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# State of the Smart Grid Briefing

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

We are very excited to release our fifth quarterly newsletter and our first one for 2014. We continue to build on existing traditions and adding new ones. We again have three original articles. Article 1 is on the need for an energy infrastructure in Africa. Article 2 looks at microgrids and a lab for testing and simulating them. The last article focuses on the next wave of technology for 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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## 1. Key Highlights

### FirstEnergy Invests \$71 Million in 2014 to Enhance Grid Reliability

FirstEnergy plans to invest in infrastructure upgrades in its Pennsylvania Power Company service area mainly focusing on improvements to reliability. Of FirstEnergy's \$71 million investment, about \$37 million will be for transmission-related projects. Project details are as:

- \$14 million on smart meter installations
- Trimming trees along nearly 1,200 circuit miles
- Rewiring parts of a 138 kV line and completing a 69 kV line
- Continued inspection and replacement of utility poles and installing capacitor banks and other equipment to improve voltage stability

### Prepay Energy at Point of Inflection

Prepaid energy is part of a mega-trend that includes gift cards, reloadable debit cards and other services that are paid in advance. Survey says, 62% of Americans have used some form of prepayment in 2013. Prepay allows consumers to pay for energy in advance and monitor their usage daily. An average 11%

reduction was seen when comparing pre- and post-enrollment-by customers who voluntarily switched to prepay for electric service.

## 2. A Smart Grid for Africa

**The Black Continent is in the Dark:** With an average of 30% (14% in rural areas), Sub-Saharan Africa is the world region with the lowest electricity access rates. 1.3 billion of the human race does not have access to electricity: **50% are Africans and more than 600,000 Sub-Saharan will still not have electricity access in 2030. This is a dreadful Paradox; a continent with large existing and nearly limitless fossil and renewable energy resources has the lowest electrification rate.** In this region most Power Utilities are saddled with daunting challenges, the chronic deficit in adequate training in grid planning, in Smart Grid/Micro Grid Technologies, customer care and asset management best practices represents very severe aggravating factors. The dramatic shortage of local capabilities to define, plan, design and execute urgently needed infrastructure projects will have a very negative impact on the performance of planned investments .

**Massive investment to come:** Many development institutions, the World Bank, African Development and African Regional organizations are now mobilizing investment funds to accelerate deployment of electric infrastructure. African Development Bank estimates about \$ 20 B/yr required between now and 2030.

**Emergency Measures:** For the planned large infrastructure to have a striking chance to accelerate the electrification rate, it is critical that a substantial part of the investment be assigned to address the following Emergency Measures:

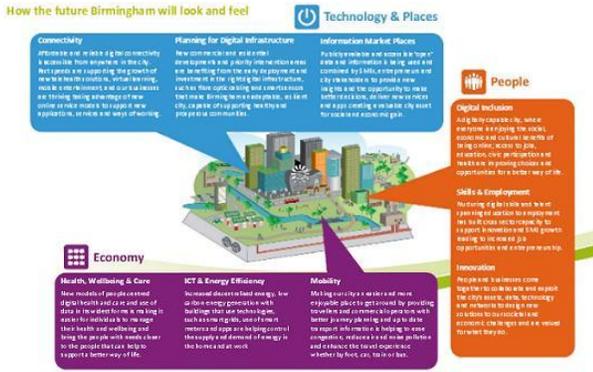
1. Training program for the management and technical staff of Power Utilities to have the capabilities to "efficiently attend the fund invested"
2. Introduction of Smart Grid/Microgrid Technologies with injection of local production capacities to eliminate endemic load shedding and blackouts.
3. Massive deployment of Solar Energy Systems along three configurations:
  - a. Large Solar Plants connected to regional interconnected grids
  - b. Mini Solar Plants in micro grid arrangements for urban and large villages
  - c. Off grid solar kits for rural and agricultural applications.

Spero Mensah, [spero.mensah@jemsmartgroup.com](mailto:spero.mensah@jemsmartgroup.com)

Managing Director  
JEM Smart Africa Power Group

## UK's City of Birmingham Launches Smart City Roadmap

Birmingham is a diverse city facing a number of challenges. A Smart City Roadmap which lays out the principles and activities it needs to undertake over the next 1-3 years. The Roadmap responds in particular to the following challenges:



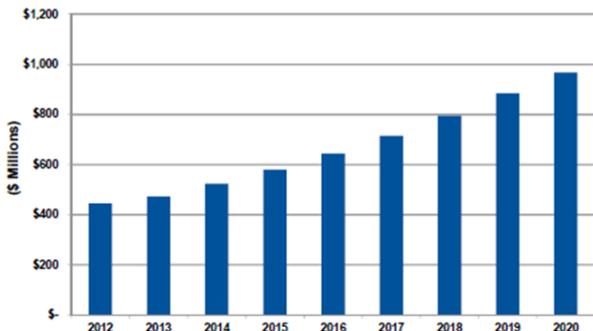
Birmingham's Smart City Roadmap – Picture Source: [www.greenbang.com](http://www.greenbang.com)

- Low economic performance, unemployment and skills gap
- Health and wellbeing inequalities
- Seamless and effective mobility in a low carbon society

The themes underpin the roadmap's 39 proposed actions, to be delivered over three years, funded by European, national and regional programs.

## Hospitality Industry Energy Mgmt Expected to Reach \$1B by 2020

Hotel operators are beginning to look to improve financial performance at the property level. The global market for energy management in the hospitality industry is expected to grow from \$473 million in 2012 to \$968 million in 2020 (CAGR of 10.2%).



Hospitality Sector Energy Management Revenue, World Markets: 2012-2020. Source Navigant Research

Hotels require specialized technological needs of individual hotel guest rooms, such as distributed control systems, sensors, and software algorithms. Hotels are going through a period of transition from autonomous, room-centric HVAC control, to property/portfolio-wide integrated energy monitoring, control, and management. Innovation in data analytics, and network-based monitoring and control will fuel the growth of the solution.

## 3. Mergers & Acquisitions

### NRG Energy to Acquire Dominion's Retail Electric Business

NRG Energy Inc. is buying the retail electric business of Virginia-based Dominion Resources Inc. NRG, which has headquarters in Houston and New Jersey, is gaining a larger Texas presence, while taking over much of Dominion's northeastern business. This acquisition also includes Plano, TX-based Cirro Energy brand.

### Efacec ACS Acquired by Falfurrias Capital Partners

Falfurrias Capital Partners has acquired Efacec ACS, Inc. The company name will change back to Advanced Control Systems, Inc. (ACS), and will operate independently under within the North American T&D Group (NATDG). NATDG has committed to keep ACS on a path of growth and innovation.

## 4. Importance of Test-beds for Microgrids

Microgrids are an exciting, challenging, and potentially disruptive technology, driving large amounts of innovative activity across many sectors. However, given the utility industry's conservative culture, the constraints imposed by regulators, and the inviolable commitment to provide uninterrupted high quality service, there are high hurdles to be leapt in implementing new solutions of any kind, and especially new technologies.

For this reason, test-beds will become increasingly important as this decentralized energy revolution proceeds from the laboratory to real-world settings. Picture this as a spectrum of testing assurance, from the lab bench at one extreme, to pure simulation, to hardware-in-the-loop simulation, to highly controlled fault-tolerant alpha test sites, to medium-control variability-tolerant beta test sites, to intolerant and uncontrolled real-world applications. Utility operators will want to know that a new technology (hardware, software, or hybrid) has passed through the applicable stages of this sequence of validation before attempting to implement it on their systems, and impose it on their customers.

The Santa Fe Community College is developing a functional microgrid test-bed on it's the campus along with an advanced visualization and simulation facility. This will emulate, at a small scale, projects at the University of California San Diego, Wesleyan University, and elsewhere, which couple testing with education, entrepreneurship, and industry use, while improving campus reliability and reducing energy costs. School campuses are an excellent environment for these facilities, given their alignment of needs, objectives, and assets, and can help pioneer the decentralization trend that microgrids are leading.

David Breecker, [david@santafeinnovate.org](mailto:david@santafeinnovate.org)  
President, Microgrid Systems Lab  
Santa Fe Innovation Park

### EnerNOC Acquires Entelios & Activation Energy

EnerNOC, acquired Ireland-based Activation Energy and Germany-based Entelios AG, two companies that both specialize in demand response. The acquisitions will allow EnerNOC to expand and strengthen its presence in the European market. Next

up in 2014 is for EnerNOC is to expand its footprint in Europe and Asia.

### Alstom Grid Acquires Reason Tecnologia S.A.

Alstom, acquired Reason Tecnologia S.A. a Brazil-based provider of measurement and substation automation network products for transmission and distribution (T&D) customers. This move reinforces Alstom Grid’s presence in the Latin American substation automation market and strengthen its digital substation offer worldwide, accelerating the innovation path towards building a fully digital substation.

### Lockheed Martin Acquires Industrial Defender

Lockheed Martin has expanded its cyber-security portfolio with acquisition of Industrial Defender, a provider of cybersecurity products and services in the oil and gas, utility, and chemical industries. This acquisition gives Lockheed Martin access to commercial markets while offering government customers a fuller suite of services.

### IEA Expects Energy Efficiency to be Biggest CO<sub>2</sub> Cutting Tool

The International Energy Agency (IEA) calls Energy efficiency (EE) as the best tool for cutting Green House Gases (GHG). Insulation, vehicle and appliance standards account for 40% of cuts needed to contain GHG to safe levels. IEA estimates a global spend of \$300 B/yr on efficiency measures. EE is low hanging fruit and shedding its “boring” image should help stimulate spending.

### ESCO Completes Divestiture of Aclara

ESCO has completed the sale of Aclara Technologies to Sun Capital Partners. The divestiture generated \$150 MM of gross cash proceeds.

### Facebook Open-Sources Code for use at Data Centers

Facebook announced that it is open-sourcing its code in its data centers for the dashboards that measure PUE (power usage effectiveness) and WUE (water usage effectiveness) levels. The efficiency dashboards have been launched its data centers in Oregon and North Carolina. They are intended to demystify data center operations and visualize their real-time energy and water efficiencies.

### 5. Next Wave of Smart Grid Technology

All technologically-driven revolutions hit the marketplace in recurring waves as certain technologies require a longer time to market than others. Smart Grid follows this pattern, with early solutions focused on metering, later beyond the meter, and more recently, in-grid devices. The subsequent wave will reduce cost and improve the successful solutions of previous waves and will soon be capable of managing voltage at the edge of the grid. With many devices capable of delivering similar capabilities already in the Smart Grid marketplace will these device succeed? Yes, here’s why.

These new devices are based on silicon, hybrid semiconductor, or power electronics. These technologies require a long and

expensive development process, which must deliver proven capabilities targeted at high volume markets. These devices will control voltage at the delivery point on the grid at a very low cost per device. Further, they differ from many Smart Grid devices because they operate autonomously, not requiring communications. These devices monitor the grid and adjust voltage and perhaps even inject VARs.

Several companies will enter the market with a variety of such devices, each with different capabilities. Some will be deployed on the high-side of the customer transformer, others on the secondary circuits. The products differ and as will the business models, regardless those that succeed will change how the edge of the grid is designed. Although the products and their business models differ, those that succeed will change the design of the edge of the grid, forever.

J.D. Hammerly, [jd.hammerly@theglarusgroup.com](mailto:jd.hammerly@theglarusgroup.com)  
 Founder and CEO  
 The Glarus Group

### 6. Smart Grid Venture Capital Funding

VC funding in the Smart Grid sector came in at \$405 million in 2013 in about 60+ deals.

There was a burst of activity in Q4 of 2013 which netted \$148 million in 31 deals, accounting for almost half the deals in 2013.

Home/Building Automation & Energy Management companies raised almost half of all VC funding with \$190 MM in 24 deals.

**Top 5 VC Deals in 2013**

Company	\$M	Investors
Nest	80	Google Ventures, Venrock
Utilidata	20.5	Formation 8 Partners, Saudi Aramco Energy Ventures, Braemar Energy Ventures, American Electric Power
Space-Time Insight	20	Zouk Capital, Opus Capital Ventures, EnerTech Capital, Novus Energy Partners
Enlighted	20	RockPort Capital, DFJ JAIC, Kleiner Perkins Caufield & Byers, Draper Fisher Jurvetson, Intel Capital
GreenWave Reality	19	The Westly Group, Craton Equity Partners

Source: Mercom Capital Group, LLC

### FP&L to Invest \$170 Million in Infrastructure Upgrades in 2014

Florida Power & Light (FPL), is investing about \$ 428 MM in upgrades to nearly 100 main power lines and other infrastructure during 2014 to further strengthen the grid. The program includes extensive enhancements in both distribution and transmission:

- Replacing thousands of distribution poles with concrete ones designed to withstand wind gusts of 130 mph or more.
- Installing technology to better detect and address power outages, and adding improved lightning protection equipment
- Upgrading FPL's power transmission system.
- Installing new flood monitoring systems at select power substations.



## 7. News from Modern Grid Solutions

**Hot off the Press:** Dr. Vadari's book "[Electric System Operations – Evolving to the Modern Grid](#)" has been selected for the course [Power System Operation in the Age of the Smart Grid](#) being held at University of Wisconsin-Madison on June 9-13. Check out the course and you may want to enroll in it.

### Training news

- Our [online training](#) with voice-over is becoming a hit with all. Very soon, we will release more online courses, both 1-hr long and 4-hrs long. Stay tuned for our next newsletter for more information on them.
- We are adding a set of new courses focused on specific project outcomes. The first one on Distribution Management is ready and has been released. The beta release of this course was well received at a major IOU in the southern United States. The next course to be released is on Microgrids, followed by one on AMI.

### Electric System Operations – Evolving to the Modern Grid

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. Check out the review from Mr. Douglas Mader, Director at Entergy.

**Comments on the book.** *This is a work that is long overdue in an industry as complex as America's electric utilities. Dr. Vadari brings a unique perspective to this subject, having a depth of experience in the complex technical aspects of power system operation, information technology, as well as the rapidly changing utility regulatory and business environment and customer expectations. In the second half of the book, we are treated to an excellent overview of utility control center operations, energy management systems, outage management systems, distribution management systems, training simulators, and the distributed energy management systems of the future. This is where the book shines its brightest in dealing simply but thoroughly with a subject area rarely discussed comprehensively in the literature. This book can benefit both the practicing utility engineer and non-engineer alike.*  
**Douglas Mader, Director, Entergy**

### Events and News

- "[Reinventing the Grid – How to find a future that works](#)", Public Utilities Fortnightly, March 2014. Dr. Vadari was one of the 11 industry-wide experts interviewed for this article.
- "[Defining a new architecture and functions to allow the system operator to manage distributed energy](#)", Dr. Vadari will be presenting at the IEEE General meeting in Washington DC in June, 2014
- Check out our Smart Grid and System Operations Ad in the [Utility Horizons Quarterly Newsmagazine](#) – Shown below:



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Key Areas of Focus – Smart Grid, System Operations, Market Operations, Electric Utilities, Smart Grid Roadmap and Business Case, Electric Utility Transformation.

<p><b>Training Modes</b></p> <ul style="list-style-type: none"> <li>• Onsite or Online</li> <li>• Instructor-led or Self-paced</li> </ul>	<p><b>Specifically Designed for</b></p> <ul style="list-style-type: none"> <li>• Utility Executive</li> <li>• Non-Utility Executives</li> <li>• Utility Personnel</li> <li>• Non-Utility Personnel</li> </ul>
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<http://www.moderngridsolutions.com/smart-grid-training.html>  
 or contact us at [info@moderngridsolutions.com](mailto:info@moderngridsolutions.com)

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