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# State of the Grid

A Service from Modern Grid Academy

This is the first newsletter of 2016 – Happy New Year to all our readers. In this issue, we have a diverse set of original articles that will be sure to tickle your interest and attention (1) Storage (2) Big data and (3) LEED certified Energy efficient home.

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

- MGS is a named partner on DOE's GMI lab award for the Development of an Open-Source Platform for Advanced Distribution Management Systems.
- Dr. Vadari's latest article "[Smart Grid – Redefined](#)" sets the new standard for re-defining what the Smart Grid is.
- Dr. Vadari is part of USTDA team focusing on helping Indian cities Ajmer, Allahabad and Vishakhapatnam become smart.
- Subscriptions to "State of the Grid" briefing grows to 1300.

## 2. Key Highlights

### National Grid launches solar marketplace

National Grid (NG) is launching an online marketplace allowing RI customers to shop for solar and incentives for improving energy efficiency. The initiative will help the state meet its goal to increase the amount of electricity generated by customer-owned equipment by 160 megawatts over 5-years. NG is partnering with EnergySage to deliver the SolarWise program. Through their online marketplace, customers will be able to compare solar options for their home or business and receive competitive quotes from pre-approved installers. NG is the first electric utility in US to offer a transparent platform for purchase of distributed solar.

## 3. 2016 - Integrating storage further into the mix

2015 saw energy storage move towards being an accepted component of the electric energy mix in the U.S. Building upon successes in utility scale projects, coupled with downward pricing trends on storage and balance of system components, look for 2016 to continue with not only increased installations but also to bring a greater focus on integrating storage as a key element of utility plans.

Drilling down, look for these trends to push forward in 2016:

1. Integrating storage into dispatch and control will continue to advance, with increased telemetry and system control options helping to allow storage to be more main stream.
2. Utility scale projects will continue to dominate installations with increased focus moving further down into distribution voltage.
3. Continued price reductions in storage components and balance of system items, along with continued development on how to commercialize "re-utilize" batteries coming out of electric vehicles.
4. Investigation of market mechanisms (e.g., transitive energy) to price various storage services (wholesale and retail) and determining how to rate base storage depending on the market structure.

In 2016 and beyond, storage will continue to move beyond just being an ancillary tool to aid in smoothing the intermittency of renewables to become one of the "go to" options in supply and demand planning. Storage becomes cost-effective to peaking capacity but with the ability to be deployed in smaller increments throughout the voltage waterfall. In markets without extensive renewables penetration, more efficient fossil-fired generation capacity factors will trend upward, using storage to shift generation to higher value times rather than cycle down overnight. Increasing the capacity factors at the more efficient end of the dispatch curve will also lower emission levels from electric production overall.

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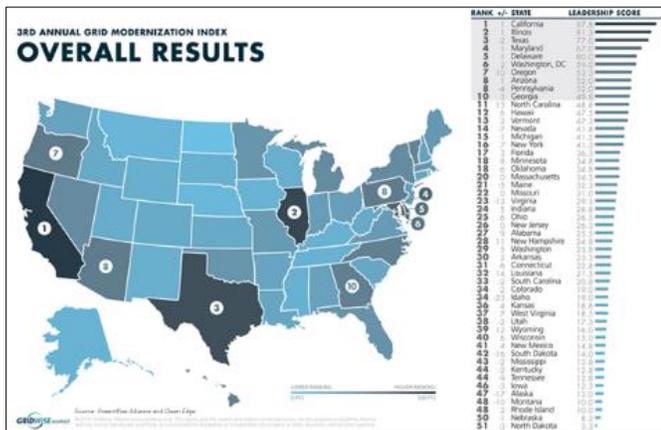
### Rise of the utility data scientist

Utilities today are poised to gather, use and benefit from the technology of companies such as Google, Facebook, and Amazon. Utilities have the inherent advantage of access to large amounts of internally sourced data such as AMI, SCADA data, etc. This combination of vast amounts of accessible data (consumer usage, system state, etc.) with readily available data science tools enables

utilities to quickly create readily understandable and insightful visualizations. The urgency for a utility to invest in data science is therefore evident. Unexplored data may contain a myriad of simple business and operational improvements.

Growing an initial bench of data scientists and growing their basic data science skills is relatively inexpensive, and the necessary tools can be conveniently accessed. Beginner data scientists could help a utility with basic process and business improvements that are less involved and time-intensive. Utilities willing to invest internally and externally in data science will see many benefits.

### 3rd Annual GMI findings



Source: gridwise.org

Grid Modernization Index (GMI) ranks and assesses all 50 states and DC, based upon the degree to which they have moved toward a modernized electric grid. The 3rd Annual GMI finds CA, IL, TX, MD, and DE leading the charge. CA, IL and TX are in this position for the third time in a row. Grid-related developments highlighted in this year's report include:

- CA now requires its IOUs to submit distributed resource plans (DRPs) that detail how they will value distributed energy resources (DERs) as distribution grid assets.
- NY's landmark Reforming the Energy Vision (REV) initiative recognizes the need for adv metering and automation functionality, to enable NY achieve its goal: reforming retail market to leverage DERs to optimize the electric system.

### 4. Big data trends and opportunities for utilities

I see an industry that is faced with some significant challenges, yet significant potential. Here are some reasons why:

- Devices and sensors. There are over 5 billion connected devices, growing to over 50 billion devices, including over 800 million smart meters by 2020. These devices will generate massive amounts of data that will need to be analyzed and acted upon. For example, power line monitors are being deployed that measure current, voltage, temperature, wind, frequency, and harmonics at hundreds of samples per second.
- Wireless communications. 5G will provide over 10 times improved latency (sub 1ms) and bandwidth (> 1Gbps), enabling new data intensive applications and solutions, connecting many more devices to rich cloud computing and analytics services.

- Big data and analytics. New analytics and machine learning applications are helping companies identify anomalies, predict events, optimize use of assets, and better understand customers and their use of utility services.

For analytics to be truly impactful, data needs to be processed and analyzed in real-time, blended with historical information and other data sets such as temperature, pressure, and social media.

However, technologies that have served utilities well in the past are challenged to keep pace with the massive volume and velocity of data and support these new analytics applications.

To address these challenges companies are now turning to new big and fast data technologies, such as those used in the capital markets industry. These technologies move operations and analytics directly to the data, combine streaming, in-memory and historical data for analytics, and use array based programming and query languages to work on these large datasets. Companies are using simple and lean technologies designed for performance for competitive advantage, delivering business insights hundreds to thousands of times more efficiently than their competition.

I am excited about the innovation underway and the potential to harness this data for benefiting utilities and their customers.

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### FBI - hacking iPhone could make power grid vulnerable?

According to Apple, the security features of the iPhone keep important things like U.S. government agencies and America's power grid safe from malicious hackers. Apple argues, the phone is part of the security perimeter that protects one's family and co-workers. Nation's vital infrastructure such as power grids and transportation hubs becomes more vulnerable when individual devices get hacked. Criminals and terrorists who want to infiltrate systems and disrupt sensitive networks may start their attacks through access to just one person's smartphone. They reiterate that the encryption technology built into today's iPhone represents the best data security available to consumers, which cannot be compromised.

### US energy storage market growth



Source:greentechmedia.com

The U.S. energy storage market had both its best quarter and best year, in 2015. The U.S. deployed 112 MW of energy storage capacity in the 4<sup>th</sup> Qtr 2015 (annual total = 221 MW). The 112 MW deployed was more than the total of all storage deployments in 2013 and 2014 combined. Propelled by that historic quarter, the U.S. energy storage market grew 243% over 2014's 65 megawatts. In 2015, front-of-meter storage accounted for 85% of all deployments for the year. Most of these deployments were in the PJM market. The residential and non-residential segments grew

405% with HI leading the residential market and CA leading the non-residential segment. The recent extension of several federal renewable tax credits is expected to increase deployments of storage paired with renewables.

## SCE plans for System of Systems at grid edge

### SCE DRP Capital Expenditure Estimates

Time Period	Capital Expenditures	CPUC Approval Mechanism	
2015-2017	Distribution Automation	\$40-70 million	Proposed memorandum account to record associated revenue requirement until expenditures are authorized by CPUC
	Substation Automation	\$30-60 million	
	Communications Systems	\$7-15 million	
	Technology Platforms and Applications	\$130-200 million	
	Grid Reinforcement	\$140-215 million	
	<b>Total</b>	<b>\$347-560 million</b>	
2018-2020	Distribution Automation	\$185-320 million	Request recovery in 2018 GRC
	Substation Automation	\$185-320 million	
	Communications Systems	\$270-470 million	
	Technology Platforms and Applications	\$215-375 million	
	Grid Reinforcement	\$550-1,100 million	
	<b>Total</b>	<b>\$1,405-2,585 million</b>	

SCE anticipates capital spending to continue at least in the range of current forecast levels, although could result in higher spending pending CPUC approval in future GRCs

July 1, 2015

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Source: greentechmedia.com

Southern California Edison (SCE) expects to spend up to \$500 MM on a Grid Management System (GMS) to bring distributed energy and intelligence to the grid. As part of its distribution resources plan (DRP) filing with CPUC, SCE laid out its capital expenditure estimates on its 5-year costs to prepare its grid for the onslaught of distributed energy resources - between \$1.4 billion and \$2.5 billion. Though expensive, SCE expects this approach to be much cheaper than handling these new, disruptive grid forces the old-fashioned way. SCE will be demanding a new level of standardization amongst the hardware, communications and software products and services that will be going into the GMS.

## 5. Mergers & Acquisitions

### DC regulators approve Exelon-Pepco merger.

DC regulators approved a \$6.8 billion merger between Pepco and Exelon on Mar 23<sup>rd</sup>, creating the largest publicly held utility in US. The decision marked a surprising turn of events for the deal, which D.C. regulators had rejected twice and which appeared to be on life support in recent weeks. The sale affects about 2 million Mid-Atlantic electric customers served by Pepco Holdings, including more than 815,000 ratepayers in the District and in Prince George's and Montgomery counties. The new offer reallocates a portion of the benefits package by placing \$45.6 million into a customer investment fund -- the move would preserve \$25.6 million in residential rate credits from the original merger settlement, and free up \$20 million for the PSC to allocate at its discretion.

### EPS acquires Elvi Energy and MCM

Electro Power Systems S.A. (EPS), has acquired Elvi Energy and 30% of MCM Energy lab ("MCM") for € 2.4 MM. This move will result in a fully integrated energy storage group under a new joint brand, "Electro Power System Group". Elvi Energy is a leading storage systems integrator worldwide, with 4.6MW of hybrid power plants installed in 7 countries and 9.5MWh of energy storage systems realized. The transaction marks a step change in EPS' deployment strategy in emerging markets through Hybrid

Power Plants and turnkey off-grid and micro-grid power solutions comprised of renewables and storage technologies.

## 6. Experiences designing an energy efficient house

Everyone lives almost half their lives in their houses. Increasingly we desire to live in comfort with reduced energy demands. Using the reduce, reuse, and recycle principles, one can build or remodel houses to dramatically enhance comfort at reduced energy costs.

Passive designs cut down on energy loss and promote energy reuse, starting with better insulation. Use double the foam board insulation for foundations. Reduce air leakage on the side walls using closed cell spray foam insulation. Low emissivity high insulation double pane (or triple pane) glass windows let in ample natural light while cutting down on energy loss. Well placed windows can create ample cross-ventilation air flow reducing need for air conditioning during summer months.

On the active design front, use of zone controlled radiant floor heating systems provides amazing levels of comfort and reduced dry air flow at low energy costs. Electrical and gas powered hybrid water heating system with recirculating pumps also reduces energy demand for hot water. Consider tank-less radiant water heating systems for on-demand hot water. High efficiency heat recovery ventilators circulate fresh air while reusing the heat from outflowing air. Finally, use LED lighting and efficient appliances to lower costs and lengthen operating life.

Pragmatic choices based on location and availability are required. For instance, geo-thermal systems or solar panels may not work because total system costs may not be economical. Key is to not lose track of the business case.

However, with key focused improvements, a house can be comfortable and reduce energy used per square foot by up to 60% compared to other houses in the neighborhood. One can adopt several ideas here for remodels as well. Exciting innovations in construction technology and smart appliances will continue to improve our lives in the years to come.

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### Facebook acquires Wit.ai

Facebook acquired Wit.ai, a startup founded 18 months ago to create an API for building voice-activated interfaces. Wit.ai's platform will remain open and free allowing Facebook to use the technology to draw developers into its Build-Grow-Monetize loop where they get help building apps, but eventually pay Facebook for ads to grow or monetize by splitting revenue with Facebook from hosting its ads. Wit.ai could help the company offer voice control development tools helping create a Facebook app one can navigate through speech.

### New global platform for sustainable cities

City leaders launched the Global Platform for Sustainable Cities (GPSC), and mobilize \$1.5 B over 5 yrs for urban sustainability programs in 11 developing countries - Brazil, China, India, Cote D'Ivoire, Malaysia, Mexico, Paraguay, Peru, Senegal, Vietnam and South Africa. GPSC is a knowledge sharing program coordinated by World Bank and supported by banks, think tanks, UN organizations, and city networks, providing access to tools and integrated approach to sustainable urban planning and financing.

## State of the Electric Utility survey findings

Utility Dive conducted a survey of 515 U.S. utility exec to provide insight into current thinking in the industry. Most utilities see the need for change in their business models. They see regulatory model, internal resistance to change and technology integration as biggest impediments to evolution. They also found energy management and efficiency services, community solar, electric vehicle charging infrastructure, green pricing programs, and rooftop solar offerings as popular emerging revenue opportunities. Utilities see revenue opportunities emerging around DERs but are unsure about how to build a business model to capture them. Utilities expect to increase customer engagement across all digital platforms - mobile, social media and utility websites. On policy and regulation, most utilities believe the traditional vertically integrated model is the most popular regulatory structure, followed by NY REV. The overarching takeaway is that transformation has arrived— but a standardized approach on how to adapt has not.

## 7. Smart Grid venture capital (VC) funding

Venture capital (VC) funding for Smart Grid companies increased slightly to \$425 MM in 57 deals, compared to \$384 MM in 74 deals in 2014. Total corporate funding, including debt and public market financing, equaled \$527 MM, compared to \$844 MM in 2014.

### Top 5 VC Funded Smart Grid Companies in 2015

Company	\$M	Investors
<b>SIGFOX</b>	115	Telefonica, SK Telecom, NTT DOCOMO Ventures, Elliott Management Corp., etc.
<b>Actility</b>	25	Ginko Ventures, KPN, Orange, Swisscom, Foxconn, etc.
<b>PubNub</b>	20	Relay Ventures, Sapphire Ventures, Scale Venture Partners
<b>Smart Wires</b>	17.3	Undisclosed
<b>Bitstew Systems</b>	17.2	GE Ventures, Cisco Investments, Yaletown Venture Partners, BDC Capital

Source: Mercom Capital Group, llc

## 8. News from Modern Grid Solutions

### DOE Grid Modernization Laboratory Consortium (GMLC) – Awards

Modern Grid Solutions is a named partner in “Development of an Open-Source Platform for Advanced Distribution Management Systems” along with PNNL and NREL as primes and other partners including Washington State University and Incremental Systems.

### MGS team grows its team of experts

MGS has assembled over 20 key industry leaders in its portfolio of experts, each with between 25-40 years of experience in their respective fields ranging from T&D Operations, Big data analytics, Grid Modernization, Utility regulatory and economics, Generation operations, Energy Efficiency and Demand Response and T&D Planning and Construction. Please ask us as to how we can help you.

### 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 any leading retailer. It is now being used at several universities as course materials. SUNY Buffalo, UW-Wisconsin, LeHigh, Pennsylvania State University, Drexel and Stony Brook.

### Training news

- The MGS-led and developed certificate course – Introduction to Smart Grid – will be live on IEEE early in the year. Stay tuned for more information on this news.
- Under Smart Cities Council, Dr. Vadari delivered several Smart Cities Readiness Workshop last year. Stay tuned for more planned for this year.

### Events and News

- “[Smart Grid Redefined](#)”, by Dr. Vadari is now ready for viewing by the public. Check it out. This article redefines the Smart Grid as it has changed over time and looks to the future.
- Dr. Vadari is now a regular contributor to the IdeaXchange blogs managed by Transmission & Distribution World. His latest article is “[Setting the Context – Defining competitive threats embedded in DER technologies](#)”. Check it out.
- Dr. Vadari is now a regular contributor to the Intel energy series blog also. His latest article is “[Smart Inverters: Revolution or Evolution?](#)”. Check it out.

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*We deliver 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.*

