The Smart Energy Report

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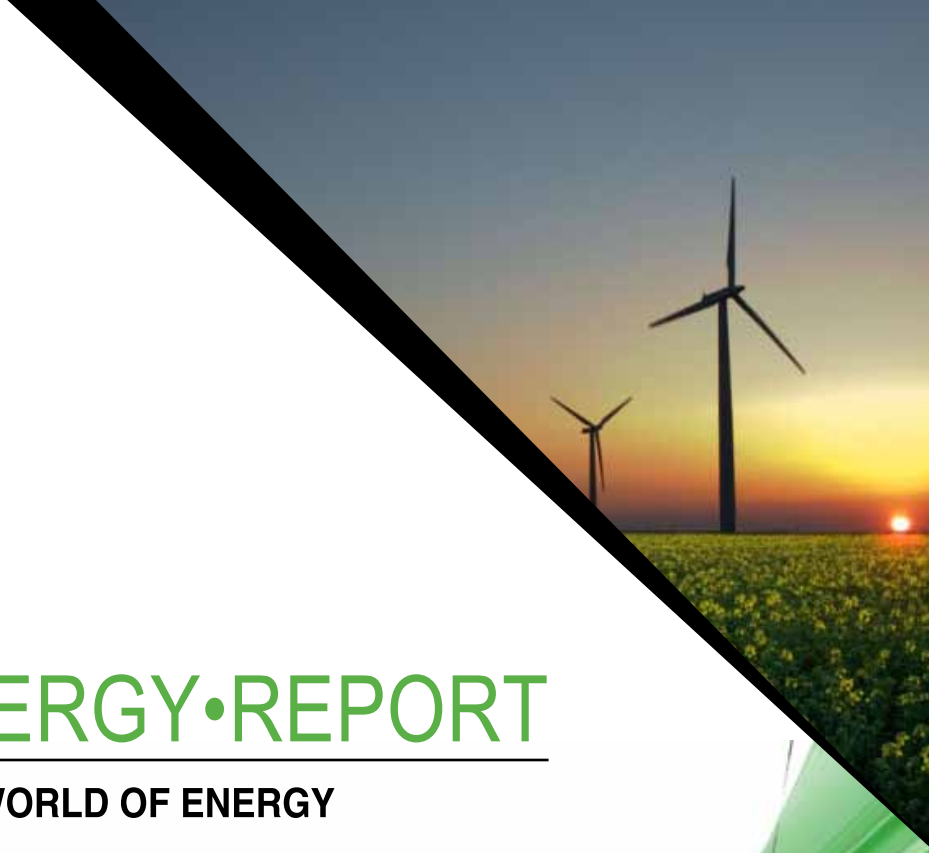

THE SMART ENERGY • REPORT

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Smart Energy – Connecting our World of Energy

The smart energy world is surely one of the most exciting places to be at this time: It is right on the cutting edge of technology, and it is transitioning irrevocably how energy is delivered and used to a more sustainable future. But it is not for the faint hearted: It is hugely costly, it is changing the traditional relationships between utilities and their customers and other stakeholders such as regulators, and it needs visionaries and pioneers to lead the industry into the unknown and to take the knocks that inevitably will ensue.

This publication is aimed at giving a current snapshot of this smart energy world, focusing in on Metering International's Smart Energy International and the co-located Smart Energy Storage Summit, which was held in San Jose, Calif., on September 7-9, 2010. Reflecting the evolution of the industry, this event combined and expanded the Smart Energy West Coast and East Coast events that have been delivered over the past four years to provide a single powerful event to cover all the information and networking needs of participants.

The three-track Smart Energy International was based on the three pillars of "Energy sustainability," "Operational excellence," and "Customer engagement," which were identified as the key focal points early on in the planning by the industry conference committee. In addition the Smart Energy Storage Summit offered a fourth track on what is emerging as one of the key technologies for the smart energy world.

The event was attended by over 400 practitioners from 17 countries in North and South America, Europe, Africa and Asia.

This report provides a summary of highlights of the core content and includes interviews with leading industry participants as well as industry analysis contributions which set out the status and future of smart energy.

Jonathan Spencer Jones
Editor, Metering International

The Smart Energy International Report is based on an original inclusive methodology that reflects the current world of Smart Energy challenges and solutions. As we present our inaugural report, we would like to thank the hundreds of decision-makers and professionals who have taken the time to share their thoughts with us. We would like to extend our gratitude to the selected panel of global observers from the business, political and institutional communities who expressed their views on the future of Smart Energy: John Bohn (Commissioner, California PUC) James Avery (Senior Vice President, SDG&E) Warren B. Causey (Vice President, Five Point Partners, LLC) Imre Gyuk (Energy Storage Systems Program Manager, DOE) Peter Honebein (Principal, Customer Performance Group) Bart Thielbar (Vice President, Five Point Partners) Jonathan Spencer Jones (Editor, Metering International) Mike Smith (GM & VP North America, Spintelligent) Nazya Ayaz (Conference Director, Smart Energy International) Bruce Haring (Conference Director, Smart Energy Storage Summit) Hrishikesh Sathawane (MBA student, UCLA Anderson School of Management). The success of this unique report is directly attributable to their participation and commitment.

Editor: Jonathan Spencer Jones
Contributors: Warren Causey, Bart Thielbar (Five Point Partners), Mike Smith, Nazya Ayaz, Bruce Haring (Spintelligent), Hrishikesh Sathawane (MBA student, UCLA Anderson School of Management).
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Is History Repeating Itself With Smart Grid?

By Warren B. Causey
Vice President Strategy, Research & Analysis, Five Point Partners, LLC

One of the best known and most oft-misquoted maxims of intellectual pursuit is: "Those who are ignorant of history are doomed to repeat it." The quote is now usually attributed to Spanish-American philosopher George Santayana (1863-1952). Santayana's expression, in turn, was a slight mis-quote of British politician-philosopher Edmund Burke's (1729-1797) statement: "Those who don't know history are destined to repeat it." Historians say Burke likely borrowed – and mis-quoted – elements of the thought from even earlier thinkers.

Regardless of the origin or exact wording of the quotation, many of those working in and around the U.S. utility industry – and many of those who now are setting policy for that industry – often seem determined to re-live the maxim. I was reminded of that reality at a recent industry conference when, during a discussion of "smart grid", someone asked me: "Are you, like me, seeing a lot of same trends in the smart grid push that we saw in the great deregulation movement?" My answer to the question was: "Yes".

The similarities between "deregulation" and "smart grid" are fascinating:

- Both started as top-down (that is from government) pushes to restructure the industry.
- Both saw the east and west coasts of the U.S. as early signees promoting themselves as "leaders" in the movements.
- Both resulted in a rush to install new technologies, new regulations and new utility operational and system changes to either try to comply with, or mitigate and resist, the demanded rapid change.
- Both resulted in confusion at many levels.
- Both resulted in extreme difficulty for utilities in building business cases to justify extensive new investment to enable the movements.
- Both resulted in many utilities being forced to ignore business cases and "just do it anyway".
- Both resulted in confusion and a large measure of indifference on the part of the general public.
- Both ignored history – deregulation ignored the fact that utilities had been highly competitive up until the 1930s or so, when they were regulated with their own complicity in the process. The smart grid movement ignored the fact that the first fully automated "smart home" subdivisions were built in the 1990s in Georgia, Arkansas and a few other places. Smart grid proponents also ignored the fact that a utility invented automated meter reading in the 1980s and that utilities have been installing advanced technologies and meters on the grid for a generation. It also ignored the fact that wind, solar and other alternative forms of generation, as well as all-electric vehicles, have been tinkered with for, well, generations and never proved practical or cost effective.
- Both resulted in many new start-up companies, many of which – in both movements – already have failed resulting in quick fortunes and quick losses of fortunes.
- Both resulted in the great middle of the country, both geographically and politically, dragging their feet in many ways to wait and see if "this too will pass."
- The smart grid movement also ignored the fact that in the 1970s climate scientists were warning about an impending new ice age, rather than an impending new global warming age.
- Both resulted in higher electrical prices for consumers, but that seems to be a norm in an economic system that ever promotes a gradual (sometimes not so gradual) devaluation of the dollar, requiring more dollars each year for every product or commodity.

Despite having spent most of my career as a journalist, technologist and analyst, my original college training and much of my part-time experience, has been as a historian/writer. The technologist and analyst in me is fascinated and gratified by the technological advances taking place now. Utilities are being forced to break down silos and view their enterprises holistically from generation to end-use. They are implementing new technologies as rapidly as they can, 100 of their 3,500 number being spurred on by government largesse through ARRA grants. That can only help improve efficiency on the system and advance the state of the art. Will the utility industry ever be the same? No, it will be better, more effective and more advanced.

But will the smart grid movement really result in an entirely new paradigm that is customer-driven and 100% emissions free? Will customers ever truly embrace an electricity constrained environment where either they, or someone else, will dictate when they can perform certain electrical tasks in their homes?

Will government ever be able to impose a lower standard of living (less electricity) on Americans, and citizens of other advanced countries, in the name of environmental damage mitigation? Those obviously are questions for prophets, not historians. But my guess, as a part-time historian, is no.

From a historical perspective, the crown jewel and driving force of the smart grid movement is mitigation of carbon dioxide emissions. That forced mitigation seems to have failed in Congress and, if the pundits are right, will become virtually impossible after the next U.S. election. True, the Supreme Court has given the Environmental Protection Agency (EPA) authority to control carbon emissions, but the EPA is, in final analysis, a political agency subject to the political winds. And right now, and likely for the next several years, EPA regulators seem destined to face increasingly stiff headwinds in this arena.

So, is this utility analyst, part-time historian, predicting the demise of the smart grid movement? The short answer is yes. I think it has peaked already and now will gradually fade away. That seems to be the historical trend, but then again, I remind the reader that I'm a part-time historian, not a prophet. That also was the opinion of my questioner, another technologist, at the recent conference.

The primary reason for that answer is that, like the deregulation movement, it is essentially a political movement and politicians have short attention spans and thus political movements ebb and flow. It also is, in large measure, an east coast/west coast movement and those also usually lack sustaining power in the heartland.

This prediction does not mean, however, that there are not many benefits – and some negatives – that will come from the movement. Benefits include the breaking down of utility silos, already mentioned. Others include:

- Utilities have become aware of the need for a holistic approach to data handling. Data can no longer be held in silos and must be collated, analyzed and acted upon to enhance the grid and customer service. Meter data management systems and accompanying business intelligence systems will gradually enhance this capability.
- The grid itself (the transmission and distribution wires, substations and other facilities) is receiving a lot more attention from utilities than politicians. There are real savings to be realized in making the grid more efficient – a great deal of the power generated (estimates vary between 10% and 50% on different parts of the system) – is lost in the process of getting the power moved from one area to another.
- Some renewable generation will enter the grid, which will overall make the environment cleaner. But the percentages will not be as large as the environmentalists would like because the intermittency problem – and the effect of that intermittency on grid control systems and the ramping of central generation – cannot be solved in the short term. However, additional research is being conducted and over another 25-50 years or so, more and more solar, wind and other alternative forms of power will provide a substantial boost in overall electrical supply. The control systems, storage systems and control systems to enable that will be worked out gradually.
- New software systems – notably MDM and BI – are coming to the fore rapidly. They aren't where they need to be yet, but vendors are investing heavily in getting them ready.
- Automation is rapidly solving the aging workforce problem utilities were so worried about as recently as four or five years ago. There is a limit to how much staff utilities can cut with automation, but that limit is being pushed back rapidly as AMI and other technologies come on line, reducing the need for workers. New workers, while fewer in number overall after the baby boom generation, are being attracted to the industry and are proving capable in most cases. The systems and policies to attract and retain them have been developed.
- While large software companies such as Oracle, SAP and Harris have consolidated and absorbed many of their smaller competitors over the past 10 years, new firms continue to spring up, offering better mousetraps solving discrete problems encountered in the march to the "smart grid" nirvana. Many of them will fail, but some will survive and grow to be major contributors to the industry.
- Better, smaller, more efficient conductors, switches, capacitor banks, system monitors and artificial intelligence devices are being deployed on the grid to solve many of the problems that have plagued it in the past.
- State regulators – except perhaps on the aforementioned coasts – are serving as an effective buffer against the worst of the excesses of the smart grid political movement, but are becoming ever more cognizant of the industry and are helping shape it for a better, more efficient future.

So, am I premature in projecting the peaking and demise of the smart grid movement? Perhaps, but the lessons of history are ignored at great peril and history seems to be pointing to yet another cycle in the 100-year-old era of political tinkering with an industry that has kept the lights on for that century and in the process given us our modern, high-tech society.

Despite my prediction, I'm quite optimistic for the future of the industry and for the rapidly advancing technology and people who support it. And, like all analysts, I'm also just reporting what others are seeing and asking me about.

New Smart Energy Era

The Changing Role of the Utility in a Decentralized World

The strength of the Smart Energy International conference was on display from the opening session when John Bohn, Commissioner from the California Public Utility Commission, discussed "The Changing Role of the Utility in a Decentralized World." He offered an insightful perspective on the need for utilities and regulators to be mindful of their positions in the global war for economic growth. After all, effective, efficient, affordable and reliable power is the base of any economic engine.

Commissioner Bohn cautions that when a government becomes more concerned with making popular decisions than with making correct decisions, the risk of damage to the economic engine increases. As utilities and regulators contemplate investments in utility infrastructure, including those inherent to the smart grid, it is wise to do so against the backdrop of economic growth. Any such investments, he argues, should assist in promoting the goals of efficient and affordable power, which will serve to fuel economic growth.

As it relates to smart grid, Commissioner Bohn advises that it is wise to consider the true dimensions of change and, of course, basic economic parameters such as a legitimate comparison of costs and benefits. Additionally, utilities and regulators must carefully consider if customers are willing to pay for smart grid technologies and if the companies behind these technologies are successful in their own right, or only because of stimulus efforts.

Because energy is a core component of economic development and growth, his comments serve as a reasonable reminder that the basics of business do not change. Smart grid technologies, although new, exciting and full of promise, should serve society's needs of affordable and reliable power. Anything less poses unnecessary economic risks.

Managing the Utility Business in a Changing Landscape

Building upon the comments by Commissioner Bohn, John Avery, Sr. VP of Power Supply for San Diego Gas and Electric (SDG&E) recognized that legislative and regulatory mandates create challenges – sometimes difficult challenges. SDG&E, like all utilities, is mindful of their obligation to provide customers with affordable and reliable power while simultaneously meeting the challenges that exist with the emergence of regulatory mandates regarding energy efficiency and renewable energy, among others.

Avery recognizes that the three macro drivers for the smart grid – environmental concerns, customer inputs and operational needs of the grid – all find support in federal and state energy policy goals and regulations. To help meet these goals, SDG&E has been forward thinking – and acting – in its approach to renewable and distributed generation. For instance, they already have 80 MW of solar generation on rooftops within their service territory and their total solar rooftop program is growing by 3% each month. Assimilating intermittent power from renewable resources is challenging to grid operators, but Avery recognizes that it is an important part of their efforts to meet the needs of SDG&E's constituents. Looking ahead, Avery advises that they are also being proactive in preparing for the impact of electric vehicles and making system upgrades and enhancements where necessary.

Avery recognizes that several things are driving the need for changes to how they provide and provision power. He specifically cites centralized renewables, distributed renewables, electric vehicles, national security and customer empowerment as key factors driving these changes. Listening to Avery share his thoughts provided great comfort to those who desire a practical and forward thinking leadership during these challenging times.

The Role of Environmental Policy in Driving Green Innovation

Moderated by Clint Wheelock, Founder and Managing Director of Pike Research, a distinguished panel of Bill Riggins, VP of Environment and General Counsel at Kansas City Power and Light (KCPL), Pete Skala, Manager in the Climate Strategies division of the California PUC, and Wendy Pulling, Director of Environmental Policy at PG&E, discussed "The Role of Environmental Policy in Driving Green Innovation Around Smart Grid and Energy Efficiency." It was an intriguing panel discussion and provided a great perspective on how environmental policy is influencing the development of the smart grid.

Each of the panelists recognized that environmental policy, although related, is not the driver of the smart grid, nor is it driven by the smart grid. Of course, there are tremendous environmental benefits associated with smart grid technologies, such as lower carbon monoxide omissions from use of renewable energy. With that said, though, Pulling does not believe the two issues are linked in the minds of the average customer. Importantly, she noted, environmental groups do not spend many resources promoting, or even discussing, the smart grid. Similarly, Skala pointed out that smart grid technologies and business practices will help to flatten the load curve, which also serves to reduce omissions. Related to all of this, Riggins made the keen observation that energy efficiency is now an important part of strategic planning at most utilities, unlike a few years ago when it received limited consideration.

As each of these panelists noted, environmental policy is certainly shaping the way utilities and consumers think about the production and provisioning of power, including the deployment of smart grid technologies. And it is having a dramatic impact on how utilities conduct their planning, allocate their power supply portfolios and interact with their customers.

Customer Education for Smart Meters

The widespread success of smart metering depends on utility customers becoming more actively involved in their energy usage, but few customers are likely to seek out information and so utilities are becoming required to take a proactive approach towards educating their customers.

But for most utilities, customer education is a new activity, outside their expertise, so how they do go about it? Peter Honebein, co-founder of Customer Performance Group and a leading expert on smart grid customer experience, says that first, utilities must see customer education as only one part of a customer performance approach. "If our objective is to enable customers to 'perform', then we must orchestrate customer education ('expertise') with the three other methods that enable desirable outcomes – 'vision,' 'access,' and 'incentives,'" Honebein says.

Second, he continues, utilities need to be thinking that customer education is a process, not an event, and they need to blend expository learning methods with discovery learning methods. And third, they need to move beyond thinking about customer education as advertising and marketing communications, and need to adopt and integrate generally accepted methods for designing instruction. "Beyond typical advertising and marketing communication methods, which are good for building awareness, customer education programs need to build understanding, adoption, and commitment," Honebein notes. What then, should customers know? The better question is what don't customers need to know, responds Honebein.

"Customers have very little bandwidth for customer education related to the smart grid. Research suggests that 80% of customers spend 30 minutes or less monthly on tasks related to their utility. Contrast this with what we want customers to know about the smart grid. A content analysis I conducted identified over 130 different learning objectives, covering everything from how smart metering works to dynamic pricing to energy efficiency.

Finally, a key element of a program is evaluation, with one of the most popular models being Kirkpatrick's four levels of evaluation - level 1 evaluating reactions to the program, level 2 the learning methods, level 3 transfer of training, and level 4 the results.

Concludes Honebein: "Being able to evaluate your customer education means that you need to follow a systematic process in developing customer education – analysis, design, development, implementation, and evaluation (ADDIE)."

Making Storage Ubiquitous on the Grid

One of the keys in the smart energy arena is the storage of energy, particularly for the widespread deployment of intermittent renewables. Over the past ten years, the recognition of storage as an important technology for the grid has advanced considerably, says Dr. Imre Gyuk, who leads the U.S. Department of Energy's energy storage research program. When he took up the position back then there were no demonstration projeccts and little academic interest, but now storage is a "hot topic." It is attracting young entrepreneurs, utilities and state and Federal legislative interest.

Gyuk explains that the program, working closely with the Sandia National Labs., funds research at all levels, including fundamental research on existing and new technologies, and demonstrations, with these latter undertaken with industry and heavily cost shared (for most of the past 10 years the $3 million budget effectively funding $20 million in research). In the last years the program budget has been increasing – $40 million is requested for FY '11 – and also $185 million in stimulus funding has been allocated to storage, which will leverage a further $550 million in private funding. When it comes to technologies Gyuk comments that voltage and frequency regulation are market ready, while peak shaving, energy management and upgrade deferral are near to becoming commercial. In addition renewables dispatch, smoothing, ramping, and peak shifting are increasingly being considered as storage options.

But the main challenges are "price, price, price," says Gyuk, with demonstrations typically on the megawatt scale, and the largest device in commercial use – a 43 MW frequency storage device in Alaska – a one-off. "We need scalability to achieve megawatts of storage and that is costly," notes Gyuk, adding that it is a chicken and egg situation. "The larger devices won't be widely available or come down in price until there is a mass market for them, but there won't be a mass market if they are not there."

That said, Gyuk believes that frequency regulation will be the first technology to be widely accepted in the market – and that will then open the way to improved grid reliability and an increase the contribution of renewables on the grid, currently restricted without storage to about 20% of capacity in the opinion of most experts.

Interview with

JOHN BOHN
COMMISSIONER, CALIFORNIA PUC

SMITH: Thank you for delivering the opening keynote presentation in San Jose. Your comments about the economic and energy challenges we face were spot-on. With the array of energy development choices today, do you see any particular renewable energy source (or sources) that appear to have a better likelihood of long-term viability?

BOHN: Storage technology is clearly key to integrated use of any intermittent sources, not just the instantaneous moment-to-moment storage, but storage that can yield results over a number of hours so that it could complement intermittent renewable energy generation. My own view, for what it is worth, is that solar will continue to occupy the fancy of the public notwithstanding it is more expensive. It is easy to explain and relate to on an individual basis. We will probably see an increase in utility scale development dispite our intention here to encourage independent development.

SMITH: A second area of focus is around customer engagement. Is there any indication of how California utility customers are embracing smart meters and the project of additional automation? We have seen a number of pilots that have had mixed results.

BOHN: By and large smart meters are being accepted as routine, notwithstanding the various and quite visible reactions in the press that you have read about. But the benefit to the consumer is not obvious yet, that is, the ability to really control usage to save money. There are popular issues such as the alleged impact of EMF on customers, much the same way it was discussed with cell phones. Those fears will need to be addressed and dealt with, just as the concerns about accuracy have had to be explored.

SMITH: California is generally regarded as a leader in smart energy. In your opinion, what are the one or two key regulatory issues that will drive change in California's utilities? This of course could possibly apply to other states, as well.

BOHN: We have already dealt with a number of the key issues that inhibit moving to smart energy. De-coupling took place years ago. We have at the PUC provided subsidies for various solar projects and have been very vocal about the policy reasons to move in this direction. We have an advantage because the public is pretty much on our side. If and when practical storage technology becomes available on a large scale, it will permit real strides into the area of distributed generation. Another key issue is the use of tradable renewable energy credits which if done appropriately, can broaden our spending decisions to a regional basis, saving us all a lot of money in the process.

SMITH: While attending Smart Energy International, you had opportunities to meet and chat with many industry colleagues. Any surprises in terms of how they are moving forward with the many challenges confronting utilities today?

BOHN: No real surprises but I didn't have an opportunity to spend any time at the exhibits. I make it a practice when I can to attend trade shows and exhibits just to try to see where the industry and the technology is. I am constantly amazed at how fast it is moving. But a cautionary note is in order: Watch China.

SMITH: Finally, if you could look into a crystal ball, where do you see the most profound and lasting impact of the smart grid and related smart energy technologies twenty years from now?

BOHN: My sense is that energy delivery and information delivery will blur together. It is hard to imagine that with an explosion of information and communication technologies coming as it is, that the management of the energy utility of the future will look much like it does now. Each side of this debate has much to contribute to efficient and reliable energy use, in the overall interest of the United States. Twenty years might even get us a national energy strategy.

Thanks, Commissioner Bohn. We appreciate both your keynote address and your taking the time to discuss smart energy with us today.

Interview with

JAMES AVERY
SENIOR VICE PRESIDENT, SDG&E

SMITH: Thank you for delivering the opening keynote presentation in San Jose. Your comments about the state of smart energy were spot-on. Can you tell us about how San Diego Gas & Electric is incorporating energy sustainability into its overall plans for the future?

AVERY: We are pursuing energy sustainability on a number of fronts, including renewable power construction and acquisition, energy efficiency programs, smart meter and smart grid technology and getting our local market ready for electric vehicles. We are committed to obtaining 33 percent of our electricity from renewable resources by 2020 and we've already installed more than 1.3 million smart meters in our service territory. These meters will give our customers a chance to exercise even more control over their energy use and reach new energy savings records. Over the past 20 years our energy efficiency program has saved more than 4.2 million megawatt-hours, about enough electricity to supply 655,000 homes for a year. We're the nation's leader in solar rooftops with more than 10,000 installations that generate about 80 megawatts. Another key player in our sustainability program is the Sunrise Powerlink, an approximately $1.9 billion transmission line project that, when completed in 2012, will bolster our system's power reliability and will help bring in solar, wind and geothermal power from California's Imperial Valley. We're also on the leading edge of the national rollout of electric vehicles and we're working with suppliers to make sure San Diego is plug-in vehicle ready to support them as they begin to arrive later this year. There's a lot going on.

SMITH: A second area of focus is around customer engagement. Is there any indication of how SDG&E's customers are embracing smart meters and the project of additional automation?

AVERY: Education and outreach are the keys to a successful smart meter rollout and our customers have been very receptive to the concept of understanding their energy usage to save money. We're collaborating with Google on their "Google PowerMeter" to give SDG&E customers choice, control and convenience in how they access and view their energy usage. Studies show a 5 to 10 percent reduction in energy usage with customers that leverage such data.

SMITH: Since SDG&E is in California we would be remiss if we did not ask you about the regulatory climate. In your opinion, what are the one or two key regulatory issues that will drive change in California's utilities? This of course could possibly apply to other states, as well.

AVERY: We currently have a constructive regulatory environment implementing the environmental policies of our state. Regulatory issues that will drive change in the future are smart grid and smart meter issues and greenhouse gas reductions. Other statewide issues include Proposition 23, the November California ballot initiative seeking to suspend AB32, the state's landmark global warming law. AB32 requires a reduction in greenhouse gas emissions in California to 1990 levels by 2020. There are also rulemakings at the commission on Alternative Fuel Vehicles and the Smart Grid that will determine how utilities move forward in these important areas.

SMITH: While attending Smart Energy International, you had opportunities to meet and chat with many industry colleagues. Any surprises in terms of how they are moving forward with the many challenges confronting utilities today?

AVERY: I think the common denominator we share is the excitement within our industry as renewable energy, smart grid technologies, electric vehicles, energy efficiency, customer choice and communications converge.

SMITH: Finally, if you could look into a crystal ball, where do you see the most profound and lasting impact of the smart grid and related smart energy technologies twenty years from now?

AVERY: The utility business has begun its most remarkable era. With the rapid changes in technology we are looking at a major transformation of our industry that can be compared to where the communications business was in the 1980s when IBM typewriters were being replaced by desktop computers. The scope and complexity of the changes will take some getting used to, but we are committed to helping our customers make the transition as smoothly as possible. I foresee a greener, more sustainable future where customers will have more information, more control and more choices over their energy use. There are many opportunities beyond the delivery of gas molecules and electrons. We are charting new territory and welcome the possibilities and the challenges.

Thanks, Jim. We appreciate both your keynote address and your taking the time to discuss smart energy with us today.

Energy Sustainability

How will the Integration of Renewables and Electric Vehicles into the Grid Happen?

Integration of renewable sources of power was the source of questions for many who attended the conference and Lee Krevat, Director of Smart Grid at San Diego Gas and Electric (SDG&E) outlined their approach to integration. The integration of renewables is a primary challenge of the smart grid and success in this area leads to significant consumer benefits. Conversely, failure will threaten the entire promise of the smart grid.

SDG&E is being proactive in this area and spending a great deal of resources examining their distribution system to determine its adequacy for handling the growing footprint of rooftop solar systems and the pending growth in electric vehicles. More specifically, Krevat notes that they are taking information from smart meters and mapping it to the load profile of their transformers to help determine adequacy. Similarly, they are pursuing expansion and modernization of their SCADA systems and additional deployment of phasor measurement units (PMUs). In addition to helping solve the integration issues, these technologies will also provide SDG&E a great foundation for asset monitoring and the use of predictive maintenance to resolve asset impairment issues before they happen.

Smart Grid Policy: The California Perspective

The alignment between federal and state regulation is an important component in the development of the smart grid. In many regulatory jurisdictions, there is a lack of alignment; in others, moderate alignment and in a select few – like California – there is strong alignment. Because of the interdependence between state and federal jurisdictions and, of course, the needs of the utilities that operate in those jurisdictions, alignment is necessary to provide clarity and cohesion to the construction and maintenance of our electric infrastructure.

Armando Infanzon, Smart Grid Policy Manager at SDG&E, notes that there is strong alignment between the Energy Independence and Security Act (EISA) of 2007and California's Senate Bill 17 (SB 17), which was passed in October 2009 and became the first statewide smart grid bill in the U.S. But there is also one important distinction in that California added the words "cost effective" to their parameters whereas the EISA is silent on the issue of cost effectiveness. It is an important distinction and likely reflects the proximity of the rate payers to the California regulators.

An Information System for Deploying Charging Stations

Considerable thought and planning is underway to address the infrastructure challenges of electric vehicles. Utilities are busy examining their distribution systems to ensure that they can handle the capacity that will be created by the additional load. Another piece that is receiving attention is the build out of charging stations that would be necessary to support our mobile society. Determining the best location for charging stations is not easy and due to the expense involved with building these, there is a great deal of pressure to get it right the first time.

Diego Klabjan, Associate Professor of Industrial Engineering and Management Sciences at Northwestern University, is one of the people working to help solve this problem. Klabjan and his team, with funding support from the Department of Transportation, are developing an "Information System for Deploying Electric Vehicle Charging Stations." Klabjan indicates that the system will use complex logic and analytics based on information about electric vehicle demand and purchases, electric infrastructure, traffic patterns, business locations, available parking, simulation capabilities and a number of other factors to produce recommendations regarding locations for charging stations.

Overview of PG&E's Efforts to Prepare for the Arrival of the Electric Vehicle

What are the challenges posed by the arrival of electric vehicles? Saul Zambrano, Director of Integrated Demand-side Management Core Products at Pacific Gas and Electric (PG&E) explains that an actively charging electric vehicle with an electric load of about 6 kW is about three times the average home peak of around 2 kW. The reason this is important is because an average pole top transformer, which supplies to an average three to five houses, can only handle 10 kW passing through it. The consequences of even just two electric vehicles actively charging on the same transformer are obvious.

Utilities have only a limited time in which to sort out not only the standards for communication, sockets, etc., but also to put in a control system to stagger these charging loads, and perhaps install a separate meter in each house for the vehicle charging, and figure out new billing methods, and get all these major changes approved by the PUCs.

Perhaps low adoption rate and differences in peoples' lifestyles may stagger the charging automatically and give utilities some more time, but only time will tell.

Seizing the Smart Grid Opportunity

Ed May, Director Product Marketing for AMI &Smart Grid at Itron, stresses the need to make customer education an important part of any smart grid rollout and not to underestimate cyber security issues.

He underscores the need to have open standards and emphasises that a patched-together solution will fail. He notes we are at the beginning of the smart grid rollout and we will need different ways to do business and unprecedented collaboration, along with a realistic vision of the smart grid, to be successful.

The Largest Carbon Market. What Have We Learnt?
Alex Desbarres, Senior Renewables Analyst at Datamonitor, talked about the carbon market and the cap and trade policy in Europe, which is theoretically sound and technology neutral. However, practically, it is subject to political concessions and thus not credible. It needs price control mechanisms. Currently there are multitude prices for carbon due to many policies which distort choices.

Private investments in the U.K. in the cleantech sector dropped from $510 million in Q1 to $175 million in Q2 in 2010. However, a bad policy in a bad economic landscape did not kill renewable policy. Investment levels in renewables only dropped by 6% in 2009 and the U.K. renewable energy markets are still capturing premium rates.

Solar and Renewable Energy Connectivity
John Nunneley, Executive Director of the Sunspec Alliance, talked about renewable energy connectivity and how information technology and computer networking are key enablers for distributed power generation and the solar electric market.

Advancements in semiconductor technology, combined with rapid innovation in the solar component industry, are driving down total system costs and increasing total energy output of solar power plants. Connectivity advancements are pushing communications into more devices utilizing wired and wireless technologies.

Achieving Sustainability Through Integration
Victor Brown, Product Marketing Manager of BPL Global, introduced their future vision of the grid and grid optimization. According to a measure of evolution based on a civilization's ability to harness energy, there are three types of civilization, of which we are type 0.

A few statistics related to the grid today along with the challenges that present themselves were shared, followed by a vision of the Future/Integrated Grid – one which is reliable, available, efficient, environmentally friendly, secure, and sustainable. Technologies necessary to realize "The Integrated Grid" include storage, communications, load reduction and integration of distributed generation.

Role of Energy Storage in Smart Grids
Pramod Kulkarni, Program Manager Industrial Energy Efficiency at the California Energy Commission, reviewed how the grid will need to evolve, going forward to accommodate intermittent renewable and distributed power sources and the role of energy storage technology.

There is a symbiotic relationship between the smart

grid and energy storage. The smart grid enables storage to serve more functions and be economically viable. Energy storage provides the ability to inject energy to enable resiliency, reliability and efficiency. Different storage technologies are suitable for different applications and modularity, multi-functionality, different ownership and business models and the ability to serve multiple markets can make storage affordable.

Smart Grid's Potential for Clean Energy
Christine Wright, Senior Analyst at the Public Utility Commission of Texas, highlighted various achievements in Texas, including meeting Renewable Portfolio Standard requirements ahead of schedule, being number 2 in the nation in carbon emissions reduction, and aggressively adding wind generation capacity (12 GW by 2014).

Texas has a two-prong solution to solve challenges in integrating the new renewable sources of energy, First is the Texas Renewable Integration plan (TRIP) that will coordinate activities by ISO, grid operators and anyone related to grid to make sure it operates efficiently and reliably. Second is the Competitive Renewable Energy Zones (CREZ), which will add transmission capacity of about 18 GW in areas where the wind is abundant.

Texas is different from other states in terms of having a central gathering of data from smart meters and making it available to customers on one website (smartmetertexas.com).

Investing in Smart Microgrids as a Viable Approach to Grid Modernization
William Torre, Chief Engineer at San Diego Gas & Electric, gave an update on the company's microgrid demonstration located at Borrego.

This project is over 50% IT related and the engineering design phase is just finishing. It contains distributed generation, renewable power, battery storage, automated switching technology and smart meter data and other grid optimization like Volt/VAr optimization. However, it does not contain community storage. This project is remotely located and the goal is to demonstrate that it can operate in isolation reliably.

This is only one of many microgrid demonstration projects across the U.S., but it is the largest in terms of DOE funding and MW power involved and covers about 100 homes. SDG&E is providing some equipment but not smart appliances. It will be fully functional by 2012.

Operational Excellence

A Look Inside the Pecan Street Project

How are utility operations fundamentally changing due to the new reality with renewable resources and smart grid? This was the theme for the first sessions of the Operational Excellence track, which began with John Baker, Chief Strategy Officer at Austin Energy, highlighting some of their achievements in the clean energy sector.

One of the surprising new challenges to the utilities he mentions is what he calls the "Chindia effect." The rapid increase in demand in these and other developing countries is putting price pressure on not just oil but many other components like reclosures, substation equipment, etc.

To confront this new reality Austin has a demonstration called the Pecan Street Project, in which they are testing various technologies and systems. How utilities will adjust from a 40+-year upgrade cycle to perhaps 10 years or shorter remains to be seen. In addition to this utilities will face workforce challenges as experienced employees are retiring.

The Future of European Demand Management and Retail

Maher Chebbo, Smart Grids Chairman of WG3 of the European Union, in a video linked presentation, then elaborated on how European utilities are facing similar challenges and how they are adapting to the new reality.

A surprising fact is that non-technical losses were the reason for distribution automation in Italy. Chebbo notes that it is interesting to learn that once the sensors and communication networks are in place to get the grid data to a SCADA, the energy management problem reduces to one of information management.

Substations, PoleTops and Bits & Bytes: Operational Excellence in the Digital Era

The operational benefits of the smart grid are, perhaps, the most noteworthy. Interestingly, they are also the least discussed. A panel consisting of Louis Fusco, Director of Engineering and Technology for PG&E, Jim Cherrie, Director of Deployment at Edison SmartConnectTM, Southern California Edison, and Bradley Tips, Product Line Manager from Cisco, provided an excellent overview of the impact smart grid technologies are having on utility operational practices.

All panelists agreed that technologies currently being deployed significantly increase situational awareness on the grid, help operators visualize performance in real time and aid in the efficient operation of the grid through advanced alarming and system warning capabilities.

Beyond those features, grid operators find comfort in knowing that decisions regarding switching and routing of power during peak times, or during emergency situations, can now be performed with the benefit of real-time information and analytics.

Although smart grid technologies have not yet been widely adopted throughout the industry, the benefits of these technologies, as explained by Fusco and Cherrie, clearly demonstrate that there is a lot of "low-hanging fruit" to be harvested by grid operators. Additionally, as Tips pointed out, Cisco continues to invest heavily in the utility industry, which will help ensure that information on and about the grid can be routed to those who can benefit from that information.

BSES Delhi Smart Grid Roadmap

The benefits of smart grid technologies largely depend on the key issues a utility is trying to solve. Rajesh Bansal, Additional VP at BSES Delhi, reminded the attendees that while utilities in the U.S. are seeking benefits associated with energy sustainability, customer engagement and operational excellence, other parts of the world are seeking to solve more rudimentary operational issues such as power reliability, theft, significant growth and customer trust. As Bansal pointed out, BSES in Delhi, India is making great progress in resolving these issues while simultaneously laying the groundwork for a comprehensive smart grid implementation.

When a utility is looking at ways to grow load from 2,800 MW to 4,760 MW while also reducing theft rates from levels as high as 62% and improving overall power availability and reliability, there is little choice but to examine new ways of doing business. BSES looked to smart grid technologies such as SCADA, DMS, AMI, and GIS to help resolve these issues.

More specifically, BSES has achieved significant improvements in power availability and reliability, accomplished 100% load growth in 5 years, reduced theft to 17% and is also improving customer relationships and engagement. One particularly noteworthy approach is their configuration of a distribution transformer automation system, including pole metering. This system reduced burning rates for transformers, optimized loads to reduce losses, provided for online power availability and load factor information and improved security monitoring.

The Complexities of Operating Five Million Smart Devices

Jim Cherrie, Director of Deployment Edison SmartConnect at Southern California Edison (SCE) started out with an update on the Irvine Smart Grid Demonstration Project and how it is helping to prove or disprove some of the assumptions regarding scalability and interoperability made in the smart grid rollout. The project will only be fully operational by 2014 but it is already helping validate the interoperability of emerging NIST and NERC standards.

Cherrie comments on SCE's deep involvement with Itron, even in the design phase, and how this has helped them successfully roll out 5 million smart meters without a major hitch. Most utilities are good at deployment of the

meters but what they should also not ignore is minute details on the operations side and scalability, Cherries says. Again very deep involvement with vendors is necessary for achieving this to the point where vendors feel uncomfortable. It is also important to keep the design and test groups separate.

Some of the challenges of doing such a large scale project in-house include changing the nature of the workforce in terms of the expertise required. Also crucial is the use of visualization software, without which it is hard to keep track of 5 million nodes.

Smart Grid Implementation: A Strategic Roadmap Discussion

Eric Dresselhuys, Chief Marketing Officer of Silver Spring Networks, discussed key elements of a successful AMI rollout, reminding everyone not to forget the human element. A project of, for example, SCE's proportion affects every single person in the utility and one needs to consider how they will adjust to this transition.

There are many standards and the industry is working on other standards, but these will always evolve. One need not wait for the ultimate standards to solidify.

Intense customer involvement is also key to successfully rolling out AMI.

The Smart Grid and Multi-Tier Communications

Rob Conant, SVP Network Products at Trilliant, commented on how the focus of grid automation has changed over the years, starting out as simple meter readings and evolving to more complex applications like demand response, voltage/VAr optimization, feeder reconfiguration, etc.

Strategies for Real Time Grid Optimization

Appliances in the home account for significant load and also present a large potential for grid optimization. In his presentation on "Strategies for Real Time Grid Optimization," Tobin Richardson, Director of Smart Grid for the ZigBee Alliance, cited a 2009 study by Hammerstrom & Pratt, PNNL, which estimated that eight home appliances, including water heaters, air conditioners and dryers, result in 10 larger generator plants worth of load being added to the grid each year. This presents utilities and consumers with a great opportunity for optimization.

By utilizing intelligence at the appliance level, such as within an air conditioning unit, utilities and consumers are able to communicate with the devices and cycle them on or off as power availability and cost, as well as customer preferences, warrant. By doing so, utilities can aggregate smaller loads to increase the overall resources available in traditional demand response programs. In short, the increasing use of intelligence at the appliance level will provide greater ability to influence overall load curves and help shift load from peak to off-peak, thereby saving consumers and utilities money. This can all be accomplished through the use of a home area network (HAN) that communicates with the various appliances and with the utility's smart meter, or through a different gateway or router.

This, of course, is just one example of grid optimization possibilities that Richardson cites. Other examples include sophisticated load purchasing and balancing programs, intelligent distribution management systems, time of use rates and participation from commercial and industrial customers in load shedding and demand response programs, to name a few.

Energy Strategies and Efforts Around Standards and Technology Alliances for Smart Grid

An intelligent grid must be able to communicate with itself and with related technology systems. The development and adoption of consistent technology standards will help ensure that the systems deployed on the grid are capable of passing and receiving information from other devices, which promotes the overall objectives of the smart grid. This topic was the subject of insightful dialogue by panelists Henry Bailey, Vice President, Industry Solutions Group, Service Industries, SAP, Tobin Richardson, Director of Smart Grid, ZigBee Alliance, and Jonathon Booe, Staff Attorney and Smart Grid Activity Lead, North American Energy Standards Board.

Technology adapts and becomes more sophisticated through time and smart grid technologies will be no exception to that general rule. The development of standards that underlie them must be flexible enough to support advances and market competition, yet firm enough to ensure functionality, security and interoperability. This is a very important component of smart grid development and is no easy task, which is why the Energy Independence and Security Act of 2007 (EISA 2007) called for the development of smart grid standards.

While final standards have not yet been promulgated for all technologies inherent to the smart grid, the panelists offered some key insights and reminders. Bailey indicated that we should monitor what is happening with European standards and see if there is anything that can be emulated. Booe offered helpful reminders about the openness of the standards development process and the importance of becoming familiar with what is transpiring. Richardson encouraged participation in the process, including reviewing drafts that are published.

Customer Engagement

Making the Customer Experience Seamless

The customer engagement track was kicked off by Carl Johnson, Strategic Planner for Oklahoma Gas & Electric, who presented their first demand response program and first smart grid pilot project in the City of Norman, Oklahoma's first smart grid community. One of the critical elements, which determined the success of the project, was their ability to effectively partner with the customer through customer communication and transparency.

Results of the pilot project were shared which increased customer energy awareness and reduced participants' bills by 11%. Many also made investments in efficiency and all participants changed their usage behavior.

Burbank's Experience of MDMS from Concept Through Implementation

Theresa Kaczmarek, Manager Customer Service at Burbank Water & Power, discussed the deployment of their MDMS project to improve the company's conservation programs and energy management.

Kaczmarek outlines three project phases: Meter-to-cash functionality, OMS/remote connect/disconnect, and completing AMI/DR and DMS. Key lessons learned were that the CIS to MDMS interface has significant development work even if the two vendors have worked together before; to plan for 12-14 months from project start to "go live"; and loading all of electric and water meter read history in one blast may create some database issues.

Privacy by Design

Eugene Kim, Policy Analyst in the Information & Privacy Commissioner, Ontario, talked about the impact smart grid would have on customer data privacy, covering topics including data ownership and how utilities should see data privacy as an aspect of CRM to avoid privacy risks such as unauthorized access and potential insider threats.

The message was that benefits of the grid can be achieved without compromising privacy. This can be done through data minimization: if you don't need it, why collect it?

Demand Side Management and Smart Grid

Dale Pennington, Managing Director of Utiliworks Consulting, wrapped up the day's last session by sharing insights on the cost-benefit model for DSM and the factors a utility needs to consider to address DSM issues. Who controls the power and pays for DSM – customer or the utility? – is a key question.

Achieving stability in each phase of a project is key to DSM success.

Delivering on the Promise of Customer Engagement

Utilities continue to wrestle with how best to communicate with customers when it comes to automation initiatives, specifically with those related to smart meter deployments and other smart grid initiatives. With the benefit of lessons learned by early adopters in California, Texas and Colorado – to name but a few – utilities are approaching future deployments with a renewed focus on communications with customers. More specifically, utilities have learned that customer centric education and communication initiatives will go a long way toward increasing customer engagement in smart grid initiatives.

This topic was the subject of a presentation by Sean Harrington, Director of Client Solutions at OPower. According to Harrington, there are several things utilities can do to increase the likelihood of successfully engaging their customers. They are:

- Be proactive – don't expect customers to take the initiative
- Engage all customer segments – use all channels to reach everyone
- Target messages – circumstances vary widely, so try to present only what is relevant for each customer
- Present insights, not data – most customers will not notice patterns in consumption, present them the "so what" so that they can understand how they benefit
- Make it interesting – applied behavioral science can make mundane energy data more interesting and, in turn, more likely to be acted upon.

Of course, part of the promise of the smart grid is to help customers to achieve real savings in their energy consumption and related costs. Additionally, utilities also benefit from more efficient production and provisioning of energy resources. By using proper messaging, utilities can help increase the likelihood that the benefits of the smart grid are available and achievable to those who engage.

The suggestions offered by Harrington are a good

reminder that customer engagement, while sometimes difficult, can be accomplished with a focused effort. Utilities are well served to consider these suggestions, especially with those customers who may not share the same understanding or level of enthusiasm about smart grid related investments.

Municipal Utilities Leverage Broadband AMI
Larry Owens, Manager Customer Service at Silicon Valley Power, talked about how they have leveraged broadband AMI through the utility communication infrastructure. They built a communications system on the backbone of a fiber optic network which made everything virtual in Silicon Valley. This has helped the community achieve its objectives as City departments moved to a mobile workforce.

The presentation also outlined dynamic system modeling and the importance of microgrids to manage data effectively and enable technology, resulting in SVP achieving the highest reliability in Santa Clara. Network security issues were also addressed by multiple SSIDS, encyrption, passwords and layers of walls embedded in the network.

Integrating Customer Engagement into AMI Implementation Planning
Kevin Cornish, Executive Consultant of Enspiria Solutions Inc., started off by highlighting gaps in traditional utility-consumer communications for AMI deployments. Customer communications must move to a customer engagement focus as AMI projects are highly visible and increase customer awareness.

The presentation addressed proactive and innovative approaches to utility AMI/smart meter project implementation planning that seeks to maximize consumer engagement at the lowest project risk. Consumers currently don't understand why they are getting a new meter and smart meters don't always lower bills due to rate changes. Privacy issues are also gaining more importance. Both data and tools must be provided to ensure ease of use and provide value to the customer. Cornish concludes that happier consumers would positively impact the benefits realization and AMI business case.

Customer Engagement: New Metric for Utility Success
Tim Roughan, Director Distributed Generation for National Grid USA, wrapped up the last session with a discussion on designing customer management systems for smart grid. The presentation discussed why customers had trust issues due to lack of understanding of their bills and clarity on what's in it for them.

The connection between the utility and the customer has to be built. Pricing structures such as index pricing can also save customers at least 20% on their energy bills. Messaging is also important when conducting customer outreach. Young people are using social media tools and therefore the strategy needs to be technologically savvy to connect with the customer group. The goal is to achieve 5% reduction in peak energy and while energy efficiency budgets have increase, paybacks are slower due to lower prices.

Looking Back, Moving Forward: Steps to Align the Industry for a Sustainable Future

Meeting regulatory targets related to the smart grid and energy efficiency is not an easy endeavor. It requires cross-functional coordination with utilities, engagement with customers, deployment and use of sophisticated technology on the grid and, of course, new ways of doing business. A panel discussion moderated by Andy Zetlan, Smart Grid Solutions, Telvent, titled, "Looking Back, Moving Forward: Steps to Align the Industry With Regulatory Targets, Meet Consumer Needs and Leverage Technological Advancements for a Sustainable Future," addressed these topics from the perspective of PG&E. Dan Pearson, Manager of Asset Strategy, David Rubin, Director of Service Analysis and Nick Ho, Sr. Manager, Enabling Technologies, served as panelists.

The PG&E team acknowledged that most customers have not asked for renewable power, demand response or really any smart grid related investments. As a practical matter, this poses customer engagement issues, especially when financial savings are unclear. Nevertheless, PG&E, Ho notes, is working diligently to help customers identify the potential benefits and more effectively manage their consumption to save money.

On the operating side of the equation, Pearson notes that customer load changes have a significant impact on the distribution system. So, as PG&E achieves greater participation in demand response and renewable energy programs, the complexities associated with operating their distribution system increases exponentially. Among other things, PG&E is evaluating the capacity and configuration of their system to ensure they can accommodate the load changes. On the analysis side, Rubin notes that participation in photovoltaic systems is growing at a rate of approximately 7% and that they already have 43,000 units, which contributes to the operational complexity. It is unclear at this point if decreases in consumption due to demand response programs are sustainable through time, or if they reflect short term behavior changes on the part of customers. Those responsible for producing and provisioning power need to be prepared for either alternative, which adds yet another layer of complexity.

Despite these complexities, it is clear that PG&E, and many other utilities, have great people working to align the industry with regulatory targets.

SMART ENERGY STORAGE SUMMIT

"The Megawatt Era Begins"

For most of his career, Stephen Clarke, CEO of Applied Intellectual Capital, says he was perceived to be toiling in the backwaters of the energy industry.

As a self-confessed "battery guy," he admits, "I was not the guy to stand next to at a cocktail party." But with the rise of interest and deployment of new energy storage technologies over the past two years, Clarke now reports, "This year I am!"

The energy storage industry is on the move after years of experiments and small projects, according to speakers at the Smart Energy Storage Summit. The panels and presentations were uniformly upbeat, with the word "bullish" being spouted by more than one presenter.

"It's true," says Dr. Imre Gyuk, Program Manager for Energy Storage at the United States Department of Energy, the keynote speaker for the event. "We're moving toward multiple megawatt projects. Finally, we have people in authority who know the words 'energy storage' and know what it might be good for. It's a completely new attitude."

A basic definition of energy storage is media that store some form of energy for use at a later time. The methodologies for achieving it differ, including batteries, flywheels, pumped hydro (using water), thermal storage using ice, compressed air (commonly known as CAES) and hydrogen, among other tactics. All of them have a place in the emerging energy storage world, Gyuk says.

"We can't declare a winner," Gyuk says. "A good number may find appropriate niches, and some may drop out."

Thanks to the American Recovery and Investment Act, some $200 million is being deployed by the U.S. government into various energy storage projects. "We are moving from 2 MW systems to 20 MW systems," Gyuk says. A key to continued growth, he adds, will be the passage of an investment tax credit now under consideration by the U.S. Congress.

But the government is not alone in its backing. "There is a natural alliance between storage and our business models," says Mark Kapner, Senior Strategy Officer at Austin Energy. "We see storage as another tool."

What's holding storage back from a full blown and unequivocal eruption, though, are perceptions that there are cheaper ways to achieve the same result. "The markets are not well structured to drive adoption," says Marianne Wu, a partner in Mohr Davidow Venture Capital. "From the VC perspective, it's a massive opportunity. From the early market structure risk, it's messy." Right now, Wu says, there is a lot of activity on the edges, where vendors are exploring adaptations on the edge of the grid.

Concerns that deploying new technologies could affect customer rates are causing some hesitation, says Jim Pope, General Manager for the Northern California Power Agency. He called for more research and development funding, and later voiced concerns with scalability and whether there is a market for storage deployment, given that some feel that demand response and other services can effectively manage power loads without the cost of installing new technologies. To put it another way, venture capitalist David Wells of Kleiner, Perkins, Caufield & Byers says his firm is focused on "price, price, price, price, price," although they are strong backers of energy storage.

Still, with mandates for increased percentages of renewable energy use in state energy portfolios driving adoption of storage technologies that can capture intermittent energy like wind and solar for dispatch on demand, storage companies are on the move.

Frank Ramirez, CEO of Colorado company Ice Energy, which offers a thermal storage solution, says his company is "transitioning from an R&D company to an operating company," citing a new deal with the Southern California Public Power Agency for retrofits and replacements for their cooling systems using Ice Energy's "Ice Bear" technology. Ramirez sets the company's projected storage capacity at 100-150 MW in 2011, doubling that in 2012.

NYSERDA, a public/private consortium in New York State, is already funding 20 storage projects, including a 130 MW CAES pilot. "We're looking for technology breakthroughs," says transportation/energy systems Program Manager Richard Drake, noting that NYSERDA recently funded $11 million in research projects.

The expected move into the market of a huge number of new all-electric vehicles should have a "dramatic impact" on how customers view energy storage, says Barbara Lockwood, Director Smart Grid for Arizona Public Service. That challenge and the possibilities of selling stored energy back to the grid should open new opportunities for utilities and others to incorporate more storage into their energy mix, she says.

While the existing United States grid is "messy, huge, non-uniform and old," according to venture capitalist Maurice Gunderson of CMEA Capital, the firm is confident new storage projects will soon emerge under their guidance. And it's just in time, too, as some speakers cautioned that the United States is falling behind other countries in deployment of storage technologies.

But perhaps the best news to come out of the Smart Energy Storage Summit is that energy storage isn't that hard a sell, says Craig Kuennen, Director of Smart Grid at Glendale Water & Power. "We have no trouble finding customers who want it on their building," he says.

The Smart Grid Operates in Real Time, and So Should Your Meter Data Management System

Our mission at Aclara® is to help you and your customers harness the power of the smart grid. We aim to make the massive amounts of information generated by meters and other energy devices useful to utilities and their customers in real time.

"One of the giants in the industry covering the entire meter data life cycle, Aclara touts a comprehensive suite of applications and an MDM system with a versatile architecture."

Chartwell Smart Grid Research Series: Meter Data Management Systems, August 2010

Data: A challenge and Opportunity

We think of the smart grid as a continuous highway of power and information – sending millions of data points and electrons from the utility, to the customer, to the meter, and back. Meter information should flow in real-time and utilities and consumers should be able to use the data in a meaningful way.

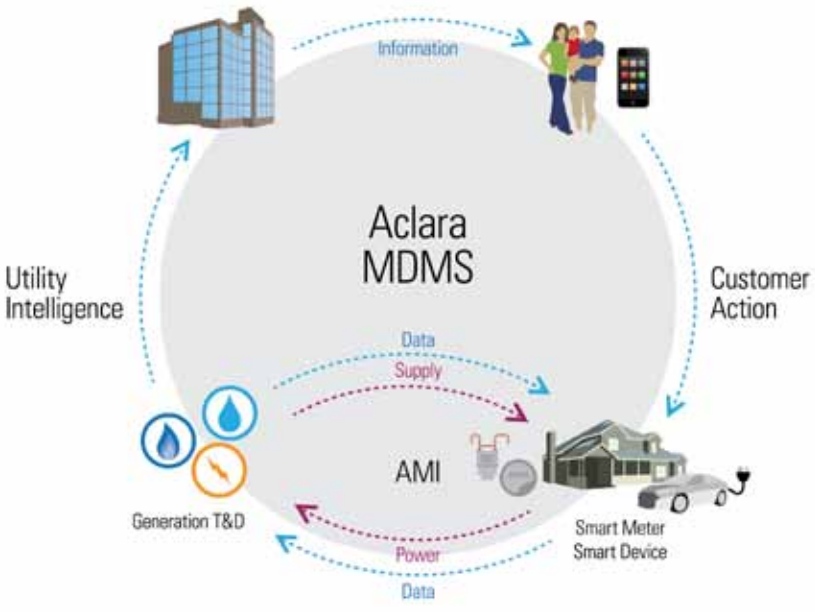
There are two challenges in achieving this vision. First, collecting, analyzing, and converting the massive amounts of data into useful information and putting it to work are large and complex tasks. Additionally, for the grid to be smart, consumers must understand how to benefit from the powerful information available to them. Utilities have to educate, encourage, and enable millions of customers to understand the grid's potential and to take advantage of its benefits.

For years, IOUs, cooperatives and municipalities have turned to Aclara to cost effectively make sense of complex energy information for utilities and their customers. Today, over 100 utilities across the country and 75 million utility customers rely on Aclara for energy analysis. Aclara's applications are proven, scalable, and the most widely used of their type in North America. At our core are superior analytics. Through analytics and integration we bring intelligence to utilities and help create smart customers, who understand, appreciate, and can reap the economic and practical benefits of the smart grid.

The Power of Meter Data Management Systems

Utilities are increasingly turning to meter data management systems (MDMS) to control the massive amounts of meter data coming from advanced metering infrastructure (AMI) deployments. An MDMS serves as the central hub to a variety of utility departments and applications. An MDMS should be capable of sorting, storing, aggregating and delivering millions of interval data points into various, desired formats for a whole host of back-end uses. In addition, many departments are looking to the MDMS to provide a deeper understanding of customer behavior and to strengthen the utility-customer relationship.

The Aclara MDMS is a full featured meter data management system with a scalable and flexible data structure, which forms the basis of our solution. The system addresses any and all commodities – including electricity, gas, and water. It also can handle any unit of measure and any data type, including SCADA data and AMI event data. In addition, the MDMS supports higher level analytics such as revenue assurance, distribution analysis, load aggregation, and forecasting.



Aclara's MDMS sits at the center of a dynamic highway of power and information. The Aclara MDMS monitors and makes sense of energy information, and provides utilities with the intelligence to better manage their AMI infrastructure, as well as enable their customers to make smart energy decisions.

According to Greentech Media, Aclara is the only provider top rated in all of the following categories:

Vision	★★★
Ability to Implement	★★★
Focus on MDM	★★★
Financial Strength and Stability	★★★

Greentech Media: Meter Data Management Research Report, August 2010

Integral to the Aclara MDMS is powerful validation, estimation and editing (VEE) functionality, which ensures that all business applications are run upon complete, thorough, and accurate interval data. Billing functions are also at the core of Alcara's MDMS. The MDMS can accurately and quickly calculate billing determinants. Unique among core MDMS features is Aclara's support for complex rates, including critical peak pricing, net metering, and other advanced programs that you may consider.

The Aclara MDMS was designed specifically for high-volume, automated processing of interval data, whereby data anomalies, estimations, and billing determinants can all be processed based on easy to define business rules.

Get More from Your AMI Data with Aclara

The functionality of the Aclara MDMS derives the right value from your AMI data to support your business cases. Simply put, Aclara MDMS delivers on the promise of AMI. Our success can be attributed to:

- Scalable architecture
- Breadth of applications.

The infrastructure that we deploy to our clients supports the breadth of Aclara's applications and is well suited to handle the massive volumes of data coming from your AMI meters. Energy companies that use our system find it is:

- Flexible, automated, and interoperable - Our SOA services are easily reused and can be rapidly assembled into new, composite applications. They provide standards-based message format and integration capabilities such as CIM and MultiSpeak®, to allow improved interoperability between various applications.
- Scalable while secure – Ability to process fast flowing and high volume data across a secure transport mechanism.

Aclara's MDMS architecture allows you to do your jobs more efficiently through:

- Tighter control over your data
- Management capability in real-time.

Harness the Power of the Smart Grid

Integrated within Aclara's MDMS is a powerful suite of business applications that can drive business and customer intelligence for the utility. Aclara's business applications utilize hourly energy data and provide utility clients with enhanced revenue protection, complex billing, forecasting, load research, settlement, and customer service through a web-based portal as well as through the call center.

The Aclara MDMS is already being used to support real-time pricing, generating day ahead pricing alerts to customers, and enabling customers to see both usage and hourly rates. Customers can also understand the impact of different control strategies, for example, programming HAN devices, to respond to different rate levels based on temperature and customer preference. The Aclara MDMS will also support direct load control efforts through communications with both the AMI head-end system and with control devices implemented on the HAN.

The extensive analytics in an MDMS can help utilities capture lost revenue by identifying meter field challenges and energy theft. Revenue Assurance is an application at the core of Aclara's MDMS. The Revenue Assurance application manages loss of revenue opportunities, including energy theft. It is a powerful, iterative tool to mine large quantities of meter information stored in the MDMS to generate lists of suspicious accounts or meters that require further field investigation by a revenue protection team.

An MDMS can also reduce the risk when purchasing power, a large expense for utilities. Increased accuracy in forecasting load means less risk. Leveraging the detailed AMI data residing in Aclara's MDM, the Load Research, Forecasting & Settlement application uses sophisticated, statistically-based profiling methodologies to generate highly accurate forecasts. The module can forecast load for any time interval and enables analysis for potential customers under alternative scenarios. The application includes robust load profiling and aggregation engines that allow flexible segmentation analysis with meter data. The industry's most powerful profiling engine automatically applies profiles against any collection of meters for a variety of business purposes such as demand response baseline calculations.

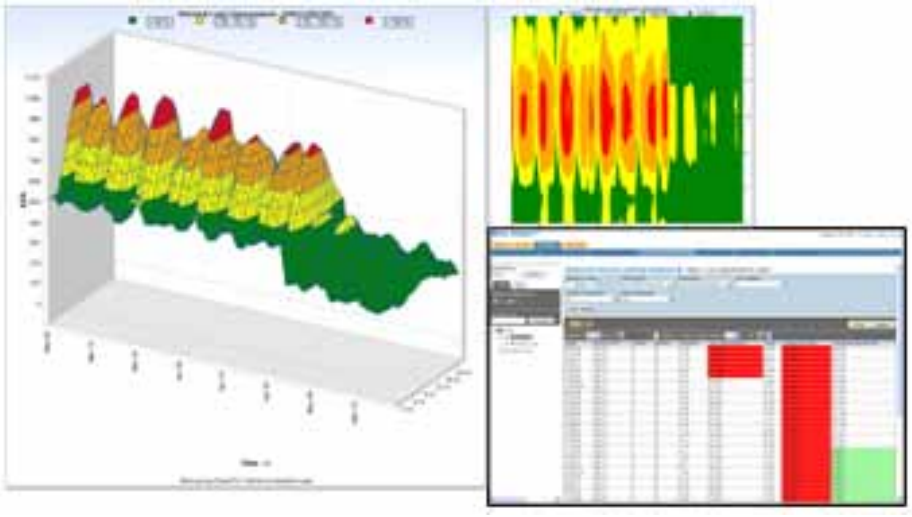
For your operations, Aclara has developed robust tools to improve asset management and operation planning. For example, the Aclara Distribution Analysis, used for distribution planning and transformer load management support, uses AMI data and leverages any available hourly interval data to create accurate hourly loadings across the system. The result is

accurate estimates of hourly usage for any point on the network, from substation to pole transformer. This information can help utilities avoid device failures and outages caused by overload, while also reducing capital expenditures by enabling more precise sizing and timing of planned system additions.

All of Aclara's applications provide you with a more holistic picture of your meter infrastructure, allowing you to make decisions faster. That means increased savings of time and money.

The Aclara MDMS Experience

Aclara is a leading provider of MDMS implementations to the utility industry. We provide the quality, scalability, and implementation and ongoing support that utilities and their customers require in an MDMS and in a partner. Aclara MDM solutions are backed by a world-class, customer service team that achieves significant implementation and ongoing support benefits. Aclara's implementation methodology focuses on proven and repeatable processes drawn from the best practices developed over years of meter data management implementation.



Avoid device failures and outages with Aclara's Distribution Analysis application, built upon Aclara's powerful MDMS

"Our approach was to provide them access to their daily and hourly energy information on the web. It was paramount that this information be easy-to understand and provide meaningful content to help them digest, compare, and manage their electric bills, and better control their energy use."

Robert M. Geneczko, vice president of PPL EU Customer Services.

In a recent Chartwell Smart Grid report on Meter Data Management Systems (August 2010), PPL Electric Utilities explains why an Aclara-PPL partnership was the right choice.

"At PPL Electric [Utilities], MDMS is a crucial part of the overall smart grid strategy. It is the tool that allows the utility to reap the business process benefits of having a smart grid system in place, and it is beginning to allow customers to become more informed about their energy usage habits. PPL's use of Aclara applications exemplifies the range of services offered in the MDMS. PPL uses the MDMS on a daily basis for VEE, loading data, time-of-use, and real-time pricing, billing, and transformer analysis. MDMS can validate and store data from systems like CIS, SCADA, GIS, weather, load research, weather, load schedule systems and other legacy systems to handle volumes of data.

"Aclara matched best with the functional and technical requirements of PPL, but it also excelled in other factors important to PPL, which included system implementation procedures, vendor viability, and vendor partnership. The vendor had to be someone PPL felt could grow with the utility as the project went on and would still be a leader in the field at the end of the project as well as the beginning."

PPL currently uses the Aclara MDMS to process data from over 1.4 million hourly-read AMI meters. In addition, PPL uses the Aclara Bill-to-Date and Load Analysis applications to display relevant energy information to their customers. Since partnering with Aclara, customer satisfaction has improved, and traffic has increased on the utility website.

"To maintain high levels of customer satisfaction, we needed a way to educate our customers so they could better understand how they were using energy," said Robert M. Geneczko, vice president of PPL EU Customer Services. "We wanted to reinforce our relationship with our customers as trusted energy advisor and to provide customers with new services and options to better manage their energy costs.

Our extensive deployed and proven solutions provide customers the assurance they are choosing a partner that supports not only their technical needs but also their business strategies both now and in the future.

No *over-hyped* vendor promises – just results. Aclara's scalable AMI solutions prove themselves everyday by handling millions of meter reads for over 500 utility customers. Whether your utility needs a complete AMI turnkey solution, or answers to specific challenges, Aclara delivers.

Create Your Intelligent Infrastructure™

Find out more at Aclara.com/delivers
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