

# WORLD-GEN

[WWW.WORLD-GEN.COM](http://WWW.WORLD-GEN.COM)

## THE SHALE REVOLUTION

BY DICK FLANAGAN



Governor Mary Fallin

OKLAHOMA CITY, OK – If the states serve as incubators and laboratories for innovation, one needs to look no farther than Oklahoma for a comprehensive national energy plan.

*World-Gen* was invited to attend the 2011 Governor's Energy Conference held in the Cox Convention Center where Governor Mary Fallin unveiled the Oklahoma First Energy Plan.

"Today the nation is undergoing an energy revolution," Fallin told the 400 delegates. "Unprecedented new supplies of natural gas, a renaissance in oil production, and a newfound ability to economically capture energy from the wind are redefining the energy landscape."

Her agenda is built around the belief that we must continue to improve, not replace, traditional energy sources like oil and natural gas, and that effective energy policy does not rely on federal subsidies or mandates, but instead allows the private sector to grow and flourish.

(continued on page 21)

## SOLAR POWER 2031

BY JULIA HAMM



Welcome to the 2031 annual meeting of Tomorrow Power and Light. Our company, also known as TP&L, has often been described as "average" throughout the years. Our retail rates are average compared to our utility peers. The energy resources available in our area of the country are average, and our customers' electricity consumption is average. But I am thrilled to declare, however, that we are becoming exceptional.

Our company surpassed several significant milestones this year including the celebration of our 100th anniversary. But what I'd like to focus on is the fact that we have made history in the utility industry. I am proud to say that TP&L is the first major utility in the continental US to have solar power as the top fuel source in its portfolio, with 30 percent of our power supplied by solar energy.

Of course, we still have a well-balanced and diversified portfolio – with coal, natural gas, nuclear, wind, and other energy resources, but solar electricity is now at the top of the list. (continued on page 22)

NOVEMBER/DECEMBER 2011  
VOLUME 23 - NUMBER 5  
*Our 23rd Year*

### THE SHALE REVOLUTION

by Dick Flanagan

pg. 1

### SOLAR POWER 2031

by Julia Hamm

pg. 1

### RENEWABLES BRING MAJOR CHANGES

by Lyn Corum, Class of 2003

pg. 13

### FUKUSHIMA'S AFTERSHOCKS

by Jean-Louis Poirier, Class of 2000 pg. 14

### ECONOMICS OF EV DRIVING

by Daniel A. Potash, Class of 2001 pg. 15

### REINVENTING ELECTRICITY

by Dennis McLaughlin, Class of 2002 pg. 16

### US ARMY INVESTS IN RENEWABLES

by Roger D. Stark and Darin Lowder pg. 17

### SMART GRID PARTNERSHIPS

by David K. Owen

pg. 18

### SMARTER TRANSMISSION BENEFITS

by Paul Myrda

pg. 19

### DEPARTMENTS

#### PUBLISHER'S LETTER

pg. 3

#### INDUSTRY NEWS

pg. 4-9

#### INTERNATIONAL NEWS

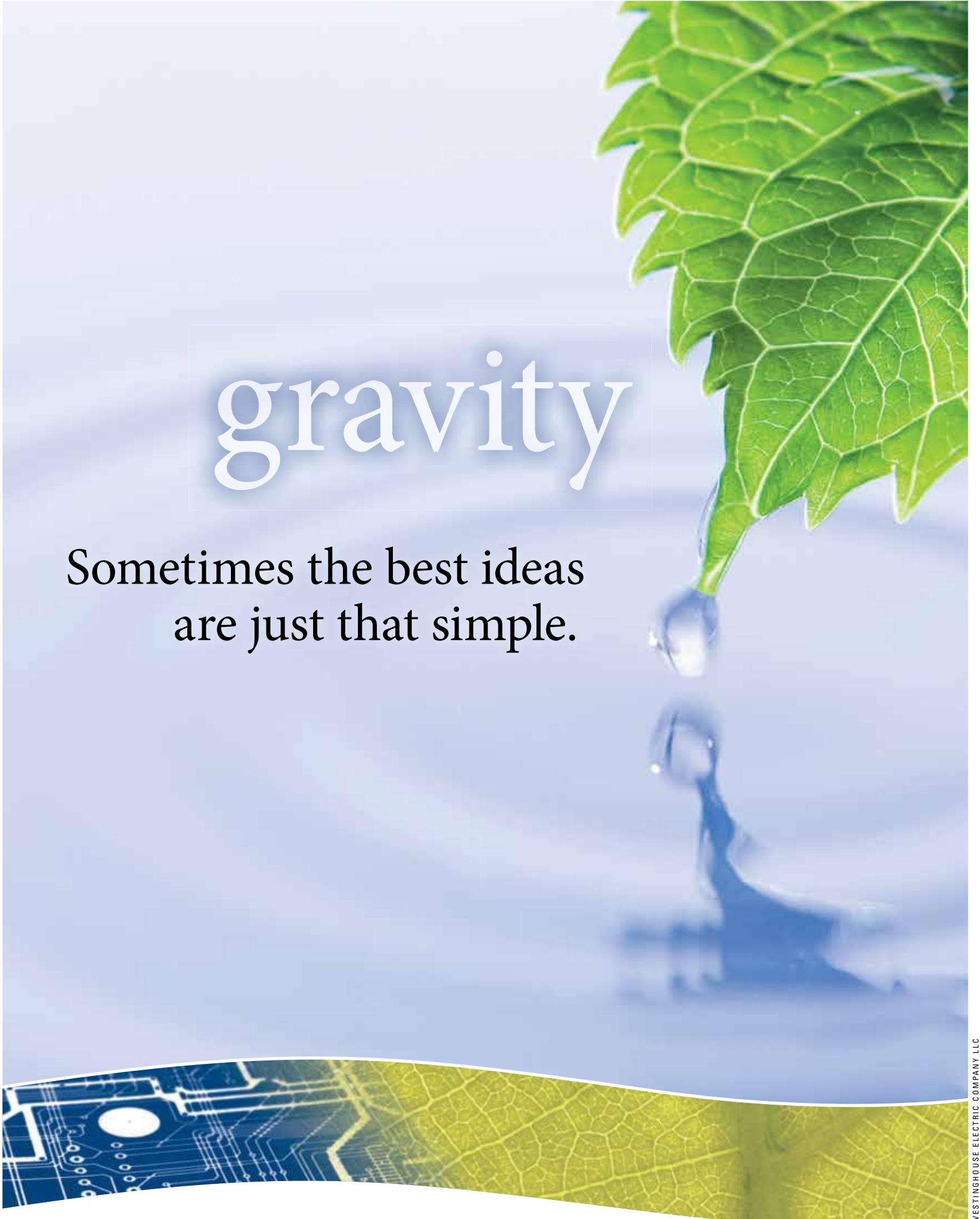
pg. 10-11

#### NEWSMAKERS

pg. 12

#### CALIFORNIA NEWS

pg. 13



# gravity

Sometimes the best ideas  
are just that simple.



**Westinghouse**

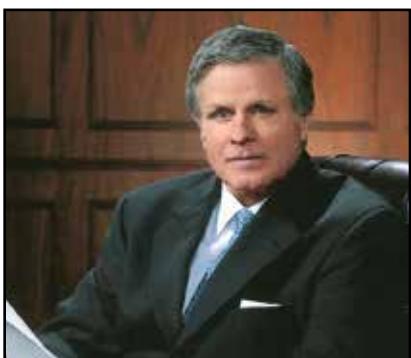
A Toshiba Group Company

You can be sure...  
if it's Westinghouse

When we designed the **AP1000** nuclear reactor, we asked ourselves which would be more reliable, multiple arrays of electro-mechanical systems or gravity. To us, the answer is obvious, which is why the **AP1000** nuclear power plant makes use of the stable forces of nature to keep the nuclear reactor safe after any unforeseen event. No need for electrical power. No need for cooling water (that is already inside the robust containment building). No need for an operator to touch a single button for a full 72 hours.

Check us out at [www.westinghousenuclear.com](http://www.westinghousenuclear.com)

WESTINGHOUSE ELECTRIC COMPANY LLC



Dick Flanagan

**WORLD-GENERATION**  
**2 PENN PLAZA**  
**SUITE 1500**  
**NEW YORK, NY 10121**  
**212.292.5009**  
**FLANAGAN@WORLD-GEN.COM**

## WORLD-GENERATION

2 PENN PLAZA ■ SUITE 1500  
 NEW YORK, NY 10121 ■ (212) 292-5009,  
<http://www.world-gen.com>

Richard T. Flanagan	Editor/Publisher
Tracy Whitman	Art Director/Design
Mary F. Kelly	Production Director
Gail E. Parentaeu	Circulation Director
Nancy Rothman	Reprints
Carol Griffiths	Europe
Alice C. Hunsberger Ph.D.	Middle-East
Brooke C. Stoddard	Washington
Martin C. Pilsch	Ports, USA

### CONTRIBUTING EDITORS

Spencer Abraham	Class of 2002
Jim Bueche	Class of 2004
Lyn Corum	Class of 2003
Ann T. Donnelly Ph.D.	Class of 2000
Tom Kuhn	Class of 2005
Jeremiah D. Lambert	Class of 2000
Colette Lewiner	Class of 2006
Fred Lyon	Class of 2003
Gene Martin	Class of 2002
Dennis M. McLaughlin	Class of 2002
Richard McMahon	Class of 2001
Ed Muller	Class of 2000
Jean Louis Poirier	Class of 2000
Daniel A. Potash	Class of 2001
Elliot Roseman	Class of 2001
Jim Reinsch	Class of 2002
Jim Schretter	Class of 2002
Richard Weissbrod Ph.D.	Class of 2000

World-Generation ISSN# 1539-0039 is published bi-monthly (except May and August) by The Flanagan Group, Inc. Corporate offices: Two Penn Plaza, Suite 1500, New York, NY 10121. Circulation office: PO Box 9157, Lowell MA 01853. Subscription rates: \$75 per year in the United States; \$100 in Canada, all other countries \$120 per year. Single copies (pre-paid) \$15.00 in the US, \$20.00 in Canada, \$24.00 all other countries. Back issues, if available, \$50.00 (US and Canada only). Add \$3.85 for shipping and handling. Mailed periodicals postage class paid in New York, NY, 10121 and additional mailing offices. Volume 23, number 5, copyright 2011 by the Flanagan Group, Inc. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means without written permission of the publisher.

Postmaster: Send all address changes to:  
 World-Generation  
 PO Box 9157  
 Lowell, MA 01853  
 Membership held in: BPA Worldwide  
 American Society of Business Publication Editors  
 National Press Club, Washington, DC



*World-Gen was invited to attend the 2011 Governor's Energy Conference in Oklahoma where Governor Mary Fallin unveiled the Oklahoma First Energy Plan, a comprehensive blueprint for the state's energy future. Key strategies include: increase NGVs; develop the Keystone XL Pipeline; support safe hydraulic fracturing; implement a new energy efficiency initiative; increase energy production in renewables and expand transmission.*

*In 2012, more than 3,000 veterans in Oklahoma's National Guard are scheduled to return home. As they return home from Iraq, Afghanistan and other locations overseas, she'll work with career technology centers to place them at good jobs in the energy sector, where many of their skills are transferable to private sector jobs. Governor Mary Fallin is the first woman to be elected Governor of Oklahoma. She served two terms in the Oklahoma House before becoming the first woman and first Republican to be elected Lieutenant Governor of Oklahoma in 1994. In 2006, she was elected to the US Congress. Coverage starts on page 1.*

*Julia Hamm, CEO of the Solar Electric Power Association, led the SPI 2011 audience twenty years into the future with her vision about solar energy in 2031. Hamm stressed the importance of collaboration between the solar industry and utilities to make her vision of 2031 a reality, on page 1.*

*Lyn Corum reports on page 13 that California needs peaker plants to handle the intermittency of renewables. Utilities must bring 33 percent renewables into the state's grid by 2020. 17,000 megawatts of renewables are planned and Cal ISO manages twice that.*

*The Fukushima disaster will have some serious impact on the global nuclear industry, Jean-Louis Poirier writes on page 14. He foresees three specific outcomes: a safer operating fleet, as a result of a worldwide call for enhanced standards and plant reinforcements; a notable reduction in new reactor building activity; and an interest in new reactor technology, including small modular reactors (SMRs) and next generation (Gen IV) reactors.*

*The EV trends have been very much supportive, said Dan Potash who reported three years ago. One of the trends supporting electric cars is the proposed curtailment rules for wind generators that reduce or eliminate the market value of off-peak power. For that and other reasons, it's time to take another look at electric cars and consider if this is not the most significant development, and opportunity, facing the U.S. power sector, he suggests on page 15.*

*Dennis McLaughlin, Class of 2001, covering Schneider's Electric 2011 Energy and Distribution Conference in Chicago points out on page 16 that the nation entered the electric economy. In 1950 only 20 percent of US GDP was dependent of electricity compared with more than 60 percent of the country's GDP reliance on electricity today. Just as the US economy grew with easy access to reliable, cheap petroleum in the 20th Century, the nation will need to key-in on the value and role of electric power to maintain its prosperity in the 21st.*

*Roger D. Stark and Darin Lowder write on page 17 that The U.S. Army announced plans to solicit and award multiple indefinite delivery, indefinite quantity contracts as the predicate for power purchase agreement task orders in an aggregate amount of up to \$5 billion (with individual task orders expected to range from \$50 million to \$900 million each). The renewable or alternative energy projects will be financed, constructed, operated and maintained by private contractors, and located on or near Army installations.*

*David Owens of EEI explains on page 18 that the smart meters utilities are installing to replace the traditional analog meters that have been in use for almost a century are a very visible feature of this new, modern grid. A new survey by the Institute for Electric Efficiency (IEE) found that as of September 2011, 27 million smart electric meters have been installed. The IEE survey estimates that approximately 65 million smart meters will be installed by 2015. A growing area of concern for electric utilities is the potential for technological obsolescence. In contrast to traditional utility investments that have long, stable asset lives, smart technologies are anticipated to evolve rapidly over the coming years.*

*Paul Myrda numbers the initiatives EPRI is taking on smarter transmission applications on page 19. Asset management and the smart grid will be a powerful tool for electric utilities. It is one of the five fundamental technologies that will drive the Smart Grid, according to the US Department of Energy along with integrated communications, sensing and measurement, advanced control methods and improved interfaces with decision support. Future research in asset management applications within the smart grid should take place in two areas. The first should be with respect to specific assets, such as transformers, circuit breakers, etc. The other area will need to enhance the computational capabilities to deal with the large volumes of asset specific data and developing algorithms to adequately interpret the data and turn it into actionable information.*

*At press time, Siemens dedicated its Charlotte, NC facility. See Industry News, page 8, Siemens Expands.*

# INDUSTRY NEWS

## TROJAN BRANDS

SANTA FE SPRINGS, CA - Trojan Battery and Palladium Energy formed a strategic alliance to combine Palladium's expertise in cell technology and design engineering with Trojan's lead-acid battery engineering to develop lithium-based battery packs under the Trojan brand.

## PIC AWARDED

ATLANTA, GA - PIC Group has entered into an Operations and Maintenance Services agreement with LCEC Generation for the 43 megawatt power generation plant that LCEC is constructing in Lovington, NM. PIC will provide O&M services for three years.

## SIEMENS TO EMS

ORLANDO, FL - Siemens will implement coordination of two New York State sites, Rochester Gas & Electric and New York State Electric & Gas, into a single system with the Spectrum Power™ Energy Management System (EMS). The project will be installed in 2013.

## ITRON PARTNERS

LIBERTY LAKE, WA - Itron and Tantalus Systems announced a strategic partnership to deliver a wide range of smart metering and smart grid benefits. The collaboration will combine Itron's SENTINEL® and CENTRON™ electricity meters with Tantalus's TUNet®.

## TEI SELECTED

SANTA FE SPRINGS, CA - Thermal Engineering International and Struthers Wells, a division of TEI, have been awarded a contract to supply feedwater heaters, moisture separators and oil to salt heat exchangers for a 280 mw Power Plant in the Southwest United States.

## ENERNOC CHOSEN

BOSTON, MA - EnerNOC will provide demand response resources to Met-Ed (Penelec) and Penn Power, FirstEnergy's Pennsylvania utilities through May 31, 2012. "FirstEnergy is committed to meeting the goals of Pennsylvania Act 129," said Doug Elliott, FirstEnergy's President.

## HITACHI SIGNS

BASKING RIDGE, NJ - Hitachi Power Systems America signed a license agreement with Balcke-Dürr GmbH to design and supply fabric filters for the US coal-fired market. Fabric filters are used in pollution control for coal-fired power plants and for removal of trace pollutants.

## CONERGY PARTNERS

DENVER, CO - Conergy's Solar Large Projects Group has partnered with solar developer Enfinity to complete a three-acre solar energy park for the municipal waste water treatment plant in Parlier, CA. Enfinity selected Conergy to provide solar EPC and O&M services.

## MILBANK REPRESENTS

LOS ANGELES, CA - Milbank, Tweed, Hadley & McCloy LLP represented Abengoa Solar Inc., in securing a \$1.2 billion Federal Loan Guarantee from the U.S. Department of Energy to project company Mojave Solar LLC for the development of the 250mw Mojave Solar Project.



## ICF CONTRACTED

FAIRFAX, VA - ICF International has been awarded two new contracts to extend and enhance energy efficiency services with Baltimore Gas and Electric Company. The contracts have a capacity of up to \$55 million and a term of three years.

## AREVA IN TVA

PARIS, FR - AREVA will partner to help the Tennessee Valley Authority complete the Bellefonte One 1,260mw nuclear power plant. AREVA's scope includes engineering, construction and component replacements as well as fuel design and fabrication.

## HONEYWELL DEVELOPS

WASHINGTON, DC - Honeywell and Opower will jointly develop energy management tools. The companies will combine Honeywell's expertise in residential automation and control systems with Opower's energy data analytics.

## SIEMENS DELIVERS

ORLANDO, FL - Siemens Energy is implementing the meter data management system eMeter EnergyIP® for member utilities of WPPI Energy. Siemens will configure, deliver and support the project implementation, which began in June.

## BWCC AWARDED

CHARLOTTE, NC - The Babcock & Wilcox Construction Co. has been awarded a \$186 million contract to engineer, procure and construct a 75mw biomass power plant in Berlin, NH. BWCC will convert the Fraser Paper Mill to a biomass plant fueled by wood chips and logging waste.

## DDI TEAMS

SAN ANTONIO, TX - Digital Defense and Veracode announced a strategic partnership. DDI will augment its current service portfolio to include Veracode's cloud-based application security testing services to offer clients enhanced and comprehensive cloud-based security solutions.

## OPT PARTNERS

REEDSPORT, OR - Ocean Power Technologies will collaborate with Lockheed Martin on OPT's proposed commercial-scale 1.5mw wave power project. Lockheed Martin will provide design, manufacturing and system integration.

## GEH TO STUDY

WILMINGTON, NC - GE Hitachi Nuclear Energy (GEH) and Exelon will study the feasibility of producing Mo-99 at the Clinton Power Station. Mo-99 decays into technetium-99m, an isotope used in 85 percent of nuclear medicine.

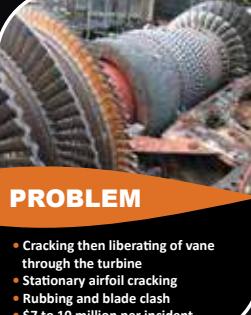
## SPRINT NAMED

OVERLAND PARK, KS - Sprint has been named to the Dow Jones Sustainability Index North America. The index is based on a rigorous analysis of corporate, economic, environmental and social performance.



## ACTMS™

### On-line Stator Vane Crack Detection



**PROBLEM**

- Cracking then liberating of vane through the turbine
- Stationary airfoil cracking
- Rubbing and blade clash
- \$7 to 10 million per incident



**IN SERVICE**

- Non-intrusive sensors
- After-market install
- Complete forward compressor coverage



**REAL TIME**

- Defect source location
- Graphical displays
- Local and network alarming



**RESULTS**

- On-line detection of vane cracking
- Insight to unknown condition
- Optimize remaining life
- Early warning to prevent failure

**The ONLY available monitoring system for the detection and early warning of vane cracking!**

**• Real-Time Alarm Notification**  
**• Easy Installation and Operation**

**It's not a question of "if" vanes will crack but "when."**

**MISTRAS Group's Asset Protection Solutions for Power also include:**  
 Pulverizer/Coal Flow Monitoring • Steam/Gas Leak Detection • In Service Transformer Testing/Monitoring  
 SF6 Predictive Gas Leak Monitoring • Complete NDT Outage Services • Exchanger Tube Inspection  
 Buried Piping Inspection • Rotating Equipment Monitoring • Wind Turbine Blade and Structure Inspection

**Call +1(609) 716-4000 or visit us on the web at**  
**[www.monitormyturbine.com](http://www.monitormyturbine.com)**



Scan this 2D code with your smartphone's barcode reader for more ACTMS™ information.



WORLD-GENERATION NOV/DEC 2011 V.23 #5

5

# INDUSTRY NEWS

## HITACHI AWARDED

BASKING RIDGE, NJ - Hitachi Power Systems America has been awarded a contract for the design and supply of a Selective Catalytic Reduction System including Hitachi's proprietary catalyst from Westar Energy for its Jeffrey Energy Center, Unit 1, located near St. Marys, KS.

## GE TO BUILD

AURORA, CO - GE plans to build its new solar panel factory in Aurora with the first panels coming off the line in 2012 with commercial availability in 2013. At a SPI press conference in Dallas, GE announced that it will manufacture thin-film cadmium telluride (CdTe) solar modules.

## PROGRESS HONORS

RALEIGH, NC - Progress Energy dedicated the newest power plant at its Richmond County Energy Complex and renamed the entire site to the Sherwood H. Smith Jr. Energy Complex. Smith is the former chairman, president and CEO of Carolina Power & Light Company.

## NXGEN SOLARS

BELLEAIR BLUFFS, FL - Seminole Financial Services is funding a \$4.3 million construction loan to install a 1.3MW photovoltaic solar farm on 10 acres in Raleigh, NC. NxGen Power will develop, manage, and own the project.

## NAVIGANT AWARDS

WASHINGTON, DC - Navigant announced the recipients of the Generation Knowledge Service Plant Operational Excellence Awards. The awards represent coal-fired plants that have best demonstrated excellence in cost and operational management over the most recent five year period (2006-2010).

Eligible coal plants were separated into three classes for evaluation purposes based on the average unit size. The top and runner up plants for each class are as follows.

In the 500 MW Average Unit Range, the top performer was Ameren Missouri's Labadie Energy Center located near Labadie, MO. The runner up was Luminant's Monticello Power Plant located in Mount Pleasant, TX.

In the 201 – 500 MW Average Unit Size Range, the top performer was MidAmerican Energy's Neal Energy Center located near Sioux City, IA. The runner up was Tennessee Valley Authority's Gallatin Power Station located in Gallatin, TN.

In the 200 MW Average Unit Size Range, the top performer was Dominion's Mecklenburg Power Station located in Clarksville, VA. The runner up was Progress Energy Carolina's Cape Fear Plant located near Moncure, NC.

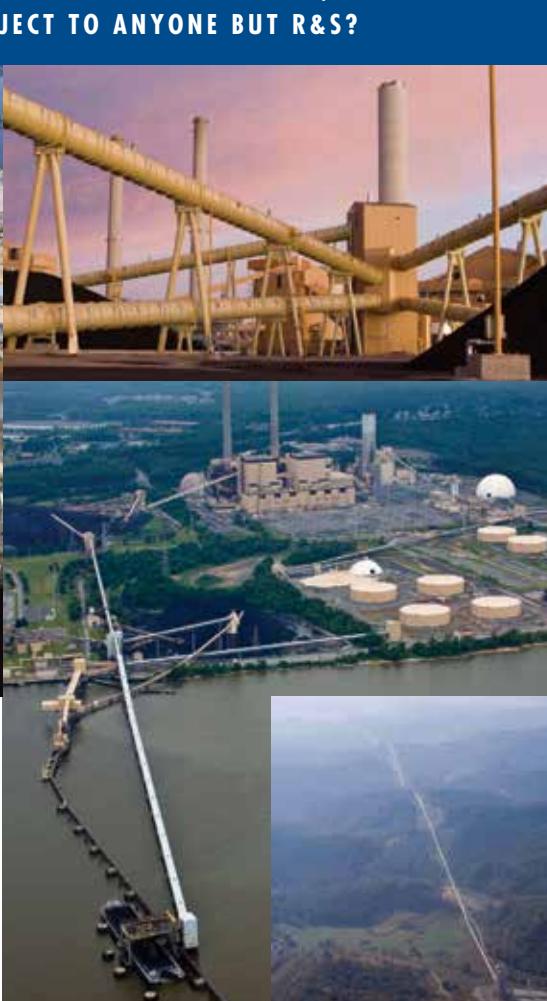
## ON24 SURVEYS

SAN FRANCISCO, CA - Energy and utility executives are revealing how the economic conditions are affecting them both in the board room and at home. In a recent survey of 200 energy and utility executives 73% of them said it is important to cut transportation expenses.

They all agreed that virtual events are the solution and are increasing the use of virtual events and webcasts to cut transportation costs.

Energy executives cited the following personal benefits of virtual events:

- Elimination of travel (91%)
- Saving gasoline (37%)
- The ability to reach people all over the globe anytime (81.8%)
- The ability to attend from one's own computer (72.7%)
- Virtual events are "greener" than traditional in-person events (64%).



Since 1903, Roberts & Schaefer has been a world leader in the design, engineering, procurement and construction of bulk material handling, coal preparation, and fuel blending systems. We provide total solutions for fuel handling, as well as limestone handling and grinding for CFB boilers, limestone and gypsum handling for FGD scrubbers, and ash handling systems. We've successfully completed projects in 40 countries, on six continents, and we're just getting warmed up.

**Whether it's complete system development, upgrades, or modifications, it's worth making a call to R&S.**



**ROBERTS & SCHAEFER**  
ENGINEERS AND CONTRACTORS  
*Company*  
A KBR Company

since 1903

222 South Riverside Plaza  
Chicago, IL 60606  
312.236.7292  
[www.rs.com](http://www.rs.com)

Offices also in Salt Lake City,  
Pittsburgh, Australia, Indonesia,  
India and Poland

## FCL TESTED

DEVENS, MA - Nexans, Siemens and AMSC announced the successful qualification of a transmission voltage resistive fault current limiter (FCL) that utilizes high temperature superconductor wire. The system reduced fault current levels by more than 50 percent.

## DANOTEK ADDS

CANTON, MI - Danotek will be adding large PM generators for low to medium speed applications for offshore wind turbines with rated outputs within the range of 6 to 8MW. The offshore market has an installed base of 4.1 GW, forecast to grow 70GW by 2017.

## ENERGATE PARTNERS

WASHINGTON, DC - Energate will be supplying its Smart Thermostats for Oklahoma Gas and Electric's 2012 residential demand response program through its partner Silver Spring Networks.

Over 25 North American utilities have utilized Energate's next-generation technologies.

## ZACHRY ACQUIRES

SAN ANTONIO, TX - Zachry Nuclear Engineering acquired Numerical Applications, Inc. (NAI). NAI provides a wide spectrum of engineering analysis services including thermal hydraulic, radiological, chemical and safety solutions.

## GTI SOLARS

CHARLOTTE, NC - Gas Technology Institute and manufacturing partner Solar Usage Now announced the first commercial installation of SUN Equinox, a new hybrid solar thermal-natural gas water heating system. This project is part of an initiative that began in 2009 at GTI.

## SIEMENS INKED

ORLANDO, FL - The City of Fort Collins, CO Utilities selected Siemens Energy for the implementation of eMeter EnergyIP® meter data management system for their Advanced Meter project, funded by the American Recovery and Reinvestment Act (ARRA).

## FLUOR INVESTS

IRVING, TX - Fluor is making a \$30 million investment in NuScale Power, based in Oregon, that is commercializing a small, modular reactor (SMR) technology. Eleven utilities in the US and Canada are advising NuScale.

## BARD BUILDS

CALHOUN, GA - Bard Holding is a U.S. based algae production company opening a Calhoun facility. The company provides algae as an alternative source to petroleum-based fuels. Algae have moved to the forefront because of its fast growth.

## EDPR PICKS GE

SCHENECTADY, NY - EDP Renewables selected GE to service its entire fleet of 402 1.5-megawatt GE wind turbines under a three-year operations and maintenance agreement. The comprehensive agreement spans three states.



**23**  
YEARS EXPERIENCE

"The Best Of The Best®"

READY TO MANAGE  
YOUR NEXT  
POWER PROJECT.

Founded in 1988, PIC has been a leader in the power generation industry for over 20 years. We are experts at managing multi-faceted projects including start-up and commissioning, operations and maintenance, installation, turbine outages, mechanical services and technical services. Combine these capabilities with our responsive approach and global resources, and it's easy to see why those who know choose PIC.

[www.picworld.com](http://www.picworld.com)

Visit us at POWER-GEN International booth 1712.

# INDUSTRY NEWS

## MERCOM REPORTS

AUSTIN, TX - Mercom Capital Group released funding and merger and acquisition activity for the solar, wind and smart grid sectors for the third quarter of 2011.

Both solar and wind funding was up and smart grid funding was down.

The full report can be viewed at [www.mercomcapital.com/cleanenergyreports.php](http://www.mercomcapital.com/cleanenergyreports.php).

## NEW PPA MODEL

LAKE MARY, FL - BlueChip Energy signed a letter of intent with Neo Solar Power for an equity participation in BCE's 120 MW Sorrento Solar Farm project. Neo Solar Power will contribute at least 10 MW of its high efficiency solar cells for an equity stake in the project,

## SONY JOINS

SAN DIEGO, CA - Sony has joined the "Pecan Street Smart Grid Demonstration Project."

The experiment is located in Austin, TX and will last for two years beginning in March 2012 with a maximum of 500 households eligible for participation.

## SIEMENS EXPANDS

CHARLOTTE, NC - Siemens Energy completed the expansion of its Charlotte hub with the opening of its new gas turbine manufacturing plant. It took thirteen months to build. The \$350 million total investment created more than 700 jobs. On Nov. 16th, Siemens Energy, state and local officials and the press, including *World-Gen*, celebrated the official grand opening of the new 450,000 sq. ft. gas turbine production plant adjacent to its existing steam turbine generator manufacturing plant. Randy Zwirn, president and CEO of Siemens Energy, said: "The first gas turbine leaving the expanded facility, an SGT6-5000F gas turbine will be exported to the 250mw La Caridad 1 combined cycle power plant in Sonora State, Mexico." Zwirn also announced that Siemens Energy and Grupo Mexico signed another agreement to supply a second 250 mw combined cycle power plant for the La Caridad 2 project.

At a press conference, Xavier Garcia de Quevedo, president of Grupo Mexico, told *World-Gen* that Siemens won the RFP based on being the only OEM able to turn-key the plant.

Siemens will be responsible for the full turnkey supply of the plant, which includes plant engineering, procurement, and construction. The main equipment to be installed in the plant includes an SGT6-5000F gas turbine, an SST-900 steam turbine, an SGEN6-1000A generator, a heat-recovery steam generator, and the complete electrical and SPPA-T3000 instrumentation & control equipment.

"The two combined cycle power plants will provide Grupo México with significant savings, as electricity is one of the main cost factors at its coal mines," said Xavier Garcia de Quevedo. The La Caridad I and II power plant projects will create over 1000 jobs during plant construction, and more than 50 direct jobs during plant operation. "With these two plants, Grupo México is starting a series of energy projects in Mexico in its infrastructure division, which will also include renewables."

## WE ARE THE ONE.

One Source. One Purpose. Many Solutions.



Babcock Power



Struthers  
Wells

TEI  
Struthers  
SERVICES

WTI

Boiler Tube Company of America

RileyPower

Babcock Power  
ENVIRONMENTAL

TEI  
MSR & ADVANCED  
PROGRAM DIVISION

Vogt Power

TEI  
CONSTRUCTION

Babcock Power  
SERVICES

[www.BabcockPower.com](http://www.BabcockPower.com)

## ALSTOM TO SUPPLY

WASHINGTON, DC - Alstom Grid has been awarded a contract to supply its Psymetrix PhasorPoint solution to ISO New England. PhasorPoint will help ISO New England improve its management of power system dynamics and system reliability.

## HONEYWELL PILOTS

MINNEAPOLIS, MN - Honeywell has been selected by Scottish and Southern Energy to conduct the first automated demand response pilot project for commercial and industrial facilities in Europe. The Auto DR project will give SSE the ability to work with its business customers.

## SOLAR PPA

BALTIMORE, MD - Constellation has started construction on a 16.1 megawatt, \$60 million DC grid-connected photovoltaic (PV) solar installation in Emmitsburg, MD. It will be financed, owned and operated by Constellation under 20-year solar power purchase agreements.

## VESTAS CONTRACTED

UVALDE, TX - Vestas received a 99 MW order from E.ON Climate & Renewables North America for 55 V100-1.8 MW turbines for the Anacacho wind-energy project. The contract includes delivery and commissioning with a five-year service and maintenance agreement.

## MISTRAS INKED

PRINCETON JUNCTION, NJ - MISTRAS Group's Acoustic Combustion Turbine Monitoring System (ACTMS™) successfully detected and located an S1 vane crack in an F-class combustion turbine at a NextEra Energy Resources' combined cycle generation facility.

MISTRAS' ACTMS™ detects and locates active stator blade cracking in the compressors of operating combustion turbines. Using noninvasive sensor mounts, the system is capable of detecting and identifying airfoil crack activity in the presence of normal turbine operational noise and conditions.

"We have found ACTMS to be effective in detecting stationary airfoil cracking on running combustion turbine compressors," says Jim Keener, Vice President of Power Generation Technical Services for NextEra Energy.

NextEra Energy, Inc. intends to purchase additional MISTRAS ACTMS™ units, adding to their current inventory of six installed systems.

## CATERPILLAR SIGNS

PEORIA, IL - Caterpillar Inc., Cat dealer Ring Power and APR Energy have signed a five-year agreement to develop temporary power solutions globally to meet the needs of emerging international markets. Caterpillar will supply mobile generator sets through Ring Power to APR.

Caterpillar also announced the introduction of a new version of SpecSizer. SpecSizer version 2.7.0 features an optimized 20-Step Wizard that automatically calculates the least number of steps for building a load scenario. The 20-Step Wizard collects loads, evaluates voltage dip and load demands, and then organizes the loads into steps.

## WÄRTSILÄ SUPPLIES

HUTCHINSON, MN - Wärtsilä has been awarded a contract by Hutchinson Utilities Commission to supply a 20-cylinder Wärtsilä 34SG engine to HUC's existing power plant located in the city of Hutchinson. The engine will have an electrical output of 9.3 MW.

## BRIGHTSOURCE EOR'S

OAKLAND, CA - BrightSource Energy is providing its proprietary LPT solar thermal technology for Chevron Technology Ventures. BrightSource's technology will support enhanced oil recovery efforts. The 29mw facility will use the sun to create pressure steam for EOR.

## EXELON, GEH SIGN

WILMINGTON, NC - GE Hitachi Nuclear Energy has been awarded a \$150 million integrated outage contract by Exelon Nuclear to help ensure the continued, safe performance of the utility's entire fleet of boiling water reactor nuclear power plants.

**Small on size, big on power.**



### Impressive size to power ratio.

High in power, yet low in mass, the Rolls-Royce Trent 60 keeps the same dimensions whatever its power output. With an engine weighing less than 15 tons, Trent 60 arrives ready to produce 58MW with Dry Low Emissions, 64MW with Wet Low Emissions and up to 107MW when operating with

a steam turbine. Trent 60 also sports the twin Rolls-Royce strengths of unmatched reliability and customer service. For mechanical drive and power generation applications, onshore and offshore, Trent 60 provides the muscle for enduring profitability.

**Trusted to deliver excellence**

[www.rolls-royce.com](http://www.rolls-royce.com)



**Rolls-Royce**

# INTERNATIONAL NEWS

## AUSTRALIA

Parsons Brinckerhoff and ElectraNet were recognized for innovative work on the Clare North substation, winning the Project Infrastructure Excellence Award at the 2011 Engineers South Australian event.

## BELGIUM

Electrabel has licensed Ventyx SystemIQ asset health management software to facilitate enhanced equipment reliability at the company's three units at the Tihange plant in Wallonia.

## BRAZIL

Alstom Grid opened a new €24 million test laboratory in Canoas. The factory will be able to design, manufacture and test AC and HVDC transformers up to 800 kV.

## BULGARIA

Westinghouse Electric Company announced the signing of a multi-million dollar contract to design the Low and Intermediate Level Waste Repository at the Kozloduy nuclear power plant. The customer for the work is SERAW, the Bulgarian State Enterprise with responsibility for the country's radioactive waste, under an agreement between SERAW and the European Bank for Reconstruction and Development.

The Decommissioning & Dismantling and Waste Management division of Westinghouse has been working across Europe for more than 20 years. Over that period Westinghouse has participated in D&D projects including those at the Vandelllos I NPP, El Cabril, Mochovce, Chooz A, CIEMAT restoration, ISPRA, La Latina, Zorita NPP and Sellafield.

## CHINA

Luc Oursel, President and CEO of AREVA, and Yu Peigen, Vice President of China National Nuclear Corporation signed a memorandum of understanding to strengthen collaboration between AREVA and CNNC in nuclear safety and operational excellence. A working group will be set up to explore the scope and modalities of this collaboration, which will encompass lessons learned from the Fukushima accident as well as measures for optimizing CNNC's power plants.

## CHINA

Emerson will install its Ovation™ expert control system at two new 1,000-MW, ultra-supercritical power generating units under construction at the China Resources Puqi power plant.

Emerson will supply a total of 64 redundant Ovation controllers and 23 workstations.

## ECUADOR

GE and Trilliant announced a joint step towards empowering Ecuador with more reliable power. 25,000 meters will be installed by Electrica de Guayaquil.

## FINLAND

The AREVA-Siemens consortium and its Finnish customer TVO jointly endorsed the establishment of a shared process to consolidate the OL3 completion schedule.

## FRANCE

Siemens has installed 112,000 solar modules on an approximately 70-hectare site on the La Colle des Mées plateau in the vicinity of the French Alps. Siemens Energy is EPC contractor for the six photovoltaic power plants with a combined peak output of 31 megawatts and will perform maintenance work on the solar power plants. Delta Solar and Siemens jointly developed a plant design which met the demands for maximized efficiency despite the difficult landscape.



{ FULL HOUSE. }



December 13 - 15, 2011

Las Vegas, Nevada • Las Vegas Convention Center | Central Halls • [www.power-gen.com](http://www.power-gen.com)

SAVE THE DATE!

Owned & Produced By: **PennWell**

Presented By: **POWER Engineering**

Supported By: **PennEnergy**

## FRANCE

EDF selected AREVA to supply 32 of the 44 steam generators to be installed in France's 1300 MW power plants. The future order will be worth around 1.1 billion euros.

## INDIA

GE Energy Financial Services and Indian-based Greenko Group agreed to invest in a new venture to develop wind energy projects across India. The GE unit will invest US\$50 million. Greenko has committed \$65 million for the venture.

## INDIA

Abound Solar announced a long-term sales agreement with Solarsis, Inc. The first project is in the state of Andhra Pradesh.

## INDIA

According to a survey conducted by Mercom Capital Group titled 'India Renewable Energy Awareness Survey,' only 56% of Indian consumers have heard of 'renewable energy' or 'clean energy', and only 27% of consumers have heard of energy efficiency. Although awareness was low, 71% of Indian consumers surveyed are willing to pay higher rates for electricity from renewable energy sources, and 65% will pay more for uninterrupted power.

## KOREA

Korea Electric Power LS Cable & System and AMSC announced that the world's longest distribution-voltage superconductor cable system has been energized at the I'cheon substation located near Seoul.

## MEXICO

Alstom Grid has been awarded a contract by Comisión Federal de Electricidad (CFE) to deliver seven new substations and 11 overhead transmission lines in the neighbouring states of Puebla, Veracruz and Oaxaca, in partnership with Sademex, Ingeniería y Construcción.

## NIGERIA

Alstom has been awarded a contract worth approximately €40 million by Ministry of Power, Rivers State Government of Nigeria to supply a 160 MW GT13E2 gas turbine for the second phase of the Afam power plant to be built in Port Harcourt.

## QATAR

Qatar Solar Technologies announced that it will be building a polysilicon production facility worth approximately \$1 billion. QSTec's plant will manufacture 8,000 MTPY (metric tons per year) of high-purity solar grade polysilicon and is scheduled to commence operations in 2H 2013.

## RUSSIA

StroyTechProekt appointed Citec as general designer for the Wärtsilä TMH Diesel Engine Building Plant in Penza. The contract is worth 2.5 million euro.

## RUSSIA

E.ON Russia has chosen Emerson Process Management as the main automation contractor for Unit 3 of its Surgut-2 power station. With a total generating capacity of 5600-MW, Surgut-2 is one of the largest natural gas thermal power plants in Europe.

## RUSSIA

Russia has a potential to install up to 2 GW solar PV capacity by 2020 estimates Solar PV Consulting.

## RWANDA

Wärtsilä has been awarded the contract to supply a turnkey project to utilize methane gas from the nearby Lake Kivu as fuel.

## SAUDI ARABIA

Colfax Fluid Handling announced a contract with Doosan Heavy Industries & Construction to provide 38 pumps to support the 2,800 MW oil-fired power plant.

## SCOTLAND

Rolls-Royce achieved a significant milestone in the deployment of tidal energy technology with confirmation that its prototype tidal turbine, located subsea off the Orkney Islands, Scotland, has successfully generated and fed over 100 megawatt hours of electrical power into the national grid.

## SENEGAL

Wärtsilä has been awarded €60 million in contracts by Senelec to expand two existing power plants.

## SINGAPORE

Vogt Power International has received an order from Siemens AG. to supply Heat Recovery Steam Generators and associated equipment for the GMR Energy Power Plant project located on Jurong Island.

## SPAIN

Struthers Wells has been awarded a contract to design and supply two sets of solar steam generators for power plants located in the Extremadura Region.

## THAILAND

Vogt Power received an order from Black & Veatch to supply Heat Recovery Steam Generators and associated equipment for two Combined Cycle Power Plants for Electric Generating Authority of Thailand (EGAT).

# POWER

Whether you have an **outage** or just need **additional power...**

Contact us today to inquire on our extensive line of Industrial Power Plant Equipment available from stock:

Boilers (various sizes & styles)  
Boiler Parts & Accessories  
Burner Management Systems  
Chillers  
Combustion Control Systems  
Construction Services  
Deaerators  
Design & Build  
Diesel Generators  
Economizers  
Engineering  
Fuel Systems  
HVAC  
Pumps  
Water Treatment Systems

...Indeck can get you the **power** you need, **when you need it!**



**INDECK**<sup>®</sup>

847.541.8300 / 800.446.3325

info@indeck-power.com

www.indeck.com

# NEWSMAKERS

## MORRIS HONORED

Michael G. Morris, chairman and CEO of American Electric Power was awarded the Edison Electric Institute's Distinguished Leadership Award by his industry peers for his 23 years of exemplary service as an electric utility chief executive.



*Michael G. Morris*

## ENERGATE APPOINTS

Energate appointed Debbie Rachlis as its new vice president of sales and also announced the appointment of Lisa V. Wood and John C. Fox to its board of directors.



*Debbie Rachlis*

## DANOTEK NAMES

Danotek Motion Technologies named Ramon Guitart VP of Engineering.



*Ramon Guitart*

## NYISO NAMES

The New York Independent System Operator (NYISO) has named Wesley Yeomans as its new vice president of operations.

## GREENE NAMED

The American Solar Energy Society is pleased to announce that Susan Greene has taken the reins as president.



*Susan Greene*

## AEHI HIRES

Alternate Energy Holdings announced the hiring of J. Peter Honeysett as Director of Nuclear Projects, a newly-created position.



*J. Peter Honeysett*

## GIGA-TRONICS NAMES

Giga-tronics announced that Mark Elo will join the Company as Vice President of Marketing.



*Mark Elo*

## BUZZ ALDRIN SERVES

Principal Solar announced that Dr. Buzz Aldrin will serve as senior advisor.

## BARD SELECTS

BARD Holding named Charles A. Clerecuzio, P.E. as Chief Operating Officer.

## ENCORE ADDS

William "Bill" Champion was named Encore Energy's Vice President of Business Development.

## ABOUND APPOINTS

Abound Solar appointed Craig Witsoe president and chief executive officer of the company.



*Craig Witsoe*

## ZURICH PROMOTES

Zurich announced the appointment of Jeanne Jankowski as head of Energy for Global Corporate in North America. Jankowski joined Zurich in 2004 from AIG.



*Jeanne Jankowski*

## URMC APPOINTS

Utility Risk Management Corporation announced the hiring of Lynn P. Costantini as the Chief Information Officer, based in New Hope, PA.



*Lynn P. Costantini*

## ROSS WELCOMED

Polsinelli Shughart welcomed attorney Matthew E. Ross as a shareholder in the firm where he will focus on all aspects of energy law.



*Matthew E. Ross*

## TECH DATA APPOINTS

Tech Data appointed Gregory S. Banning to Vice President, SMB Sales and General Manager, Costa Rica.



*Gregory S. Banning*

## FLANAGAN-PUBLISHER'S LETTER

CONTINUED FROM PAGE 3

## 2012 MEDIA SCHEDULE

February/March, 2012

### CLASS OF 2012

Closing – January 15th

May/June, 2012

### AMERICAN WIND ENERGY ASSN. (AWEA)

### EDISON ELECTRIC INSTITUTE (EEI)

### POWER-GEN EUROPE (PGE)

### ELECTRIC POWER (EP)

Closing – April 15th

August/September 2012

### SOLAR POWER INTERNATIONAL (SPI)

### GRID WEEK

Closing – July 15th

October/November 2012

### POWER-GEN INTERNATIONAL (PGI)

Closing – September 15th

December 2012/January 2013

### 25TH ANNIVERSARY ISSUE

Closing – November 15th

I wish my bonus was as big as this check for banners. I thought they were free?

They're only free in World-Gen.

I guess I should call World-Gen now.



Please stop-by PGI Exhibit 10013 in Las Vegas.

HAPPY HOLIDAYS!

*Wish Flanagan*

# RENEWABLES BRING MAJOR CHANGES

BY LYN CORUM, CLASS OF 2003



The subject of grid integration has become the hot topic in industry news, webcasts and conferences as solar and wind resources are being developed to satisfy state mandates for utilities to add renewable resources to their fuel supply mix. In California, utilities must bring 33% renewables into the state's grid by 2020. The ubiquitous "smart grid" is the solution many utilities are seeking to play a large role in that integration.

But Jim Detmers, former chief operating officer at the California Independent System Operator, is looking at the larger picture. He told an audience at an EPRI conference this spring, and later to GreenTech Grid: "What we are dealing with is a major transformation of the current system." Now a consultant with his firm, Power System Resources, Detmers said this dispatchable wind and solar power will change the characteristics of the system.

Some 17,000 MW of solar and wind resources are under construction, or on the drawing boards. On a typical day in California, Cal ISO manages between 30,000 MW to 33,000 MW as power is generated and flows to customers. Summer peaks generate well over 50,000 MW.

Detmers said "we should be thinking about how much mass or spinning reserve we should maintain on the system," or whether another source of power can fill in. Synchrophasors are being installed throughout the system, he said, and they are part of the solution because they will help identify what the grid conditions are. System operators should be thinking about what else needs to be designed with the system so that you can safely operate it and eliminate oscillations or instability.

He was skeptical about energy storage. It needs to be designed to solve problems on the power system side, Detmers said. "But battery companies are waiting for instructions, and that's not providing the right value to the system or the ISO."

There will be costs, but nobody knows what they are yet, and ratepayers will be expected to pay them, Detmers said.

## PEAKER PLANT NEEDED

The Quail Brush Generation Project, which popped up at the California Energy Commission in September, is typical of what utilities are looking for to handle the intermittency of renewables. Filed by Cogentrix Energy, a subsidiary of The Goldman Sachs Group, the project is intended for development in San Diego. But as of late October, it had not yet qualified for a full review by CEC staff which has asked for additional information that was not included in the original application.

The 100-MW gas-fired project is proposed as an intermediate/peaking load plant and already holds a power purchase agreement with San Diego Gas & Electric. If certified by the CEC without delays, Cogentrix estimates construction will begin in March 2013 with operations commencing soon after June 2014.

SDG&E will use the resource to help it balance out the intermittent solar and wind power it will be buying to meet the state's renewables mandate: by 2020 33% of the electricity it sells to its customers is to come from renewables. The project, once built, will provide peaking and load-shaping power to the grid, along with several ancillary services intended to assure system reliability within the SDG&E service territory.

The proposed project would generate power with a set of 11 gas-fired reciprocating Wartsila engine generators and operate up to 3,800 hours/year. Each engine will be fitted with a selective catalytic reduction unit and an oxidation catalyst unit and each will have a 100-foot tall stack. A closed loop cooling system will limit water use. SDG&E would build a new natural gas pipeline and transmission line.

## DISTRIBUTED GENERATION

Another non-solar project slowly working its way through the CEC review process is the Watson Cogeneration steam and electricity reliability project. The owners, the Watson Cogeneration Company, want to improve the reliability of the steam supply at the BP Carson refinery which currently is generated by the 385-MW cogeneration plant. This proposed project will increase capacity by approximately 85 MW.

By increasing reliability the additional supply of steam would reduce the possibility of refinery upsets due to loss of steam or power. The owners also say the new project will conserve natural gas and

reduce emissions and their environmental impacts.

The application was first filed in March, 2009 and only a preliminary staff assessment has been released. Documents filed in mid October with the CEC indicate disputes between the staff and the project developer over use of reclaimed water. Whether or not to require an agreement for reclaimed water are at the heart of that dispute along with the maximum amount of water to be used.

It was likely the CEC's overwhelming work load in 2010 certifying nine utility-scale solar projects that put this project's review on the back burner.

## SOLAR TECHNOLOGY IN FLUX

The same issues that did Solyndra in – rapidly dropping costs to manufacture photovoltaic panels tied to competition from China – has modified plans for several projects in Southern California. The sale of two very large utility-scale solar plants by Tessera and the conversion of most of its Stirling Energy "SunCatcher" technology to PV technology has been the big newsmaker.

In August, Solar Trust of America, a subsidiary of Solar Millennium, lured by the falling prices of PV technology, announced it was abandoning central station thermal technology for the cheaper panels at two of its projects – Blythe Solar and Ridgecrest – being built in Southern California. At the same time, it said it was rejecting the \$2.1 billion loan guarantee the Department of Energy had awarded in April. Edward Sullivan, a Solar Trust spokesman, said improved conditions for solar PV projects in the commercial bank market made commercial financing a more attractive strategy.

Wishing to end its involvement, Solar Millennium announced early in October it was selling the four projects it was developing in Southern California and Nevada to German company solarhybrid. (Yes, it does not capitalize its name.) Terms of the sale are still being negotiated and expect to be concluded by the end of the month.

At the same time, the announcement said construction of the 1000-MW Blythe, California solar project, which broke ground in June amid much publicity, will be delayed until 2013.

The three other solar projects still under development in California and Nevada are the 500-MW Palen solar project, the 250-MW Ridgecrest solar project, both in Southern California, and the 500-MW Amargosa Farm Road solar project in western Nevada near the border with California.

Blythe and Ridgecrest held power purchase agreements with Southern

California Edison but the utility withdrew the Ridgecrest PPA. The Blyth PPA was approved by the California Public Utilities Commission. The two remaining projects have no PPAs.

A sale price for the 2.25-GW portfolio was not announced, but Solar Millennium said solarhybrid has already paid the first installment on the purchase price. Solar Millennium is to receive a significant profit-share upon construction of the power plants in addition to being reimbursed for its entire investment in the projects, according to the October 6 announcement.

Sullivan said the parties are contemplating that Solar Trust will continue to develop the projects for solarhybrid. He said a permit amendment is required for the Blythe project because the first 500 MW is being converted from solar thermal to photovoltaics technology. This will delay the start of construction to 2013.

Blythe received its construction permit from the California Energy Commission in September 2010 and the US Bureau of Land Management awarded its right-of-way grant a month later.

Palen received its certification from the CEC in December 2010, but it and Ridgecrest are still waiting on the BLM to rule on their applications for ROW grants. Amargosa was awarded its ROW grant by the BLM in November 2010. It appears to be still waiting for local and state permits.

## SOLAR COMPANY PULLS BACK

The conversion of solar technologies of at least two projects appears to be behind the sale, since Solar Millennium sells solar thermal technology. Sullivan said, however, the final decision has not been made on which technologies will be used at the Palen and Amargosa projects.

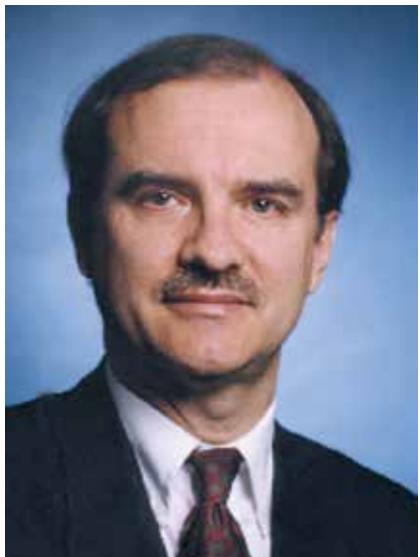
Solar Millennium, headquartered in Erlangen, Germany, said in its announcement it is now focusing on solar-thermal and hybrid power projects in Europe, Asia, North Africa and Latin America. Brilon, Germany-based solarhybrid is a project developer and general contractor for utility-scale photovoltaic power projects in Italy, the Middle East and US.

Earlier, in July, Solar Trust asked the CEC to continue reviewing the Ridgecrest project although the company was replacing the solar thermal technology with PV technology which is not in the CEC's area of responsibility.

The CEC is reviewing that jurisdiction waiver, leaving the Ridgecrest project in limbo. However, California Governor Jerry Brown signed Senate Bill 226 in early September which will change the rules and allow the CEC to review non-thermal solar projects. That law takes effect on January 1.

## FUKUSHIMA'S AFTERSHOCKS

BY JEAN-LOUIS POIRIER, CLASS OF 2000



The Fukushima disaster will have some serious impact on the global nuclear industry just when it started experiencing a renaissance of some sort. That impact is not sparing anybody - from nuclear plant operators to regulators (both domestic and international), governments, equipment vendors, uranium producers, consumers and the public at large.

While the issues involved are undoubtedly complicated and intertwined, we can already foresee three specific outcomes:

- A safer operating fleet, as a result of a worldwide call for enhanced standards and plant reinforcements
- A notable reduction in new reactor building activity
- An interest in new reactor technology, including small modular reactors (SMRs) and next generation (Gen IV) reactors.

The first outcome is positive: nuclear power generation will become even safer as the result of enhanced safety standards and associated required investments at existing reactors. The industry-wide upgrade cost to consumers will remain limited though - less than \$2/MWh. However, we also foresee some plant closures, plants

that are not life extended, and more expensive life-extension conditions. The total cost to the industry could be roughly \$60 billion or \$5/MWh if fully passed on to customers. The outcome, however, will be a safer fleet with better response times and communication procedures in cases of unforeseen events.

The second outcome is an expected reduction in reactor build-up. Overall, the global nuclear industry will keep growing but at a slower rate: we estimate that at least 60 GW of announced nuclear capacity will be cancelled or delayed as a result of Fukushima and several countries will see the build up of their first reactor delayed by 5 years or more. In reality, some of the announced capacity would not have taken place or be delayed as well due to the current economic crisis. Still, one has to conclude that the Fukushima tragedy will not act as a brake for the next 3-5 years.

The third outcome is a likely increase in interest in new reactor technologies, namely SMRs and Gen IV reactors and yet, we believe that the net impact on the global nuclear industry will remain minimal through 2030.

### A SAFER FLEET

Many countries have launched their own response efforts to ensure the safety of the nuclear plants on their soil. Waves of inspections took place in the first 30-60 days typically followed by more in-depth task force efforts that can take 90 days to a year. In the US, the NRC has already received its first Task Force report and held its first review meeting September 14; the Canadian regulator will soon follow; and in Europe, stress tests are under way and a report is due by the end of the year. Finally, the next meeting of the IAEA on the Convention of Nuclear Safety is planned for August 2012.

So we can expect an evolving global response over the next 12 months. Even though studies are under way, we can

already foresee new requirements for technical and organizational process improvements in five specific areas:

- Redefinition of crisis management procedures (including evacuation plans, ability to deal with multi-event accidents)
- Tougher probabilistic assessments
- New methodologies for multi-event Probability Risk Assessments (PRAs)
- Increased protection of spent fuel pool cooling to ensure spent fuel integrity
- Redefinition of primary containment protective strategies to effectively manage and mitigate post-accident conditions, including elevated pressure and hydrogen concentrations.
- Reinforcement of peripheral systems (including back-up diesel capability) to prevent plant blackout and ensure functioning of critical safety functions such as reactor core cooling, spent fuel storage pool and containment integrity - including improved access to emergency cooling water, especially for multi-reactor sites.

The result will be a more or less coordinated call for enhanced safety measures that, we project, will trigger the need for \$20-25 billion in additional investments by the global nuclear industry plus an extra \$925 million per year in additional monitoring and reporting.

We also forecast some early plant closures and some utilities will give up on their efforts to renew some plant licenses as many life extension programs, reactor upgrades and plant retrofit projects become more scrutinized. We forecast 28-35 reactor shutdowns (out of some 425 reactors in operation) and 9-33 reactors (with a capacity of up to 40 GW) that may not be life-extended - that's about 10%-15% of the total that was expected to apply for extension by 2030. Combined, this would imply an expected \$31 billion industrywide write-off. Finally, plants that do get life-extended will take longer to get their approvals and the final tab for some of these extension projects may be quite

higher (we estimated up to \$4-12.5 billion in additional life extension costs for some 40-50 reactors that may be at issue).

All in all, we project the need for \$62 billion in additional investments through 2030. If this were fully passed on to customers, the impact would be about \$5 per MWh.

### A REDUCED 'NEW BUILD' ACTIVITY

At the start of 2011, there were 275 GW of nuclear plant capacity under construction or serious consideration, including 38 (37 GW total) under construction. We have assessed in detail the impact of Fukushima on these plans across a wide slate of 65 countries. The impacts have ranged from none (when plant construction continues as permitted) to moderate (there are delays of 1-2 years) to more significant (delays of 5 years or more) to drastic (project cancellations and/or countries' announcements that nuclear energy is no longer being considered for the foreseeable future).

Our post-Fukushima projection now includes between 22 GW and 71 GW of project cancellations or delays; when combined with plant shutdowns and fewer life extensions, we forecast a reduction of 57 GW to 110 GW in the amount of nuclear capacity on line by 2020. That's roughly a 10%-25% impact compared to what could have realistically been expected to be on line by the end of the decade. That impact is projected to subside in the following decade resulting in a potential reduction of 59-139 GW in the amount of nuclear capacity that was projected to be on line by 2030 prior to the Fukushima accident.

### A DISTANT NEW TECHNOLOGY HORIZON

The third impact from Fukushima is likely to be an increased interest in new reactor technologies, namely SMRs and Gen IV reactors. However, we contend that the impact will remain limited and so "Gen III+" reactors will be the prevailing options for the next 15-20 years and thus the focus of any future reinforced standard effort by the IAEA.

There is already definitely more industry interest in SMRs - say 2-3 times more than 18 months ago in terms of number of competing designs, amount of R&D monies spent and number of players involved. In the US, the NEI is supporting the technology and the NRC has decided to open a new procedure to review SMR applications.

Still, this uptake will take a while to translate in orders. Arguably, SMR technologies could be marketed by 2025 assuming that pilot plants come on line by say 2020. It is worth noting, however, that several SMR designs are aimed at industrial appli-

(continued on page 22)

The impact (in GW) of Fukushima on the global nuclear sector (2011-2030)

Country	Plant Shutdowns	Plants not Life-Extended	Plant Cancellations	Plants delayed past 2030	Total Impact (GW)
Japan	10-17	0-24	0-2		10-43
Germany	12				12
Ukraine				7-10	7-10
Sweden		9			9
Russia	5			0-4	5-9
Italy			5		5
Switzerland			4		4
India				0-13	0-13
US			2	3-5	5-7
Others	1		0-3	1-23	2-27
Total (GW)	28-35	9-33	11-16	11-55	59-139

Note: Ranges reflect low-high impact scenarios

# ECONOMICS OF EV DRIVING

BY DANIEL A. POTASH, CLASS OF 2001



Since I first wrote about electric cars three years ago, the trends have been very much supportive. Electric cars could be a game changer, especially helping wind energy producers and the coal subsector, boosting home solar and the residential construction industry, and it could help the financing sector get back on track.

One of the trends supporting electric cars are the proposed curtailment rules for wind generators that reduce or eliminate the market value of off-peak power. If someone can, effectively, put that excess or surplus power in their gas tank, it could change the landscape of power pricing and consumption. For that and other reasons, it's time to take another look at electric cars and consider if this is not the most significant development, and opportunity, facing the U.S. power sector.

## TOO MUCH WIND AT NIGHT

To the credit of the wind industry, there is now installed capacity of more than 30,000 MW of wind generation in the U.S., and yet, wind power represents only 3% of total installed capacity. In certain conditions of high wind and low load, such as in the middle of the night, there is too much wind power supply for the grid to absorb it without instability. As a result, power purchasing utilities and regional market operators want to curtail wind supply and want to reduce mandatory absorption and unconditional purchase of wind supply.

A look at a typical recent day and night in Southern California shows why wind produced at night is unwanted.

Now consider power from renewable resources, again for September 13, 2011, in the California Independent System Operator control area.

As one would expect, geothermal, biomass, biogas, and small hydro are all well-behaved base-load generating resources. Wind and solar vary with time of the day. Note the wind production fluctuating from over 900 MW at midnight to 100 MW at noon. Also note the load profile of solar that peaks at about 2 PM. Clearly the wind power resource is coming in at the

wrong time of day in terms of the domestic customer. CAISO reports solar generation well into the night.

## ARE ELECTRIC CARS NOW VIABLE?

Typically, a car sits idle 90% of the time, mostly at night. And typically it is used for short trips during the day. The prevalent usage pattern, for most drivers, potentially provides a widely distributed load that can flexibly soak up power when it's cheap.

One of the misconceptions about driving in the U.S. is that driving revolves around the commute to work. In fact, driving to and from work is only 16% of household driving in the U.S., according to a 2009 survey done by the U.S. Department of Transportation. Average auto trips are generally relatively short as the accompanying chart shows.

My prediction is that anxiety about driving range is overestimated. Consumers may modify their behavior subject to economic factors, but the data indi-

cate they won't have to change all that terribly much.

So, the right way to look at electric cars is to not look at extra long commutes to work, or other tail-of-the-distribution-curve behavior, but rather look at actual data. Electric car marketers should be successful by meeting most of the needs of most automobile users most of the time, and in a way that appeals to their economics.

## ECONOMICS OF EV DRIVING

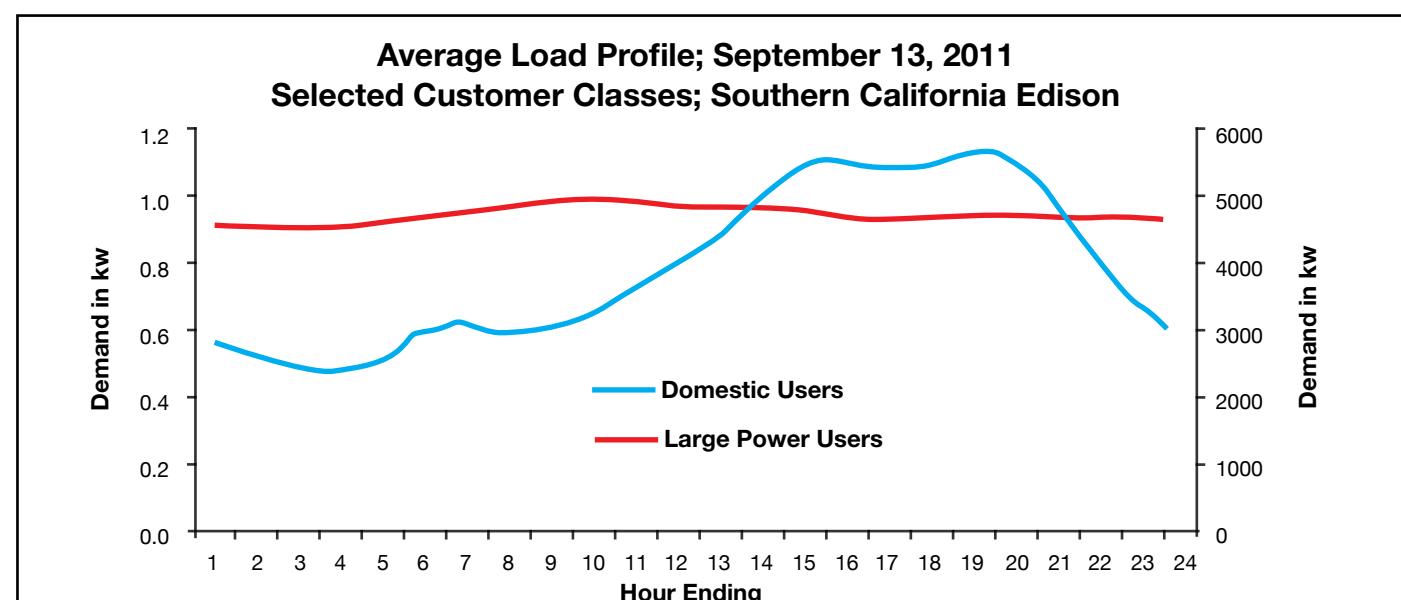
Once an electric car is purchased, driving on grid-supplied electricity should be fairly inexpensive. According to Consumer Reports, Ford Motor Company estimated the cost to fully charge its Ford Focus Electric (100-mile electric range) vehicle at \$2 to \$3, based on nationwide average electric rate of \$0.11 per kWh. This equates to about 22.7 kWh of energy consumption.

What are the economics of switching to an electric car? Since the gasoline ver-

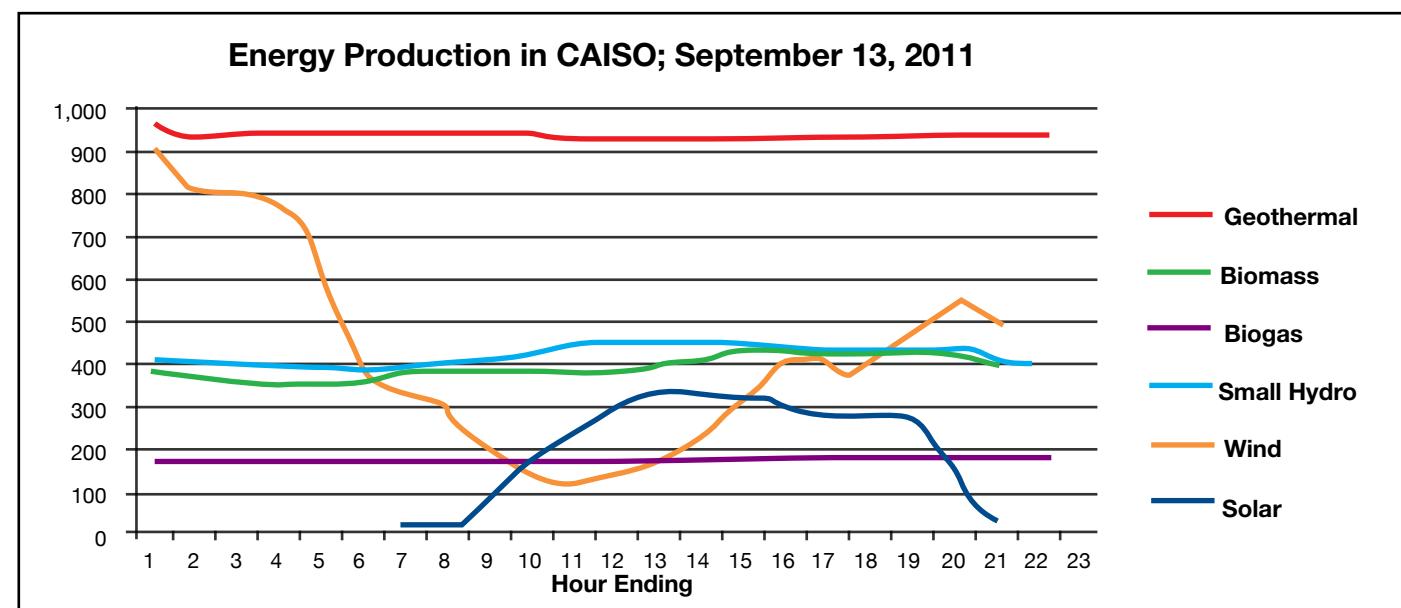
sion of the Ford Focus gets 28 MPG, the aforementioned 100-mile electric range would use about 4 gallons of gas, which, if you filled up where I live, in Los Angeles, for \$3.80 per gallon, would cost you \$15. So that's \$15 for gasoline or \$2-\$3 for electricity, for the same 100 miles. So, on fuel alone, electricity is a big winner.

An electric car now costs more up-front. Ford announced its price for the Ford focus will be in the range as the Nissan Leaf, which is \$33,000. The gasoline-power Focus costs about \$20,000, and so \$13,000 is estimated to be the incremental extra up-front cost to go electric with the Focus. But most drivers do not pay up-front for their car. If one assumes a five-year loan financing at 5%, then that is an annual cost of about \$3,000. If one assumes driving 15,000 miles per year, then the extra cost per mile to go electric is a fairly hefty 20 ¢/mile, or based on 28 miles per gallon, about \$5.60 per gallon gas-equivalent. Currently there is \$7,500

(continued on page 20)

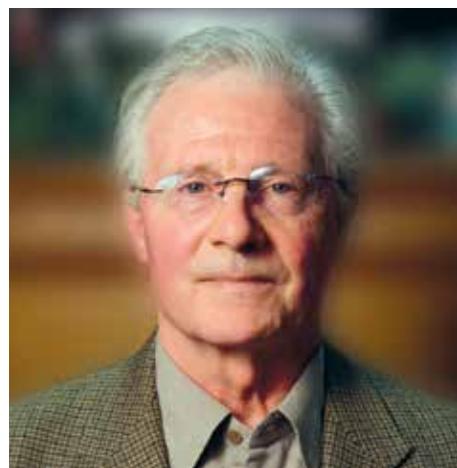


The graph shows two types of power customers, domestic users and large power users. Domestic users have peak activity from about 3:00 PM to about 10:00 PM. Large power customers run flat out at all hours of the days and night. If only residential customers used more power from midnight to 6:00 AM, then there should be no problems absorbing wind power generated at night.



## REINVENTING ELECTRICITY

BY DENNIS MC LAUGHLIN, CLASS OF 2002



Since 2005 when the term Smart Grid was coined, its concept has created great expectations. Engineers, urban administrators, planners, environmentalists and policy makers see the Smart Grid as the answer to how the power generation industry will satisfy increased energy demands from a world census that will add two billion more people in the next 20 years – 60 percent of whom will live in cities. Such population densities challenge cities to become “smarter” about a multitude of urban concerns and issues. But Jesse Berst, keynote speaker for Schneider Electric’s 2011 Energy and Distribution Conference, pointed out, “We can’t have smart cities that are more livable and more sustainable without smart energy – and smart energy requires a smart grid.”

With developing technology that can anticipate electrical usage by businesses and consumers, along with the prowess of power generation engineers to respond to how people go about switching electricity on and off during a typical day, Smart Grids promise efficient, reliable, economic and sustainable power. In fact, Smart Grids are already making good on that promise. They’re on track to deliver 30 to 40 percent of all electricity consumed in the United States by 2013, notes Berst, founder of Global Smart Energy and chief analyst of SmartGridNews.com.

But in an increasingly polarized culture, it is not surprising that the Smart Grid has also stirred up controversy. Ironically, in this all-important national energy discussion about aging infrastructure, rising energy prices, climate change, security and GHG emission mitigation, even groups with opposite ideological perspectives on the issue have used the same term to criticize the Smart Grid. Both sides have at one time or another called it “a Trojan Horse wearing a green hat.”

Environmental idealists and consumer watchdogs argue the billions of federal dollars allocated for Smart Grid development represent a gold rush for utilities, investors and equipment makers to pursue taxpayers’ money with no guarantee against rising energy costs. The more par-

anoid warn that Smart Grid devices and equipment can expose the public to increased radiofrequency radiation (RF). Still others raise alarms about the loss of privacy and the threats to personal security with all that data on energy consumption and usage patterns floating around.

On the other side of the fence, some industries and businesses worry Smart Grids – with their enhanced capacity to collect and organize data – could make it easier for Cap and Trade proponents to devise repressive tax policies and create nightmarish reporting/accounting structures that would offset the cost savings and efficiencies of this emerging energy management technology.

Most of the concerns are trumped up or way overstated. That’s why Schneider Electric’s 2011 Energy and Distribution Conference last month in Chicago was a refreshing, informative break from the often politically-driven chatter emanating inside the Beltway on the subject of the Smart Grid.

Tracing the emergence of the Smart Grid concept of energy management, the Schneider event focused on the nuts and bolts (or, should we say, the switches, sensors and meters) of the innovative smart energy technology and systems – describing how the Smart Grid is replacing traditional networks with their antiquated centralized power generation and top-down energy flow to passive users.

“Smart Grids promote active energy management that allows the power industry to integrate energy from renewable sources with traditional generation networks and decentralized distribution stations,” said Don Rickey, Senior Vice President of Energy Business at Schneider Electric. He noted Smart Grid technology addresses the industry’s most pressing concerns: system failure; plant-wide security; and energy efficiency. Fully integrated electrical distribution solutions from HV substation to LV point of use, Rickey explained, will reduce system failure. He also said that Schneider’s ability to deploy dedicated equipment and devices – mobile substations, explosion-proof switch-gear, SVC systems for arc furnace, non-ferrous electrolysis – enabled utilities to provide security for plant assets and safety for its employees. Rickey went on to say that active, advanced energy management systems “optimize the validity of energy while ensuring reduction of energy-related costs.”

The dominant message at the Schneider conference seemed to be articulated best by keynoter Berst who stressed that in a world of distributed electricity there has to be a Smart Grid. “That’s the only way we can ship power back and forth to each other and to the main grid,” he said, adding, “When you have an excess of

power you can ship it to where it is needed, and when you need extra power it’s always there and ready.”

In its most fundamental form, Berst maintains, the Smart Grid technology “is simply smart devices talking over smart communications to smart systems.” When Smart Grids become the standard in the industry, Berst expects power engineers to be able to predict problems before they occur. He emphasized this would be a first for the industry. “And for the first time, as well,” he claimed, “we will be able to control with great precision how much power flows, where it flows, when it flows for maximum efficiency and reliability.”

Perhaps even more useful than its ability to foresee breakdowns and malfunctions is the Smart Grid’s capacity, as Berst put it, for self healing. “Again, for the first time,” he went on, “equipment in the field will take action automatically to isolate problems, to flow power around the problem and to test and restore equipment – all within seconds without operator intervention.”

Beyond the improved quality of life which a growing world population can count on from reliable, clean, efficient and economical energy provided by smart energy technology, the Smart Grid is also creating significant business prospects for equipment and device manufacturers – as well as savings for operators of existing power plants and governments that finance and regulate them. Berst said that smart energy systems would allow existing power generators to use their assets more efficiently. Retrofitting old plants with Smart Grid technology would allow utilities and taxpayers to save billions of dollars that otherwise would be spent on new construction. According to calculations by consulting firm McKinsey & Company, the total value of indirect benefits to cities and states implementing Smart Grid systems will total more than \$131 billion by 2019. “And that’s before you add in hard-to-quantify benefits such as the environment and national security,” Berst emphasized.

There will also be big opportunities for electrical device makers and distributors. SmartGridNews.com estimates the value of the global Smart Grid market for meters, IT and communication equipment and sensors to be \$171.4 billion by 2014. Sensor devices will be the top category in this market with \$85.5 billion in anticipated sales, followed by IT equipment and systems at \$39.4 billion, communications at \$27.4 billion and meters at \$19 billion.

The future could be looking even brighter for device and equipment makers, Berst hinted. “When the tipping point arrives, the pace accelerates,” he said, noting in his remarks that smart meter market share will surpass 25 percent this year.

### TELVENT JOINS SCHNEIDER ELECTRIC

Jesse Berst reinforced the message that not only had the nation entered the electric economy, but “we’re reinventing electricity.” In 1950 only 20 percent of U.S. GDP was dependent of electricity.

Currently more than 60 percent of the country’s GDP relies on electricity. Just as the U.S. economy grew with easy access to reliable, cheap petroleum in the 20th Century, the nation will need to key-in on the value and role of electric power to maintain its prosperity in the 21st. To be successful in this transformation or “to win,” as Berst described it, “you must choose the right platform and partners.”

So Schneider Electric also used the conference venue to announce it had completed the acquisition of Telvent Worldwide, a global IT systems and information services company with 6,000 employees working from 17 offices worldwide. The acquisition puts in place a strategic combination of Schneider’s energy process management services with Telvent’s strong suite of software and IT capabilities for asset management. As Smart Grid technology develops worldwide, Telvent is expected to complement Schneider Electric’s field level services and expertise with its grid monitoring and control software.

Utilities have struggled to organize information on a wide variety of assets in support of operations, accounting and other business processes. According to Telvent engineers presenting at the conference, “with asset management functionality spread across several software applications, utilities have been forced to maintain multiple databases and cope with approaches to synchronize them.” Further, with asset management systems in place that were initially intended for power stations, utilities are now trying to adapt older asset management approaches to the Smart Grid, where the fabric of the network can change frequently and where a vast amount of asset information is being added each day in terms of meters, home automation devices and sensors and other hardware. Telvent IT and software systems will be also incorporated as integral components of the services Schneider provides to the oil and gas, agriculture, transportation and weather information industries.

In a statement detailing the acquisition, Rickey said Telvent and Schneider Electric will be able to provide customers with data visibility to meet customers’ sustainability and efficiency challenges for today and tomorrow. Jesse Berst underscored that commitment when he said, “We’re reinventing electricity; and the choices we make – (about) the technologies, the standards, the policies – will affect our country for generations.”

# US ARMY INVESTS IN RENEWABLES

BY ROGER D. STARK AND DARIN LOWDER



*Roger D. Stark*

The U.S. Army recently announced plans to solicit and award multiple indefinite delivery, indefinite quantity (ID/IQ) contracts as the predicate for power purchase agreement task orders in an aggregate amount of up to \$5 billion with individual task orders expected to range from \$50 million to \$900 million each. The renewable or alternative energy projects will be financed, constructed, operated and maintained by private contractors, and located on or near Army installations.

Pursuant to targets initially established in the Energy Policy Act of 2005 and then updated in the John Warner National Defense Authorization Act for Fiscal Year 2007, twenty-five percent of the energy purchased by the Department of Defense must come from renewable resources by 2025.<sup>1</sup> (The Army currently obtains just 2 percent of its electricity from renewable energy technologies.) Using the expressions of interest it has received thus far, the Army is determining how best to configure solicitations for specific projects and anticipates that multiple award ID/IQ contracts will be awarded beginning in 2013, with successful bidders permitted to compete for PPA task orders during the following five years.

Eligible energy resources under the solicitation will include solar, wind (subject to potential limitations on the height of wind turbines), geothermal and biomass projects, and may also include projects using alternative energy sources that reduce greenhouse gas emissions, reduce energy costs, or improve energy security. A key goal of the renewable energy initiative is achievement of the Army's "net zero" objectives for installations in the continental United States.

## EVOLUTION OF DOD ENERGY PROCUREMENT

The Department of Defense has previously approached renewable energy



*Darin Lowder*

resource development projects using structures that did not include long-term PPAs. For example, the Fort Irwin Army Base announced a 500 MW solar project using an "enhanced use lease" (EUL) model, where rent on the project site would be paid by the project sponsor through in-kind services such as electric generation to serve on-base demand. In that case, the project was awarded to private developers in 2009, but has yet to begin construction. By contrast, the 15 MW solar installation at Nellis Air Force Base used a PPA between the Navy and the project owner, and in Fiscal Year 2010, the Department of Defense awarded over \$300 million in Energy Savings Performance Contracts or Utilities Energy Savings Contracts.<sup>2</sup>

Although it is expected that PPAs will be the primary vehicle used under the Army's solicitation, other mechanisms are not precluded. Also, the Army's prior experience with EUL's and energy savings performance contracts has led to some institutional reticence about departing from such structures in connection with future task orders for renewable energy. However, it appears that the Army's senior legal advisors have now concluded, based in part on authority granted pursuant to the Energy Policy Act of 2005,<sup>3</sup> that suitable procedures exist for the Army to approve and enter into PPAs with terms of up to thirty years.

## CENTRALIZATION OF RENEWABLE ENERGY DEVELOPMENT

On September 15, 2011, the Army established the Energy Initiatives Office Task Force (EIO), which is charged with streamlining existing acquisition processes and leveraging private investment to develop large-scale renewable and alternative energy projects on Army installations. By centralizing its efforts on large-scale projects, the Army hopes to attract the sub-

stantial private investment that it will need over the next 10 years to meet its internal goals and federal mandates.<sup>4</sup> This approach is in addition to base-specific development efforts already under way on various projects across the country.

EIO representatives have not yet specified the form that the solicitations will take, but have announced an Army Energy Initiatives Task Force Summit, which will be open to the public and will take place on November 3, 2011 at the Navy Yard in Washington, DC. (see [www.ArmyEIO.com](http://www.ArmyEIO.com)). It is anticipated that additional information will be forthcoming at that event, which will be broadcast via the EIO website.

## NET ZERO STATUS

In addition to assisting the Army in lowering greenhouse gas emissions and complying with its renewable energy mandate by 2025, the development of large-scale renewable or alternative energy facilities is also a key component of the Army's "net zero" objectives for U.S. installations.

The Army defines a net zero energy installation as one that produces as much renewable energy on site as it uses, on an annual basis. This includes conservation and efficiency efforts in addition to renewable energy generation. Similarly, a net zero water installation reduces the potable fresh water consumed, and repurposes or recharges an amount equal to that consumption on an annual basis (net zero waste installations use a similar methodology). Thus, the Army is interested in using waste-to-energy technologies as well as large scale energy storage, wind energy generation, geothermal energy, microgrids, solar energy and the design and installation of net zero homes to advance its broader policy objectives.<sup>5</sup>

The Army previously satisfied its renewable energy mandates through the purchase of renewable energy certificates or clean energy rather than on-site generation. Although the Army's recent solicitation is not restricted to on-site generation, projects on or near Army installations will serve the dual purpose of moving the Army towards achievement of both renewable energy mandates and net zero objectives, and are therefore likely to be preferred.

## CONCLUSION

Project sponsors should consider opportunities presented by the Army solicitation from a variety of perspectives. First, it is important to bear in mind that the Army's initiative likely will be implemented from both the "top down" and the "bottom up." Base commanders will have significant input to the procurement and selection process, while the Pentagon

Brass continue to establish and implement policy directives.

Second, although the Army's preliminary solicitation issued this summer sought expressions of interest from potential future bidders, the actual solicitations likely will prefer bidders having some or all of the following characteristics: (i) large organizations that can deliver a standardized offering to the Army at a number of locations (which may in turn offer financial and operational economies of scale), (ii) organizations that can deliver projects that are largely self-contained, without extensive supply chain or fuel requirements, (iii) organizations with multi-renewable resource capabilities, and (iv) organizations having pre-existing relationships with the Army.

In short, the Army's proposed procurement of renewable and alternative energy offers a variety of significant project opportunities, and successful sponsors will tailor their proposals to highlight both their own strengths in renewable energy development as well as their ability to support attainment of the Army's renewable energy mandates and net zero objectives.

<sup>1</sup>This goal is codified at 10 U.S.C. § 2911.

<sup>2</sup>Energy savings contracts typically involve the installation of energy efficiency equipment, where the contractor provides financing for the equipment and is repaid through a portion of the energy savings realized.

<sup>3</sup>See 10 U.S.C. § 2922A

<sup>4</sup>The Army has estimated that meeting the renewable energy targets will require \$7.1 billion in investment over the next ten years. Under the current solicitation, the Army has stated that it plans to issue task orders for \$5 billion in future projects.

<sup>5</sup>Fort Bliss recently closed a request for information related to achieving a net zero energy consumption on base by 2015, followed by net zero water and waste by 2018.

Ballard Spahr LLP has extensive experience with various forms of renewable energy, tax-exempt and public-private partnership finance structures involving the U.S. Army and other branches of the U.S. military as well as related experience in other aspects of renewable energy project development and finance. If you have any questions on opportunities regarding energy projects with the Army, please contact Roger D. Stark at 202.661.7620 or [starkr@ballardspahr.com](mailto:starkr@ballardspahr.com), or Darin Lowder at 202.661.7631 or [lowderd@ballardspahr.com](mailto:lowderd@ballardspahr.com).

# SMART GRID PARTNERSHIPS

**BY DAVID K. OWENS, EXECUTIVE VP, EDISON ELECTRIC INSTITUTE**



The promises of a modern, smart grid are enticing to both electric utilities and their customers: improved reliability, greater efficiency, and more control over electricity use for both utilities and their customers.

To turn these promises into reality, electric utilities are modernizing their electric transmission and distribution systems, replacing analog technologies with digital communications, information, and control technologies. As they do so, they are pursuing a close collaboration with a wide range of stakeholder groups.

The “smart meters” that utilities are installing to replace the traditional analog meters that have been in use for almost a century are a very visible feature of this new, modern grid. A new survey by the Institute for Electric Efficiency (IEE) found that as of September 2011, 27 million smart electric meters, representing more than one-in-five households in the country, have been installed. Based on utility projections, the IEE survey estimates that approximately 65 million smart meters, equaling more than half of all households in the nation, will be installed by 2015.

Beyond the operational benefits that smart meters offer, such as automated meter reading, automated outage detection, and faster responses to customer requests for connections and disconnections, smart meters also make it possible for utilities to use smart rates—electricity prices that reflect a utility's true cost of electricity. By charging higher rates during peak periods and lower rates during off-peak periods, a utility can reduce its peak demand, which will lead to lower electricity costs for its customers.

Along with smart meters and smart rates, in-home energy displays, internet energy information dashboards, and smart appliances will help consumers to take more control over how and when they use energy.

Smart meters and smart rates are also the essential underpinnings for most effectively bringing plug-in electric vehicles into the smart grid. The smart grid

will enable consumers to charge up during the overnight hours when electricity is cheaper, and then wake up to a car ready for their daily commutes.

These smart meters coupled with other automated technologies create real-time awareness about how electric distribution systems are operating. This awareness in turn creates a number of benefits for utilities and their customers alike:

- More Constant System Voltage Levels—The capability to maintain more stable voltage levels throughout the electric system benefits all customers, especially those with digital equipment at home or at work. Steady voltage levels also result in lower electricity losses due to line resistance, which is a direct saving for customers.
  - Improved Substation Monitoring and Diagnosis—Being able to more closely observe their distribution substation operation and identify problems quickly contributes to greater system reliability.
  - Enhanced Distribution Power Systems Management—The ability to efficiently and effectively integrate distributed energy resources, such as rooftop solar units and even devices that can store electricity, such as batteries, into the grid, benefits the utility and customer alike.

- More Demand Response Tools—The ability to send electricity price signals also will create more opportunities for customers to lower their power costs by avoiding electricity use during the high demand periods.

- Advanced Outage Management Systems—A smart grid will also benefit customers with the capability to detect outages more rapidly. In some cases, this capability will even be able to prevent outages from occurring. These features are important to all customers, especially those remote or hard-to-serve locations.

Combined, all of these new technology capabilities allow electric utilities to more closely monitor and control all of the points on their system between the power plant and the customer. The result is a more efficient, reliable, and manageable grid.

To address the many logistical and policy challenges inherent in building this modernized grid, EEI has taken the lead in initiating an industry-wide collaboration process. On behalf of our member companies, we are working closely with all major stakeholder groups including regulators (state and federal), the present administration, consumer advocates, and industry to develop options for integrating smart grid technologies and systems with legacy technologies and systems.

We also are supporting the continued development of interoperability standards and cyber security requirements through

the National Institute of Standards and Technologies (NIST) process. It is essential that standards ensure that new equipment meets cyber security requirements, is interoperable with other new devices, is compatible with legacy systems, and will be compatible with future equipment.

Although it is clear that products of the future must have appropriate security "built-in" as part of design, nevertheless, one-size-fits-all solutions are not appropriate. It is essential to ensure harmonization between standards in use today and those being developed for the future.

Another area where we are working closely with the federal government is in allocating the spectrum necessary for smart grid operations. Likewise, we are involved in establishing important web portals and smart grid testing and risk mitigation centers will be essential.

Federal leadership in these areas and the need for collaboration does not diminish the important role of the states. Just the opposite, the role of the states must be respected. Many of the solutions will be state or regional in nature, and because of the pivotal role that state regulators play in approving the new technologies for inclusion in customer rates and in overseeing reliability and other aspects of utility services.

A growing area of concern for electric utilities is the potential for technological obsolescence. In contrast to traditional utility investments that have long, stable asset lives, smart technologies are anticipated to evolve rapidly over the coming years.

The smart grid technology itself may have a substantially shorter life cycle than the equipment it replaced. Efforts are underway to understand better the potential impacts of replacing an increasing amount of grid assets (which may have asset lives of several decades) with smart grid technologies that have asset lives of perhaps a single decade.

Given the rapid rate of technological change that is occurring, depreciation rates may need to be adjusted to reflect the relatively short economic lives of some Smart Grid assets. State and federal regu-

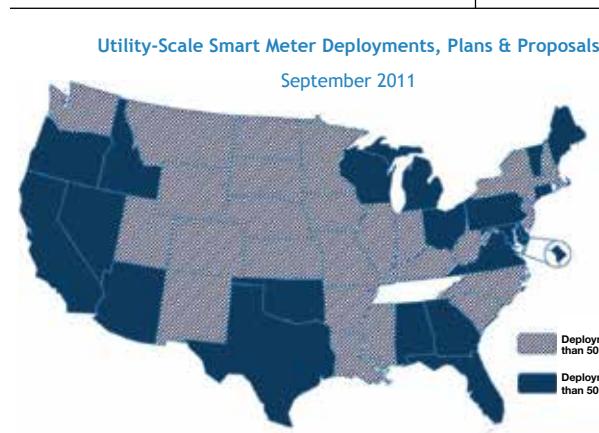
lators may also need to consider adopting policies that limit the impact on utilities of prudent investments in assets that subsequently become underutilized or obsolete.

For their part, many EEI members are actively engaged in developing potential smart grid scenarios to establish a long-term vision of the smart grid and to identify best methods to transition to it. The goal of these efforts is to develop a technology game plan or roadmap that appropriately balances state and federal policy objectives, customer needs, business objectives, and the adoption of new smart grid technologies.

Another major focus of electric utilities in the transition to a more modern grid is customer education and engagement. Providing for customer education at all levels is critical in order to maximize participation, and to avoid problems caused by lack of understanding of the full range of a modernized grid's benefits.

Generally, customers have not been exposed to the various concepts and unique issues introduced by the smart grid, and many customers are unfamiliar with the changes and related benefits that the more modern grid will produce. Residential consumers, in particular, often may not completely understand the full range of benefits made available with new metering equipment, including the opportunities for cost savings. Nor do they typically understand the time-varying value of electricity, dynamic pricing structures, or demand response benefits. Consequently, customer education about these features is essential so that customers become better at managing their energy use.

The modern grid is already beginning to return benefits to both utilities and their customers today. In addition, like the Internet, it is creating a platform for integrating new applications whose future benefits are hard to imagine. Realizing the full potential of the modernized grid will of course take time. The nation's electric power industry is confident that through its commitment and its partnerships, the future for the electric industry and its customers never looked brighter.



*This map and table summarize current smart meter installations, as well as planned deployments and proposals, by investor-owned utilities, large public power utilities, and some rural electric cooperatives. IEE estimates that approximately 65 million smart meters will be deployed by 2015, representing 54% of U.S. households. As of September 2011, 27 million smart meters have been installed.*

# SMARTER TRANSMISSION BENEFITS

BY PAUL MYRDA, ELECTRIC POWER RESEARCH INSTITUTE



A smarter transmission grid requires the transformation of the existing grid in three ways. These are improving the operating efficiency of the existing infrastructure, deploying advanced technologies, and building a new and efficient transmission infrastructure. If successful, the resulting grid can be robust, with state-of-the-art technologies and enhanced safety, reliability, and security while promoting efficient markets and economic growth.

The Electric Power Research Institute has a number of initiatives that focus on smarter transmission applications.

## ASSET HEALTH INFORMATION

"Control Center Display of Asset Health Information" is an EPRI project that focuses on enhanced awareness of asset health. The project uses real asset condition information from participating utilities that is sent to EPRI's Smart Grid Substations Lab where it will be mapped into IEC61850 and the CIM standards (IEC61968 & 61970) as appropriate. That information will then be analyzed using existing asset health algorithms and combined with other relevant information into an information display suitable for operations. This project will also investigate the feasibility of transferring the result to a tablet environment so that the display can be portable. One of the goals of this project is to explore the development of an "electric utility" application store.

## OVERVIEW

Electric power delivery is under pressure from both a business and technical perspective. In the United States, recent legislation is becoming a driving force for the industry. The Energy Independence and Security Act (EISA) of 2007 and also The American Recovery and Reinvestment Act (ARRA) of 2009 have

mobilized significant efforts to modernize the grid. One key aspect of the ARRA is the funding of Smart Grid Demonstration Projects. These projects will significantly enable new learning about the smart grid functionality and its ultimate benefits.

Electric transmission systems form a critical power transport backbone that is seeing increasing demands for integration of new and more diverse power generation from a variety of sources, including variable sources like wind generation. Furthermore, several new operating strategies are envisioned including operating closer to performance limits, and engaging customers in the provision of ancillary services. All of these new operating paradigms will require the careful application of communications, networks, and embedded computing in what can be broadly described as "distributed computing."

The use of more sophisticated control algorithms and technologies such as expert systems, inference engines, knowledge bases and other advanced processing approaches have been studied for over twenty years. In trying to move forward with these ideas in power delivery systems, the field has typically run into implementation challenges due to the high cost of communications systems. With the smart grid deployment, communications infrastructures are being designed based on open standards which will allow more widespread integration with field equipment for asset management applications.

## CURRENT STATE

Today's transmission systems have a fair amount of intelligence. Energy management systems (EMS) employ advanced applications such as state estimation, contingency analysis, and voltage stability for continuous management of generation and power flow on the grid. These applications are based on data collection from substations throughout the grid with a scan rate ranging from 2-4 seconds.

Besides the EMS system, there is other information available to the operator. Some of these are dynamic line ratings, synchrophasor data and variety of condition monitoring information. The majority of this information tends to reside outside the EMS and may not be well integrated into the overall situational awareness capabilities in the control center.

Much of the condition monitoring information is implemented within stand-alone systems that monitor transformer conditions or circuit breaker conditions. The goal of the smart grid is to make monitoring information more generally available to a wide range of applications which would include a broader range of asset management functions. Data historians are examples of data repositories that pro-

vide the infrastructure for this objective.

## SENSOR DEPLOYMENT

Sensors and actuators in the smart grid are fundamental elements required for successful operation of the grid. It is through these devices that the actual power system's reaction to various inputs and outputs is measured. As in classic control systems, it is through sensors that vital information about a variety of conditions is received. The sensors convert voltage, current, phase angle, position status and other data into manageable signals that are either analog or digital in nature.

Today, these sensor signals are usually sent to a centralized operations center for a geographic region. At the operations center, various control computers process this sensor data into information and control signals. This system is capable of responding to manual inputs from system operators for manual actions such as energizing and de-energizing lines for maintenance.

In the power delivery smart grid, sensors will increase in both type and quantity. In fact, over the last 10-15 years, a number of new commercially produced sensors have been introduced by suppliers. These have included transformer monitors, circuit breaker monitors, infrared cameras and others. While all of these sensors provide useful information to the utility operators and managers, they have been difficult to apply due to the lack of wide area, high bandwidth communications out to the field assets.

One prevalent sensor at every utility is the microprocessor relay. Each of these relays contains within it a significant number of data values that go beyond what is necessary for protection. Included in many of these devices are digital fault records, sequence of event recorders, calculation of I<sub>2</sub>t, synchrophasor measurement, breaker contact status and timing, etc. System wide communications infrastructure and standard interfaces for collecting and managing this information will make this valuable data source available to a wide range of applications.

The influx of sensors into the electric utility marketplace has been extensive, including the installed base of microprocessor based relays. The limitation to fully utilize this data for both operations and asset management has been limited bandwidth connecting the field assets to the utility enterprise and lack of standards for sharing and managing the data.

Standards for data integration are based on the IEC Common Information Model so that the data can be shared by many applications across an enterprise service bus. New analytics will process and evaluate this information to optimize

the performance and maintenance of assets throughout the grid.

Asset management and the smart grid will be a powerful tool for electric utility companies in many ways. It is one of the five fundamental technologies that will drive the Smart Grid, according to the US Department of Energy (along with integrated communications, sensing and measurement, advanced control methods and improved interfaces with decision support).

Asset management functions are made possible through the implementation of a Smart Grid Conceptual Model and architecture that facilitates interconnection within and between power system domains with standard interfaces that facilitate interoperability.

Asset management functions primarily cut across the operations, transmission and distribution domains of the conceptual model.

Asset management functions will take advantage of widespread sensors that are integrated with operational functions in each of the domains but can be used for a wide variety of functions even across domains through interoperability standards like the Common Information Model (CIM).

Future research in asset management applications within the smart grid should take place in two areas. The first should be with respect to specific assets, such as transformers, circuit breakers, etc. These research efforts should analyze the data sources available associated with these assets and look for ways to tap into the data for more comprehensive diagnostics, performance assessment, lifetime estimation, maintenance optimization, and replacement strategies. Upcoming activity will be part of an EPRI project. The other area of future work will need to be in enhancing the computational capabilities to deal with the large volumes of asset specific data and developing algorithms to adequately interpret the data and turn it into actionable information.

## NEW REPORTS OFFER INSIGHTS

Several new reports provide interesting insights for utilities that are focusing on smart transmission applications for their operations.

"Needed: A Grid Operating System to Facilitate Grid Transformation" – (EPRI\_Report\_1023223)

Estimating the Costs and Benefits of the Smart Grid - White Paper – (EPRI\_Report\_1022519)

Smart Grid Technologies Can Aid In Asset Management (Related EPRI Report 1017828).

## POTASH CONTINUED FROM PAGE 15

tax credit available for electric car owners, so, to be rigorously correct, that reduces the per gallon cost to \$2.40.

Thus overall the economics of electric driving are somewhat better than that of gasoline. This is quite a dramatic result because it is based on using existing technology, and fairly high electric prices. Pundits are predicting a fall in battery prices as there was a fall in solar panel prices in the last three years. The cost of electric driving is very likely to come down, with higher volume mass production, but we're already at parity.

### RETAIL TARIFFS FOR CHARGING EV'S

Utilities are getting ready for electric driving. Regular residential consumers at Los Angeles Department of Water and Power pay 7 ¢/kWh to 12 ¢/kWh depending on how much power they use and the time of year, and that would correspond to a gas price of under \$1 per gallon, extrapolating from a 2007 study of the Electric Power Research Institute. (EPRI, in a study of electric vehicles in 2007, said that 8.5 ¢/kWh would translate to a per-gallon gasoline equivalent of 75 cents per gallon.)

As of fall 2011, LADWP offers a time-of-use rate that allows consumers to charge up at rates of 5 ¢/kWh to 8 ¢/kWh, year round, if they are simply willing to avoid peak hours, between 1:00 and 5:00 PM, Monday through Friday. If the consumer can limit their charging hours to 10 PM to 8 AM, the price is 5 ¢/kWh.

Those TOU prices do not include credit of 2.5 ¢/kWh Electric Vehicle Discount. According to LADWP: "Owners of licensed passenger electric vehicles shall be entitled to a discount on the block of energy designated by the Department as necessary for basic vehicle charging."

Proof of vehicle registration and charging location is required." Fair enough. If one is willing to charge up after 10 PM and before 8 AM, it looks like your price for power can be as little as 2.5 ¢/kWh.

At 2.5 ¢/kWh, the equivalent gas price for electric driving is something like 20 ¢/gallon, by the EPRI methodology. Economics is one reason why electric vehicles could be a power-sector game changer. It is also a reason why night-time power consumption could go up dramatically.

Across town, at Southern California Edison, rates are somewhat higher and a bit more complicated. There is a blended tariff that includes vehicle charging, plus SCE has a vehicle-only tariff, which is seasonal and time-of-use, ranging from 10 ¢/kWh off-peak in the either winter or summer, to a peak winter price of 21 ¢/kWh and summer peak price of 30 ¢/kWh. However, SCE's peak hours are more lenient, from 12 PM to 9 PM year round. That would seem to me quite flexible and consumer-friendly, so if you forget to plug in at night, you can recharge in the morning for a few hours and still get the off-peak 10 ¢/kWh price. That is still equivalent to dollar-a-gallon gas-equivalent.

### COAL, GAS-FIRED POWER MAY RESURGE

Electric cars should make great sense based on today's low power prices, which are expected to continue. Electric Power Research Institute recently made a study predicting the future cost of generation that is most useful. EPRI predicts the lowest cost of electricity would be from natural gas combined cycle, in a range from 49 ¢/MWh to 79 ¢/MWh.

EPRI predicts coal prices at low levels also, although there uncertainty from the specter of additional charge for carbon impact. Still, even adding \$20 per kWh for carbon cost, the generation price of coal would be only 74 to 80 ¢/MWh, which relates quite favorably to the 8.5 cents/kWh and 75 cents/gallon relationship EPRI

has postulated. Note this does not count transmission and distribution cost. But, remember that the distribution infrastructure is already in place and underutilized at night. T&D engineers and utility accountants should be delighted to increase asset capacity utilization in the off-peak hours.

As it relates to the cost of charging up an electric car, the power generation prices for all technologies are well within an acceptable for electric vehicle charging, as compared to gas fueling. Even the photovoltaic cost is reasonable, if one considers roof-top distributed charging. Using the Ford Focus example, from above, we can calculate that 22.7 kWh is needed to "fill up" the tank for 100 miles of driving. I find it very impressive that these decent levels of economic performance in the transportation sector are available right now, using off-the-shelf technologies.

The reason why coal-fired power projects may come back in favor is due to low cost and relative price stability, and less exposure to international price impact. Gas-fired projects will no doubt continue to dominate new supply in the near term, but the fracking risk and price volatility could attenuate market share for new gas projects.

In California, for the three Investor-Owned Utilities, the cost of generation is on average about 8 - 9 ¢/kWh, the cost of distribution is about 4 - 5 ¢/kWh, and the cost of transmission is about 1 ¢/kWh. The total cost of 14-15 ¢/kWh is more expensive than the 11 ¢/kWh national average estimated by Ford in the Focus example. Still at 14-15 ¢/kWh that makes the effective cost of gas to be about \$1.50 per gallon, an attractive price point. In order for California IOU's to maintain its generation component at a cost of 8 cents, it would be necessary to have a fair amount of coal or gas-fired electric power. Therein would lay the pressure to maintain the gas and coal fleet, if there is a lot of new demand for electric charging.

Currently in the U.S. in general there is a high reserve margin, and very high night-time reserve margin. According to the latest annual statistics (2009) available at the U.S. DOE Energy Information Agency, capacity factor of coal plants in the U.S. is around 64% and gas plants are 25%. And as a result of renewable portfolio standards and tax credits, there is a preponderance of wind generation that increasingly is affecting grid stability, in good windy places like Oregon and Texas. As a result, independent grid operators are looking at changing, or already have changed, rules that allow wind generators unlimited access to put power on the grid. For example, the California ISO has proposed revising market floor price from negative \$30 per MWh to negative \$300 per MWh.

Rather than pay generators to not produce power, it may be a better approach to accelerate the electric car roll-out, and thereby flatten out the load curve, which should benefit

coal, gas and wind power producers.

### CONCLUSION

Rather than pay wind producers to not make electricity when the wind is blowing, for free, it seems to me that there is golden opportunity to charge electric vehicles at night. While the "smart grid" could, elaborately, and expensively, adjust demand and timing of charging vehicles, a simple timer could delay charging until after midnight.

The rate structures outlined above, from LADWP and SCE, already push customers into the proper behavior. One can imagine a confederation of electric car consumers and wind producers, aligned on environmental reasons. Another confederation would be electric car consumers and coal-fired power plant operators whose interests are aligned simply in regard to time-of-day and price.

Counting tax credits, the cost of driving on electric fuel is about the same as driving with gas. The tipping point may already be here, and this may be a boon to utilities looking to smooth out their daily load curve.

### About the author

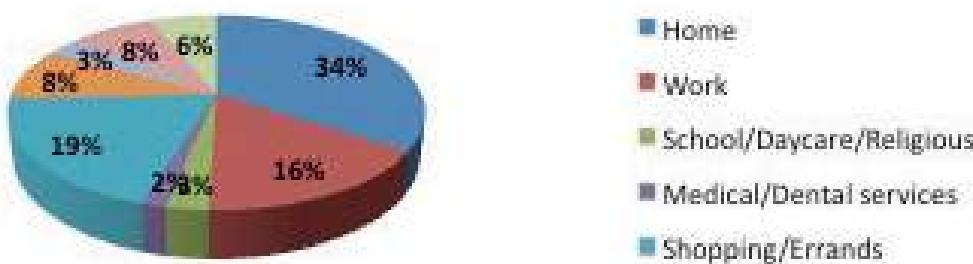
Daniel A. Potash is Senior Financial Analyst and head of power project financing with Advanced Engineering Associates International, Inc., Washington D.C., a consulting firm specializing in the power industry, international energy reform and privatization, and renewable energy.

### World-Generation Statement of Ownership Management and Circulation Legal Notice U.S. Postal Service Postal Service Statement of Ownership Management and Circulation

(Required by Section 3685, title 39, United States Code)

1. A Title of publication: World-Generation
  2. Publication No: 005-708
  3. Date of filing: September 27, 2011
  4. Frequency of issue: Five times, Jan/Feb, Mar/Apr, June/July, Sept/Oct, Nov/Dec.
  5. No of issues published annually: 5
  6. Annual US Subscription: \$75.00
  7. Location of known office of publication: 2 Penn Plaza, Suite 1500, New York, New York 10121.
  8. Location of headquarters or general business offices of the publisher: 2 Penn Plaza, Suite 1500, New York, New York 10121.
  9. Names and addresses of publisher and editor: publisher Richard Flanagan; editor 2 Penn Plaza, Suite 1500, New York, New York 10121.
  10. The owner is Flanagan Group, Inc. 2 Penn Plaza, Suite 1500, New York, New York 10121. Stockholders holding one percent or more of stock are: Richard Flanagan, president, 2 Penn Plaza, Suite 1500, New York, New York 10121
  11. Known bondholders, mortgagees, and other Security Holders Owning or Holding 1 percent or more of total amounts of Bonds, Mortgages or other Securities: None.
  12. Not applicable.
  13. World-Generation
  14. Issue date for circulation below: Sept/Oct '11
  15. Extent and nature of circulation:
- | Average no. of copies each issue during preceding 12 months. | Actual no. of copies of single issue published nearest to filing date. |
|--|--|
| A. Total number of copies 3428                               | 3364   |
| B. Paid and/or requested distribution by mail                |  |
| 1. Outside county 2232                                       | 2228   |
| 2.-4. n/a  | n/a  |
| C. Total paid and/or requested circulation 2232              | 2228   |
| D. Nonrequested distribution by mail,                        |  |
| 1. Outside county 1056                                       | 1041   |
| 2.-4. n/a  | n/a  |
| E. Total nonrequested distribution 1056                      | 1041   |
| F. Total distribution 3288                                   | 3269   |
| G. Copies not distributed 140                                | 75   |
| H. Total 3428  | 3364   |
- I. certify that the statements made by the above are correct and complete.  
Richard Flanagan, Publisher

### National Household Travel Survey 2009; Data on Purpose of Travel



### Effective Cost of Gasoline for Different Generation Technologies

Technology	Average Cost of Energy \$/MWh	Transmission and Distribution \$/MWh	Total Cost of Energy \$/MWh
Coal: Pulverized Coal	57.0	70.0	127.0
Coal: Integrated Gasified Combined Cycle	70.5	70.0	140.5
Natural Gas: Combined Cycle	64.0	70.0	134.0
Nuclear	81.5	70.0	151.5
Biomass, Bubbling Fluidized Bed	115.5	70.0	185.5
Wind: On-shore	106.5	70.0	176.5
Solar: Concentrating Thermal	144.5	70.0	214.5
Solar Photovoltaic	303.0	-	303.0

## FLANAGAN - THE SHALE REVOLUTION

CONTINUED FROM PAGE 1

She continues to aggressively support the construction of the Keystone XL Pipeline that will link Oklahoma to new markets. The pipeline represents an investment that could result in \$1.2 billion in increased business activity in Oklahoma and an increase in personal income of \$874 million. Her support of safe hydraulic fracturing is unwavering. Fracking is an essential process to the future of Oklahoma's energy industry. "Oklahoma companies have been doing it safely for over 60 years. So to show the rest of the nation that fracking is a safe and essential process, I'm asking our policy makers and the energy industry to support public disclosure of chemicals on the Oklahoma-originated website, FracFocus.org," she pledged.

The Oklahoma City-based Ground Water Protection Council (GWPC), working in conjunction with the Oklahoma City-based Interstate Oil and Gas Compact Commission developed the nationally acclaimed FracFocus ([www.fracfocus.org](http://www.fracfocus.org)) voluntary disclosure database for chemicals used in hydraulic fracturing.

Oklahoma enacted the Oklahoma Energy Security Act, establishing a 15% renewable energy target by 2015. As of 2011, renewables, energy efficiency and demand-side management already account for about 13% of power generation, much owed to the development of Oklahoma's wind resources.

### WIND

Oklahoma's wind resources are ranked 8th in the US for wind production. Wind energy provides 3,000 jobs throughout the state and contributes to more than \$13 million a year in property tax and land lease payments. In the Panhandle alone, the state could develop more than 8,400mw's of wind generation capacity, leading to as much as \$38 million in land payments and \$1.2 billion in wind electricity generation.

The Oklahoma Corporation Commission recently approved utility status to Plains and Eastern Clean Line to build 800 miles of HVDC transmission. Between 2020 and 2025, the Southwest Power Pool expects its nine-state region to produce 8,500 mw's of wind power, with more than half coming from Oklahoma. The US Department of Energy predicts that by 2030, Oklahoma could be the sec-

ond-largest generator of wind power in the nation. According to the Oklahoma Wind Power Initiative (OWPI). Oklahoma has about 2.3 times more wind energy potential per square mile than Texas.

Michael Revak, vice president of Siemens Wind Power Americas', spoke of Siemens commitment to Oklahoma. Siemens provided 44 SWT-2.3-93 wind turbines to Oklahoma Gas & Electric and the University of Oklahoma for the OU Spirit Wind Farm located near Woodward. Additionally, Siemens supplied 442.3-93 units for the Keenan I farm and 66 SWT-2.3-101 units to CPV Renewable Energy Company's 151.8mw Keenan II Wind Farm. Siemens is also providing 95 SWT-2.3-101 wind turbines and three units of the SWT-3.0-101 direct drive wind turbines for OG&E's Crossroads Wind Farm located in Dewey County.

Siemens announced plans for a new wind service warehousing operations in Woodward. Construction of the two facilities is expected to be completed by the end of 2011. With a total of 64,000 sq. ft., the combined main component, tooling and spare parts facilities will be Siemens' largest wind power service distribution center in the US, creating up to 40 "green-collar" jobs.

and is imported from Wyoming. The cement and lime industries serve as the primary consumers of Oklahoma coal with increasing volumes of metallurgic-grade coal. The Oklahoma coal industry accounts for an estimated \$146 million in economic activity, generates \$42 million in Oklahoma income, and supports 1,153 full-time equivalent jobs.

### ENERGY EFFICIENCY

"Oklahoma continues to be ranked as one of the least energy-efficient states in the nation. That's why I'm asking the legislature to work with me to pass a law requiring every state agency to establish an efficiency improvement target of 2% per year through 2020," Fallin noted.

### NGV'S

Fallin announced a new initiative launched jointly with Governor John Hickenlooper of Colorado designed to increase the use of natural gas vehicles (NGV's) in state automobile fleets. Other states, including Wyoming and Pennsylvania have also signed onto the agreement.

The MOU lays the groundwork for the formation of a Multi-State Request for Proposal, where the states would prepare a

100 year old Oklahoma vertical well case law to adopt advancements in horizontal drilling. John Richels, CEO and president of Devon Energy, called it "The Shale Revolution" in his morning address. There's been a "geological paradigm shift" and we are no longer chasing structural and stratigraphic traps. Shale gas now represents greater than 25% of domestic supply, with estimates of 100 years of supply. US gas reserves have increased by 55%.

Oklahoma produced more than 1.8 trillion cubic feet which accounted for more than 80% of the state's overall energy production. Oklahomans consumed only one-third, leaving about two-thirds for export. Oklahoma currently boasts nearly 23 Tcf in reserves. Its energy supplies vary slightly from the US average primarily due to the absence of nuclear generation. In 2009, the state produced almost 2.6 quads of energy, ranking the state eighth in terms of total energy production.

### R & D OPPORTUNITIES

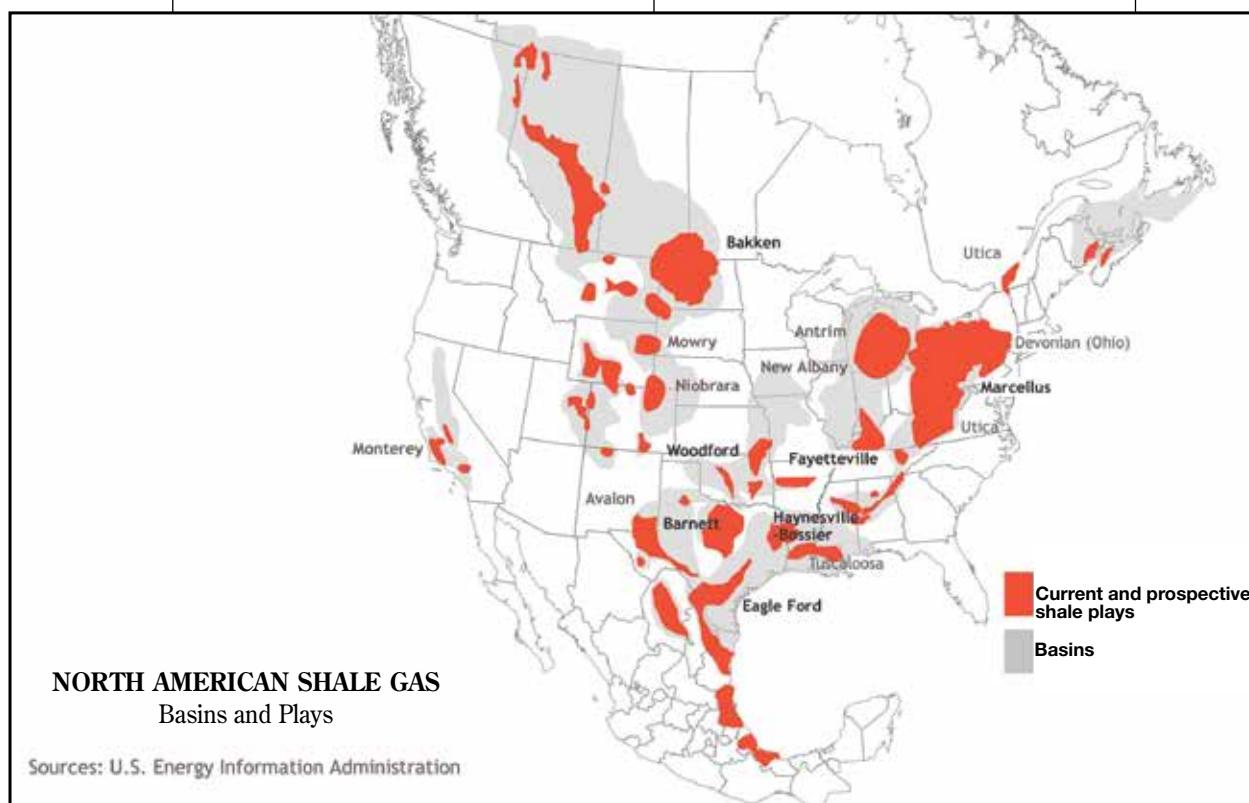
Both private and public investments in R&D programs play a key role in positioning Oklahoma at the forefront of the emerging energy industry. The US Energy Independence and Security Act requires the production of 35 billion gallons of ethanol by 2022.

Nearly half will come from cellulosic feedstocks. Oklahoma can play a key role. If Oklahoma were to dedicate 35% of the farm land in the state to biofuels feedstocks, it could supply the US with as much as 49.5 million tons of switchgrass used to generate these biofuels. The EPA estimates that, by 2022, 85% of the biofuels produced from switchgrass in the US will come from biorefineries located in Oklahoma.

At the Oklahoma Bioenergy Center, a consortium between the University of Oklahoma, Oklahoma State University, and the Noble Foundation, researchers specializing in energy and agricultural development are working to advance the next generation of renewable alternatives for petroleum-based transportation fuels.

Conservative estimates suggest that the state's \$15.4 million investment into the center has already resulted in an economic development impact of nearly \$97 million.

In 2011, through a project made possible by the Oklahoma Bioenergy Center, researchers at the Samuel Roberts Noble Foundation uncovered a gene responsible for controlling the growth density of plant material. The discovery, termed "biomass densification," has been heralded as a key advancement in biomass feedstock research.



### GEOTHERMAL

"Our capitol building is the only geothermal state capitol in the country and is in that sense a model of efficiency," she went on to say. Oklahoma is also the nation's leading geothermal heat pump state. The geothermal industry in Oklahoma employs more than 4,200 with annual revenues in excess of \$550 million per year.

### COAL

97% of the coal consumed in Oklahoma is used for power generation

formal request to automobile manufacturers to design an NGV and sell it in bulk to participating states.

### HB 1909

The Governor's plan was shepherded by C. Michael Ming, Oklahoma's Secretary of Energy who was appointed to his first government position by Governor Fallin in January, 2011. Over 200 stakeholders participated in the year-long energy working group.

The centerpiece of the First Energy Plan was H.B. 1909, the Shale Reservoir Development Act of 2011 that repealed the

# PERSPECTIVE

## HAMM - SOLAR POWER 2031

CONTINUED FROM PAGE 1

This year also marks a personal milestone. It is my twentieth anniversary with TP&L. When I started with the company in 2011, our portfolio had less than 1% solar, and the idea that we could get 30% of our power from solar seemed inconceivable. As I look back on my twenty years with the utility, it provides some perspective for how we reached this great accomplishment.

In 2031, we take solar power's role in our economy for granted, but it wasn't always that way.

When I joined the utility in 2011, solar power wasn't very high on the list of national priorities, and actually, neither was energy in general. A recession, skyrocketing unemployment rates, national debt, and global security issues far overshadowed energy issues. The world was also shaken by natural disasters and political unrest.

Everywhere we looked, we saw what seemed at the time to be insurmountable national and global challenges. With all the changes going on outside the utility world, not much attention was being paid to the changes we were going through within the industry or those that were quickly coming down the road.

Most utilities were just beginning to become aware of the increasing role that solar energy would play in our future. Hindsight is 20/20, but looking back now we can see that 2011 was actually a real turning point. Let's take a look at some of the solar developments that happened that year:

For one, it was the first gigawatt year. The US added well over a gigawatt of solar...almost 100% growth in the middle of a recession!

Second, solar was spreading, and spreading fast, moving beyond California, the Southwest, and the northeast to places like Texas, Georgia, Indiana, Idaho. It was quickly evolving from a regional energy source to a truly national one. We saw all types of utilities getting into solar in a big way.

Municipal utilities in states like Ohio and Texas, for example, made big strides that year towards hundreds of MW of new solar, whereas previously, municipal utilities had done solar only on a much smaller scale.

The "smart grid" was also moving from concept to reality with smart meters paving the way for utilities like us to maximize the value of distributed PV on the grid.

Finally, and probably most significantly, the price of solar had come down substantially – 60% between 2008 and 2011. In some places the price of solar power

was lower than natural gas.

The momentum we saw building in 2011 continued as the next twenty years brought changes that helped us get to where we are today. We saw our first comprehensive national energy policy with the Energy Policy Act of 2013. This really set the stage for us to reach the 30% solar we have today at TP&L.

In 2014, as a result of the Energy Policy Act, the national Clean Energy Bank was set up to provide long-term, low cost project financing for renewable energy projects which helped to transition solar away from reliance on subsidies.

By 2016 most of the smart grid standards put in place by the Energy Policy Act had taken effect.

Solar intermittency and high penetration became less and less of an issue. We were seeing smarter use of energy throughout the electric grid and customers were using significantly less energy.

By 2018, solar was the least-cost resource at the retail level for our customers and was quickly approaching our wholesale costs. Our customers could 'go solar' cheaper than we could provide them electricity.

For other utilities in the US, they reached this point even earlier. We were in the business of selling electricity. So what were we going to do? Fortunately, Congress passed the Energy Growth & Security Act of 2020, which in part provided incentives for utilities like ours to decouple energy sales from fixed and capital costs. It also incented us to work with the solar industry to structure rates, grid services and cost-recovery in innovative and equitable ways that helped us both.

Today our electricity sales are half of what they used to be, but our revenue has kept pace with these changes, allowing us to maintain and upgrade the electric grid over time. Our business model has shifted from one primarily based on electricity sales to one that includes electric grid balancing of on-site generation for a segment of customers.

In 2022, the majority of cars became primarily electric – again largely as a result of the Energy Policy Act of 2013. This shifted transportation from petroleum to our more diverse, and domestic, electricity portfolio. We adjusted rates to encourage off-peak charging and we didn't need significant new generating capacity – the vehicles themselves became distributed power plants we could utilize in conjunction with the smart grid.

By 2025, the price of storage technologies had come down enough that many utilities had more available compressed air and battery storage than gas peaking plants – some of it dispatchable from our customers' electric vehicles, some of it strategically sited on our distribution and transmission grids. Today we have over 1 GW of storage that can be dispatched on demand.

By 2026 the solar industry was the single largest economic development driv-

er within our service territory, creating thousands of new jobs year-upon-year, putting our unemployed customers back to work, and helping to rebuild residential, commercial and industrial loads for TP&L.

By 2028, the combination of new technology, lower costs, storage, smart grid...basically everything we had been working on for the last 18 years came together in alignment.

Solar was mainstream for both consumers and utilities. It was only a matter of time before solar became our biggest generating resource, which as I've reported happened this year.

Through it all, there has been one constant that has been evolving throughout the last twenty years, one that has made our current solar generation portfolio possible - the relationship between utilities like ours and the solar industry.

There were many issues that we needed to work through like technical solutions to high penetration rates on individual feeders, managing system-wide variability, and developing regulatory solutions to address cost recovery.

Without the collaboration between the utility and solar industries, we never would have gotten here. I remember many long days working with industry stakeholders to develop solutions and compromises and as a result, we all benefited with stronger and more sustainable businesses.

The last twenty years have certainly been full of change in the utility world. At times it was hard but we persevered. The result is a TP&L portfolio that shifted from less than 1% percent solar in 2011 to one that is over 30% today in 2031.

So, the sun that started breaking through twenty years ago is now shining in full force – thanks to an innovative and responsive solar industry, the creativity of many electric utilities in developing innovative business models, and the implementation of effective and logical government policies.

There never was a 'silver bullet.' Everything we needed, it turns out, we had at our fingertips back in 2011. It's been exciting to play a utility CEO in the year 2031, looking back on the dramatic growth of solar power. But it's time for me to come back to the present and to resume my role as President & CEO of the Solar Electric Power Association.

I believe a future like I've just described for you is very possible, even though the details on how we get there most certainly won't look exactly like I've envisioned through my crystal ball.

Julia Hamm is the president and CEO of the Solar Electric Power Association (SEPA). Prior to leading SEPA, she worked as a senior associate at ICF International. She holds a Bachelor's of Science in Business Management from Cornell University.

## POIRIER - FUKUSHIMA'S AFTERSHOCKS

CONTINUED FROM PAGE 14

cations rather than utility applications – for example, to support large oil shale and gas field extraction ventures or for large energy-park-type cogeneration applications. The deal flow for these rather unique projects is not that large and one wonders if adding a SMR increases the likelihood of successfully financing such ventures. For example, the need to cogenerate creates a "mill risk" – how do we know that the industrial plant will still be there for the entire 30-or 60-year life for the SMR? In addition, only a few industrial projects can justify a 150-200 MW captive baseload plant and siting an SMR in remote locations may not be an easy environmental proposition. Finally, some of the "perfect" customers – e.g., O&G and chemical companies – are likely more comfortable with integrated coal gas combined cycles (IGCCs). Many have bought gasifiers and the IGCC technology is much more in their "process" culture and IGCCs offer better load following capability if needed.

However, some utilities (e.g., TVA) may also be interested in SMRs although the economics of grid-based SMRs are not obvious yet. Consequently, how big can that SMR grow remains to be seen – one reasonable forecast calls for a potential 1-3 GW per year over the 2025-2030 period. While SMRs may remain a niche play, their largest contribution could be to help the entry of Gen IV reactors as many SMR designs share common features with Gen IV designs.

With a new type of coolant and reactor design, Gen IV plants could reach nearly 50-percent efficiency. However, a review of the materials presented at the last meeting of the Gen IV International Forum (GIF) as well as those of the IAEA working group on gascooled reactors held in late March 2011 leaves you with a mixed feeling: clearly, there is a lot of R&D work being considered (some planned as far back as the early 2000s when the Gen IV R&D work was actually much stronger) but funds are limited (GIF's budget is about \$400 million per year) and coordination remains weak.

Therefore, it would take a serious turnaround in world consensus to reset priorities and inject noticeably more monies in Gen IV R&D, especially in the current crisis climate. Even if we could see an acceleration of such R&D over the next 3-4 years, Gen IV reactors would not have much impact until 2030 and that's assuming that at least one demo plant has satisfactorily worked by 2027 and then repeat licensing is occurring in several key countries followed by orders from pioneer utilities.

**Power Generation Products**

**Environmental Control Solutions**

**After Market Services**

## ***TRAC® (Triple Action Catalyst) for Mercury Oxidation***

- \* Hitachi offers the latest evolution in SCR NO<sub>x</sub> reduction catalyst. TRAC® has been developed to increase the oxidation of mercury with minimal chlorine levels and can be used on bituminous and sub-bituminous (PRB) fuels.
- \* TRAC® significantly reduces or even eliminates the need for other mercury mitigation technologies saving owners and operators money and resources.
- \* The TRAC® advantage is the triple benefit of reducing NO<sub>x</sub>, minimizing SO<sub>2</sub> to SO<sub>3</sub> conversion and enhancing the mercury oxidation capabilities at the same time.

**Visit us at POWER-Gen Booth #1207**

**HITACHI POWER SYSTEMS AMERICA**

645 Martinsville Road, Basking Ridge, NJ 07920  
power.info@hal.hitachi.com Tel: 908-605-2800  
[www.hitachipowersystems.us](http://www.hitachipowersystems.us)

**HITACHI**  
Inspire the Next

# BECHTEL



## BECAUSE EXPERIENCE MATTERS

Since Bechtel's founding in 1898 we've measured success against our ability to repeatedly exceed customers' expectations and deliver innovative solutions for unique challenges. With over 65 years of experience in the power industry, we are continuing to help customers provide power for the 21st century.

We have an unrivaled standard for performance in the industry, having developed a diversified portfolio across six continents. When it comes to power projects, no one offers greater teamwork, experience, service, or dependability than Bechtel.

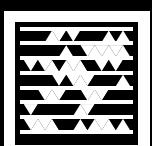
**BECHTEL**  
Frederick, Maryland USA  
[www.bechtel.com](http://www.bechtel.com)

San Francisco

Houston

London

Brisbane



Mobile Access QR-Code