Certified Minority Business Enterprise MBE

State of the Grid

A Service from Modern Grid Academy

Welcome to the 4th quarter newsletter from Modern Grid Solutions. We have passed a major milestone with this newsletter – it is now going to an organically evolving subscriber list of almost 1900 people. It is a packed newsletter full of very interesting articles that I believe you would enjoy. Please also keep an eye open for the Distributech 2018 blog straight from San Antonio.

Don't miss the last segment which also includes information on our successes and other activities. ***Sincerely yours***

Mani Vadari, Modern Grid Solutions

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1. MGS news – Hot off the Press

- Dr. Vadari's second book "**Smart Grid Redefined: Transformation of the Electric Utility**" is off to the printers and will be released by publisher Artech House in Feb 2018.
- Subscriptions to "State of the Grid" briefing has now blown past 1800 and is on its way to reaching 1900.
- Dr. Vadari to deliver a master class "Leading transition to a Smart City – A strategic 360-degree and in-depth review of the current state and future direction of Smart City" at India Smart Grid Week in Delhi (March 2018).
- Dr. Vadari will present at the 3rd Annual Grid Modernization Forum, May 23-24, 2018 in Chicago.

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 3 times. Call us to find out more.

2. DTech blog – Straight from San Antonio

I'm partial to San Antonio, since it is my hometown. For whatever reason though, turnout at DTECH appeared to be noticeably off and that cascaded down to the exhibit area. A little disappointing at first, but after walking it several times throughout the week, booth traffic was more pronounced. Some vendors didn't miss a beat from the apparent attendance curve ball while others were noticeably/uncomfortably sparse. There might be anomalies, but comparing across vendor segments, the patterns potentially indicate a validation of market leaders or a shift in the competitive landscape. Time will tell.

In addition to that, there is always a buzz around new solutions; this year was "DERMS." It seemed every vendor was positioning themselves with the usual strategies: those with new/enhanced capabilities (primarily with targeted use cases) either carving out a niche or making a beachhead; those committing only to a roadmap to buy time; and then the few audacious ones who try to sell either repackaged solutions (relying on brand) or a new technology without any specific use case (wanting investment).

From utilities to consultants to vendors to customers, the lack of definition with DERMS is creating misalignment, functional gaps, and a lot of frustration. The viability of existing solutions today rests on connecting with the right customers now while developing the right product strategy for tomorrow. As of yet, no clear voice or leader, and there didn't appear to be any catalyst coming out of DTech to change that. The potential is there; the question is when. Will something happen this year to convert the buzz into a market or will we be right back here next year?

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3. Mergers & Acquisitions

Hubbell Inc. to Acquire Aclara Technologies

Hubbell Inc. entered into a definitive agreement to acquire Aclara Technologies, for approximately $1.1 B in an all-cash transaction. The transaction strengthens and broadens Hubbell's competitive position across utility markets. The acquisition will combine the complementary strengths of Aclara and Hubbell, providing the opportunity to integrate Aclara's strong customer relationships and smart infrastructure solutions into the Hubbell portfolio and accelerate ongoing innovation efforts to address utility customers.

Powin Energy Sells Projects and Pipeline to esVolta

Powin Energy Corporation, a leading manufacturer of fully integrated energy storage solutions, has sold over 110MWh of select project assets and contracted pipeline to esVolta. esVolta recently received a large financial commitment from Blue Sky Alternative Investments LLC to accelerate its growth in the North American utility-scale energy storage market. Powin Energy will be esVolta's exclusive provider of energy storage systems through 2022.

Westinghouse Electric Sold to Brookfield

Westinghouse Electric announced that it agreed to be sold to Brookfield Business Partners for $4.6 B, pending approval by a US bankruptcy court. Westinghouse, owned by Japan's Toshiba since 2006, has faced deep losses due to its stalled nuclear business, including cancelled plants in South Carolina. The company filed for bankruptcy protection in March 2017. Brookfield, would take on about $3 B in long-term debt to finance the transaction.

Dominion, SCANA All-Stock merger

Dominion Energy and SCANA Corp. have agreed to an all-stock merger expected to lower customer rates and help unwind financial obligations related to the abandoned V.C. Summer nuclear project. SCANA, parent company of South Carolina Electric & Gas, has been looking for a buyer, after it and Santee Cooper announced they would abandon construction of the V.C. Summer nuclear plant, having already spent $9 B. Acquiring SCANA could help cushion the blow of the Summer debacle for Dominion. In addition to a $1.7 B write-off of nuclear costs, the company proposes a $1.3 B payment to SCE&G customers. If approved, SCANA would operate as a wholly-owned subsidiary of Dominion.

4. Key Highlights

New York's 2018 Clean Energy Agenda Unveiled

Governor Cuomo delivered a comprehensive plan to combat climate change by reducing GHG emissions and growing the clean energy economy. The 2018 Clean Energy Jobs and Climate Agenda will build on progress made under the Reforming the Energy Vision (REV) policy, which includes the Clean Energy Standard mandate to generate 50% of the state's electricity needs from renewable sources by 2030, and climate protection activities under the Environmental Protection Fund. The 2018 Clean Energy Jobs and Climate Agenda includes:

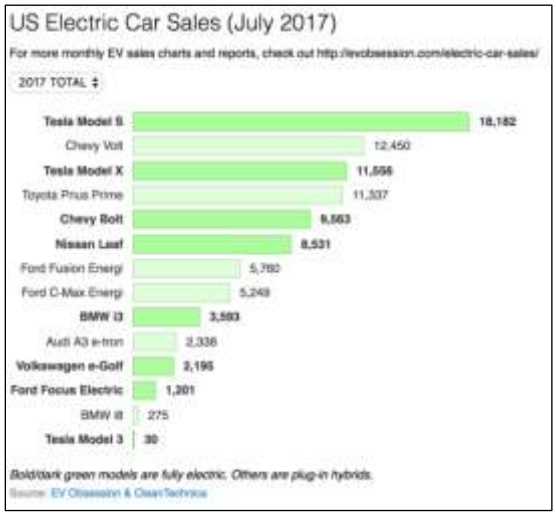
- Expand regional initiatives and reduce emissions equitably from highest-polluting, high demand "peaker" plants
- Solicit proposals for offshore wind power
- Increase transmission of renewable energy by investing $200 MM to meet storage target of 1,500 MWs by 2025
- Invest $200 MM from NY Green Bank to support storage
- Create the Zero Cost Solar for all program for 10,000 low-income New Yorkers, and others.

4th Grid Modernization Index Findings

GridWise Alliance, in collaboration with Clean Edge, Inc., released its fourth Grid Modernization Index (GMI-4). The Index assesses and ranks all 50 states and the District of Columbia based on the degree to which they are moving toward a modernized electric grid. GMI-4 benchmarks states on a wide range of grid modernization policies, investments, and activities, and provides insights into some of the relationships and connections between state policies and regulations, customer engagement, and utility investments in modernizing the grid. GMI-4 shows that more states than ever are working to address grid modernization related issues. The Index offers 7 Key Takeaways which include:

- The pace of grid modernization efforts has accelerated, particularly on the policy front;
- Recent hurricanes and other extreme weather events, as well as cybersecurity and physical security threats, are focusing attention on grid resilience;
- Leading states continue to make progress toward comprehensive grid modernization;
- Many states are just beginning their own grid modernization efforts;
- Some of the early movers may be seeing their momentum slow, particularly in the Grid Operations category;
- Utilities are prioritizing efforts to address customer demands for greater choice and the capability to manage their own energy usage; and
- Clean energy targets by states, cities, and corporations are driving utility efforts to accommodate rapid growth in DERs.

2017 the Best Year Ever for Electric Vehicle Sales in the US



Source: cleantechnica.com

In 2017, nearly 200,000 electric vehicles were sold in the US. This is a significant increase from 2016. Tesla remains at the head of the pack. The Model S, now in its fifth year of sales, remains the nation's best-selling EV with 27,060 sold. The Model X SUV had a good year as well finding more than 21,000 buyers to become the third-best-selling EV. Chevrolet's Bolt EV was a strong second notching just over 23,000 sales in 2017. The combined sales of Bolt EV and Volt put GM in a clear second place overall. 2017 was not a great year for the Nissan Leaf which is being replaced by a cheaper, better, longer-range model. 2018 is expected to be another year of EV growth in the US. Despite fears it would be abolished, the IRS tax credit remains on the books for another year, something that's still necessary to spur adoption of alternative energy vehicles as they remain more expensive than conventionally powered cars, even if the total costs of ownership are lower.

Machine Learning Over Existing Utility Analytics Techniques

Machine learning is rapidly moving into the mainstream and is high on the agenda of many utilities. While the technology has existed in parts of the utility value chain for years, various drivers are expected to increase its use throughout other areas of the business. Machine learning has several advantages over existing utility analytics techniques when performing customer segmentation, pricing forecasts, anomaly detection, fraud detection, and predictive maintenance. The utilities industry is already using self-learning algorithms, particularly in the field of asset monitoring and predictive maintenance, and several reasons suggest the use of machine learning will expand to many more use cases and its adoption will accelerate. Utilities are encouraged to investigate how and where machine learning can help their businesses now and in the future, but should be aware of existing limitations. Machine learning is best suited for a handful of specific analytical processes, including clustering, regression, and classification.

Residential Energy Storage Systems Ready for Prime Time?

Energy storage for the residential solar market has always been something of a holy grail for energy companies. If storage becomes cheap enough, it could allow a rooftop solar system to provide all the energy a homeowner needs, potentially making it possible to go off-grid. It could also be the energy hub for the home, deciding how to use energy most efficiently and connecting smart devices. In 2017, commercial and utility energy storage markets started to thrive and grow. In 2018, it looks like the residential energy storage market will start to show the same promise. Energy storage needs a financial reason to have it. Net metering allowed customers with solar systems to sell excess electricity to the grid at the same price they paid for, effectively making the grid their storage location. As net metering has come under pressure across the country the economics of residential energy storage systems have changed. Energy storage may start to make sense for customers, but the products still need to get to installers, who will be the sales engine.

Bill to Establish Investment Tax Credit for Energy Storage

U.S. Reps Mike Doyle (D-PA) and Ryan Costello (R-PA), both members of the House Energy and Commerce Committee, introduced the Energy Storage Tax Incentive and Deployment Act of 2017.

Energy storage systems serve as complementary reserves to renewable resources like wind and solar power. They can provide backup power and help lower costs for electricity during peak demand, when energy is most expensive. Additionally, energy storage systems are integral to increasing deployment of advanced grid technologies and enhancing the operation of all types of generating resources.

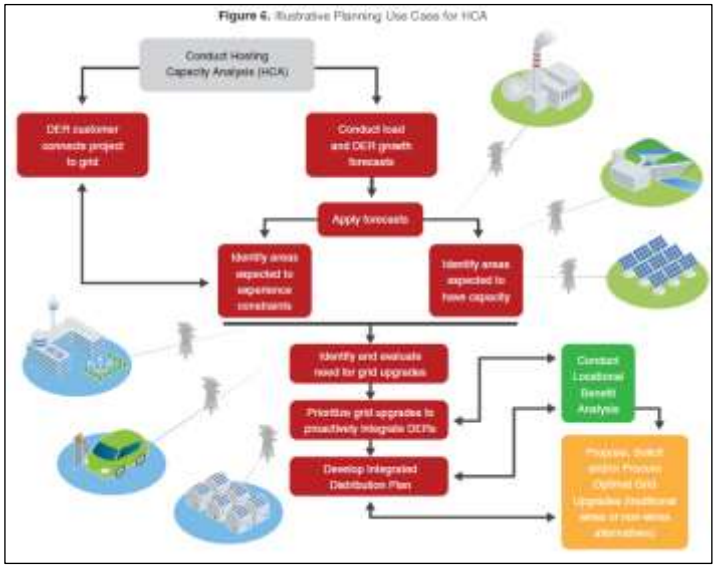
The Act, is modeled on the existing investment tax credits for solar energy and can apply to large, utility-scale energy storage projects

or smaller battery systems for residential use. The current tax code allows an ITC for energy storage when it is installed in conjunction with a solar energy system; this bill would extend the ITC for energy storage investments in a wider range of applications and provide greater clarity and assurance to prospective investors.

Global DER Capacity to Reach 530 GW in 2026

Consolidation of distributed energy resources (DER) has represented a significant component of the energy market. Initially, DER was considered the fringe, with conventional power being difficult and expensive to provide. However, technology advances, business model innovation, changing regulations, and sustainability and resilience concerns have brought DER into the core of the future deployment. This change has generated both concern and optimism throughout the power industry as regulators and grid operators work to understand the evolving landscape. This shift requires the use of innovative technologies and solutions on the part of grid operators, including advanced software and hardware that enable greater control and interoperability across heterogeneous grid elements. According to Navigant Research, global DER capacity is expected to grow from 132 GW in 2017 to 528 GW in 2026.

Regulator's Guide to Optimize Modern Electric Grid



Hosting capacity analysis (HCA), has emerged as a key tool for capturing and optimizing the benefits of DER on the grid, while proactively managing increasing their penetrations and ensuring the reliability of the grid. HCA can determine the amount of DERs that the distribution system can accommodate at a given time and a given location. It also allows utilities, regulators, and DER customers to make efficient and cost-effective choices about whether to pursue interconnection of a DER technology at a specific grid location by providing data about the amount of new DERs that can be accommodated at a node on the grid. Key steps in implementing HCA include:

- Establish a stakeholder process
- Identify criteria to guide implementation of the HCA
- Select and define the use cases for the HCA
- Develop an HCA methodology (or methodologies) most appropriate to the use cases
- Validate the results

Source: www.irecusa.org

$160 MM Kennedy Energy Park in North Queensland

Construction of the first utility-scale wind, solar and storage hybrid generator connected to the national electricity network is set to start near Hughenden in North West Queensland. This system will produce and feed clean renewable energy into the grid with much greater consistency and reliability from a combination of solar, wind and battery storage – an industry first. It's also an important and valuable demonstration of how renewable energy can be used to cost effectively meet most network demand for power – day and night. Kennedy Park Energy Hub will have a maximum generating capacity of 60 MWs of renewable energy – 43 from wind, 15 from solar and 2 from Li Ion batteries. On completion, the wind farm is expected to generate around 210 GWHs of electricity per annum – enough power to supply more than 35,000 average Australian homes.

NY has Plan to Transform Puerto Rico's Electric Power Grid

Governors Andrew M. Cuomo and Ricardo Rosselló announced a plan to rebuild and transform Puerto Rico's electric power system, which was severely damaged by Hurricane Maria. The new system will be more resilient, efficient, advanced, and less dependent on fossil fuel imports that cost Puerto Ricans more than $2 billion annually. The plan, created by the Puerto Rico Energy Resiliency Working Group established by Governor Cuomo to aid the island in its damage assessment and power grid rebuild planning, calls for the island's new electric power system to be designed with the resiliency to withstand future storms and to be built with modern grid technologies and control systems. The new system will have increased renewable generation, such as wind and solar; incorporate new distributed energy resource technologies, such as energy storage and microgrids; reduce dependency on fossil fuels; and enable energy to become abundant, affordable and sustainable for the people of Puerto Rico.

Tesla's Giant Battery Responds to Outages in Australia

The world's largest Li-on backup power system installed by Tesla, has already responded to two major power outages after just weeks in use. Last week, the Hornsdale Power Reserve which uses the same Li-on technology utilized in Tesla's electric cars, kicked in just 0.14 secs after the Loy Yang station in neighboring Victoria, suffered a sudden drop in output. South Australia has been grappling with rising electricity prices ever since a 2016 storm knocked out the state's power grid, causing 1.7 M residents to temporarily lose their electricity. Storms and heatwaves have resulted in other blackouts. The Hornsdale wind farm is capable of supplying energy to up to 30,000 homes and can act as a last-ditch defense against sweeping power failure.

FERC Rejects DOE's Coal and Nuclear Energy Bailout Plan

FERC rejected DOE's Notice of Proposed Rulemaking (NOPR), which would have provided cost recovery for power plants that

keep 90 days of fuel onsite. Instead, the Commission asked regional grid operators to review an extensive list of questions about improving power system resilience and report back within 60 days. In its September letter announcing the NOPR, the DOE argued that the expected retirement of coal and nuclear plants in the nation's wholesale power markets could put the U.S. power supply at risk. FERC, however, said the agency and supporters of the rule failed to prove that to the commission. The 90-day fuel supply requirement, FERC noted, would "appear to permit only certain resources to be eligible for the rate, thereby excluding other resources that may have resilience attributes."

5. Smart Grid venture capital (VC) funding

VC funding for Smart Grid companies in Q3 2017 totaled $76 MM in 14 deals, compared to $139 MM raised in eight deals in Q2 2017. In a year-over-year comparison, $11 MM was raised in seven deals in Q3 2016. In Q4 2017, $380 MM was raised in 36 deals compared to $343 million raised in the same number of deals in Q4 2016.

Top VC Funded Companies in Q3 2017

Company	$ MM	Investors
Advanced Microgrid Solutions	34	Energy Impact Partners, Southern Company, DBL Partners, etc.
Romeo Power	30	Undisclosed
Power Survey	24	EnerTech Capital, Cycle Capital Management, BDC Capital, etc.
Particle	20	Spark Capital, Qualcomm Ventures

Source: Mercom Capital Group, llc

Dr. Vadari will present at the 3rd Annual Grid Modernization Forum.

The 3rd Annual Grid Modernization Forum, May 23-24, 2018 in Chicago, closely examines lessons learned to date by industry leaders pushing the frontiers of grid modernization and reliability. Key technology innovators and executives will come together to share perspectives on how best to leverage smart grid investment, effectively engage customers, and meet the challenges of the changing energy ecosystem. Case studies of improved network performance, resiliency, outage restoration, and distributed energy resource (DER) integration will be examined with an eye toward determining best practices and evaluating technology advances for possible implementation. As in prior years, this is a unique opportunity to network with top industry professionals who are leading the way toward effective grid modernization and the integrated, interoperable, resilient energy network of tomorrow. Visit www.grid-modernization-forum.com for full details and to register

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6. News from Modern Grid Solutions

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New Projects at Modern Grid Solutions

MGS assists a broad range of clients performing a broad range of work. In summary, our current work with clients includes

- Developing the conceptual design for a grid innovation center in New York to support the REV mandate.
- Assisting the Pacific Northwest National Laboratory on a DOE project - development of an OpenADMS application development platform (GridAPPS-D).
- Assisting with an EMS integration effort
- Assisting with the evaluation of distribution operations
- Assisting a major international transmission services provider in developing its technical and modeling capabilities.

MGS team grows its team of experts

MGS has built a portfolio of experts with 25-40 yrs 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 Grid

To be released in Feb 2018. This, book #2 from Dr. Vadari, to be published by Artech House focuses on different aspects of the Smart Grid that are now becoming mainstream at utilities worldwide are its impacts on how utilities are transforming themselves.

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