabolic wall to concentrate the waves and increase energy production.

Given the results of sea trials from the two companies, Hydro plans for wave-energy production to start by mid-2004. In the meantime, the utility is tackling project siting and permitting issues. As for projected energy costs, BC Hydro estimates 10 cents/KWh for this first venture.

Off the northwest corner of Washington state, in Makah Bay, a proposed 1-MW offshore wave-energy project is being developed by a consortium including developer AquaEnergy Group and the Northwest Energy Innovation Center, composed of Energy Northwest, the Bonneville Power Administration, the Pacific Northwest National Laboratory and Washington State University.

The project would rely on buoys moored several miles from the shoreline, according to a news release. "The wave action moves the buoy up and down, which in turn creates a pumping action, producing pressurized seawater that then is directed into a turbine driving a conventional 1-MW electrical generator."

AquaEnergy hopes to complete its plant by summer 2003. It would produce an estimated 1,500 MWh annually, representing an average 25 percent capacity factor. ***[Mark Ohrenschall]***

More Information:
BC Hydro's Vancouver Island Green Energy Demonstration Project (www.bchydro.com/power_future//tomorrow/vi_green_energy_demo_project.html)
BC Hydro's Ocean Wave Energy Project (www.bchydro.com/power_future//green/wave.html)
Pelamis news release (www.bchydro.com/news/2002/mar/mar02-13a.html)
AquaEnergy news release (www.nrglink.com/pressreleases/pr120901aquaenergy.html)
Energetech Australia (www.energetech.com.au)
Ocean Power Delivery (www.oceanpd.com)
AquaEnergy (www.aquaenergygroup.com)

10] FC Buses to Hit Europe's Streets in 2003

Starting next year, hydrogen fuel cell-powered buses will be hitting the streets as more than mere prototypes designated for full-time transit routes in some undetermined, distant future. Ballard Power Systems and DaimlerChrysler subsidiary EvoBus are moving ahead with the world's first small production series of 30 fuel cell buses for full transit service in nine European cities and Reykjavik, Iceland, starting in 2003. According to a recent survey by the newsletter *Fuel Cell Today*, that will double the number of zero-emission public transit vehicles in use since 1993. During 2003, an additional seven buses equipped with Ballard's proton-exchange-membrane fuel cells will be delivered to California and another three to Perth, Australia.

Bruce Rothwell, manager of heavy-duty fuel cells at Ballard Power, outlined the goals of the European Fuel Cell Bus Project in a presentation at the International Public Transportation Expo in Las Vegas in late September. These include exposing ridership to fuel cell technology, offering operating and maintenance experience to public transit agencies, demonstrating operation in a variety of climates and conditions and expanding a hydrogen-fueling infrastructure based on various configurations.

The 10 cities—Amsterdam, Barcelona, Hamburg, London, Luxembourg, Madrid, Porto, Reykjavik, Stockholm and Stuttgart—are slated to begin integrating the buses into routes in mid-2003. Several cities will create hydrogen on-site with electrolysis using only renewable energy resources such as solar, wind and geothermal. Others will purchase hydrogen from natural gas suppliers. Stuttgart will create hydrogen from steam-reformed natural gas. London will use liquid hydrogen.

The Citaro, a low-floor urban transit bus, is equipped with Ballard's proton-exchange-membrane fuel cell stacks and nine 40-kilogram hydrogen-storage tanks in a rooftop compartment. These allow the bus to travel up to 250 miles. Xcellsis, a subsidiary of the Vancouver, BC-based company, will install the fuel cell system for the first bus in the series. EvoBus will assemble the remaining 29 at a factory in Mannheim, Germany. ***[G.H.]***

More information:
Ballard Power Systems (www.ballard.com)
EvoBus (www.evobus.com)
Fuel Cell Today survey (www.fuelcelltoday.com/FuelCellToday/FCTFiles/FCTArticleFiles/article_512_marketsurveyfuelcellbuses0902.pdf)

11] Communications Protocol Quandary

Distributed generation providers may have solutions for letting users balance their output with load and send the excess on to the grid, trading signals with local distribution systems, but getting these systems to interface with transmission systems, utilities, RTOs and power marketers is a challenge of a different magnitude. As Pacific Northwest National Labs program manager Landis Kannberg pointed out at BPA's Communications and Control Systems Conference October 24-25 in Stevenson, Washington, in a context where "complexity grows with scale," the model for managing a multitudinous web of distributed resources communicating and spewing electrons in real time is just beginning to take shape.

The "endgame" in the smart energy, intelligent grid concept is not just a shift from the linear flow of electrons and money in opposite directions to distributed resources that talk to each other—it should ultimately lead to value transactions resulting from these virtual conversations, according to Jesse Berst, managing director of the Athena Institute. This means that the traditional value chain would be dissected throughout the grid as new data service opportunities and needs arise.

Putting the right price signals on these transactions on a broad scale requires a level of communications

architecture and infrastructure not yet fully conceived of, modeled or deployed, and is fraught with devilish tripwire details from incompatible communications programs to physical assets such as mismatched cables.

The data templates, control commands and data-transfer protocols programmed in different control systems often speak different proprietary languages depending on the system and the manufacturer. Speakers from PNNL, the Electric Power Research Institute and Portland General Electric called for open protocols and standard designs during the conference, stressing the importance of plug-and-playability in making DG work.

Mark Osborn, Portland General's manager of distributed generation, is trying to create a "virtual utility" for distributed peaking generation, for which ease of communications and control is essential. Portland General built its own dispatch system based on open protocols but ran into trouble when one fuel cell company used a serial communications link with proprietary protocols that no other segment of the utility could communicate with.

And according to Manuel Carabott, a business development engineer from Schneider Electric's Square D power management division, which uses a publicly accessible Modbus protocol, the competitive advantage for communications companies isn't to be gained in the protocols and esoteric, behind-the-screen technologies, but in customized user interfaces that effectively translate the complex electrical and market information according to the user's needs and level of expertise.

The US Department of Energy's advanced communications and control program is soliciting proposals for a demonstration project this fall to test the boundaries and challenges of data flow in a distributed-resource environment. According to Eric Lightner, DOE's program manager for the project, many companies say they can do data aggregation, but no data have been collected for a geographically wide area with various control manufacturers aggregating the data over dispersed networks with multi-vendor distributed resources, which will be the goal of the project.

But as complexity grows with scale, the prospect of moving from a limited demonstration to a broad market scale, with a wider transmission and distribution area and more diverse distributed resources at the end of ever more feeders, creates an enormous data aggregation and digestion problem. Not only the physical IT infrastructure but the data acquisition and control systems requirements to work across the entire scale will be massive, which is why IBM is developing middleware, the goal of which is to "stitch together" the data thread between different end-use applications, said Nicholas Noecker, an IBM executive and economist. IBM is beginning to look at the Internet, on which the data travels, as an operating system for Internet-scale control systems. "Real-time business controls is where the next work will be done," he said. "No one knows what the model is yet." ***[B.G.]***

More information:
Pacific Northwest National Laboratory (www.pnl.gov)
The Athena Institute (www.theathenainstitute.com)
Portland General Electric (www.portlandgeneral.com)
Square D (www.squared.com)

OPEN SESAME

12] H_2 Is Ideal Fuel For Green Power

I don't use the term *renewable* much any more, preferring to refer to green power. Renewable is grounded in the idea that we are running out of fossil fuels, which is not true within any time frame worth considering. I agree with Amory Lovins that we will most probably leave much petroleum in the ground as cheaper and cleaner alternatives are developed.

In energy matters, we are not running out of anything that the laws of supply and demand cannot mitigate. Green power in my estimation should ignore supply issues and focus on environmental impacts. Ultimate green power goals vary; some see green power as a climate change imperative and others as cleaner air for its own sake.

In fact, I think the underlying theme in the technology dynamic *Energy Prospects* is covering is a perceived need to find new ways of fueling the energy industry. The fossil era is ending for reasons good and bad, but ending it is. A generation ago, this trend appeared to be nuclear; that appears now to be somewhere between dead and moribund. Now the ideal fuel in this greening refueling context is hydrogen.

This observation is true, I think, even if the fuel cell remains the promised check-in-the-mail that seems to be taking its own sweet time on its way to the mailbox. H_2 does not really need fuel cells to become hard currency in new-age energy resource accounting. It is combustible in turbines and reciprocating engines. Alternative fuels such as methanol, ethanol, natural gas and liquefied natural gas are important in and of themselves in the short run and also as H_2 feedstock.

Gasoline is also H_2 hydrocarbon feedstock, and ZTEK in Massachusetts is working on a gasoline reformer designed to be sited in gas stations to make H_2 on the fly. This would make transitions from gasoline to H_2 auto fueling more practical.

There is no best and cleanest way to turn H_2 into torque. We have a cautionary industry peddling constructive dangers like peanuts, and the specter of the blowup of the dirigible *Hindenburg* colors the issue. But the baseline fuel is gasoline, which is a dangerous baseline by definition. I don't think H_2 refueling will be stonewalled by safety issues.

Jack Robertson, retired acting and deputy CEO of the Bonneville Power Administration, chaired the Energy Technology Showcase 2002 on technology economics. One problem in separating H_2 for fuel is that more energy is expended in separation throughput than gets back in output. But with reduced loads at night, a hydroelectric system

could generate power for which there is now no market at near zero cost. There have been proposals in years past to make H_2 factories at the dams—in effect, finding a way to store surplus energy as hydrogen.

But Robertson points out that a better option would be to move surplus hydropower over transmission and distribution lines idle at night to a hydrogen load center. That center would be fleet vehicle parks or bus barns where vehicles have been modified to burn H_2. Hydrogen would be separated from water by conventional electrolysis and stored in tanks. This distributed H_2 generation could also be operated from power windmills running at night.

The best way to test H_2 fuel systems is with fleets of trucks and buses. Off-peak hydro and wind power would not be the only economic way to produce hydrogen in fleet quantities. At Showcase, one exhibitor was Hydro Environmental Resources Inc., demonstrating hydrogen generators that separate H_2 from water and other fuel-stock ingredients by chemical reaction. Solar H_2 separators are also under development.

I said above that I see H_2 as an ideal fuel. In the interim on our stumbling way toward making that ideal real, we need other non-petroleum fuels. The dependence of US energy systems on "foreign oil" is not an issue to be discussed here other than to note it has tied lots of energy policy knickers in a knot. The best usefully renewable energy is biofuel. A column on that subject is in the works. ***[Cyrus Noë]***

PROSPECTORS

13] Green Building with John Wesley Miller

"My grandmother used to sit me on a windowsill in the winter to keep me warm, so I guess I've been associated with the sun ever since I can remember," says John Wesley Miller. He chaired the Arizona Solar Energy Commission under four governors, and today at age 69, he's building Armory Park del Sol, a residential community that upon completion will generate more than 99 KW of rooftop solar energy in Tucson's inner city.

In March, the National Association of Home Builders named Miller its "Green Advocate of the Year" for his efforts to promote "green building," which incorporates environmental considerations into every step of home construction and land development. "John is really progressive in understanding what we can provide to the contemporary American family in terms of sustainable technologies, especially solar," said Carlos Martin of PATH, the public-private Partnership for Advancing Technology in Housing.

Miller began his solar career in the early 1970s, working with the University of Arizona's Environmental Research Laboratory on ways to incorporate new solar technologies into buildings. This led to his being hired as "energy czar" and general contractor to build Biosphere 2 in Oracle, Arizona, the giant desert terrarium where eight Biospherians attempted to live for two years in the early 1990s. They built the biggest solar installation in the state at the Biosphere and "tried a lot of neat stuff" in the 10 years he was there, Miller said.

Miller dreamed up the idea of building a large solar village in Tucson that would have an on-site photovoltaic-equipment manufacturing plant while he was sitting on a beach in Puerto Vallarta reading A *Golden Thread: 2,500 Years of Solar Architecture and Technology* by Ken Butti and John Perlin. That brainstorm eventually led to Civano, a master planned community southeast of Tucson where Global Solar Energy opened its PV plant in 1999.

At Civano, homeowners have the option to install solar equipment, Miller pointed out. At Armory Park del Sol, "I wanted to raise the bar" and build homes that had a 1-KW PV system and solar hot water heater as standard equipment, he said.

After three decades of working with solar, what has Miller learned? The importance of thermal mass storage, or "T-Mass," as he calls it. "You want the walls to be affected by the temperature, and you get that by using solid masonry that is insulated on the outside."

According to the Southern Arizona Home Builders Association, T-Mass works like this: in summer, the thermostat is set a few degrees lower than usual to "supercool" the house overnight when kilowatts cost less. Then the "chilled" walls suck up the heat during the hottest part of the day. "T-Mass costs more, but the homeowner gets paid back in resale value and comfort," Miller said.

If solar is so good, why isn't more of it in use? Cost and education are the obstacles, according to Miller. "Builders will build what the buyer demands, but most builders don't want to be pioneers because they get shot on the prairie," he said.

Miller sees signs of progress, though, with more homebuyers asking "what will my utility bill cost?" and a younger generation that seems interested in new energy technologies. He says passage of the proposed federal tax credit for solar energy would definitely inspire the states to do more.

In Miller's ideal universe, "every home would contain some aspect of solar utilization." Zero-energy homes, like the one he is pioneering at Armory Park del Sol, Arizona's first, wouldn't be unusual.

But what about houses that are already built? Miller sees an energy-efficiency gold mine in the thousands of old masonry homes in a city such as Tucson. You need to do only three things, he said: insulate them on the outside and stucco over that, convert to energy-efficient windows and install solar water heaters. That's Miller's vision of how the golden solar thread could reach across the generations and link his grandmother's windowsill to the children of today. ***[S.W.]***

More information:
Armory Park del Sol (www.armoryparkdelsol.com)
Partnership for Advancing Technology in Housing (www.pathnet.org)
Global Solar Energy (www.globalsolar.com)

14] FC/Turbine Hybrid Pushes Efficiency to New Level

A system billed as the world's first fuel cell/natural gas turbine hybrid is demonstrating unprecedented efficiency levels, according to researchers at the University of California–Irvine. At 53 percent electrical efficiency, the hybrid system has set a world record for a fuel cell system operating on natural gas.

Irvine officials say the system costs less than a stand-alone fuel cell but offers twice the efficiency of a stand-alone microturbine. And because it uses an electrochemical process rather than combustion, the system emits few of the pollutants released by conventional power plants. It does emit nitrogen oxide, but researchers say the emissions are significantly less than those from the average natural gas turbine.

At 53 percent electrical efficiency, the hybrid system has set a world record for a fuel cell system operating on natural gas.

The hybrid system, composed of a solid-oxide fuel cell linked together with an Ingersoll Rand natural gas microturbine in a mini-power plant the size of a small house trailer, recently passed the 1,000-hour proof-of-concept period and is now undergoing 3,000 hours of testing at Irvine's National Fuel Cell Research Center to ensure system stability. As research continues, industry experts maintain that efficiencies could increase to 60 percent for smaller systems and 70 percent or higher for larger systems.

"In the power industry, efficiency gains of even a few percentage points can make a major economic difference over the life of a generating system," said John Leeper of Southern California Edison, owner and operator of the system.

The hybrid plant is currently producing approximately 190 KW of electricity, with an installed cost of $1,000 per KW. Scientists admit that the system's price-performance ratio must be boosted before it can compete with a conventional turbine plant. ***[L.F.]***

15] Nanotechnology to Make Big Impact on Fuel Cells

Plug Power and Albany NanoTech at the University at Albany–State University of New York in mid-October announced a five-year, $5-million research and development program to reduce the amount of the noble metal platinum needed as a catalyst in low-temperature proton-exchange-membrane fuel cells. By reducing the amount of platinum required in electrode assemblies through nano-structuring designs, the two aim to reduce the cost of PEM fuel cells and improve performance.

Developers of PEM fuel cells have already curtailed their need for high-cost platinum in recent years. But such next-generation nanostructured fuel cell electrode assemblies represent a possible order-of-magnitude reduction. Along with the economies-of-scale benefits that developers expect to kick in as a result of manufacturing in greater numbers than demanded by today's mostly pre-commercial markets, reducing reliance on the expensive noble metal catalyst is expected to be one of the most critical factors in taming the high cost of fuel cells in this decade.

Nanotechnology is set to affect fuel cells in many other ways too. Nanoporous and nanostructured materials and nanocones are also being developed for fuel storage, membranes and reformers. Sixty-seven patents involving nanotechnology and fuel cells have been granted since 1998. ***[G.H.]***

More information:
Plug Power (www.plugpower.com)
Albany NanoTech (www.albanynanotech.org)

16] California Firm Installs Cogen Without Capital Costs

A California medical supplies company expects to reduce its power costs by nearly 3 cents per KWh, saving $80,000 annually with a cogeneration system that required no capital expenditure on its part. Instead, BD Biosciences of San Diego will pay only for the power, similar to its previous arrangement with San Diego Gas & Electric.

The cogen system, which consists of two natural gas-fired 150-KW generators, was designed and installed by Clarus Energy, also of California. Clarus offers clients complete installation and maintenance with no up-front costs but requires a long-term contract to supply power. The client can choose to buy the power at a fixed rate, with Clarus assuming the risk of price fluctuations, or at a variable rate, thereby assuming the risk itself.

The system supplies 90 percent of BD Biosciences' power needs; it remains on the grid for the rest of its power as well as for backup. The facility, which covers 43,000 square feet, has a maximum power demand of 599 KW. Heat from the generators is captured to heat water for space heating, meeting nearly 80 percent of the company's heating requirements. BD Biosciences turned to DG when it had exhausted all its conservation options and was still facing losses due to grid outages.

The project qualified for a rebate from the California Self-Generation Incentive Program, which offers financial incentives for clean, on-site distributed generation. CSGIP will pay 30 percent of the installation costs, which Clarus said will be reflected in lower power costs to BD Biosciences. ***[L.F.]***

17] NAS Battery Pack Tests Peak-Shaving Capability

American Electric Power is demonstrating a stationary sodium sulfur (NAS) battery at an AEP office park in Columbus, Ohio. The installation of two 50-KW batteries is rated at 100 KW for peak shaving for a length of about seven hours between off-peak rechargings, or 375 KWh each, but the installation is capable of surging to 500 KW for short-term power quality mitigation. NAS

batteries can supply about five times their nominal rating for up to 30 seconds or exceed their rated capacity by lesser multiples for longer time periods.

NAS batteries also claim higher energy density than their conventional lead-acid counterparts, requiring only a third of the area. The AEP batteries are expected to last 15 years, or 2,500 full discharge cycles. The installation has been in test operation since late August and will be operated for two years, but AEP has so far been mum on the cost of the demonstration. Last year, AEP conducted a successful test of a 12.5-KW NAS battery for improved reliability during short-term power fluctuations.

The batteries were produced by NGK Insulators and Tokyo Electric Power, which tout their beta alumina electrolyte material as improving battery performance. NGK plans to begin building a commercial-scale manufacturing plant in the first half of 2003. About 30 MW of NAS batteries are currently installed in Japan, including a 2,000-KW emergency power system for the International Broadcasting Center at the World Soccer Cup earlier this year. ***[B.G.]***

More information:
American Electric Power (www.aep.com)
Tokyo Electric Power (www.tepco.co.jp/index-e.html)
NGK Insulators (www.ngk.co.jp)

18] EleQuant's AGORA Software Improves Grid Reliability

Barcelona-based Grupo AIA is launching a North American campaign to convince utilities that the mathematics in its grid-modeling software will improve grid reliability and efficiency. AIA opened a new subsidiary branch, EleQuant, in San Francisco earlier this year, and last month it appointed a director of sales, John Sell, to deploy the product at utilities across the United States and Canada.

The Advanced Grid Observation Reliable Algorithms, or AGORA, system uses a mathematical approach to solving load-flow equations that is vastly different from most estimators using the Newton-Raphson iterative method, which starts the equation from an estimated point and converges on a load-flow solution through several iterations. If the wrong starting point is chosen or the grid is near collapse, the calculations will not converge. This can prevent grid operators from delivering the proper voltage levels or avoiding brownouts or blackouts.

AGORA uses a proprietary, non-iterative algorithm that can solve the load-flow equations nearly 100 percent of the time, archiving solutions every two minutes. It can also determine the most efficient course of action for restoring power in an outage or rerouting during maintenance. Pacific Gas and Electric's Bob Stuart, manager for system operations planning, said the mathematical method's ability to bolster reliability was what convinced PG&E to adopt it.

The North American market's confidence in Grupo AIA was bolstered by successful deployment throughout PG&E's network. While in bankruptcy and facing blackouts during the energy crisis, the utility sent four engineers to Spain to examine AGORA, ran a trial test in San Francisco at the end of 2000 and purchased the software for system-wide deployment last June. PG&E has been impressed with AGORA's capabilities, according to Stuart, but one of the biggest challenges after installation has been changing the habits of individual operators, who often prefer to trust the grid to more familiar technology. ***[B.G.]***

More information:
EleQuant (www.elequant.com)

19] MDU Demo Explores Economics of FC System Installation

A demonstration partnership between Montana State University–Billings and Montana Dakota Utilities Company will allow two of Global Thermoelectric's solid-oxide fuel cell systems to double as an economics case study for the university's Center for Applied Economic Research and as a technical experiment and training exercise for utility workers.

The Center for Applied Economic Research will look specifically at "transaction costs"—costs that are external to the cost of the hardware itself—and how they accrue through siting, permitting, marketing, selling and installing fuel cells, as well as how they affect overall system pricing. "It can be as much as the unit itself if you're not careful," said center director Tom Yoder.

Yoder said Global Thermoelectric's ceramic planar SOFC design "has a lot of potential to be manufactured at low cost," as opposed to tubular fuel cell designs, because "it uses standard manufacturing processes and equipment that are readily available and are currently used for mass-producing other items."

The first system, expected to come on line early next year, will handle a 2-KW grid-interconnected residential load, while the second system will power a 3-KW to 5-KW off-grid remote load and is tentatively expected to be on line in the third quarter of 2003.

The ideal location for the remote system will be a coal-bed methane well, according to John Delvo, Montana Dakota's customer energy consultant. The fuel cell will power the well's water pump while excess methane that dissipates from the well powers the fuel cell. Montana Dakota and Global Thermoelectric will also be monitoring how well the system performs in various weather conditions, whether it can economically compete with other alternative energy sources or with grid power and what type of maintenance it requires. ***[B.G.]***

More information:
Montana State University–Billings (www.msubillings.edu)
Montana Dakota Utilities Company (www.montana-dakota.com)
Global Thermoelectric (www.globalte.com)
Center for Applied Economic Research (www.msubillings.edu/caer/energy.htm)
Ceramic planar SOFC design (www.globalte.com/advantages.htm)

20] Portland Buys Energy Savings With LED Retrofit

A three-month citywide LED streetlight retrofit project completed in Portland, Oregon, last December will result in a projected annual energy and maintenance savings of $400,000 and will pay for itself in less than three years, according to a report released this summer by the city's Office of Sustainable Development and the Northwest Energy Efficiency Alliance.

LED cost reductions, lease options and state tax credits let Portland retrofit the city's more than 13,000 signals in one fell swoop and also complete the $2.2-million project with no capital investment. Curt Nichols, the Office of Sustainable Development's senior energy manager, explained the project's financial feasibility as the result of three benefits from leasing the lights rather than purchasing them outright.

Since Portland's retrofit, 18 more Oregon jurisdictions have taken advantage of a $60-per-LED-bulb incentive.

First, the lease spreads the capital cost of the lights over time at a level close to the projected annual energy savings. Second, the initial capital saved from leasing the lights allowed the city to use contract labor for installation, hurrying to finish the project before 2002 and claim utility efficiency rebates totaling $715,000. Third, Oregon's Business Energy Tax Credit, ordinarily reserved for businesses investing in energy projects, allowed the lease company to pass $500,000 in tax savings on to the city.

LED bulbs use between 16 watts and 25 watts each and are expected to last six or more years, compared to more than 140 watts for standard and even energy-saving incandescent bulbs, whose life averages just two years. That translates to energy use of 1.2 million KWh per year and a bill estimated at $85,000 for the LEDs, compared to 6.1 million KWh costing $435,000 using incandescents. The maintenance savings from fewer replacement projects are expected to run around $45,000 per year, according to the report.

Since Portland's retrofit, 18 more Oregon jurisdictions have taken advantage of a $60-per-LED-bulb incentive from the Energy Trust of Oregon. The incentive was limited to 3,000 bulbs, leaving between 7,000 and 8,000 bulbs in those 18 jurisdictions to be replaced, according to Nichols, who administered the program. But most cities retrofit as they relamp rather than all at once, and the average savings from these 18 projects are expected to reach about 1.6 million KWh per year. ***[B.G.]***

More information:

EPA energy star rated signals (http://yosemite1.epa.gov/estar/consumers.nsf/content/traffic_signals.htm)
Consortium for Energy Efficiency traffic signals site (www.cee1.org/gov/led/led-main.php3)
Office of Sustainable Development (www.sustainableportland.org)
Northwest Energy Efficiency Alliance (www.nwalliance.org)
Energy Trust of Oregon (www.energytrust.org)
Business Energy Tax Credit (www.energy.state.or.us/bus/tax/taxcdt.htm)

21] Northwest Energy Technology Collaborative Gets Rolling

Washington state's new effort to boost the regional energy technology market, the Northwest Energy Technology Collaborative, is ramping up, with the appointment of a full-time director and two new partners joining just weeks after Governor Gary Locke announced the collaborative's creation in August.

H. Day Chapin, a former technology executive and entrepreneur, was selected to lead the coalition of industry, governmental, non-profit and educational institutions. At its inception August 21, Avista Corporation, the Bonneville Power Administration, the Pacific Northwest National Laboratory, the Spokane Intercollegiate Research and Technology Institute and the Washington Technology Center signed on, followed by two more organizations in October—the Washington State Office of Trade and Economic Development and the Inland Northwest Technology Education Center.

NWETC's ambition is to make the Northwest a marketing and development hub of energy technology. Chapin said the collaborative is looking at a wide mix of projects and soon will have a clearer idea of which technologies it wants to pursue. More efficient use of existing generation capacity and more efficient generation will likely be the two main areas of focus, with attention given as well to transmission improvements, such as communication technology that makes the grid "more intelligent" and distributed-generation projects such as fuel cells, he added.

The collaborative's next steps will be to gather more members and put together demonstration projects "to show that the technology is real and marketable and timely." This collaborative approach should allow developers to test their products within a live grid environment and get feedback from grid infrastructure experts. The goal, Chapin said, "is to increase the productivity of the technology sector and help remove barriers that would be in the way of creating businesses and expanding businesses in this sector." ***[B.G.]***

More information:

Northwest Energy Technology Collaborative (www.nwetc.com)
Avista Corporation (www.avistautilities.org)
Bonneville Power Administration (www.bpa.gov)
Pacific Northwest National Laboratory (www.pnl.gov)
Spokane Intercollegiate Research and Technology Institute (www.sirti.org)
Washington Technology Center (www.watechcenter.org)
Washington State Office of Trade and Economic Development (www.oted.wa.gov)
Inland Northwest Technology Education Center (www.intec-center.org)