



Certified Minority  
Business Enterprise  
**MBE**

# State of the Grid Briefing

A Service from Modern Grid Academy  
[Click here to subscribe to the Newsletter](#)

We are very excited to release our ninth quarterly newsletter. We have three articles again. Article 1 is from Dr. Veeraraghavan on social impact of solar installations. Article 2 is on the siliconization of the grid. Article 3 is an excerpt of an article from yours truly published in T&D World on new skillsets for the utility of the future. Also, check out the information on the latest edition of the best-seller from Andres Carvallo. This revamped edition is sure to reach new heights just like its predecessor.

**Don't miss the last segment which also includes information on our successes and other activities.**

Sincerely yours

Mani Vadari, Modern Grid Solutions

## Table of Contents

1. <b>MGS news – Hot off the Press</b> .....	1
2. <b>Key Highlights</b> .....	1
CA Passes Bill - 50% Renewables by 2030 .....	1
SCE Integrates 1.1 GW of DR into CAISO .....	1
First U.S. Small Modular Reactor .....	2
US Unveils a Clean Power Plan .....	2
PNNL's Future Power Grid Initiative .....	4
The Economics of Demand Flexibility .....	4
3. <b>Improving Social Impact of Solar Energy</b> .....	1
4. <b>Mergers &amp; Acquisitions</b> .....	2
GE acquisition of Alstom Approved .....	2
Robert Bosch Acquires Seeo .....	2
Honeywell to Acquire Elster .....	3
Verizon Introduces Smart Energy As-A-Service .....	3
5. <b>Siliconization of the Grid – Phase 1</b> .....	2
6. <b>Smart Grid venture capital funding</b> .....	3
7. <b>New Skillsets for the Utility of the Future</b> .....	3
8. <b>News from Modern Grid Solutions</b> .....	4

## 1. MGS news – Hot off the Press

- “**State of the Grid**” briefing – our newsletter has now blown past 1000 subscribers and crossed 1100. Thanks to all for your interest.
- “**Electric System Operations – Evolving to the Modern Grid**” debuts at Stony Brook University. 6 Universities use it now.
- **Smart Cities Readiness Workshop** delivered at Smart Cities Week in DC and at ICMA (Seattle). 3 more scheduled in next two months – Mauritius, Cape Town, and Johannesburg.
- **Distinguished Lecture.** Dr. Vadari to deliver Distinguished Lecture on Energy Technologies at Lawrence Berkeley in Oct.

## 2. Key Highlights

### CA Passes Bill - 50% Renewables by 2030

CA lawmakers passed SB 350 promoting greater deployment of clean energy technologies over the next 15 years. SB 350 will increase building energy efficiency in the state by 50% by 2030. It will also boost the amount of renewable energy utilities need to buy to 50% by 2030. California Public Utilities Commission (CPUC), says, the 3 CA IOUs are well on their way to meeting the state's 33% renewable energy goal by 2020.

CPUC will implement the 50% renewable energy standard for the private utilities and CA Energy Commission (CEC) for municipal utilities. The 50% increase in energy efficiency in buildings will be done through the use of existing energy efficiency retrofit funding and regulatory tools already available to state energy agencies. The addition made by this measure requires state energy agencies to plan for, and implement those programs in a manner that achieves the energy efficiency target.

### SCE Integrates 1.1 GW of DR into CAISO

Southern California Edison (SCE) announced integration of 1,118 megawatts of DR into CAISO. This amount exceeds the capacity of most of the state's large electric generators and is made up of over 320,000 SCE customers participating in DR programs. This is a significant milestone for SCE. The full integration of SCE's DR portfolio into CAISO will result in a more efficient energy market for California and increased reliability for all customers. Revenue generated will help offset the prices that customers pay for power bought on their behalf by the utility.

## 3. Improving Social Impact of Solar Energy

As the Levelized Cost of Energy (LCOE) of Solar energy is becoming more and more competitive with the cost of grid power the adoption rate of PV solar is on the rise across the globe. The social impact of solar energy adoption is most significant in developing nations, providing opportunities to improve the basic standard of living, raise productivity and create new business opportunities. Yet the rate of adoption has been slow in developing nations compared to developed nations.

There are two key factors slowing adoption of solar in developing countries which need to be addressed in order to accelerate the adoption rate. The first factor is economic; the initial cost of solar installations. Lower capacity distributed generation systems like roof top solar will have a relatively lower initial investment than larger systems, as well as enable a larger social impact by reaching homes not currently powered. In addition, there are several financing avenues such as micro-finance options that are becoming available for such installations directly benefitting the end user.

The second factor is the lack of optimized solar energy solution packages that are tuned to the requirements of the developing countries and conditions that exist in them. Almost all of the currently available solar solutions are designed exclusively to function either in the grid connected mode or off-grid mode. The

grid connected systems depend on the grid power as a necessary input for harvesting solar energy and the off-grid systems rely on very expensive battery storage for storing the DC energy prior to conversion to usable AC. These are serious limitations for adoption of solar energy in developing countries where the grid power is not always present and the reliability of grid power is low even when present. Solutions designed to operate whenever solar radiation is present, without the requirement for battery or connectivity to grid power, address these limitations and enable efficient harvesting of solar power and associated social impact.

V. G. Veeraraghavan Ph.D  
 Founder, Director: Kripya Group of Companies  
[solar@kripya.com](mailto:solar@kripya.com)

## First U.S. Small Modular Reactor

The process of building the first U.S. small modular reactor generation units nudged forward this summer. The Associated Municipal Power Systems (UAMPS) and NuScale Power notified of their plans to submit a design certification application by the end of 2016. This will be followed by a combined construction and operation license application by early 2018.

If built, the plant would provide 600 MW of baseload capacity, produced by a dozen 50 MW SMRs fabricated by NuScale and its primary investor, Fluor. It would be operated by Energy Northwest on behalf of UAMPS, and possibly additional utility partners.

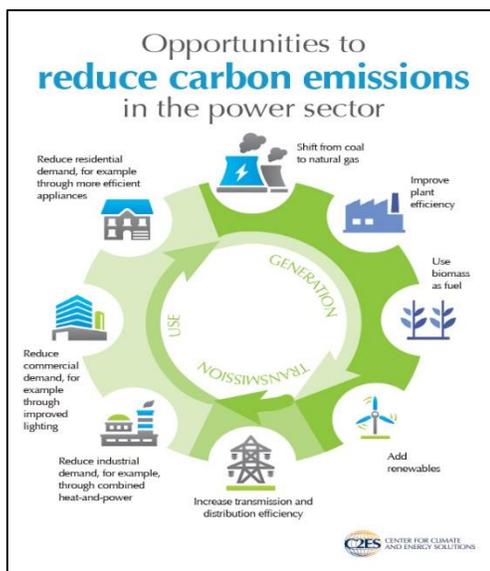
If the project successfully navigates the regulatory and economic hurdles, it could begin producing power by 2023. An early leading candidate installation site is the Idaho National Laboratory complex.



Source: [energybiz.com](http://energybiz.com)

## US Unveils a Clean Power Plan

President Obama announced the US EPA final Clean Power Plan, which will cut US carbon pollution from the power sector by 870 million tons, or 32 percent below 2005 levels, by 2030. The Plan accelerates the transition to a clean energy future. By 2030, the plan will cut carbon pollution from the power sector by nearly a third. Additional reductions will come from



pollutants, emissions of sulfur dioxide from power projects will be 90 percent lower and emissions of nitrogen oxides will be 72 percent lower, compared to 2005 levels.

Source: [ces.org](http://ces.org)

## 4. Mergers & Acquisitions

### GE acquisition of Alstom Approved

The EC has approved the proposed acquisition of the energy businesses of Alstom by General Electric (GE).

The approval is conditional upon the divestiture of central parts of Alstom's heavy duty gas turbines business to Ansaldo of Italy. The Commission had concerns that the transaction would have eliminated one of GE's main global competitors in the heavy duty gas turbines market, where GE is #1 and Alstom is #3 globally. This would have led to less innovation and higher prices.

The Commission did not identify any competition concerns in other businesses that are a part of the transaction (such as thermal power generation other than gas and renewables) because the activities of the two companies are complementary and do not overlap. GE has committed to address all the concerns.

### Robert Bosch Acquires Seo

Auto parts maker Robert Bosch bought Seo Inc, a CA company that has developed next-generation li-ion batteries. Seo's advanced lithium polymer cells have an energy density of 350 watt-hours per kilogram, roughly twice the level of batteries used in today's electric vehicles. Seo's technology may help to increase energy density by 50 to 100%, which could almost double the operating range of an electric vehicle.

Seo has an exclusive license to core patents from Lawrence Berkeley National Laboratory that could help Bosch produce lightweight batteries on an industrial scale.

## 5. Siliconization of the Grid – Phase 1

Over the last decade, "Smart Grid" has become a catch-all for everything from replacing analog meters with microprocessor meters to down-line voltage regulators. Smart Grid technologies have improved traditional processes, for example meter-to-cash, but haven't made the grid "smarter." In the coming decade, the grid will become smarter because of the deployment of silicon technology. This siliconization of the grid will not be exclusively digital technology. Just as High Voltage DC solutions adopted power electronics to increase reliability and reduce cost, the low-voltage grid will realize similar benefits from hybrid solutions combining power electronics with digital control. The first of these solutions will begin to appear in the second half of 2016.

The initial solutions will be installed on the low voltage side of the distribution transformer. These solutions will monitor, in real time, the delivered power's electrical characteristics such as power factor and voltage. Further, these devices will automatically adjust these characteristics providing the consumer "cleaner" electricity. The first wave solutions will be limited in their abilities, perhaps only capable of adjusting voltage plus or minus ten percent, but as power electronics technologies improve, their capability to adjust for lower and higher voltage and bring power factor closer to unity will expand. These devices will improve reliability and reduce losses while preparing for the impacts of distributed energy resources and electric vehicles charging.

Initially, some devices will cost less than \$1,500 and weigh less than five pounds. In addition, most will include communications,

enabling uploading of measurements, load profiles, and anomalies for use in analytics. Competition will rapidly drive improvements in these products, expanding functionality, reducing cost and size, and simplifying deployment in what will be a largely retrofit market. As we enter the post Smart Grid era, the grid will finally become smart.

*John (JD) Hammerly*  
*CEO, The Glarus Group*  
[jd.hammerly@theglarusgroup.com](mailto:jd.hammerly@theglarusgroup.com)

## Honeywell to Acquire Elster

Honeywell has signed a definitive agreement to acquire the Elster Division of Melrose Industries plc for approximately \$5.1 billion. Melrose purchased Elster three years ago for \$2.3 billion. Since then, Elster increased profits substantially, despite the substantial slowdown in metering contracts in the past-ARRA period.

Bringing together Elster’s metering with Honeywell’s controls, both in homes and commercial buildings, offers an opportunity for deeper energy and water management for utilities and end-use customers. The acquisition of Elster is expected to generate strong future returns for Honeywell’s shareholders by increasing its growth profile globally - creating both organic and inorganic growth opportunities.

## Verizon Introduces Smart Energy As-A-Service

Verizon announced Grid Wide Utility Solutions, a new Internet of Things (IoT) platform service offering utility companies an easy on ramp to grid modernization. Grid Wide offers an integrated solution for smart metering, demand response, meter data management and distribution monitoring and control. Grid Wide turns the utility-owned meters into a power-quality sensor to help utility companies understand the quality of the electricity they are delivering to their customers. The smart meters communicate its meter data over Verizon’s wireless network, through Verizon’s private network and then to Verizon’s cloud environment. The solution’s pre-configured data and analytics dashboards provide timely information regarding outages and abnormal usage patterns while also helping utilities drive revenue.

## 6. Smart Grid venture capital funding

There were 18 deals worth of \$104 MM Q2 2015, down from 15 deals for \$185 MM in 15 deals in Q1. Thirty-seven investors participated including two accelerators. Within Smart Grid, Data Analytics companies raised the most funding.

### Top 5 VC Funded Smart Grid Companies in Q2 2015

Company	\$M	Investors
Actility	25	Ginko Ventures, KPN, Orange, Swisscom, Foxconn, Bpifrance Investissement, Idinvest Partners, Truffle Capital
Smart Wires	17.3	Undisclosed
Bitstew Systems	17.2	GE Ventures, Cisco Investments, Yaletown Venture Partners, BDC Capital
DataTorrent	15	Singtel Innov8, GE Ventures, AME Cloud Ventures, August Capital, Morado Venture Partners
Itineris	10	Gimv and Gimv Arkiv Tech Fund II, Edgard Vermeersch, PMV-Vinnof

## 7. New Skillsets for the Utility of the Future

Utilities are in the throes of some phenomenal change. The changes heralded under the banner of the Smart Grid are unlike any our industry has seen in the past.

- **Customer expectations are changing:** The customer expects the utility to provide instant feedback on status of outages, accurate ETOR, consumption, power quality and so on.
- **New sensors and control are being added to the grid:** Advanced technologies such as FLISR, VVO and others are added many capable of functioning in an automated manner.
- **Electro-mechanical devices replaced by electronic devices:** Replacement of existing meters with Smart Meters and a future with Solid-State Transformers, utilities are seeing an influx of electronics and power electronics on the grid.
- **New additions to the grid:** Additions of DERs (Distributed Energy Resources), electric cars, electric storage and others, have the potential to disrupt utility operations.

**New training:** Utilities will need to do more with fewer people through increased automation, and improved business processes.

- **Understanding the basics:** Everyone in a utility, the vendors providing products to them and the consultants performing work at these utilities need to understand and internalize this change. They need to understand that we are now moving into a period of change that may continue for the next several years.
- **Technology Training:** In addition to technologies identified above, utilities are implementing new systems for data mining and analytics, DMS/OMS, enhanced CISOs, cloud-based systems, and automation. These systems and devices need to be installed, configured (sometimes many times), operated, and managed by utility personnel.
- **Business Training:** Utilities are transforming - sometimes being moved into transformation either by their regulators or by their customers who have come to demand more. Utility personnel need to be taught business skills to be able to perform more complex tasks not all of which may have an engineering or technical basis.
- **The Regulator’s Dilemma:** One side, they represent the customer’s interest and keep the costs low. They also don’t want to be perceived as holding up progress by not approving anything. The new regulator needs to be a combination of technologist, economist, and engineer so that they understand the various options.

### So - What comes next?

This is not a business, not technical discussion. The workforce of today will need to transform itself to handle new technological, business, and regulatory changes. In particular, the growing numbers of workers retiring over the next 3-5 years will quickly reach crisis level unless we react soon and proactively. We are beginning to see academia gearing up math and science programs in conjunction with some utilities to increase both the number of students they can handle and the technical skill sets that will be needed to meet these challenges. However, there is much more to be done – and the time to do it is now!

\* *Excerpts taken from T&D World Article – [Skillsets for the Utility of the Future](#), Sep, 2015.*

*Dr. Mani Vadari*  
*Founder, President, Modern Grid Solutions*  
[mani.vadari@moderngridsolutions.com](mailto:mani.vadari@moderngridsolutions.com)

## PNNL's Future Power Grid Initiative

As part of the Future Power Grid Initiative (FPGI), PNNL researchers are developing several tools to aid in operators' situational awareness and real-time decision making. PNNL recently developed a new forecasting tool that delivers 50% increase in accuracy. PNNL researchers developed Power Model Integrator tool that can adaptively combine the strengths of different forecasting models continuously and in real time to address a variety of scenarios that impact electricity use, from peak periods during the day to seasonal swings.

With greater amounts of power being generated from renewable resources, operators are challenged daily to meet unit commitments and load demand while maintaining



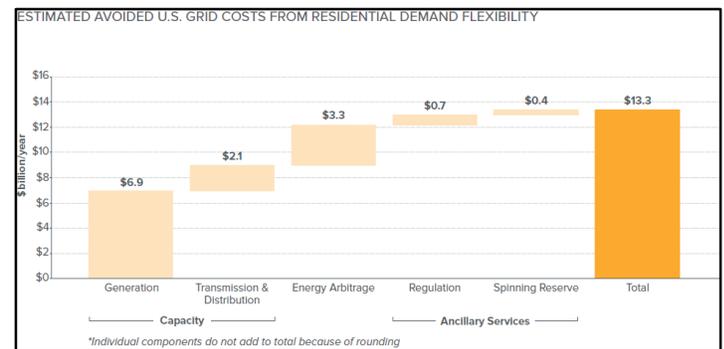
system reliability. As part of the initiative, PNNL also developed The Ramping Uncertainty Tool that goes beyond simply forecasting wind, by providing operators with a look-ahead capability that shows when the ramping and capacity limits will be exceeded in the up and down directions with a specified probability level.

Source: pnnl.gov

## The Economics of Demand Flexibility

Electric utilities typically focus on supply-side solutions to meet peak demand, balance electric loads, and meet customer needs. Demand profiles are assumed to be static, and the grid must be built to meet that load profile. The grid will need an estimated \$1.5 T in investment over next 15 years, translating to about \$50–80 B/yr.

A new report, The Economics of Demand Flexibility, shows how simple, Internet-connected technologies like smart thermostats to control AC, dryer timers, grid-interactive water heaters, and smart EV charging can drive 10–20% of those anticipated grid investments, while simultaneously saving customers 10–40%. This approach, termed demand flexibility (DF), relies on more-granular electricity rates such as time-varying pricing and residential demand charges, some that exist today. Simple technologies, costing only a few hundred dollars can help customers automatically respond to these price signals.



Source: The Economics of Demand Flexibility, rmi.org

## 8. News from Modern Grid Solutions

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

Several Universities use “[Electric System Operations – Evolving to the Modern Grid](#)” as textbook. Stony Brook is the latest joining an illustrious list of universities using this book. **Get your copy soon.**



- SUNY Buffalo – Regular course – combined undergraduate and graduate course, University of Wisconsin-Madison. Summer course, Lehigh University, Pennsylvania, and now Stony Brook. Other universities are actively assessing.
- Pennsylvania State University – to be used in the graduate program in Smart Grid
- Drexel University – Active consideration by Charles D. Close School as the foundation for a course in energy entrepreneurship.

### Training news

- MGS is now working with IEEE to deliver a certificate course in Smart Grid through the EdX mechanism.
- Under the Smart Cities Council banner, Dr. Vadari delivered a Smart Cities Readiness workshop as a part of the Smart Cities Week in Washington DC 14-16 September and will also join Jesse Berst in delivering the same workshop as a part of the International City/County Management Association (ICMA) annual conference in Seattle, WA.

### Events and News

- Under the banner of Smart Cities Council, Dr. Vadari will present the keynote at the Mauritius Smart Cities 2015 on October 14-15 in Balacalava, Mauritius. Dr. Vadari to deliver the Smart Cities Readiness workshop in Cape Town and Johannesburg, South Africa.
- Check out the latest and greatest revised edition of the best-seller from Smart Grid Maven and Guru, Andres Carvallo “[The Advanced Smart Grid: Edge Power Driving Sustainability](#)”. It is available at leading booksellers everywhere.

This is a production of Modern Grid Solutions. Send all comments and inquiries to [info@moderngridsolutions.com](mailto: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.