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CLASS OF 2010



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Our 22nd Year

PUBLISHER'S LETTER	pg. 3
JACK FUTCHER	pg. 4
DANIEL C. HEINTZELMAN	pg. 5
DR. SULTAN AL JABER	pg. 6
DR. BERND UTZ	pg. 7
SIMON BERESFORD-WYLIE	pg. 8
JACK MCCALL	pg. 9
LAURA K. IPSEN	pg. 10
BRUCE PHILLIPS	pg. 11
JIM KOHLHAAS	pg. 12
AKIHISA TOMIOKA	pg. 13
STEPHEN WHITLEY	pg. 14
REX BALLARD	pg. 15
BRENT SMITH	pg. 16
CAREN S. FRANZINI	pg. 17
ART LOCKE	pg. 18
JOHN JOYCE	pg. 19
DR. ALAN WM. NIEDORODA	pg. 20
BOB VALAIR	pg. 21
BRUCE STUDLEY	pg. 22
JULIE BLUNDEN	pg. 23

Generating energy is about
generating ideas. Ideas to
help us reduce emissions,
build intelligent networks and
conserve valuable resources.

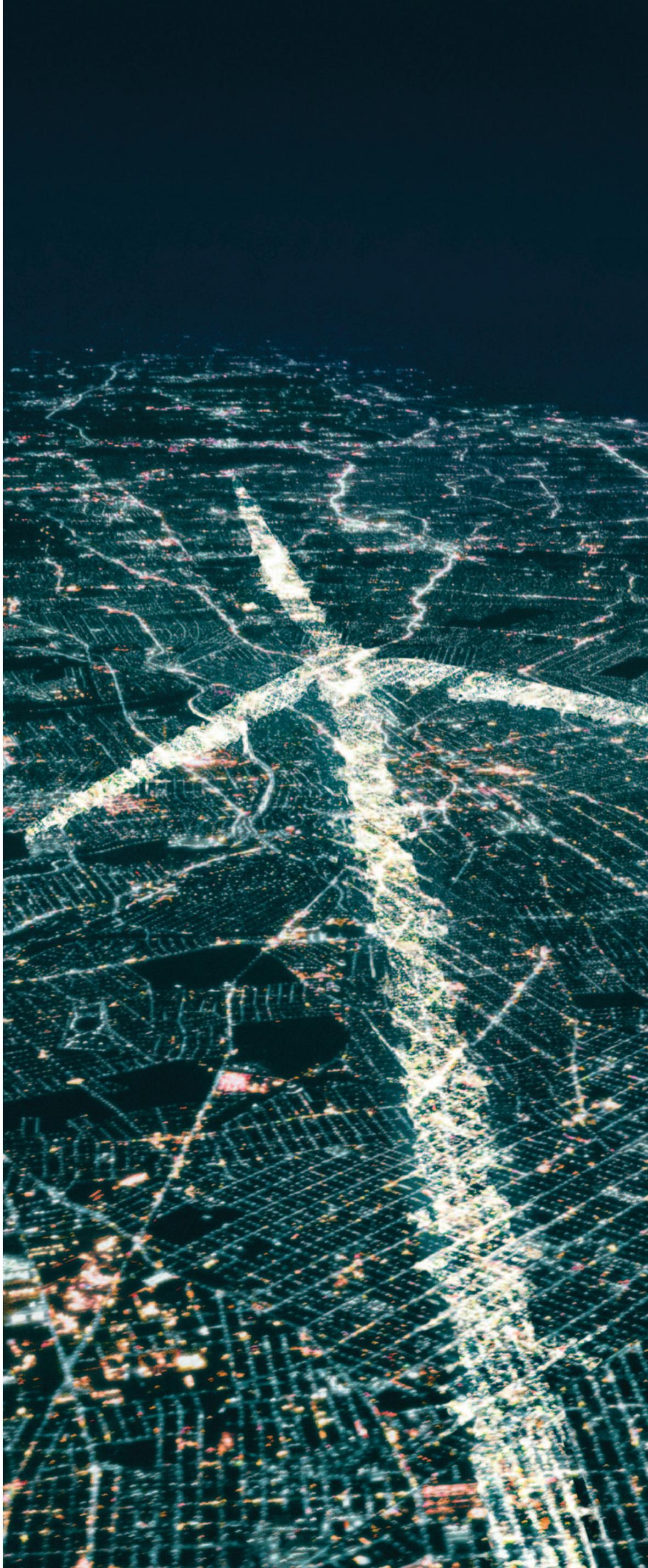
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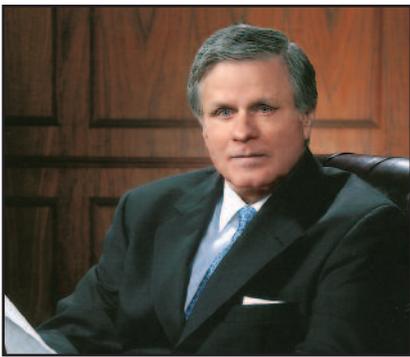
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delivering cleaner, smarter,
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imagination at work





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It's almost as if this year's class saw the Toyota debacle coming and put in motion this mantra: stay on message, focused on what we do best, working as a team, transparently. You'll see this reading the Class of 2010. We are pleased and proud to present our 11th class of the millennium.

Bechtel's strategy is to work for repeat business and is not looking to grow too fast, Jack Futcher, new president of Bechtel Power, shares on page 4. Bechtel is the largest employer of union labor in the US and can bring its own craft people and construction equipment to build a project in nuclear, IGCC and renewables.

Dan Heintzleman, president and CEO of GE Energy Services, sees three solutions as the answer for improving supply-side energy generation: a mix of equipment upgrades, continuous monitoring solutions, and operational and maintenance programs. This is the strategic path that power producers should take to make their operations cleaner, smarter and more efficient, he underscores on page 5.

US, UK educated Dr. Sultan Al Jaber is chief executive officer of Masdar, Abu Dhabi's renewable energy company established in 2006 to develop and deploy sustainable energy solutions. Masdar City will be the world's first carbon neutral city and will serve as headquarters for the International Renewable Energy Agency, a clearing-house to share data for its 138 member states, Dr. Al Jaber told World-Gen on page 6.

Dr. Bernd Utz, chief technology officer of Siemens Renewable Energy, said in his interview on page 7 that offshore wind projects are coming close to conventional plants. Wind employment at Siemens has grown from 800 in 2004 to 5,500 in 2009. He sees the US market as the most important in both wind and solar power.

Simon Beresford-Wylie joined Elster Group as CEO in November, 2009 from CEO of Nokia Siemens Network. He sees important parallels between the telecommunications space and the smart grid space on page 8. Elster has operations in 38 countries staffed by 7,000 employees and has delivered 3.6 million devices worldwide.

The US-DOE has identified seven key characteristics and five fundamental technologies that will drive the smart grid. Jack McCall tells us on page 9 that AMSC's "Secure Super Grid" technology is underway at New York's Con Ed and Homeland Security has invested \$25 million to develop the concept.

Laura Ipsen leads CISCO's smart grid vision to build an end-to-end IT-based network and launched an ecosystem with 30 members. She's doubling her staff and sees North America and Europe as CISCO's primary markets and mentions a number of wild cards globally on page 10.

The year 2010 may go down as the year of the Smart Grid, Bruce Phillips, group president of Aclara predicts on page 11. Electric utilities are using two-way communications with meters, direct load control and a variety of smart sensors. The federal government has awarded over 100 smart grid investment grants this past fall.

Jim Kohlhaas heads-up Lockheed Martin's initiatives in support of global climate, energy and water challenges. His team partners with governments, utilities and academia, and is currently exploring how nanotechnology solutions will change how the world transmits energy on page 12.

Marubeni purchased PIC and named Akihisa Tomioka president and CEO in March 2008. He highlighted PIC'S 5,000 projects world-wide on page 13 and wants to expand business lines to focus more on renewables.

NYISO plays four key roles, CEO Stephen Whitley tells us on page 14. NYISO manages New York's bulk electricity grid, runs the state's wholesale electricity, conducts planning and innovates technology transfers. NYISO is the first grid operator to integrate wind power.

Science Applications International Corporation (SAIC) drafted the greenhouse gas (ghg) inventory protocols used by the California Climate Action Registry, Rex Ballard said on page 15. SAIC has 28 design awards in recognition of energy-efficient facilities.

Alfa-Laval's CEO Brent Smith has targeted solutions to minimize energy use and reduce waste in conventional and nuclear power plants. He asserts on page 16 that Alfa-Laval holds a unique position in alternative power sources in geothermal and solar.

New Jersey introduced its Energy Master Plan in 2008 to supply 30 percent of its electricity from renewables by 2020. Caren Franzini, CEO of the New Jersey Economic Development Authority, launched loan-grants, a combined heat and power program and an energy manufacturing fund outlined on page 17.

Utilities are turning to advanced information technologies to facilitate the real-time exchange of information, Alcatel Lucent's Art Locke tells World-Gen on page 18. DOE and Homeland Security are drawing on the experience of Bell Labs experts for eco-sustaining and systems modeling.

The electrical distribution landscape is a hodgepodge of devices from different vendors, Ambient's CEO John Joyce spells out on page 19. Ambient's Smart Grid Platform pulls ERT meters into the Smart Grid.

Dr. Alan Niedoroda of URS laments the little attention given to Ocean Thermal Energy Conversion (OTEC). The technology generates electric power by exploiting the vertical temperature gradients in the world's oceans. OTEC generating stations can be located on a shoreline, shallow offshore and on offshore platforms and vessels, he tells us on page 20.

Staples will exceed its commitment to cut their absolute carbon footprint by 7 percent by 2010. Bob Valair heads Staples energy team and reports on page 21 that Staples was the first national retailer to offer in-store, recycling, and recycled an estimated 50 million cartridges in 2009.

The power plant aftermarket business is estimated to average \$4 billion a year over the next 10 years in the US. Hitachi Power Systems is expanding its after-market services and has appointed Bruce Studley to serve as Vice President, on page 22.

SunPower's sales have grown from \$11 million to \$1.4 billion in five years, Julie Blunden told World-Gen on page 23. Solar PV installations can be built within a year and have the flexibility to be scaleable in time and location.

Dick Flanagan

JACK FUTCHER



Jack Futcher
is the
President of
Bechtel Power
Corporation

Jack Futcher is the President of Bechtel Power Corporation, the lead entity among the Bechtel group of companies for Bechtel's Power Global Business Unit (GBU). This Business Unit is organized into three markets: Fossil Power, Nuclear Power, and Renewables and New Technology. As a 30-year Bechtel veteran, Jack has served multiple business units in a variety of leadership positions around the world. He managed Bechtel's Global Procurement and Contracts Organization for six years, during which the company purchased \$30 billion in equipment and materials. He was responsible for the Downstream business line of Bechtel's Oil, Gas & Chemicals GBU during a time of exceptional expansion. He has lived in London and Egypt, where he managed Bechtel's oil and gas projects in the Middle East, India, and the former Soviet Union. He was elected a Bechtel Senior Vice President in 1999.

In addition to these responsibilities, Futcher also serves on several committees and task forces of the Nuclear Energy Institute and is Chairman of the Board of the United States Energy Association.

FOSSIL POWER

The Fossil Power business line is itself divided into four market segments: Solid Fuel, Emissions Retrofit, Natural Gas, and Integrated Gasification Combined Cycle (IGCC). The Solid Fuel segment works with coal, which has been the largest portion of Bechtel's power business for the last six years. Futcher, however, sees the coal plant work declining. "With pending CO₂ impacts and the difficulty of permitting coal plants, we expect the market for new plants to diminish over the next several years," he says. "But there are still opportunities for our Emissions Retrofit segment, such as adding pollution control back-ends to existing power plants, which has been a significant portion of our power business."

Futcher says Bechtel's mix of work between coal and gas, and its experience with both, provides great flexibility in responding to changes in the market. "Like many others, we see gas being the baseload gap filler until new nuclear plants come online," he says. "We're well-positioned in this market and have won a project already in California."

Futcher is also enthusiastic about IGCC. Bechtel is doing IGCC work for Duke Energy at Edwardsport, Indiana. Bechtel also finished a big IGCC project for

Tampa Electric (TECO Energy) in the late 1990s and a gasification project at Kingsport, Tennessee, for Tennessee Eastman that converts coal to syngas for chemicals. Says Futcher, "IGCC is a critical portion of our business. We are the leader in it, and we see it as a big part of our business going forward."

NUCLEAR

The Nuclear Power business line has three market segments: Nuclear Operating Plant Services (NOPS), Major Modifications and Services, and New Generation. NOPS supports utilities running nuclear plants, doing engineering, helping during outages, writing Combined License (COL) Applications, and the like. At present, NOPS is involved in seven Combined License Applications.

Under the Major Modifications and Services segment, Bechtel replaces steam generators and reactor pressure vessel heads and also uprates plants. Says Futcher: "When new nuclear plants stopped being built, Bechtel became the nation's leader for steam generator replacement work. SGR work is demanding, but we have competence and credibility in the market."

With respect to the uprates, Futcher says Bechtel's analysis of the market identified the kind of big complex work at which it excels and led to several contracts. It is now working at FPL's Turkey Point and St. Lucie plants in Florida, as well as their plant at Point Beach, Wisconsin.

The New Generation segment is working on the Watts Bar 2 completion project in Tennessee. Although technically not new because it has already received its permits, Bechtel is treating Watts Bar as such because it is a restart. "It's as close to new nuclear as you can get," Futcher says. New Generation is also looking at the possibility of a third reactor at Calvert Cliffs, Maryland. The customer is UniStar, a joint venture of the French company EDF and Constellation Energy. For this project, Bechtel has partnered with the French company AREVA and is using AREVA's EPR (Evolutionary Power Reactor) technology. Futcher says New Generation is also looking at new nuclear work outside the US.

RENEWABLE AND NEW TECHNOLOGY

Futcher's Renewables and New Technology division is building on Bechtel's 30-plus years experience in carbon capture, solar thermal, photovoltaic, wind, and biomass projects. Ian Copeland (*World-Generation* Class of 2008) started the business about a year ago. Futcher says that Renewables and New Technology has won the contract for BrightSource Energy's Ivanpah facility in California, the largest solar thermal project in the world at 440 MW. Bechtel is taking a small ownership position in the project and is enthusiastic about the technology. Futcher expects Bechtel to be active across a wide range of renewable energy projects, both in the US

and abroad. "We have the experience and the focus to succeed in a market poised for tremendous growth."

LOOKING FORWARD

Futcher says the company strategy has always been to work for repeat business. With this in mind, Bechtel is not looking to grow too fast, but rather to attract skilled persons, do work that exceeds expectations, and grow slowly where it sees opportunity. "We had been concentrating on the United States, but noting the demand curve in the US is flatter than in other places has made us look increasingly overseas," he says. "We have targeted six countries to begin with: Canada, the UK, Libya, Egypt, the UAE, and India. We have very good opportunities in each of these countries in each of our business lines. We have good offices there and know the countries well. So we see a good future in these nations."

Concerning power mix, Futcher sees coal struggling because of the carbon problem, and nuclear as the big opportunity. But with nuclear, cost is the biggest challenge. Increasing the Department of Energy loan guarantee program beyond the present allocation of \$18 billion will help. "If the US can get six nuclear plants online by 2020, I think we'll be doing well" he adds.

For renewables, Futcher worries over the issues of high cost and intermittency. "The market has to play out on these things," he says. "We see gas as the gap solution. Building a gas turbine with solar or wind projects may be a remedy for the intermittency problem." He's bullish about gas, at least for a while: "With the price of gas and the relative ease of bringing gas on line, we think gas will be heavily in play in the next 10 years."

Of carbon capture and sequestration (CCS), Futcher is confident in the technology, noting that the oil industry has been pumping CO₂ underground for years in oil fields to maximize their yields. The big problems are scalability—the amount of CO₂ to be injected is huge—and liability in the event of significant CO₂ leakage: "Some entities might take the liability for 2 or 5 years, but who is going to take it for 100 years? I think the government may have to step in as it has with nuclear and structure a liability regime like the Price-Anderson Act."

Futcher is hard pressed to see the decades ahead without higher energy prices. "We are moving away from our lowest cost fuel—coal—and toward higher-priced ones. How do we deal with carbon without raising the cost of energy so high in the United States that industry sends even more jobs overseas, to countries that are less inclined to reduce carbon emissions? I think our carbon price will have to be balanced with technical innovation that will allow us to deal with energy prices more effectively than what we see now with CCS, wind, solar, and nuclear. But you have to place a high-enough price on carbon to drive innovation. And how do you say to developing countries that they should have

high energy costs? It's hard to figure out what the right thing to do is."

THE BIDDING CLIMATE

Futcher notes that the marketplace for bids has changed a bit since the beginning of the recession. "Owners are demanding higher-risk terms from contractors and more fixed price contracts," he says. "Reduction in demand has led to fewer projects, which means fewer jobs to bid on by more contractors, which has meant more risk being taken on by the contractors." But Bechtel has always worked well with lump-sum contracts, he says. "If we have good history on a technology, we don't object to lump-sum contracts. But familiarity with the type of job the owner wants is a big factor in how much risk we are willing to take. With combined cycle plants, which we know very well from having completed 50 of them, we know the scope and risk and we can price them accurately.

"New technology and first-of-a-kind projects present more of a challenge for the contractor and the owner," says Futcher. "The pricing of a job becomes less a cards-to-the-vest negotiation and more of a collaboration. The pencils are still sharpened of course, but we're working on the same page to reach a fair price."

Futcher is quick to point out Bechtel's competitive advantages. "For the biggest, most complex projects in the world, we are the best," he says. "For the newest, too, such as the BrightSource solar thermal project. In addition, we are the largest employer of union labor in the country. We are very proud of our relationship with the unions; they do great work for us, and they are a differentiator for our company. We know union labor and how to work with unions.

"Moreover, we are able to engineer, buy everything, and build a project using our own people and our own construction equipment. So we are one of the few big engineering, procurement, and construction companies that do all the work themselves, using our own craft people. And we are private; we don't have the same pressures on us as publicly owned stock companies. We try to grow prudently, because our model is driven by repeat business with satisfied customers. We try to make sure that for every job we take on, we apply the best people, persons who know how to get the work done in the way customers want. Thus, our customers have certainty on the outcome of the project. We have never walked away from a job; we finish what we start. It's the culture of a private company that sets us apart.

"Additionally, Bechtel is not just a collection of projects. We invest a huge amount of money in what we call our functional organization. We have hundreds of people working above the project helping get the job done correctly. These people own the work processes, the tools, and the computer systems, and they try to improve them all the time. This is unique in our business. No one matches us in that sort of investment," he says.

DANIEL C. HEINTZELMAN



Dan Heintzelman is the President and CEO, GE Energy Services

Power plant managers and executive decision-makers continually face the challenge of increasing efficiency, extending asset life and simultaneously optimizing power plant operations. No matter the external conditions, reaching optimum power levels with the least cost, effort and emissions is critical to business success.

Today's challenges include growing populations that demand more power at a low cost at a time when companies are relying on fewer people and have constrained capital resources. Add to that increasing scrutiny from regulators who demand more environmental care as that growth occurs.

The end result is societies, industries and factories that demand cleaner, smarter, more efficient power. To achieve these goals, energy consumers of all kinds need industry leaders who focus on design, operation and advanced maintenance service to keep the world reliably running. With much of the focus today on demand-side management, it is equally important energy producers consider the supply side of the energy equation. In fact, much of the electricity generated today is lost before it reaches the consumer.

Responding to current challenges by purchasing new plant assets may not always be a feasible solution to improve business metrics or bottom-line efficiency. What may make more sense, for some utilities and industrial energy suppliers, is to pursue a strategy based on utilizing the best available technology with a focus on maintaining and improving existing assets and infrastructure. This strategy can be accomplished through a mix of equipment upgrades, continuous monitoring solutions and operational and maintenance programs. Heintzelman sees these three solutions as the answer for improving supply-side energy generation.

RETROFITTING TECHNOLOGY

Simply making what is in place today more efficient seems a smart place to start. For example, gas turbines retrofitted with new compressors or rotors, advanced combustion systems and newly updated emissions and controls packages can help to extend the life of the unit by up to 25 years, in addition to providing the owner and operators with better performance, operational flexibility, and often improved efficiency.

The benefits of upgrading existing gas-fired, combined-cycle power plants could be considerable. They are a signifi-

cant source of power in Asia, Europe, Latin America, the Middle East and North America along with a smaller, but still meaningful, use in Africa and China.

Even a small percentage change in efficiency gained through retrofitting these gas-fired plants can create large environmental results. For example, a 1-percent-age point efficiency improvement in the GE fleet of 1,000 F-Class gas-fired turbines could reduce carbon dioxide emissions by 4.4 million tons a year.

Dubai Aluminum, also known as Dubal, is the seventh largest producer of hot metal aluminum in the world and is one of the largest non-oil contributors to Dubai's economy. GE is working with Dubal to retrofit a series of company-owned gas turbines rather than replace them with new models. When the project is completed in 2012 or 2013, it is expected that the 1 gigawatt of capacity Dubal had before the retrofit will be expanded by 100 megawatts, allowing them to increase output. The retrofitted turbines will also help to reduce NOx fumes by 15 percent and help cut fuel consumption by several million dollars annually.

IMPROVING GRID MANAGEMENT AND CONTROLS

Reducing VARs in electrical transmission and distribution

Today's electric grid is inefficient. Losses occur throughout the system—from generation, through transmission, to consumption. Reliability issues also are problematic, and these challenges can cost businesses money.

Across business sectors, the U.S. economy loses \$104-\$164 billion a year to outages and another \$15-\$24 billion to power quality phenomena, according to the Electrical Power Research Institute. That makes it easy to see why improved controls can be valuable.

When businesses are equipped with the proper tools, they can respond in real-time to power demands and power pricing to increase productivity, efficiency and cost savings. For example, line losses can be minimized and, at the same time, power quality and reliability can be improved using VAR control.

Further, peak-period voltage control could help reduce peak load, lowering peak generation costs and deferring capital expenditures for new generation and transmission. Continuous voltage controls also help reduce overall load, lowering generation operating costs and reducing base load capital expenditures.

Looking more broadly, the value of a controls upgrade might be underestimated; even minor adjustments can sometimes yield large gains in performance improvements. When customers understand how their control systems can be used to optimize plant and asset performance, they ultimately realize operations and performance improvements.

Controls come in all forms, whether for power generation, mechanical drives, or

balance of plant systems, and can be delivered in all geographies, whether the Alaskan North Slope or the Gobi Desert. Controls can be applied to equipment and systems regardless of the original manufacturer or in whichever industry the equipment is being used. GE's customers have tasked the company with making control upgrades and supporting services work effectively for their turbines, generators, compressors, power plants, and transmission and distribution systems for more than 100 years, and these efforts have led to operation and performance improvements.

E.ON Benelux is one of the largest energy providers in Europe, concentrating on the production and supply of electricity and gas to private customers and business customers. GE is working with E.ON at their natural gas power plant to increase asset availability at a lower cost and with manageable risk due to deregulation in the European energy market and volatility in energy prices. The solution is accurate, real-time condition data that allows for an up to 80 percent increase in time between outages, a decrease in outage durations by up to 60 percent and helping to decrease non-availability by 3.5 percent through the use of specialized monitoring systems and diagnostics software.

MONITORING PROCESSES

Installing automated software and hardware

For many electrical utilities, there's a focus on distributing power at a lower cost with manageable risk. Some of these inefficiencies can be corrected by simply monitoring the system and responding as needed. But a time-based maintenance approach can produce the unintended effect of reducing the reliability and availability of machinery—simultaneously impacting the experience of customers, and unnecessarily increasing the overall lifecycle cost of the asset.

It can be far more efficient to install monitoring processes that give up-to-the-minute reports so that current conditions can be assessed and the concept of condition-based maintenance can be applied, resulting in significant savings to the owner.

A monitoring solution provides accurate, real-time condition data. In some cases, that allows for an 80 percent increase in time between outages and a 60 percent decrease in outage durations. The right monitoring hardware along with diagnostics software in some cases can help decrease asset downtime by nearly 4 percent.

Early detection of asset performance degradations and malfunctions also helps extend asset service life and reduce maintenance costs, and decreases the overall likelihood of a significant event. Meanwhile, lessons learned could be embedded in the system as knowledge-based rules to continuously improve, automate and validate diagnostics that can help predict future events.

For example, a large refinery with an onsite power generation facility consisting of five gas turbines and four steam generators that provide steam and electricity for

its operations is employing machinery protection systems to continuously sample vibration and field current data from critical machinery. The ability of the systems to correlate vibration levels with load and field current and VAR changes enabled the plant to identify a thermal sensitivity issue in one of the generators. The monitoring technology in place was credited with helping to avoid an estimated 8-week outage and saved close to \$1 million by planning repairs for the regularly scheduled outage while running the unit at reduced load until that time.

Sustaining growth means, in large part, sustaining power. Strategically responding to the energy sector's new normal will dictate how effectively societies, utilities and companies overcome challenges—issues that will transform the energy landscape for decades to come. A holistic solution to address energy use, changing electricity demand characteristics and climate change is more crucial than ever.

Be clean. Be smart. Be efficient. The economic and environmental realities of 2010 demand that industrial power managers identify solutions to meet these three goals.

Power generators will be expected to improve all aspects of operations, from energy usage to greenhouse gas and particulate matter emissions. Power plant managers will invest in upgrades to existing systems and processes with incremental solution replacements rather than large-scale deployments of new infrastructure. Meanwhile, improvements like installing monitoring processes and upgrading control systems will help companies make the most efficient use of what they have and still yield relatively high benefits in step with the stricter compliance criteria.

Smart technology can be used to monitor and diagnose aging operating assets and is critical for achieving improved efficiency. A three-pronged approach of retrofitting older technology and thereby bringing it up to its maximum operational entitlement, installing the latest in controls and monitoring systems, and a relentless focus on operational optimization will result in an increase in equipment reliability, improved performance, and in many cases, enhanced efficiency.

This is the strategic path that power producers can take to make their operations cleaner, smarter and more efficient.

Daniel C. Heintzelman is president and CEO of GE Energy Services, a leading supplier of power generation technology, services and management systems. He was named to his current position in September 2005.

Heintzelman's General Electric career began in 1979 as a member of the GE Aircraft Engines Management Development Program. Since then, he has progressed through leadership roles in the company. In 2000, Heintzelman was named a GE Company Officer and Vice President and General Manager of Aircraft Engine Services.

DR. SULTAN AL JABER



Dr. Sultan Al Jaber is the Managing Director and Chief Executive Officer, Masdar, Abu Dhabi

“The time is now. It is our responsibility and duty to shape our energy future and the future of our energy lies in the combined efforts of governments, academia, and the private sector,” Dr Sultan Al Jaber told delegates in his welcome keynote address to the Third World Future Energy Summit held in January in Abu Dhabi. “There has to be greater collaboration between the public and private sectors and the private sector must drive the transfer of technology and be prepared to assume financial risks.”

The Third WFES attracted over 20,000 delegates and exhibit space grew by 51% to over 600 exhibitors. More than 100 government delegations participated. One hundred and thirty four speakers presented papers during the four day annual event held on January 18-21, 2010 at the Abu Dhabi National Exhibition Centre.

Dr. Al Jaber is managing director and Chief Executive Officer of Masdar, a multi-faceted renewable energy company established in 2006. Its mission is to develop and deploy sustainable energy solutions in three business units and in one investment arm.

MASDAR CITY

World-Gen visited the six square kilometers Masdar City construction site being built in six phases at a cost of \$22 billion. Masdar City will house 1,500 cleantech companies, 40,000 residents and 50,000 commuters. Anchor tenants include GE, IRENA, Schneider Electric, BASF and the Masdar Institute of Science and Technology, among others. Tenants will receive free trade zone status. It will be the world's first carbon neutral city when completed in 2013. Phase One broke ground in 2008 for the Masdar Institute of Science and Technology (MIST), a private, non-profit graduate institution affiliated with the Massachusetts Institute of Technology. MIST faculty will work with MIT's faculty on joint research projects and prepare a syllabus over a 12 month period at MIT. Partnerships also currently exist with Imperial College, Tokyo Technology Institute and the University of Waterloo through fellowship programs.

Designed by the UK's Foster and Partners, the institute's campus will cover 54,000 sq.m. The buildings are being constructed on concrete pedestals in close proximity to take advantage of natural shading and air circulation to reduce cooling by 75 percent.

MASDAR INSTITUTE

MIST received over 1,200 applications from 82 countries to enroll 88 students for its first class in 2009. Twelve percent are from the UAE. Another 140 will be enrolled in the new Masdar City facility opening in September, 2010. Over the next five years, the student body is expected to grow to between 600-800 students pursuing the 2 year MS degree.

Over 30 research projects are underway to develop, test-bed, and benchmark commercially viable energy solutions. Three patent applications have been filed.

Boeing, Etihad Airways, the national airline of the UAE, and Honeywell have established a five year project at MIST to study evolutionary saltwater farming to harvest salicornia seeds for aviation biofuels. In an Integrated Seawater Agriculture System (ISAS) operation, water is pumped from the sea via canals, flowing through an aquaculture system in which fish and shellfish are produced using monitored procedures. The seawater effluent from this operation is high in nutrients and is used to irrigate and fertilize mangrove forests and meadows of salicornia, which is harvested, and its seeds pressed for their oil. The oil can then be processed into liquid fuels, while the seed meal becomes feed for the aquaculture crops and animal feed. Sustainable biofuel development is a key element of aviation's carbon emissions reduction strategy. The closed loop system does not distort the global food-chain, or compete with fresh water or lead to unintended land use change.

MASDAR POWER

Masdar Power builds and invests in utility renewable energy power projects. Two desalination technology tests are underway for Masdar City. Concentrated solar power generation is being sited to evaluate solar beam-down technology. A joint venture between Dong Energy, E.ON and Masdar invested in London Array, the 1,000 mw offshore wind farm in the UK. It is also investing in wind projects in the Seychelles and Sir Bani Yas, the UAE's largest natural island and a premiere tourist destination.

Masdar Power invested € 120 million in WinWinD oy, a Finnish wind turbine manufacturer. Masdar will hold three seats on the board. WinWinD manufactures 1 to 3 megawatt, low speed wind turbines, and is a division of Sterling Infotech Group of Chennai, India. There are plans to expand elements of the operation to Abu Dhabi.

MASDAR CARBON

Masdar Carbon provides end-to-end management services to develop clean tech projects and monetize carbon emissions at home and globally. In partnership with Abu Dhabi's National Oil and Onshore Operations Companies, Masdar is developing a large-scale CCS project. The project will capture carbon dioxide emitted from

power plants and be transported on a national pipeline for injection into Abu Dhabi oil and gas reservoirs for enhanced oil recovery (EOR). Upon completion in 2014, 5 million tons of carbon dioxide will be captured per year.

BP and Masdar will build the world's first industrial-scale hydrogen-fired power plant with an integrated carbon capture and storage system. The 400 mw plant will separate natural gas into hydrogen and carbon dioxide. 1.7 million tons of carbon dioxide will be captured annually for EOR. The hydrogen will be burned to produce low-carbon electricity.

Torresol Energy, a joint venture between Masdar and SENER, a leading international multidiscipline engineering company, with offices in Abu Dhabi, has secured \$760 million project finance loans for the construction of its twin Concentrated Solar Power plants, Valle 1 and Valle 2, in Andalucia, Spain. The total investment value for the two plants is \$1bn.

Both plants incorporate energy solutions developed by SENER, including molten salt thermal storage capacity of up to 7.5 hours. The plants will be capable of generating electricity at night and through periods of poor sunlight, enabling a continuous supply of electricity and overcoming intermittency.

Dr. Al Jaber said: “The CSP projects currently under construction in Spain will introduce and test new technologies, which will help promote CSP as an economically competitive and viable alternative to traditional power sources. Through Torresol Energy, we are actively promoting the development and operation of large-scale CSP plants throughout the world and hope to implement additional projects across Southern Europe, North Africa, the Middle East and the southwestern United States”.

The construction of the new plants will have an estimated 3,200 new direct employment opportunities during the two year construction period.

INVESTMENT ARM

Masdar Clean Tech Fund was launched in 2006 with partners Consensus Business Group, Credit Swisse and Siemens AG to invest \$250 million. The US received 65 percent and Europe 35 percent. A second fund was launched in January to secure financial commitments of \$500 million to invest in clean energy. The fund is co-managed by Masdar Venture Capital and DB Climate Change Advisors to build a diversified portfolio. Siemens, Japan Bank, Japan Oil, Nippon Oil and GE will be investors.

IRENA LAUNCHED

Dr. Al Jaber announced the establishment of the International Renewable Energy Agency, IRENA, the world's first intergovernmental agency fully dedicated to renewables. “With 138 member states in its first year, IRENA is a true reflection of the global commitment to renewable energy in

developed and developing nations,” he said in his keynote address. IRENA selected Masdar City for its headquarters. It will act as a clearing house, collecting, sharing and building a comprehensive database to become a one-stop shop. Its 138 members are comprised of 46 from Africa, 36 from Europe, plus the EU, 32 from Asia, 14 from the Americas and 9 from Australia. IRENA will continue its outreach to IEA, the UN General Secretary, and the International Panel on Climate Change.

Staffing is a priority in 2010 and over 500 applications have been filed, 41% from women. IRENA is also working with the Abu Dhabi Fund for Development to place \$50 million annually in renewable projects.

2010 ZAYED PRIZES

Dr. Al Jaber, serving as Director General of the Zayed Future Energy Prize, said at the awards ceremony: “The caliber of entries has been phenomenal and the jury had tough choices to narrow the selection to three finalists.” The three finalists were chosen from over 300 entrants. The award is open to individuals, companies and non-governmental organizations that can demonstrate a tangible clean energy solution.

The Zayed Future Energy Prize was created in 2008 to honor the legacy of the late ruler of Abu Dhabi and the founding father and President of the United Arab Emirates, HH Sheikh Zayed bin Sultan Al Nahyan, who championed environmental stewardship. The Zayed Future Energy Prize Jury is made up of eight leading international energy experts. Toyota was the 2010 winner for the hybrid Prius launched in 1997 that has saved seven million tons of carbon dioxide. Dr. Zhrengong Shi, founder of Suntech Power, the world's largest manufacturer of silicon solar modules and Amitabha Sadanji, CEO of IDEI who reduced carbon dioxide by 1.8 million tons in India by deploying an irrigation technology for farmers, were the two other finalists.

Dr. Sultan Ahmed Al Jaber is the Managing Director and Chief Executive Officer of Masdar. Dr. Al Jaber led Masdar's participation in the UAE's successful bid to host the headquarters of the International Renewable Energy Agency (IRENA) in Masdar City. In 2009, UN Secretary General Ban Ki-Moon elected Dr. Al Jaber to join the UN's Advisory Group on Energy and Climate Change. Dr. Al Jaber is also a Senior Advisor to Mubadala Development Company. He is a Chairman of the Board of the Abu Dhabi Ports Company. He also serves on the boards of ALDAR Properties, Advanced Technology Investment Company (ATIC) and the Young Arab Leaders Organization. He received his PhD in Economics from Coventry University in the United Kingdom and has a Bachelor of Science in Chemical Engineering from the University of Southern California and Master of Business Administration (MBA) from California State University in Los Angeles.

DR. BERND UTZ



Dr. Bernd Utz is the Chief Technology Officer, Siemens Renewable Energy

WORLD-GEN: HOW REALISTIC AND COST EFFECTIVE IS RENEWABLE ENERGY?

Bernd Utz: Global power demand is growing, driven by the increasing world population and increasing urbanization. It is projected that by 2030, the share of renewable energy will increase from the current three percent to 17 percent of worldwide power generation. At the same time, renewable power generation is expected to increase roughly tenfold from 581 terawatt hours (TWh) to 5,583 TWh.

In terms of capacity, wind projects are coming close to that of conventional power plants (e.g., London Array with 630 MW in the first expansion stage and up to 1 GW in the second expansion stage).

The cost situation has improved significantly due to various factors. For example, over the last 20 years, the cost per MW of installed onshore capacity has decreased from € 3 to € 1 million and the realistic goal is € 800,000.

Depending on the specific wind conditions on site, projects can be profitable without subsidies now. An example of this is the Westwind onshore wind farm in New Zealand.

Similar price reductions are also expected for solar power. The best example is a substantial price decrease in the photovoltaics industry. We also expect economies of scale effects for solar thermal power plants and their components.

W-G: PLEASE UPDATE SIEMENS' WIND BUSINESS.

BU: The success story of Siemens Wind Power began with the acquisition of Bonus Energy in Denmark on December 1, 2004. Siemens Wind Power has grown exponentially since then. The number of employees worldwide has increased from 800 in 2004 to about 5500 in 2009. The wind power business is a success story whose narrative we wish to continue.

W-G: HOW DOES SIEMENS ENVISION THE U.S. MARKET?

BU: The USA is the most important wind power market and we have been expanding our presence there during the last five years. Our headquarters location for North and South America activities is located in Orlando, Florida. We have opened a new research and development

center in Colorado.

In addition to opening a rotor blade production facility in Fort Madison, Iowa, we recently also celebrated the groundbreaking of a wind turbine nacelle assembly plant in Hutchinson, Kansas. We are already a top three wind turbine equipment supplier in the U.S. With the Fort Madison and Hutchinson facilities, we can now more easily meet the high demand for wind farms in North and South America.

Recent announced projects include the Keenan II wind farm in Oklahoma, the Top of the World project in Wyoming and the Windy Flats extension project in Washington State.

W-G: WHERE DO YOU SEE THE GREATEST POTENTIAL FOR FURTHER SCIENTIFIC BREAKTHROUGHS IN WIND?

BU: A good example that showcases significant wind turbine technology advancements is our SWT-3.6-120 wind turbine. We launched our new 3.6-MW wind turbine with a rotor diameter of 120 meters in April 2009.

This wind turbine has a swept area that equates to two football fields and will generate roughly 10 percent more electricity at a typical offshore site compared to its predecessors. We have sold more than 450 wind turbines of this type so far.

We also developed and introduced a wind turbine for moderate wind speeds last year. The SWT-2.3-101 wind turbine is designed to produce more power with less wind resources and will therefore be a valuable asset for energy providers looking for greater returns from sites with moderate wind speeds.

We have already sold a total of more than 240 turbines to customers in the USA, Canada, New Zealand, Turkey and Mexico.

To stay at the forefront of technological leadership in the wind energy industry, we've also developed a direct drive wind turbine. Our new gearless turbine marks the start of the next wind turbine generation for us. The new turbine has a capacity of 3 MW and a rotor diameter of 101 meters.

Gearless wind turbines are characterized by an intelligent, yet simple, design. With this turbine, we have been able to reduce the number of components by half compared to a standard geared wind turbine. A smaller number of rotating parts could reduce maintenance and thus further increase availability.

W-G: WHAT IS YOUR STRATEGY TO GROW SIEMENS' WIND BUSINESS?

BU: We are on the right track. Our strategy is to strengthen our position as a global market leader in offshore wind farms while expanding our international production network in key markets and ensuring technology leadership with inno-

vative products, including gearless wind turbines and floating wind turbines.

W-G: HOW IMPORTANT IS SOLAR THERMAL TO SIEMENS' RENEWABLE STRATEGY?

BU: Until 2030, approximately 40% of investments in power plants worldwide will be directed to the deployment of renewable energy sources. As mentioned earlier, we will see a substantial increase in renewable forms of energy. Wind power will account for around 50% of renewables, followed by solar power (30%). Based on forecasts, solar power will show the highest growth rate at over 28% per year.

Parabolic-trough power plants are currently the most efficient solar thermal power plants on the market. The technology has a track record spanning over 20 years. Following the acquisition of Solel last year, Siemens is now in a position to offer solar thermal products, system solutions and plant solutions, including key technologies like the solar receiver and the steam turbine with the steam cycle. We intend to increase the efficiency of the technology to make it cost competitive as fast as we can. We now have 70 percent of economic value added in a solar thermal power plant available in-house.

But Siemens is not only engaged in concentrated solar power, we also offer photovoltaic power plants. Our focus is on large-scale roof top and ground-based photovoltaic arrays as an EPC contractor. The two technologies – photovoltaic and solar thermal power plants – are not in competition with each other but should be regarded as complementing technologies.

W-G: HOW QUICKLY WILL YOU BE ABLE TO DECREASE THE COST OF SOLAR THERMAL POWER?

BU: For California, for example, a forecast predicts that wholesale parity, which means that the cost of power generated by solar thermal power plants equals the market price of electricity, can be achieved as early as 2015.

W-G: ARE THERE ANY TECHNOLOGICAL RISKS ASSOCIATED WITH SOLAR THERMAL POWER PLANTS?

BU: The technological risks are relatively small. Parabolic-trough power plants have a successful track record of 20 years. The SEGS (Solar Energy Generating Systems) are located in the Mojave Desert in California in three different locations, hosting nine plants with a total capacity of 354 MWe.

They have been running for more than 20 years now. There is therefore comprehensive empirical data for solar thermal power plants available.

W-G: WHERE ARE YOUR GROWTH MARKETS FOR SOLAR THERMAL?

BU: We expect that the market for solar thermal power plants will be growing in many regions of the world. Key regional markets for solar thermal power can be found within the sun belt.

There is currently significant demand in Spain, North Africa and the Middle East, and we are anticipating high growth rates in the U.S. In 2020, we expect a worldwide market volume for solar thermal power plants of approximately EUR20 billion, and large-scale photovoltaic arrays will account for approximately EUR30 billion.

The U.S. is expected to be the world's biggest market for solar power with a market volume of approximately EUR11 billion.

W-G: WHAT IS SIEMENS' ROLE IN THE DESERTEC PROJECT?

BU: The consortium has only recently been formed. Concrete details, including financing, still have to be worked out. Desertec is a visionary and fascinating project idea. And solar thermal energy generation in the desert is feasible.

I am convinced that Africa will utilize the associated opportunities and that we will play a positive and leading role there.

Siemens is the world's leading technology partner for future-oriented projects like the Desertec Industrial Initiative. Solar and wind power produced in North Africa can make a significant contribution to a sustainable power supply in the MENA (Middle East, North Africa) region as well as in Europe in the future.

We are already extremely successful in building low-loss power transmission lines over hundreds and thousands of kilometers.

For example, we are helping to transmit power from hydro power plants in the southern Chinese province of Yunnan to the mega-cities around Guangzhou and Hong Kong over a distance of more than 1,400 kilometers with minimal power losses.

All of the essential technologies for the Desertec project already exist.

And I believe that electricity generated in Africa should be for Africa. But of course, this is an energy source that can also benefit Europe.

We need to create a win-win-situation, and I am confident that this will work out well.

Dr. Utz has been with Siemens for 12 years in various R & D and strategy positions. He graduated from the Technical University in Munich with a degree in physics.

SIMON BERESFORD-WYLIE



Simon Beresford-Wylie
Is the
CEO, Elster
Group

The energy world is rapidly changing, presenting new opportunities for the advancement of smart grid technologies. Simon Beresford-Wylie, CEO of Elster Group, is confident that Elster is poised as a leading provider of cutting edge solutions for the utility industry in this vibrant new world.

Elster Group is a global leader in advanced metering infrastructure, integrated metering and utilization solutions for the gas, electricity and water industries, reflecting more than 170 years of knowledge and experience in measuring precious energy resources.

Elster provides solutions and advanced technologies to help utilities more easily, efficiently and reliably obtain and use advanced metering intelligence to implement energy conservation measures, improve customer service, enhance operational efficiency and increase customer benefits. Elster's AMI solutions enable utilities to cost-effectively deliver, manage and conserve electricity, gas and water.

With more than 7,000 staff and operations in 38 countries, Elster has delivered more than 3.6 million devices worldwide with more than 65 smart systems located in North America, Europe, Central America, Australia, New Zealand and the Caribbean.

Beresford-Wylie joined Elster Group in November 2009. Previously, he served as CEO of Nokia Siemens Networks, a position he held from its inception in 2007. He also was a member of the Nokia Group Executive Board. He credits his 27 years of telecommunications industry experience as pivotal to his leadership of Elster.

"My experience leading and transforming a global technology company that integrated hardware, software and professional services to deliver customer solutions is very relevant for Elster, particularly as the company enters a period of sustained growth driven by the transition to smart grid technology," he said.

From 1998 to 2007, Beresford-Wylie held a variety of senior leadership positions with Nokia in Asia-Pacific and Europe. From 1995-1998, he served as CEO of Indian mobile network operator Modi Telstra, and prior to this was an executive with Australia's Telstra Corp. He holds a degree from the Australian National University, and is a graduate of the Executive Development Program of Stanford/University of Singapore.

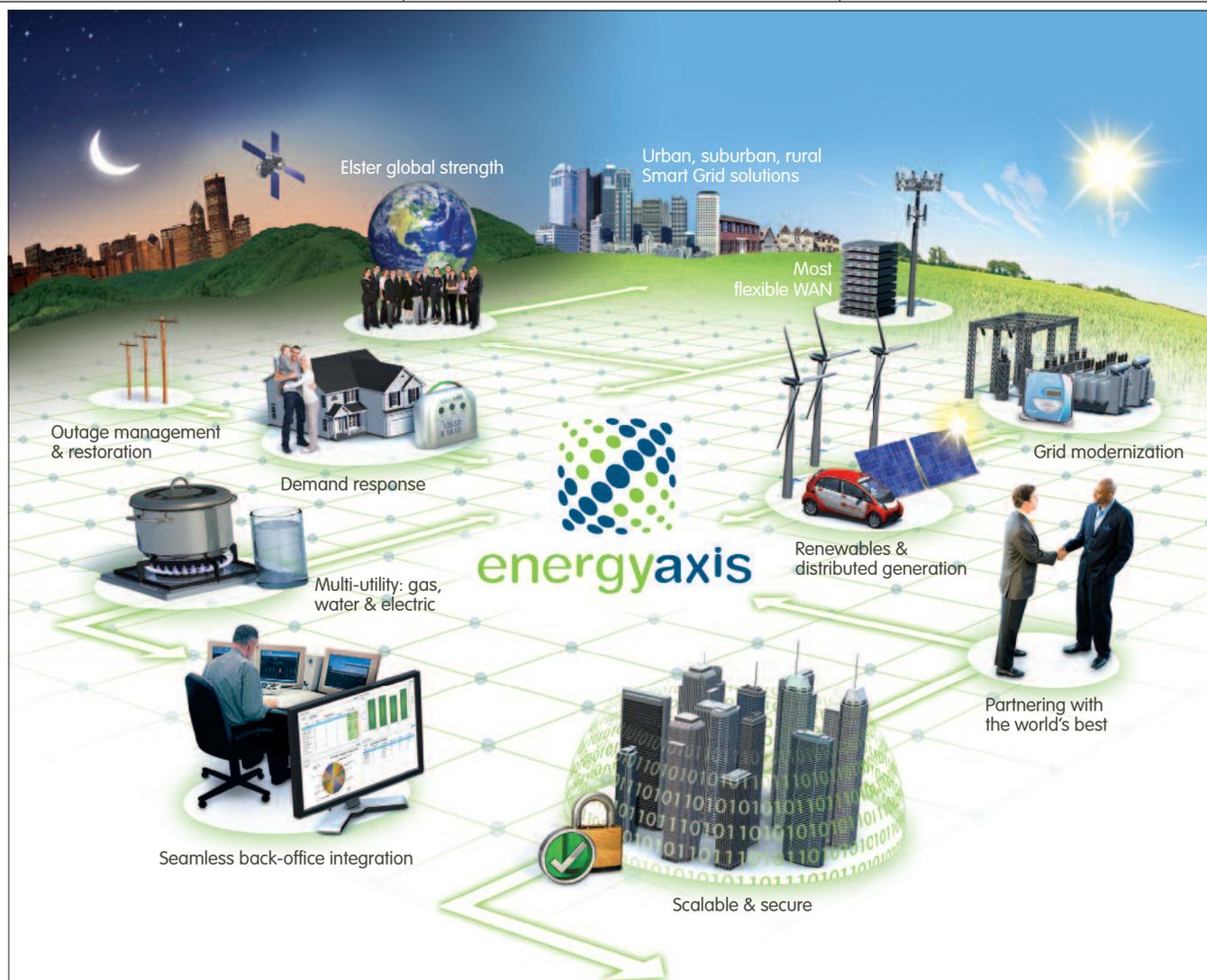
"There are important parallels between the telecommunications space and the smart grid space," he noted. "Advanced communications technologies sit very much at the center of smart grid networks. Similarities include networks that incorporate next generation subscriber data management capabilities, unified charging/billing platforms, advanced operational support systems and end-to-end solution design, deployment and management. Elster has a long track record of developing and providing end-to-end

advanced metering/grid solutions to its customers."

Beresford-Wylie believes that Elster is well positioned to respond to industry challenges and competitive pressures. "The smart grid space is poised for a period of significant and sustained growth and Elster is very well positioned in many segments," he stated. "Indeed, Elster has a superb, and possibly unique, set of assets and capabilities, including a global presence (almost 40 countries) and scale, one of the worlds' largest combined installed

bases of electricity, gas and water meters, great people and a long history of developing and providing innovative, trusted solutions to its customers."

As to his company's future, Beresford-Wylie points out, "In a competitive marketplace like ours, we believe that superior products, customer focus and continued innovation lead to success and we will be fighting hard to introduce new customers to our integrated solutions while continuing to provide outstanding support to our existing customers."



Others promise... We deliver

Proven, fast and interoperable Smart Grid solutions.

While many others have promised the delivery of smart grid technologies and systems that will integrate with complex utility operations, they continue to fall short of expectations.

Elster's EnergyAxis® System delivers a proven two-way communications network, field-tested in real-world utility environments. With established solutions for Demand Response, Grid Modernization, Outage Detection/Restoration, Revenue Protection, and a host of other utility requirements, we know how to seamlessly integrate with your operation. Simply put, EnergyAxis works...it can be deployed today and is engineered to expand for future Smart Grid requirements.

Make the proven choice today. Contact us for more information about Elster's EnergyAxis System: 800.786.2215 or energyaxis.com



JACK MCCALL



Jack McCall is the Director of Business Development, HTS T&D Systems, American Superconductor

Already over-taxed metropolitan power grids around the world are being challenged to meet the rising electricity demands associated with today's growing, digitally-based economy. As a result, the threat of power outages is ever present, particularly in dense urban areas where massive amounts of power must be carried through severely congested underground right-of-ways.

With the ability to transmit up to 10 times more power than traditional copper-based cables, high-capacity, very low impedance superconductor cables are now beginning to be deployed in the grid. Over the past several years, three superconductor cable systems have been energized in the United States.

Since late April 2008, a 138 kV HTS transmission line has been operating successfully in the United States just outside of New York City on Long Island Power Authority's (LIPA) primary transmission corridor. American Superconductor, LIPA and the U.S. Department of Energy (DOE) worked jointly to implement the project. LIPA's installation is the longest and most powerful superconductor cable system in the world. At full capacity, it is capable of transmitting up to 574 megawatts (MW) of power, enough to supply the electricity to 300,000 homes, in a right of way approximately just one meter in width.

Superconductor cable systems exhibit a number of unique operational characteristics. In addition to their ability to conduct significantly more power at lower voltages and in a smaller right of way, superconductor cables offer a highly desirable alternative to conventional cables or even overhead lines. Replacing an existing cable with a superconductor cable can provide the ideal means to increasing power supply to dense urban environments without building new lines. This is not only an attractive option to meeting traditional urban area load growth, but also to addressing future needs such as the advent of plug-in hybrid vehicles (PHEVs), which are expected to dramatically increase electricity demand in the decades ahead.

SECURE SUPER GRIDS™ DELIVERS MORE POWER WHILE MANAGING FAULTS

Introduced by American Superconductor in 2007, Secure Super Grid™ (SSG) technology is a system-level superconductor cable solution that provides electric utilities with a means to simultaneously address rising electricity demands

and increasing fault current levels.

In many urban areas, fault currents now approach the limit of installed circuit breaker and related equipment ratings and, given the unrelenting expansion of grids, they will continue rising. While higher fault-rated equipment is available, the expense involved in upgrading substations can be prohibitive. AMSC's second generation high temperature superconductor (HTS) wire, known as 344 superconductors, is able to carry massive amounts of power one minute and then turn into a resistor when it encounters too much current. The SSG technology takes advantage of this capability and the surrounding grid to enhance power grid reliability and security.

A project focusing on the deployment of AMSC's Secure Super Grid™ (SSG) technology is underway at Consolidated Edison, the utility that serves New York City. The SSG concept has attracted major support from the U.S. Department of Homeland Security (DHS), which is spending at least \$25 million with AMSC to develop and deploy the concept. DHS's interest stems from the fact that SSG technology allows for the construction of multiple electrical paths in dense metropolitan power grids by allowing interconnection of multiple substations' secondary buses. This grid concept boosts system reliability when individual circuits are disrupted due to equipment failure, severe weather, accidents, or willful destruction. However, one result of these interconnections is to dramatically increase the level of potential fault currents. Superconducting cables incorporating SSG technology are ideal for this application, due to their ability to switch rapidly to a high-resistance cable that limits these high fault current magnitudes.

HTS-BASED FAULT CURRENT LIMITERS

Even without additional inerties, utilities are witnessing a marked increase in fault current levels. New transmission and distribution equipment installed to meet load growth, as well as the requirement to add new generation sources, all contribute to increases in potential fault currents. Companies around the world are developing superconductor-based fault current limiters (FCLs) with varying designs. One such design, termed a "resistive" FCL, offers promising economic and practical benefits.

Under this approach, the superconductor serves as an automatic switch, creating a state of high resistance the moment a fault current exceeds a preset value. The resistive FCL's ability to operate in this manner hinges on a fundamental property of HTS materials: above a critical current, their superconductivity is quenched and their electron transport characteristics become resistive. It is for this reason that high temperature superconductors have been termed "smart materials," switching rapidly whenever a fault current exceeds their critical current. The inherent conduc-

tive properties of HTS materials establishes the most important characteristic of superconductor-based fault current limiters – they require no external control scheme or other devices to ensure the current limiting effect.

HTS CABLES AND THE SMART GRID: THE BRAVN TO SUPPORT THE BRAINS

HTS cables have a significant role to play in the Smart Grid. While many conversations about the Smart Grid center on communications and metering technologies, the actual definition of Smart Grid is much broader and encompasses grid infrastructure itself – or the 'brawn' needed to support the 'brains' of the Smart Grid.

The U.S. Department of Energy (DOE) has identified seven key characteristics and five fundamental technologies that will drive the Smart Grid. One of the identified technologies is Advanced Components. This category specifically includes superconductor power cables because of their ability to be used to both increase transmission efficiency, and significantly enhance the flow of power under our city streets to enable, for instance, widespread adoption of PHEVs. Superconductor power cables additionally can automatically suppress power surges, enabling resilient power grids that can survive attacks and disasters.

In addition to their ability to carry significantly more power and increase reliability, driving interest for HTS cables among both utilities and merchant transmission companies is the value they offer when applied to applications that optimize the use of their electrical characteristics such as paralleling urban substations. The huge capacity of an HTS cable enables the power transfer necessary when making such an interconnection while the fault current limiting capability prevents the introduction of damaging short circuit currents when substations are tied together. HTS cables are additionally ideal for separating the high and medium voltage portions of substations where real estate is limited such as at remote substations.

For these reasons, high capacity HTS cable solutions offer unique capabilities for upgrading urban networks. For example, Korea Electric Power Corporation (KEPCO) has announced its intention to replace all 22.9kV and 154kV cables supplying the Seoul power grid with HTS cables that have six times the current rating of the cables they will replace. KEPCO estimates this will result in an 80% reduction in civil construction costs compared to more conventional means of increasing Seoul's power supply by an equivalent amount and will address a variety of other issues including public opposition to the construction of new substations in urban areas and the need environmental friendly power apparatus. The first 22.9kV HTS cable is expected to be installed in KEPCO's grid later in 2010.

DC SUPERCONDUCTOR ELECTRICITY PIPELINES FOR LONG-HAUL TRANSMISSION

Perhaps most exciting is the potential for using DC superconductor cables for transmitting very large amounts of power (5GW or more) over very long distances. Termed Superconductor Electricity Pipelines, these systems combine conventional underground pipeline construction techniques with two highly complementary electric power options: superconductor cables and multi-terminal (voltage-source converter-based) DC power transmission. The result is a high-capacity electric transmission "pipeline" that is underground, easy to site and access, highly efficient, controllable, and offers greater security than competing technologies.

In conjunction with DC power transmission, HTS materials have absolutely zero resistance to the flow of electricity, which means that DC superconductor cables are literally perfect conductors and introduce no electrical losses of their own. Superconductor Electricity Pipelines are uniquely and ideally suited to address all of the requirements to move renewable energy to distant load centers, notably including providing the highest power capacity, the highest efficiency (lowest power losses) of any transmission technology, long distance capability, the ability to accept power from multiple distributed sources, and precisely deliver power to multiple distributed destinations, all in underground construction with very small right of way requirement.

The recently announced Tres Amigas project in Clovis, New Mexico will utilize a Superconductor Electricity Pipeline to carry 5000MW of DC power among its three HVDC terminals. The Tres Amigas SuperStation will act as a power market hub, enabling multiple gigawatts of electricity to be bought and sold between the nation's three power grids known as the Eastern Interconnect, Western Interconnect and Texas Interconnect (also known as the Electric Reliability Council of Texas, or ERCOT) for the first time.

As a result, wind, solar, hydro and geothermal renewable energy sources that do not currently have access to transmission lines and/or customers will be able to tap into multiple markets through the Tres Amigas SuperStation. For example, regions rich in solar energy will be able to buy electricity at night, when the sun is not shining, from regions rich in wind energy. Once completed, Tres Amigas will enable faster adoption of renewable energy and increase the reliability of the U.S. grid.

The use of high voltage DC transmission technology to link power grids and enable greater utilization of renewable energy is also accelerating rapidly overseas with projects such as the Supergrid in the United Kingdom and DESERTEC in the Middle East. HTS cabling can make such long distance transmission economic, eliminating the costs and energy losses associated with conventional T&D infrastructure.

LAURA K. IPSEN



Laura Ipsen is the Senior VP and General Manager, Smart Grid, Cisco.

WORLD-GEN: HOW DO YOU SEE TODAY'S ENERGY LANDSCAPE?

Laura K. Ipsen: I think it's an exciting time to look at the landscape and ask how we change the balance of power and the cost of energy in the future. For Cisco, it's about how the smart grid build-out creates a new opportunity to use communications networking technology to manage, monitor and distribute power in a different way and to create efficiencies and improved the reliability and security of our energy ecosystem.

I think we're in an evolving state with a dynamic tie to supply and demand and pricing that are creating pressure on all of us to look at energy much differently. We're pretty excited about the new opportunities around renewables because that's one of the key drivers for the smart grid and I think it's a great opportunity for us to all move towards a more carbon-free world. So we see the energy landscape as dynamic and evolving.

There are obviously challenges with energy sources that are unlikely to change over time. I think that pushes a new wave of innovation into the energy industry, when we think about how to use technology either for new waves of carbon sequestration, onboarding renewables, or offloading carbon. So for Cisco, it's a very dynamic time. We're not utilities or energy experts. We're communication networking experts, and we know how to make things smarter through technology. We look forward to bringing that experience to our customers.

W-G: WHAT'S YOUR STRATEGY FOR THIS NEW SMART ECOSYSTEM THAT YOU'RE IMPLEMENTING?

LKI: Our overall Smart Grid vision is to build an IT-based network that is end to end. It's going to be a platform for smart, highly secured energy for the 21st century. We're big believers in collaboration. In fact, the reason I have my position is that we've collaborated around energy and the environment through our boards and councils model driven by John Chambers, our CEO. So in my former role of heading up government affairs and co-chairing our eco board, I collaborated on many different business area solutions, and that is what led me to now run the smart grid business unit.

The ecosystem is an example of where we're bringing partners and other experts in the field together to collaborate around things like standards, IP and interoperability. We believe the future of the smart grid will be open and innovative. So as we build this ecosystem, whether it's the energy integrators, solution developers, the telecoms, or other experts, we bring all these parties to bear to get their thoughts and to get on the same page about how we can motivate and accelerate these opportunities.

W-G: YOU HAVE 30 MEMBERS. ARE YOU TESTING ANYTHING AT THIS TIME, HAVE THEY DONE ANYTHING TOGETHER OR SEPARATELY?

LKI: We did the launch of the ecosystem in October 2009. When we put this together, we thought we might have a dozen members, but we actually launched with 30 and are now up to 40. We've got the system integrators which include companies like Accenture, Capgemini, and Oracle, and the power utility integrators from Areva, Siemens and GE, our technology vendors, and others.

As we bring out products, we'll start doing many types of testings. Right now we've had great engagements on standards issues, regulation and policy. It's really a place for all of us to find some common ground and make progress on a diverse range of issues. It will get into interoperability testing and hammering through some of those tough issues, but right now we're sticking in the middle of standards with NIST and other international bodies.

W-G: SO WHO'S YOUR CLEARING HOUSE THEN?

LKI: Well NIST on standards. There are many standards organizations. I think NIST and IEC are two, and we're looking to see how the IEEE and IEGPF connect into these other standards bodies. I don't think there's one clearing house. There are certain places where I think we can move forward on standards. As you know, there are more standards than most of us can count or know about and our goal is to try to get it to a reasonable amount that we can support and build off.

W-G: HOW DO YOU COMMUNICATE?

LKI: Right now, we use our great WebEx technology. My goal is that we continue to build a collaboration of states. This is where the power of technology helps us bring these organizations and great companies forward. We hope we'll be able to use our telepresence technologies so we can actually have virtual face to face meetings, not quite carbon-free but certainly limiting the amount of travel that all of us have to do. We can all be in a room that is scaled to as many endpoints

as to where these members are located. We're in Phase I or 1.0 of the ecosystem. We'll move to a 2.0 which will include a lot more collaboration space and chats and places where members can post content. We'll continue to grow the ecosystem.

So the goal is to provide a platform for these discussions and have a lot of voices coming to some agreement on things that we can work constructively on together with a number of utilities to build the smart grid and, along with our energy customers, to make sure that we have an environment where we have strength in the relationship and to create a vision and mission for the smart grid.

W-G: LONGER TERM, HOW WILL YOU WORK WITH UTILITY CUSTOMERS ON THINGS LIKE WORKFORCE?

LKI: We're really excited about a number of ways we can work with our customers to address their key issues. We are going to be very challenged with figuring out what the smart grid jobs of the future will look like and how we train a workforce that works for the grid. We will leverage our Cisco Networking Academy program to help train technology workers and our networking technologies to help our utility customers scale.

We have the ecosystem that is able to be reflective on the whole market, and there's a lot of expertise there. We share information across these different focus areas. We are engaged with innovative "light house" customers where we hammer through issues on technology, product issues, and road mapping. They talk about the issues that they have and share best practices. It's a classic Cisco approach of using collaboration to listen closely to our customers to make sure that we build out this end to end opportunity in the right way. We certainly don't intend to forklift the internet on top of the grid. We know where we made early mistakes with the internet, and we plan to use the lessons learned to become savvier with the opportunity presented by the smart grid.

W-G: HOW IS CISCO DELIVERING GRID SECURITY AND CYBER SECURITY?

LKI: There are many concerns around building out a secure infrastructure. The reality is that there are going to be more intelligent connective devices built into the grid. There are going to be billions of endpoints, and the grid is going to need to manage that. So the goal is to know when you go end to end and have security that not only does things like point-to-point encryption but also thinks about behavioral security and how something connecting to the grid behaves. The concept of behavioral security and advanced security architecture for the grid is absolutely something that's going to be needed, not five years from now, but

now as we build out the smart grid, and as more devices are connected in our homes, in our businesses, and with end points like cars. It's absolutely a concern. We've got to integrate physical security with cyber security so that we can use things like video surveillance and sophisticated analytics to make the grid smarter and be preventative in security.

If we do this, we can isolate risks and identify gaps before things happen. That's really the future of where we believe the smart grid needs to go in security.

W-G: WHAT'S THE SIZE OF THE TEAM NOW?

LKI: My business unit is housed in our emerging technology group, so I'm considered a "start up" within the company.

I'm going to double the size of my team in the next two quarters.

My team is about 50 today, but the larger ecosystem of the business unit is 100s if not thousands of people from our sales and technical support, all the resources and engineering that it gets from our full development organization and our marketing team.

We're a start up with leverage and access to a strong balance sheet which is what the utilities look for.

We have an ecosystem of experts across the company so it's good to have a little bit of both. We've got pressure to move quickly in a small group, but we also have the bigger nest that we can draw from.

W-G: WHERE DO YOU SEE THIS HAPPENING FIRST?

LKI: Well for us if you look at where the utilities are today in terms of deployments and investments, most people would probably agree that they're just starting with metering which is not the whole smart grid.

I think it is a catalyst for the smart grid. Most deployments have happened first in Europe, then North America, so my primary focus as a business unit right now is North America and Europe, but I think there are a number of wild cards we see in Australia, Japan, China, Korea, and India. While I'm going to stay pretty focused on light house customers that we have, we're actively engaging, monitoring and looking at deployment in those newer areas.

I work quite a bit with John Chambers, our CEO, on building relationships across the Middle East and am actively looking at emerging markets and emerging countries in the Middle East.

Actually I pursued an accelerated Arabic program in college in Jordan and part of my studies were Middle Eastern studies in the international relations area, so the Middle East has been a deep fascination for me then and continues to be.

(continued page 19)

BRUCE PHILLIPS



Bruce Phillips is the Group President Aclara®, ESCO Technologies Inc.

The limitations of our present electrical grid have come into sharp relief in the past few years, as utilities struggle to keep up with demand for electricity. In its recently released Short Term Energy Outlook, for example, the Energy Information Administration, the statistical unit of the Department of Energy (DOE), projects U.S. demand to increase in the next two years after a decline in 2009. Long-term projections by the DOE have energy demand increasing by 40% by 2030, a trend powered in part by new technologies such as electric vehicles. U.S. electric utilities face a growing challenge in meeting peak demand for electricity, a situation that may lead to power shortages, blackouts, or brownouts.

Yet construction of power plants and transmission facilities capable of meeting peak demand have not kept up. Demand is still outstripping investment in new electrical supply, according to the North American Electric Reliability Council. The gap is attempting to be mitigated by a number of factors, including the construction of a few natural-gas-fired power plants, which can take as little as 18 months, and generation from renewable resources such as wind, solar, hydropower, and geothermal. Even if President Barack Obama's recent State of the Union pledge to increase the number of nuclear plants comes to fruition, the length of time it takes to construct a nuclear plant means that utilities have to take additional steps now to ease the gap between supply and peak demand.

In the absence of increased generation capacity, one of the major strategies being used by utilities is to try to control usage. Efforts in this arena include educating customers on "green" construction and remodeling techniques to include reflective roofing, energy-efficient lighting and windows, and insulation. Another productive way for utilities to encourage reduced energy use during peak-usage periods is through demand-side management programs. Typically, these programs allow the utility to automatically turn off large appliances such as water heaters and air conditioners during demand peaks. Aclara has been a leader in load control and demand response solutions for over 20 years.

Although present demand-side management programs are helpful in closing the gap on electric demand until new generation come to fruition, these and many other current efforts are just a few of the solutions for what can be done to improve grid efficiency. There are literally millions of devices operating across the transmis-

sion and distribution grid and the data they generate are critical to utility operations. The challenge for utilities is to collect the data from these devices efficiently, and to communicate with them effectively to have centralized monitoring and control over their assets. The electric industry has had a general inability to monitor and control the vast and multifaceted electric distribution system.

This is where the concept of the Smart Grid comes in. Simply defined, the Smart Grid comprises the applications that automate the monitoring and control of electrical transmission and distribution. On the distribution side of energy, these applications can include advanced metering infrastructure (AMI), demand response, load control, distribution automation, and other monitoring and control systems.

The confluence of increased demand coupled with limited supply has led utilities, regulatory agencies, and government entities to look to Smart Grid automation as the primary means of improving grid efficiency. In fact, the year 2010 may go down as the year of the Smart Grid for a number of reasons. Electric utilities from one end of the country to the other are implementing projects that put more intelligence into their systems using two-way communications with meters, direct load control, and a variety of smart sensors through their distribution and transmission systems. In addition, the federal government has taken an active role in promoting the concept of the Smart Grid by awarding 100 smart grid investment grants this fall, some as large as \$200 million. These diverse Smart Grid projects involve the deployment of 18 million smart meters to about 13 percent of the nation's homes, the installation of 200,000 advanced transformers, 700 automated substation systems and similar systems for the nation's distribution grids, as well as 850 sensors for transmission grids. For residential customers of utilities, grant winners plan to install one million in-home energy displays, 175,000 load management devices, and 170,000 smart thermostats to help homes save energy.

All of these efforts contribute to making the grid more intelligent. To maximize the effectiveness of the Smart Grid, however, utilities must take a holistic, top-down approach to collecting and managing data from diverse metering, distribution, and transmission systems.

Today, the applications and devices that populate the grid form islands of intelligence that rely on a variety of methods to communicate back to the utility. For example, SCADA (Supervisory Control and Data Acquisition) solutions might connect via computers linked to groups of devices, while AMI might utilize cellular telephone signals to communicate with the utility. This hodge-podge of communications systems and their interfaces into the utility's local-area network are difficult to manage.

What is needed is a seamless way to link the standards-based utility LAN to the intelligent applications, devices, and subsystems that comprise the utility infrastruc-

ture. One way to build an Intelligent Infrastructure for utilities is to eliminate the outdated clutter of communications methods now being employed, replacing them with a single, multipurpose, wide-area network (WAN) that seamlessly links with the utility LAN via standard, IP-based communications protocols. This approach improves utility infrastructure planning, implementation, support, and maintenance. Such a network not only simplifies utility communications, providing a coherent strategy for sending and receiving data, but it also reduces costs for utilities.

KEY FEATURES OF THE UTILITY WAN

What does a top-down utility WAN look like? It is a general-purpose, private network that essentially plugs into the utility's local-area network (LAN). As such, it is important that it be standards-based, complying with existing IT requirements such as TCP/IP that guarantee interoperability. In this way, the utility WAN can be counted on to provide high-speed, two way communications for such applications as SCADA, AMI, mobile systems, and substation automation. The standards-based approach to utility communications provides numerous benefits such as improving infrastructure planning, implementation, support, and maintenance, while providing a coherent strategy for sending and receiving data, and reducing costs.

Another important characteristic of the utility WAN is that it be owned by the utility. Today, much utility backhaul depends on networks owned by third parties, such as telecommunications companies and satellite communications providers. Utilities literally "rent" their telecommunications infrastructure. However, third parties may not have the same priorities as utilities, so utility requirements may not be given precedence. What's more, monthly bills for third-party communications solutions can be significant, costing thousands of dollars per month.

Utilities today also are concerned with maintaining secure connections to their LANs, so it is important that backhaul WAN connections support security features that meet developing industry standards for advanced encryption, authentication, and digital-signing procedures.

Finally, fault tolerance and redundancy are also important requirements of the utility WAN. That is why utilities should consider mesh networks, which offer multiple paths for transmitting data back to the utility for the WAN configuration. This type of network employs "self-healing" features that reroute communications paths should a network node fail, ensuring continued operation.

TOP DOWN VERSUS BOTTOM UP

Today, many vendors are taking a bottom-up approach to developing a utility WAN, trying to repurpose networks for applications such as AMI to meet WAN

requirements. Aclara's position is that this approach may not be successful, primarily because these networks are tuned to specific field applications and are not designed to meet the broader requirements of WAN communications.

That is why our organization has become a member of the Wi-Fi Alliance and chairs its Smart Grid task group. The Smart Grid task group provides technical expertise to utilities and government officials on the properties of Wi-Fi that make it suitable for the Smart Grid. Wi-Fi is especially suited for Smart Grid applications in part because of the ongoing roadmap of innovation and established mechanisms for collaborations developed by the Wi-Fi Alliance as well as IEEE. Aclara offers a smart communications network that specifically considers the unique requirements of utility WANs.

Aclara continues to enhance both our power-line system and radio-frequency AMI technologies to better serve our AMI customers. Certainly, the requirements of the Smart Grid demand this approach. However with utilities having limited visibility into what is happening on the electrical distribution network, Smart Grid technologies must be augmented by a top-down communications strategy that will allow utilities to efficiently communicate with devices on the edges of their networks, improve reliability of power delivery, and take control over the power delivery process. Such an Intelligent Infrastructure evolves from strategic planning and targeted investments, all aimed at a long-term vision and not from a single rollout of technology or a single technology supplier. All parts of utility operations and services must communicate together and affect one another. Utilities can reinvent their companies and strategies in order to gain the full impact of improved operational efficiency, customer satisfaction, resource conservation, and risk mitigation through an Intelligent Infrastructure.

The Aclara brand includes Aclara Power-Line Systems Inc. (formerly known as DCS) and the TWACS® technology, Aclara RF Systems Inc. (formerly known as Hexagram, Inc.) and the STAR® Network technology, and Aclara Software Inc. (formerly known as Nexus Energy Software) collectively known as the Aclara Technologies of ESCO.

Bruce Phillips graduated with honors from the University of Texas in 1975 with a Bachelors of Science degree in Chemical Engineering. He is licensed with the Texas State Board of Registration for Professional Engineers since 1980. An energy executive with more than 30 years in the energy industry, Bruce's career has included the major energy companies including Exxon Chemical, Sun Oil Company, Tenneco Oil Company, Enron, and Koch Industries. He's had extensive international experience with two British companies, Advantica PLC (formerly British Gas) and APV.

JIM KOHLHAAS



Jim Kohlhaas is the Vice President, Energy Initiatives Corporate Engineering and Technology at Lockheed Martin

In 2009, Jim Kohlhaas was named Vice President, Energy Initiatives within Lockheed Martin's Corporate Engineering & Technology (CE&T) organization. Jim is responsible for leading the Corporation's strategic growth in support of global climate, energy, and water challenges. His team evaluates emerging technologies, develops partnerships with key companies and academic institutions, leads internal Research and Development, and serves as the catalyst to integrate technologies and solutions from several parts of the Corporation.

For example, his team is currently exploring how nanotechnology solutions will dramatically change how the world collects, stores, and transmits energy. They are also exploring how information technology can support sustainability management goals being set by governments, cities, and businesses; for example, we are investing in Carbon Modeling research and developing state of the art sustainability management solutions. In 2009, Jim's team announced a major research \$5 Million research partnership with the MIT Energy Initiative to transform how the world combats climate change and produces and consumes energy. The centerpiece of the collaboration will focus on global climate initiatives, such as carbon modeling and verification and utility-scale energy storage.

Graduating with a degree in Petroleum Engineering from Penn State University, he began his career as an offshore oil industry engineer for Texaco. He came to Lockheed Martin 20 years ago and for much of his career working as a chief engineer, chief architect, or program manager supporting the development of information systems for the classified intelligence community.

Prior to his current role, he served as Lockheed Martin's vice president of Spatial Solutions where he was charged with delivering spatial intelligence and information solutions to national, tactical, and civil communities.

Mr. Kohlhaas orchestrated Net-Centric strategies across the corporation's programs and initiatives. In this role, he was responsible for delivering prototypes, experiments and analysis that demonstrates the advantages of a net-centric approach.

This content is displayed at Lockheed Martin's Center for Innovation in Suffolk, VA.

ORGANIZATIONAL OVERVIEW:

Lockheed Martin's Efforts to Address Global Energy and Climate Challenges

As a global security company, Lockheed Martin recognizes the economic and strategic challenges posed by a dependence on foreign oil, the potential destabilizing effect of climate change, and the vulnerability of our nation's aging power grid.

In support of a sustainable future, the vision focuses on four key areas. "First, we see the solution starting with energy efficiency—the cleanest, cheapest, fastest energy source. The vision continues with leveraging our innovations and manufacturing capabilities to design and produce the next-generation of alternative energy solutions. That mix of traditional and alternative energies then needs to be smartly and securely stored, managed and distributed to consumers. Finally, space-based climate monitoring, information technology, and environmental services will ensure that our Nation and the world are making positive progress", Kohlhaas told *World-Gen*.

ENERGY EFFICIENCY

As one of the largest implementers of utility energy efficiency programs in the country, Lockheed Martin helps utility customers conserve energy and protect the environment. "Whether residential or industrial, we manage programs for utilities to ensure they increase operational efficiencies, maximize the benefit of capital spending, and help their customers use less energy. As an approved Energy Savings Performance Contractor (ESPC), we can help the government reduce its energy costs and environmental impact through increased energy efficiency, additional use of renewable energy, and improved utility management decisions at Federal sites", he added.

ALTERNATIVE POWER GENERATION

Using its globally renowned expertise in engineering and systems integration, Lockheed Martin is successfully pioneering new ways to leverage the sun, wind, ocean and biomass as alternatives to fossil fuels.

"From a solar perspective, we are working to develop solutions that leverage the sun's concentrated thermal energy to create electricity on a utility scale; we recently built a solar field test bed in New Jersey to integrate and test a variety of solar technologies and materials", he pointed out.

OTEC

A more unknown renewable energy, Lockheed Martin is exploring the power of ocean thermal energy. Ocean Thermal Energy Conversion (OTEC) is a process that generates electricity by leveraging the temperature difference between warm sur-

face water and deep cold water. Since developing the world's first successful floating ocean thermal energy system to generate net power in the 1970's, Lockheed Martin has continued to mature and validate the critical technologies necessary for a utility-scale OTEC system. To leverage other parts of the oceans, engineers are collaborating with a key provider of wave power technologies to pursue utility-scale wave power generation projects.

WINDTRACER

WindTracer®, a Doppler lidar system developed by Lockheed Martin to detect dangerous wind conditions at airports, can also be used by wind farm developers to select locations with the strongest and most-consistent winds.

ENERGY MANAGEMENT, STORAGE & SECURITY

In the near future, a new mix of traditional and alternative energies will need to be smartly and securely stored, managed and distributed to consumers.

Smarter Grids will enable utilities to monitor and optimize consumer energy use through time-of-use pricing, demand response, advanced metering and load control programs. Lockheed Martin has partnered with utilities, industry leaders and academia to shape and implement projects that leverage expertise in command-and-control, systems integration, nanotechnology, and cyber security expertise to ensure that new Smart Grid technologies not only deliver dramatic increases in efficiency and reliability but that they remain interoperable and secure. "As there are challenges in taking our energy grid into the digital world, we are applying our expertise in cyber security to grid management. Because it's one thing to make the grid smart. But even smarter to make it secure", Kohlhaas said.

"We are designing products to help power companies better manage power supply, demand and distribution with less generating capacity or off-grid power purchases. Our Smart Energy Enterprise Suite (SEESuite™) is a set of smart grid software products that help utilities improve grid reliability and situational awareness to reduce operating costs and enhance organizational responsiveness", Kohlhaas underscored.

Military customers will have broader uses in the energy marketplace. For example, Lockheed Martin is developing micro-grid technology to allow installations such as refugee camps and forward military bases to incorporate alternative energy sources and manage power more efficiently. Lockheed Martin is also working to develop several advanced battery products, such as solar power and fuel cell energy storage for powering military air vehicles, personal power vests for soldiers that incorporate a lithium ion battery and fuel cell technology, and scalable central energy

storage units to supply power to larger sites in the field.

"Finally, we are leveraging decades of expertise in engineering, information technology and services to help our U.S. Department of Energy customer set up and manage complex facilities; we also perform advanced R&D and provide other technical services. Lockheed Martin has support the nuclear energy community, on both the commercial and DoD sides, with safety-critical control room solutions and services for power generation", Kohlhaas shared.

CLIMATE MONITORING AND ENVIRONMENTAL PROTECTION

Applying expertise with space systems and advanced information technology,

Lockheed Martin can keep our nation informed about progress in mitigating climate change. Lockheed Martin has been investing in Carbon Modeling research and developing state of the art sustainability management solutions targeted for the Federal Government, cities and businesses.

As the leading environmental monitoring satellite builder, Lockheed Martin has helped collect environmental data for nearly 50 years—supporting weather and solar monitoring, forecasting, and climate data monitoring. In addition, out data systems help manage, store and analyze environmental information.

Going forward, these types of spacecraft and technologies can help monitor treaty compliance and validate emissions, as well as support carbon monitoring and sensing.

Lockheed Martin has been supporting the U.S. Environmental Protection Agency and its environmental missions for over 25 years with IT solutions to enable secure information exchange, environmental data analysis, and scientific investigation and also supports the EPA's Environmental Response Team with 24-hour technical and analytical support during environmental emergencies.

"Whether you are a government agency trying to meet sustainability goals, a utility trying not to build a new power plant, we are able to offer you an integrated solution—reducing energy demands with efficiency, leveraging appropriate alternative energy solutions, and securely managing and distributing that power to your energy consumers", Kohlhaas emphasized.

"The need for high-level capabilities in complex systems integration, information technology, cyber security, nanotechnology, and advanced manufacturing techniques — along with the global security component of the effort — make energy and climate solutions a natural fit for Lockheed Martin.

We are proud to invest our talent in clean, secure, and smart energy—supporting global security, a strong economic future, and climate protection for future generations", Kohlhaas concluded.

AKIHISA TOMIOKA



Akihisa Tomioka is the President and CEO of PIC Group, Inc.

Akihisa Tomioka joined PIC Group, Inc. (PIC) in March 2008 as President and CEO. Armed with 20 years of diverse power industry experience, Tomioka has led PIC through a successful acquisition by Marubeni Group and on to a strong year. "I am very proud of the employees of PIC and their focus on the fundamental values of the company. This year we strived to be the industry standard and will continue developing our business until PIC's name is synonymous with power generation services," said Tomioka.

Tomioka began his career with Marubeni in 1990. Then working in Japan, Tomioka was assigned to engineering, procurement and construction (EPC) projects in Southeast Asia, with a special focus on Thailand.

Tomioka was involved in numerous EPC contracts including large conventional coal-fired power plants, large combined cycle power plants, hydro-electric power plants, high voltage transmission and distribution projects, geothermal power plants, coal-fired power plants using circulating fluidized bed (CFB) technology, and flue gas desulphurization (FGD) retrofit projects.

"I eventually moved to Thailand for five years, where I represented Marubeni's interests in the company. While I enjoyed my time there, I was happy to move back to Tokyo in 2003. Upon my return home, I again became involved with Marubeni's EPC business in Southeast Asia.

A year before PIC was acquired I was assigned to new business development. In this role I was one of the principle people in charge of overseeing the PIC acquisition.

After the transaction was finalized, I moved to Atlanta, Ga. and took over as President and CEO of PIC," he told *World-Gen*.

PIC IN '88

Founded in 1988 as Power Industry Consultants, PIC is now a wholly owned subsidiary of Marubeni Group. Since its inception, PIC has continued to deliver the "The Best Of The Best"® people, processes and programs available to its customers. With Marubeni's financial support as well as its global reach and capabilities, PIC has expanded its service offerings to support all aspects of power project development. Spanning the entire project lifecycle, PIC's solutions include

start-up and commissioning, installation, operations and maintenance, outage, documentation and training, and project support services.

"I have always admired PIC's exceptional work and value-based culture. When given the opportunity to become part of such a respected company, the decision was an easy one. I feel honored to work with professionals of such high caliber," expressed Tomioka.

COMMON CULTURE

"PIC's values have long been a driving force in defining the company's culture, and our culture has led us to the success we currently have. These values have been instilled in our company since day one, and they are just as relevant today."

Tomioka feels that Marubeni and PIC share common ground in their core philosophies. "At Marubeni I was immersed in the Company Doctrine that guides all aspects of the business: Fairness, Innovation and Harmony. The employees at PIC have shown that they too are dedicated to similar ideas, especially as they apply to customer satisfaction.

PIC distinguishes itself by being more than a vendor.

PIC is a partner. We know that our success depends on our customers' success, so we customize each solution to fit their unique needs," said Tomioka.

5,000 PLUS PROJECTS

Developing and executing tailored programs ensures that each facility operates at peak performance. PIC's complementary service lines combine years of hands-on knowledge with intelligent planning to optimize reliability and efficiency while reducing cost and risk.

With over 5,000 projects executed world-wide, PIC's team of specialists has the knowledge and ability to create complete strategies focused on quality and safety. PIC's commitment to project success is evidenced by the longevity and satisfaction of its business partners and relationships.

REPEAT BUSINESS

Tomioka explained that satisfying customers and sustaining growth should be the goal of any business. PIC accomplishes this by actively recruiting the top professionals in the industry.

These highly qualified individuals, combined with PIC's field-proven programs and processes, ensure that customers' goals are consistently met or exceeded.

This, in turn, leads to the repeat business on which PIC has built its reputation.

"PIC's reputation for high quality work is what allowed us to experience a great year even in the midst of an econom-

ic downturn," said Tomioka.

Although the effects of the current recession have made an impact worldwide, PIC endured and achieved a profitable year.

"I have to give credit for this accomplishment to the employees of PIC. I believe that there are two main factors that are responsible for this success. First, everyone performed both professionally and consistently. PIC's in depth training and performance measures ensure that every job is done safely and correctly. This is paramount in the power generation industry where lost time can be associated with huge costs, not to mention the potential safety risks involved when companies lack consistency."

PIC SAFETY AWARD

In Tomioka's first full year as president, PIC completed over a million safe work hours with a 0.0 Lost Time Incident Rate (LTIR). PIC also reported a 1.7 Recordable Incident Rate (RIR) for 2009, well below the national industry RIR average of 4.2.

PIC Group, Inc. (PIC) received the "Award of Excellence" sponsored by the Safety Engineering Division of the Georgia Department of Labor for exceptional workplace safety in 2009. The award will be presented at the annual Georgia Safety, Health and Environmental Conference held September 7-10, 2010 in Savannah, Ga.

PIC is now eligible for additional awards sponsored by the Georgia Department of Labor.

"While working in a safe and consistent manner is our top priority, companies can't stand still. The second factor to which I credit our success is innovation. PIC's employees seem to have an innate desire to evaluate emerging trends and rapidly embrace new technologies."

EXPANDS INTO RENEWABLES

Tomioka plans to expand PIC's existing business lines to include even more innovative projects with a focus on renewable energy. While PIC has already completed multiple renewable projects in the biomass, solar, wind, hydro and geothermal arenas, there is still plenty of opportunity for growth in this sector.

Already recognized as an industry leader, PIC will take a more active role in setting the direction of the power industry going forward.

Developing new services and programs that deliver improved efficiency while incorporating safety, quality, productivity and cost are another of Tomioka's main priorities. "I think that the current economic climate along with changing world-wide priorities will have a noticeable effect on the industry.

PIC is a trailblazer and will help guide the industry by setting the tone for the future," Tomioka answered.

Tomioka has already started to see

several trends in the industry impacted by these global changes. The economic recession has caused power plant owners and other industry players to decrease their capital expenditures.

One would think that this would be good for an organization such as PIC because it would mean an increased demand for their expert maintenance personnel and for their highly qualified operators to ensure that equipment remains in sound condition.

However, Tomioka went on to explain that industry-wide maintenance budgets are also being cut. This indicates that power industry service providers can expect decreasing revenue and fewer jobs being released for bid.

WHAT SETS PIC APART

Tomioka's response to these conditions is to highlight PIC's skilled workforce and emphasize the additional benefits that set PIC apart from other power generation service providers.

Whereas some service providers treat even minor contract changes as an opportunity to increase costs, PIC wants to ensure that the job is completed on budget, on time, safely and to the client's complete satisfaction.

Most importantly, unlike many competitors who focus on a single service line or product, PIC has extensive experience in the construction, commissioning and maintenance of power facilities encompassing virtually all technologies.

PIC leverages this internal knowledge base to best support its customers as well as to act as a resource for the entire power generation industry.

According to Tomioka, "[t]he value-added nature of our business structure is something that few others in the industry can match. Combined with our industry recognized experts, PIC offers something that will always be in demand - a high quality solution implemented by top-notch professionals that delivers more than the customer expects."

Akihisa Tomioka is well-prepared to lead PIC into whatever the future holds for the company.

His internal focus on the firm's core values and his external focus on providing value-added services to all clients is a winning strategy no matter what industry your company is in.

It is for building this solid framework and leading PIC to a successful year despite the economic climate that Akihisa Tomioka has been named to the *World-Generation Class of 2010*.

Marubeni is headquartered in Tokyo, Japan with 3,856 employees and revenue of \$41.1 billion. It has 114 overseas offices with 1,595 employees. Marubeni has EPC power projects of 81,840 mws and 7,550 mws in IPP projects.

STEPHEN WHITLEY



Stephen Whitley is the President and CEO of New York Independent System Operator.

Offering consumers greater grid reliability, economic value from competitive markets, and thorough planning for future energy needs have been top priorities over the first decade of operation for the New York Independent System Operator (NYISO), which controls New York state's bulk electricity grid and administers the state's marketplace for wholesale electricity.

"In the years to come, my job will be to help the NYISO build on its solid foundation of success. The NYISO and other electric system operators must focus on enhancing regional interconnectivity and achieving even greater grid reliability through the incorporation of 'smarter,' more responsive grid technologies, while also expanding the use of demand-side reduction strategies and other tools," said Stephen Whitley, president and CEO of the NYISO. "How successful we are at these initiatives will greatly influence the future success of the United States in expanding its use of renewable energy and enabling the growth of new technologies such as plug-in electric vehicles."

The NYISO, a not-for-profit company created in 1999, has helped New York State become a national leader in the integration of renewable power resources, development of advanced energy technologies and improvements in the efficiency of the power system. It is one of 10 independent system operators and regional transmission organizations in North America, which are represented by the Independent System Operator/Regional Transmission Organization Council (IRC) and together serve two-thirds of electricity consumers in the United States and more than half of Canada's population. The IRC works collaboratively to develop effective processes, tools and methods for improving competitive electricity markets across North America.

The NYISO plays four key roles. The first is to manage New York's bulk electricity grid, comprising hundreds of generating units and thousands of miles of high voltage transmission lines, to keep the grid operating in the most reliable and efficient manner possible, with fair and open access to all qualified electricity suppliers.

Second is to run the state's wholesale electricity marketplace in collaboration with an array of stakeholders who produce, deliver, and consume electricity. The market design continues to evolve to a level of sophistication few imagined possible a decade ago. It functions like a commodities exchange, with participation by buyers and

sellers and competitive bidding for electricity supplies. The efficiencies attained through the market design have produced substantial savings for New York consumers.

Third is to conduct comprehensive planning to project consumer demand and to help verify that adequate electricity supplies will be in place to meet these needs. NYISO expertise also provides authoritative source of information on energy issues for policymakers and others charged with decision-making on behalf of consumers.

Finally, a focus on technology has been an integral element of the NYISO's creation and progress from day one, and it continues to develop and implement smart solutions with advanced technical innovations to serve evolving energy needs.

NYISO CREATED BY INDUSTRY RESTRUCTURING

Prior to the restructuring of the electric industry in the 1990s, New York's private utilities and public power authorities owned and operated all aspects of the state's electric system. This included the generation and transmission of electricity as well as the delivery of electricity to customers. This system was financed by consumers at rates approved by state regulators. Operation of the electric grid was coordinated by a voluntary collaboration of the utilities and power authorities—the New York Power Pool—which had been set up after the northeast blackout in 1965.

By the 1990s, a movement to restructure the electricity industry was underway throughout the nation, driven by the desire to address high electricity prices and stimulate competition in what had been a market dominated by regulated monopolies.

State and federal regulators initiated an array of changes. In 1996, the U.S. Federal Energy Regulatory Commission (FERC) issued orders that opened access to the nation's transmission grid and encouraged the creation of independent entities to administer wholesale electricity markets. In 1997, the New York State Public Service Commission (PSC) ordered the unbundling of electric supply and delivery, strongly encouraging utilities to divest their generation assets and open access to transmission to all qualified parties. This shifted the financial risk of capital investment in the grid from ratepayers to private developers.

The NYISO's creation as the independent entity in New York was authorized by FERC in 1998. In November 1999, New York State's competitive wholesale electricity markets were opened to utility and non-utility suppliers, and to users as well, as the NYISO began its management of the bulk electricity grid. The formal transfer of the Power Pool's responsibilities to the NYISO took place on December 1, 1999.

Reliable electricity and increasingly rigorous power quality requirements are critical for economic growth in the Empire State. At the outset, the NYISO was focused on operation of the bulk electricity grid and

the management of the new wholesale electricity markets. This is no simple feat, as reliable management of New York's large and complex bulk electricity grid requires constant balancing of electricity supply to meet consumer needs on a moment-to-moment basis, 24 hours a day, every day of the year.

COMPETITIVE POWER MARKETS

The NYISO-administered power markets have encouraged competition, leading power producers to invest in new facilities and upgrade the performance of existing assets. This has resulted in significant benefits to consumers through lower wholesale power prices, improved operational efficiency of power plants, higher unit availability and improved environmental performance.

CHANGE IS CONSTANT

The supply of power and the consumer demand for electricity is constantly changing, as new power plants and transmission facilities are brought on line, older facilities retire, energy technology advances and consumption patterns ebb and flow. The NYISO's responsibility is to anticipate and prepare for the impact of such changes on the reliable operation of the grid and in the efficient operation of the markets.

Technological sophistication is integral to this responsibility, and the NYISO has been committed to staying ahead of the technological curve since the turn of the century when considerable resources were devoted to the Y2K transition. The NYISO has worked continually since inception to make the grid smarter, more flexible and responsive. NYISO information technology incorporates architectures and platforms that rival the best in the nation, resulting in significant efficiencies for the competitive wholesale electricity markets and for market participants.

INTER-REGIONAL PLANNING

The 2003 blackout, which originated in Ohio and spread through a portion of Canada and the Northeast United States, offered grid operators many lessons, including the need for greater collaboration among regional grid operators and enhanced inter-regional planning. The NYISO is involved in coordinated inter-regional planning among electric system planning authorities, sharing information about emerging energy needs and working together to more efficiently develop solutions. It is actively developing broader coordination and collaboration protocols and practices to serve the common interest of grid operators and electricity planning authorities.

For example, in 2009 the NYISO was part of a group of electric planning authorities that created the Eastern Interconnection Planning Collaborative (EIPC). The Eastern Interconnection is the grid network ranging from the Rocky Mountains to the Atlantic Ocean and from

the Canadian Northeast to the Gulf of Mexico. The planning collaborative will benefit power system stakeholders by providing modeling and analysis concerning the entire Eastern Interconnection, identifying potential opportunities for efficiencies between regional transmission plans, providing coordinated analysis of scenarios of interest to policymakers and stakeholders and developing potential transmission expansion options and cost estimates to inform their decisions.

The U.S. Department of Energy recently announced that the EIPC, as well as state groups in the Eastern Interconnection, will share in \$60 million of federal stimulus funds to support the regional transmission planning process.

CLEANER, GREENER POWER

The continued growth of economical, emission-free, renewable power resources is essential to meeting New York's energy policy objectives, and the NYISO is playing a vital role in that effort.

For example, the NYISO is the first grid operator to integrate wind into its economic dispatch function. Wind energy is a rapidly growing segment of New York's power supply and is an essential element of the state's portfolio of renewable resources. Indeed, the amount of wind power in New York grew by 300 percent in the past year alone. By the end of 2009, New York's installed wind capacity exceeded 1,200 megawatts and developers have submitted more than 7,500 megawatts of additional wind power project proposals to be studied by the NYISO for potential interconnection to the grid.

New York's marketplace for electricity has also fostered new energy resources in the form of demand response. These innovative programs provide incentives for electricity customers to reduce their power during times of peak demand and now provide more than 2,000 megawatts as alternatives to traditional power resources.

MARKET ADVANTAGES

New York's wholesale electricity markets attract investment in wind power thanks to open access to the grid and market features such as the "uniform clearing price." Wind projects are relatively capital-intensive power sources with very low operating costs. When selected by the market to provide power, wind projects are paid the clearing price, which is higher than their operating costs and which supports repayment of construction-cost debt, other investment costs, personnel and a return on investment.

Other "green" resources on the NYISO grid, or being studied for interconnection, include hydroelectric energy, land-fill gas/methane generation and storage technologies like batteries and flywheels. Such storage technologies are complementary to the integration of renewable

(continued page 23)

REX BALLARD



Rex Ballard is the General Manager, SAIC Commercial Business Services

In January 2010, both President Barack Obama's State of the Union address in the U.S. and the "Rethinking Energy Security" panel discussion at the World Economic Forum's 40th anniversary gathering in Davos, Switzerland, made it clear that energy security, economic growth and climate change are interlinked the world over and that shifts in supply and demand, as well as climate change challenges, will exert greater pressure than ever before on both corporate and national energy planning over the next decade.

SAIC HELPS POWER THE WORLD'S ENERGY FUTURE

Enter Science Applications International Corporation (SAIC). As a global organization with more than 40 years of history, \$10 billion in revenues and 45,000 employees committed to turning science into solutions, SAIC has been providing energy solutions to leading commercial, industrial and government organizations for decades. Energy consumption and supply have never been more important to the global economy, security, and environment than they are today, and there is little debate that long-term energy security fundamentally comes down to questions of affordability, acceptability and accessibility. That's why SAIC's global energy and utility practice is dedicated to helping power a brighter energy future tomorrow by solving customer's mission-critical problems with innovative applications of technology and expertise today.

SAIC does all this by focusing on solving problems in the following areas of the global energy industry:

- Energy efficiency and demand reduction
- Clean and renewable energy
- Refineries and alternative fuels
- Global climate change
- Energy-related "design-build"
- "Smarter" utilities
- Oil and gas transformation

ENERGY EFFICIENCY AND DEMAND REDUCTION

SAIC has helped create hundreds of energy-efficiency, demand reduction, and sustainability programs for private and public sector clients. The results are long-term, effective solutions that are designed to save cost, manage risk, and minimize environmental impacts associated with energy consumption.

SAIC's energy management expertise ranges from modeling and risk management to purchasing energy more efficiently to incorporating sustainability into strategic planning. "Our analysts find opportunities for efficiency and plan implementation strategies. Our architects design LEED® (U.S. Green Building Council)-certified and "green" facilities, and our engineers and constructors build energy-efficiency projects," Ballard told *World-Gen*. SAIC also serves as an energy service company (ESCO), using the energy dollars saved in performance contracting to help finance and implement solutions.

CLEAN AND RENEWABLE ENERGY

SAIC's deep domain expertise and our multidisciplinary staff of scientists, technicians, and policy analysts have helped it become a leader in developing innovative clean and renewable energy projects and carbon management technologies. SAIC has assisted energy users in becoming more energy self-sufficient. SAIC also helps energy producers deliver cleaner alternatives for the benefit of future generations and the environment.

REFINERIES AND ALTERNATIVE FUELS

For more than three decades, SAIC has helped fuels-refining clients address America's aging fuel production facilities, the growing demand for energy, and new government mandates that drive the need for cleaner and alternative energy sources. "Our solutions help the fuels industry with ongoing challenges to execute cost-effective, accelerated projects in addition to keeping up with the growing demand for alternative fuels", Ballard added.

GLOBAL CLIMATE CHANGE

SAIC is passionate about mitigating global climate change. Clients seek SAIC's deep domain expertise in subjects as diverse as environmental and atmospheric sciences, policy analysis, information technology, and energy-efficient design-build services.

For example, SAIC drafted the greenhouse gas (GHG) inventory protocols used by the California Climate Action Registry and The Climate Registry. SAIC also supports U.S. federal agencies such as the National Oceanic and Atmospheric Administration to collect data and interpret weather patterns that are critical in assessing the impacts of global climate change.

SAIC helps government and private clients develop clean fossil, carbon capture and engineered sequestration technologies. "We help international agencies assess ways to reduce energy demand and GHG emissions in developing countries. Using our multidisciplinary expertise and global perspective, we provide reliable and sustainable solutions that help clients thrive in a carbon-constrained world and an unpredictable energy market", Ballard said.

"SMARTER" UTILITIES

For more than 25 years, SAIC has implemented solutions that improve utility operations and efficiencies. SAIC has been a major collaborator in developing technology-intensive operating models and new ways of looking at the utility business.

"We work closely with utilities to deploy cutting-edge solutions in asset management, advanced metering infrastructure, Smart Grid, IT integration and operations, security, and other enterprise solutions. Our innovative solutions help modernize facilities and improve the way utilities collect and manage data and deliver service to their customers", Ballard shared.

SAIC believes tomorrow's winners will be companies that successfully navigate regulatory uncertainty, take advantage of new market structures, and respond quickly to new threats and opportunities. There will almost certainly be companies that can demonstrate "breakout" performance, with modest risk and capital requirements — an elusive combination given current strategies and operating models in the global energy market.

To this end, SAIC has been an early proponent and collaborator in developing the Utility of the Future — a new technology-intensive operating model and wholly new way of looking at the utility business. SAIC is working closely with clients to evaluate and deploy cutting-edge solutions in asset management, advanced metering infrastructure, modern grid, information technology integration and operations and enterprise solutions.

SAIC's industry experts help clients adopt completely new ways of doing business, rethinking major core processes, and embracing operational philosophies and approaches from outside the industry. The goal is dramatically better financial and operational results, improved capacity for further improvement and change, and "portable" processes and technologies to support growth and acquisition and meet regulatory mandates.

ENERGY-RELATED DESIGNBUILD

SAIC's DesignBuild services provide a seamless union of architecture, engineering, and construction of critical infrastructure. SAIC professionals clearly understand each other's roles and work hand-in-hand to deliver comprehensive, award-winning solutions.

"Our teamwork and focus on meeting client objectives from the outset result in more innovative, cost-effective and timely project completion than typically result from traditional methods. That is why our projects have won some of the design-build industry's highest honors and awards, including 28 design awards in recognition of energy-efficient facilities", Ballard said.

OIL AND GAS TRANSFORMATION

SAIC has been working with oil and gas companies around the world for nearly 30 years to solve their most difficult challenges — managing and understanding the vast amounts of data they collect, helping them transform their business processes, or communicating with remote employees worldwide. Whether it's exploring the most distant reaches of the planet, using satellite or digital experience gained in other spaces, or more efficiently extracting oil and gas, customers know they can rely on SAIC's deep industry experience to meet their needs.

SAIC is at the forefront of assisting oil and gas companies transform their operations. SAIC helps oil and gas customers:

- Discover ways to deploy innovative technologies to increase production rates and recoverable reserves
- Ensure that all facility engineering documentation is centralized, current, consistent, controlled, searchable, and easily available to those who need access
- Reduce costs and focus on core business through flexible IT outsourcing services
- Link locations around the globe through integrated communications networks
- Explore new business models (digital oil field and broadband integration for oil and gas are two examples) that can change the rules of the game in how stakeholders define success for tomorrow's energy companies today.

SAIC SUBSIDIARIES COMMITTED TO THE ENERGY INDUSTRY

In addition, SAIC subsidiaries also work closely with the global energy industry around the world to develop solutions to many of the pressing business and technology problems that the parent company is also engaged in. Some of these SAIC companies with an energy industry footprint include:

- Bechtel SAIC Company, LLC: A joint venture between SAIC and Bechtel, it provides research, engineering and nuclear science capabilities to meet the unique challenge of science and engineering for the Yucca Mountain Project in Nevada.
- R. W. Beck: A new SAIC company acquired in 2009, R. W. Beck is a leading provider of business and technical consulting services to the energy, water, wastewater and solid waste industries.
- Varec, Inc.: As a wholly owned subsidiary of SAIC, Varec has been a leading innovator in the petroleum and chemical sectors for over seven decades — delivering automated systems and professional services for most major oil companies worldwide.

In conclusion, SAIC's work with the U.S. government since its inception in 1969 sometimes makes its commercial business heritage seem more like "breaking news" or the best kept secret in the professional services/information and communication technology space.

BRENT SMITH



Brent Smith is the President, Energy and Industrial Process Division, Alfa Laval U.S.

Alfa Laval is a world-leading manufacturer of a wide range of equipment, systems, and services for heat transfer, liquid/solid separation and fluid handling. Energy efficiency through innovation is a key focus in every Alfa Laval technology.

Brent Smith leads the Energy and Industrial Process Division in the United States. Smith senses continued uncertainty on the horizon for 2010, but sees clear indications that the economic environment is emerging from hibernation caused by the credit crisis and the worst global recession in 70 years. "More than ever before, we need to be nimble. As businesses begin investment following a very tough 2009 economic climate, they will be more demanding and cautious in how they allocate capital. They will be looking for partners with a proven track record who can operate not only in real-time – but future-time where future needs are anticipated before they occur," Smith projected.

Simply put, every successful business has a basic need to manage cost efficiently. The topic of energy costs will impact many business decisions for the foreseeable future. Whether seen in today's headlines or heard in discussions within the halls of Congress, the acquisition and efficient use of energy is a topic of our times. Smith expanded, "The world has become smaller and more interdependent. We are all targeting efficiency with costs, energy and resources. And, we all have to be less tolerant of waste – whether we are looking at resources, time, energy or the environment."

This outlook runs in parallel to Alfa Laval's long-standing commitment to the environment. "For over 125 years globally, and a full 125 years here in the U.S., Alfa Laval has targeted solutions that make a difference in minimizing energy use and reducing waste for our customers. We have a great longevity and history, with our equipment in conventional and nuclear power plants for over 50 years and a unique position in alternative power sources like geothermal and solar," Smith asserted.

The recovery and re-use of costly energy, whether purchased for use or generated during process operations, can make a huge impact on an organization's bottom line. Ever-increasing attention on greenhouse gas emissions, minimizing carbon dioxide and other greenhouse gases and energy recovery will no doubt continue to be key issues in the coming months and years.

To address this need, many businesses are relying on compact plate heat exchangers. Power plants that want to up-rate operations increasingly turn to plate heat exchangers as they provide the most efficient heat transfer commercially available today.

"An investment in compact plate heat exchangers can mean huge improvements – increased heat recovery, lower energy consumption, less waste and reduced emissions. Alfa Laval compact heat exchangers maximize heat recovery. It's one of those solutions that provides both excellent performance and enhanced environmental responsibility, as well as lower acquisition costs for the user when compared to other technologies," explained Smith.

"The concept is simple, but the results are significant," added Smith. Between corrugated plates, liquids or vapors flow through channels, creating a high degree of turbulence in the media resulting in very efficient heat transfer between the media. A combination of counter-current flow and the corrugated pattern enables a close temperature approach, where the cold fluid can be heated to temperatures very close to those of the hot fluid. Smith detailed "The closer the temperature approach between two fluids, the more heat is recovered. And, that's energy saved and energy re-used."

To get the most from operations, plants can now recycle this valuable energy for a wide range of uses rather than producing or buying more, thus reducing fuel consumption and emissions while also reducing operating costs.

Today, there are over 80,000 Alfa Laval compact heat exchangers in use – both as utility and process equipment. "By offering the world's most extensive selection of compact heat exchangers, including gasketed and semi-welded – as well as gasket-free, such as all-welded and fusion bonded solutions – all sorts of facilities can benefit from this environmentally-responsible technology. The design is infinitely flexible," Smith explained. A number of configurations and materials can be combined to handle a range of temperatures, pressures and aggressive media.

"Alfa Laval heat exchangers are a natural fit for a multitude of industries when you look at their many benefits," Smith expounded. "They are highly competitive in terms of capital, installation, operating and service costs. They are lighter in weight, take up little space and can be easily installed and retrofitted in existing facilities where competing technologies will not work."

Smith gave further detail: "From design, production and installation to service through the equipment life cycle, Alfa Laval know-how, experience and a global team of skilled engineers help to ensure maximum plant uptime and efficiency." Many companies are already using compact heat exchangers in their operations and with rising energy costs and environmental concerns, many more are in the process of considering this technology.

HERE ARE A FEW REASONS WHY:

- Optimum heat recovery from each and every process, using less cooling and heating medium.
- Increased cooling and/or heating capacity using less area.
- Savings in capital investment and installation due to compact size and lighter weight.
- Lower operating costs with higher heat transfer efficiency.
- Less fouling due to better flow patterns and greater turbulence, resulting in less maintenance and increased uptime.
- Improved process control due to lower hold-up volume.
- Reduction of fuel consumption and greenhouse gas emissions, lessening the effect on the environment.

Smith added, "While shell-and-tube exchangers have reached their efficiency peak in most regards, compact heat exchangers continue to rise to the occasion. Alfa Laval is committed to lead the world in heat exchanger innovation and to that end we continue to dedicate significant resources to Research and Development. Even in these challenging economic times, Alfa Laval continues to innovate, launching more than 50 new products per year."

ALFA LAVAL PRODUCT PORTFOLIO

In addition to its compact plate heat exchanger solutions, Alfa Laval offers a full equipment portfolio for the plant, in a wide range of shapes and sizes – making it possible to tailor solutions throughout the plant. Some examples include:

COMPABLOC:

All-welded yet fully accessible, the Compabloc helps to handle tough duties involving high pressures and temperatures as well as aggressive media without compromising fast and easy cleaning and inspection. Flexible connection sizes and placements allow dissimilar flows, and combine with the short plate construction to make the Compabloc an excellent choice for condensing and reboiling duties.

PACKINOX:

The cutting edge technology of Alfa Laval Packinox heat exchangers ensures optimum performance and reliability even in the most demanding operating conditions. In 1980, Alfa Laval Packinox made the breakthrough that successfully combines the high-temperature, high-pressure performance of shell-and-tubes with the thermal and hydraulic efficiency of plate technology in a compact, large capacity design. Because Packinox exchangers can withstand extreme temperatures at high pressure, they are suited to a variety of applications.

ALFA DISC:

The all-welded AlfaDisc is ideal for duties involving high pressures and temperatures, as well as for steam applications. Its cylindrical shape makes the unit capable of withstanding very high pressures, and the accordion-like plate pack makes it less sensitive to thermal expansion. Furthermore, with its flexible connection sizes, the AlfaDisc is an excellent choice for duties involving dissimilar flows.

ALF FILTER AND STRAINER:

For automatic removal of larger debris and particles from the flow prior to entering plate heat exchangers, the ALF filter and strainer is also ideal for sifting seawater before sending it into cooling-water coolers.

HIGH SPEED SEPARATORS (HSS):

Much of the world's energy derived from diesel or heavy fuels is generated with the help of high-speed separators. Alfa Laval separators are able to separate and purify widely ranging mixtures of oil, water and solids prior to combustion. Their compact size, easy installation and high processing capacity make them a good solution for many plants.

Brent Smith is currently the President of the Energy and Industrial Process Division, Alfa Laval USA. Smith joined Alfa Laval in 2002.

Smith's responsibilities at Alfa Laval include leading the sales and marketing of Alfa Laval's Energy and Industrial Process Division in the various industries served by Alfa Laval's key technologies of heat transfer and separation, throughout the USA.

Prior to joining Alfa Laval, Smith has been involved in the business planning and strategy across many industries, affecting change and working closely with service areas.

Smith started his career at AT&T / Lucent Technologies in 1990.

In 1996 he joined AlliedSignal/Honeywell and worked in several industries including Automotive, Engineered Chemicals and Home and Building Controls.

Smith has a Bachelor of Science degree in Industrial and Labor Relations from Cornell University. He has completed Executive Management Programs at Northwestern's Kellogg School of Management, The Johnson School of Management at Cornell, The University of Michigan's Business School and Ashridge University in the United Kingdom.

Smith is based at the Alfa Laval Inc. offices in Richmond, Virginia.

CAREN S. FRANZINI



Caren Franzini is the Chief Executive Officer, New Jersey Economic Development Authority

New Jersey is fully committed to developing clean and renewable energy sources to reduce its carbon footprint. This commitment to become one of the more energy efficient and “green” states is clearly reflected in the very aggressive goals New Jersey established in its Energy Master Plan, which was launched in 2008.

“These objectives include reaching several milestones by the year 2020,” says New Jersey Economic Development Authority (EDA) Chief Executive Officer Caren S. Franzini. “Our goals include supplying 30 percent of the state’s electricity from renewable sources, reducing overall energy consumption by at least 20 percent, which would save 20,000 gigawatt hours per year and result in annual heat savings of nearly 110 trillion Btu, and investing nearly \$33 billion to stimulate development of innovative, clean energy technologies.”

Achieving these goals means providing strong support for New Jersey companies, organizations and institutions that are developing and implementing measures to improve energy efficiency. The state, through its various agencies and entities, offers a wide variety of financing and incentive programs to buttress the efforts of businesses that develop and manufacture clean energy technologies, as well as for end users of those technologies.

The state’s investment in clean and renewable energy delivers at least four important benefits, Franzini says. “It reduces the cost of energy, helps the state become more energy self-sufficient, positions New Jersey as a leader in the development of clean technologies, and builds the infrastructure and generation capacity to make clean energy available and affordable throughout the state,” she says.

THE ROLE OF THE EDA

The EDA is a state financing and development agency that works to strengthen New Jersey’s economy by retaining and growing businesses through financial assistance, by renewing communities, and by promoting the state’s strategic advantages to attract domestic and international businesses. With its array of financial, technical assistance and real estate development resources, the EDA supports business growth and job creation and retention, and promotes investments in New Jersey’s communities, developing economic opportunities for thousands of businesses. In fact, since its creation in 1974, the EDA has provided nearly \$20 bil-

lion in bonds, loans, loan guarantees and incentives to businesses and nonprofits throughout the State of New Jersey.

The EDA, in conjunction with the state Board of Public Utilities (BPU) and the New Jersey Department of Environmental Protection, has launched Clean Energy Solutions, a suite of products for green programs that have the goal of reducing the amount of greenhouse gases in New Jersey. These products enhance the state’s capacity to provide funds to encourage the creation of green-

collar jobs in New Jersey.

The Clean Energy Solutions Capital Investment (CESCI) Loan/Grant program, for example, was introduced in June 2009 to commercial, institutional or industrial entities advancing energy-efficient end-use projects, combined heat and power (CHP or cogen) production facilities, or construction of state-of-the-art, efficient electric generation facilities, including renewable energy. The CESCI program offers zero-interest loans and grants of up to \$5 million to eligible commercial, industrial

or institutional customers, with up to a 10-year loan term to fund the purchase of fixed assets, like real estate or equipment. Due to overwhelming demand, this program will be closed out and subsequently reintroduced with revisions following the first round of applicant approvals.

The Combined Heat and Power (CHP) Program, started in August 2009, offers performance-based grants of \$450 per kilowatt of installed electric generation capacity on a first-come, first-served basis.

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The electric power distribution infrastructure, or “grid,” is a modern day marvel from an engineering standpoint. But with the ever evolving environment of growing energy demand running head on into concerns about the environmental impacts of producing electricity from fossil fuels, and/or concerns about the reliability and security of this “critical infrastructure”, the industry is turning to technology for answers. In particular, advanced information technologies (IT) can help utilities to

better utilize the existing infrastructure while ensuring that they can introduce alternative energy supplies to the system, further improving reliability and security. These kinds of changes need to happen without any negative impact on consumers’ and businesses’ electricity service.

INFORMATION EXCHANGE TO IMPROVE ELECTRICITY EXCHANGE

Fundamental to this evolution is the

existence of reliable, secure, two-way communications platforms that can facilitate the real-time exchange of information necessary to make a grid “smart.” For example, a smart grid will generate a steady stream of data about its current condition – data that will be used to make split-second decisions that will improve the flow of electricity or mitigate the effects of a local power outage, often without human intervention. Moreover, the smart grid will reshape the relationship consumers have with their utility by providing them with things like usage data, time-of-use pricing, and remote management of their in-home consumption, thereby reducing waste, reducing their monthly bills, and creating a more involved and socially responsible culture. And a smart grid will be more efficient (think better use of power lines and other grid assets) and flexible (through the ability to incorporate locally-generated energy from things like solar panels, or store excess electricity in batteries until users need it) than today’s grids.

ALCATEL-LUCENT HELPS UTILITIES MAKE GOOD CHOICES

Alcatel-Lucent has been helping electric utilities build mission critical communications networks for decades. Today the company is working with utilities around the world to help them understand the options and make wise decisions about every aspect of building and managing the sophisticated communications required by Smart Grids. The Department of Energy and the Department of Homeland Security draw on the experience of Bell Labs experts to help with the framing of public policy in areas critical to Utilities, such as disaster recovery; eco-sustainability; systems modeling; and Utility-Telecommunications industry interdependencies. Recently, Alcatel-Lucent met with the FCC to reinforce the need for dedicated spectrum to serve utilities. The communications networks necessary for the smart grid will rely heavily on broadband wireless technologies in order to serve urban and rural environments with enough bandwidth to support a wide variety of smart grid applications.

Alcatel-Lucent recognizes that utilities use a wide range of older IT technologies that still have many years of life in them and will have to be maintained while new, smart grid technologies are deployed. So, future communications networks supporting smart grids not only have to handle state-of-the-art technologies but those of the last three decades as well, creating difficult technology and operations integration problems. Alcatel-Lucent has been contracted by Pennsylvania Power & Light (PPL) to build a wide-area broadband network that will address these challenges by extending IP network technologies into PPL’s grid and integrating them with existing communications technologies using sophisticated engineering and change management processes.

(continued page 23)





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JOHN JOYCE



John Joyce is the Chief Executive Officer of Ambient Smart Grid®

The energy market is being driven by a host of smart grid applications and technologies, from smart meters and renewable energy resources, to demand response, electric vehicles, smart homes and intelligent appliances. What is often not focused on is the enabling network that links all of these building blocks together. Creating these networks is Ambient Corporation's core competency – using open-standard, IP-based communications to link together each of these separate entities into a single unified smart grid.

Ambient Corporation has worked on utility centric communications for more than a decade. Working with leading U.S. and international utilities, Ambient has developed a robust communications platform that provides both the connectivity and functionality required by the utility customer, and each of the smart grid elements a utility may decide to incorporate into their smart grid architecture.

Ambient's smart grid platform supports multiple communication technologies, such as radio frequency (900MHz and 2.4GHz), cellular, Wi-Fi, power line carrier (PLC), Zigbee, or WiMAX, and has open communication ports for integration of even more communication technologies. This lets a utility pick and choose solutions end applications and devices using a wide array of technologies, but sharing a common flexible communications backbone. Ambient provides an open architecture allowing partnering utilities to increase the usefulness of deployed or "stranded assets" as well as support devices and standards currently in development.

CONNECTING SMART GRID RESOURCES

The core of the company's platform is the X-3100 smart grid node, which is the building block of the network. The node houses Ambient's communication technologies, processing power, memory and backhaul connectivity and enables open smart grid architecture. The node is the device central to the network that intelligently manages data traffic to and from the utility and smart grid devices using many different communication technologies.

For example, Ambient can leverage a utility's existing communication infrastructure, such as fiber, wireless mesh etc., or leverage our partnerships to create an entirely new network. Once connectivity is established at the node, Ambient can use a utility's preferred communication technology to reach the end device. For Duke

Energy's smart grid deployments, Ambient nodes are providing the communications backhaul for a power line carrier (PLC) based electrical metering system, a radio frequency (RF) based gas metering system and Wi-Fi based line sensors, all housed in one device. In short, this communications platform leverages today's smart grid technology, while also incorporating legacy technologies to bridge the gap to tomorrow's smart grid.

RESCUING STRANDED ASSETS, BUILDING ROI ON EXISTING AND NEW INVESTMENTS

Advanced grid technologies such as smart meters, line sensors and intelligent switching gear have been deployed for years, but not universally or in a holistic fashion. The resulting electrical distribution landscape is a hodgepodge of devices from different vendors, using unique communications protocols and technologies.

One of the predominant technologies, now becoming obsolete, are advanced meters that emit a radio frequency signal allowing a utility to drive by the meter to collect usage data without having to physically inspect the meter. There are more than 60 million of these meters, known as ERT meters, deployed in North America that have now become obsolete by next-generation smart meters capable of both emitting and, more importantly, receiving data.

ERT meter deployments reduce meter reading costs, but do not have two-way communication capabilities, processing power, or memory. As utilities begin to look at smart grid and smart metering with its precise incremental measurement capability – which in turn enables a utility to do time-of-use pricing – ERT meters have quickly become obsolete, well before their scheduled depreciation and replacement.

Working with one of its metering partners, Ambient has developed a backwards-compatible solution within the Ambient Smart Grid® platform which pulls ERT meters into the smart grid space through the Ambient® EDC module. The company's platform is comprised of smart grid nodes that have both processing and storage capabilities. Ambient has leveraged this distributed intelligence and, for ERT metering, has incorporated the EDC module into its node to upgrade and leverage an AMR deployment into smart metering. The EDC module listens for the ERT signal in an AMR deployment and records the data on the smart grid communications node.

The processing power and distributed intelligence of the node as well as its remote configurability, allows Ambient to configure the smart grid node and how often the EDC records an ERT meter read from a given meter. This allows incremental reads to be stored, retaining the information needed by a utility to do time of use pricing, and detailed outage management. The EDC can also be configured as to how many meters it listens to, how frequently it records a reading and also for how long

those meter reads are stored on the communication node.

This storage capability means that a utility can pull metering data from Ambient's device on an as needed / configurable basis. Ambient's EDC can supply a month of metering data back to the utility for end-of-month billing, or on a weekly, daily or hourly basis as the utility deems necessary.

The EDC module coexists in Ambient's smart grid node with most any other metering concentrator or collectors, allowing a single node to communicate with legacy ERT meters, as well as with newer smart meters a utility may consider deploying. The EDC solution embodies the company's vision and commitment to an open architecture that integrates legacy equipment and offers a migration path to the smart grid of tomorrow.

OPEN STANDARDS

As grid technologies advance and become more pervasive, interoperability between devices is essential.

While many standards are proposed, the clear forerunner for grid interoperability and networking is TCP/IP. Ambient's platform is based on IP and is ready for plug-and-play integration with other technologies that communicate via IP. While the company's platform is based on IP, Ambient Smart Grid also backhauls and passes on non-IP communications, transmitted via any of the aforementioned communications technologies, allowing the Ambient Smart Grid® to incorporate legacy and proprietary systems.

This capability helps a utility deploying the Ambient Smart Grid recover stranded assets and offers a bridge from legacy/non open standards technologies to those that will comply with emerging open standards regulation.

MODULAR / SCALABLE ARCHITECTURE

Each Ambient communications device is a standalone device that is uniquely addressable and manageable under the company's network management system, AmbientNMS®, and is powered off of the power grid.

This means Ambient's communications devices can be deployed anywhere throughout the electric distribution system, offering connectivity to grid assets where needed and as needed.

Ambient allows its utility partners to deploy the backbone communications platform "at the speed of functionality." Nodes may be placed as close together or far apart as needed by the utility to communicate with its grid assets.

As functional requirements such as communication protocols or bandwidth change for the utility, Ambient can expand the Ambient Smart Grid® to meet these evolving needs.

LAURA K. IPSEN

CONTINUED FROM PAGE 10

W-G: IS THERE ANYONE ELSE THAT IS LEADING THIS WITH CISCO, OR ARE YOU ALONE OUT THERE?

LKI: I think we're going to have many competitors in terms of getting into the smart grid area. In terms of leadership, I think we bring the leadership of IP and communications networking with an end to end vision and approach, so in addition to my business unit for the grid, we have a team of people focused on home energy management with our consumer group, and connected to our building group.

I look at the whole energy ecosystem from where an electron is born to where it's consumed, so that means from generation, whether it's renewables or traditional energy, all the way up to the home or in an industry complex, so we have technologies and IP and solutions that run through all of it.

I think Cisco's really got the winning strategies, but by no means are we out there alone.

I think there's going to be a lot of healthy competition which is really good for innovation and of course, partnership, which will be key to success.

Laura Ipsen is the co-chair etc. of Cisco's EcoBoard, which leads Cisco's comprehensive "green" strategy related to the use of information technology to achieve a positive impact on the environment and climate change.

In 2008, Ipsen received the Women Making History award from U.S. Senator Barbara Boxer for her work on environmental issues.

In addition, Ipsen leads Cisco's Women's Advisory Group, which identifies and recommends gender-focused strategies as part of Cisco's Inclusion and Diversity Council.

Ipsen serves on the boards of the GridWise Alliance, the Public Affairs Council, One Economy Corporation, and the Technology Board for Pacific Research Institute.

Ipsen is the past president and chair of the board of the Organization of Women in International Trade and the past chair of the Board of Directors for the Information Technology Industry Council.

Ipsen holds a bachelor's degree in international relations from the University of Virginia and has studied Arabic at Yarmouk University in Jordan.

ALAN WM. NIEDORODA



Dr. Niedoroda is the Vice President and Senior Consultant Coastal Oceanography URS Corporation

This started with a simple question . . . “whatever happened to OTEC?” With all of the attention to greenhouse gases and climate change, renewable non-polluting energy, increasing water shortages, and depletion of sea food resources, there seems to be little attention given to a well-established technology that touches on all of these concerns.

THE CONCEPT

Ocean Thermal Energy Conversion (OTEC) is a way to generate electric power by exploiting the vertical temperature gradients in the world’s oceans. This was first suggested by Jules Verne. However, the actual design concept was developed by the French engineer, Jacques d’Arsonval in 1881. Noting that tropical ocean surface temperatures are on the order of 20°C (36°F) higher than near the bottom, he proposed a system with a heat exchanger which isolates a working fluid (ammonia) maintained at a pressure such that a flow of surface water causes it to boil. The ammonia vapor drives a turbine to generate electricity and then is condensed by deep ocean cool water drawn through another heat exchanger.

Georges Claude successfully demonstrated this concept in 1930. However, this test facility on the north coast of Cuba was not designed to produce more power than required for its operation.

The concept has been further developed, tested and demonstrated in several places. Japan and the United States made significant contributions.

After the OPEC oil embargo of 1973-74, the US Government invested more than \$260 million in R & D. By the early 1980’s oil prices plummeted, soon to be followed by the loss of federal support. It is noteworthy that the October 17, 1973 OPEC price increase in oil was from \$3/barrel [\$14.38 today] to \$5.11 [\$23.97] and then to a brief maximum in January 1974 of \$11.65/barrel [\$55.85].

THE RESOURCE

Commercial OTEC plants need to be located where the vertical temperature difference is about 20°C (36°F) over 1000 m (3,280 ft) or less. Sunlight continually warms the ocean surface layer and waves mix it to a relatively uniform temperature over a depth of 100 m (330 ft). There is a sharp temperature drop at the bottom of this layer. The temperature continues to

decline with depth as a result the sinking of a cold, dense polar water masses that flow along the bottom towards the equator in the major oceans.

Solar energy absorbed by the ocean surface layer is 37 trillion kilowatts annually. Each year the energy equivalent of 7,000 barrels of oil is absorbed beneath each square mile.

In total, this is several thousand times the total amount of energy used by the whole world economy.

The majority of this resource is located between +/- 200 latitude of the equator. The zone includes major industrial nations such as the United States, Australia, Brazil, Japan, and China, territories including Guam, Samoa and the Virgin Islands and more than 66 developing nations.

PRESENT DESIGNS

The OTEC plant design concept proposed by Jacques d’Arsonval is called a closed-cycle system because the working fluid is isolated from both the warm and cold waters by the heat exchangers. There are other variants.

If the pressure in the intake chamber is suitably reduced, the warm water will flash into steam. This steam is used as the working fluid to drive low-pressure turbines. The steam is then condensed by a cold water heat exchanger. This is called an open-cycle OTEC process. The condensed steam can provide a supply of desalinated water.

A hybrid cycle OTEC plant uses low pressure flash-evaporation of the warm water and the resulting steam enters a heat exchanger where it vaporizes ammonia. This ammonia vapor drives the generator turbine and is then condensed in the cold water heat exchanger.

Hybrid-plants can also provide desalinated water.

Another variant is the mist-lift system. Here the flash-evaporation of the warm sea water at low pressure is used to accelerate the vapor with fine water droplets up a vertical duct. At a height on the order of 15 m (50 ft) a cool mist is injected causing condensation and a large pressure drop. The resulting vertical pressure gradient further accelerates the vapor and mist droplet far up the duct where it is condensed to flow down to drive a hydro-turbine.

OTEC LOCATIONS

OTEC generating stations can be located on a shoreline, in the shallow offshore, and on offshore platforms and vessels. It is relatively easy to provide for the intake of a large volume of warm surface water but sourcing the huge volume of cold water needed to complete the cycle requires a large diameter pipe that extends to depths approaching 1,000 m (3,300 ft) below the ocean surface.

For example, the cold water pipe for the planned 40 MW Kahe Point [Hawaii] OTEC facility was to be 6 m (20 ft) in diameter and extend to a water depth of 670 m

(2,200 ft). This pipe was to be located in a trench to protect it from storms but beyond a depth of 24 m (80 ft) it would emerge to rest on the steep ocean floor.

The requirement for a long, large-diameter cold water pipe and the need to transmit the electrical power ashore favor shore- and near-shore based facilities. However, the possibility exists for applying the electrical output of platform or vessel-mounted systems to hydrolyze water so that hydrogen or ammonia can be used as an energy storage system. Also, platforms at exhausted offshore oil and gas fields might be utilized.

APPLICATIONS

Commercial OTEC plants are most cost efficient when designed to provide several different outputs including electric power, desalinated water, refrigeration and a source of nutrient enriched water.

For example, nutrient-rich cool water discharge has been used at the Natural Energy Laboratory of Hawaii and the Japanese demonstration facility in the Pacific Island Republic of Nauru for clam, trout, salmon, lobster and seaweed mariculture. Japanese engineers at Saga University and the Xenosys Corporation have introduced the DTEC concept (“D” for discharge) wherein heated industrial discharges are used to augment the surface water temperatures in coastal OTEC facilities and STEC (“S” for spring) that makes similar use of flows from hot springs.

ENVIRONMENTAL CONSIDERATIONS

The world’s oceans function as an incredibly large solar collector capable of nearly inexhaustible amounts of power. OTEC facilities would be essentially non-polluting.

There are two discharges to be considered. The cold water discharge must be diverted away from sensitive nearshore areas. Provided this discharge is routed to a sufficient water depth it can be effectively harmless.

The warm water components such as intake structures, pumps, heat exchangers and other parts need protection against bio-fouling through periodic injections of chlorine at concentrations of about one tenth the maximum allowed by the U.S. Environmental Protection Agency.

With the market growth for carbon offset credits, the OTEC facilities can be considered as a great asset because every kilowatt generated removes the need for its equivalent from a facility powered by fossil fuels.

LIMITATIONS

There are inherent limitations to commercial OTEC applications. The need to provide huge flows of both warm and cold sea water produce system efficiencies in the 3 % range compared with about 30 % for conventional electric generating facilities. Engineering challenges remain in design-

ing the heat exchangers, turbines and the cold water pipes.

Although considerable engineering research is available, especially from the government-supported projects that followed the second OPEC oil embargo, it is unlikely that industry can appropriately develop these concepts to commercially viable applications without further government support.

CURRENT EVENTS

Although the OTEC concept has been relatively under-popularized in light of current concerns with non-polluting sustainable green-energy, it has not been forgotten.

According to *Aerospace and Defense News*, on September 30, 2009 the U.S. Navy (NAVFAC) awarded Lockheed Martin an \$8.12 million contract to advance OTEC technology. In October 2008 Lockheed Martin was awarded \$1.2 million by the Department of Energy to develop the manufacturing process for the large diameter cold water pipes.

According to *Defense News*, the U.S. plans to transfer 8,000 Marines and 17,000 family members from Okinawa to Guam by 2014. A February 2009 award from the US Navy to Makai Engineering for a Guam OTEC feasibility study has been announced in the Ocean Energy Council website.

The Japanese Xenosys Corporation has announced a project to develop a commercial OTEC facility in Tahiti. They are also working with the government of India in developing a test installation.

URS is an international engineering firm with more the 45,000 employees and FY 2008 revenues of over \$10 billion. The major markets for URS include power, infrastructure, general industry and government. It has been ranked as one of the top three design firms for the past decade by *Engineering News Record (ENR)*.

ACKNOWLEDGEMENTS

Sources used in preparing this article include: <http://www.otecnews.org>, <http://www.nrel.gov/otec>, <http://www.asdnews.com>, <http://www.energybulletin.net>, <http://www.oceanenergycouncil.com>, and the web sites for the Lockheed Martin and Xenosys Corporations.

Dr. Alan Niedoroda, a graduate of Queens College of the City University of New York and Florida State University, is a Vice President based in the Tallahassee, FL office of URS.

He has over 40 years of professional experience as a coastal oceanographer in both the commercial and academic environments.

He has carried out projects on all of the coastal United States, including Alaska and Hawaii, and on all continents around the world except Antarctica.

He has also published more than 100 technical papers.

BOB VALAIR



*Bob Valair
is the
Director of
Energy &
Environmental
Management
Staples*

Staples is the world's largest office products company, with \$23 billion in sales, serving in 27 countries throughout North and South America, Europe, Asia and Australia. Staples invented the office super-store concept in 1986, headquartered outside Boston and acquired Corporate Express in July 2008. Staples has been a leader in the retail world supporting energy efficiency and corporate sustainability for over a decade. Some of the early commitments lead to the 1999 Green Lights Retail Partner of the Year Award for embracing energy efficient lighting as well as a commitment to cut their absolute carbon footprint by 7% against a 2001 baseline by 2010...a commitment that Staples will exceed. Through Staples Soul, the company continues to define itself not just through its strong earnings growth and profit margin, but also by the communities it serves.

Staples demonstrates performance in driving incremental energy efficiency throughout their business since 1993. This is not a company that has suddenly discovered the value of energy efficiency, but that has been committed to being a leader in operating their business in an energy efficient fashion for over a decade. The Staples Energy team, lead by Bob Valair, embraced the challenge from top management to drive an additional 5% usage reduction across a portfolio that was already considered one of the best in the business. Staples first studied the opportunity through LEAN Six Sigma principles and pulled in their business partners to formulate a plan. Through a combination of capital investment in more efficient lighting, improved control and monitoring strategies of their energy management systems, recommissioning their stores, driving employee awareness in energy efficiency through innovative reporting program and contests, and rolling out cost effective emerging technologies, Staples achieved greater than a 10% reduction in the energy usage across the portfolio.

Staples is committed to a sustainable green environment today and tomorrow. Embraced by Executives, associates and community, their energy efficiency has grown through corporate growth, innovative quality projects, technology, team collaboration, and awareness. The Staples Annual Strategic Energy Planning process is comprehensive and encourages continued accountability to drive improved results. The Operational Excellence demonstrated by the Staples Energy Efficiency Program since January 2008 is a testimony

of what can be achieved by continuing to promote corporate growth coupled with a team passion for delivery.

The Staples history and uniqueness is to partner with the leaders in the energy industry and strongly encourage innovations. They prototype, experiment, analyze, and implement the latest technologies ahead of most of their peers. Staples continues to invest in advanced store design prototypes with newest proven strategies such as latest solar, wind, fuel cell solutions. Staples also looks to retrofit existing stores with the newest technology where possible. Staples' new Roslindale, MA LEED certified store uses 35% of the energy on a BTU/sq ft basis compared to other MA stores. Staples also embraces new innovations in information management and reporting to tap the power of their associates to manage their business more effectively through training and visibility to their energy consumption.

Staples has been a leader in the retail world supporting energy efficiency and corporate sustainability for over a decade. The strategic vision of the energy management program is to operate the Staples business as the most energy efficient major retailer in the world, be recognized as such, and deliver to the Staples associates the lowest possible predictable energy costs. In addition, the ability to educate the Staples associates and customers on energy efficiency improvements and the commitment to corporate sustainability helps to differentiate Staples as an employer, supplier, and business partner.

Educational and training videos are developed as part of the comprehensive energy communications plan. These informative and educational videos tell energy efficient stories in areas such as green buildings like the Leadership In Energy and Environmental Design (LEED) certification to help understand the process and qualifications needed to reach LEED status as in the recognition of latest LEED Gold certification store in Massachusetts. Other individual videos include an educational video on the benefits and process of solar technology highlighting multiple Staples solar projects through the U.S., Fuel Cell technology one of Staples latest initiatives and an all inclusive video of energy efficient solutions for Staples like lighting, energy control systems, and HVAC systems.

Staples Soul reflects Staples commitment to corporate responsibility and communicates globally their long time commitment to diversity, the environment, community and ethics. It's a holistic approach to business that recognizes the close connection between Staples financial success and their desire to make a positive impact on associates, communities, and the planet. Web users can find information on Energy Conservation and Renewable Energy and the latest corporate responsibility report.

Recycle Campaigns are plentiful in the organization for many years and Staples is the first national retailer to offer an in store technology recycling program.

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BRUCE STUDLEY



Bruce Studley is the Vice President After Market Services Hitachi Power Systems America

The power plant After Market is projected to average \$4 billion a year over the next 10 years in the U.S. Hitachi Power Systems is expanding its Hitachi Power Systems is expanding its After Market organization organization, and Bruce Studley has been appointed to the position of Vice President, After Market Services. Studley comes to this position with extensive senior management experience both as an engineering consultant/supplier and owner/operator in directing and managing major power plant projects. His extensive experience includes both design and supply and EPC, including major plant upgrades, retrofits, conversions, engineering assessments and studies. Most recently, Bruce has directed the successful execution of three projects being retrofitted with Hitachi's Wet Scrubbers.

As a single-point supplier, Hitachi Power Systems provides a complete package of After Market services and products to both Hitachi supplied power products as well as other equipment manufacturers. This support is available on both a short term and long term basis.

BOILER SERVICES AND PRODUCTS

Hitachi offers a wide range of boiler services and products. This includes inspection services along with emergency support, outage planning and assistance. In addition, Hitachi offers installation and construction services, commissioning, start-up and troubleshooting support, spare parts including equipment replacement for boilers, burners, and pulverizers.

UPGRADES AND INSPECTIONS

Hitachi also provides engineered equipment quality upgrades and inspections inclusive of proven NOx solutions, low NOx design criteria, low NOx burner upgrades, OFA optimization and integration with existing or new SCRs. Hitachi also offers pulverizer maintenance services inclusive of inspections, regular maintenance, wear parts, component installations, upgrades, rebuilds, coordinated management services, and field engineering.

AIR QUALITY CONTROL SYSTEMS

As an OEM for state-of-the-art wet FGD Systems, Hitachi Power Systems supports all of its own equipment, and can undertake both engineering studies and upgrades of other manufacturers' equip-

ment. Hitachi has its own global combustion and flue gas test facilities and several R&D initiatives.

Hitachi offers both Catalyst and SCR System services which includes catalyst management and inspections, catalyst testing and catalyst supply of a number of enhanced catalysts. In addition, Hitachi offers recycling support services and spare parts.

HYDRO MARKET

For the hydro market, Hitachi offers

turbine upgrade performance studies including computational fluid dynamic analysis and a complete line of rehabilitation services.

These include model runner fabrication and testing, improvement and output increases, Additional services include Governor renovation from mechanical or electrical to digital type, improvement in control philosophy on pressure relief valves, control system component upgrades, additional auxiliary equipment supply and spare parts.

In 2005 Hitachi acquired Mechanical Dynamics & Analysis, the largest multi-OEM supplier of turnkey steam turbine-gen-

erator services in the U.S.

Hitachi's experienced field personnel and home office expertise will ensure customers receive services that are unmatched in the industry. "Customers expectations in the areas of increased safety and equipment life, efficiency and reliability, reduced operating and maintenance cost will be exceeded, and we'll always be on-time," Studley told World-Gen.

Studley holds a BS in Mechanical Engineering from Northeastern University and a MS in Management Engineering from New Jersey Institute of Technology.

ONE HITACHI...



SCR

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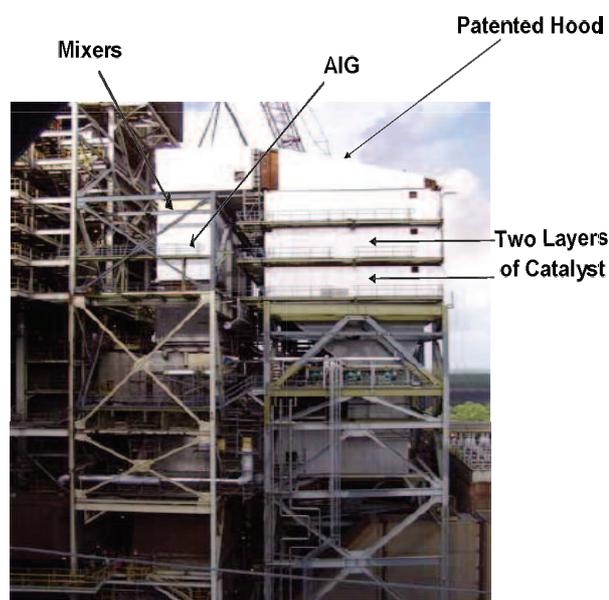
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JULIE BLUNDEN



Julie Blunden is the Vice President Public Policy Sunpower Corporation

Julie Blunden joined SunPower Corporation in 2005 and is responsible for public and financial relations, public policy and market development. SunPower, headquartered in San Jose, California, is the leading manufacturer of residential and commercial photovoltaic solar systems installed in the US, according to Blunden, who is vice president for public policy and corporate communications.

SunPower's greatest challenge now, Blunden charged, is keeping up with its growth. Revenues five years ago were \$11 million. In 2009, they climbed to \$1.4 billion, and are about evenly divided between US and overseas sales.

SunPower was founded in 1985 by Dr. Richard Swanson following years of research on solar power funded by the Electric Power Research Institute and the US Department of Energy. And it has an illustrious history. Honda Motor Company, one of SunPower's first major customers, wanted efficient solar cells and chose SunPower's to compete in the 1993 annual Darwin to Adelaide solar car race across Australia. Honda won the race by an entire day. NASA then chose SunPower's cells for the world's first solar-powered aircraft, the High-Altitude Long Endurance UAV Project.

Blunden has a bachelor's degree in engineering and environmental studies from Dartmouth College and an MBA from the Stanford Graduate School of Business. She joined SunPower after working at KEMA-XENERGY where she consulted on renewable resources and policy with utilities and state and federal governments. Before that, in 1997, she cofounded Green Mountain Energy Company, a retail electricity service provider, now headquartered in Texas.

SOLAR MARKETS COMPETITIVE

Current market conditions are quite strong for solar, Blunden said. It is very different from last year when confusion in the marketplace affected the business, a result of the disastrous financial meltdown in the fourth quarter of 2008. "We're in a much stronger position now, first because policies around the world are encouraging utilities and companies to invest in solar," she said. Secondly, solar is now established globally, with over 20 GW of solar systems installed worldwide. SunPower has 1 GW installed, globally, she said.

And adoption is accelerating, Blunden reported. The growth of the business in 2009 was also helped by the building of sili-

con feedstock plants in the past two years which increased the supply of silicon for PV systems. This has also increased competition which is driving down prices leading to real growth in solar panel sales. This trend has affected SunPower's bottom line. In its third quarter reporting for 2009, net sales and revenues were \$466M, up from \$377 million in the 2008 third quarter. "We anticipated for years that this would happen and we prepared cost structures that support this downward pricing."

SunPower's response was to lower costs through being more efficient. "Everybody would like to have higher efficiencies," Blunden said, "and SunPower owns that position in the market." Its panels are about 18.6% efficient. Our panels are twice as efficient as conventional solar panels and 2-4 times more efficient than thin film solar. SPWR solar cells are 22% efficient. "And we'll continue to work on it over time."

This includes finding opportunities in areas like tracking technology where it has worked to lower the cost structure and increase the solar panel's energy output by up to 30% by improving the design across the board, Blunden said. A cost effective tracker can lower the levelized cost of energy by increasing the energy output of the individual solar panel. "So we worked very hard on our system technology, whether it's roof top or ground-mounted, to make sure we're getting the maximum energy out of each and every watt of power that we're putting on the roof or on a tracker."

In a similar effort, the T5 roof tile is a pre-engineered, all unitary construction roof tile designed for installation on commercial roof tops that was developed with DOE funding in just 18 months, Blunden said. The costs of the T5 roof tile were reduced by thinking through the whole value chain to lower the cost of the structure: material selection, how it is designed, and cost of packaging an entire pallet, rather than each individual segment.

Moving up the value chain, the cost of transportation was reduced by lowering the weight of both the panel and packaging material. Installation costs were reduced by making the roof tile easier to install in less time. The T5 is a combined solar panel, frame and mounting system. Workers take it off the pallet, carry it to the roof, line it up with the one next to it and install it using hand tools. Operations and maintenance costs are also reduced because the roof tiles are made out of polymer that won't rust or corrode. Furthermore, it does not need to be grounded which takes an entire piece of insulation out of the requirement, Blunden explained.

Solar PV installations give utilities an advantage, Blunden argued. They have the flexibility to be scaleable in time and location which allow utilities to add systems as they comply with their state's renewable portfolio standard. Furthermore, PV plants can be built faster – once a plant is contracted for, it can be built within a year, she said.

STEPHEN WHITLEY

CONTINUED FROM PAGE 14

resources such as wind power. Flywheels, for example, have the capability to inject electricity into the bulk power system to help compensate for drops in generation when the wind-generated power slows.

As the NYISO enters its second decade of service, it is striving to build on past achievements to meet future energy challenges. The economic conditions facing New York—and indeed, the entire nation—present challenges that are best overcome by united, collaborative efforts that the NYISO and its actively engaged stakeholders embody.

Stephen G. Whitley is a veteran of the energy industry with extensive experience in bulk power system planning and operations. He joined the NYISO in July 2008.

Before that, he served for seven years as senior vice president and chief operating officer of ISO New England (ISO-NE). Prior to that, he completed a 30-year career with the Tennessee Valley Authority (TVA) where he last served as general manager, electric system operations, of the Transmission Power Supply Group and was responsible for control area operations, power supply, economic dispatch, system protection, transmission security and services and dispatching for the seven-state, 80,000 square-mile TVA service territory.

Mr. Whitley is the 2010 Chair of the Independent System Operator/Regional Transmission Organization Council (IRC), which represents the 10 ISO/RTOs in North America serving two-thirds of electricity consumers in the United States and more than 50 percent of Canada's population.

In October 2009, he was selected to chair the Executive Committee of the Eastern Interconnection Planning Collaborative (EIPC). The Eastern Interconnection includes electric systems serving most of the United States and Canada from the Rocky Mountains to the Atlantic coast.

He is also a member of the Electric Power Research Institute (EPRI) Power Delivery Executive Committee. During his career, he has served as a member of the Northeast Power Coordinating Council (NPCC) Board of Directors, the Executive Committee of CIGRE (International Council on Large Electric Systems) U.S. National Committee, and he has served on numerous North American Reliability Corporation (NERC), NPCC, and SERC reliability committees.

He earned a Bachelor of Science degree in electrical engineering from Tennessee Technological University prior to beginning his electricity industry career with the TVA.

ART LOCKE

CONTINUED FROM PAGE 18

Recent projects between Alcatel-Lucent and partners such as Vodafone Germany in which local municipal utilities are able to provide their customers with current meter data through a managed service, are enabling customers to shape energy demand patterns in the future to meet their "green agenda".

One recent customer win includes a smart meter operation service installed with German municipal utility Stadwerke Pasewalk GmbH. The solution will help the municipal utility deal with the multiple challenges that are imposed on utilities throughout Europe: the pressure from stakeholders and regulators for greater asset efficiency, the urgent climate-protection need which means informing, educating and incentivizing consumers and encouraging renewable energy.

BELL LABS HELPS INDUSTRY LEADERS WITH NEW SOLUTIONS

In January 2010, a global consortium led by Bell Labs was formed called GreenTouch™, where leaders in the industry, academia and government labs recognized the need to come together on this very topic to invent and deliver radical new approaches to energy efficiency that will be at the heart of sustainable networks in the decades to come. Additionally, Bell Labs and Korea's Gachon Energy Research Institute (GERI) have entered into a joint research agreement to design the communications infrastructure, comprehensive security systems, and develop innovative business models for the next-generation smart power grid (Smart Grid).

Advanced communications are critical to the cost effective, safe and reliable operations of the electric grid. Alcatel-Lucent is committed to making it easier for electric utilities to build and transform the end-to-end communications capabilities needed to support the millions of intelligent devices, such as smart meters and voltage sensors, that will comprise the smart grid. Equally important is helping utilities understand how to manage these new network technologies and the enormous amount of raw data they will produce so that the potential of the smart grid to provide ultra-reliable power, cost-effectively and securely, is realized.

Arthur Locke joined Alcatel-Lucent in 2004 where he is currently Regional VP, North America Utilities - Vertical Markets Division, responsible for bringing turn-key communications solutions to the Utility market. He has over 25 years of leadership experience in telecommunications performing operations management, engineering, sales, marketing, business development, managed services, network management, and outsourcing delivery, in both carrier and enterprise markets. Art received his MBA from Cornell University's Johnson School of Management.



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