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# State of the Smart Grid Briefing

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We are very excited to release our eighth quarterly newsletter and our first one for 2015. This time we have two articles both written by yours truly. Article 1 is on a very important topic – The growth of solar and its associated incentives. Article 2 is an excerpt from a very popular article Grid Modernization Plans.

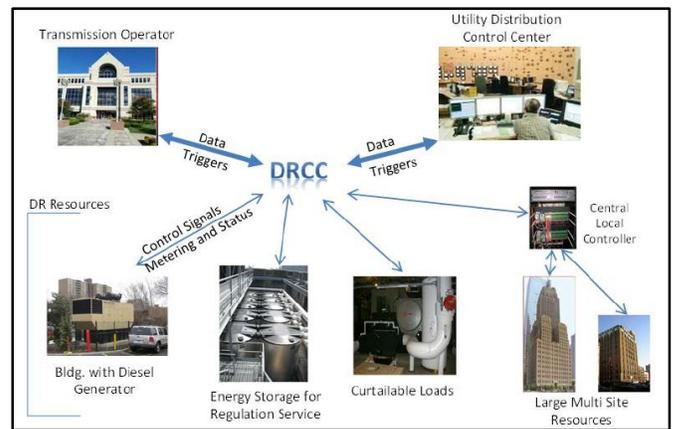
Dr. Vadari also has some exciting news!!!! Modern Grid Solutions has embarked on an alliance (Director, Smart Cities Sector Services) with Smart Cities Council offering solutions to cities and vendors worldwide to help create the Smart City of the Future.

Sincerely yours  
**Mani Vadari, Modern Grid Solutions**

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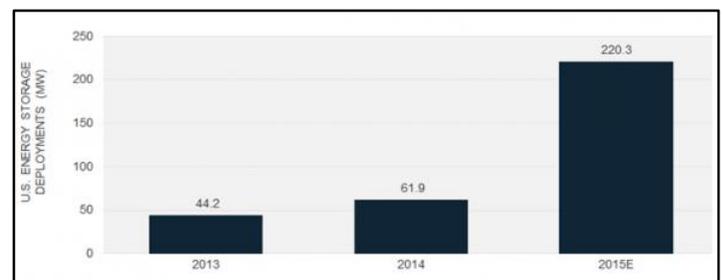
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The project focused on four main components: Demand Response Command Center, incremental Building Control Unit, Thermal Storage Plant, and Virtual Generator.



Demand Response Command Center Architecture  
Source: ConEdison Technical Report, Feb 2015

## US Energy Storage Market to Grow 250% in 2015



U.S. Energy Storage Deployments 2013-2015E

Source: GTM Research/ESA U.S. Energy Storage

## 1. Key Highlights

### \$16B Texas Advanced Energy Market Estimated

The advanced energy industry in Texas is estimated at \$16 Billion in 2014 revenue. Advanced energy is defined as a broad category of technologies and products, and is made up of seven major segments. Building efficiency is the largest segment, with \$5.4 billion in revenue. Building efficiency improvements, efficient lighting, high efficiency HVAC equipment, and demand response are significant contributors to this segment. The second largest segment, at \$3.6 billion, is made up of advanced generation technologies such as wind, solar, and natural gas.

### Interoperability of DR Resources Demo in NY

DOE awarded the Interoperability of Demand Response Resources Demonstration to Con Edison in 2009. The objective of the project was to develop and demonstrate methodologies to enhance the ability of customer sited demand response resources, both conventional and renewable, to integrate more effectively with electric delivery companies. The interoperability was achieved by integrating the operations of a DR Service provider, a large multi-facility retail customer, and a delivery company.

The US is forecasted to deploy 220 MWs in 2015, more than three times its 2014 total, and growth should continue at a rapid clip thereafter. In 2014, 180 grid-connected electrochemical and electromechanical storage installations came on-line, representing 61.9 MWs of power capacity. That's up 40 percent from the 44.2 MWs completed in 2013. Ninety percent of new U.S. energy storage capacity in 2014 was in front of the meter, while 10 percent was behind the meter at residential or non-residential sites. It is expected that behind-the-meter storage will account for 45 percent of the overall market by 2019.

## 2. Solar Industry and Incentives

Question: *How can the solar industry be weaned off the “incentive bottle” so solar can become the competitive energy resource the industry says it is?*

There is no doubt that the cost of generating solar energy is coming down. Just in the last few years we have seen prices that have come down dramatically come down to about 1/4th of what used to exist earlier. This does not mean that we are there – it needs to come down a lot more. This will happen in several ways. Either existing technologies will need to reach the next level of scale so that cost of manufacturing can come down dramatically or new technologies need to be developed with a greater yield and better performance or most importantly, we are able to find avenues to incorporate solar generation into existing materials such as roofing materials, window glass and other common construction components. We believe that a combination of the points above will accelerate the acceptance of solar into the mainstream much more than it is now.

However, it is very important to note that regardless of the reduction in costs or acceptance into the mainstream, certain limitations of the solar cell needs to be accepted. These limitations are well known and all associated with exposure of the PV-cell to sunlight and the unpredictability that comes with it. New mechanisms need to be thought through in how to integrate Solar into the power system. We believe that a combination of NY and CA are looking at new and innovative mechanisms to do just this. Not all of us can (or should) hope for storage to be the white knight to bail us out.

The business case of solar is also complicated and varies wildly from locations such as in sunny parts of Arizona when compared to cloudy parts of Washington. This makes it complicated for solar to make broad statements or conclusions about the efficacy of this technology to be the panacea for all of our energy woes. The business case also gets complicated because, unlike other existing sources of generation, solar is not dispatchable – we have to take what is being generated when it is being generated.

Lastly while much brouhaha has been made about incentives to solar – they are not the only industry getting tax incentives. Every form of generation gets tax incentives – just in different forms. This is another of those not-so-easy solutions. We believe that incentives need to be analyzed in their entirety for all generation technologies (fossil-fired, hydro, nuclear, wind, solar and others) so that an apples-to-apples comparison can be made.

*Dr. Mani Vadari  
Founder and President, Modern Grid Solutions  
Excerpts from article in “[Solar Incentives](#)”*

### The Impact of the Internet of Things-The Connected Home

The Internet of Things (IoT) is transforming family life through the wireless connection of devices in the home, such as smart meters and security systems, helping to save money and increase peace of mind, according to a report by GSMA. Approximately one in four people in Germany, Japan, the UK and the US already own a connected device such as a smart meter (28 per cent), security system (23 per cent), lighting system (23 per cent), or health monitor (23 per cent), underscoring the growing impact of wireless connectivity and the Internet of Things on the lives of consumers. The uptake of connected devices is set to grow rapidly

over the coming years. Consumers have a strong interest in connecting virtually everything in their homes including security systems, thermostats, smart meters, lighting and cars, as well as health monitors, washing machines, smart watches, activity trackers, ovens, refrigerators and elderly monitors.

### SDG&E Integrates EVs and Storage into CAISO

SDG&E is actively bidding energy storage and electric vehicle fleets as one resource directly into CAISO. The project aggregates stationary storage systems with the charging demand of EV fleets at five separate locations throughout San Diego County. The assets are remotely controlled using software that balances charging needs, and DR services at the grid level. It achieves this by correlating charging activity with wholesale energy prices. By agreeing to not charge during certain high price hours, the aggregated resource is paid the marginal energy price in those hours, similar to a conventional generator. The pilot project will end in late 2015.



Fleet of Electric Cars charging from solar PV

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

## 3. Mergers & Acquisitions

### CLEAResult Acquires Triple Point Energy

CLEAResult, acquired Triple Point Energy which provides a people first approach to energy management to help utilities engage with commercial and industrial customers of all sizes in a low cost and no capital cost way. Triple Point allows businesses to implement behavioral and operational changes to increase quality and productivity while driving meaningful and persistent energy savings. Since 2011, Triple Point has helped its utility clients and their customers save approximately 175 million kWh.

### SunEdison Acquires Solar Grid Storage

SunEdison, Inc., acquired Solar Grid Storage LLC. SunEdison now offers battery storage solutions to complement solar and wind projects worldwide, providing solutions that can benefit utilities, municipalities, businesses, and consumers alike. This move follows SunEdison's successful acquisition of First Wind. With 5 gigawatts of solar and wind assets, the company expects to realize significant synergies and opportunities for growth by integrating energy storage into its global finance, project development, and asset ownership platform.

### Accenture Closes Structure Acquisition

Accenture completed acquisition of Structure, a provider of consulting, system integration and customized solutions and services to energy and utilities clients. In the utilities industry, the combination adds Structure's deep skills, including those in grid

operations, with Accenture’s strengths in IT. Examples include the deployment of advanced distribution management systems, automation solutions, along with improved outage management and grid analytics. It also brings Structure’s end-to-end expertise in market operations and commodities trading to help clients optimize their assets and commercial portfolios in natural gas, electric power, chemicals and crude oil.

## 4. Key Considerations for Grid Modernization

Utilities are embarking on the first set of movements in the post-ARRA world. ARRA provided the biggest shot-in-the-arm for electric utilities in North America by funding a series of infrastructure grants and demonstration projects. On their own, much of this effort would not have taken place.

### What a Grid Modernization Plan should not be

Despite the list of bullets provided above, grid modernization cannot be only about technology – IT and/or OT. A focus purely on technology alone misses out on several potential benefits – such as the ability to focus the right technologies to solve the right problems. It also misses the need to assess the impacts of both disruptive business models and disruptive technologies.

### What Grid Modernization should be

The Grid Modernization Plan should be one of the most important strategic initiative at a utility. The Grid Modernization Plan should provide an integrated view of future business capabilities, and a plan that integrates and prioritizes the changes required to transition the utility to increased levels of performance in order to respond to stakeholder expectations.

At the very least, it should incorporate a broad segment of the utility operations such as –

- Grid Operations (real-time), Operations Support and Restoration
- Planning and Engineering
- Meters, Sensors and Controls
- Operation Technology

It must also consist of the following key set of steps –

- Identification of key technologies (applications, field equipment and infrastructure) that will be enablers to upgrade the business capability
- An impact analysis for infrastructure changes that can be further detailed in the future
- Assessment of the major capability (People, Process and technology) gaps and initiatives to close those gaps
- The benefit categories that will add value and increase overall performance.
- A prioritized plan that describes the major initiatives and timelines (e.g. a roadmap for execution, subject to a more detailed program plan and business case)

**The major outcomes of the Grid Modernization Plan should finally include key Initiatives outlining the key projects and activities that are required to close gaps and reach the target state aligned into a roadmap for future capabilities upgrades.**

### Key Challenges and Risks

Developing a Grid Modernization Plan is not without Challenges or risks – we can try to identify some of them:

- Policy: Both at the utility level and at the regulatory level, having the right policies in place are critical for the success of both the development of the plan but also for its successful implementation
- Linking to the utility’s business drivers: The Grid Modernization Plan must be directly and inextricably linked to the most important business drivers for the utility.
- Utility leadership buy-in: It is imperative that the leadership buys into the plan as the best way forward. This can only happen if they are involved in the development of the plan right from the beginning.

*Dr. Mani Vadari*

*President, Modern Grid Solutions*

*Excerpts from Article in Intel Energy Insights*

## Lux Research Acquires Energy Points

Lux Research, a global leader in emerging technology research and advisory services, acquired Energy Points, a leading provider of data and analytics. Energy Points helps large companies and government entities improve their resource efficiency through analysis of energy, water, fuels, and materials. Lux Research clients will gain access to the Energy Points team, who have a combination of modeling, predictive analytics, statistical programming, and physics-guided data mining experience.

## Puget Sound Energy to join CAISO Energy Imbalance Market

PSE will begin participating in the CAISO Energy Imbalance Market (EIM) in Oct 2016. PSE’s economic analysis indicates benefits of between \$18 to \$30 MM/yr by taking advantage of the EIM intra-hour power scheduling and power plant dispatching capabilities. Furthermore, existing EIM participants yield additional benefits of nearly \$4 million annually as a result of PSE’s participation. Using the EIM’s real-time market allows PSE to purchase the lowest cost energy available across the West to meet their customer’s needs.

## 5. Smart Grid venture capital funding

Venture capital funding into smart grid technology companies was \$383 MM in 73 deals in 2014, compared to \$410 MM in 64 deals in 2013. Total corporate funding, including debt and public market financings, came to \$844 MM in 2014, compared to \$584 MM in 2013. There were 88 total VC investors in 2014, with eight active investors participating in multiple deals. Home automation companies received the most funding within Smart Grid.

### Top 5 VC Deals in 2014

Company	\$MM	Investors
Savant	90	Kohlberg Kravis Roberts
Zonoff	31.8	Grotech Ventures, Valhalla Partners
Chargepoint	22.6	Rho Ventures, Kleiner Perkins Caufield & Byers, Braemer Energy Ventures, Siemens Venture Capital, Voyager Capital, BMW
Sigfox	20.6	Idinvest Partners, FSN PME, Digital Ambition Fund, Elaia Partners, Intel Capital, Ixo Private Equity, Partech Ventures
Enverve	15.4	Cassiopeia Capital Partners, Cisco, UMC Capital, Benchmark Capital, New Enterprise Associates, Walden International

## New York Launch's \$40 Million NY Prize Microgrid Competition

Gov. Cuomo launched the state's \$40 MM energy competition, NY Prize, proposals for microgrids to meet energy and resiliency needs of local communities. The prize money will be used to build microgrids across New York State to reduce customer costs and promote clean energy. Potential projects must be integrated into utility networks and serve multiple customers, including at least one critical infrastructure customer, such as a hospital, police station, fire station or water treatment facilities.

## US State of the Electric Utility

Electric utilities are faced with a future of tremendous change and uncertainty, largely triggered by advancements in grid technology, new regulatory models and heightened customer expectations. Utility executives are confident in the industry's growth, but also expect to see new models and approaches.

**Emerging Technologies:** Utilities showed interest in storage technology at the gigawatt-scale for the first time in 2014. The sudden interest in storage stems from the technology's renewed

value proposition. Battery prices are dropping fast and are likely to fall further as massive manufacturing facilities, such as Tesla's wildly ambitious Gigafactory, drive prices down through economies of scale.

**Business and Regulatory Models:** A significant number of utilities see themselves becoming smart integrators. The smart integrator utility is a deregulated entity responsible for building, operating, and maintaining the smart grid platform on which new services, technologies, and marketplaces will rely. The smart integrator utility, whose revenue is decoupled from electricity sales, is expected to fulfill energy efficiency mandates.

**Distributed Energy Resources:** Utilities view distributed energy as a massive opportunity. While 88% see distributed energy resources as an opportunity, 63% of these same respondents are not sure how to build a successful business around it. Utilities want to find ways to incorporate distributed energy into their business models rather than letting competitors own the sector.

**Grid Security:** Utilities see themselves as the primary line of defense in securing the grid, most say their grids are not adequately protected from physical and cyber-attacks. The vast majority of utilities surveyed are increasing spending to prevent attacks.

## 6. News from Modern Grid Solutions

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**NY State and REV:** Dr. Vadari is a core team member of the New York State REV process supporting the New York State Smart Grid Consortium and the US-Department of Energy (Brookhaven National Laboratory). In this role, he is deeply embedded into the Architecture and the market structure teams.

**Smart Cities Council:** Dr. Vadari is now also the Director of Sector Services at the Smart Cities Council producing Smart Cities Readiness Guide workshops and providing city assessment and other related smart cities services.

## Electric System Operations – Evolving to the Modern Grid

Dr. Vadari's book "[Electric System Operations – Evolving to the Modern Grid](#)" continues to be received extremely well in the industry to 5-star reviews. In addition – it is now being used at several universities as course materials. It is now available both in the hardcover and the eBook/Kindle versions. Buy them at Amazon.com and other leading retailers.

## Events and News

- IdeaXchange blogs managed by Transmission & Distribution World.
  - [How can the solar industry be weaned off the “incentive bottle” so solar can become the competitive energy resource the industry says it is?](#)
  - [To Drone, or Not to Drone, That Is the Question](#)
  - [DC or AC – Can we all get along?](#)
- Intel energy series blog also - [Key Considerations for Grid Modernization](#)
- **Smart Cities Readiness course at Dubai** – sponsored by the Dubai Real-Estate Investment Trust and under the auspices of the Global Smart Cities Council. April 26<sup>th</sup> and 27<sup>th</sup>

*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](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.*