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State of the Smart Grid Briefing

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

Dear All - This is our third quarterly newsletter and we are building on existing traditions and adding new ones. The segment on mergers, acquisitions and buyouts appear to be a hit and has become a staple. We again have three original articles in this newsletter. Article 1 on DMS provides insight on how one can prepare ahead of time. Article 2 discusses improvements in condition monitoring and the move towards predictive maintenance. The last article focuses on Smart Cities.

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 Developments/Highlights

Energy Storage – California

Proposed Energy Storage Procurement Targets (in MW)

| Utility | 2014 | 2016 | 2018 | 2020 | Total |
|-----------------------|------|------|------|------|-------|
| SCE | 90 | 120 | 160 | 210 | 580 |
| PG&E | 90 | 120 | 160 | 210 | 580 |
| SDG&E | 20 | 30 | 45 | 70 | 165 |
| Total-All 3 Utilities | 200 | 270 | 365 | 490 | 1325 |

Source: greentechmedia.com

The CPUC recently released a proposal that mandates an unprecedented 1.3 GW of energy storage to support the state's power grid by 2020. The proposal outlines specific, year-by-year targets for California's 3 main IOUs: Southern California Edison, San Diego Gas & Electric and Pacific Gas & Electric. It also calls for them to consider all forms of ownership such as utility-owned, third-party owned, customer-owned, joint ownership, and entering into contracts with customer-sited storage resources.

This is significant, because it opens up a new business model for utilities which can now own storage assets behind the meter.

Energy Storage - Germany

Germany recently announced measures to increase energy storage in the form of its relatively new solar storage subsidy program. The €25 million scheme covers up to 30 per cent of the cost for residential storage equipment when added as part of a new residential PV system. These measures are expected to allow households to increase their level of self-consumption from around 30 per cent to around 60 per cent.

It is projected that energy storage market will be dominated by the residential sector, with 30MW of installations already supported in 2013.

Decreasing PV system prices, coupled with increasing electricity prices, are expected to be economically favorable for a home-owner to self-consume PV energy on-site rather than export it to the electricity grid.

2. DMS Implementation Challenges – Preparing Ahead.

As utilities embark on Smart Grid journeys, Distribution Management System (DMS) has become central to their transformation programs. This article will highlight key challenges with DMS implementations and recommend actions to avert them or reduce complexity ahead of deployment.

- 1) Solidify your objectives:** Develop long-term objectives and stay true to your course. Clearly defined DMS objectives (e.g. SCADA, State Estimation) will lead to better governance along the journey.
- 2) Leverage Operations Technology (OT):** Embed OT personnel within DMS project to resolve challenges from hardware specs, SCADA, to GIS integration. Leverage their expertise by providing ownership in the modernization journey.
- 3) Do not underestimate data:** If DMS is the car to drive the Distribution grid, data is its engine. Data issues, if neglected, will eventually surface and delay projects. Discover data needs ahead and prepare your technology team to collaborate with Power Engineers.
- 4) Understand network model process:** DMS model import process is complex and data intensive. Disciplined procedures need to be developed and enforced for long-term sustainment of the model.

- 5) **Sample early and often:** Your system integrator will likely be unfamiliar with DMS power applications. Import data early to test application behavior with distribution operators to confirm solution fidelity.
- 6) **Respect data change processes:** DMS output is only as good as the data fed to it. Install a tiger team to design actionable data processes and use principles of Information Management to keep DMS model current.
- 7) **Plan with stage gates:** DMS is still early in its maturity. Plan to have your IT, OT and DMS teams collaborate around known variables and execute through a stage gate process.
- 8) **Consider smaller geographic footprint before roll-out:** Distribution network is data heavy and extensive. Consider a soft go-live with a pilot area representative of the utility demographic to iron out fundamental challenges.

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Smart Cities

For the first time in history more than 50 percent of the world's population lives in cities. This puts tremendous pressure on city resources such as energy, water, transportation, housing, and city services. It is estimated that over 70 percent of global energy consumption and GHG emissions comes from cities. Given the resource crunch, cities are increasingly looking for innovative ways to optimize assets. Cities are looking to Information and Communications Technology (ICT) as the chief enabler.

Sensors and smart devices deployed across the city collect a plethora of data that is analyzed to extract intelligence for situational awareness and city-wide operations. Smart cities which sit at the intersection of Smart Grids, sustainability, and the broader city services, include Smart Energy, Water, Transportation, Buildings, Education, and Healthcare, all of which synergize to optimize assets, reduce city's carbon foot print and help alleviate its impact on global climate change.

Enter the Dynamic Microgrid

The US Army recently commissioned their first grid-tied microgrid at Fort Bliss, Texas. Of late, microgrids are getting a lot of attention not just for national security but also for energy security, allowing for increased penetration of renewables and energy storage.

The future points to a dynamic microgrid, that will move the microgrid from its present niche position to a mainstream position in which the distribution grid may eventually become a series of interconnected microgrids.

Dynamic microgrids have the potential to be a key element of the ultimate self-healing grid – the holy-grail of the Smart Grid. They allow the grid to divide itself into smaller self-sustaining grids which can then be configured to form the regular distribution grid.

Until now, microgrids have generally been implemented outside the regulated utility business model. However, dynamic microgrids allow the utility to take a front-and-center role thereby delivering on the customer mandates as well as their own need to provide an enhanced customer experience. The utilities directly impacted by Superstorm Sandy have a unique opportunity to

demonstrate their leadership by moving the dial in this new direction.

3. Mergers & Acquisitions

ESCO to sell Aclara

St. Louis-based ESCO Technologies recently announced its intention to sell its Smart Meter unit, Aclara. Aclara is a mid-tier vendor in the U.S. smart metering industry. The bulk of its business is with small to mid-size rural electric cooperatives and municipal utilities. Its TWACS powerline carrier technology deployed with some major utilities including Pacific Gas & Electric, accounted for 21 percent of ESCO's revenues in 2012, according to company filings.

With the passing of the one-time federal stimulus grants which boosted smart meter installations, the smart meter market is seeing a slow-down especially in North America.

Cisco Acquires JouleX

Cisco acquired privately held company, JouleX, for approximately \$107 million.

JouleX is a leader in enterprise IT energy management for network-attached and data center assets. JouleX complements Cisco's existing services portfolio by using the capabilities of the network to gain visibility into and control energy usage across global IT environments.

AMAT Acquires TEL

The chip-making equipment giant, Applied Materials agreed to buy Tokyo Electron in a deal valued at \$9.4 billion. Applied Materials is the number-one builder of semiconductor manufacturing equipment and Tokyo Electron is number three.

The acquisition enables Applied Materials to be larger player as well as re-enter the market as the provider of a-Si equipment for solar panels, through TEL.

4. Online Condition Management and the move towards the predictive grid

Today's data deluge paradigm has many in the utility business asking the same question – "*What to do with all the available data now?*" From an asset manager's perspective, the question of essence is, "*What does this data mean in terms of present asset health so I predict future asset (and system) performance/health?*"

Much like how advanced applications to control power systems in real-time leverage SCADA systems, today's paradigm – online condition management – leverages data from online condition monitoring sensors. Asset condition is based on both online measurements and off-line data sources. At a high level, online condition management addresses the following functionality:

- 1) **Aggregation of data from various sources** (on-line and off-line) to compute a health index that provides the user a sense of the health of assets comprising the power system.
- 2) **Creation of baselines and trends to assess asset condition** over a period of time to facilitate various comparisons and assess relative risks of failure.
- 3) **Allow the user to predict future health** and performance for a given asset and the power system.

To summarize, asset managers are recognizing the significance of online condition management as the cornerstone of their risk mitigation strategy. Vendors are busy deploying their solutions to meet these new needs.

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Electric Meters to reach 100M by 2014

Annual smart meter shipments world-wide are expected to pass the 100 million mark in 2014 and remain there until at least 2017. This will be up from an estimated 82 million units in 2013. These meters are expected to account for almost \$5 billion in revenue for meter manufacturers.

The projection comes despite a rapidly decreasing North American market that is experiencing the end of government funding, disappointing meter legislation in Latin America, and delays in smart meter rollouts in the European Union.



Source: IHS Inc., August 2013

Smart Grid Venture Capital Funding

Smart Grid venture capital (VC) funding in Q2 2013, totaled \$50 million in ten deals. Home and building automation companies totaled \$33 million in five deals; grid optimization companies totaled \$17 million in three deals, and advanced meter infrastructure (AMI) and security companies with one deal each.

Top 5 VC Deals in Q2 2013

| Company | \$ M | Investors |
|--|------|---|
| Enlighted | 20 | RockPort Capital, DFJ JAIC, Intel Capital, and others |
| C3 Energy | 15 | Undisclosed |
| Optimum Energy | 12.2 | Navitas Capital, Columbia Pacific Capital Management |
| Ecolibrium | 1.6 | Infuse Capital IFC |
| Integrated Energy Management Solutions | 1 | Undisclosed |

Source: Mercom Capital Group, LLC

Energy Department Announces Awards for Cyber Security

The Energy Department recently announced awards totaling approximately \$30 million for the development of new tools and technologies to strengthen protection of the nation's electric grid and oil and gas infrastructure from cyber attack.

With support from the Energy Department, energy sector organizations in California, Georgia, New Jersey, North Carolina, Tennessee, Virginia, and Washington State will develop new

systems, frameworks, and services that advance the Department's vision of more resilient energy delivery control systems.

5. Why utilities should care about smart cities?

The smart grid was the "flavor of the decade" in the 2000s. Smart cities have become the Next Big Thing particularly in Europe and parts of Asia. I would argue that North American utilities need to pay more attention to this growing sector both for their own sake and their customers.

Any utility that understands smart grid will understand smart cities. You 1) place sensors on key assets, 2) communicate the resulting data and 3) analyze the data for situational awareness and actionable insights. Instead of putting sensors on power assets, you put them on roadways, bridges, buildings, etc.

Here are five reasons utilities should engage right now with cities in their service territory to collaborate on smart city projects.

- **Smart grid is fundamental to a smart city.** Smart cities include sustainability as one of their goals which requires renewables and a smart grid to integrate them. The cities you service can't achieve "smartness" without a smart grid.
- **Smart city can create synergies and revenue streams** for a utility. When Chattanooga, TN decided that to become a world-class city, it had to upgrade both energy and telecommunications. It engaged its municipal utility to put in a dual-purpose, high-bandwidth network which services the city's new smart grid and also provides Internet access to residents and businesses, at speeds many times faster than in most American cities. Also, the communications services have generated nearly \$60 million in revenues for the utility in less than a year.
- **Economic development.** The motto at Smart Cities Council, is livability, workability, sustainability. As we recover from a global recession, workability (economic development) is front and center in all smart city projects. Installing smart grid and other smart city enhancements, makes the city more competitive translating to more jobs and more businesses and a greater need for the electricity you sell.
- **Participation** in smart city activities **enhances customer engagement.** The everyday consumer has a hard time relating to the system benefits of a smart grid. Reliability while important does not inspire passion. But when you engage customers with ideas of better urban life, better jobs, greater livability, you increase chances of capturing their enthusiasm.
- You can **pay me now or you can pay me later.** The smart cities trend resembles issues like energy efficiency, demand response and net metering. You can ignore them for a while, but will have to face them sooner or later. If you start sooner, you have a greater chance to implement it in a way that enhances both the utility's reputation and its business model.

Smart cities are an unstoppable trend. Electric power utilities can jump on board and help to steer and help to invent their own future. Or they can ignore this trend and be dragged into the future on somebody else's terms.

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6. News from Modern Grid Solutions



Training news

- Our [online training](#) now has voice-over to assist the trainee in following the materials. Check them out and also let us know if you feel one or more courses are missing.

Events and News

- Two articles written by Dr. Vadari were recently published
 - “**Smart Grid and Aging Infrastructure – Why Technologies are Important to Modernization**”, Feature article, Electricity Today, Jun 2013
 - “**The Intelligent Workforce Meets the Utility of the Future**”, Feature Article, Utility Horizons Quarterly – Automation Rising, 2Qtr2013.
- 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 is publishing weekly 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](#)
- Dr. Vadari can be seen at the following events in the 4th quarter of 2013
 - Cyber Security Forum (November 13th – 15th in Toronto) – “**The Cyber Security Dilemma - Challenges Implementing Cyber Security in a Smart Grid World**”
 - DMS-Tech Summit (December 3rd – 4th in Irvine, CA) – “**DMS implementation challenges and how one can prepare for it ahead of time**”
- Dr. Vadari presented the keynote speech at TechFest 2013 – “**Smart Grid, System Operations and the Management of Big Data to drive Utility Transformation**”

Comments on Amazon.com. **Electric System Operations – Evolving to the Modern Grid, a book by Dr. Mani Vadari.** *The book provides excellent coverage for various areas of utilities business operations and associated technologies. The author has done a fantastic job of explaining the complex engineering topics from a business perspective and also providing sufficient technical details.*

The uniqueness of the book is that it explains the complex relationship between engineering side of the grid and the commercial aspects of the markets (for example - see RTO and Markets interaction with an EMS, commercial operations in a system operator, etc.) The Chapter "Impact of Deregulation on System Operations" provides deep insight into system operations and markets; I have not seen any other book covering this crucial topic.

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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.