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State of the Smart Grid Briefing

A Service from Modern Grid Academy
A Subsidiary of Modern Grid Solutions

Modern Grid Solutions wishes all of you a Very Happy and Prosperous New Year (2014).

We are very excited to release our fourth quarterly newsletter and we are building on existing traditions and adding new ones. We again have three articles in this newsletter. Article 1 on Substation Automation and how it supports the Smart Grid mandate. Article 2 discusses an innovative AMI implementation in India. The last article focuses on looking ahead into 2014.

Don't miss the segment at the end which includes information on our successes and other activities.

Sincerely yours

Mani Vadari, Modern Grid Solutions

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1. Key Highlights

WH triples federal agency renewable energy mandates

As part of the Obama administration's goal of reducing greenhouse-gas emissions 17% over 2005 levels by 2020, the White House released an executive order in December mandating federal agencies, both civilian and military, to triple the use of renewable sources of energy by 2020. The mandate will require federal agencies to replace 20% of the electricity they use with renewable sources by 2020, up from a 2005 mandate of 7.5% by 2013.

While the order only applies to federal agencies, this represents a significant boost in the renewables mandate due to the fact that it affects about 500,000 buildings, 600,000 federally operated vehicles for agencies that spend on average \$500 billion annually in goods and services.

Transmission Investment Boom in NA

An estimated \$163 billion worth of transmission investment is underway in the U.S. and Canada, with \$13.5 billion in 2013, and \$25.6 billion slated for 2014.

Most of the construction involves 345-kV and 500-kV DC and AC lines and is set to occur in the West, including WECC region, Canada's Alberta and British Columbia, and the Northeast.

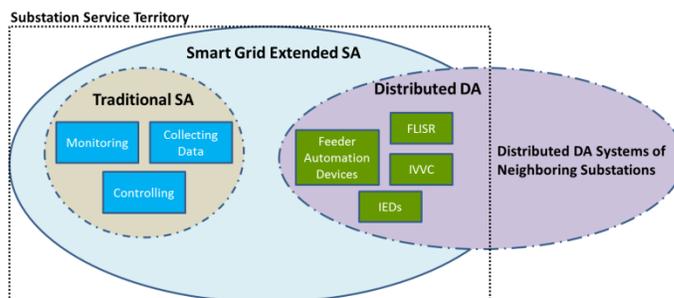
Transmission development is largely being driven by the need to upgrade aging infrastructure, reliability concerns, plant retirements and the need to meet renewable portfolio standards in several states across the U.S.

2. Extending substation automation to smart distribution

Traditional Substation Automation is focused on automation functions such as monitoring, controlling, and collecting data inside the substation. Distribution substations had little to no automation and were rarely connected to a central SCADA system. However, with proliferation of IEDs, they are increasingly seen as distributed nerve centers of the utility.

Utilities deploying advanced feeder automation applications such as Fault Location Isolation and Service Restoration (FLISR), and Integrated Volt/VAR Control (IVVC), are looking to extending distribution substation automation to improve operational performance and reduce costs.

For example, extending substation automation to include feeders served by the substation, would enable auto-restoration schemes to operate at the local distribution level. Coordination of distributed feeder automation with neighboring substation automation systems would enable a self-healing grid at the larger distribution network level.



Case in point - PECO Energy Co. needed a better way, both locally and remotely, to monitor, control, diagnose, and maintain equipment in the substation to reduce operating costs and provide improved customer service. It upgraded one substation to an integrated protection and control design, with over 140

microprocessor-based relays and communications processors, making it the largest completely microprocessor-controlled substation in existence.

Most distribution automation designs rely on a master connection to share data between IEDs. When this master connection is lost, the IEDs become stranded. With the PECO approach, the communications processor creates an autonomous coordinated distribution automation with SCADA, and protection system that does not rely on a master connection. This allows mediation of local or remote control of the entire substation and automated feeder circuits, reducing fault isolation and restoration from several hours to just a few seconds, leading to improved reliability and increased customer satisfaction.

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North America's Best Energy Storage Projects

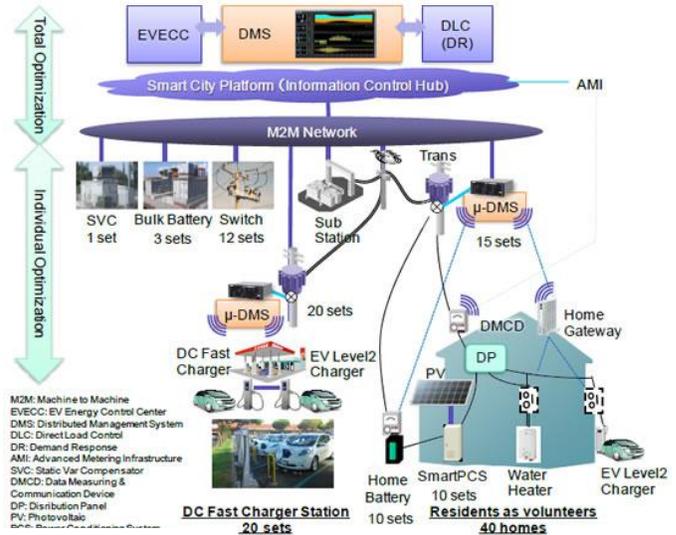
Four energy storage projects won the Energy Storage North America (ESNA) Innovation Award for demonstrating energy storage potential in providing services to the grid, financing options, ownership models and technology strengths. They include:

- **Notrees Wind Energy Storage Project:** Performs frequency regulation, renewables capacity firming and electricity shifting with a 36MW, 24MWh advanced lead acid storage system in Texas.
- **Southern California Public Power Authority (SCPPA) Thermal Energy Storage Program:** Uses thermal energy installed at 200 customer facilities, totaling 2.5MW, 15MWh of rated capacity to supply services to the grid: energy time shifting, T&D deferral, and renewable energy time shifting.
- **Santa Rita Jail Smart Grid:** Operates the largest CERTS-based microgrid with renewable generation and large-scale energy storage. The dynamic CERTS microgrid remains operational even in the event of a regional power outage, which helps with reliability and security at Alameda County's Santa Rita Jail.
- **Grid on Wheels:** This Delaware project uses electric vehicle batteries, chargers, and charging infrastructure to participate in, and generate revenue from, open ancillary services markets, including frequency regulation.

Japan-U.S. Island Grid Project in Hawaii

The demonstration site on the island of Maui, Hawaii is scheduled to begin operations December 17, 2013, through end of March 2015. The project is based on an agreement between the American and Japanese governments, to demonstrate Smart Grid technologies that enable the efficient use of renewable energy in island regions through the use of electric vehicles (EV). An EV Energy Control Center, Distribution Management System (DMS), and Energy Management System-Plus (EMS-Plus) are being deployed as part of the solution.

Lessons learnt from the demo site will be used to build business models for future "Island Smart Grids" in sub-tropical regions with environmental conditions similar to Maui.



Source: Hitachi

3. Mergers & acquisitions

Schneider Electric to Acquire Invensys

Schneider received EU approval to acquire the automation and control activities of Invensys for \$5.2 billion. While Schneider Electric is mostly focused on automation and control for discrete industries, Invensys is mainly active in automation and control for process industries. The acquisition is expected to considerably strengthen Schneider Electric's overall offering to its industrial and infrastructure customer base in addition to gaining access to the British company's large customer base in the oil and natural gas sectors, where it provides control and safety systems.

Buffett's Berkshire Buys NV Energy

A subsidiary of Warren Buffett's Berkshire Hathaway is buying Nevada's largest electric utility for \$5.6 billion in cash.

NV Energy has about 1.3 million electric and natural gas customers in Nevada. It will operate as a separate company using its current name, headquartered in Las Vegas.

The deal needs to be approved by NV Energy's shareholders and government regulators and is expected to close in the first quarter of 2014.

Heijmans Acquires Brinck Group

Heijmans is acquiring the Brinck Group BV in Zeewolde as a means of strengthening its smart metering market position in supplying, installing, servicing and maintaining smart gas, electricity, water and heat meters. The acquisition is consistent with the market trend towards decentralized energy generation and development of Smart Grids.

4. India's first Smart City Pilot

As India embarks on its ambitious Smart Grid plans to upgrade its electrical grid, one project stands out – The Puducherry Smart City Pilot Project. This project is touted to be one of the most complex smart city projects in the world sponsored by Power Grid (India). What makes it even more important for India is that home-grown solutions are used instead of importing them. For the first time, an Indian Smart Grid solutions company has

deployed an advanced smart metering solution that includes Demand Response (DR), Energy Audit, Pre-paid metering, Outage management system, etc with 505 smart meters of various single phase and three phase configurations which even provide real time energy audit for the 1st time in India. This has been made possible using hybrid wireless communication for AMI (Advanced Metering Infrastructure) with 865-867 MHz and 2.4 GHz for short range NAN/ LAN with GSM/ GPRS for long range back haul communication to IRIS, MDAS (Meter Data Acquisition System) software with Enterprise Service Bus (ESB) application for MDMS integration.

The Smart metering solution provides remote meter reads on hourly basis and on user definable basis to Power Grid, along with various instantaneous, power quality and power measurement parameters for web reporting to the utility in various formats like tabular, graphical, GIS based and also as push services for MDMS applications modeling. The solution also has one-of-a-kind prepaid metering solution in which the customer billing mode can be converted from prepaid to post-paid credit mode on the fly over the air as remote upgrade.

In future the solution will incorporate deployment of 6LoWPAN communication to showcase IPv6 technology is ready for large scale Smart Metering field deployment.

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UK Working to Lead the Way for Smart Cities

In the UK, government, cities, businesses and universities are collaborating to lead the global race to develop smarter cities. A new forum called the Smart Cities Forum, led by the government, will facilitate local authorities and businesses to work together to ensure growth in the Smart Cities market, estimated to be worth more than \$400 billion globally by 2020.

The government is already investing in the development of new technologies to support this sector. £50 million is being invested by the Technology Strategy Board in a Future Cities Catapult in London that will support businesses looking to commercialize their products and get them into the market place. It is also investing £24 million to create a future cities demonstrator in Glasgow.

5. Smart Grid venture capital funding

Smart Grid venture capital (VC) funding was slightly up in Q3 2013 totaling \$65 million in 12 deals compared to \$50 million in 10 deals in Q2 2013.

Top 5 VC Deals in Q3 2013

Company	\$M	Investors
Space-Time Insight	20	Zouk Capital, Opus Capital Ventures, EnerTech Capital, Novus Energy Partners
Onramp Wireless	15	Enbridge, Third Wave Ventures, Energy Technology Ventures
Varentec	8	Bill Gates, Khosla Ventures
Bidgely	5	Khosla Ventures
WaterSmart Software	4.5	Physic Ventures, Draper Fisher Jurvetson, Apsara Capital, The Westley Group

Source: Mercom Capital Group, LLC

Advanced Metering Infrastructure Mandate Ordered In MA

The Massachusetts Department of Public Utilities (DPU) has issued an order aimed at fortifying the state's power grid by requiring Massachusetts' utilities to develop grid modernization plans that include investments in advanced metering infrastructure (AMI).

The order follows the completion of a study that looked into the potential for grid modernization technologies such as smart meters, cellular communications networks and smart appliances.

The DPU has proposed a targeted cost-recovery mechanism that will enable the utilities to recover costs for investing in grid modernization technologies more quickly than the typical cost-recovery mechanism allows.

Hacker Exposes Vulnerabilities in Smart Grid Communications

A hacker at computer security conference in Miami showed a group of about 60 security researchers how to intercept radio communications used by some major electric utilities. He demonstrated that utility communications systems could be hacked by understanding the communications mechanisms between them. This opens the door to inflicting potential damage and power outages. He mentioned that radio frequency communications could be intercepted in part, by examining publicly available patents and user manuals. He expressed concern that unless the systems were tested now, "10 years down the road they will be a real problem."

6. Highlights of 2013 and look ahead to 2014

2013 was momentous for a variety of reasons. The term Smart Grid was becoming more commonly accepted and vendors were seeing growth. While growth in AMI was slowing down (at least in North America), there was marked growth in Distribution automation. Distributed generation was for the first time seeing major reductions in pricing (at least in solar PV) thanks to low-priced PV imports from China.

Two key events that really stood out and required us all to watch out were storms/floods and energy storage. We believe that there is a renewed level of focus on storms and how utilities prepare for it ahead of the storm but also react to the aftermath. The furor created by the response to Superstorm Sandy and the one in Calgary have set the stage in such a way that have put all utilities on watch and slipups may no longer be tolerated. Moving on to the one-two punch on energy storage from California and Germany within a short period of each other have the potential of creating the greatest impetus to move storage through its present valley of despair onto potential heights of success. Following through with technologies like Solar PV (reducing costs), microgrids (grid resiliency) and smart cities have shown an upsurge both in their availabilities but also the potential to disrupt the entrenched utility's business models in the not-to-distant future.

In 2014 we should be able to see the impact of the energy storage moves by California and Germany. As the states of NY and NJ

implement their system hardening plans, their impacts of this year's storms will be watched by all. Lastly, all eyes will be on progress of renewable sources of energy specifically solar PV and offshore wind and their potential impacts on the utility as it reacts to this potential onslaught from non-utility generation and individual customers who are trying to go either net-zero or go completely grid-free.

Excerpts from article by Dr. Mani Vadari. (Nov/Dec 2013 Volume 26, No. 9). 2013: "A Year in Review, Reviewing major events and emerging technologies". *Electricity Today* (pp. 26–30). http://online.electricity-today.com/doc/electricity-today/et_november_december_2013_digital/2013121101/#26

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7. News from Modern Grid Solutions

Training news

- Our **online training** now has voice-over to assist the trainee in following the materials. We are also signing up several new clients becoming the default providers of Smart Grid training to their employees.
- Modern Grid Solutions has also signed on with Clarion Training to deliver our Smart Grid and Power Systems training globally. Our first 2-day course "[Smart Grid: Commercial, Technical and Market Drivers](#)" will be delivered in London on 26th Feb, 2014.
- We are adding a set of new courses focused on specific project outcomes. The first one getting ready is Distribution Management. We will provide more information on this course in our next Quarterly Newsletter.

Events and News

- Three articles written by Dr. Vadari were recently published
 - "[Management of Big Data to Drive Utility Transformation](#)", Feature article, CIO Review Magazine - Technology for the Utility sector, November 2013.
 - "[2013, A Year in Review](#)", Guest editorial *Electricity Today*, December 2013
 - "[Life Extensions for Grid Automation Products: What Utilities Want and How Equipment Vendors Can Deliver](#)", Coauthored with Ramesh Saligame (JANIL), Feature Article, *Utility Horizons Quarterly* – Automation Rising, 4Qtr2013.
- Dr. Vadari's book "[Electric System Operations – Evolving to the Modern Grid](#)" continues to be received well in the industry. Buy them soon at Amazon.com and other leading retailers. Smart Grid News has published several excerpts from the book.
 - [Smart Grid 101 - Understanding the key players](#)
 - [Smart Grid 101 - Understanding system operations](#)
 - [Smart Grid 101 - The key drivers of a Smart Grid](#)
 - [Smart Grid 101 - How the Smart Grid is changing system operations](#)
 - [Smart Grid 101 - The Smart Grid's new systems](#)



Comments on our online training. *The Smart Grid for Non-Utility Personnel training delivered an excellent framework to comprehend the benefits of modernizing the Grid. Dr. Vadari's approach gets you grounded on Grid basics, its current short comings and paints a picture for the benefits of Smart Grid. I feel like I have a much better understanding of Grid infrastructure having taken this course from Modern Grid Solutions.* **Michael Taylor, Intel**

Hope to see some/all of you at Distributech 2014

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.