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State of the Smart Grid Briefing

A Service from Modern Grid Academy

We are very excited to release our seventh quarterly newsletter and our third one for 2014. In this newsletter we have a reprint of Dr. Vadari's article from our blog for wider dissemination to our audience. This article discusses a major new development that is happening in the states of New York and California on the focus of incentivizing introduction of Distributed Energy Resources into the grid. We also have some very exciting news about happenings at Modern Grid Solutions that could not just wait until the last page. So, we reproduced them here.

Modern Grid Solutions News

- *Pennsylvania State University Press Release – **coming out soon**. MGS and GridSTAR collaborating to offer unique courses – credit and non-credit courses offered online and instructor-led to provide top quality educational opportunities for utilities and solution providers to gain insight and understanding about smart grid and related topics.*
- *Dr. Vadari's book (**Electric System Operations – Evolving to the Modern grid**) is now being used at undergraduate and graduate courses at UW-Madison, SUNY Buffalo, LeHigh and being considered for course work at Penn State University.*



Sincerely yours

Mani Vadari, Modern Grid Solutions

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1. Key Highlights

Reusing Electric Car Batteries

A report by Berkeley suggests that used electric car batteries may be an ideal solution for California's need for cheap energy storage. Most batteries retain much of their capacity and value after the use of the car, and repurposing them can absorb excess renewable energy and dispatch it when needed. Utilities can stack reused batteries to store excess power during times of heavy demand, which would provide substantial savings and reduce the need for costly fossil fuel-burning power plants. Repurposing these car batteries can help California achieve its renewable

energy, greenhouse gas reduction, and energy storage goals more efficiently and lower the cost of owning an electric car.

2. NY & CA incentivizing DER

The electric grid is changing in ways that we cannot yet imagine. Smart Grid technologies such as Distribution Automation and Smart Meters are making it possible for other new technologies such as storage, Demand Response, and other forms of distributed generation as they become a serious force for change in the utility industry.

The United States specifically and the world in general is seeing a tremendous growth in a variety of distributed sources of energy and new sources of consumption as well. This is because the technologies associated with Distributed Energy Resources (DER) are also not staying still. They are getting better, they are getting cheaper and new technologies are making it easier to integrate into the grid. Examples of these include everything from photovoltaics, distributed storage, electric vehicles (along with the possibility of vehicle-to-grid storage), fuel cells and even demand response.

Is this it, just a technology pure play?? No – not even close. New York and California have decided to change the rules of the game.

New York was influenced by the devastation caused by Super-Storm Sandy along with other factors such as (1) increasing dependence on high-quality electric supply by both residential and business customers, (2) need for new reliability and resilience approaches in response to the likelihood of increasingly severe storms and heat waves, (3) rapid declines in costs and increased capabilities of DER which is expected to drive increased DER penetration and (4) Continued competitive pressure on the state's economy.

California, on other hand is influenced by its environmental and energy policies combined with customer choices enabled by innovation. Its transition towards a substantially more decentralized future is creating an opportunity to significantly reduce greenhouse gases by harnessing the value of energy across the grid from customers at the edge through the bulk power system. Essential to achieving this outcome is enabling customer choice via an electric distribution system that becomes an open, integrated electric network platform that is more than smart.

Both initiatives are looking to:

- Address locational benefits and costs of distributed resources and enable seamless DER integration.
- Expedite DER participation in wholesale markets and resource adequacy, unbundle distribution grid operations services, create a transparent process to monetize DER services and reduce unnecessary barriers for DER integration.
- An independent technology-neutral electric distribution Service Operator (DSO) with an expanded role in utility distribution operations while avoiding any operational conflicts of interest.
- Build customer and market confidence in the expanded role of DERs by increasing utilities' experience relying on DER for expanded uses in distribution planning and operations, increasing customer awareness, interest, and confidence in DER and developing familiarity with new DER-oriented markets

However they deviate in other areas – and could possibly learn from each other. The areas of divergence include:

The NY Divergence:

- The NY DSP mechanism visualizes a distribution level market sending real-time price signals to settle the market and planning level price signals to encourage investment.
- NY is heavily focused on interface and system standards including the behavioral characteristics that DERs need to exhibit – connection characteristics.
- NY has a belief that its DER penetration objectives can be reached with existing designs, better automation and more sophisticated DSP systems.

The CA Divergence

- CA believes that its distribution system planning, design and investments should move towards an open, flexible, and node-friendly network system (rather than a centralized, linear, closed one) that enables seamless DER integration.
- The distribution system design should eventually converge to include water, gas and other services.
- CA also believes that they should expedite DER participation in wholesale markets and resource adequacy and unbundle distribution grid operations services.

Conclusions and closing thoughts: Both NY and CA have taken a significant leap forward in reimagining the distribution grid. They have put forth bold and innovative ideas that will unfold over the next year or two as the stakeholder process comes to near-term and long-term plans. These two initiatives have the potential to set the stage for reimagining the future of distribution grid for the next 20-50 years.

I have always believed that increasing penetration of DER should never be the main objective. Developing a plan for a grid that is more flexible, reliable, resilient, efficient, sustainable, and affordable all to support the customer's changing needs should be the objective.

Article previously published in <http://blogs.intel.com>

Dr. Mani Vadari

President Modern Grid Solutions

NYISO Issues DER Outlook for NY State

NY State, is pursuing an array of initiatives to further increase the use of on-site power generation and storage systems. NYISO issued a new report assessing the state of DER technologies and their prospects for growth in the coming years. According to the report, more residential and commercial customers are interested in adopting DER technologies to lower their utility costs, improve power quality and access new revenue. The study found that 57% of New York's DER capacity is generated by small-scale CHP –

not PV as in other states. The study asks government and utilities to address challenges and obstacles for expanding use of DER.

SCE unveils largest storage system in U.S.

Southern California Edison (SCE) unveiled its new 8 MW, Li-ion battery storage system. It is the biggest battery project in North America and one of the biggest in the world. SCE will begin testing its costs and impacts in conjunction with variable generation. The installation located in CA's Tehachapi area, which has about 4.5 GWs of installed wind capacity. The system costing \$53.5 MM will have over 600K cells similar to those used in GM's Chevy Volt and be housed in a substation on SCE's 66-kV Antelope-Bailey transmission line.

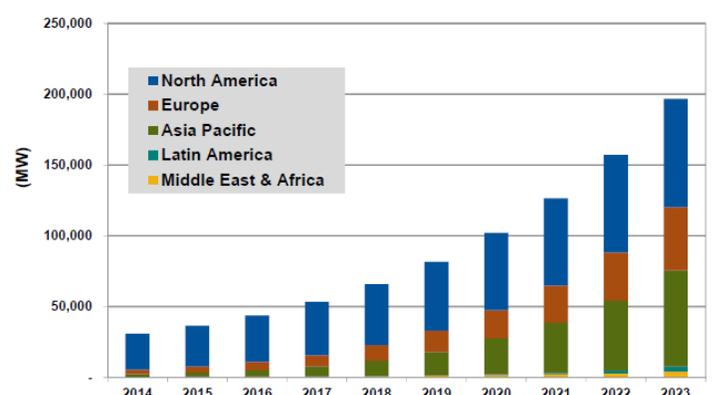
Rural Electrification Programs in Asia-Pacific

The microgrid market in Asia-Pacific is on the threshold of exponential growth, with numerous pilot projects being tested in most countries. Japan leads with several established microgrids, while Australia is following close by. A key driver is the need for a resilient power supply. The proliferation of microgrids in Asia-Pacific is encouraged by establishment of commercial microgrids in developed nations and Rural Electrification Programs in developing countries. REPs such as the 1000 islands project in Indonesia, PV program in the Philippines, and other projects in Malaysia are leading the pack. Frost & Sullivan expects the Asia-Pacific microgrid market to reach US \$ 800 MM by 2020.

DR Capacity to Increase Six-Fold by 2023

Navigant states that a combination of limiting utility generation, the need to reduce peak load, and changing resource mix globally, are creating new demand for demand response (DR) programs. While US is leading in the DR market, utilities worldwide are finding new ways to incentivize active customer participation in DR programs. Worldwide capacity of DR programs is expected to grow from 30 GW to 200 GW by 2023. US's leadership position is expected to erode soon as world regions start moving from pilots to build out of full-scale markets or programs. The largest growth is expected to occur in Asia Pacific, and approach North America in terms of DR capacity and spending by 2023.

DR Capacity by Region, World Markets: 2014-2023



Source: Navigant Research

3. Mergers & Acquisitions

Brightergy Acquires part of Acumen

Brightergy finalized a deal to acquire the Supply-Side Division of Acumen Energy Solutions, an energy management services provider. This acquisition marks a move by Brightergy enhancing its ability to provide holistic energy analysis to its business and nonprofit clients, acting as an outsourced energy manager.

LM Purchases Sun Catalytix Corporation

Lockheed Martin (LM) completed the acquisition of the assets of Sun Catalytix Corporation, complementing existing capabilities in the area of energy management and efficiency. The purchase includes IP, contracts, and facilities. The new business unit will be known as Lockheed Martin Advanced Energy Storage.

NRG Purchases University Fuel Cell Project

FuelCell Energy, Inc. has agreed to sell its 1.4 megawatt fuel cell power plant project at University of Bridgeport to NRG Energy. Commercial operations at the power plant are expected to commence early 2015. The university will buy the electricity and heat produced under a multi-year power purchase agreement.

Echelon to sell its Grid operations to S&T AG

Echelon Corporation, signed an agreement to sell its Grid operations to S&T AG, a publicly traded European IT systems provider with an existing focus on smart energy products and services. The companies expect the deal to close by end of 2014 allowing Echelon to focus fully on Industrial Internet of Things.

Echelon Acquires Lumewave

Echelon Corporation, acquired Lumewave Inc., a wireless outdoor lighting control system provider to U.S. universities, medical facilities, municipalities, and enterprises. Echelon will sell Lumewave's products such as individual lighting controllers, gateways, and management and maintenance software through its existing channels in North America and worldwide.

Samsung Electronics to Acquire SmartThings

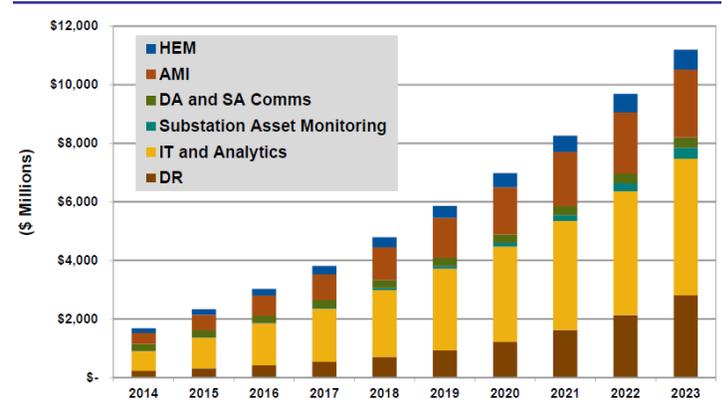
Samsung Electronics Co., Ltd. entered into an agreement to acquire SmartThings, a leading open platform for smart home and the consumer Internet of Things. SmartThings supports an open and growing ecosystem of developers, producing new types of connected devices and unique apps in the cloud that change how everyday objects work. Samsung's resources can allow SmartThings to expand its platform to more partners and devices.

Smart Grid as a Service to reach \$11.2 Billion

Hardware and software vendors are increasingly offering managed services solutions, also called smart grid as a service (SGaaS). SGaaS offerings are now available for smart grid applications in several categories, such as HEM, AMI, distribution and substation automation, communications, asset management and condition monitoring and others. Vendors believe that as first wave of utility smart grid deployments wane, the next wave will come from smaller utilities where managed

services business model makes more sense. Navigant Research forecasts the global SGaaS market to grow from \$1.7 B in 2014 to more than \$11 B in 2023.

Annual SGaaS Revenue by Category, Worldwide 2014-2023



4. Smart Grid Venture Capital Funding

VC funding into smart grid companies came in at \$81 MM in 13 deals in Q2 2014. Smart Charging raised \$22.6 M, followed by communications at \$18.6 M, and grid optimization at \$17.8 M.

Top 5 VC Deals in Q2 2014

Company	\$M	Investors
ChargePoint	22.6	Rho Ventures, Kleiner Perkins, Caufield & Byers
Sunverge	15	Southern Cross Renewable Energy Fund, Siemens Venture Capital
Onramp Wireless	13.6	Undisclosed
Gridco Systems	12	RockPort Capit Source: Navigant Research Partners, North Bridge Venture Partners
GeoDigital	5.8	EnerTech Capital, Emerald Technology Ventures

Source: Mercom Capital Group, LLC

PG&E Fires Three Executives

Pacific Gas and Electric (PG&E) fired three executives for improper email communications with state regulators where the utility appears to be negotiating for a favorable administrative law. CPUC President, Michael Peevey asked his chief of staff to resign for responding to the emails leading up to utility's gas transmission and storage rate case. PG&E is creating a new role of chief regulatory compliance officer, who will oversee compliance with all of PG&E's interactions with state regulators.

Smart Cities on the Rise

Smart cities are emerging in response to an increasingly urbanized world dealing with scarce resources. Through use of technologies, smart cities deal with issues such as congestion, while utilizing resources more efficiently. The number of smart cities worldwide is expected to quadruple by the 2025, to more than 90 cities globally. This rise is attributed to local governments working with the private sector to solve several challenges confronting urban centers. While the EMEA region has the largest number of smart cities today, Asia-Pacific is expected to take the lead by 2025.

5. News from Modern Grid Solutions



We are now on Social Media -



Training news

- Our **online training** with voice-over is continuing to attract new subscribers. We continue to release more online self-paced courses of 1-hr length making it easy to take on the go. The information on our courses is at <http://www.moderngridsolutions.com/smart-grid-training/smart-grid-online-training-courses.html>. The new and updated list is provided below:

Power System Fundamentals	Introduction to Electric Utilities
Electric Value Chain	Introduction to Smart Grid and Analysis of Drivers
Smart Grid Dimensions & Architecture	Major Smart Grid Projects & Industry Mega Trends
Smart Grid Dimensions – Distributed Energy, Energy Storage, Transmission and Distribution Automation, Advanced Operational and Decision-Support Systems, Microgrids, Smart Meters, Demand Response and Energy Efficiency, Data Analytics, Communications, Smart Homes and Buildings, Electric Transportation, Privacy and Cyber Security	
System Operations	Market Operations
Smart Grid Business Case Modeling & Analysis	Smart Grid Technology Progression
Utility Business Model Evolution and Transformation	Smart Grid Roadmap and Value Proposition
Smart Cities	Distribution Management

Check them out on our web-site or call us for any of your Smart Grid and System/Market Operations training needs.

Electric System Operations – Evolving to the Modern Grid

Dr. Vadari's book "[Electric System Operations – Evolving to the Modern Grid](#)" is still rated at 5-stars in Amazon.com. Buy them soon at Amazon.com and other leading retailers.

Events and News

- Dr. Vadari presented at the IEEE General meeting held in Washington DC. The topic of presentation was "**Defining a new architecture and functions to allow the system operator to manage distributed energy**".
- Dr. Vadari delivered a presentation to a group of electrical contractors from Denmark. This presentation was made in New York City and the topic of the presentation was "**Overview of Smart Grid Technologies**".
- Dr. Vadari will present a special invited talk on **robustness, resiliency and reliability of energy systems** at the IEEE International Test Conference (Oct. 21-23, 2014, Seattle). The topic of the presentation is "**Dynamic Microgrids – A Potential Solution for Enhanced Resiliency in Distribution Systems**".

Hot off the Press: Dr. Vadari is now also a Sr. Consultant with the CMG group.

*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*



At Modern Grid Solutions, *Smart Grids are Business as Usual*

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.