

NRG, SIEMENS REPOWER

BY DICK FLANAGAN AND LYN CORUM



John Chillemi, Sr VP, CEO David Crane of NRG, and Barry Nicholls, Sr VP at Siemens are joined by other dignitaries representing state and regional energy agencies that permitted the El Segundo project at the ribbon cutting ceremony.

EL SEGUNDO, CA – On September 12th, Siemens Energy and NRG Energy celebrated the official grand opening and repowering of the El Segundo Energy Center, the second Siemens “Flex-Plant” in the nation with a ribbon cutting ceremony and luncheon. Southern California Edison has a 10 year power purchase agreement. The first Siemens “Flex-Plant” is operating at the Lodi Energy Center also in California (See world-gen.com, Featured Articles, Aug/Sept 2012).

Before the ceremony, NRG executives George Piantka and Tim Sisk hosted a press tour for *World-Gen* editors around the ten acre plant footprint, and shared its history. Along the tour, they pointed out the new 11 foot high undulating sea wall NRG constructed, fronted by a bike path, ocean walkway and native landscaping NRG planted. The plant created 400 jobs and will increase tax revenue by \$3 million annually. No tax dollars were used on the project.

(continued on page 19)



Governor Rick Scott, Orlando Mayor Buddy Dyer, and Siemens CEO Randy Swirn touring the new Orlando training facility.

SIEMENS WIND TRAINING CENTER

BY DICK FLANAGAN

ORLANDO, FL – On September 19th, Siemens inaugurated a new 40,000 square foot, \$7 million wind service training center in Orlando, built according to US LEED gold building standards and accredited by the Global Wind Organization (GWO) for safety training. Another three Siemens wind training centers are located in

Europe – Denmark, Germany and the UK – all are GWO accredited.

Randy Swirn, President and CEO of Siemens Energy Americas welcomed Florida Governor Rick Scott and other state and local government officials, customers and the media including *World-Gen*. “Our investment in this new training

(continued on page 22)

OPTIGRID LAUNCHED

BY JENNIFER EIRICH, ENERSYS



READING, PA – Despite numerous increases in efficiencies, demand for energy worldwide continues to rise. At the same time, the use of renewable energy sources is also increasing at the residential, commercial and utility levels. This exposes the worldwide energy grid to a higher rate of intermittencies, with potentially far-reaching effects. With so many choices available, it is important to develop a profile of the specific application to ensure effective protection. This article looks at current trends in renewable power and the role of energy storage providing a reliable energy buffer throughout the generation and delivery system.

GLOBAL ENERGY DEMAND

According to the BBC, our collective worldwide appetite for energy is expected to rise by at least 50 percent by 2030, as developing countries like China and India seek to fuel their rapid economic growth. China and India have joined the United States and Russia to comprise the top four largest energy consumers in the world, primarily due to energy demand rising to meet the needs of their expanding economies, with coal serving as the leading source of energy.

In the U.S., energy demand also continues to grow, but at a slowing rate due to efficiency gains from new appliance standards and investments in energy efficient equipment. According to the U.S. Energy Information Administration’s *Annual Energy Outlook 2013*, total electricity demand is expected to grow by 28 percent from 2011 to 2040. Other sources estimate more rapid growth. According to “A Word to the Wise: Know Your Power” in the May 2012 issue of *The Data Center Journal*, U.S. demand for electricity is forecasted to grow by 40 percent over the next two decades.

RENEWABLES: “A BRIGHT SPOT”?

Despite the heavy reliance on coal and other fossil fuels, renewable power, including hydropower, is the fastest-growing power generation sector, expected to increase by 40 percent in the next five years — “a bright spot in an otherwise bleak assessment of global progress toward a cleaner and more diversified energy mix,”

(continued on page 20)

NO COMPANY IS MORE FOCUSED ON ADVANCED NUCLEAR PLANT TECHNOLOGY

Westinghouse AP1000® plant under construction in Haiyang, China



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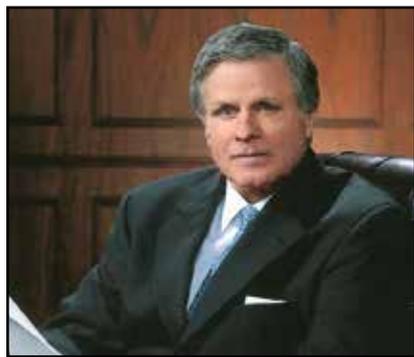
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Dick Flanagan

The Siemens Energy Solution Portfolio is designed as an environmentally friendlier way to meet the needs of markets with diverse generation and is being widely dispatched in California, from the fast start simple cycle and gas turbines at Marsh Landing to the Flex-Plant 10 combined cycle plants at El Segundo and the Flex-Plant 30 combined cycle plant at Lodi. In Orlando, Siemens inaugurated a 40,000 square foot, \$7 million wind service training center. The center will host more than 2,400 trainees annually from the Americas, and is accredited by the Global Wind Organization (GWO). Since 2007, Siemens has invested over \$110 million in wind energy manufacturing and service in North America, starting on page 1.

Jennifer Eirich at EnerSys looks at current trends in renewable power and the role of energy storage providing a reliable energy buffer throughout the generation and delivery system. A buffer is needed to help maintain reliability. Energy storage can provide the solution by serving as a shock absorber against service interruptions. She offers five points to select the right solution on page 1.

With the closure of the San Onofre Nuclear Generating Station south of Los Angeles, California's state energy agencies are being forced to do away with their traditional stove piped regulatory decision-making process. The loss of 2,200 MW of resources, including reliability and voltage support that SONGS provided, plus 5,000 MW of very old coastal generating stations that will be forced to repower or close by 2020, have motivated state energy leaders to devise new ways of working and rethink energy resources in Southern California, Corum reports on page 13.

Greg Stubbs writes on Dresser-Rand's fourth annual Corporate Sustainability Report on page 14 for 2013. The report identifies 14 sustainability goals across three core focus areas for the company — environment, society and governance. These goals were defined by the Dresser-Rand Sustainability Council under the direction of the company's Board of Directors. The Sustainability Council sets the goals for each year based upon the company's performance the year before, an assessment of opportunities for improved sustainability and various regulatory changes and trends in the marketplace.

Nuclear power is a safe and reliable source of sustainable, CO2-free base-load electricity. Nuclear power generation is an established part of the world's electricity mix, and the demand for water and the need for quality evaluations will be required well into the 21st century. The NRC's conservative and thorough review process demands that owners seek hydrologic expertise in developing accurate hydrogeologic models as well as hydrologic analysis. The reliability of site-specific data and its interpretation is essential for building accurate models, Diane Yeager asserts on page 15.

In today's financial market, financing and building a central plant, district energy system, or MicroGrid has always been complicated. There is very little financing available for a project unless the counterparties are all investment grade, the debt service coverage is around 1.5 x EBITDA and ROI is at least in the high teens. Given that a developer or owner must achieve this benchmark debt service coverage and ROI, only sustainable, high-efficiency projects are feasible today. Determining the feasibility of such a system requires an accurate engineering and economic analysis, Albert Pope shares on page 16.

The Electric Power Research Institute (EPRI) developed an innovative methodology for identifying and quantifying value for grid energy storage opportunities. The EPRI Energy Storage Valuation Tool (ESVT) was developed to support this methodology and enable preliminary cost-effectiveness analysis prior to more resource-intensive analytical efforts. An EPRI report describes results from the application of EPRI's valuation methodology and supporting software to analyze cases in California. Inputs to the ESVT analyses were provided by the CPUC technical staff with an industry stakeholder group, Ben Kaun tells us on page 17.

Noah Ginsberg says on page 18 that the American Council On Renewable Energy (ACORE), California Clean Energy Fund, and Climate Policy Initiative issued a study titled "Strategies to Scale-Up U.S. Renewable Energy Investment." It highlights the role of policy at the state, federal, and regulatory level in unlocking record levels of private capital in the industry during the past decade and explores policies that would significantly increase private capital into renewable energy development.

By way of explanation, we would like to point out our new design on page 1. The contents can now be found on this page in the future. Like all changes, we asked ourselves, "Why didn't we do this sooner?"

See you at SPI and PGI,

Dick Flanagan

SOLARWORLD EXTENDS

HILLSBORO, OR - SolarWorld has extended its popular Freedom Plan to six additional states. The program is now available to residential solar customers in Colorado, Connecticut, Hawaii, Maryland, Massachusetts and New Jersey. SolarWorld launched the Freedom Plan in California in February and will further expand into Arizona and New York in the coming months.

SIEMENS INKED

ORLANDO, FL - Siemens Energy received an order for the supply of two power plant units with H-class gas turbines for the Liberty combined cycle power plant in Pennsylvania. The overall power plant is to be erected by Gemma-Lane. The plant will have an electrical capacity of 829 megawatts in combined-cycle. Commissioning of the plant is scheduled for 2016. This order will mark the sale of 24 H-class gas turbines worldwide by Siemens.

DNV KEMA PARTNERS

ROCHESTER, NY - The Eastman Business Park in Rochester will host a new \$23 million Battery and Energy Storage Technology Testing and Commercialization Center. DNV KEMA Energy & Sustainability is partnering with New York Battery and Energy Storage Technology Consortium to relocate its existing energy storage testing operation in Pennsylvania to the new center in Rochester.

IBM'S "HYREF"

ARMONK, NY - IBM announced an advanced power and weather modeling technology that will help utilities increase the reliability of renewable energy resources. The solution combines weather prediction and analytics to accurately forecast the availability of wind power and solar energy. The solution, named "Hybrid Renewable Energy Forecasting" (HyRef) uses weather modeling capabilities, advanced cloud imaging technology and sky-facing cameras to track cloud movements, while sensors on the turbines monitor wind speed, temperature and direction.

BECHTEL, EDF SOLAR

FREDERICK, MD - Bechtel completed construction of the Catalina Solar Photovoltaic Generating Facility. Catalina Solar is one of the world's largest photovoltaic facilities.

It was built on 900 acres and includes a 7.2-mile (11.6-kilometer) transmission line that connects the facility to the substation. "Catalina Solar is a strategic project for EDF Renewable Energy as it represents our largest utility-scale photovoltaic solar plant developed in North America," commented Mark Tholke, Vice President West Region for EDF Renewable Energy.

DUPONT INNOVATES

SUNNYVALE, CA - DuPont announced the expansion of capabilities within its Silicon Valley Technology Center. The extended capabilities include commercial-grade tools and process capabilities to produce solar cells and solar panels. A rooftop testing station for solar panels is planned for later this year. A new technology lab has been added to explore the formulation of new DuPont™ Solamet® photovoltaic metallization pastes for more efficient solar cells.

DuPont has been granted nearly 200 patents worldwide for solar innovations since 2008, with over 1,300 patent applications pending.

BWRPLUS FORMED

PITTSBURGH, PA - Westinghouse Electric Company and Toshiba Corporation announced the formation of BWRPLUS, a new joint marketing organization for operating nuclear power plants in North America.

BWRPLUS is a single communication channel offered to customers interested in boiling water reactor (BWR) nuclear steam supply system, steam turbine/generator, balance of plant, or transmission and distribution products and services.

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EMERSON INTEGRATES

PITTSBURGH, PA - Emerson Process Management offers an integrated solution that enables biomass-fueled power plants to continually monitor feedstock moisture content and adjust the combustion process for better efficiency.

The new solution, which combines a biomass fuel moisture sensor with Emerson's Ovation™ expert control system, can help reduce maintenance costs as well as boost net yearly MWh production.

Biomass fuels vary considerably in their energy content.

IHS PROJECTS

EL SEGUNDO, CA - According to the PV Manufacturing & Capital Spending Tool from information and analytics provider IHS, global capital spending by producers of photovoltaic (PV) modules, cells, ingots, wafers and polysilicon is expected to rise by 30 percent in 2014 to reach \$3.0 billion.

South America, Africa and the Middle East are now leading the world in solar capacity additions.

PW POWER

GLASTONBURY, CT - PW Power Systems, a group company of Mitsubishi Heavy Industries, announced the sale of its latest aero-derivative power solution, the FT4000™ gas turbine, to a unit of Exelon Generation.

Exelon purchased a 120 MW simple-cycle FT4000™ SWIFTPAC® power generation unit.

URS SELECTED

SAN FRANCISCO, CA - URS Corporation has been awarded a five-year alliance contract by DTE Energy to provide engineering, procurement, construction, maintenance, and technical consulting services in support of DTE's fleet of nuclear and fossil power generation plants in Michigan.

Alliance operations will be based out of URS's office in Southfield, Michigan.

MISTRAS AWARDED

PRINCETON JUNCTION, NJ - MISTRAS Power Generation Group has signed a contract with Babcock & Wilcox to provide Non-Destructive Evaluation inspection services for replacement of the Unit No. 2 steam generators at the Prairie Island Nuclear Generating Plant located in Welch, MN. The NDE Services will include Radiographic Testing, Visual Inspection, Liquid Penetrant Testing, Magnetic Particle Testing, and Ultrasonic Testing.

NAVIGANT REPORTS

BOULDER, CO - The wind power market currently provides almost 3 percent of global electricity production. As the wind power industry matures, wind forecasting technologies are becoming critical in order to integrate greater amounts of variable wind energy into the grid. Meteorological towers, or met towers, the predominant solution at present, serve a range of forecasting needs.

SOLOMON ACQUIRES

HARTFORD, CT - HSB Solomon Associates, a subsidiary of The Hartford Steam Boiler Inspection and Insurance Company, announced the acquisition of Ziff Energy Group, an international energy consulting firm. Ziff Energy, with offices in Houston and Calgary, focuses principally in exploration and production studies across 40 countries covering more than 4,300 production fields and gas services.

SANCHEZ TO ACQUIRE

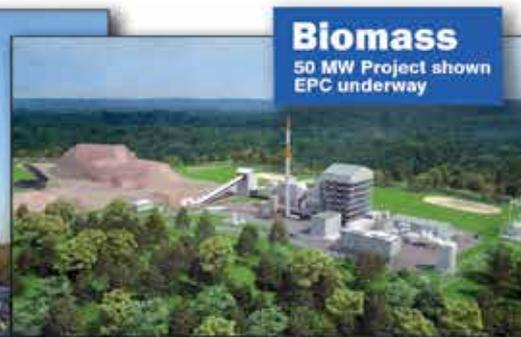
HOUSTON, TX - Sanchez Energy Corporation has entered into agreements to acquire approximately 40,000 net undeveloped acres in the core of the Tuscaloosa Marine Shale. Sanchez is an independent exploration and production company focused on the acquisition and development of unconventional oil resources in the onshore U.S. Gulf Coast, with a current focus on Eagle Ford.

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(We team with EPC Contractors selected to suit the project)



Gas & Steam Turbines
300 MW Combined Cycle EPC Project Completed



Biomass
50 MW Project shown EPC underway



Photovoltaic
Design assistance for rooftop PV shown



Engine-Generators
Study for 50 MW "Wind-Firming" Project

SCR (Selective Catalytic Reduction)
Utility EPC detailed design



Bob Bibb
Chairman / CEO
bobbibb@bibb-eac.com



Lou Gonzales
President / COO



Roger Petersen
Mgr. Bus. Develop., LA

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OEMs • Banks/Investors

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• MSW • Gasification • Pyrolysis Plant Improvements
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SOLAR'S BANKABILITY

SHANGHAI - JA Solar Holdings and VDE Testing and Certification Institute launched a strategic partnership to increase understanding of the importance of cutting-edge quality assurance and technical bankability in the solar industry. They are working closely with the Fraunhofer Institute for Solar Energy Systems.

WOOD UPGRADES

HOUSTON, TX - Wood Group GTS achieved a 45 per cent reduction of NOx on a GE Frame 5P gas turbine as part of an \$800,000 turnkey NOx performance project at a power station in Ohio. The black start unit at the coal plant was being re-permitted for commercial operation as a peaking unit. The facility was required to reduce NOx emissions from 119ppm to 65ppm.

CH2M HILL SELECTED

DENVER, CO - CH2M HILL has been selected by TransCanada for Program Management for the Energy East Project. This project would convert an existing 3,000 km natural gas pipeline to safely transport oil from Alberta to Eastern Canadian refineries and will require 1,400 km of new pipeline construction.

SOLAR FUNDED

SAN FRANCISCO, CA - Admirals Bank recently opened a Renewable Energy Lending Business Development Center in San Francisco, CA.

Admirals Bank has been heavily focused on financing residential solar and renewable energy systems and has financed over \$10 million for residential solar and renewable energy systems over the past seven months. Admirals is headquartered in Boston.

MPSA SELECTED

LAKE MARY, FL - Mitsubishi Power Systems Americas has been selected by Old Dominion Electric Cooperative to supply two natural gas powered M501GAC Gas Turbines and associated electric Generators for installation at the Wildcat Point Generation Facility in Cecil County, MD. MPSA will also provide comprehensive turbine maintenance for the gas turbines.

The Wildcat Point Generation Facility is expected to become operational in 2017 and generate approximately 1,000 megawatts of electricity.

DUPONT SIGNS

SHANGHAI - DuPont China Holding and GD Solar signed a strategic cooperation agreement focused on collaboration to improve the power output, quality and reliability of solar energy systems.

Under the agreement, DuPont will supply key photovoltaic materials and work with GD Solar to optimize their performance and application for high-efficiency solar cells and panels, integrated frames, new protective backsheet constructions and other system components.

PANDA TO BUILD

DALLAS, TX - Panda Power Funds intends to build, own and operate an 859-megawatt combined-cycle power plant in an industrial-zoned area of Brandywine, Maryland.

The Panda plant will utilize the latest, most advanced emissions-control technology, and will also be a zero-liquid-discharge plant.

SOLECTRIA INSTALLS

LAWRENCE, MA - Solectria Renewables announced that its SGI 500 inverters will power an 8MW solar system located on a 45 acre parcel of land at Mercer County Community College, saving the college approximately \$750,000 annually.



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load rates and environmental performance. The Trent 60 with its unrivalled availability and reliability combines these formidable traits to blend seamlessly and profitably into your operating conditions. **Trusted to deliver excellence**



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MPSA TESTS

LAKE MARY, FL - Mitsubishi Power Systems Americas successfully completed all performance and compliance testing requirements on the Selective Catalytic Reduction (SCR) Systems for four large frame F class simple cycle gas turbines (SGT6 PAC F4) that will generate 800 MW at the Marsh Landing Generating Station in Antioch, CA.

ALSTOM, UCC LAUNCH

KNOXVILLE, TN - Alstom and United Conveyor Corporation announced an alliance agreement to jointly provide new emission control systems for coal-fired power plants in North America and Europe. These systems would combine the two companies' respective expertise in air quality control systems (AQCS) and dry sorbent injection.

VIESTE PARTNERS

CHICAGO, IL - VIESTE Energy has engaged ESD (Environmental Systems Design, Inc.) to perform design services on a national portfolio of data centers that will be run on 100 percent renewable energy. These data center facilities will be supported by the co-development of 8-15MW of power generated from gasification based waste-to-energy facilities.

GRID INDEXED

WASHINGTON, DC - The GridWise® Alliance and the Smart Grid Policy Center announced the release of the first Grid Modernization Index. The GMI evaluates and ranks states based on their progress in modernizing their electric systems with smart grid technologies. The report highlights the 15 states that scored the highest.

AP1000 REVIEWED

PITTSBURGH, PA - Westinghouse Electric Company announced that its AP1000® pressurized water reactor has completed Phase 2 of the Canadian Nuclear Safety Commission Pre-Project Design Review. The objective of a Pre-Project Design review is to verify, at a high level, the acceptability of a nuclear reactor design with respect to Canadian safety requirements and criteria, including the identification of fundamental barriers to licensing a new reactor design in Canada.

For Phase 2, Westinghouse presented a completed AP1000 reactor design, providing a significantly higher level of assurance that the AP1000 design has taken into account Canadian regulatory requirements and expectations, safety analysis methodologies, and lessons learned from Fukushima. Additionally, as in the Phase 1 review, the Phase 2 review of the AP1000 reactor was conducted against all related CNSC regulatory documents and Canadian codes and standards.

BECHTEL HONORED

RESTON, VA - Bechtel announced that researchers from three National Nuclear Security Administration sites managed and operated by Bechtel partnerships have received nine 2013 R&D 100 Awards, known as the Oscars of Innovation. "The R&D 100 Awards celebrate the innovative minds behind these groundbreaking technologies, each of which will have a lasting positive impact for generations," said Craig Albert, president of Bechtel National, Inc., Bechtel's government services business.

MERCOM REPORTS

AUSTIN, TX - Mercom Capital Group released its report on funding and merger and acquisition activity for the wind sector during the second quarter of 2013. Wind venture capital funding picked up significantly this quarter amounting to \$210 million with the help of some large deals going to project developers in India compared to just \$16 million last quarter. There were a total of 42 investors that participated in project funding deals this quarter.

25

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ALSTOM UPGRADES

HOUSTON, TX - GDF SUEZ Energy North America has awarded Alstom a \$480 million long-term service contract. Alstom will provide maintenance services and gas turbine upgrade packages for four GDF SUEZ natural gas-fired power stations in Texas and Massachusetts.

PHOENIX CONSTRUCTS

SAN RAMON, CA - Phoenix Solar signed a contract with Silicon Ranch Corp. to construct a 38.6 megawatt solar plant outside of Atlanta, GA. Once completed, by the end of 2013, the solar plant will represent the largest solar installation in Georgia.

SOLARWORLD DEBUTS

HILLSBORO, OR - SolarWorld is debuting a leading power-performance guarantee for its Sunmodule Protect glass-glass solar panel that covers about 25 percent more energy generation than the industry-standard 25-year guarantee.

MIT INITIATES

CAMBRIDGE, MA - Most efforts at improving solar cells have focused on increasing the efficiency of their energy conversion, or on lowering the cost of manufacturing.

But now MIT researchers are opening another avenue for improvement, aiming to produce the thinnest and most lightweight solar panels possible.

Using two layers of such atom-thick materials, Jeffrey Grossman of MIT says his team has predicted solar cells with 1 to 2 percent efficiency in converting sunlight to electricity. That's low compared to the 15 to 20 percent efficiency of standard silicon solar cells, but it's achieved using material that is thousands of times thinner and lighter than tissue paper. The two-layer solar cell is only 1 nanometer thick, while typical silicon solar cells can be hundreds of thousands of times that.

The stacking of several of these two-dimensional layers could boost the efficiency significantly.

Pound for pound, he continues, the new solar cells produce up to 1,000 times more power than conventional photovoltaics. At about one nanometer (billionth of a meter) in thickness, it's 20 to 50 times thinner than the thinnest solar cell that can be made today. This slenderness is not only advantageous in shipping, but also in ease of mounting solar panels.

Half the cost of today's panels is in support structures, installation, wiring and control systems, expenses that could be reduced through the use of lighter structures.

In addition, the material itself is much less expensive than the highly purified silicon used for standard solar cells, and because the sheets are so thin, they require minuscule amounts of raw materials.

ENERGY STORAGE

NEW YORK, NY - UEP, in partnership with the CUNY Energy Institute, Con Edison and NYSERDA, has constructed on The City College of New York campus a 100 kW energy storage system utilizing advanced zinc anode battery technology.

It is capable of 5,000 deep discharge cycles with high round-trip energy efficiency.

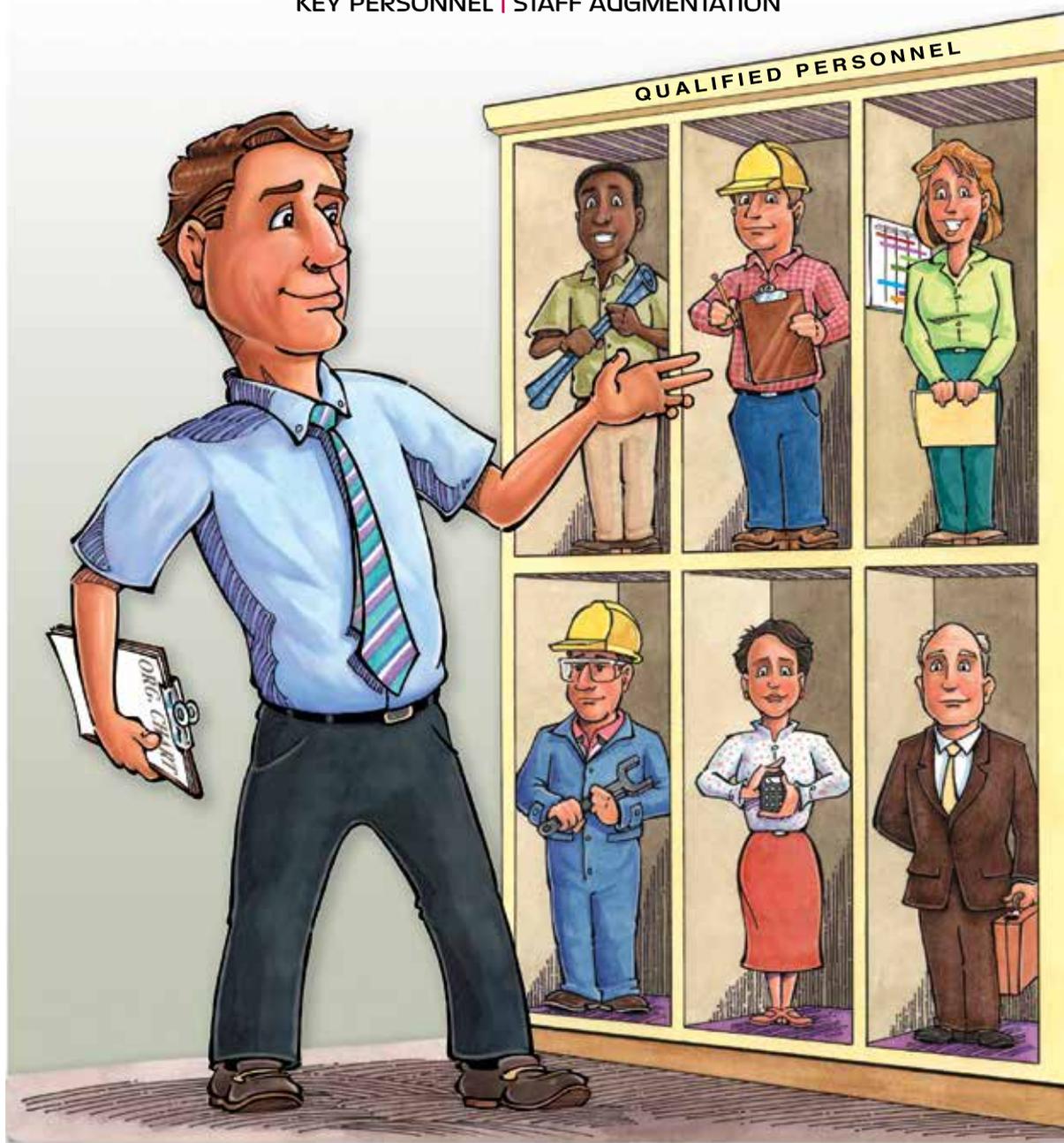
The batteries, which contain no lead and are 100% recyclable, will be used to reduce the school's peak electricity use and yield significant cost savings.

The UEP GreenCat batteries are the first renewables based on zinc anode technology to reach commercial demonstration and grid scale.

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Director Power Division
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SOLARWORLD INKED

HILLSBORO, OR - The General Services Administration has awarded a Federal Supply Schedule Contract to SolarWorld. The contract authorizes SolarWorld to sell solar panels and complete solar systems directly to federal government agencies, offices and departments, including the Department of Defense, by dint of streamlined processes and procedures. The contract, which began in May, allows SolarWorld to offer solar engineering, procurement and construction services – for projects ranging from 20 kilowatts to 2 megawatts – to federal-government customers under pre-negotiated terms, conditions and pricing.

B&W TO SUPPLY

CHARLOTTE, NC - Babcock & Wilcox Power Generation Group has been awarded a contract to design and supply FM water tube package boilers to Black & Veatch for a project at a manufacturing facility in Virginia. The dual fuel boilers will replace coal-fired units currently used at the plant, with delivery scheduled for April 2014.

PATTERN BUILDS

Panhandle, TX - Pattern Energy Group LP is starting construction of the 218-megawatt Panhandle Wind project located on 18,000 acres in Carson County, 30 miles from Amarillo. Panhandle Wind will sell power to Citigroup Energy under a long-term hedge offtake agreement. GE Energy Financial Services and Citigroup Global Markets will invest structured equity in the project. Completion is estimated in August 2014.

INSTEP TO MONITOR

CHICAGO, IL - European energy producer EDF Group has selected InStep Software's predictive asset analytics software to monitor its nuclear power plant fleet in France. EDF will use InStep's PRiSM software for continuous real-time asset monitoring of 58 nuclear units at 19 sites. The software will be used to identify and alert personnel of subtle changes in equipment behavior to provide early indication and diagnosis of asset health and performance problems.

MPSA INKED

LAKE MARY, FL - Mitsubishi Power Systems Americas received an order from Abengoa to supply a natural gas powered Combined Cycle Power Train for installation at the Carty Generating Station for Portland General Electric near Boardman, OR.

TOSHIBA ACQUIRES

HOUSTON, TX - Toshiba International Corporation will acquire all assets and intellectual property from Elettra Technology Inc. (ETI), a manufacturer of custom electrical industrial motors based in Hamilton, Ontario, Canada. The acquisition is a strategic move for TIC to add its strength in the electric motor marketplace and support the growth of TIC's industrial and infrastructure business.

DUKE DEVELOPS

DURHAM, NC - Duke University engineers have developed a method for producing clean hydrogen using a new catalytic approach, and they can reduce carbon monoxide levels to nearly zero in the presence of hydrogen and the harmless byproducts of carbon dioxide and water. They also demonstrated that they could produce hydrogen by reforming fuel at much lower temperatures than conventional methods.

PANDA EXPANDS

DALLAS, TX - Panda Power Funds has completed the acquisition and successful financing of Moxie Energy's planned 829-MW natural gas-fueled, combined-cycle "Liberty" generating station, located in Bradford County, PA. The Liberty project will be the first new power plant near the Marcellus Shale gas formation.

HITACHI INTRODUCES NEW COMBUSTION TURBINE TECHNOLOGY

HITACHI GAS TURBINE PRODUCT LINE – 60 HZ				
ITEM	UNIT	H-15	H-25	H-80
Output	MW	16.9	32	99.3
Efficiency	%(LHV)	34.4	34.8	37.5
Heat Rate	Btu/kWh	9,950	9,806	9,100
Exhaust Flow	lb/h	420,000	767,000	2,262,000
Exhaust Temp	°F	1,047	1,042	986

ISO Conditions (Sea Level, 59°F, 60% RH), Natural Gas Firing

HITACHI HAS DEVELOPED SEVERAL NEW MODELS including a 100 MW combustion turbine (Hitachi H-80), and several upgrades of the mature H-25 combustion turbine technology, ranging from 32–42 MW. Hitachi's combustion turbine lineup is ideal for upgrading/replacing existing simple cycle and combined cycle combustion turbines. Nominal combined cycle outputs of 140 MW or 285 MW are achievable with the H-80 combustion turbine in 1x1 or 2x1 plant arrangements. Learn more from Hitachi Power Systems America.

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HITACHI
Inspire the Next

INTERNATIONAL NEWS

AUSTRALIA

Wärtsilä has signed a ten year service agreement with Energy Developments Ltd of Australia to maintain the 53 MW McArthur River Mine plant. The plant will be fully operational by the end of 2013 and is the first major agreement for Wärtsilä in Australia. The agreement includes technical support.

BANGLADESH

Siemens delivered gas turbine packages for two plants in Bangladesh. Siemens received the order for Ashuganj 225MW from Daewoo International, which is responsible for turnkey construction of the power plant. For the Ashuganj 385MW station, Siemens was contracted by UTE TSK-Inelectra, which is also responsible for turnkey construction.

BRAZIL

Alstom signed a contract worth around 25 million euros with Enerplan, a power company from the Brazilian group Oleoplan, to supply wind turbines to the Pontal wind project. The equipment will be installed in a new wind farm located in Viamão, city of Rio Grande do Sul State. The commissioning of Pontal project is scheduled at the end of 2015.

CHINA

Siemens Energy has received orders for the compressor trains for three LNG plants in China for liquefying synthetic natural gas from the Hangzhou Zhongtai Cryogenic Technology Corporation.

CHINA

Alstom signed a cooperation agreement with Dongfang Electric to supply turbines and generators for Chinese nuclear projects using AP 1000 reactors.

DENMARK

Babcock & Wilcox Vølund A/S was awarded a \$40 million contract to engineer and supply steam generating equipment, ash handling systems and combustion control systems for I/S Nordforbrænding's municipal solid waste-to-energy power plant located north of Copenhagen.

Start-up of the completed plant is anticipated in the spring of 2016.

ESTONIA

GE announced the opening of the Paldiski Wind Farm on the Pakri peninsula in northwestern Estonia. With 18 GE 2.5-100 wind turbines, the Paldiski Wind Farm marks the commercial debut of the company's wind turbine technology in Estonia, one of Europe's most promising wind sectors.

FRANCE

Alstom and Soitec have signed a cooperative agreement to provide concentrated photovoltaic power plants.

GERMANY

Westinghouse Electric Company announced that E.ON Kernkraft GmbH will exercise an option in an existing contract for additional deliveries of replacement fuel assemblies for its nuclear power plants, extending the original 2012 contract for additional replacement deliveries to 2016 and 2017.

Westinghouse will produce the fuel at its fabrication facility in Västerås, Sweden.

GUAM

NRG Solar acquired a 25.65-megawatt solar project on the island of Guam from Quantum Guam Power Holdings. NRG Solar will construct, own and sell all of its power output to the Guam Power Authority under two twenty-five year power purchase agreements.

MALAYSIA

Siemens will supply two H-Class gas turbines for the TNB Prai combined cycle power plant.

The order was placed by Samsung C&T, which will construct the power plant on a lump sum turnkey basis. The end customer is Tenaga Northern Bhd.

FIELD REPORT #7

Topic	Fleet Safety
Location	Worldwide

Demonstrating fleet safety reinforces public confidence.

Experience shows that very unlikely events may occur and that plant operators need efficient systems to safely shutdown their plants and to remain in control in case of an unexpectedly complex sequence of events. In that context, utilities worldwide will perform safety checks to reassess the safety margins of their existing nuclear fleets.

AREVA is already helping utilities in that process with its Safety Alliance framework to analyze safety issues and mobilize the solutions to address them.

AREVA's unique network of safety experts and innovative catalog of products and services are supporting utilities to successfully pass safety inspections, meet new regulatory requirements and achieve their safety objectives.

Find out how AREVA is helping utilities demonstrate the safety of their nuclear fleets, while reinforcing public confidence.

Return on Experience

SAFE, PREDICTABLE AND COMPETITIVE PLANT PERFORMANCE

Find out why: www.aveva.com/fieldreport

AREVA
forward-looking energy

Energy is our future, don't waste it! - © Copyright: AREVA ; Photo: AVE Multimedia - September 2011

MEXICO

Comexhidro Viento, Next Energy de México and Conduit Capital announced the opening of Santa Catarina, the first operational wind farm in Mexico powered by GE wind turbines. Eight GE 2.75-103 turbines are online and are expected to generate 45 gigawatts of power annually. GE also was awarded a five-year agreement to operate and maintain the Santa Catarina wind farm.

MEXICO

Alstom has been awarded a contract with ENEL Green Power Mexico to supply 34 wind turbines to its first wind power project in Mexico.

MEXICO

Martifer Solar is building a 30 MW photovoltaic plant which is being constructed for Gauss Energía and is located in La Paz, Baja California Sur, on a 100-hectares site.

RUSSIA

Siemens will deliver the key components for a 376 MW power station to supply the future Yamal LNG production plant with electricity and heat. The order has been placed by the Russian engineering company Technopromexport, a wholly owned subsidiary of Rostec State Corporation.

RUSSIA

Wärtsilä has been awarded the contract to supply a 110 MW power plant. The order was placed by Transmashenergo, an independent power producer, and the power plant is to be located in Tikhvin in Russia's Leningrad region. It will run on natural gas.

SARDINIA

REC sold four ground-mounted solar plants to IKAV Global Energy S.a.r.l., an investment arm of the Luxembourg Investment Fund IKAV SICAV FIS.

SAUDI ARABIA

Siemens will supply the key components for a major combined cycle power plant designed to deliver electricity to the Jazan Industrial city area and to the refinery of Jazan. With an installed capacity of 4,000 megawatts, Jazan will be the largest gasification-based power plant site in the world.

SPAIN

Emerson Process Management upgraded the control systems at the EnergyWorks Cartagena combined heat and power (CHP) power plant. The project was managed to ensure completion during a 10-day scheduled outage.

SPAIN

Westinghouse Electric has been awarded a contract by ENRESA to provide architect engineering services in support of the El Cabril low- and intermediate-level nuclear waste repository in southern Spain.

SWITZERLAND

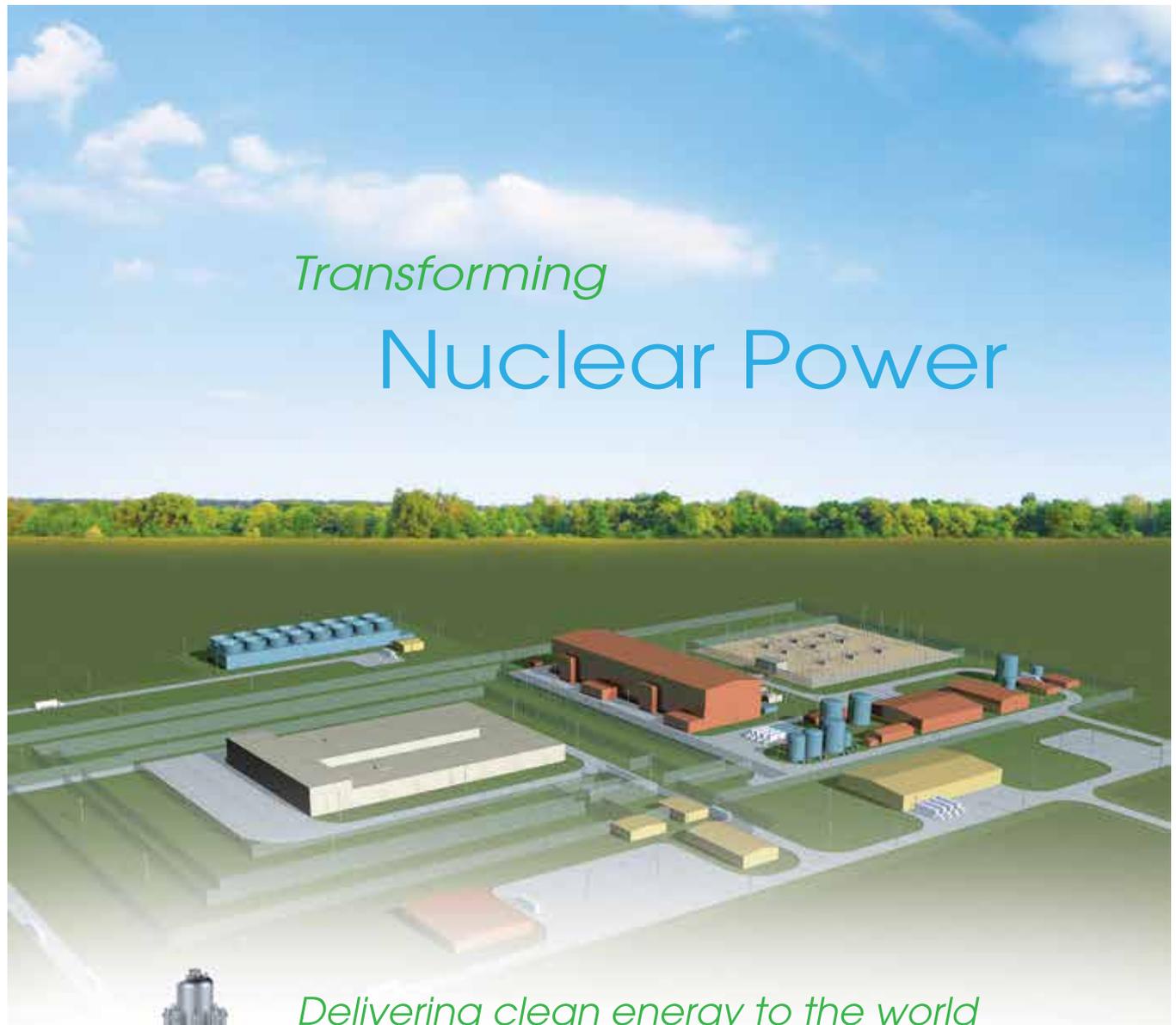
AREVA has been awarded a contract for the fabrication of fuel assemblies for five reloads for the Gösgen nuclear power plant. AREVA will deliver 180 fuel assemblies to the Swiss utility, Gösgen-Däniken AG (KKG), starting in 2018.

TURKEY

GAMA Enerji and GE Energy Financial Services joint venture, has achieved financial close and completed the first drawdown for a 35-megawatt (MW) wind power plant in Akhisar, Manisa.

UK

RWE npower renewables is using High Voltage SCADA systems installed by Emerson Process Management as part of a standardized High Voltage SCADA approach across its wind assets.



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generation
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ABB NAMES CEO

The Board of ABB appointed Ulrich Spiesshofer as Chief Executive Officer, succeeding Joe Hogan.



Ulrich Spiesshofer

MONIZ SWORN IN

Dr. Ernest Moniz was sworn in as the nation's 13th Secretary of Energy. Most recently, Dr. Moniz served as the founding Director of the MIT Energy Initiative and of the MIT Laboratory for Energy and the Environment.



Dr. Ernest Moniz

STARK JOINS

Roger Stark joined Stoel Rives Washington, DC office. Stark is a member of the Class of 2013.



Roger Stark

BROOKS NAMES

Brooks Instrument announced that Scott Amsbaugh has been appointed as general manager responsible for overseeing Brooks' global business operations.



Scott Amsbaugh

PB PICKS

Cezmi Bilmez has been named General Manager, Power in the Istanbul office of Parsons Brinckerhoff.



Cezmi Bilmez

PSI APPOINTS

Principal Solar appointed Jeff Heller, former vice chairman of Electronic Data Systems to its Board of Directors.



Jeff Heller

AZAR APPOINTED CEO

Mario Azar was appointed CEO of the Solutions Business Unit in the Oil & Gas Division of Siemens' Energy Sector, based in Houston, TX. Azar is a member of the Class of 2013.



Mario Azar

WESTINGHOUSE SELECTS

Westinghouse Electric Company announced the appointment of Jeff Bradfute as vice president, Global Nuclear Fuel Engineering.



Jeff Bradfute

URS NAMES

URS Corporation has chosen William Harnagel as Vice President and Corporate Controller and will be based in San Francisco.



William Harnagel

TORYS TRANSFERS

Torlys announced that Tara Mackay transferred from its Toronto office to New York. Tara is a partner in the Infrastructure and Energy Group and a member of the Public-Private Partnerships (P3) Practice.



Tara Mackay

FABER JOINS

J.L. Patterson & Associates announced that James M. Faber, P.E. has joined the firm as Director of Technical Services and Business Development.



James M. Faber

STANDISH NAMED

Benjamin Standish, P.E., has been named a Senior Project Manager at Primary Integration.

TAS SELECTS

J.T. Grumski was named President & CEO of TAS Energy. Craig Hurlbert, formerly CEO, will remain Chairman of the Board. Grumski is a member of World Gen's Class of 2011.



J.T. Grumski

TACKE NAMED

Markus Tacke has been appointed CEO of Siemens Energy Sector's Wind Power Division.



Markus Tacke

AWEA PICKS CEO

American Wind Energy Association (AWEA) announced that Tom Kiernan has been named the organization's new Chief Executive Officer. Kiernan has served as President of the National Parks Conservation Association (NPCA) since 1998.



Tom Kiernan

LARKIN HONORED

Jeff Larkin, Director of Power and Water, Middle East, at Parsons Brinckerhoff, has been awarded the OBE (Order of the British Empire) for services to the reconstruction of Iraq.



Jeff Larkin

ASSURANT SELECTS

Assurant's solar group named David Smith to the new role of senior product manager.



David Smith

WALKER PROMOTED

Valerie Walker has been appointed a Vice President for Merrick & Company.

ALSTOM APPOINTS

Alstom has appointed Amy Ericson as the company's Country President for the United States.



Amy Ericson

EPRI APPOINTS

The Electric Power Research Institute announced that Kimberly S. Greene, president and chief executive officer of Southern Company Services, will chair the Board of Directors. The board also announced the election of Denis P. O'Brien, senior executive vice president of Exelon and CEO of Exelon Utilities, as vice chair.



Kimberly S. Greene

HUSSEY PROMOTED

The Board of Directors of the New York Independent System Operator (NYISO) has named Cheryl Hussey as vice president and chief financial officer. She served as assistant treasurer at NYISO.



Cheryl Hussey

MINTON APPOINTED

Sylvia Minton, Mage Solar's Senior Vice President for Corporate, Institutional & Government Affairs has been appointed to serve on the Renewable Energy and Energy Efficiency Advisory Committee at the U.S. Department of Commerce.



Sylvia Minton

CHROMALLOY NAMES

Chromalloy appointed Andrea Colombo the company's new Vice President, Energy.



Andrea Colombo

LUCIANI JOINS

Navigant announced that Ralph Luciani has joined Navigant's Energy practice as a Director in the Washington, DC office.

CALIFORNIA RETHINKING RESOURCES

BY LYN CORUM



With the closure of the San Onofre Nuclear Generating Station south of Los Angeles, California's state energy agencies are being forced to do away with their traditional stove piped regulatory decision-making process. The loss of 2,200 MW of resources, including reliability and voltage support that SONGS provided, plus 5,000 MW of very old coastal generating stations that will be forced to repower or close by 2020, have motivated state energy leaders to come together, devise new ways of working and rethink energy resources in Southern California.

The starkness of this news was presented at the latest of a series of workshops and hearings held September 9 at the California Energy Commission. For the first time, staff members from the California Public Utilities Commission, the CEC and the California Independent System Operator jointly presented a plan, trading off the same power point presentation to each other, to identify preferred resources that will replace these losses.

CEC Chairman Robert Weisenmiller opened the workshop, saying, "Life going forward without San Onofre is both a challenge and an opportunity. The challenge is the entire transmission system was built around SONGS operating ... It is a real opportunity to make the power system in Southern California in a new way."

Phil Pettingill, with Cal-ISO, said Southern California has enough power for the next three years. However, getting the power into the ten load pockets will be tricky because of limited options due to limited transmission. "Our challenge now is to focus on the Los Angeles and San Diego areas."

PREFERRED RESOURCES

Ed Randolph, a staff member with the CPUC, described the preferred resources to be developed. "Our overriding goal is to [derive] 50% of incremental need from energy efficiency, demand response, and distributed generation" in that order. Conventional gas-fired combined cycle plants will fill the

gaps. He continued, "We need transmission upgrades and we need to authorize the development of conventional resources where preferred resources and transmission development is insufficient."

The participants in the workshop all stressed that new ways of procurement planning, transmission siting applications and project certifications at the agencies must be expedited if new resources are to become available by 2017 when demand is expected to grow. Cal ISO is proposing a forward year auction for demand response or energy efficiency resources to offset reliability needs, said Pettingill.

Sylvia Bender, on the staff at the CEC, said a notice of intention process is being discussed where the agency could approve potential sites ahead of actual applications to speed up the siting process.

The CEC sponsored two similar workshops in July and August in preparation for writing its Integrated Energy Policy Report due for final approval in December. One of these was the Joint Workshop on Electricity Infrastructure Issues Resulting from SONGS Closure cohosted with the California Public Utilities Commission. The second was a workshop on evaluation of electricity system needs in 2030.

Joining the president of the CPUC, Michael Peevey, and the CEC chairman, Robert Weisenmiller at the workshops were executives from the California Independent System Operator, South Coast Air Quality Management District, California Air Resources Board, the State Water Resources Control Board and the South Coast Air Quality Management District. These agencies collaborated to formulate the preferred resources plan introduced on September 9.

ONCE THROUGH COOLING BANISHED

The 5,000 MW of aging coastal generating stations that utilize once-through ocean cooling technologies must be repowered, replaced or removed by 2020 on orders of the State Water Resources Control Board to comply with federal water quality requirements. Most of these plants in Southern California are scheduled for repowering, and one - El Segundo - already has had two units replaced. It began operating its new combined cycle plant this summer. The owner, NRG Energy, has an application at the CEC requesting certification to repower the two remaining units.

AES also has applications at the CEC requesting certification to repower its Huntington Beach and Redondo Beach plants.

NRG Energy has also received certification to build its Carlsbad combined cycle plant which will replace the ancient Encina plant near San Diego. All Carlsbad needs to begin construction is to have a power purchase agreement in hand with a utility.

EMISSION OFFSETS SOUGHT

The replacement plants will be dependent on the South Coast Air Quality Management District for the emissions offsets they will need for construction permits. On September 6, the SCAQMD Board of Governors approved a fee to recoup the fair market value of its private reserve of emission offsets it identifies as valuable public goods. The staff said it seeks a fair return on its finite, valuable public good (its internal bank of emissions offsets which new projects draw on). It intends to invest the proceeds in emission reduction projects in the communities surrounding the power plants.

Electric utilities and private power plant owners have been allowed for 25 years to freely access this account to replace aging electric steam plants. Once the electricity market was deregulated, the district felt it was time to revise the rule. It spent more than eight months meeting with working groups to develop the fee. Early on, it was controversial, but SCAQMD staff continued to modify and reduce the fee to where companies such as AES and NRG endorsed it at the Board's public hearing.

SCAQMD believes the fee will have minimal cost impacts on projects. Laki Tisopulos, assistant director of planning rules and development at SCAQMD, told the board the fee represents an increase of \$0.06/kWh - less than a 1% increase in utility bills.

Greenfield projects have never had access to SCAQMD's private reserve of offsets which were designed to go to public good institutions like schools, hospitals - and power plants. The greenfield projects have to go to the open market for emissions offsets and are virtually impossible to find. SCAQMD said two recent power projects nearing the end of construction each paid \$50 million for their offsets.

There is also a long delayed state legislature-mandated report, known as AB 1318 directing the California Air Resources Board, in collaboration with the state's energy agencies to estimate the required offsets for the capacity required in the South Coast to meet long-term reliability. Options are to be proposed to address the required offsets and to report findings to the governor and legislature. A draft report was due out in August but has been delayed until the end of the year.

UTILITIES TO SEEK RESOURCES

At the July 15 workshop, Mark Nelson, director of integrated planning at Southern California Edison, said the utility needs 2,800 MW to 3,300 MW of new resources and will pursue transmission additions and upgrades plus conventional generation.

SCE is targeting 700 MW of preferred resources - energy efficiency and demand management, renewable resources, and gas-

fired generation in that order - in Orange County where the shuttered SONGS is located. Nelson labeled the effort a "living pilot" because the utility will be testing whether the resources can meet reliability needs.

The CPUC has already authorized the utility to procure between 1,400 and 1,880 MW of gas-fired generation, energy storage and preferred resources in the Los Angeles basin. Another 215 MW to 290 MW are to be procured for the Big Creek/Ventura area northwest of Los Angeles, according to Noushin Ketabi, senior analyst in the energy division at the CPUC.

Will Speer, director for regional transmission at San Diego Gas & Electric, said the utility is planning transmission enhancements and adding dynamic reactive capability to substations. It has received approval from the CPUC for 343 MW of new local capacity for 2018.

Speer said the SONGS shutdown and the required replacement or retirement of the aging coastal power plants that have once-through cooling are driving talks with SCE to do long-term planning together.

Randy Howard, director of power system planning and development at the Los Angeles Department of Water and Power told commissioners at the July 15 meeting the department is replacing nine generating units with quick-starting units at its three coastal once-through cooling power plants. Two new units at the first of the three became operational in June. The final unit will be replaced by 2029.

Howard said LADWP and the Bonneville Power Administration are jointly embarking on a project to upgrade the Pacific DC Intertie to deliver renewable power to LADWP and Cal-ISO and to improve reliability.

SCE is looking at both Los Angeles basin transmission and regional transmission upgrades, said Nelson. It is planning to loop the Tehachapi transmission line now being built into the Mesa Substation east of Los Angeles, making it a power hub known as the Mesa Loop.

The Tehachapi transmission line will bring wind power south from the Tehachapi Mountains where up to 4,000 MW is being developed. Nelson said the power hub will reduce the amount of generation needed in the basin.

Speer said SDG&E is initiating talks with the Navy at Camp Pendleton to propose the Pendleton Energy Park where 1,000 MW of generation would be developed by bidding it out in chunks. CPUC president Michael Peevey expressed skepticism of the plan at the July 15 meeting because of the difficulty of obtaining leases on the marine base when SONGS was being developed in the 1960s.

14 SUSTAINABILITY GOALS

BY GREG STUBBS, DRESSER-RAND



Using the theme of Sustaining Success with Technology & Operational Excellence, Dresser-Rand published its fourth annual Corporate Sustainability Report earlier this year.

The report identifies a variety of Dresser-Rand technologies that specifically support its clients' competitiveness by improving process efficiencies and reducing emissions.

Using real-life examples where Dresser-Rand products and people are making positive impacts on the environment and society, the report identifies 14 sustainability goals across three core focus areas for the company — environment, society and governance.

THE PURPOSE BEHIND EACH SUSTAINABILITY GOAL

These goals were defined by the Dresser-Rand Sustainability Council under the direction of the company's Board of Directors. The Sustainability Council at Dresser-Rand sets the goals for each year based upon the company's performance the year before, an assessment of opportunities for improved sustainability and various regulatory changes and trends in the marketplace.

The company's Sustainability Council represents a cross-functional team of senior managers and executive leaders who are charged with developing a sustainability strategy of competitive advantage that engages opportunities of shared value for Dresser-Rand and its stakeholders.

As a leading supplier of custom-engineered rotating equipment solutions for the worldwide energy infrastructure, including oil, gas, petrochemical, power generation, and process industries, Dresser-Rand has a goal to operate efficiently and, in turn, reduce cost, cycle time and waste.

Below are descriptions of how Dresser-Rand's Sustainability Council determined its 14 goals for 2013.

ENVIRONMENT

Dresser-Rand focuses on the impacts that its products, services and operations

have on the environment. The company also adheres to the belief that its clients also want to be responsible stewards of the world's limited resources and reduce their own environmental footprints. To that end, Dresser-Rand set five specific goals with regard to the environment.

Goal #1: Continue with the Second Phase of the U.S. Waste Management Program

In 2012, Dresser-Rand set a goal to manage waste by adopting a waste management hierarchy at its facilities that maximizes economic return and minimizes environmental risk by pursuing waste management options that eliminate or reduce waste or recycle waste wherever possible.

Dresser-Rand strives to recycle all metal waste and solvents, and continually looks for other opportunities to conserve environmental resources. One example involves converting to energy-efficient lighting in the plants to reduce energy waste. In 2013, the goal is to continue expanding this initiative across all facilities in the United States.

Goal #2: Continue to Advance Active Magnetic Bearing (AMB) Technology for Land-based and Subsea Applications, and for Market Development

Bearings in high-speed rotating equipment typically are lubricated with oil. Active magnetic bearings are replacing oil-lubricated bearings because of their superior performance, absence of auxiliary oil systems and improved efficiency. AMB technology translates into higher reliability, lower vibration, little to no maintenance costs, reduced downtime, simplified installation, elimination of lubricants, and environmentally-friendly operation.

Thanks to its acquisition of Synchrony Inc., a technology development company with a portfolio of world-class technologies including AMBs, high speed motors and generators and power electronics for clean, efficient and reliable rotating machinery, Dresser-Rand has strengthened its value proposition of its DATUM® compressor line and advanced its sustainability goals by adding AMB technology.

Dresser-Rand plans to capitalize on the anticipated global shift toward oil-free operations by retrofitting compressors, motors and steam turbines that currently use an auxiliary oil system with AMBs.

Goal #3: Incorporate HSE into Standard Work and "Lean to Green" into Key Lean Processes

Dresser-Rand's goal is to be more efficient in how it addresses health, safety and environmental (HSE) issues. HSE data attributes were included in Dresser-Rand's Lean Six Sigma value stream mapping in 2012.

From "A3 Safety" training being introduced to the company's 13 major manufacturing sites, to ergonomic considerations meant to

improve, develop or move manufacturing operations, Dresser-Rand took major strides forward in 2012 to improve efficiency in HSE issues.

By doing these types of projects and incorporating HSE into key lean processes, Dresser-Rand takes a holistic approach to eliminate waste in present-time rather than after the fact.

Goal #4: Continue to Advance Eco-Design Process and Complete Engineers' Eco-Design Training

Dresser-Rand continually looks at the environmental impact of its products and processes from a lifecycle or gate-to-gate perspective. Based on its analysis, the company finds ways to manufacture high-quality and reliable products with environmental benefits. Training engineers with eco-design technology is a core part of ensuring that Dresser-Rand's products are designed with eco-efficiency in mind.

For example, Dresser-Rand designs biogas units at a variety of plants worldwide. Biogas, a renewable energy source, reduces the need for diesel for electricity generation. Dresser-Rand's other environmentally friendly power generation offerings include technologies involving compressed air energy storage, ocean waves, wind, and solar power to generate electricity.

Goal #5: Improve Sustainable Supply Processes, Including Controls over Conflict and Prohibited Materials

There have been many European directives created that specifically ban or strongly discourage manufacturing that uses conflict or prohibited materials. In some parts of the world, such as Congo and other countries in Africa, there are roving gangs that use human trafficking or slavery to mine certain minerals and raw materials. Dresser-Rand is strengthening supplier processes to ensure it has accurate records of the origins of all such materials to safeguard against using conflict and prohibited materials.

SOCIETY

Dresser-Rand also places great importance on its relationships with the communities in which its employees live and work. In the communities where Dresser-Rand has a presence, its objective is to achieve long-term economic, social and environmental benefits by creating jobs, engaging local suppliers, encouraging community involvement, and supporting education.

Dresser-Rand has four goals specifically geared toward society. These are:

Goal #6: Enhance its Progress and Oversight for Privacy Issues

The company is working to assess and adhere to legal requirements impacting its operations across the globe. The company is also striving to find the right balance between respecting the privacy of

its workforce while addressing security and compliance initiatives.

Goal #7: Continue Efforts to Expand the Reach of Corporate Charitable Initiatives

Dresser-Rand's charitable programs emphasize education, civic and social programs. Historically, certain Dresser-Rand locations used company resources committed to charitable endeavors more than others. In addition to encouraging the participation of all the company's operations in charitable opportunities with these focus areas, one of Dresser-Rand's goals is to educate employees worldwide to take advantage of the company resources in ways they can promote local charitable programs important in their individual communities.

Goal #8: Develop Globally Effective Programs, Resources, Policies, and Procedures for Implementing a World-Class HSE Management System

Dresser-Rand has embarked on improving its current Global Health, Safety and Environmental (HSE) Management System to align with the universally recognized OHSAS 18001 framework and ISO 14001 standards to achieve its desired goals and objectives. Global certification to OHSAS 18001 is scheduled for 3rd quarter 2013, and to ISO 14001 in 2014.

The implementation of an effective HSE Management System proactively manages HSE performance and provides a framework for consistently identifying and managing health and safety hazards/risks and environmental aspects.

The company believes that this systems approach to identifying and managing risk establishes a baseline of disciplined processes and, therefore, a standard for operational excellence. This corporate HSE management system will better leverage the centralized functional HSE reporting relationships by providing strategic and process direction to all HSE professionals worldwide, further advancing our culture of caring.

Goal #9: Continue to Engage Schools in Communities in which Dresser-Rand Employees Work to Foster Education

Dresser-Rand has existing relationships with several colleges located in various countries. By sponsoring programs and actively contributing to technical schools or colleges, Dresser-Rand can do two things. One, create learning and skills development opportunities for students. And two, get to know students who could potentially be future Dresser-Rand employees.

GOVERNANCE

The focus within the governance realm includes protecting the company's reputation and goodwill, abiding by laws

(continued on page 20)

NUCLEAR POWER DEVELOPMENT REQUIRES HYDROLOGIC EXPERTISE

SAFE, EFFICIENT, COMPLIANT OPERATION IS ALL ABOUT THE WATER

BY DIANE YEAGER, LEGGETTE, BRASHEARS & GRAHAM, INC



Nuclear power generated 19 percent of the United States' electricity in 2012 and 12.3 percent of the world's electricity in 2011, according to the Nuclear Energy Institute (NEI). While several U.S. nuclear power plants have elected to decommission, two new plants are currently being constructed, one in South Carolina (V.C. Summer) and the other in Georgia (Vogtle). Additionally, there are nine combined operating license applications (COLAs) under review by the U.S. Nuclear Regulatory Commission (NRC). Nuclear power is expected to be an integral part of the U.S. base-load energy portfolio throughout the 21st century. As water plays a crucial role in nuclear power, in the generation of electricity, hydrologic expertise is critically important for the safe design, siting and environmental compliance of nuclear power plants.

WATER RESOURCES: AVAILABILITY, QUALITY ARE KEY

The U.S. Geological Survey (USGS) reports that in 2005, about 201,000 million gallons of water each day were used to produce electricity (excluding hydroelectric power), and surface water was the source for more than 99 percent of total thermoelectric-power withdrawals. In 1995, the USGS estimated that thermoelectric power plants consumed about 2 percent of withdrawn water — leaving more than 97 to be returned to its natural sources. While the industry has improved cooling system designs and developed new technologies, along with the innovative use of alternative water resources to reduce freshwater consumption, these statistics highlight the fact that water availability and water quality are still essential to a power plant's ability to operate efficiently, maintain compliance

with the Clean Water Act (CWA), and minimize water consumption.

With the exception of the Palo Verde Nuclear Power Plant (located in the Arizona desert), which gets its water from the nearby Phoenix municipal waste water, nuclear power plants in the U.S. use surface water for their operations, and thus are located on large reservoirs of water, or along the nation's coastlines. While surface water may be the primary water resource for the majority of nuclear power plants, the interrelationship between surface water and groundwater must be carefully evaluated. The NRC, the licensing agency for new plant construction and for license renewals of existing plants in the U.S., utilizes a conservative bounding approach to site-specific evaluations — and is viewed worldwide as the gold standard. The NRC requires an accurate hydrogeologic conceptual model of the plant site to ensure design safety of the facility and identify any potential environmental impacts. Prior to the NRC granting an operating license, a comprehensive review of the applicant's hydrologic safety evaluation, including a hydrogeologic model, is conducted by the NRC's Subject Matter Experts (SMEs). This process typically takes at least three years to complete. Of the nine COLAs currently under review by the NRC, eight were docketed for review before January 2009.

HYDROGEOLOGIC MODELS AND HYDROLOGIC ANALYSIS

The NRC's review methodology for the safety and environmental sections of nuclear power plant applications is published in NUREG 0800 Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants and NUREG 1555 Standard Review Plans for Environmental Reviews for Nuclear Power Plants, respectively. The NRC reviews groundwater conditions to assess the effects of groundwater on plant foundations and the impact of postulated leaks of contamination into the groundwater. Explicitly, aspects of NUREG 0800 guidance include the "... identification of the aquifers and the type of onsite groundwater use, the sources of recharge, present and future withdrawals, monitoring and protection requirements, and design bases for groundwater levels and hydrodynamic effects of groundwater on safety-related structures and components. Flow rates, travel time, gradients, other properties pertaining to the move-

ment of accidental contamination, and groundwater levels beneath the site are reviewed, as are seasonal and climatic fluctuations, or those caused by man, that have the potential for long-term changes in the local groundwater regime." For standard design certification (Design Control Document) applications, design groundwater levels are specified in the site parameter envelope and must also include the site-specific plant design of a COLA.

As professional groundwater and environmental engineers with expertise in water and groundwater modeling, Leggette, Brashears & Graham, Inc. (LBG) hydrogeologists have served as SMEs to the nuclear power industry by providing technical expertise for hydrologic evaluations, including the review and evaluation of hydrogeologic conceptual and numerical models.

Hydrogeologic numerical models are typically simulated using quantitative software such as MODFLOW. LBG SMEs are currently providing a third-party review of a MODFLOW model with a Groundwater Modeling System (GMS) visual interface, which includes a three-dimensional visualization of the post-construction excavation geometry. The hydrogeologic model utilizes pre-construction water levels measured at the site to provide the basis for the post-construction groundwater elevation. The hydrogeologic model must precisely assess any subsurface pathways that could potentially serve as preferential transport mechanisms for a postulated release of radionuclides to the nearest groundwater and surface water body. The pathway that provides the most rapid transport to a receptor is considered as the bounding condition. Plant design parameters must be able to meet bounding conditions or design controls, and/or modifications will be proposed.

Employing the same standards as the post-construction groundwater conditions and pathway evaluation, the Probable Maximum Flood (PMF) elevation is a hydrologic analysis that is essential to the final plant design. The PMF elevation must employ the most conservative assumptions in order to meet the NRC's requirements for a plant's safety analysis. The safety analysis report must identify historical flooding (defined as occurrences of abnormally high water stage or overflow from a stream, floodway, lake, or coastal area) at the proposed site or in the region of the site. NUREG 0800 guidance for flooding evaluations includes requirements that an analysis "... identifies the individual types of flood-

producing phenomena, and combinations of flood-producing phenomena," and considers the flood design basis for safety-related plant features and the potential effects of local intense precipitation. Two of the U.S. Army Corps of Engineers Hydrologic Engineering Center's public-domain computer software programs, the Hydrologic Modeling System (HEC-HMS) and the HEC River Analysis System (HEC-RAS), are used to assess the potential of post-construction flooding.

ENVIRONMENTAL IMPACTS FOR PLANT WATER DISCHARGES

Upon the successful review of an applicant's Environmental Report, the NRC will issue an Environmental Impact Statement (EIS). The quality of the discharge water from the plant's cooling tower blow-down is one of the primary considerations for the EIS and must meet applicable National Pollutant Discharge Elimination System (NPDES) permit requirements and state-specific water quality standards. As the term "thermoelectric" suggests, water temperature plays a major role in determining the water resource for the cooling system, and the discharge temperature must be within the tolerance intervals for the aquatic biology of the water body. Naturally occurring concentrations of certain compounds in the cooling water intake may be concentrated in cooling tower cycles such that the conservatively estimated discharge concentrations may exceed the NPDES discharge limits or the state's standards. The conservative analysis is intended to allow the applicant to design mitigated measures that will ensure that the plant's discharge concentrations will not adversely impact the water quality of the receiving water body.

Nuclear power is a safe and reliable source of sustainable, CO₂-free base-load electricity. Nuclear power generation is an established part of the world's electricity mix, and the demand for water and the need for quality evaluations will be required well into the 21st century. The NRC's conservative and thorough review process demands that owners seek hydrologic expertise in developing accurate hydrogeologic models as well as hydrologic analysis. The reliability of site-specific data and its interpretation is essential for building accurate models — and, ultimately, the successful operation of a new nuclear energy facility.

ENERGY MONITORING

BY ALBERT A. POPE, CHAIRMAN, XTN GROUP

Financing and building a central plant, district energy system, or MicroGrid has always been complicated. In today's financial market, this process has become infinitely more complex ... at least, if you are aspiring to produce a

favorable result. There is very little financing available for a project unless the counterparties are all investment grade, the debt service coverage is around 1.5 x EBITDA (earnings before interest, taxes, depreciation, amortization), and ROI

(return on investment ROI) is at least in the high teens. Given that a developer or owner must achieve this benchmark debt service coverage and ROI, only sustainable, high-efficiency projects are feasible today. That is why a detailed continuous energy monitoring and plant optimization strategy is a critical component of the operational and financial success of a sustainable district energy or MicroGrid project.

With the movement in the industry toward expanding the use of the term, MicroGrid, to include district energy

systems, many developers, owners and operators are focusing on gas-fired combined chilled water, heat and power (CCHP), which is by far the most efficient system. Determining the feasibility of such a system requires an accurate engineering and economic analysis. Realizing the system's potential efficiency requires the wherewithal to optimize its operation — and that requires accurate, detailed continuous operating data and engineering analysis.

INFORMATION IS POWER

One of the challenges developers, owners and operators have always had in developing district energy systems — and a pitfall to financial and operational performance — has often been the lack of accurate, detailed continuous operational data. A project may “work on paper,” but long-term sustainable performance depends on the integration of two levels of data — building environmental conditions and demand for hot water, steam, chilled water and electricity — and operating the equipment and making adjustments to ensure that the system is operating at maximum efficiency.

Many owners and operators have a misperception that a building automation system (BAS) is sufficient to provide accurate data, and that staff have the information and expertise required to make the appropriate adjustments. In our experience, equipment meters may not be properly calibrated, so they may be putting out inaccurate readings; in many cases, staff are required to walk around with handheld check meters. Moreover, these procedures are rarely performed more than twice a day, at best, or may be deferred until occupant complaints or equipment failures require immediate corrective action. Owners and operators typically see only retrospective operating reports, which are based on meter readings and utility bills. As a result, plant performance may suffer and owners lose money before a problem can be corrected. This problem is often compounded if night-crew staffing is reduced.

A 10-15% REDUCTION IN ENERGY USAGE

The solution is continuous monitoring of key facility indicators using the existing BAS and power measurement systems. An independent continuous energy monitoring and verification firm can provide detailed energy oversight, analysis and optimization strategies to the owner's facility engineers and staff. As a result, facility services personnel have the wherewithal to identify and resolve HVAC issues to ensure stable demand and the appropriate environment for occupants and enterprise-critical equipment, such as data systems. Moreover, with better optimization of the HVAC system, an owner has the potential to reduce energy usage, in my experience, at least 10% to 15%, and often much more.

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METHODOLOGY FOR VALUING STORAGE

BY BEN KAUN, ELECTRIC POWER RESEARCH INSTITUTE



The Electric Power Research Institute (EPRI) has developed an innovative methodology for identifying and quantifying value for grid energy storage opportunities. The EPRI Energy Storage Valuation Tool (ESVT) was developed to support this methodology and enable preliminary cost-effectiveness analysis prior to more resource-intensive analytical efforts. An EPRI report describes results from the application of EPRI's valuation methodology and supporting software to analyze cases in California, informing stakeholders of the California Public Utility Commission (CPUC) Energy Storage Order Instituting Rulemaking (OIR) Proceeding, R. 10-12-007. In total, EPRI investigated the value of storage in approximately 30 different scenarios.

BACKGROUND OF ENERGY STORAGE VALUATION

Energy storage valuation for grid use cases has historically been challenging, due to unique technology attributes, future technology cost and performance uncertainties, and regulatory challenges. EPRI has developed a method for clarifying analytical stages of storage valuation and developed the Energy Storage Valuation Tool (ESVT) software to support this methodology by enabling user-friendly, customizable, and transparent storage value analysis.

Energy storage has unique advantages and limitations, and it does not fit neatly into the existing electric system asset categories. Conventional assets for the electric grid generally can be classified as generation, transmission, or distribution, and existing policy, regulation, and even technical tools have evolved around these distinctions. Fossil power plants are distinctly generation, and wires and transformers are distinctly transmission or distribution, depending on voltage class. In contrast, energy storage systems may be located on either the transmission or distribution network (or on the utility customer premise), and they have characteristics that sometimes bring value to generation and other

times to transmission or distribution. As a result, it is often not possible to benchmark storage clearly with identical size, usage, and location against a conventional grid asset. Furthermore, there are business cases and regulatory complexities. Generation is deregulated, and generation companies make their business cases in the California Independent System Operator (CAISO) market, where transmission and distribution assets earn a regulated return on investment. The owners of these assets differ as well; independent power producers (IPPs) own most of the generation assets, and investor-owned utilities (IOUs) own most T&D assets in California.

METHODOLOGY FOR ENERGY STORAGE VALUATION

EPRI has developed a methodology for valuing storage. This method enables the investigator to determine value of the distinct services offered by storage, rather than trying to simply compare energy storage to a dissimilar asset like a fossil generator or power line. The four step methodology includes 1) identify distinct grid services, requirements, and benefits; 2) define feasible use cases of multiple compatible services and their direct benefits and costs (enabled by ESVT software); 3) quantify local and regional grid impacts of storage use cases; 4) calculate real world business cases for energy storage.

The analyses in the CPUC report focus on the first two steps of this methodology. The results for storage cost-effectiveness provide a comparison of direct, quantifiable benefits versus costs to all parties benefiting from storage operation, on a net present value basis. It is an analysis of the technical potential of energy storage operation to provide multiple services to the electric system. CPUC results do not consider: 1) the indirect impacts of storage deployment levels on market prices, operation of other assets, or greenhouse gas emissions; 2) third-party business models, or regulatory considerations that may limit real-world owner value.

The goal was to understand cost-effectiveness and operation of energy storage with different assumptions including: 1) different energy storage technologies and configurations; 2) different technically compatible grid service combinations; 3) different storage installation locations; 4) future electricity market conditions; and 5) different installation years (2015 and 2020). This information helps investigators to screen a large number of potential cases, prior to embarking on resource-intensive exercises in network and production cost modeling.

THE ENERGY STORAGE VALUATION TOOL (ESVT)

To provide the capability to screen the cost-effectiveness of energy storage at sufficient granularity, EPRI developed the Energy Storage Valuation Tool, with the development assistance of Energy and Environmental Economics (E3). This software tool was used to produce all results in the report. The ESVT utilizes three main categories of input data to simulate storage operation and provide cost-effectiveness results: 1) grid service technical requirements and benefit calculation defined by electric system need; 2) financial characteristics of the storage project owner, including discount rate and tax assumptions; 3) cost, performance, size, and configuration of a storage system technology. The ESVT uses the provided information to simulate storage operation to meet all technical requirements of the grid services and maximize value to the electric grid. The tool can provide a number of outputs from the simulation, including lifetime, annual, daily, and hourly cost-benefit and storage system operational performance.

LIMITATIONS OF THE ESVT

The EPRI Energy Storage Valuation Tool was not designed to capture all of the environmental or societal impacts associated with deployment of energy storage on the grid. Understanding these benefits requires more detailed electricity system modeling.

HOW THE ESVT CHANGES THE LANDSCAPE

Currently there are gaps in the existing tools to evaluate the economics of energy storage. Existing grid operational and planning tools have been modified in an attempt to value storage, but they have not been specifically designed for storage valuation. Existing tools do not consider all potential value streams of energy storage, because they do not combine customer, distribution, transmission, and generation services for energy storage. Due to a large number of storage technologies, potential sites, and services, existing network modeling tools are too unwieldy to look at the full scope of energy storage opportunities.

The ESVT overcomes these limitations. It provides an accessible tool to utilities, regulators, and energy storage technology developers to determine what storage should do, where it should be located, which technology should be used, and under which future scenarios it makes economic sense.

Stakeholders in the CPUC storage proceeding identified several different potential use cases of energy storage. For transmission connected energy storage these include bulk storage system (aka peaker substitution) and ancillary services.

Distributed storage sited at utility sub-

station was also investigated. Due to resource constraints, the CPUC prioritized scenarios based on perceived potential for high value and ease of adaptation to the ESVT.

Inputs to the ESVT analyses were provided by the CPUC technical staff with an industry stakeholder group, including the California Energy Storage Alliance (CESA), Pacific Gas & Electric (PG&E), San Diego Gas & Electric (SDG&E), and Southern California Edison (SCE).

Validation of inputs was not part of EPRI's scope in the analyses.

Summary results from the analyses were provided to CPUC below in two primary forms: 1) benefit-to-cost (B/C) ratio and 2) break even capital cost. B/C ratio is the net present value (NPV) of all direct, quantifiable benefits divided by the NPV of the direct, quantifiable costs of a defined energy storage system providing specific grid services over its lifetime. Break even capital cost is the estimated upfront capital cost of a storage system with certain defined performance characteristics, which would result in a B/C ratio of 1, or breakeven net present value. The actual capital cost of different storage systems may vary widely, but the potential value may vary widely, too. This table summarizes all cases, including those with project start years in 2015 and 2020, but all break even capital costs are adjusted for inflation and displayed in 2013 dollars.

At the summary level, under the cost and performance assumptions assumed by the CPUC, most analysis runs return B/C ratios of greater than 1.

Across the three use cases considered, it is difficult to draw strong conclusions about the relative cost-effectiveness between use cases. A disproportionate number of cases investigated the bulk storage use case.

1. Some of the other key conclusions from the analysis include: Storage system rated capacity duration of 2 hours exceeded cost-effectiveness of 4 hours for assumed "base case" battery storage system

2. Storage system durability was material to cost-effectiveness. A storage system 10 year usable battery life had substantially better cost-effectiveness than 5 year usable battery life.

3. Frequency regulation service provided a significant proportion of the value in most cases. Cases with a 2x price multiplier for assumed (FERC 755) "fast regulation" provided by battery storage returned significantly higher B/C ratios.

In a case with no regulation service value, spinning reserve value filled a portion of the lost value, but an overall significantly lower B/C ratio.

4. High CAISO energy and ancillary service price increases over time resulted in more cost-effective results for energy storage.

5. Energy storage projects beginning operation in 2020 were more cost effective than 2015, due primarily to assumed technology cost reductions and higher values for capacity, energy, and ancillary services.

PRIVATE CAPITAL FOR RENEWABLES

BY NOAH GINSBERG, ACORE

WASHINGTON, DC - The American Council On Renewable Energy (ACORE), California Clean Energy Fund, and Climate Policy Initiative issued a study

titled "Strategies to Scale-Up U.S. Renewable Energy Investment." It highlights the role of policy at the state, federal, and regulatory level in unlocking

record levels of private capital in the industry during the past decade and explores policies that would significantly increase private capital into renewable



energy development.

Since 2004, the private sector has invested more than \$300 billion in the U.S. renewable energy market, and as a result there has been a great increase in job creation, project development, and cost reduction.

RENEWABLE PORTFOLIO STANDARDS

The study goes into detail about ways state and federal policies can work together to create a strong policy framework for renewable energy financiers and finds that state policies such as Renewable Portfolio Standards (RPS) have effectively leveraged over a hundred billion dollars in private investment into the 29 states with RPS policies. "Just look at the past two years and you'll see that we've had the best two years on record for private investment in the industry," said Dan Adler, Managing Director of the California Clean Energy Fund (CalCEF).

MASTER LIMITED PARTNERSHIPS

The study also explores how federal policies play an important role in leveraging private dollars into renewables. Garnering more low-cost capital remains a priority for the industry and a problem that can be resolved with tweaks in the tax code, opening up Master Limited Partnerships (MLPS) to renewables and strengthened policy aimed at increasing private sector cash flow into the industry. "The next step is to drive low-cost private investment - and to do so as cost-effectively as possible," added Uday Varadarajan, a Senior Analyst at Climate Policy Initiative.

"We're at an important juncture," said Todd Foley, Senior Vice President of Policy and Government Relations at ACORE. "Energy tax policy is at the crux of important discussions occurring in D.C. right now and these issues will shape America's energy future."

Existing tax policies continue to be successful in driving private capital investment. And renewable energy access to MLPs and Real Estate Investment Trust (REIT) policies would make available even larger sources of private capital needed for scale-up. We must get this right."

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NRG, SIEMENS REPOWER CONTINUED FROM PAGE 1

NRG was originally issued a license in 2005 for a 630 MW, ocean-cooled baseload plant, but elected to redesign to an air-cooled, rapid-response, 550 MW plant. CEC granted approval in July, 2010. Construction began in May, 2011. The new design included two 280-MW Siemens SCC6-5000F Flex Plant 10 combined cycle power islands. Air-cooled condensers replaced the once-through cooling system. Fortuitously, NRG moved ahead of the 2010 state regulation that requires all once-through cooling systems be removed or replaced by 2020.

The air cooled system allows closed-loop circulation of cooling water. Water/steam cycle wastewaters are recycled back to the single-pressure reverse osmosis water storage tank where they are diluted for reuse as evaporative cooler makeup or reprocessed by mobile demineralizers. A zero liquid discharge system has been added to all wastewater discharge from the facility. The West Basin Municipal Water District is providing through an underground pipe the reclaimed water used as feedwater for the steam turbine and the landscaping. Water for domestic use and for firefighting is being provided by the City of El Segundo.

The project involved the removal of units 1&2 at El Segundo and developing two trains of fast start, highly efficient combined cycle power plants. These units are ideal for responding to peak demand and have the capability to provide efficient base-load generation as well. Capable of providing about more than half of its power generation capacity in 10 minutes, these new units are ideal as back-up to California's non-dispatchable renewable generation.

For El Segundo, Siemens delivered two power islands with each featuring the main components: an SGT6-5000F gas turbine; an SST-800 steam turbine; an SGen6-100A generator; an SGen6-100A-2P generator as well as a heat recovery steam generator, and an air-cooled heat exchanger. Siemens also supplied the complete electrical equipment and the SPPA-T3000 power plant instrumentation and control system. The company also provided the engineering services and commissioning of the plant.

EL SEGUNDO REPOWERING

Plant start-up times are significantly reduced by introducing and integrating fast-start features, including the single-pressure HP drum heat recovery steam generator (HRSGs), full capacity steam bypass systems, and innovative piping warm-up strategies. The plants will provide high power density while requiring a relatively small plant footprint. The unique small footprint air-cooled heat exchanger allows these plants to use 90% less water than traditional ramping solutions, and meets the



Siemens dedicated El Segundo in California on September 12th.

standards of the once-through cooling initiative in California. The Siemens SPPA-T3000 control system provides an easy-to-use control platform for the entire combined cycle power plant. Its fast start capability delivers over half of the plant's power in 10 minutes and the balance of power in under an hour. This can result in a carbon monoxide reduction of over 200 tons per year when compared to traditional F-class combined cycle plants.

Fast start combined cycle technology does more than offer fast power to the grid. It makes the plant's start up emissions lower. This technology avoids holding the gas turbine at low load to start, so you ramp up to a low emissions point very fast. This results in 89% less CO per start and 95% less NOx.

NEM's DrumPlus™ HRSGs are part of the Siemens power island at El Segundo. Allowing the Siemens SGT6-5000F gas turbines unrestricted ramp up, NEM's ultramodern HRSGs are vital for flexible operation of the plant. The innovative HRSG design allows the Flex-Plant™ 10 to meet the challenging emission regulations for the California power market. El Segundo is one of the first sites to incorporate Siemens Clean-Ramp™ technology which keeps stack emissions low while ramping fast. Plants without Clean-Ramp experience increased emissions during fast transients. This

technology keeps the operation clean even when the plant is changing load constantly to compliment renewables.

SITE SAFETY

In partnership with NRG, Siemens followed a detailed safety program for the site. Siemens Project Manager and Project Engineer independently conducted and documented a formal site Safety Walk at every site visit. There were also regular site audits to assure adherence to Siemens and site procedures and prompt action and resolution for any quality incident reports.

DELIVERY ON SCHEDULE

All OEM equipment for El Segundo was delivered ahead of construction plan. Siemens assigned a factory load planner to monitor the manufacturing of the gas turbine and steam turbine for all projects to resolve any schedule issues.

Siemens also assigned a project specific specialist to support needs for parts and services. For El Segundo, they developed a logistics plan for special rail car usage and transit clearance and routing to ensure the gas turbine and the generator delivery to site without schedule delays including steam turbines 63 days early, gas turbines 3 days early, HRSGs 42 days early and air cooled heat exchangers (condenser) 21 days early.

TRAINING

NRG personnel received classroom, hands-on operating and maintenance training on site and on the simulator in Orlando. Over 20,000 plant operators have been trained by Siemens since 1990.

Siemens has implemented nine large scale gas turbine projects in California since 1997. The Siemens Energy Solution Portfolio is designed as an environmentally friendlier way to meet the needs of markets with diverse generation and is being widely dispatched in California. From the fast start simple cycle and gas turbines at Marsh Landing to the Flex-Plant 10 combined cycle plants at El Segundo and the Flex-Plant 30 Combined Cycle plant at Lodi, Siemens solutions fit the needs of California with high efficiency for low cost generation, flexibility for fast dispatch, and low emissions for a clean environment.

Siemens has successfully completed over 330 projects worldwide and procured over 70 HRSGs globally since 2000. In the Americas, over 105 turnkey projects have been completed.

NRG is a Fortune 500 Company and is the largest IPP with 47,000 MWs. Last December, NRG and Genon, formerly Mirant and RRI Energy, merged.

14 SUSTAINABILITY GOALS

CONTINUED FROM PAGE 14

and regulations, and encouraging ethics and safety in the workplace.

The five key goals specifically geared toward governance for 2013 are:

Goal #10: Enhance Subsidiary Governance and Compliance through the Implementation of an Entity Management Software Platform

Dresser-Rand has undertaken a process to ensure that all subsidiaries are following corporate governance policies and to make sure they are compliant with the company's internal controls policies and procedures.

Goal #11: Initiate Participation by Dresser-Rand Manufacturing Facilities in the U.S. Customs-Trade Partnership against Terrorism Initiative

The Customs-Trade Partnership against Terrorism (C-TPAT) is a voluntary program between companies and the U.S. Customs and Border Protection agency.

The goal of the program is to improve supply chain security with respect to goods imported into the United States. To participate in the program, a company must assess its supply chain processes and meet required C-TPAT security criteria.

Members of the program benefit from membership in expedited customs clearances, fewer inspections and reciprocity from other governments with similar programs. Also there is the general industry acknowledgement of meeting recognized security criteria.

Goal #12: Monitor and Respond to Regulatory Developments Relating to Governance and Disclosure Issues

This is an ongoing goal at Dresser-Rand to ensure that the company follows all the government requirements and disclosures related to investments.

The recent Dodd-Frank Wall Street Reform and Consumer Protection Act, for example, have a variety of investor disclosure changes that Dresser-Rand needed to implement.

Goal #13: Implement the Process Control Points Developed in 2012 for Most of the Company's Major Product Lines

In 2012, Dresser-Rand developed critical process controls for key work streams for most of the company's major product lines. While this is an ongoing goal at Dresser-Rand, process controls will be implemented in 2013 to ensure that the company's operations follow a specific process control program consistently corporate-wide.

Goal #14: Implement an Upgrade Release of the Oracle System

In 2012, Dresser-Rand implemented Oracle, an ERP software system, in Canada. After its success in Canada, Dresser-Rand will gradually expand the GSP further in 2013. The goal is to have a singular process that encompasses the entire organization.

ABOUT THE AUTHOR

Greg Stubbs is the Global Director of Sustainability & HSE Process Innovation for Dresser-Rand and a member of Dresser-Rand's corporate Sustainability Council with 30 years of professional health, safety and environmental experience in government and private industry.

Other members of Dresser-Rand's Sustainability Council also contributed to this article including: Ann Ackerso, Vice President, Supply Chain Management Worldwide; Asier Alea, Director of Strategy; Blaise Derrico, Vice President, Investor Relations; Mark Mai, Vice President, General Counsel & Secretary; Gustavo Nechar, Vice President, Human Resources; Peter Salvatore, Vice President, Chief Safety Officer; Greg Stubbs, Global Director, Sustainability & HSE Process Innovation; Scott Wisler, Director, Centers of Technical Excellence.

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according to the *Medium-Term Renewable Energy Market Report*. As such, by 2018, the report estimates that renewables will make up a quarter of the world's energy mix, up from 20 percent in 2011. In fact, it is projected that renewable energy will edge out natural gas as the second biggest source of electricity, after coal, by 2016, according to the International Energy Agency (IEA).

Unfortunately, all renewable energy is not equally as beneficial for our fragile ecosystem, as environmentalists and sustainability experts are quick to point out. Hydroelectricity, which represents roughly 80 percent of renewable capacity, has no impact on air quality but requires the construction of dams that can have a negative impact on natural river systems and their fish and wildlife.

Non-hydroelectric sources, such as wind and solar, are a much smaller but rapidly growing portion of the global mix:

- In 2011, non-hydroelectric technologies were just 4 percent of the world's energy supply. This number is expected to double by 2018.
- In 2011, there were fewer than 200,000 wind turbines worldwide. By 2020, wind power is expected to produce 9.1 percent of the world's electricity demand. "By 2030, the market could be three times bigger than today... A new turbine every seven minutes — that's our goal." — Sven Teske, Senior Energy Expert from Greenpeace International. The strongest growth is expected to be in China/Asia.
- According to IEA analysis, under extreme assumptions solar energy could provide up to one-third of the world's final energy demand after 2060.

Generation and growth of renewable energy varies widely from one country to another. According to the IEA, developing countries, led by China, will account for two-thirds of the global increase in renewable generation. Growth in much of Europe and the U.S. is expected to slow, although President Barack Obama's plans released this summer may encourage renewed investment in renewable sources. Germany is also an exception. The German government's Renewable Energy Source Act (EEG) promotes renewable energy by allowing people to produce and sell renewable energy to the power grid at fixed prices for a period of 15-20 years. Through the EEG Act, the German government's goal is to achieve 35 percent renewable generation by year 2020.

According to the IEA, policies to decarbonize electricity systems have served to magnify investment risk and uncertainty. At the same time as renewable

support schemes have proven effective in facilitating deployment of wind and solar photovoltaic, they also introduce new challenges to design a stable regulatory framework and well-functioning markets.

While it is easy to support renewable energy sources because they are environmentally friendly, they also pose a potential problem. An article by Reuters hints at the question on everyone's mind... With 40,000 MW+ of wind or solar power at its disposal, what could happen on a wind-free, overcast winter day?

TODAY'S RENEWABLE LANDSCAPE: TOO MUCH OF A GOOD THING?

While renewable energy sources deliver powerful environmental benefits, some, such as solar and wind, are volatile sources of power with inherent intermittencies. Wind power is affected by wind speeds, wind temperature/air density, and turbine characteristics, among other factors. Intermittency also affects solar energy. Solar output varies throughout the day and by season, as well as cloud cover. The more we increase our reliance on renewable energy, the more susceptible we become to such intermittencies.

In the U.S., our increasing appetite for power and our aging infrastructure further compromise reliability. Power outages are a significant problem today in the U.S. A 2012 Ernest Orlando Lawrence Berkeley National Laboratory study, entitled, "An Examination of Temporal Trends in Electricity Reliability Based on Reports from U.S. Electric," analyzed 10 years of electricity reliability information collected from 155 U.S. electric utilities (accounting for roughly 50 percent of total U.S. electricity sales). The study reported "reliability is getting worse, on average, over the [past] 10 years."

Decreasing reliability and increasing outages cost consumers and businesses money. According to the U.S. Environmental Protection Agency (EPA), "cost of a service interruption varies by customer and is a function of the impact of the interruption on the customer's operations, revenues, and/or direct health and safety." In one study, Pacific Gas & Electric Company (PG&E) estimated the total annual cost of power outages to its customers at \$79 billion per year.

These fluctuations can impact the stability of the power grid as a whole, potentially leading to widespread blackouts. According to a joint report by Allianz insurance company and the Chief Risk Officer Forum, an action-focused Independent Industry Network of 13 European insurance companies, aging infrastructure combined with cross-

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border electricity networks have “heightened the likelihood of a devastating collapse of power supplies lasting months and covering several continents.” Furthermore, leading risk analysts modeled a worst-case scenario in which transformers are knocked out in the U.S., causing outages to cascade through the grid into Canada, Russia and Scandinavia. In this scenario, electronic banking services would stop immediately, and gasoline pumps and refineries would shut-down within six hours and back-up generators powering hospitals, stock exchanges, emergency services and sewerage plants could run out of fuel within days. Longer lasting blackouts could create significant impacts on society and economy. The analysts even wrote about “supra-national blackouts” with even larger economic losses. These outages could be triggered by cyber attacks, terrorist action, natural disasters or even solar storms.

ENERGY STORAGE: THE BUFFER ZONE

So how do we avoid these worst-case scenarios? Energy storage can provide the solution by serving as a buffer or shock absorber. Frost and Sullivan’s research predicts “electric energy storage technologies will be an inseparable part of smart grids and distributed energy generating systems in the future.” This is coming to bear as electric utilities already are among the largest owners and users of electrochemical battery systems.

Choosing the right energy storage can be challenging, however. It is important to understand where the storage is needed and the role it will play in each position within the energy delivery system.

Generation: At the point of generation, energy storage can help support peak generation capacity deferral, energy arbitrage and spinning/non-spinning reserve requirements. It also can serve as an intermittency buffer for renewable integration and to regulate service support (frequency and volume). Batteries have evolved in recent years and there is a wide selection of cost-efficient, reliable and familiar energy storage solutions, including flat plate and tubular lead acid batteries, to meet a wide range generation and integration needs.

T&D: On the transmission side, energy storage provides fast relief for congestion by subsidizing loads in congested areas (downtown NYC). It also enables capital deferral. Meanwhile, energy storage can improve the distribution system efficiency through power factor correction, reducing system losses and providing more stable voltage for sensitive customers while maximizing asset utilization by reducing current needed to supply electrical loads.

However, the greatest challenge is

likely to come from the duty cycle to which these batteries will be exposed. A typical energy storage installation on the T&D side must be capable of handling frequent discharges to the grid and frequent charging cycles from the grid. It is important to choose a battery that is optimized to handle these short, recurrent cycles. There are several battery systems that are capable of meeting these demanding conditions. When selecting an energy storage supplier, beware of those that claim to be “battery agnostic.” The right vendor should be “battery intelligent” and be able to discuss how to treat the battery, how to measure the battery charge and how to proactively manage the battery system.

Consumer: At the consumer’s residence or business, energy storage can provide back-up power for use during renewable downtime and to improve power quality by augmenting existing energy supplies. Selecting the right-sized battery is one of the most critical decisions in setting up backup storage for all energy storage systems including residential or commercial renewable system. However, when factors, such as cost, play a big role, proper sizing sometimes takes a back seat. It’s no surprise then that one of the most common mistakes in battery selection is the improper sizing of the battery. This occurs when the installer miscalculates the number of days of autonomy and the size of the renewable generation needed to support the load and charge the batteries.

The most important rule is that “energy in” must be greater than “energy out.” Without enough power generation in the system, the batteries become depleted. With no recharge period, they plateau and then discharge again, creating a downward “stair step” cycle pattern. For example, continuously discharging lead acid batteries greater than 80 percent will cause the battery life to decrease. Therefore, the more cycles anticipated, the lower the depth of discharge (DOD) should be designed into the battery system. For maximum investment, it is best to not discharge the battery more than 40 to 50 percent in a diurnal system.

ENERGY STORAGE PROFILE: FIVE POINTS TO SELECTING THE RIGHT SOLUTION

The key to choosing the right energy storage solution is a solid understanding of the application at hand. Following are five key decision-making factors to help develop a clear profile of the application:

Performance: The first step is to determine whether the user needs to generate power and/or store energy. Also, it is important to identify other performance requirements that need to be

addressed, such as increasing reliability, improving power quality and/or integrating renewables. The user also needs to have a firm idea of how much capacity is needed and how quickly it needs to respond to a signal to dispatch/absorb (reaction time).

Period (Cycle Life): In some applications, long life cycle is critical; in others, it’s costly overkill. Lithium ion batteries, for example, can offer more than twice the life cycle of a lead acid battery. However, at almost five times the cost, it is only cost-efficient for those applications in which size, weight and longevity make it absolutely necessary.

Three factors impact cycle life and must be considered when choosing the right chemistry:

- **Depth of Discharge:** There is a direct correlation between the depth of discharge and the number of charge and discharge cycles a battery can perform.
- **Temperature:** Some batteries are less tolerant of cold and/or heat; others operate at higher temperatures and need to be insulated against the cold to prevent degradation.
- **Charge:** Charging methods vary; Charge management is key, as overcharging can shorten the lifecycle.

Peril: Risk management means weighing one’s appetite for risk. With so many new technologies come safety risks. Storing energy involves understanding what to do when there is a failure, how to control it and how to avoid the potential catastrophic results. Like water in a pool, the more energy stored in a device, the more will be released in a catastrophic failure. Electrical shorts also generate heat that can spread to surrounding cells. Effective monitoring is critical. Some systems monitor individual cells, while others monitor strings of devices. The former is more effective at spotting spikes, identifying trends and avoiding failures.

Power: High energy, high cycling solutions sound impressive, but as industry engineers like to quip, not every application requires a nuclear reactor. Likewise, energy density is attractive, but it comes at a significant premium and is only required when space is limited. For example, in many applications, lead acid batteries may deliver the necessary performance requirements at greater savings than other high-energy storage solutions.

Price: Cost is a key determining factor in storage selection. Users may be surprised to find that familiar technologies may be more cost-efficient than newer solutions at addressing energy storage needs.

In addition to the five P’s, maintenance is also a key consideration. Maintenance requirements differ based on the type of technology, the amount of runtime and the physical environment. While some technologies are widely familiar, others may require hard-to-find specialists that can result in added cost and downtime.

CONCLUSION

Despite improved efficiencies, demand for electricity in the U.S. is anticipated to grow over the next few decades, with renewable energy growing faster than any other power generation sector. Our dependence on renewable energy sources is making us increasingly susceptible to power outages and other intermittencies. A buffer is needed to help maintain reliability. Energy storage can provide the solution by serving as a shock absorber against service interruptions. Today’s utilities have more choices than ever for energy storage. A good understanding of the application is the key to choosing the right energy storage solution. With a well-defined understanding of the application, users may be pleased to find that there are multiple ways to incorporate energy storage and that conventional technologies can still provide cost-efficient solutions that work.

ABOUT THE AUTHOR

Jennifer A. Eirich, is a marketing manager, Utilities/product manager, Optigrid, at EnerSys. Eirich joined EnerSys a year ago as part of the team responsible for launching OptiGrid™ Stored Energy Solutions, the company’s first utility-scale energy optimization system. Eirich has more than a decade of experience in mixing and systems engineering, previously serving as a sales engineer and project manager at Komax Systems Inc. She began her career as a territory sales manager for Philadelphia Mixing Solutions, Ltd. is one of the world’s most experienced fluid mixing equipment and process optimization firms. Eirich is a member of the U.S. Technical Advisory Group to IEC TC120 for the standardization of Electrical Energy Storage Systems. She also supports her local community as a member of Rotary International. Eirich holds a Bachelor of Science degree in Chemical Engineering from the Pennsylvania State University.

ABOUT ENERSYS

EnerSys® (NYSE:ENS), the world leader in stored energy solutions for industrial applications, manufactures and distributes reserve power and motive power batteries, chargers, power equipment, and battery accessories worldwide.

SIEMENS WIND TRAINING CENTER

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facility underscores our strong commitment to supporting the long-term continued growth of the wind industry in the Americas," said Zwirn. As renewable energy continues to grow as part of the world's energy mix, our customers depend on us for highly skilled technicians who are committed to helping insure the long-term reliability of their assets." He thanked the State of Florida and City of Orlando for their support.

The new Orlando Center has two Siemens nacelles weighing over 100 tons each inside the training center. The Siemens fleet of 2.3 MW wind turbines currently sets the industry standard for availability. The geared 2.3 MW turbines of the G2 platform are optimized for all wind conditions. The Siemens 3.0-MW wind turbines of the D3 platform embody tried and tested innovation in the field of direct drive generators.

Siemens direct drive turbines of the D3 offer innovation through the consistent implementation of a common, highly efficient generator concept. With less than half the moving parts of a conventional geared turbine, the direct drive wind turbines improve performance, reliability and maintainability. In addition, the compacted design allows for cost-effective transportation and installation.

The Siemens D3 platform offers the simplest and most straightforward wind turbine design. The gearbox is fundamentally the most complex component of a wind turbine, eliminating the gearbox reduces complexity and can increase reliability.

Replacing the gearbox, the coupling and the high-speed generator with a low-speed generator eliminates two-thirds of the conventional drive train arrangement. As a result, the number of rotating and wear-prone parts is vastly reduced compared to a geared machine. Siemens has opted for a permanent magnet generator for improved efficiency. The wind turbines of the D3 platform have a dual cooling system that provides an even cooling of the generator via a top-mounted, passive cooling system for improved energy efficiency.

Siemens offers an innovative and economically-viable tower concept to allow its wind turbines to reach heights above 100 meters. The bolted steel shell tower consists of multiple tower sections, mounted on top of each other and assembled together on site. The modular space concept of the bolted steel shell tower allows for very high hub heights (in excess of 140 meters) with very low transportation requirements.

Power conversion is implemented by the Siemens' NetConverter® system. This system is characterized by full conversion of the power generated, efficiently decoupling generator and turbine dynamics from the grid. The NetConverter® system offers maximum flexibility in the turbine's response to

voltage and frequency control, fault ride-through and output adjustment.

SIEMENS WEBWPS SCADA SYSTEM

Via a standard web browser, the Siemens WebWPS SCADA system provides a variety of status views of electrical and mechanical data, operation and fault status, meteorological and grid station data.

WIND TURBINE CONDITION MONITORING

Siemens' wind turbine condition monitoring compares the vibration levels of the main nacelle components with a set of established reference spectra and instantly detects deviations from normal operating conditions. This allows Siemens to proactively plan the service and maintenance of the wind turbines, as any unusual event can be categorized and prioritized based on severity.

TURBINE LOAD CONTROL

The Turbine Load Control system continuously monitors the structural loading on the wind turbine. In case the loads exceed normal values, the turbine automatically regulates operation to bring loads back within the design envelope. In addition, the TLC system – an optional feature of the D3 platform – monitors the accumulated fatigue loading on the turbine, thereby providing key input for fact-based asset management.

Earl Walker, who heads up training and development at the center, said at a press briefing for the media held in one of the new classrooms that one reason Siemens moved from Houston where the first training center was established in 2007, was to find a facility to house the nacelles inside in a climate-controlled setting. Another factor was it being only minutes from the Orlando International Airport, and its close proximity to Siemens corporate headquarters.

The center also has three 30-foot high climbing towers, ladder structures, electrical and hydraulic modules, and a service crane station to make training, safety and rescue simulation possible. The center will host more than 2,400 trainees annually from the Americas.

Siemens created 50 new full-time jobs associated with the training center. Twenty-five percent are currently held by military veterans.

Siemens has hired over 1,000 veterans across its US businesses and is an active participant in the White House *Joining Forces* initiative as well as *Still Serving Veterans* to increase training and employment opportunities for returning service members.

Seventeen of the new 50 full-time positions are set aside for staff trainers who initially conduct a three week basic training on site. The first week of training is devoted solely to learning safety measures, followed by a three month field training program under supervi-

sion. The trainee returns to Orlando for three weeks of advanced classroom training and laboratory work with a return to the field for 6 to 8 months. Siemens currently provides service and maintenance for more than 3,000 installed turbines in the Americas. Maintenance is performed once a year for 40 off-line hours.

Since 2007, Siemens has invested over \$110 million in wind energy manufacturing and service in North American businesses including a 300,000 sq ft Nacelle assembly facility in Hutchinson, KS; 650,000 sq. ft.

blade factory in Fort Madison, IA for more than 8,000 integral blades delivered in the Americas (See world-gen.com "Featured Articles" Sept/Oct 2007); wind turbine R&D center in Boulder, CO focusing on aerodynamics, blade efficiency and meteorology; blade factory in Tillsonburg, Ontario's first wind turbine blade manufacturing facility, and a 73,000 sq. ft. warehouse distribution and tooling facility in Wichita, KS with seven acres of outside storage.



The new 40,000 square foot, \$7 million wind service training center in Orlando.



Both nacelles were manufactured in Denmark. The 3.0 was shipped to Kansas for testing and the 2.3 was originally in Houston; both arrived in Orlando for the new center.



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