



State of the Smart Grid Briefing

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

Dear All

This is our second newsletter and includes the comments and feedback we received from our loyal readers of the first one. With this issue, we have decided to include a combination of news and feature articles. In this newsletter, we have included articles from The Glarus Group on “**New Optimization Mechanisms**”, from Alstom Grid on “**Big Data**” and from Smart Grid Interconnect on “**DMS and its impact on the Smart Grid**”. 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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- In the U.S., EIA estimates wind generation to increase by 19% in 2013 and by 8% in 2014. Robust growth is expected in solar generation, both from centralized and distributed sources of PV and solar thermal generation projects.
- Grid operators are employing a variety of tools to maintain a reliable electricity supply while handling higher percentage of electricity from renewable sources. These tools include: multiple wind power sources, accurate forecasts, and dynamic grid design.

Roof-top Solar and Energy Self-Sufficiency

- Wal-Mart intends to install solar on 1,000 rooftops by 2020, a 500% increase over current installations. In addition, they have also announced a commitment for all of their stores to be supplied with 100% renewable energy by 2020, a major portion of which it either plans to produce or procure.

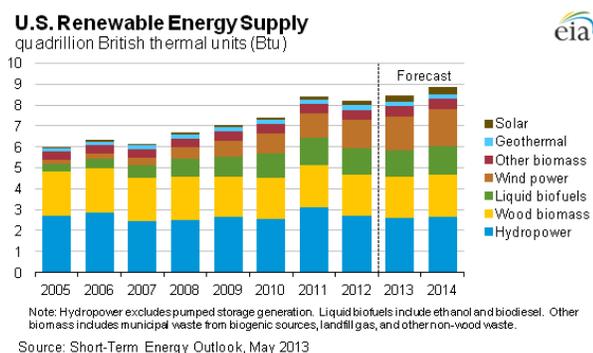


- If adopted by other customers-at-scale, it can disrupt traditional utility business model by reducing demand. It also presents opportunities for utilities to evolve their business models, by offering services like roof-top solar installation, maintenance of power inverters, etc.

1. Key Developments/Highlights

Renewable Growth Trend

- Record numbers of new wind and solar installations are coming online in the U.S. Nine states currently generate 10% or more of their electricity from wind and solar power, including Iowa (24%), Minnesota (14%), Colorado (12%), and Oregon (10%).



- Iowa and South Dakota rank second in the world in renewables penetration at 24%.

Data Analytics and Dashboards

The industry has recognized the importance of utilities obtaining, integrating, analyzing and acting on the rapidly expanding volume of energy related data. In response to this critical need, Calico has extended their Energy Intelligence Suite™ with a data analytics and visualization module called **EIS Insight™**. Insight provides utilities with an easy-to-use business intelligence tool that delivers actionable data and empowers users to interactively experience a

broad range of energy data. As a result, Utilities can optimize energy programs and realize improved return on investments. More information can be obtained from their [white paper](#).

Renewed Interest in Integrated Microgrids

- U.S. Army in collaboration with Lockheed Martin commissioned the first U.S. Department of Defense (DoD) grid-tied microgrid integrating both renewable resources and energy storage at Fort Bliss, Texas.
- Fort Bliss microgrid demonstration will provide the DoD and others with data and confidence necessary to transition microgrid technologies into wider scale use. Its success will mark the growth for military microgrids - *Pentagon spends \$4 billion a year to power 300,000 buildings at 500 military installations across the world.*

Focus on Smart Cities

- Cities that own their utilities are increasingly looking to deploy cross-functional Smart City technologies to attract large companies and businesses.
- Smart Cities include various market segments: Smart Energy, Transportation, Industry Automation, Security, Healthcare, Education, etc.
- By 2016, the smart energy management market is expected to grow to \$ 81 B, smart transportation market to \$ 69 B, and the Smart security market which includes cyber security to \$ 307 B.



2. Finally, Optimization Algorithms That Are “Code-Free”

Our world is awash with both traditional and Smart Grid data containing valuable information which could enable actions to improve the economics, reliability, and environmental friendliness of our electricity supply. Analytics have become the key to unlock that value and optimization has become the most important category of analytics. They reveal not only the most efficient outcomes but also can produce predictive results. Further, when coupled with simulations and stochastic analyses, these mechanisms provide answers to both specific and general questions. Specific questions, such as “which device should be the first priority for maintenance or replacement to have the greatest impact on reliability”, are now answerable via analytics. In the future, broader problem solutions will appear, such as how to

configure a grid to minimize the amount of electricity necessary to meet demand, which resources to use, and where best to produce that electricity.

How to build these optimization-based analytics continues to be the industry’s challenge. Today, data is stored in databases and our industry has many user interfaces to choose from, but the optimization algorithms remain complex, difficult and costly to build. For the most part, individuals with the necessary domain knowledge do not also possess the skill to implement architecturally sophisticated software, and those with these skills, often lack the problem domain knowledge. Thus complexity, cost, and time-to-market, limits rapid advances. **Today – we have better options!!!**

Today, it is possible to build advanced optimizations by utilizing off-the-shelf environments not requiring traditional computer coding. Domain experts can decompose problems into equations, expressing the constraints and objective functions, eliminating the need to “program” the optimization algorithms. An additional benefit is reduced time to build, test, and modify the optimization. After two to four weeks, the first application release produces results available for testing, and debugging requires only changes to the equation(s). On-going application enhancements simply require the addition of more equations to enable access to newly available data or to enrich the algorithm. Further, these environments can take immediate advantage of computing platform performance improvements, such as parallelization, without any impacts on the optimization solution. This capability exists today and a few organizations are already applying it to real-world problems, reaping the benefits they provide.

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3. Mergers & Acquisitions

Toshiba Acquires Consert

- In February, Toshiba Corporation acquired Consert Inc., for \$11 MM. Consert Inc. is an intelligent energy management company that converts electric consumption in homes and small businesses into sources of capacity and energy reserves for utilities. The Consert purchase will enhance Toshiba's smart community business in US and will be integrated with Landis+Gyr, also a Toshiba Group company.
- Consert enables Toshiba to be better positioned to support utilities in generating and delivering stable power supply and to ensure end-user environments that optimize energy use and maximize energy savings.

ESCO Acquires Metrum

- In January, ESCO Technologies Inc. acquired Waco, Texas-based Metrum Technologies. The transaction also includes Metrum's R&D center located in Dallas. Metrum will become part of Aclara.
- Metrum provides wireless public communications network products for electric utility customers, and also supports them through hosted software systems and network operation center

services. In addition, Metrum also offers communications products and devices for specific distribution automation and demand response applications.

- The combination of Metrum's and Aclara's platforms will allow Aclara to offer cellular, RF and powerline communications technologies to their utility customers.

4. DMS: Brain of the Smart Grid

The good news: after several years in the incubator, the DMS is becoming reality and beginning to create value for a handful of leading utilities. Although the shape and color of the systems varies by vendor, its mandate to become 'central control' for the distribution grid is being realized.

From a business perspective, we want to pay attention. The ability to understand what is actually happening on the distribution grid in real-time is remarkable. The improved situational awareness immediately provides the utility with the 'next level' ability to manage load flow (i.e. peak shaving, distributed generation, demand management) and new capabilities to keep field crews safe. For an abundance of Smart Grid technologies, it is the brain that enables a majority of Distribution Automation and Substation Automation and it does so from the control room. Central control helps dramatically reduce actions being performed remotely which in isolation which may jeopardize the personnel working on planned and unplanned outages.

Is it a silver bullet? No, but it is clearly the next stage in Grid Operations Transformation (transforming distribution operations). Utilities considering DMS as a tool will need to change their business activities and how they do their work. It can help support more efficient processes and increase teamwork. Its implementation to support faster restoration time and better outage management will earn utilities much kudos from their customers.

Developing a blueprint of how a utility wants to operate in the control room before the system implementation will multiply the probability of success and remove unnecessary angst for overworked operators and support engineers alike. Sponsoring executives that prefer proactive measures and on-time and on-budget delivery will also benefit by developing a strong vision with their teams during the blueprint stage.

The future of Distribution Operations is bright and the journey to increasing performance is enabled by the DMS. It will be the core of many grid improvements to come and a necessary step. Integrating this complex technology requires tenacity but is a win/win for utilities and ratepayers.

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Transmission & Distribution Automation

ComEd's Success with Distribution Automation

- ComEd showed major accomplishments in the first year of its 10-year program which included installation of 470 devices which in turn resulted in 82,000 fewer customer power

interruptions in 2012. These DA devices prevented 20,000 service interruptions during the severe storms that hit the Chicago area in mid-April.

- ComEd's 10-year grid modernization program will allow it to increase the number of customers served by DA from 55% to nearly 90% through investments in DA increasing from \$ 32 MM in 2012 to over \$ 44 MM in 2013. ComEd's DA budget is \$245 MM and is part of a larger \$ 2.6 B grid investment over the next decade.

Smart Grid Venture Capital Funding

- Smart Grid venture capital (VC) funding in Q1 2013, totaled \$62 million in nine deals.
- The Top 5 VC deals in Q1 2013 raised a combined \$52 million.

Top 5 VC Deals in Q1 2013¹

Company	\$M	Investors
Cylance	15	Khosla Ventures, Fairhaven Capital
Sentient Energy	15	Foundation Capital
Utility Funding	11.3	Foresight Group
Xtreme Power	5.8	SAIL Capital Partners, Bessemer Venture Partners, Dow Chemical, Fluor, Dominion Power, Spring Ventures, BP, Posco
Smart Grid Solutions	4.8	Scottish Equity Partners, Scottish Investment Bank, University of Strathclyde

5. Big Data? Big Deal!

Turning distribution grid data into actionable information

The largest producers of power grid data are the hundreds of millions of sensors and controls embedded in smart devices installed in buildings, substations, generators, transformers and other equipment in electricity transmission and distribution networks. The amount of data from a higher penetration of renewable generation resources with variable outputs, demand response programs, weather agencies and distributed energy resources like electric vehicles and battery storage has the potential to overwhelm even the most experienced distribution grid operator. Add to that the potential social media data and video surveillance available from various sources and the challenge becomes clear: "extracting actionable information from this abundance of operational and non-operational grid data".

Since Super-storm Sandy and other recent large scale events that have had significant impacts on the electricity infrastructure in the United States, we're experiencing a new focus on planning for and responding to these kinds of power system disruptions. In the case of the tornado that struck Oklahoma on May 20th, 2013, it is reported to have rapidly intensified to an EF-5 level tornado in

¹ Source: Mercom Capital Group, LLC

under a half-hour. Grid operators need to be able to harness the available data to simulate these kinds of anomalies and run ‘what if’ scenarios to better anticipate how the grid reacts in certain situations and what remedial actions to take.

Transmission operators have benefitted from operator training simulator technology for years. Now distribution operators are also finding value in sophisticated simulation software not only for distribution planning purposes, but also in preparing for storm response and system restoration drills. Imagine the grid operators and field crew who can re-run the actual storm scenario that was recorded on the network during a disruptive event. This kind of

operational preparedness training, fueled by big data, is an effective tool to examine complex operations, crew management, trouble call analysis and overall network analysis in study mode to increase operational efficiency and field safety. Now that’s a pretty big deal.

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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

- Dr. Vadari to present the keynote speech at TechFest 2013 – “**Smart Grid, System Operations and the Management of Big Data to drive Utility Transformation**”
- Dr. Vadari’s blog “[Integrating Utility-Scale Renewables into the Grid](#)” is listed on Grid Insights a series sponsored by Intel.
- Dr. Vadari was an invited guest speaker at AERTC 2013 “**What makes for a Smart Utility?**”
- Dr. Vadari was named as a [2012 Smart Grid Pioneer](#) by editors of Smart Grid Today
- 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.
- Modern Grid Solutions has received certification as a Minority-Owned Business from the states of CA and WA – more states to come soon. OH and NY to be added soon.

Comments on **Electric System Operations – Evolving to the Modern Grid, a book by Dr. Mani Vadari.**

This book does a great job at explaining what power system operators do, why they do it in a certain way, what challenges they face and how computer systems help them do their job. It is a great introduction to the topic for non-power system engineers. It is also very useful for power system engineering students (graduate and undergraduate) who want to understand what is the point of the techniques of power system analysis that are presented in the standard textbooks.

Prof. Daniel Kirschen



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.