



State of the Grid

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2ND QUARTER 2018



WELCOME TO OUR Q2 NEWSLETTER!

We hope you'll appreciate our updated layout. The intent was to make our content easier to read and give a simple refresh to our presentation.

Content is still king and this quarter we've got some great articles from various industry players I hope you'll find valuable.

Dr. Mani Vadari
President

AT MODERN GRID SOLUTIONS, SMART GRIDS ARE BUSINESS AS USUAL

*Differentiated services to utilities and their vendors focusing on Smart Grid and System Operations.
Our team brings deep expertise in all aspects covering technology and management consulting.*



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MGS NEWS HOT OFF THE PRESS!

This quarter's 'State of the Grid' newsletter has a definite renewables theme. We didn't start out with the intention of weaving a ribbon of renewables through it, but as we looked back on the energy-related news over the last few months, it became clear that it was going to happen. From BP's acquisition of an EV charging company, to Lyft's plan to offset its carbon emissions, to a glance at the renewable energy landscape (spoiler alert: it's exactly what you would expect), we've packaged up grid-related news in bite-sized portions.

Along with our new look, we've added a section called, "Meet the Experts" where we'll introduce an industry player each quarter. This time we're featuring Bill Blastic, a 27-year veteran of PG&E.

Here's a snapshot of what's happening with Modern Grid Solutions:

- Dr. Vadari's second book "[Smart Grid Redefined: Transformation of the Electric Utility](#)" has been released and is now available at bookstores near you and online. **It is on sale (40% off) at Amazon.com - Get your copy now.**
- Dr. Vadari is a keynote speaker at the CARILEC Renewable Energy and Smart Grid Conference to be held in Miami in September 23-27, 2018.
- Dr. Vadari was keynote speaker at the 3rd Annual Grid Modernization Forum, May 23-24, 2018 in Chicago. The topic of the presentation was "Grid Modernization and the Imperative for Utility Transformation"
- MGS's experts (more than 20) are making a difference. Our mantra: "**If you have a problem, someone in our team has solved it at least three times**". Call us to find out more.



MERGERS AND ACQUISITIONS

Nokia Acquires SpaceTime Insight to Expand IoT Software Portfolio

SpaceTime Insight provides machine learning-powered analytics and IoT applications for some of the world's largest transportation, energy and utilities organizations, including Entergy, FedEx, NextEra Energy, Singapore Power and Union Pacific Railroad. It's analytics predict asset health and optimize related operations. The acquisition supports Nokia's software strategy and is expected to strengthen Nokia's IoT software portfolio and IoT analytics capabilities and accelerate the development of Nokia's IoT offerings to deliver high-value IoT applications and services.

BP to Acquire UK's largest electric vehicle charging company

With the number of UK electric vehicles set to grow from 135,000 currently to 12 million by 2040, even big oil company, BP has seen the writing on the wall. It announced plans to purchase Chargemaster (to be rebranded as 'BP Chargemaster') which operates the UK's largest public network of EV charging points, with over 6,500 across the country. The deal is valued at £130 million. This comes after a BP investment earlier this year of \$5 million in FreeWire, a US manufacturer of mobile rapid charging systems for EVs. They aren't the only oil giant in the game. Shell bought NewMotion, Europe's largest electric charging player with over 30,000 charging points, last year and started deploying EV chargers at its gas stations in the UK and Netherlands. With Volkswagen, the world's biggest car maker, last year pledging to offer an electric version of each of its 300 group models by 2030, building out the infrastructure can't be far behind.



NextEra to Buy Gulf Power & Florida City Gas and Additional Assets from Southern Company

The deal is valued at approximately \$6.475 billion, including the assumption of approximately \$1.4 billion of Gulf Power debt. The acquired companies are expected to benefit from NextEra Energy's operating capabilities and since NextEra already owns Florida Power & Light, the transaction will expand its operations in the state without too much overlap. This deal comes after two big offers from NextEra to buy Hawaiian Electric Industries and Energy Future Holdings unit Oncor both were rejected by regulators.

GE to Buy Alstom JV Stakes for \$3.1 Billion

General Electric Co. will be required to buy Alstom SA's stakes in three energy joint ventures for \$3.1 billion. Alstom said it would exit the renewable energy, grid and nuclear businesses that were created as part of the original \$10 billion deal. The joint venture assets will be transferred on October 2, 2018. In other GE news, for the first time in 110 years, GE will not be a member of the Dow Jones Industrial Average. It was recently replaced in the top 30-stock index by Walgreens Boots Alliance.

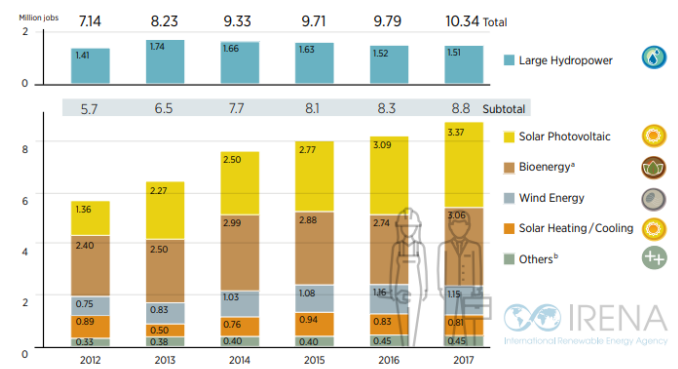


KEY HIGHLIGHTS

Lyft Combats Climate Change with Every Ride

Lyft, the global ride-hailing service, has partnered with 3Degrees to use carbon offsets as a tool to fund emission reductions and help address other environmental impacts from vehicle use. As part of delivering on their Green Cities Initiative, Lyft eventually wants to offer an all-electric vehicle fleet powered by 100 percent renewable electricity. While that is the vision, they found a more immediate way to address their environmental impact by offsetting emissions from all rides, expected to reduce over a million metric tons of carbon annually. Lyft says their overall climate impact efforts are aimed at reducing CO2 emissions for the U.S. transportation sector as a whole by at least 5 million tons per year by 2025.

FIGURE 1: GLOBAL RENEWABLE ENERGY EMPLOYMENT BY TECHNOLOGY, 2012-17



Source: IRENA jobs database.
Note: The numbers shown in this Figure reflect those reported in past editions of the Annual Review.
a. Includes liquid biofuels, solid biomass and biogas.
b. Other technologies include geothermal energy, hydropower (small), concentrated solar power (CSP), heat pumps (ground-based), municipal and industrial waste, and ocean energy.

Renewable Energy Jobs on the Rise

The industry created more than 500,000 new jobs globally in 2017, with the total number of people employed in renewables (including large hydropower) surpassing 10 million for the first time. The fifth annual "Renewable Energy and Jobs" review from the International Renewable Energy Agency (IRENA) found that jobs in the sector increased 5.3% in 2017 and that China, Brazil, US, India, Germany and Japan have remained the world's biggest renewable energy employers representing more than 70% of the jobs. Solar photovoltaic jobs increased almost 9% to reach 3.4 million around the world in 2017, reflecting the year's record 94 gigawatts of PV installation. (Image above from IRENA jobs database.)

US White House to Allow Dramatic Expansion of Drone Use

The White House will allow a swift and dramatic expansion of the way drones are used across the U.S. The announcement was positioned as President Trump following through on his promise to the industry to slash regulatory barriers that are sending companies to test the technology overseas. This creates new potential approaches for utilities to perform field inspections. Examples such as damage assessment during a storm, transmission tower/line/insulator inspections, and remote repair of live facilities are examples that immediately come to mind.

DOE Moves to Boost Electric Vehicles

The US Department of Energy announced \$19 million for research focused on rapid charge times with twelve cost-shared projects. The DOE seeks to lower the charge times to 15 minutes or less by 2028

using a connector or wireless fast charging system. The agency also wants to reduce battery pack costs to under \$100/kWh and increase range to over 300 miles.

CEC Adopts Building Standards Requiring Solar Systems Starting in 2020

Moving to cut energy use in new homes by more than 50 percent, the California Energy Commission has adopted building standards that require solar photovoltaic systems starting in 2020. The building energy efficiency standards, which are the first in the nation to require solar, will reduce greenhouse gas emissions by an amount equivalent to taking 115,000 fossil fuel cars off the road. Updates to the Title 24 standards are projected to reduce home energy use by 53 percent compared to the current code, saving Californians \$1.7 billion in energy costs over the next 30 years.

Research Reveals Revenue from Intelligent Building Solutions to Grow Strongly

According to Navigant Research, revenue for intelligent building solutions is expected to grow from approximately \$15.1 billion in 2018 to \$67.5 billion in 2027 at a compound annual growth rate (CAGR) of 18.1 percent. The report released in May analyzes the global intelligent buildings market and explores the evolution of legacy solutions in the era of digital transformation. Navigant has coined the phrase, “Energy Cloud” to describe the digital transformation of the electric grid. Their research points to the conclusion that intelligent building data can become a platform in the Energy Cloud. With buildings accounting for 40 percent of global energy consumption, this sector should play a key role in grid transformation.

California Renewables at Record High

The California Independent System Operator’s (Cal-ISO) set a record for “Renewables served demand” of 73.9%* on May 26. The ISO’s instantaneous solar generation also hit an all-time peak of 10,735 MW on June 8. California is well ahead of its aggressive 50% renewable target. And as renewable energy increases as a percentage of the state’s overall production, energy storage solutions continue to be tested to help deal with renewable curtailments. For example, earlier this year Southern California Edison and Tesla brought online of the largest lithium-ion energy storage systems in the world which can store 80 megawatt-hours, enough energy to power more than 2500 households for a day.

Historic Milestones Hit in New England

Solar power and wind power are breaking regional records in New England. Over 130,000 solar power installations now span the six New England states totaling 2,400 MW with over 5,800 expected by 2027. Wind power is gaining momentum too with 1,400 MW already installed and over 8,000 MW more proposed regionally, both on and off shore. In fact, proposed new wind projects eclipsed proposed new natural gas fired generation for the first time in 2017. The New England region exceeded 364 GWh of monthly wind power in January and Solar power also pushed past 2,300 MW for first time in April.

Executive Order 13800 and Office of CESER Address Cyber-attack Threats to US Electric Grid

A year ago President Trump issued Section (e) of Executive Order 13800 on “Strengthening the Cybersecurity of Federal Networks and

Critical Infrastructure.” The order called for an assessment of the potential scope and duration of a prolonged power outage associated with a significant cyber incident, as well as an evaluation of the readiness and gaps in the country’s ability to manage and mitigate consequences of a cyber incident. The assessment identified gaps around enhancing cyber incident response capacity, developing high-priority plans, augmenting scarce and critical resources, and understanding and characterizing response efforts to catastrophic incidents. Following the report’s release, Secretary Perry announced the creation of the Office of Cybersecurity, Energy Security, and Emergency Response (CESER), which aims to further strengthen DOE’s ability to play a vital role protecting energy infrastructure from cyber threats, physical attacks, and natural disasters.

After 70 Years as Puerto Rico’s Sole Power Provider, PREPA to sell Energy Assets

Nearly nine months after Hurricane Maria destroyed up to 75 percent of Puerto Rican distribution lines, almost 30,000 customers are without power. Just one month after announcing its Electric Power Authority would adopt a US national standard to design and rebuild the island’s power grid, Puerto Rico’s Governor Ricardo Rossello signed a bill on June 20th to privatize its power company and attract more investment. Legislators now have 180 days to approve another measure to establish a public energy policy

and regulatory framework that Puerto Rico’s Energy Commission will use as a guide to award contracts. The transformation and privatization process is planned to take place over 18 months. Governor Rossello, an oversight board, and an advisory team plan to form a working group to guide the process.

Wind and Solar to Surge to 50% of World’s Generation by 2050

Bloomberg’s New Energy Outlook 2018, an annual long-term economic analysis of the world’s power sector out to 2050, says wind and solar technology will provide almost 50 percent of total electricity globally with hydro, nuclear and other renewables taking total zero-carbon electricity up to 71%. The report shows expectations of only 29 percent of the electricity production worldwide to result from burning fossil fuels, down from 63 percent today. An expected \$548 billion is expected to be invested in better capacity by 2050, two thirds at the grid level and one third installed behind-the-meter by households and businesses. Coal is reported to shrink to just 11 percent of global electricity generation by 2050, from 38 percent currently.

The New Energy Outlook sees \$11.5 trillion being invested globally in new power generation capacity between 2018 and 2050, with \$8.4 trillion of that going to wind and solar and a further \$1.5 trillion to other zero-carbon technologies.

Source: <https://about.bnef.com/new-energy-outlook/>

New 70-Mile Midwest Transmission Line Increases Reliability and Access to Cleaner Energy

The collaborative project started in 2013 by Pioneer Power, LLC (The joint venture between American Electric Power, Duke Energy and Northern Indiana Public Service Company) has been completed. It features a new extra-high voltage 765 kV transmission line among other upgrades and represents an investment of \$347 million. It’s the first



phase of Pioneer Transmission's 290-mile plan to create a more efficient link between the region's power plants, allowing for the integration of renewable energy to the grid, and make significant improvements to the overall energy delivery system.



FEATURED ARTICLES



Accessing Real-time Data is Key to Unlocking Smart Building Technology Benefits

Buildings are the largest energy consuming sector in the world, and account for over one-third of total final energy consumption and an equally important source of carbon dioxide (CO₂) emissions.

Smart building technology is poised to help lead modern utility conservation efforts in commercial buildings; the data generated by these systems enables both facilities management and owners to take actionable steps in addressing efforts toward both cost containment and environmental stewardship. Historically, the most impactful technology in this space has been reserved for the highest-end commercial real estate, with dedicated



facilities teams and big budgets. This as a big problem because those are often also the most efficient structures. To truly lessen negative impact to the environment, accelerate smart city development, and bring the benefits of efficiency and savings to all, smart building technology must be democratized and create a closed feedback loop that includes building occupants.

Buddy Platform, Inc. recently commissioned a survey of building owners, facility managers, and occupants across the United States to uncover perceptions around energy management and conservation in a facilities setting, and how to advance the adoption of sustainable building technology. Overwhelmingly, facility managers indicated that the primary driver to leveraging such technology was cost savings. Yet interestingly, the cost vs. benefit was also identified as being the primary deterrent to deploying such solutions. The conflicting opinions among the same response group could indicate a lack of certainty about (or access to) the technology. This was also acknowledged by nearly one third of the facility respondents who indicated the need for additional education regarding the benefits as well as technical requirements for deployment and support. The cost vs. benefit as a deterrent to deploying smart building technology is also likely based on speculation since without the data to compare, the benefits remain untapped. At any rate, it is clear that the business case for deploying smart building technology begins with mining critical data to quantify need (e.g. anticipated cost savings) and understanding each buildings' unique opportunities.

Democratizing building data by acquiring and providing easy access to it can move facility managers from reactive to proactive as they change the way in which they manage daily workload. In addition, providing feedback to building occupants helps ensure buy-in and greater participation in achieving energy management goals. In all of these situations, real-time data solutions that can be easily deployed and shared among both building managers and occupants alike is key to realizing the full benefit and potential of smart building technologies.

Article submitted by: Gayle Wooster, Senior Communications at Buddy Platform, Inc. gayle@buddy.com

Access the full survey results and white paper here: <https://buddy.com/resources/whitepapers/the-importance-of-data-accessibility/>



Regulation... 'Tis the Question

Today, significant forces are transforming our industry, resulting in new entrants, technologies, strategies, opportunities, threats, etc. It is an exciting but nerve-racking time. Utilities are inundated with change while (1) they significantly alter their generation mix and at the same time (2) respond to mutating load curves (e.g., "duck", "Nessie", "shark"— see recent GTM article). Regardless of the applicable curve (labeled or not), a utility with its own circumstances will require a unique combination of actions to optimize and rebalance supply and demand.

Already creating significant challenges, those same forces promise to make change perpetual in an industry that was practically OCD for decades. Climate change has shifted and amplified individual and societal ideals around energy, leading to investment and innovation. This increased awareness coupled with better products at lower costs has boosted consumer and corporate adoption into the mainstream. This part of the industry now appears to be in a self-sustaining cycle of continual growth, innovation, and change, which is positive overall but presents added complexity for utilities.

With this drama at the forefront, the industry is basically working under the same regulatory backdrop of the last century. It doesn't seem like a fair fight. At this point, would the industry benefit from additional intervention?

California raised eyebrows (possibly blood pressures) with recently announced solar mandates on new housing and EV targets, both major policies coming within weeks of each other.

However, the consumer energy market appears healthy across the US, even in areas with little intervention. We need governments to refocus their efforts on redefining industry regulations (e.g., New York's REV initiatives), giving utilities more, possibly complete, latitude in dealing with their new reality. That would balance this industry transformation, making it more fascinating as opposed to cringe-worthy.

Article submitted by: Michael Burck,





Dispatch in the 21st Century, Unintended Consequences

Not long ago, base-load dispatch generally resulted in significant coal-fired generation before more flexible resources. The more flexible generation delivered critical ancillary services such as load-following and regulations. This dispatch approach was economically driven, with coal-fired generation displaced only by lower cost hydro generation in some regions. For decades, this dispatch “stack” was the norm.

With the penetration of large-scale renewables, such as wind, and distributed resources, such as roof-top photovoltaics, flexible resources became critical for reliable electricity supply. Further, single cycle natural gas fired peaking resources have aged and become less competitive when compared to state-of-the-art combined cycle natural gas fired generation.

With this as a backdrop, the complexity of 21st century dispatch will be driven by several forces. These forces include not only “must-take” or heavily subsidized renewable requirements but also the economically driven transition from coal to natural gas fired generation. On its face, this shift from traditional base-loaded coal to combined cycle natural gas represents a positive direction because it reduces emissions, reduces cost, and delivers a significant increase in generator response.

Going forward this direction, however, creates a dispatch conundrum. As slow-response coal-fired generation is displaced from base-load by more flexible and responsive gas-fired combined cycle, dispatch becomes more challenging. Economically driven base-load dispatch committing significant portions of the available gas-fired generation capacity moves the less responsive coal-fired generation to the dispatch margin where responsiveness is critical to “blend” the increasing renewables. Yet coal-fired generation is less than 20% as responsive as natural gas-fired combined cycle, and even less so than aging peaking capacity combined with modest storage capacity. In the 21st century, dispatch complexity represents a critical challenge, requiring valuing flexible economic dispatch calculation, so reliability of supply can be insured.

Article submitted by: JD Hammerly, CEO, The Glarus Group, Inc.



MGS Editorial: Renewable Energy Situation in India

India has been making impressive strides in defining and marching forward on a focused effort towards making itself energy independent, and more importantly towards a renewable energy future. This is both an impressive and a lofty goal. At the center of all of this is a Ministry of New and Renewable Energy (MNRE) which is the nodal Ministry of the Government of India for all matters related to new and renewable energy.



“Its vision is to develop new and renewable energy technologies, processes, materials, components, sub-systems, products & services at par with international specifications, standards and performance parameters to make the country a net foreign exchange earner in the sector and deploy such indigenously developed and/or manufactured products and services in furtherance of the national goal of energy security.”

Underpinning its vision is an aggressive goal of 227 gigawatts of renewable-based capacity by 2022.

Progress has been an impressive 70+ gigawatts of capacity by the end of 2017 – much of it through a combination of solar and wind taking advantage of resources where available (wind in Tamil Nadu and Solar in other places). Adding to this is the reduction of global prices for renewable energy technologies. Energy demand in India continues to grow and renewable energy is allowing that demand to be met at the best price possible. Unfortunately, India continues to also add thermal (fossil fuel) power each year, but the good news is its utilization is decreasing.

It is truly incredible to see developing countries begin to take the lead regarding installing renewable energy. It was not long ago that they complained they could not take a global role in fighting climate change. Now that renewable energy makes sense economically, they are taking a leading role in continuing to bring down the costs of renewable energy.

Should India reach this new goal, it will only be behind China and the US in terms of installed renewable energy capacity.

Excerpts taken from article [India Increases Its Massive 2022 Renewable Energy Target By 28%](#) by Kurt Lowder.



MEET THE EXPERTS

Mr. Blastic has over 35 years of utility industry leadership and consulting experience. He has broad experience developing and implementing strategic objectives to maximize business results while enhancing organizational effectiveness and commitment. In 27 years at Pacific Gas & Electric Company (PG&E), he held Director level positions in engineering, electric operations, quality management, and emergency management. While at PG&E, Mr. Blastic established a Quality Improvement Department responsible for the identification of core processes, development of process-centered performance measures, and reviewed the effectiveness of management control systems to ensure compliance with legal and regulatory requirements.

He also drove all efforts associated with the optimization of PG&E's electric transmission and distribution operations functions; including facility consolidation, work process redesign, staffing strategy, labor negotiations strategy, facility design, operations information technology transformation strategy, change management strategy, and all deployment strategies. Since leaving PG&E, Mr. Blastic has spent over eight years crafting solutions for problems facing gas and electric utilities.



William R. Blastic

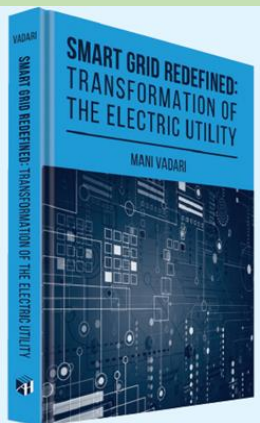


NEWS FROM MODERN GRID SOLUTIONS

Ongoing Projects at Modern Grid Solutions

Our current work with clients includes:

- Assisting the Pacific Northwest National Laboratory on a DOE project - development of an OpenADMS application development platform (GridAPPS-D).
- Assisting with a major multi-OpCo distribution operations transformation – Control center consolidation, ADMS specification and procurement, and operations standardization.
- Major Canadian utility Restoration processes update and improve
- Defining a Smart Grid Roadmap for a major Northwest Municipal utility
- Assisting an international Transmission company with their North American expansion and worldwide technology roadmap
- Assisting with an EMS integration effort



ARTECH HOUSE

PRACTICAL BOOKS FOR ENGINEERING PROFESSIONALS

Smart Grid Redefined: Transformation of the Electric Utility

Mani Vadari

- Guides professionals in the evolution of the Smart Grid and offers insight into distribution automation, storage, and microgrid;
- Highlights the journey to a transformed electric utility, provides solid examples, and includes real-world case studies;
- Presents new energy storage solutions and electric value chain disruptors;
- Learn how to overcome challenges related to integrating supply and demand diversity;
- Discusses how new technologies impact the day-to-day operations of a utility and how these technologies can transform the normal functioning of the utility;
- Provides discussions about how a transformed utility can be a springboard to a smart city;
- Demonstrates how to apply the strategies of technologies in this resource to guide them to success in the field;
- Defines the roadmap to the utility of the future and provides a vision for how utilities can thrive in their new environment.

MGS team grows its team of experts

MGS has built a portfolio of experts with 25-40 years of experience in fields ranging from Grid Modernization, T&D Operations, Generation operations, Utility regulatory & economics, Energy Efficiency and Demand Response and T&D Planning. Check us out!

Electric System Operations: Evolving to the Modern Grid

Dr. Vadari's book "[Electric System Operations – Evolving to the Modern Grid](#)" continues to receive rave reviews from readers. Buy them soon at a leading retailer.

Smart Grid Redefined: Transformation of the Electric Utility 3.0

The book has been released and is now available in all leading bookstores and an online store near you.



ABOUT THIS NEWSLETTER

This quarterly newsletter is a production of Modern Grid Academy under the auspices of Modern Grid Solutions. Please send all comments and inquiries to info@moderngridsolutions.com