

ALSTOM'S SOLAR GRID

BY DICK FLANAGAN



*Grégoire Poux-Guillaume
President, Alstom Grid Sector*

This interview was conducted on February 12th in the sun-kissed French Riviera city of Nice, on the rocky coast of the Mediterranean.

The interview with Grégoire Poux-Guillaume, President of the Alstom Grid Sector culminated the two-day press tour of Alstom's NICE GRID for *World-Gen* and 34 other journalists from 14 countries. Alstom's NICE GRID, the world's first solar energy

smart grid storage demonstration project was launched with partners ERDF, EDF, SAFT and RTE at a cost of €30 million.

Poux-Guillaume serves on Alstom's eight-member Executive Committee and travels about fifty percent of the time from his Paris headquarters. He shared these observations: "Different countries have different priorities. US utilities embrace innovation and have been able to roll out things in the US that we're still piloting elsewhere. It's not only innovation, but also about execution. US utilities track record is second to none. China is interested in digital substations with a smaller footprint. India has inherent weakness in its grid and is concerned about distribution, not so much transmission. (The Power Grid Corp. of India Limited (PGCIL) awarded Alstom a \$41 million contract for 1,100 phasor measurement units, 18,000 phasors in 351 substations and established 34 new control centers. In July, 2012, India's blackout hit 22 states affecting 640 million people and lasted up to eight hours.) "Europe is moving aggressively towards renewables. You have all

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WTE-RENEWABLE FUEL

BY DICK FLANAGAN



*Bill Arvan
General Facility Manager,
B&W's Palm Beach Resource Recovery Corp.*

WEST PALM BEACH, FL – The nation's first new waste to energy power plant to be built in twenty years is being constructed by Babcock & Wilcox and its consortium partner KBR on a 24 acre greenfield

site for the Solid Waste Authority of Palm Beach. SWA is a governmental agency with 400 employees governed by seven elected County Commissioners of Palm Beach County and is funded by user fees through an annual property tax bill on the county's 1.4 million residents and businesses. B&W and KBR are sharing the design and work scope, while B&W will exclusively perform the operations and maintenance for the 95 megawatt facility expected to come online in Q-1-15. Florida Power and Light has a 20 year power purchase agreement.

The new plant referred to as PBREF#2 can process a million tons of municipal solid waste annually producing electricity and reducing the waste sent to the county's landfill by up to 90 percent. (Landfills generate methane which is 21 times more potent of a greenhouse gas than carbon dioxide.) B&W will supply three mass burn boilers, grates, ash and metal recovery systems and emissions control equipment

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MAGNETIC FUSION

BY JEANNE JACKSON DEVOE



*Jeanne Jackson Devoe
PPPL, Office of Communications*

The heart of the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) is the National Spherical Torus Experiment (NSTX-U), a device that will help researchers develop magnetic fusion as a safe, abundant and inexpensive source of electric energy.

Magnetic fusion harnesses the same process that fuels the sun. Researchers heat an ionized gas called a plasma to a temperature far hotter than the core of the sun in a device called a tokamak, which controls the gas with powerful magnets. The extreme heat and magnetic confinement force positively charged atomic nuclei — or ions — to fuse together and create a powerful burst of energy that could ultimately produce steam to generate electric energy.

The NSTX-U is undergoing a \$94 million upgrade that will make the facility the most powerful tokamak of its type in the world when it is completed around the end of the year. The two main components of the upgrade are the central magnet, or center stack, and a second neutral beam injector to heat the plasma. These components will double the heat and electric current in the tokamak and quintuple the duration of the plasma.

PROGRESS OVER THE LAST YEAR

"We're building a scientific tool for the country and the Laboratory and there's been great progress over the last year," said PPPL Director Stewart Prager during the annual State of the Laboratory address. "To date, every technical challenge has been met."

The second neutral beam is already in place in the NSTX-U and the center stack magnet is being constructed. Prager noted that the center stack is really two magnets in one: A cylinder composed of 36 copper bars that create a magnetic field, and a coil around the cylinder that drives a current through the plasma. Constructing the center stack "requires incredible engineering and craftsmanship and it's gone extremely successfully," Prager stated.

He noted that the U.S. Department of Energy has strongly supported the NSTX-U project despite the ups and downs of federal funding. "This is a fantastic result for this year. Next year we'll be talking about the initial experiments on the NSTX-U," Prager said.

The NSTX-U will allow researchers to produce "a sustained high pressure plasma" over the next decade, Prager explained.

(continued on page 15)

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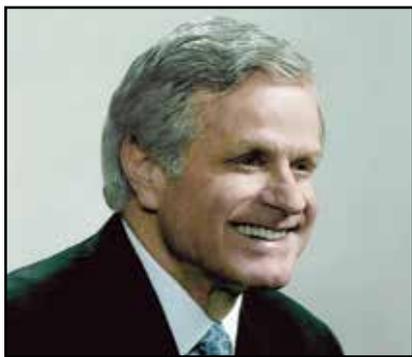
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Dick Flanagan

This is an issue of "firsts!" Alstom is piloting the world's 'first' solar grid; B&W is building the 'first' US-WTE plant in 25 years; PPPL joined ITER, the world's 'first' joint experiment in magnetic fusion, and Alton Energy joined our family of advertisers for the 'first' time. We hope you enjoy reading this issue as much as we did publishing it.

World-Gen and 34 other journalists from 14 countries visited Alstom's NICE GRID, the world's first solar energy smart grid storage demonstration project launched with partners ERDF, EDF, SAFT and RTE spread over four years at a cost of €30 million starting on page 1. Alstom envisions that the smart grid market has the potential to grow to €51 billion by 2020, up from the present €29 billion creating 100,000 new highly skilled engineering jobs and another 300,000 indirect jobs.

Alstom is studying how data is becoming the fuel of future economic development, and exchanging data that is at the core of the smart grid development. Alstom, its partners, and the Nice Town Council responded by building a micro grid, optimizing energy production from solar panels. Alstom supplied its new MaxSine™ eStorage conversion solution connecting batteries to the high/medium voltage network.

The nation's first new waste to energy power plant to be built in twenty years is being constructed by Babcock & Wilcox and its consortium partner KBR on a 24 acre greenfield site for the Solid Waste Authority of Palm Beach, FL, covered on page 1. The 95 megawatt facility is expected to come online in Q-1-15; Florida Power and Light has a 20 year power purchase agreement. The new plant reduces the waste sent to the county's landfill by up to 90 percent. SWA has recycled more than two million tons of residential and commercial material that otherwise would have been landfilled and recovered nearly 250,000 tons of clean vegetation annually. The State of Florida counts waste delivered to a Renewable Energy facility towards the State's 75% Recycling Goal, and the State provides one ton of recycling credit for each megawatt hour of energy produced.

Jeanne Jackson Devoe tells us on page 1 that the heart of the U.S. Department of Energy's Princeton Plasma Physics Laboratory (PPPL) is the National Spherical Torus Experiment (NSTX-U), a device that will help researchers develop magnetic fusion as a safe, abundant and inexpensive source of electric energy. PPPL is one of 17 national laboratories funded by the Department of Energy, managed by Princeton University and has about 450 employees. The NSTX-U is undergoing a \$94 million upgrade that will make the facility the most powerful tokamak of its type in the world when it is completed around the end of the year. The next step in developing magnetic fusion as an energy source is the huge fusion experiment called ITER in Cadarache, France, that is supported by seven international partners that include the United States. ITER is designed to create a sustained fusion reaction — or burning plasma — that produces more energy than it takes to create the reaction. Experiments are to begin in the 2020s.

Lyn Corum writes from California on page 12 that California's electricity world has been upended following the retirement of the San Onofre Nuclear Generating Station in June 2013. Southern California Edison and San Diego Gas & Electric are scrambling for new resources to replace the lost 2,200 MW SONGS produced.

However, new resources do not necessarily mean the traditional base-load generating plants. What utilities are looking for in the load center formerly served by SONGS is fast-starting dispatchable power to buffer renewable resources coming online and new transmission. In March, the CPUC approved a plan for SCE to acquire 500 MW to 700 MW and SDG&E to acquire 500 MW to 800 MW by 2022. At least 600 MW must include renewable, demand response and energy efficiency resources plus 75 MW of energy storage. SCE said it will add the newly approved resources to a solicitation it was conducting. The CPUC ordered SDG&E to design a solicitation for the newly approved resources. The California Independent System Operator had recommended 2,400 MW in new capacity but the CPUC believes new transmission capacity and energy efficiency savings will lower the region's needs.

Samir Succar tells us on page 13 that the future of the utility industry has become a central focus for many as the sector grapples with several existential threats. Among the chief threats looming on the horizon is the large projected growth in distributed energy resources (DERs) and its potential to compound the impacts of the anemic growth in net load observed in many regions today. But this growth in DERs is relatively recent. While the resource base has certainly grown significantly for specific resources in particular regions, on a national basis these resources still occupy a relatively small fraction of the overall mix. Nevertheless, the conditions for growth for this class of resource are approaching a tipping point toward widespread viability in many more markets and there is growing enthusiasm around the potential for growth of DERs in the years and decades to come.

The growth of distributed generation and its impact on price formation in U.S. capacity markets implies a fundamental shift in the structure of resource adequacy mechanisms. As variable, distributed generation increasingly becomes a prevalent source of generation in regions, changes in capacity market dynamics will have a profound impact on generating assets and their future economic viability. These impacts will be felt most acutely in organized markets with well-developed capacity market mechanisms.

Dick Flanagan

SIEMENS REALIGNS

MUNICH - Siemens AG has named Lisa Davis to the Managing Board, effective August 1, 2014. She will be responsible for the Power and Gas Division, the Wind Power and Renewables Division, the Power Generation Services Division, in the Americas'.

CALCHARGE ENROLLS

SAN FRANCISCO, CA - A pioneering initiative designed to accelerate the development of the energy storage sector in California has signed its first corporate members. CalCharge enrolled Duracell, Hitachi, Volkswagen, LG, Eaton, Enovix, Volkswagen, LG and Enovix.

SOLAR4AMERICA

HILLSBORO, OR - SolarWorld announced a partnership to offer homeowners an affordable path to solar ownership. SolarWorld will supply high-performance solar panels for PetersenDean residential installations who plan to expand into five new US state markets.

DNV GL ACQUIRES

BERKELEY, CA - DNV GL and PV Evolution Labs have signed an agreement for the acquisition of PVEL by DNV GL. PVEL is the leading provider of PV solar module technical due diligence testing services in the US solar PV industry. PVEL has laboratory and outdoor test facilities to evaluate solar panels.

NY SUN FUNDED

ALBANY, NY - Governor Andrew M. Cuomo announced a nearly \$1 billion commitment to NY-Sun, to significantly expand deployment of solar capacity throughout the state and transform New York's solar industry to a sustainable, subsidy-free sector. New York now has more than 400 solar companies operating across the state, employing over 5,000.

DUKE RFP'S

CHARLOTTE, NC - Duke Energy announced it had substantial participation in response to its request for proposals for 300 megawatts of new solar energy capacity in the Duke Energy Carolinas and Duke Energy Progress territories. The RFP gave bidders the flexibility to offer power and associated renewable energy certificates, and/or to provide a turnkey proposal through which Duke Energy would acquire the new facility. Duke Energy received both types of bids.

WESTINGHOUSE SIGNS

PITTSBURGH, PA - Westinghouse Electric Company and Ontario Power Generation, Inc., through its subsidiary, Canadian Nuclear Partners, announced an agreement to consider a diversity of nuclear projects including refurbishment, maintenance and outage services, decommissioning and remediation of existing nuclear facilities, and new nuclear power plants. Westinghouse and OPG have collaborated recently on several key projects. Westinghouse is performing work to design filtered containment vents at OPG's Darlington Nuclear Power Station as part of the site's refurbishment program.

EMERSON INKED

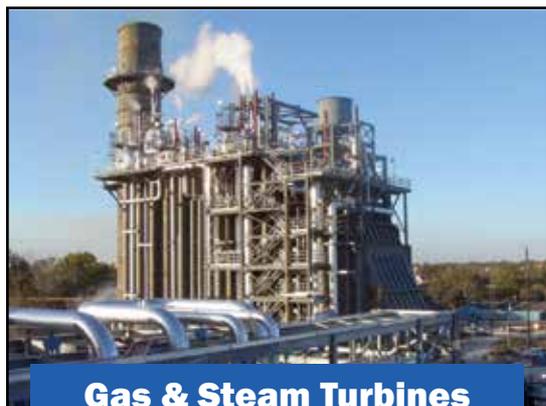
PITTSBURGH, PA - Emerson Process Management was awarded a \$15 million contract to Engineer and install its Ovation™ control system at Craig Station, the second-largest power generating facility in Colorado. Implementing a common automation platform based on Ovation technology will enhance reliability, efficiency and availability at the facility.

Powerplant Engineering DESIGN & EPC CONSTRUCTION

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



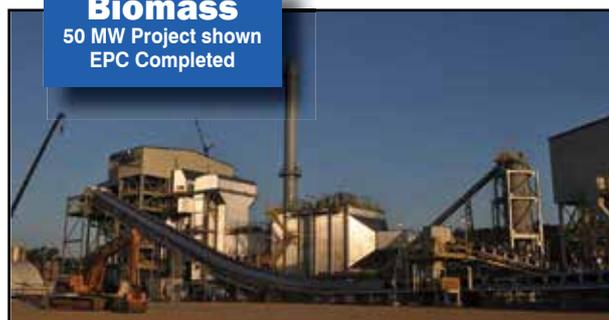
Bob Bibb, President / CEO
bobbibb@bibb-eac.com



Gas & Steam Turbines
300 MW Combined Cycle EPC Project Completed



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



Biomass
50 MW Project shown
EPC Completed



Photovoltaic
Design assistance for rooftop PV shown

SCR (Selective Catalytic Reduction)
Utility EPC detailed design



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MEMPHIS, TN – Thomas & Betts offers these four unusual places to save energy and money around the home.

Windows – Window treatments are an easy and aesthetically pleasing way to conserve energy. Installing window treatments and keeping them closed prevents heat from entering your home through your windows and diminishes the demands on your air conditioning system.

Refrigerator – Cleaning out your refrigerator helps your refrigerator run more efficiently. As you clean, be sure to vacuum and remove residue from refrigerator coils. This ensures that the refrigerator is cooling properly and not wasting energy.

Extension Cords – Extension cords are often used to power appliances, lamps, televisions and speakers, but did you know that these cords can lose energy when continuously plugged into appliances? Installing floor boxes can enable easy access points to electrical outlets from anywhere in the room, eliminating the need for extension cords and energy loss.

Cable Entry Points – As it warms up and you turn your air conditioning back on, remember airflow can escape your home through these small entry points and end up costing you over time. Sealing electrical boxes results in more efficient heating of the house in the winter and cooling of the house in the summer.

GE FUNDS

ELGIN, IL – GE Energy Financial Services is providing a loan to investment firm Rockland Capital llc to support its acquisition of the gas-fired Elgin Energy Center. Rockland Capital purchased the power generation facility, which sits on a 27-acre site 40 miles northwest of Chicago. The 484-megawatt Elgin peaking power plant sells its capacity into the PJM market.

SOLAR IMPULSE - 2015

ZURICH, SW – ABB will support Bertrand Piccard and André Borschberg in their attempt to fly around the world in a solar powered airplane in 2015.

Solar Impulse is the first airplane that can fly day and night without fuel or polluting emissions.

This revolutionary carbon fibre airplane has the wingspan of a Boeing 747 and the weight of a small car. The 12,000 solar cells built into the wing provide four 10HP electric motors with renewable energy.

The solar cells recharge the 400kg / 881 lb lithium batteries.

SOLAR GAME CHANGER

CAMBRIDGE, MA – The problem with solar power is that sometimes the sun doesn't shine. Now a team at MIT and Harvard University has a material that can absorb the sun's heat and store that energy in chemical form.

The principle is simple: Some molecules, known as photoswitches, can assume either of two different shapes, as if they had a hinge in the middle. Exposing

them to sunlight causes them to absorb energy and jump from one configuration to the other, which is then stable for long periods of time. But these photoswitches can be triggered to return to the other configuration by applying a small jolt of heat, light, or electricity, and when they relax, they give off heat. They behave as rechargeable thermal batteries taking in energy from the sun, storing it indefinitely, and releasing on demand. This system uses material that can be reused.

EXELON ACQUIRES PHI

CHICAGO, IL – Exelon Corporation and Pepco Holdings Inc. signed a definitive agreement to combine the two companies in an all-cash transaction.

The combined utility businesses will serve approximately 10 million customers and have a rate base of approximately \$26 billion.

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EMERSON INNOVATES

AUSTIN, TX - Emerson Process Management held the grand opening of its Emerson Innovation Center - Process Systems and Solutions in Round Rock, TX.

This 282,000-square-foot, \$70 million facility will be the global headquarters for Emerson's automation systems and project services business.

PHI SELECTS

LAWRENCEVILLE, NJ - Parsons Brinckerhoff has been awarded a contract to provide owner's engineer services to Pepco Holdings, Inc. in support of a five-year power transmission capital program valued at more than \$1 billion.

Parsons Brinckerhoff will manage and coordinate the activities of the consultants.

ITRON SOLAR SELECTED

LIBERTY LAKE, WA - Itron announced that its solar monitoring solution has been selected by Clean Power Finance as the preferred metering solution for residential solar installations across North America. CPF will use Itron's solar monitoring solution to monitor and sub meter residential solar systems.

ND-GAIN INDEXED

SOUTH BEND, IN - The University of Notre Dame's Global Adaptation Index (ND-GAIN) announced that PepsiCo and Monsanto were the 2013 winners of its ND-GAIN Corporate Adaptation Award, an annual award for contributions to awareness, science or action in creating resilience to climate change.

PepsiCo was recognized for its overall approach to precision agriculture in India. In collaboration with the Columbia Water Center of the Earth Institute at Columbia University, and supported by a grant from the PepsiCo Foundation, the company has worked with rice farmers in India, deploying water measurement, seeding and disease management technologies that allow farmers to conserve 20 percent more water than traditional flood irrigation.

Monsanto and its partners in WEMA (Water Efficient Maize for Africa) were recognized for an agricultural sector food and water vulnerability project in Kenya.

WEMA is a public/private partnership with the objective to improve food security and rural livelihood among smallholder farmers and their families in Sub-Saharan Africa by developing and deploying new drought-tolerant and insect pest-protected maize varieties.

The partnership project is led by the African Agricultural Technology Foundation (AATF) and it is funded by the Bill and Melinda Gates Foundation, the Howard G. Buffett Foundation and the U.S. Agency for International Development (USAID).

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www.eei.org/2014

AEP SELECTS B&W

CHARLOTTE, NC - Babcock & Wilcox Nuclear Energy, Inc. was awarded a contract from American Electric Power (AEP) to provide steam generator services for the Donald C. Cook Nuclear Plant just north of Bridgman, MI.

The D.C. Cook Plant contains two units, one of which is outfitted with Babcock & Wilcox replacement recirculating steam generators.

As part of this contract, B&W NE will execute a comprehensive inspection and cleaning campaign, which includes eddy current testing, visual inspections and water lancing.

The inspections and cleaning activities are conducted periodically to monitor and maintain the condition of the steam generators. The D.C. Cook units are built to a more compact design known as an ice condenser plant, for which B&W NE's proprietary tooling and technology are ideally suited to efficiently perform the steam generator inspection and cleaning operations in restricted spaces.

SOLARWORLD PARTNERS

HILLSBORO, OR - Dragonfly Solar, a commercial solar developer based in Lakeville, MN, and SolarWorld will partner to deliver a 517-kilowatt solar array to four electric utility cooperatives in the US midwest. "Utility cooperatives are leading the way in making clean power an integral part of their energy portfolios," said Mukesh Dulani, US president of SolarWorld.

ALSTOM AWARDED

CECIL COUNTY, MD - Alstom has signed a contract worth close to €75 million (\$100 million) to supply a steam tail package for Old Dominion Electric Cooperative's Wildcat Point Combined Cycle Power Plant. It will generate approximately 1,000 megawatts and is scheduled for commissioning in mid-2017.

ENEC JOINS EPRI

PALO ALTO, CA - The Electric Power Research Institute announced that the Emirates Nuclear Energy Corporation has joined its nuclear research program. The collaboration will enable EPRI and its global membership to collect data and draw lessons from ENEC's plants under construction that can be shared with the broader nuclear industry.

Energy demand in the United Arab Emirates is growing at an annual rate of about 9 percent.

SIEMENS ACQUIRES

MUNICH - Siemens is acquiring the Rolls-Royce Energy aero-derivative gas turbine and compressor business and thereby strengthening its position in the growing oil and gas industry as well as in the field of decentralized power generation. The purchase price is £785 million or about €950 million. The transaction is expected to close before the end of December 2014, subject to regulatory approvals.

ACSI REPORTS

ANN ARBOR, MI - Energy utilities failed to improve customer satisfaction for the first time in eight years, according to a report released by the American Customer Satisfaction Index (ACSI). Following an unusually harsh winter, customer satisfaction with gas and electric service providers is down 1.8%. Customer satisfaction with IOU's fell 2.6%. Customer satisfaction with municipal utilities is stagnant at 76. Rural cooperative utilities hold a strong lead over the other utility categories.

CHP FORECASTED

LONDON, UK - Strong encouragement from North American countries for the implementation of Combined Heat and Power (CHP) technology forecasts that the region's CHP installed capacity will increase from an estimated 93.5 GW in 2014 to 115.9 GW by 2020.

Sowmyavadhana Srinivasan, GlobalData's Senior Analyst covering power, says: "Both the US and Canada

have been pushing for the use of clean energy sources and CHP technology. The US government set a target to increase the total CHP installed capacity by 40 GW by 2020, while Canada has been providing many incentives at the provincial level for heat and energy conservation, making investments towards CHP very attractive."

URS SELECTED

SAN FRANCISCO, CA - URS Corporation has been selected by We Energies to provide engineering, procurement, and construction services to convert the Valley Power Plant in Milwaukee, WI from coal to natural gas. The Valley Power Plant has two 140-megawatt generating units, each comprised of two boilers and one steam-turbine generator. Completion of the conversion is targeted for late 2015 or early 2016.

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EDF EXPANDS

SAN DIEGO, CA – EDF Renewable Energy has placed an order with Vestas for 194 megawatts of V100-2.0MW wind turbine generators. The order brings the firm commitment of the Vestas turbines to 794 MW to meet the demands of the projects in the Texas Panhandle. Deliveries and commissioning are expected to be complete in the 4th quarter of 2015.

LANDMARK PROJECT

PHILIPSBURG, ST. MAARTEN - The Westin Dawn Beach Resort & Spa is the first Westin hotel or resort in the world to utilize solar panels to replace its energy consumption.

OneWorld Sustainable has completed the installation of 2,602 Lightway solar panels for a total system capacity of 755 kilowatts.

FIRST SOLAR PARTNERS

NEW YORK, NY - First Solar and GE's Power Conversion business are partnering to develop a utility-scale PV power plant design that combines First Solar's thin-film CdTe modules with GE's new ProSolar 1,500-volt inverter/transformer system.

This development enables power plant engineering design that significantly increases the size of the solar array served by each inverter and reduces the number of inverter/transformer stations required for each plant to convert the power from direct current (DC) to alternating current (AC) and feed electricity to a commercial electrical grid.

SMART GRID Q1

AUSTIN, TX - Mercom Capital Group reports that venture capital funding into smart grid technology companies came in at \$101 million in 21 deals in Q1 2014, compared to \$148 million in 31 deals in Q4 2013. There were no debt or public market financing tracked in the quarter.

Smart Grid Communication technology companies received the most VC funding, raising \$62 million in 11 deals. Demand Response companies raised \$14 million in three deals. Data Analytics companies raised \$13 million in three deals, and Grid Optimization companies brought in \$8.1 million in one deal. Notably, AMI did not see any VC funding in Q1.

There were six M&A Smart Grid transactions in Q1 2014: The \$3.2 billion acquisition of Nest Labs, a smart thermostat and home energy solution provider by Google, and the \$150 million acquisition of Aclara Technologies, a provider of advanced solutions, by Sun Capital Partners, a private equity firm from ESCO Technologies.

INGERSOLL RAND ACQUIRES

DAVIDSON, NC - Ingersoll Rand acquired Fellon-McCord & Associates, LLC, an energy supply procurement and management services company based in Louisville, KY. Fellon-McCord offerings will be added to the Trane energy services and controls portfolio and expand Trane capabilities for supply-side energy management.

EMERSON CONTRACTED

PITTSBURGH, PA – Union Power Partners, a subsidiary of Entegra Power Group, has awarded Emerson Process Management a contract to replace turbine controls at Union Power Station, located in southern Arkansas.

Union Power Station has a generating capacity of 2,200 MW and comprises four individual 2X1 combined cycle power blocks. Emerson will replace legacy controls on the power block's GE Frame 7FA gas turbines and GE D11 steam turbine with Ovation™ control technology, and the GE EX2000 systems with its Ovation generator excitation technology.

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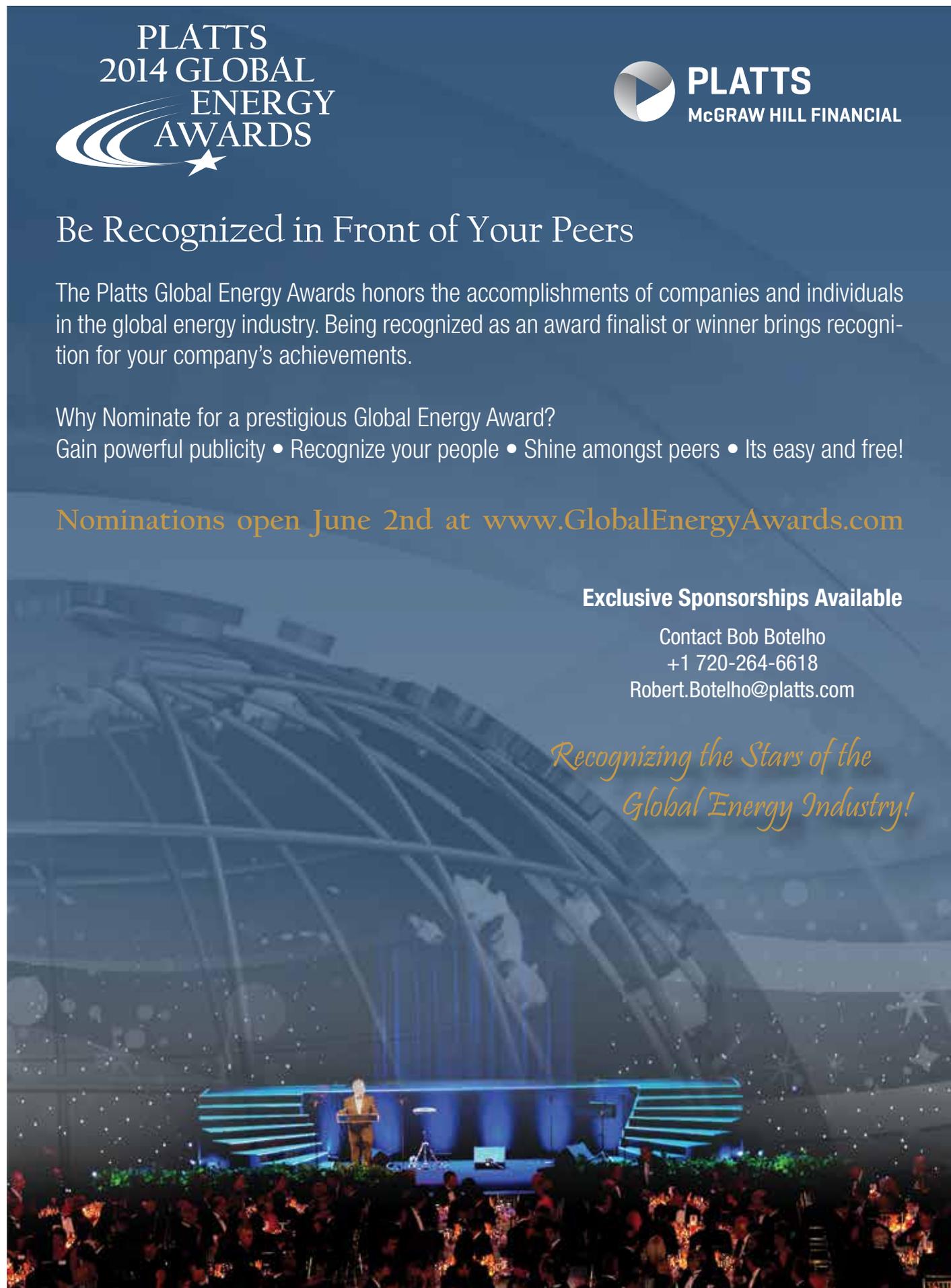
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ABU DHABI

Prysmian Group has been awarded a €30 Million contract by Emirates Holding on behalf of offshore oil and gas producer ADMA-OPCO (Abu Dhabi Marine Operating Company) for the design and manufacture of submarine cable links.

AUSTRIA

Alstom was awarded a contract by Vorarlberger Illwerke AG for the supply of two generators and exciters for the Obervermuntwerk II pumped-storage power station. The generators have an output of 180 MW each. Operation begins in 2018.

BRAZIL

GE's Digital Energy business is providing Furnas and Triangulo Mineiro Transmissora (TMT)/Geoenergia with the latest in protection and control equipment to ensure high-efficiency performance and quality for each of the utility's grid modernization projects.

CHINA

Westinghouse Electric Company announced the successful completion of a significant milestone at the AP1000® nuclear power plant currently under construction in Sanmen, China. The Unit 1 main control room was declared operational by Sanmen Nuclear Power Company, Ltd. (SMNPC) and State Nuclear Power Technology Corporation (SNPTC). Westinghouse delivered all of the I&C systems, as well as the design documentation, engineering services and mechanical equipment in support of this milestone.

CHINA

DuPont China Holding Co., Ltd. and Zhenfa New Energy Technology Co., Ltd., one of the leading engineering, procurement, construction (EPC) and power generation companies in China, have signed a strategic cooperation agreement to collaborate on improving the performance, reliability and return on investment of solar power installations.

FINLAND

Westinghouse Electric Company received a contract from Teollisuuden Voima Oyj (TVO) to provide two new traversing incore probe (TIP) systems for the two boiling water reactors (BWR) at Olkiluoto. The systems are used to calibrate the Nuclear Reactor Power measurement. Westinghouse Electric Sweden AB will manage the overall project, as well as perform the mechanical/electrical installation and commissioning.

GERMANY

Siemens received an order from TenneT for an offshore wind farm grid connection in the North Sea. Siemens will supply the complete technology for direct-current transmission.

INDIA

GE Energy Financial Services is making its first investment in a solar power project in India, funding \$24 million for a 151 (DC)-megawatt solar photovoltaic power project that WREPL, one of India's leading clean energy generating companies, put into operation in August 2013. Power from the project is sold to the Madhya Pradesh state utility, helping the country meet its target of 20 percent energy generation from renewable sources by 2020.

IRAQ

Alstom has been awarded a €225 million contract to provide power generation equipment for the Al-Anbar gas-fired combined-cycle power plant being built in the Anbar province in Iraq.

A consortium of Metka SA and Metka Overseas Ltd is building the power plant for the Ministry of Electricity of Iraq. The 1,642 MW power plant is due to be commissioned in 2016.

IRELAND

Prysmian Group has been awarded a €40 million contract by ESB for the "Shannon River Crossing" project to provide electricity between Kilpaddocke and Moneypoint across the opposite banks of the river and along an underwater route of approximately 3 km, scheduled for 2016.

The Prysmian Group is currently carrying out the submarine connection between Scotland and England Western HVDC Link.



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Westinghouse AP1000® plant under construction in Haiyang, China

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INTERNATIONAL NEWS

LUXEMBOURG

Upsolar announced its participation in Empower, an international SICAV SIF fund created to promote the deployment of renewable energy technologies. Upsolar will provide an initial contribution of \$20 million. The fund is expected to reach \$30 million by 2015. Empower's initial goal is to finance 200 mw in renewable energy projects globally.

MEXICO

Alstom and Isolux have signed a contract with Mexico's Federal Electricity Commission (CFE) to convert two 158 MW units at the Altamira thermoelectric power station in Mexico. Alstom will supply the project's technological components by providing two Circulating Fluidized-Bed boilers, while Isolux will be the EPC contractor.

SAUDI ARABIA

Siemens Energy has received a \$590 million order to supply six gas turbines, three steam turbines and nine generators for Rabigh 2 IPP combined-cycle power plant for the Korean Samsung C&T with completion in mid-2017.

The project site at Rabigh is located in western Saudi Arabia on the Red Sea, about 150 kilometers north of the port city of Jeddah.

SCOTLAND

GE's Digital Energy business will provide series compensation capabilities to three of SP Power Systems Limited's (Scottish Power) facilities in southern Scotland. The utility will be installing series capacitor banks with sub-synchronous resonance (SSR) filters to its substations, increasing the reliability, efficiency and power transfer capabilities of Scottish Power's 400-kilovolt transmission network.

TURKEY

Alstom signed a contract worth more than €55 million with Petkim for the supply of 17 ECO110 wind turbines of 3MW each for the Petkim Wind Farm that will be installed in the Izmir Aliaga peninsula. The scope of the contract includes construction, supply and engineering works of the power plant to be built as turnkey delivery project. The first phase of Petkim wind farm will be commissioned in 2015, and the second phase will be commissioned in 2016. In addition, Alstom will also provide operation and maintenance for the power plant for 15 years.

UK

Martifer Solar connected 78.4 MWp to the UK grid before the March 31st 1.6 ROC (Renewable Obligation Certificate) deadline. This 78.4 MW cluster consists of five plants and was built for Lightsource Renewable Energy.

UKRAINE

Westinghouse Electric Company and the National Nuclear Energy Generating Company of Ukraine agreed to a contract extension for fuel deliveries to Ukrainian nuclear power plants through 2020. The contract provides for the continuation of the long-standing partnership between the two companies in providing competitive and secure nuclear fuel supplies for Ukraine's reactor fleet. Westinghouse will produce the fuel at its fabrication facility in Västerås, Sweden.

The Västerås facility is one of the largest and most modern fuel plants in the world, serving every major market in Europe and South Africa.

Westinghouse is a single-source fuel provider for pressurized, boiling and advanced gas-cooled reactors worldwide and has 10 fuel manufacturing locations around the world, including two manufacturing sites in Europe: Westinghouse Springfields (Preston, Lancashire, U.K.) and Westinghouse Electric Sweden (Västerås, Sweden). Westinghouse is currently providing fuel for 147 nuclear power plants worldwide.

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WALSH TO CEO

David M. Walsh has been appointed President and Chief Executive Officer of Mitsubishi Hitachi Power Systems Americas (MHPSA) with responsibility for all aspects of the business in the Western Hemisphere. Walsh is a member of the Class of 2013.



David M. Walsh

NYISO NAMES

The New York Independent System Operator Board of Directors announced that Michael Bemis has been named board chair, taking over the role from Robert Hiney whose term expired.



Michael Bemis

MELANSON JOINS

Ed Melanson, PE has joined T&M Associates to oversee company-wide automation initiatives focused on the energy, environment, water/wastewater and transportation sectors.



Ed Melanson

KELLY PROMOTED

The American Public Power Association Board of Directors appointed Sue Kelly the organization's new President and CEO. Kelly has served with APPA since 2004.



Sue Kelly

NECCI NAMED

Raymond P. Necci, former President and Chief Operating Officer of The Connecticut Light and Power Company, Connecticut's largest electric utility, has been named a consultant at utiliVisor.



Raymond P. Necci

TAYLOR PROMOTED

James N. Taylor, a 26-year nuclear industry veteran, has been named General Manager of URS Corporation's Global Management & Operations Services Business Group.



James N. Taylor

GLATCH JOINS

CH2M HILL announced that Lisa Glatch has joined the firm as Chief Strategic Development Officer.



Lisa Glatch

SLOAN TO COO

TAC announced the addition of Fred Sloan as Vice President and Chief Operating Officer to the company's energy marketing division, TAC Energy.



Fred Sloan

DR. CHAN NAMED

Matthew Chan has been named Assistant Vice President and West Hydropower Operations Manager in the Portland, Oregon office of Parsons Brinckerhoff.



Matthew Chan

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CALIFORNIA SEEKS DISPATCHABLE POWER

BY LYN CORUM



California's electricity world has been upended following the retirement of the San Onofre Nuclear Generating Station in June 2013. Southern California Edison and San Diego Gas & Electric are scrambling for new resources to replace the lost 2,200 MW SONGS produced. In addition, the generating station provided voltage support to the transmission grid between Los Angeles and San Diego.

However, new resources do not necessarily mean the traditional base-load generating plants. It seems there are already plenty of those. What utilities are looking for in the load center formerly served by SONGS is fast-starting dispatchable power to buffer renewable resources coming online and new transmission.

In March, the CPUC approved a plan for SCE to acquire 500 MW to 700 MW and SDG&E to acquire 500 MW to 800 MW by 2022. At least 600 MW must include renewable, demand response and energy efficiency resources plus 75 MW of energy storage.

SCE said it will add the newly approved resources to a solicitation it was conducting. The CPUC ordered SDG&E to design a solicitation for the newly approved resources.

The California Independent System Operator had recommended 2,400 MW in new capacity but the CPUC believes new transmission capacity and energy efficiency savings will lower the region's needs.

As to new transmission capacity, Cal-ISO approved \$1.83 billion in 30 new transmission projects, also in March, under its 2013-2014 transmission plan. Approximately \$1,210 billion of those projects are targeted for SCE and SDG&E territory to add flexibility and bring additional power into the Los Angeles and San Diego service territories to make up for the loss of SONGS power.

The Cal-ISO decision does not award this funding - it allows the utilities to file applications with the CPUC for permission to build the projects and recover

their costs from ratepayers.

Cal-ISO had identified a significant reduction in electricity deliverability in the San Diego service territory due to changes in flow patterns resulting from SONGS' retirement. While the transmission plan identified above will provide reinforcement of the transmission system, Cal-ISO said only 1,000 MW of the 1,715 MW of renewable generation in the Imperial Valley portfolio will be deliverable into the San Diego load pocket.

The import capability of the Imperial Irrigation District at a level of 1,400 MW will also be impacted, said the Cal-ISO, and it is planning further study to identify the most effective solution to these issues.

GENERATION RESOURCES

In February, the CPUC approved SDG&E's 20-year power purchase agreement with the owners of the 305-MW Pio Pico power plant. The commission had already decided that San Diego would need 298 MW by 2018 to partially replace capacity from the retired SONGS plant. The plant was designed to satisfy SDG&E's load requirements. SDG&E will have dispatch capability.

Pio Pico is a simple-cycle, gas-fired project being developed by Apex Power Group. The California Energy Commission certified the plant in September 2012. The contract requires that the plant be operational by the end of May 2014. However, it has not yet begun construction, according to the CEC, probably because the CPUC delayed approving the signed contract.

The Pio Pico Energy Center will be located within an industrial park adjacent to the operating 590-MW Otay Mesa Energy Center owned by Calpine.

In other developments at the CEC, commissioners finally put to terminal rest the Ridgecrest Solar Power Project. It had been proposed by Solar Trust of America, but that company disappeared when its German parent company, Solar Millennium AG filed for bankruptcy. Both were liquidated during the 2012-2013 period. A buyer for Ridgecrest never appeared. The Bureau of Land Management terminated the applicant's right to the project site in 2011. The CEC received its last communication from the project in February 2012.

AES, Southland, a subsidiary of AES Corp, owner of the aging 2000-MW Alamitos Generating Station in Long Beach, California, has submitted an application to the CEC to replace the old plant with 1,936 MW of natural-gas fired, fast

starting, combined-cycle gas turbines, and air-cooled electrical generating facility. It will be constructed on the site of the original plant.

The CEC has begun its review and if all goes smoothly AES hopes for a final approval and certification in March 2015. However, that doesn't mean the project will begin construction immediately. It will first need a power purchase contract with a utility. The immediate need is to show intent to replace the once-through ocean cooling system currently being used in the generating station. Those systems have been outlawed by the California Water Resources Board, and the plant must be retired or replaced by 2020.

DISPATCHABLE PUMPED STORAGE

At the Seventh Annual Renewable Energy Summit organized by the Imperial Valley Economic Development Corporation in March, David Olsen, one of the Board Governors of the California Independent System Operator, while speaking on a panel said the flows on the transmission grid in Southern California have changed since SONGS retired. "How we respond and improve deliverability and alleviate congestion between regions is a policy decision and not about power flows," he said.

James Avery, senior vice president for power supply at SDG&E said on the same panel, "We have no need for more baseload generation. We have a major problem with transmission bringing resources into San Diego. [So] the system wants dispatchable resources."

Continuing, Olsen said that the Cal-ISO Board and management agree the future is decarbonized and decentralized and is looking at reduction of natural gas production by half over the next 10 years. He said 40% renewables by 2024 is being studied at Cal-ISO and he believes these resources can be integrated into the grid.

In an interview Olsen said SDG&E is very interested in two pumped storage projects now in permitting phases which would provide the dispatchable power it is seeking in light of SONGS retirement.

The LEAPS project, originally proposed more than 20 years ago, has taken on new life, never having gotten beyond the design stage primarily due to regulatory roadblocks. And the San Diego Water Authority is pursuing it plan to build a second pumped storage facility above its San Vicente Dam.

Rex Waite, vice president of Nevada Hydro Company, said in an interview the retirement of SONGS is driving new interest in the company's 500-MW Lake

Elsinore Advanced Pumped Storage facility. Cal-ISO has added it to its 2014-2015 transmission plan along with the related Talega-Escondido/Valley-Serrano 500-kV Interconnect transmission line.

Furthermore, the CPUC has included 550 MW of large-scale pumped storage in its Long Term Procurement Plan, he said.

LEAPS is planned as a 500-MW pumped storage facility to be built in a 100-acre dammed canyon reservoir 1,650 feet above Lake Elsinore in Riverside County. The City of Lake Elsinore is 73 miles east of Los Angeles and 74 miles north of San Diego.

When the cost of electricity is low, water from Lake Elsinore would be pumped to the reservoir and released to generate power when electricity costs are high.

David Kates, the project manager, said once LEAPS is built, it would be among the top five most efficient pumped storage facilities in the world because of the 1,650-foot water drop from the reservoir to the lake.

"We modified the transmission project to connect at the Talega-Escondido substation on the backside of SONGS," Waite said. The 500-kV line is designed to run south from the Valley-Serrano substation near where LEAPS would be built. Nevada Hydro late last year finalized its interconnection agreements with SCE, SDG&E and with the ISO.

The company has a preliminary permit from the Federal Energy Regulatory Commission for pumped storage, and it and US Forest Service have completed the environmental impact statement. Nevada Hydro needs to refresh permits with the various resource agencies, such as the California Fish & Game Service, and the California State Water Resources Board.

Waite said they would like to have the transmission line application submitted to the CPUC in the next two months. That process will take one year and construction will take another year. Approval of the pumped storage facility will take two years, and another four years to build. The pumped storage project cost is estimated at \$945 million, while the transmission interconnect is estimated to cost \$750 million.

Frank Belock, deputy general manager of the San Diego County Water Authority, said his agency, in partnership with the City of San Diego is continuing to pursue a 500-MW hydroelectric pumped storage system at its San Vicente Reservoir.

IMPACTS OF DISTRIBUTED GENERATION

BY SAMIR SUCCAR
ICF INTERNATIONAL



The impact of Distributed Generation on market operations and system reliability becomes increasingly dire as penetration levels increase in those regions where capacity market mechanisms provide the primary vehicle maintaining resource adequacy. The variability of the resource and its location on the low-voltage grid undermine efficient market operation at high penetrations by effectively decoupling price formation from supply/demand fundamentals. While regions such as California at the forefront of variable resource integration can provide useful lessons, the provision of flexibility by way of state procurement mandates is untenable in the context of organized markets that rely on capacity market constructs for resource procurement. Although such solutions might work well in other regions, they would only further compromise the integrity of price formation in markets such as PJM and New England. Indeed, if one central aim of the organized markets is to shift the risk of efficient investments to investors and away from consumers, the integrity of the capacity market construct must remain a necessary prerequisite for the future design of the system.

DER'S

The future of the utility industry has become a central focus for many as the sector grapples with several existential threats. Among the chief threats looming on the horizon is the large projected growth in distributed energy resources (DERs) and its potential to compound the impacts of the anemic growth in net load observed in many regions today. But this growth in DERs is relatively recent. While the resource base has certainly grown significantly for specific resources in particular regions, on a national basis these resources still occupy a relatively small fraction of the overall mix. Nevertheless, the conditions for growth for this class of resource are approaching a tipping point

toward widespread viability in many more markets and there is growing enthusiasm around the potential for growth of DERs in the years and decades to come.

The growth of distributed generation and its impact on price formation in U.S. capacity markets implies a fundamental shift in the structure of resource adequacy mechanisms. As variable, distributed generation increasingly becomes a prevalent source of generation in regions, changes in capacity market dynamics will have a profound impact on generating assets and their future economic viability. These impacts will be felt most acutely in organized markets with well-developed capacity market mechanisms.

Sources of generation like wind and solar with a free fuel source will operate at zero marginal cost. This leads to the canonical price suppression effect wherein zero-fuel-cost plants flatten the left side of the supply curve, resulting in lower wholesale energy prices in the real-time market. As observed in the Texas context, real-time prices can descend into negative territory when a production-based incentive drives the effective short-run marginal cost below zero and there is insufficient transmission capacity to move power to load pockets. These impacts alone have the impact of distorting capacity prices without mitigating measures and in fact, we have seen that the reduction of inframarginal revenues in Europe have led to the recent shut down or mothballing of 30 GW of gas fired capacity, including last year's decision by E.ON SE to mothball a two-year old combined cycle unit in Malženice, Slovakia.

UTILITY SCALE SYSTEMS

Unlike utility scale systems that can rely on the bulk power grid to more effectively leverage geographic diversity of the resource, DG resources interconnect at the distribution level where the impacts of variability are not as easily mitigated. The aforementioned negative prices in Texas were effectively alleviated in large part through large-scale transmission expansion and the development of the competitive renewable energy zone (CREZ) transmission lines. However DERs interconnect at the low-voltage side of the power system and therefore do not have the same level of access to the bulk grid. Distribution feeders function as the capillaries of the power system, and thus the ability to leverage geographic diversity of the resource across weather fronts and climatic zones becomes a much greater challenge.

The PJM market operates one of the most well-developed capacity market con-

structs in the U.S. and provides a unique window into how DERs could substantially call into question both the assumptions of accurate resource valuation and price signals accurately reflecting the market's supply/demand balance. PJM's three-year capacity market relies on the mechanism of net cost of new entry (CONE) to form the upper boundary of the market demand curve, that dictates the clearing price in the capacity auction. Because net CONE is defined as the cost of adding a new resource minus the expected energy revenue from that generator, the impact of cost suppression will be to inflate net CONE. In fact, the ability of distributed generators to underbid all conventional generation in economic dispatch on the basis of near-zero, short-run marginal cost means that expected capacity factors for all plants will be lower in those regions where DER penetrations are high.

Under these types of conditions, it is not unreasonable to expect significant impacts on energy prices in the real time market with significant commensurate impacts on the clearing price in RPM. This impact is especially high for distributed resources, because, unlike utility scale resources that can bid into the capacity market on the basis of their impact on loss of load expectation (i.e., their effective load carrying capability or ELCC), distributed resources do not participate in capacity procurement for the regional transmission organization. Therefore, while systems interconnecting to the bulk system can bid in an amount of unforced capacity equal to the determined capacity value the distributed resources cannot bid their capacity in the BRA which means that they are effectively distorting the demand curve through price suppression without offsetting that by extending the capacity supply curve.

RESOURCE VALUATION

Resource valuation and flexibility concerns are central to price formation in the market. It is clear that in addition to the capacity market distortions already present due to the price suppression, if the need for flexibility and fast ramping resources is not somehow internalized into the capacity procurement mechanism, then the resource adequacy objective function is fundamentally incomplete. In order to address these issues, the New England Independent System Operator's pay-for-performance plan currently pending before FERC (ER14-1050) attempts to address some of these deficiencies through performance incentives that apply during system shortages.

California has been at the forefront of this issue in many respects. The state accounts for roughly half of the residential and commercial PV in the U.S. and has more than twice as much capacity than any other state. Furthermore, the sustained deployment rates necessary to meet California's 33% renewable portfolio standard by 2020 are projected to impose significant new flexibility requirements on the system. To address these issues, the CPUC has proposed a Reliability Services Auction to provide a voluntary platform for capacity procurement and in September 2013 approved a 1.3 GW energy storage mandate designed to bring new energy storage technologies to market and improve system flexibility.

LESSONS LEARNED

However, the lessons learned in California will be directly transferrable in the east. While markets such as PJM have embraced capacity market mechanisms for maintaining resource adequacy, this has not been the path chosen in California. In markets such as PJM, procurement mandates to deploy a specific flexibility solution would undermine the price formation of the market and the ability of the rest of the resource base to remain financially viable.

The variability and location of distributed generation resources mean that their growing participation in organized markets undercuts many of the assumptions around a dispatchable resource base and fundamentally alters the definition and scope of what must be considered in the context of resource adequacy. The California experience offers a view as to the challenges likely to be faced by existing generators as DER penetrations increase in PJM and ISO-NE, but the lessons learned will not be directly applicable and the solutions will need to be unique. There remain significant challenges in these markets to address the market integrity and resource adequacy challenge that these resources pose to the system. Whether policies and market conditions favor distributed resource to the extent that they reach significant penetrations is still largely uncertain, but the improved economics of these technologies suggest that in select areas participation is poised to accelerate rapidly. As it does, market design must adapt to accommodate this swiftly changing landscape to ensure that sufficient resources come online and that the market efficiently allocates capital to bring online those resources equipped to address the full scope of future system needs.

ALSTOM'S SOLAR GRID

CONTINUED FROM PAGE 1

these stability issues because of the intermittent nature of renewable energy and the only way around that is to interconnect so France has to double its interconnections with neighboring countries in the next five years. That's a big part of its plan."

He continued. "We're an American business masquerading as a French company," the Harvard MBA grad said. "All our software development is actually in Redmond, [Washington State] where a team of roughly 400-450 employees work. It's all our development for network management, energy management, the distribution management, demand response now." Alstom Philadelphia is home to the company's US grid headquarters and its Power Electronics Center of Expertise for Static Var Compensator (SVC). The Power Electronics Philadelphia unit provides support and enhancements to Flexible AC Transmission Systems (FACTS) projects in the Americas. Alstom Grid has three other locations in the US and Canada for a total of 35 manufacturing plants globally, 30 grid projects are under development worldwide and is a global leader in mission-critical software solutions with a market share of 13.7%.

Patrick Plas said in his opening remarks that "Alstom envisions that the smart grid market has the potential to grow to €51 billion by 2020, up from the present €29 billion creating 100,000 new highly skilled engineering jobs and another 300,000 indirect jobs." He defined the smart grid as an intelligent electrical network with two-way flow of energy and real-time information between power generation, grid operators and consumers. Its three-level architecture includes traditional grid equipment (substations, lines, etc.) to transmit electricity at low, medium and high voltage; automated systems that interconnect renewable energy sources, storage solutions and consumers to manage the flow of electricity across the grid and control centers using software solutions to manage transactions, balance supply and demand and interconnect all networks.

In the next ten years, energy demand is expected to grow by 22 percent in the US and Europe, 78 percent in Latin America and by triple digits in the rest of the world. Plas, using the smart grid model, sees a twenty percent savings achievable by demand side management in the investment needed for generation and infrastructure; by load shedding, the smart grid manages peak demands and blackout risks; smart-grid solutions can balance supply in real time transparency balancing electricity from renewables and the smart grid will make consumers into prosumers to control costs and volatility on real time information and incentive offers.

Laurent Schmitt followed Plas in the opening press briefing saying: "Data is becoming the fuel of future economic development. Exchanging data is at the core of the smart grid development, and is one of the new concepts of smart grids. This is about being able to benchmark each other in our energy usage, not only as a consumer but also knowing how much we're doing in the neighborhood."

He was referring to the lessons learned from the US-based project which is nearing completion. The Smart Grid Pacific Northwest demonstration project tested the software solution across five states from 60,000 metered customers. The goal was to establish pricing in real time and plan new methods of demand side management using cost based incentives toward peer-to-peer exchanges. "Peer to peer exchange does not mean that the utility will not exist. The utility will exist and grid operation will be a fundamental element of the smart grid, but in a slightly different model," Schmitt underscored. The first two years have been spent in design of the project and now we are recruiting customers," he said in conclusion.

The sun-kissed French Riviera attracts large summer populations straining the supply of electricity. Alstom, its partners, and the Nice Town Council responded by building a micro grid, optimizing energy production from solar panels. The town of Carros, a 20 min-



*Patrick Plas, Senior Vice President
Grid Power Electronics and Automation
Alstom Grid*



*Laurent Schmitt
Vice President, Alstom Smart Grid Solutions*

ute bus ride from Nice, was chosen as the test site because its location on the periphery of France's transmission grid increases the risk of outages, along with its seasonal sunshine and diverse commercial and residential population. The NICE GRID draws on three key factors to balance supply and demand: next day forecasts for solar energy production compared with demand; battery storage to maintain voltage and frequency across the grid offsetting any intermittency in solar energy and consumption peaks and incentivizing residential and industrial customers to manage their consumption.

Christophe Arnault, Project Director of Smart Grids at Electricite Reseau Distribution France told *World-Gen* that, "Linky is the name of the smart meter program ERDF launched. Linky will be installed in Carros by the end of 2014. These customers are the basis for the recruitment of participants in the pilot as they will represent 95% of the customers whose home electric installation is suitable for the NICE GRID pilot. Out of these 2600, the project will seek to recruit several hundred participants for the load management program. The linky meter is used both ways: from the customer's premises up to the NICE GRID central computer to transmit the load curves and from the NICE GRID computer down to the customer premises (always through an aggregator) for the control of the flexibilities (manageable load) that are activated by the system."

DATA MINING

Once data has been collected, it must be immediately processed into actionable information (data mining) for the grid operator to balance the complex system. Control room IT systems are configured to cover the full range of mission-critical power grid issues, such as congestion analysis, dynamic stability, anticipation of contingencies, snapshots of estimated output from renewable sources, forecasts and outage management. Operators have the intelligence for electricity flow (quality, measurements, oscillations, metering, etc.) across the lines, substations and equipment.

NETWORK MANAGEMENT

Marc Delprat is in charge of Alstom's small pilot programs within the network management solutions. "Network management solutions (NEM) are like the brains behind the grid," he said during his presentation in the NICE GRID Showroom in Carros.

In the NICE GRID, NEM handles load reduction from demand response and storage. It collects solar production and load forecasts and imports regional load reduction requests, calculates local grid constraints and identifies risks of overvoltage. It then sends power adjustment needs to the suppliers, computes an optimal schedule of flexible solutions and activates flexible solutions to counter local and regional grid constraints on a rotating basis. Finally, it balances the grid in islanding and manages over voltage situations due to massive solar generation.

MAXSINE™ eSTORAGE

Alstom supplied its new MaxSine™ eStorage conversion solution connecting batteries to the high/medium voltage network, Alstom's Davy Theophile told the journalists. MaxSine™ eStorage is installed with a power converter and software which controls storage facilities. The NICE GRID solar district is the only solution able to handle megawatt-scale storage providing a connection of up to 12 MW's.

SAFT PARTNERS

The NICE GRID project enables testing of multiple functionality associated with electricity storage using the LI-ion batteries integrated at three grid levels: at the originating substation, at several distribution substations and finally at the residential level. These batteries will have different functions at every level, and can be also synchronized to constitute a 1,5 MW load management capacity.

MaxSine™ eStorage is a modular solution comprised of a two-way power converter that connects the direct current battery to alternating current grid, converting electricity to be stored in the battery or dispatched to the grid and provides real-time battery control to balance the frequency and flow of electricity while optimizing the efficiency and service life of the system. Pike Research projects 70% of the energy storage market will be driven by integrating renewables, reaching 10 GW's of installed capacity by 2020 with 20% going to North America, 30% in Europe and 50% in Asia.

FROM SMART GRID TO SMART CITY

The worldwide population is projected to reach 6.5 billion with 70 percent living in cities by 2050. Cities cause eighty percent of CO2 emissions. Alstom and CEA-INES, the French state owned research agency have joined teams to investigate the use of direct current applications in smart city projects.

Smart grids offer a solution to the challenges of smart cities. Alstom defines a smart city as a municipality or district using networked energy, transportation, communication infrastructures to improve economic and political efficiency enables social, cultural and urban development.

A smart grid is by definition an open communications network, giving rise to the question of hardware and software compatibility and data standardization. Efforts are underway in Europe and the United States to ensure interoperability. Alstom is working to develop IEC 61850 standards on electrical substations and CIM standards on control rooms.

WTE-RENEWABLE FUEL

CONTINUED FROM PAGE 1

with KBR providing the balance of plant equipment and construction services. The new plant employed about 700 during construction, will have 175 permanent staff and will also include a LEED Platinum Visitors Center.

The plant is adjacent to SWA's 52 megawatt PBREF#1 built by B&W and Bechtel in 1989. The Stirling boilers were replaced in 2010. "We'd typically do 860,000 tons; after the refurbishing, we did 900,000 tons," said Bill Arvan. B&W's operations and maintenance contract was extended to 2029.

Arvan, a chemical engineer who holds an MBA from Florida Atlantic University, explained the operation of the WTE plant and conducted a tour for *World-Gen* to point out the differences between Refuse Derived Fuel in PBREF#1 and the Mass Burn for PBREF#2. "On mass burn facility's, recovery of non-ferrous and ferrous metals is performed post-combustion.

This differs from an RDF facility in which ferrous and non-ferrous metals are recovered both during the processing of MSW into RDF and post combustion," Arvan shared.

TIPPING POINT

"The fuel arrives on the tipping floor from six transfer stations hauled by SWA tractor trailers subject to 80,000 lb road limits. SWA receives about 500 loads a day or 1,000 trips daily," he said. Three procedures take place in the Refuse Derived Fuel (RDF) preprocess to remove hazardous materials, household materials and appliances before the conveyor carries it to the shredder. Overhead magnets sort out ferrous metals, recyclables and coins before going into the two Stirling boilers, he explained. The chemically inert bottom ash is combined with fly ash and sent to the landfill.

Ferrous metals [contain iron] are sold to Trademark Metals who essentially nuggetize the material and ship it out on rail cars," he added.

Non-ferrous materials are melted down and made into ingots. Last year, SWA sold more than 79,000 tons of recyclables and recovered coins accounting for \$100,000.

SWA has recycled more than two million tons of residential and commercial material that otherwise would have been landfilled. In addition to recyclables, SWA recovers nearly 250,000 tons of clean vegetation annually which is mulched and either composted, processed into boiler fuel, or returned to the land as a soil amendment.

In answer to a question, he said the plant operates 120 hours a week and stores the fuel on site, though the power plant is operating 24/7.

The new facility will reduce 63 percent less carbon dioxide, 94 percent less sulfur dioxide and 62 percent less nitrous oxides that the traditional coal fired power plant. For every ton of municipal solid

waste processed, one barrel of oil or ¼ ton of coal is saved and one ton of GHG avoided. The facility will save 1.9 billion cubic feet of natural gas annually.

As the EPA has specific emissions limits for facilities that combust waste to produce energy, the Solid Waste Authority is incorporating the most modern and most sophisticated air pollution control systems of any facility of its kind in the world. All of the emission levels from the PBREF#2 will be below the Federal standards, with the performance of the emissions control equipment guaranteed by the manufacturers and by the facility operator.

SWA'S ADDED VALUE

The SWA constructed a \$40 million, 138,000 square foot Recovered Materials Processing Facility (RMPF), the largest in Florida. This facility allowed the SWA to expand the material accepted in the recycling program to include all cardboard such as dry food boxes, beverage cartons and tissue boxes. The expansion of materials also included junk mail and steel cans, further reducing reliance on the landfill.

At the SWA's Biosolids Pelletization Facility (BPF), landfill gas is used to power the sludge dryers as an alternative to natural gas. The SWA and its partners constructed this facility to provide for the disposal of sludge from waste water treatment plants. At the BPF, sludge will be dried, pelletized and sold to fertilizer blenders as a natural and nutrient rich component of commercial fertilizers.

SWA'S REVENUE STREAM

The Solid Waste Authority of Palm Beach County is in a unique position to lower its customer rates for up to 7 years, while adding an estimated \$45 million economic boost to the county's economy. PBREF#2 was permitted to process 1 million tons of material a year. Given the county's current population and waste generation, in the first year there is capacity for an estimated 200,000 tons of additional waste within this permitted capacity. So, in an effort to maximize the facility's use and maximize revenue, the Solid Waste Authority is exploring options to import waste from neighboring counties to fill this deficiency.

The ultimate decision if the Solid Waste Authority will import out-of-county waste will be made by the SWA Board, after holding public meetings which could be as early as 2015. Nothing in the Palm Beach County Solid Waste Act or any other legislation prohibits SWA from either importing or exporting solid waste.

The State of Florida counts waste delivered to a Renewable Energy facility towards the State's 75% Recycling Goal, and the State provides one ton of recycling credit for each megawatt hour of energy produced.

MAGNETIC FUSION

CONTINUED FROM PAGE 1

A HISTORY OF LEADERSHIP IN FUSION AND PLASMA PHYSICS

PPPL has a 63-year history of discovery and leadership in the field of fusion, going back to Princeton astrophysicist Lyman Spitzer, the laboratory's cofounder who began research under the code name "Project Matterhorn" in 1951. The Laboratory was declassified in 1958, allowing researchers to collaborate with scientists in other countries. The name was changed to the Princeton Plasma Physics Laboratory in 1961.

Spitzer's achievements were many. He first came up with the idea of creating magnetic fusion in a figure-eight shaped device called a "stellarator," and is credited with inspiring the development of the Hubble Space Telescope.

PPPL produced a then-world record 10.7 million watts of controlled fusion power in the Tokamak Fusion Test Reactor (TFTR) in 1994 — enough power to briefly meet the needs of more than 3,000 homes.

ROLE IN ITER

The next step in developing magnetic fusion as an energy source is the huge fusion experiment called ITER (Latin for "the way") in Cadarache, France, that is supported by seven international partners that include the United States.

ITER is designed to create a sustained fusion reaction — or burning plasma — that produces more energy than it takes to create the reaction. Experiments are to begin in the 2020s.

PPPL is strongly contributing to ITER, Prager said. For example, PPPL is designing and engineering diagnostic port plugs and is responsible for procuring ITER's steady-state electric power network. "When ITER is constructed, it will be a landmark scientific experiment for the 21st century," Prager predicted.

ITER won't solve all the problems of nuclear fusion, Prager said, and researchers are looking ahead to a device called a fusion nuclear science facility (FNSF) that could lead to a demonstration power plant. PPPLers are involved in preliminary research for an FNSF, Prager said.

Theory and computation are also essential to the Laboratory, Prager said. PPPL researchers last year were awarded 275 million core hours on supercomputers — the equivalent of some 20,000 years on a personal computer — to study the plasma edge and plasma confinement.

OTHER NEW EXPERIMENTS & COLLABORATIONS

In addition to NSTX-U, PPPL's main experiment, the Laboratory has moved ahead with a range of new experiments and collaborations. One such facility is a new version of a current PPPL device called the Magnetic Reconnection Experiment (MRX). The new experiment,

called the Facility for Laboratory Reconnection Experiment (FLARE), will study a process that gives rise to auroras, solar flares, geomagnetic disturbances, and numerous astronomical phenomena. FLARE will be three times larger and much more powerful than the MRX. It will be constructed over three years and funded with \$3 million from the National Science Foundation and \$1.2 million from Princeton University.

PPPL began the Center for Heliospheric Physics last year, a joint project with the University's Department of Astrophysical Sciences. The center will study the region surrounding the sun that produces space weather that can interrupt cell phone service, damage satellites and knock out power grids.

Researchers at the Laboratory have pursued numerous collaborations nationally and internationally, including the Max-Planck/Princeton Center for Plasma Physics, a collaboration between Princeton University and the Max Planck Society of Germany.

The Laboratory has also begun studies of plasma-based nanotechnology. Other technologies being investigated at PPPL include a plasma mass filter that could be used to clean up large amounts of radioactive waste. Researchers are working as well on X-ray imaging techniques that could have "enormous impact in a huge array of applications," Prager noted.

Researchers at PPPL and the U.S. Department of Agriculture are developing a technique that uses radio frequency waves to pasteurize eggs. Princeton University and PPPL researchers are also working on a method to verify that presumed nuclear warheads that are to be decommissioned actually are nuclear warheads.

"All of this diversity of activities does not add up to a huge pile of money," Prager commented. "However, it does lead to huge scientific creative activity at the Laboratory, so in that way it is incredible."

Some of PPPL's research is geared toward educating and informing students and the general public. One example is the Remote Glow Discharge Experiment (RGDX) devised by Arturo Dominguez, a postdoctoral fellow in the Science Education Department. The RGDX allows users anywhere in the world to log on to a program that enables them to create and manipulate a glowing plasma in a device at PPPL, and to watch the results via a live web stream video.

Prager said the past year "was a good year for the fusion program and a great year for PPPL." He added that PPPL has "planted the seeds for an even greater harvest next year."

PPPL is one of 17 national laboratories funded by the Department of Energy.

(Photo by Elle Starkman/PPPL Office of Communications)

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