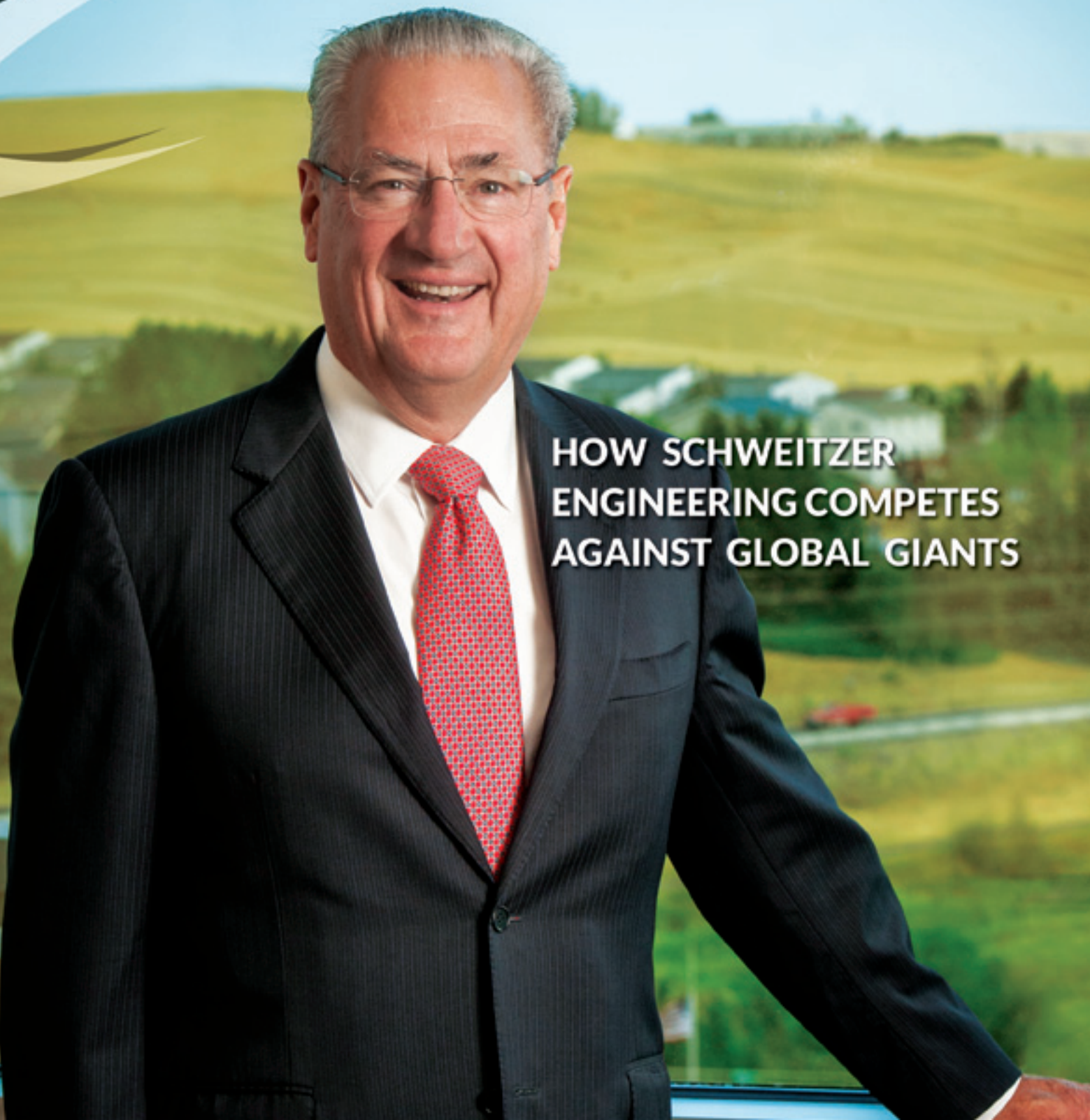




# ***Electric Energy T&D***

## **MAGAZINE**

SEPTEMBER-OCTOBER 2015 Issue 5 • Volume 19



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announced the finalized language of their Clean Power Plan (CPP).

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Automatic Vehicle Location (AVL) technology is no longer in the 'nice to have' category of needs and wants for companies in the electric energy industries; it is a very necessary tool for business intelligence.

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Given the current immigration situation between Haiti and the Dominican Republic, it would be remiss not to acknowledge the devastation caused by the 7.0 magnitude quake that hit Haiti in 2010, the effects of which are still omnipresent in the small country.

## 38 SECURITY SESSIONS Secure? Who cares – it complies with the regulations!

Over the last few years I have had ample opportunity to see organizations attempting to implement cyber security in industrial plants and facilities (such as power generating stations) all too often using guidance and best practices borrowed from the IT world.

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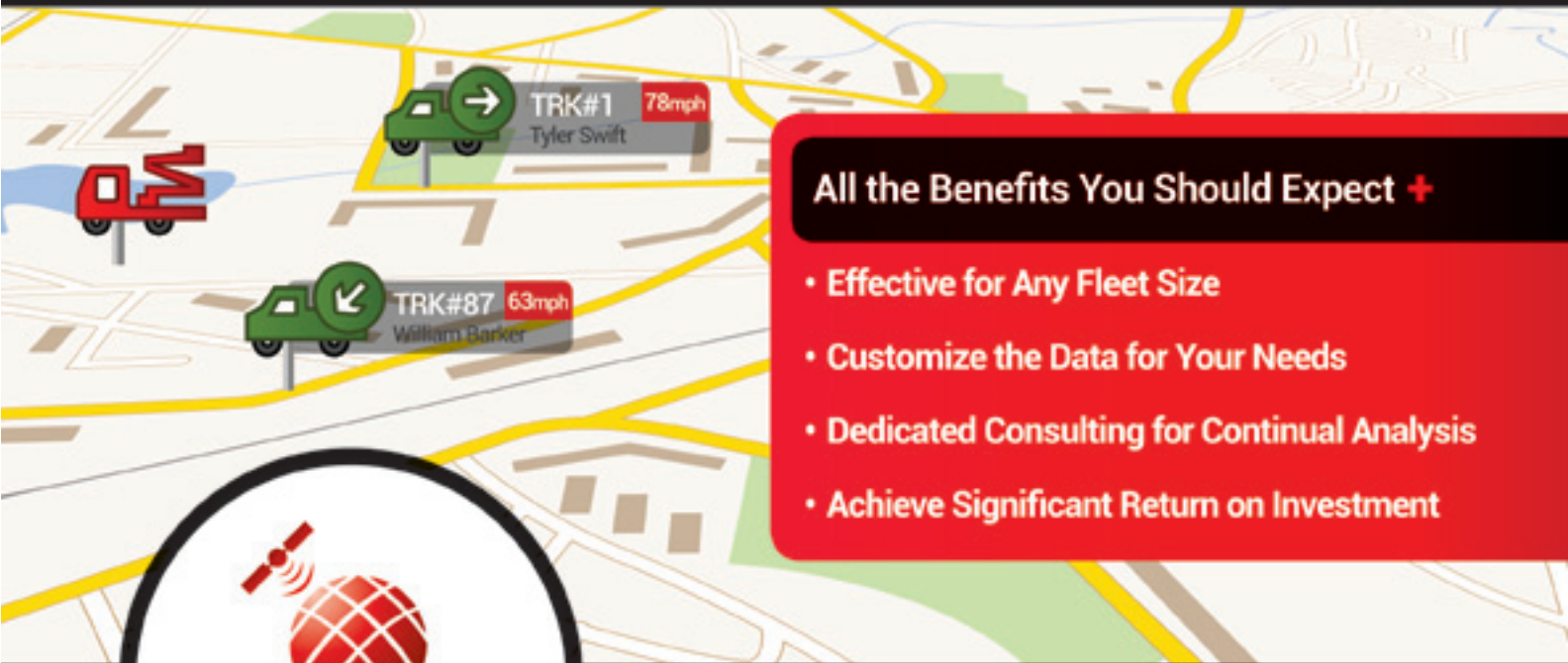
Utilities today face a myriad of complex challenges – from aging infrastructure to changing regulation and increasing customer demands – but the biggest issue for many utilities is something that has traditionally been hard to predict: increasing severe weather and its impact on infrastructure.



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# POWERPOINTS

## Blowing Carbon Bubbles



Canada is currently in the throes of an election campaign heading towards an October date when a new federal government will be elected to run the country. As things stand, there are only a few platforms that each of the five parties in the race are running on that are important enough to the Canadian people to decide the future of the country. One of these planks is how each contestant will deal with climate change. Under the current government the economy is still weak and verging on recession mainly because the self-serving ruling party has invested so much money in keeping oil prices high by continuing to unevenly leverage the Alberta tar sands while letting the manufacturing sector slip away and ignoring climate change. If the existing government was to hold onto power, it would leave the task of fighting climate change up to the individual provinces, which are already making strides in the fight to save the planet. Real progress can only be achieved if the feds are a working, responsible member of a national team.

But oil prices have fallen – dramatically letting the air out of the government's hope chest! The much-hoped-for recovery of the one hundred dollar per barrel benchmark isn't expected to return for some time to come. Because the economy and climate change are inextricably linked, it stands that whichever party can cook up the best of both worlds will very likely see its political opponents going down the road kicking stones.

During a recent interview, Canadian author, economist, and former chief economist at CIBC World Markets Jeff Rubin posed the question. "What does the collapse of oil mean for the future of the Canadian economy and when the carbon bubble bursts, will it be a preview of what's in store as the world wakes up to the perils of climate change?" Rubin then went on to answer the following questions:<sup>1</sup>

### What is a carbon bubble?

The carbon bubble, the subprime mortgage bubble, and the dot-com bubble are all based on a fundamental premise that turns out to be false. In the case of the dot-com bubble, it was that we could have unending exponential growth in IT sales. Regarding the subprime mortgage bubble, it was that securities funded by mortgages of unemployed people should be as credit worthy as government of Canada treasury bonds.

With the carbon bubble, the implicit assumption here is that we can burn and emit as much carbon as we can afford.

That view has become increasingly challenged by the link between what we emit and the impact of climate change we are now seeing.

### Has the carbon bubble already burst?

For all intents and purposes, the bubble has burst. If you look at the Blackrock's iShares Oil Sands Index ETF, which is an exchange-traded fund that covers all of the TSX-listed oilsands producers, it has lost about 70 percent of its value since early 2011.

Not only has this been a huge negative for investors in energy stocks, it's also been an albatross around the index. It has brought down TSX returns relative to other indices.

### What lies ahead for the oilsands?

I think what lies ahead for the oilsands is what's happened to coal stocks. Three years ago, investors in Peabody Energy (the world's largest private-sector coal company) would go to sleep every night confident that there would never be a global agreement on carbon emissions. Three years later, they woke up to a nightmare. Even though there was still no global agreement, China and the U.S. – the two largest coal-consuming countries on the planet – both took actions (to curb emissions) that were as devastating to the valuations of coal stocks as a global binding treaty on carbon emissions would be. It's a small step to go from coal to oil.

### What's in store for Canada as the world moves to limit carbon emissions?

I think that one of Harper's (current Canadian Prime Minister) greatest failings is his denial of climate change. It turns the blinkers to what could be great economic opportunity in the country.

Climate change is going to have a profound impact on the Canadian Prairies. When you consider the kind of temperature increases being talked about, two or three degrees, that's going to transform the agriculture potential of the region. Growing grain is going to be a lot more value-added than producing bitumen.





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## How does that create new opportunities for Canada?

The same climate change that will allow you to grow corn on the Prairies will also make it much more difficult to grow corn in places like Kansas and Iowa. When we had that huge drought in the U.S., which is exactly what climate change models are predicting, we saw corn prices rise by 50 percent.

Climate change is not only going to increase crop yields, it's going to open the door to growing higher value-added crops. Climate change is likely to push food prices a lot higher than oil prices.

## How prepared is Canada for these changes?

We're not really preparing for the opportunities that climate change is going to bring. We have to start thinking about how our economy is going to operate in the next couple of decades as the climate warms. Water management is going to be our biggest issue. I think we also have to start bulking up in terms of the Arctic and build deep-water facilities and recognize the opportunities there.

I feel, and have often said, that one day in the not-too-distant future, clean water will be more valuable than any oil. As Canada watches and listens to the campaign promises of each political party, it was refreshing to read about how water recycling is gaining momentum in California. Struggling through the fourth year of a severe drought, the state now encourages the reuse of so-called gray water to save gardens. Sources typically include the gently used runoff from bathroom sinks, showers, bathtubs, and washing machines. Once again, many of California's 38 million people have the option of once-again having a little bit of green to adorn their property. In fact, much new-home construction includes the plumbing necessary to recycle such water. The downside is, however, that many families were ignorant of the pathogens swimming in untreated water and fell ill through consumption. Greywater Action, a group that promotes household water recycling and trains families and installers on the do's and don'ts estimates that a million Californians had illegal systems before plumbing codes were updated. Interest in doing it the right way has soared – great news!

On August 3, the U.S. announced its Clean Power Plan Rule for existing power plants. It will seek to accelerate the shift to renewable energy while setting tougher goals for slashing carbon emissions. The new plan sets a goal of cutting carbon pollution from power plants by 32 percent by 2030 compared with 2005 levels – a seven percent jump from the previous target. States and utility companies that move quickly to expand their investment in solar and/or wind power will be rewarded. The revised plan will be farther reaching and many states will face tougher requirements for lowering greenhouse gas emissions. Governments will be given more time to meet their targets and more flexibility in how they achieve their pollution-cutting goals. As a way of avoiding disruptions in the power supply and gain more time to meet commitments, states will be able to buy a 'reliability safety valve,' a proposal to ensure that any federal carbon dioxide rule or State

Implementation Plan includes a process to assess and, as relevant, mitigate electric system reliability impacts resulting from related environmental safety compliances.

The rule – the first to regulate carbon emissions as a pollutant – may actually face legal challenges and opposition from Congress arguing that the federal overreach could impose costly burdens on energy providers and their customers. Problems or penalties notwithstanding, the new rule, if it stands, should substantially alter the U.S. energy landscape, driving the expanded use of 'clean' energy while further reducing coal's long dominance as a source of power. The upside, of course, is the public will see major gains in improving air quality and fighting climate change.

To bolster the initiative, President Barack Obama visited the Alaskan Arctic to call attention to global warming and in September, Mr. Obama will entertain Pope Francis, an ardent supporter in the fight against climate change. The government's effort will culminate in December with talks on a proposed international treaty curbing carbon emissions.

In a recorded video message, the president describes the Environmental Protection Agency's plan to rein in coal burning as "...the biggest, most important step we've ever taken to combat climate change. Power plants are the single biggest source of the harmful carbon pollution that contributes to climate change," Obama said according to the Washington Post. "But until now, there have been no federal limits to the amount of that pollution those plants can dump into the air."<sup>2</sup>

Reliance on coal, which produces about 40 percent of the electricity used by Americans, has been falling for several reasons, including government pollution controls and lower prices for solar and wind energy. There has also been a resurgence of cheap natural gas, which during this past spring surpassed coal as the biggest single source of electricity generation.

The Clean Power Plan requires each state to cut carbon emissions from its energy sector over the next 15 years – the exact amount of reduction varies depending on each state's energy mix – while allowing governments to choose from a menu of options, including closing older coal-burning power plants and increasing reliance on solar and wind energy.

Opponents warned that the regulation would devastate the coal industry and force energy providers to jack-up electricity rates effectively slowing any economic recovery and hurting consumers. Thus far, independent studies on this matter have produced wildly fluctuating bottom-line estimates ranging from onerous to negligible.

Canadian government inaction notwithstanding, my hope is that all of the individual, provincial and state efforts by countless people across our continent will prevail in the fight against climate change and global warming.

<sup>1</sup> Madhavi Acharya-Tom Yew, "Canada Loses when the carbon bubble bursts." *Toronto Star* (May 16 2015): B1, B6

<sup>2</sup> Joby Warrick, *The Washington Post*, "U.S. to establish aggressive emissions targets." *Toronto Star* (August 3 2015): A8



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## Manitoba Hydro Hosts 10th Annual CIGRÉ Canada Conference

CIGRÉ (Conseil International des Grands Réseaux Électriques) is a French acronym that translates to the International Council on Large Electric Systems. It is also better known as an international association based in France with members in over 80 countries that aims to facilitate and develop the exchange of engineering knowledge and information between engineering personnel and technical specialists in all countries as regards to generation and high voltage transmission of electricity.

Manitoba Hydro last hosted the CIGRÉ Canada conference in 2008 and saw 260 delegates attend. This year close to 400 delegates from around the world attended the CIGRÉ Canada Conference held in Winnipeg, August 31 to September 2.

"Our industry is rapidly changing," said **David Jacobson**, Section Head, Transmission Planning and Design Division and Chair of the Technical Committee. "It is amazing to me how many companies in Manitoba are industry leaders in this rapidly changing environment. Hosting the CIGRÉ Canada conference is a great way to showcase this local expertise as well as to find out *What's next for the Power Grid.*"

The conference opened with a keynote address from Mark Lauby, Senior Vice President of the North American Electric Reliability Corporation, who spoke on some of the upcoming reliability challenges that will be faced by industry. Throughout the two days, sixty-five technical papers were presented in parallel sessions on a wide variety of topics ranging from asset management to emerging technology developments in substation equipment. In addition, thirty-seven technical papers were presented in a poster session including many quality student contributions.



Conference Chair **John McNichol** (HVDC Division) learning the ropes from legendary escape artist Dean Gunnarson.

In conjunction with the conference was a sold out Technical Exhibition, thanks to **Steven Desrochers** of Jaguar Expo, which included many of the manufacturing and technical consultant experts in our line of business. In addition, a one day workshop was held to exchange engineering knowledge on the latest techniques to help avoid equipment damage due to different kinds of electrical and mechanical resonances.

Manitoba Hydro staff were instrumental in organizing this highly successful conference. The members of the organizing committee were: **John McNichol** (HVDC Division), **David Jacobson** (System Planning), **Zibby Kieloch** (Transmission & Civil Design), and **Kelly Monkman** (HVDC Division).

For more information on CIGRÉ Canada and the benefits of becoming a member please visit [www.cigre-canada.org](http://www.cigre-canada.org).

## Spoon River Transmission Project Receives Final Approval from Illinois Commerce Commission

**September 2015**

Ameren Transmission Company of Illinois (ATXI), a subsidiary of Ameren Corporation (NYSE: AEE), has received a Certificate of Public Convenience and Necessity from the Illinois Commerce Commission (ICC) authorizing construction of the Spoon River Transmission Project, including approval of a final route for the transmission line. This transmission project, estimated to cost approximately \$150 million, is directly aligned with Ameren's goals of providing reliable, efficient and environmentally responsible energy.

"Today's (9/17) action by the ICC is welcome news for Illinois," said Maureen Borkowski, chairman and president of ATXI. "This project will benefit the state's economy, create jobs and provide Illinois electricity customers greater access to lower-cost energy and electricity from renewable sources, such as wind energy. It also will improve transmission system reliability in and around the project area."

The 345,000-volt transmission line, using single-shaft steel poles, will span 46 miles in Illinois between Galesburg and Peoria, with an in-service date anticipated in 2018. Line construction is expected to commence in late 2016 and is estimated to support approximately 100 construction jobs.

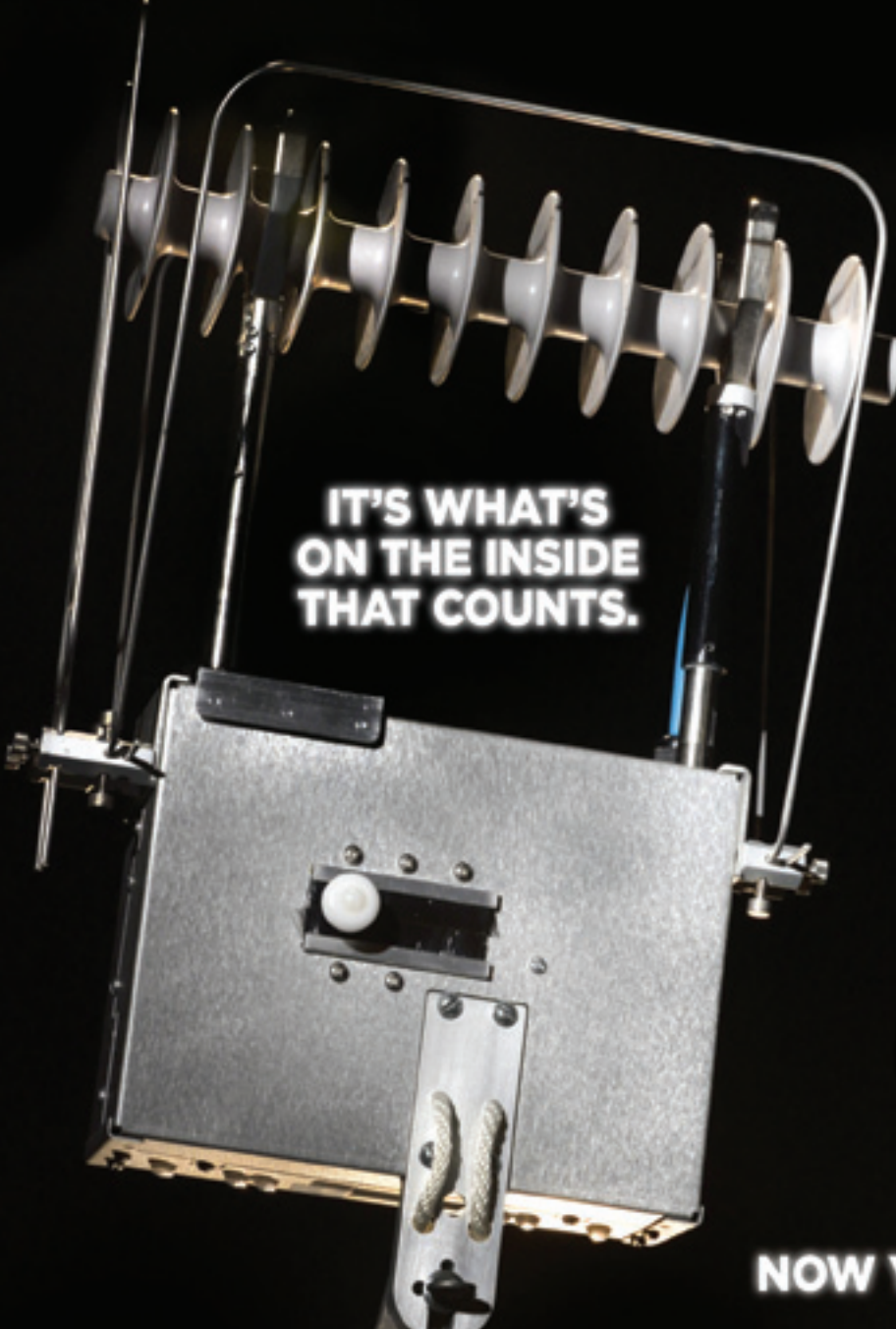
The project previously received approval in 2011 from the Midcontinent Independent System Operator, Inc., a regional transmission organization serving a 15-state region and the Canadian province of Manitoba.

For more information on the project, visit [SpoonRiverTransmission.com](http://SpoonRiverTransmission.com).

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## U.S. Department of Energy: Secretary Moniz Unveils Roadmap to Double U.S. Energy Productivity by 2030

September 2015

In support of the President's goal to double U.S. energy productivity by 2030, Secretary Moniz unveiled a strategic plan laying out a path businesses, state and local governments, consumers and other stakeholders can use to achieve this goal. The report, *Accelerate Energy Productivity 2030: A Strategic Roadmap for American Energy Innovation, Economic Growth, and Competitiveness*, identifies proven and effective strategies and actions to advance energy efficiency. Strategies include: states securing energy productivity through setting and updating vehicle and product codes and standards; and providing energy performance information to consumers; utilities and regulators designing rates and related policies that more effectively align energy efficiency with utility business models; and businesses reinvesting avoided energy costs. By doubling energy productivity, American families will be able to power their homes and vehicles using less energy, while American businesses will be able to manufacture more while spending less and cutting harmful carbon emissions.

"Cutting energy waste and doubling energy productivity will help American families save money on their energy bills, enable businesses to produce more while using less energy and strengthen the U.S. clean energy economy," said Energy Secretary Ernest Moniz. "This roadmap provides a path for families, businesses and governments, among others, to follow. By taking steps to increase efficiency and cut waste, the U.S. will be more competitive globally and will see direct and long-lasting benefits for decades to come."

Alliance to Save Energy President Kateri Callahan said, "*Accelerate Energy Productivity 2030* already has fostered dialogues and galvanized action across all sectors of the economy, and with the release of the Roadmap, a broader range of stakeholders and activists now have access to concrete strategies and recommendations on how to achieve impactful and verifiable energy efficiency gains across the country. I am bullish on our prospects for achieving a doubling of energy productivity in the U.S. because it just makes good economic sense. The *Roadmap* is an actionable blueprint for success that will lead to wide-ranging benefits for American consumers and businesses alike."

Council on Competitiveness President and CEO Deborah L. Wince-Smith noted, "As the Council's longstanding work - including this partnership with the Department of Energy and the Alliance to Save Energy - demonstrates, energy is everything. This *Roadmap* makes the compelling competitiveness case for a doubling of national energy

productivity - as an engine for job creation; economic growth; a more globally-competitive manufacturing base; and a greater standard of living for every American."

The **Roadmap** focuses on scalable actions that have the potential to reduce energy consumption and support economic growth. The federal government, many state and local governments and a number of organizations in the private sector are already deploying energy productivity strategies, including some that are featured in the report, demonstrating that the goal of doubling energy productivity can be achieved. While energy productivity strategies often involve multiple economic sectors and levels of government, the strategies laid out in this report demonstrate that any organization or individual can take steps to double national energy productivity by 2030. The report provides a foundation for scaling up these efforts nationwide, while allowing for flexible and tailored solutions.

## Dominion's New Online Map Makes it Easier to Track Power Outages and Restoration

Enhanced mobile capability means faster, easier access for customers

September 2015

Dominion Virginia Power has introduced a new online interactive outage map that provides more streamlined, detailed information to enable customers to quickly report and accurately track power outages and restoration.

"Next to energy, the most important thing we can provide to customers is information," said Becky Merritt, vice president of Customer Service. "This new outage map provides greater access to the information customers need to help us restore their power quickly in the event of an outage. It also provides information to help manage their lives and reduce the inconvenience."

New features include:

- mobile compatibility for most smartphones and tablets;
- new icons that indicate the number and general locations of work requests;
- customized views with street-level or satellite imagery and live weather radar;
- improved search options, including searching by landmarks or road intersections;
- faster updates-- information refreshes every 15 minutes;
- option to bookmark multiple outage locations to follow restoration progress; and better tracking of a specific outage through the outage reporting system.

Customers can view a quick "how to" video at <https://youtu.be/MnVjAwNKMNM> and bookmark their address and any other locations for future reference. The outage map can be found at [www.dom.com/outages](http://www.dom.com/outages).



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## The government proposes a 2030 GHG emission reduction target for Québec in the order of 37.5%

September 2015

The Minister of Sustainable Development, Environment and the Fight against Climate Change, David Heurtel, announces that he will soon hold a consultation on a proposed greenhouse gas (GHG) emission reduction target in the order of 37.5% below 1990 levels by 2030, which would be the most ambitious target in all of Canada. Following September 17's tabling in the National Assembly of the "Cible de réduction d'émissions de gaz à effet de serre du Québec pour 2030" white paper, parliamentary committee consultations will be held shortly in accordance with the provisions of the Environment Quality Act. The government will then be in a position to unveil its target in time for the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change (COP-21) to be held in Paris in December, 2015.

"Québec intends to remain a leader in the fight against climate change. In addition to contributing to worldwide efforts in this area, setting an ambitious target for 2030 will help us improve the health, safety and quality of life of Quebecers and secure the sustainable development of our economy. Together, we have a collective responsibility to fight climate change and ensure a better quality of life for our children," stated Minister Heurtel.

"The advisory committee, composed of experts in a variety of fields, is pleased to learn that the Government of Québec followed its recommendation in proposing a GHG emission reduction target in the order of 37.5% below 1990 levels. This target will position Québec among the most ambitious regions of the world in terms of GHG reduction goals and enable us to profit from opportunities that are associated with the shift toward a carbon-free economy," affirmed Steven Guilbeault.

The Advisory committee on climate change is a stakeholder in the government's process of reflection on preparing the consultation. Its members include authorities in a number of fields such as the environment, the economy, energy, health, public transit, construction and municipal action. "This target is consistent with the urgent need to act in the face of climate change and with our will to develop Québec in sustainable and responsible ways. The work accomplished by the committee and its vital contribution to Québec's thinking on our post-2020 targets are simply remarkable," added Minister Heurtel.

Co-chaired by Équiterre's Steven Guilbeault and Hélène Lauzon from the Quebec Business Council on the Environment, the Advisory committee on climate change includes the following members: Karel Mayrand (Director General for Quebec, the David Suzuki Foundation); Philippe Bourke (Executive Director, Regroupement national des conseils régionaux de l'environnement); Suzanne Blanchet (CEO, Cascade Groupe Tissu); Bernard Sinclair-Desgagné (Tenured Professor, Chair of International Economy and Governance, HEC Montreal); Daniel Beauchamp (Executive Director, Association du transport urbain du Québec); Philippe Dunsky (President, Dunsky Energy Consulting); Marie-France Patoine, Environmental Policy Advisor, Union des municipalités du Québec); Denis Leclerc (CEO, Écotech); Christian Savard (Executive Director, Vivre en ville); Alain Webster (Vice-Rector, Sherbrooke

University); François Reeves (Physician, Hôtel-Dieu hospital, Montréal); Robert Ladouceur (Executive Director, Canada Green Building Council) and Stéphanie Trudeau (Vice-President-Strategy, Communications and Sustainable Development, Gaz Métro).

In addition to securing benefits for the population of Québec that directly flow from GHG emission reductions, the 2030 target takes account of Québec's current and historical international commitments in this field. For example, in July, Québec joined other governments that committed to reducing their GHG emissions by 80 to 95% by 2050 when it signed the Under 2 MOU Subnational Global Climate Leadership Memorandum of Understanding. In August, Québec also joined with its ten other partner states and provinces of the Conference of New England Governors and Eastern Canadian Premiers in setting a regional GHG emission reduction target of 35 to 45% below 1990 levels by 2030.

Through these kinds of structuring actions, Québec is an active contributor to international GHG emission reduction efforts. Even though its carbon footprint is already among the smallest in North America, Québec was successful in reducing its GHG emissions by 8% in 2012, compared to 1990 levels, thus exceeding its original goal of 2% for that year. It is also worth recalling that the government, in conjunction with California, set up the biggest carbon market in North America, which Ontario will also join. "With this important tool for growing a green economy available to it, Québec intends to reach its objective of reducing its GHG emissions by 20% compared to 1990 levels, by 2020. Thanks to the Green Fund, whose revenues mainly comes from the carbon market, the government can support Québec businesses, municipalities and private citizens in transitioning to a low-carbon world that is more resilient to the impacts of climate change," concluded Minister Heurtel.

## FERC Proposes Requiring Access to NERC Databases

September 2015

The Federal Energy Regulatory Commission (FERC) today (9/17) proposed to require the North American Electric Reliability Corporation (NERC) to provide the Commission with access to NERC's transmission availability data system, generating availability data system and protection system misoperations databases.

The proposed access would be limited to data regarding U.S. facilities only and would not require NERC to collect any additional data. The intent is to inform FERC more quickly, directly and comprehensively about reliability trends or reliability gaps that might require development of new or modified Reliability Standards. Access to the databases also would provide FERC with more information to better understand the reliability and adequacy assessments periodically submitted by NERC.

Comments on today's (9/17) Notice of Proposed Rulemaking (NOPR) are due 60 days after publication in the Federal Register.

In other reliability matters, FERC approved the following items:

- A final rule approving Reliability Standard PRC-002-2, which requires the availability of adequate time-synchronized data for post-disturbance analysis (RM15-4-000).
- A final rule approving Reliability Standard PRC-005-4, revising the current protection system maintenance reliability standard to add certain sudden pressure relaying systems (RM15-9-000).
- A NOPR proposing to approve Reliability Standard PRC-026-1, to ensure that applicable entities use protective relay systems that can differentiate between faults and stable power swings (RM15-8-000).





# THE GRID TRANSFORMATION FORUM

Envisioning the 21<sup>st</sup> Century Grid

## A Glimpse at the Grid of the Future

In August of 2007, the National Energy Technology Laboratory (NETL) released its 'Modern Grid Benefits' report for the U.S. Department of Energy's Office of Electricity Delivery and Energy Reliability as part of the NETL Modern Grid Initiative, Powering our 21<sup>st</sup>-Century Economy. It is a useful look at the seven principal characteristics that NETL identified eight years ago to launch the grid transformation, the progress made, and what the grid of the future looks like today.

Given the current focus on grid modernization and the grid of the future, have we made progress? We asked Gary Rackliffe, vice president of Smart Grids for ABB in North America, to answer that question and share his views on where he thinks the grid and the power industry is headed over the next decade.

**EET&D:** What did NETL define as the principal characteristics needed to meet the demands of the 21st century?

**Rackliffe:** In 2007 NETL identified seven essential characteristics needed for the grid of the 21st century. These characteristics define a grid that can 1) be self-healing, 2) engage the consumer, 3) resist attack, 4) provide power quality, 5) accommodate all generation and storage options, 6) enable markets, and 7) optimize assets and operate efficiently.

**EET&D:** Do these grid characteristics create benefits?

**Rackliffe:** Yes. NETL identified significant benefits related to eliminating cascading outages, increasing national security, reducing reliance on imported fuel, reducing energy losses, more efficient generation, better power quality, lower environmental impact, improved U.S. competitiveness, and new customer benefits. Smart grid benefit to cost ratios previously estimated by the Electric Power Research Institute (EPRI) range from 2.8 to 6.0 and market analysts continue to be positive for technologies that improve reliability and resiliency

or that improve generation capacity utilization by reducing peak demand. Volt/Var optimization and demand response are examples of technologies that can reduce peak demand. The DOE also identified significant benefits from the Smart Grid Investment Grants (SGIGs) and Demonstration Projects.

More recently in February, as part of the New York State Reforming the Energy Vision proceedings, the Order Adopting Regulatory Policy Framework and Implementation Plan stated that "if, for example, the 100 hours of greatest peak demand were flattened, long-term avoided capacity and energy savings would range between \$1.2 billion and \$1.7 billion per year" for the state.

**EET&D:** What has changed on the grid?

**Rackliffe:** There have been several significant changes to the grid. Events such as Superstorm Sandy, the physical attack on PG&E's Metcalf substation in California, the availability of natural gas, the impact of energy conservation and the economy on load growth, and the drop in the cost of solar PV panels have changed the landscape. Utilities now need to address physical security threats as well as cybersecurity threats.

The DOE SGIGs resulted in a major investment spike in advanced metering infrastructure (AMI). These meter systems provide utility operational savings, but they also improve customer services and engagement, provide outage notification and restoration verification for storm response, and provide the foundation for new demand response initiatives. The communications infrastructure for AMI data backhaul can also support communications to distribution automation devices between the substations and meters. The SGIGs also contributed to the sustained investment growth in distribution automation technologies.

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Aging infrastructure has aged an additional eight years since that 2007 NETL report. The grid assets installed as part of the transmission investment bubble in the 1970s are now 40 years old and utilities are operating assets that are 50 to 60 years old. Older assets can continue to perform, but utilities are concerned about the potential impacts to reliability and the costs to maintain and replace these aging assets. At the same time, the retirements from an aging workforce are depleting the technical resources.

Baseline U.S. Smart Grid Spending 2008-2017 (Historical and Forecast)



Costly weather-related events increased significantly in the past decade. DOE's Quadrennial Review released this year shows that there were 11 events causing at least a billion dollars in damage in 2008 and 2012 and the number reached 16 in 2011, new highs for these weather-related disasters. Superstorm Sandy was a wake-up call for the industry. This storm in particular highlighted how critical situational awareness is and triggered investments in grid modernization such as advanced distribution management systems (ADMS) and distribution automation, storm hardening such as elevation of substations, and grid resiliency such as microgrids.

The generation mix in the US is changing. Coal generation has decreased from generating approximately half of our electricity to about a third of the production and natural gas generation has filled the gap. The increased supply of domestic natural gas at significantly lower prices and lower emissions have contributed to this change. Wind and solar PV generation continue to grow to meet renewable portfolio standards, but they currently represent a small share of the US electricity production, even with the significant drop in the price of solar panels.

The variable nature of wind and solar do stress the transmission and distribution systems respectively and have the potential to erode the efficient utilization of centralized generation under high-penetration scenarios. Load growth has been flat. A steady growth in load has historically helped utilities, but economic growth has been decoupled from growth in electricity consumption as the economy rebuilds following the 2008 recession. As the economy has recovered, electricity consumption growth has been flat. A likely factor is the cumulative impact of energy conservation and efficiency investments.

Energy storage is now another strategic tool that utilities can use for operational effectiveness with recent trends focusing on commercialization, standardization, and pre-engineered solutions. Energy storage systems are providing ancillary services such as frequency regulation, power quality, spinning reserves, and ramp rate control and capacity firming for renewable generation. Peak shaving and load leveling are additional applications. Utilities are recognizing the strategic value of energy storage.

Finally, distributed energy resources and microgrids are emerging as key elements of the grid of the future. Demand response aggregators, third-party owned solar PV installations, and customer microgrids are part of the grid landscape and potentially threaten current utility business models.

**EET&D:** As we look at the grid of future, what is the focus of utilities?

**Rackliffe:** I would highlight distribution grid management, transmission technologies, utility analytics, and distributed energy resources. For example, reliability and grid resiliency investments have enabled utilities to reduce customer outage minutes. Advanced distribution management systems are integrating distribution SCADA, outage management, automated switching applications, mobile work force management, and business intelligence to drive improved outage life cycle management. Improved situation awareness to provide accurate assessments of storm damage and restoration time estimates are enabling stakeholder communications.



# THE GRID TRANSFORMATION FORUM

Envisioning the 21<sup>st</sup> Century Grid



Situational awareness at the transmission level provides visualization of power oscillations, voltage stability, and improved data for state estimation. Other transmission technologies include digital substations; HVDC for grid support, regional interconnections, and connecting wind generation to load centers; and FACTS to add capacity and resiliency to the transmission grid.

**EET&D:** So what are the roadblocks holding us back?

**Rackliffe:** Two items: policy and education. Under policy, utilities are concerned about how DERs will change the existing business model and how the industry would transition. There are technology issues, but the policy alignment, largely at the individual state level, will set the pace of how the industry transitions. Some policy developments to watch:

- DOE 'Future of the Grid' project in collaboration with the GridWise Alliance which will establish clear and comprehensive guiding principles, along with a unifying architecture, and create a framework for guiding investments to transition from today's grid to the future grid.
- US Court of Appeals in DC vacated FERC Order 745 and ruled against FERC's role in demand response. The Supreme Court is scheduled to rule on the Obama Administration's appeal later this year.
- EPA 111d Clean Power Plan establishes state emission targets that will impact generation resources. The plan will be challenged but is a part of the Obama Administration's current agenda.
- Renewable portfolio standards, wind production tax credit, and solar PV investment tax credits will impact renewable energy investments.
- New York State's 'Reforming the Energy Vision' process is moving forward to address market design and platform architecture.
- California utilities have filed Distribution Resource Plans and are procuring 1.3 GW of energy storage as required by the commission. California is also updating the Rule 21 interconnection standard.

Second, regarding education, customers must be engaged. This grid transformation and integration of DERs will require customer engagement and public support for policy change to transition to the grid of the future. To achieve the grid operational effectiveness and the economic competitive advantages that were defined by NETL and now incorporated into the current grid of the future initiatives will require consumer education.

**EET&D:** We can't thank you enough Gary for finding time for us to discuss the grid of the future. With the importance of the smart grid growing exponentially, your words and thoughts couldn't be more timely.

## About the author



**Gary Rackliffe** is vice president for Smart Grids for ABB Inc., leading ABB's smart grid and distribution automation initiatives in North America and managing the ABB Smart Grid Center of Excellence in Raleigh, North Carolina. Gary has worked for ABB for more than 25 years.

He is past chair of NEMA's Smart Grid Council and member of the DistribuTECH Advisory Committee, US Department of Commerce Renewable Energy and Energy Efficiency Advisory Committee, and IEC Smart Energy Systems Committee. He serves on the Board of Directors for the Research Triangle (N.C.) Cleantech Cluster and for the GridWise Alliance. Gary holds BS and ME degrees in Power Engineering from Rensselaer Polytechnic Institute and a MBA from Carnegie Mellon University. He is based in Raleigh. Gary may be reached at: [Gary.Rackliffe@us.abb.com](mailto:Gary.Rackliffe@us.abb.com).

Gary is scheduled to speak at the upcoming Smart Grid Canada 2015 / Smart Grid Road Show in Toronto on October 6 on the topic of microgrids and grid resiliency.

# GREEN OVATIONS

Innovations in Green Technologies

## NYPSC Approves New Smart Meters in Residential Buildings

By Gord Echlin



In 2014 New Yorkers spent \$21.9 billion on electricity. Not surprisingly, state and municipal governments continue their efforts to raise citizens' awareness of electricity consumption, promote conservation efforts, and reduce overall demand.

Earlier this year New York City's Local Law 88 (LL88) came into effect and the energy industry is watching closely to see what the impact will be. Local Law 88 requires all commercial buildings larger than 50,000 square feet to install submeters by January 1, 2015. LL88 is part of the larger Greener, Greater Buildings Plan (GGBP) initiative, which targets energy efficiency in large existing buildings in New York City. New York City is one of the first cities in the United States to require submetering.

On the residential side of the equation, the New York Public Service Commission (NYPSC) has instituted strict requirements to govern residential electrical submetering in the state. The rules affect how submeterers (building owners, property management companies, or third-party energy resellers) bill for electricity use and provide protection to residents. Several requirements relate to the process a submeterer must follow prior to providing submetered electricity, while others apply to the submetering technology itself.

### What is submetering

Many commercial and residential buildings in New York use a single 'master meter.' Electricity comes into a building through a meter at bulk rate prices and landlords bill tenants for electricity based on flat fees or formulas derived from how much of the building they occupy. Occupants pay for electricity as part of a monthly bill, but energy use is not itemized. Paying a set price for energy use no matter how much is consumed is a disincentive for energy conservation and punishes those who do make the effort to use less.

Countless stories exist about tenants leaving lights, air conditioners or machinery on all day – even when space is unoccupied. They pay no extra fee for this luxury so have no

real incentive to change their behavior. An equal number of anecdotes exist, however, that show significant drops in energy consumption and large cost savings when submeters are installed and tenants are empowered to monitor their energy use.

A property using submeters still has electricity metered by the utility through a master meter, but each designated area's consumption is measured through individual property-owned submeters. Submeters allow for the granular measurement of energy use, right down to the individual circuit level. By installing submeters, building owners and managers can pinpoint energy use, identify failing equipment, and allocate cost fairly.

The benefits of submetering are numerous; tenants pay only for the electricity they use, can account for their own consumption, conserve energy, and lower their bills, while property owners can identify failing equipment, monitor building processes to increase energy efficiency, increase property value, and experience an overall reduction in energy costs.

### A growing wave of regulation

There is a growing wave of regulation throughout the United States focused on the metering of electrical consumption. One after another, cities and states are establishing ever-tightening directives in an effort to reduce energy use and align electricity payment with consumption.

If money changes hands (as with government incentive programs or tenant billing for example) certified meters become a legislated requirement in many of these jurisdictions. Regulatory bodies (including the NYPSC) are using the tried and tested American National Standards Institute (ANSI) C12.20 standard as the target to meet for accuracy and performance, and are requiring third-party laboratory certification to prove that installed meters attain these standards.



ANSI C12.20 performance testing is rigorous and covers many aspects of meter operation, including accuracy, accuracy maintenance over time and across variations in current and voltage, meter ruggedness, relative humidity operating and non-operating performance, electromagnetic interference, and immunity and electrical surges.

## Demand for submetering on the rise

Given that the cost of virtually all generation fuels (oil, nuclear, coal) has risen dramatically in the past decade, it should come as no surprise that electricity costs will continue to head in the same direction. And in addition to rising cost, more complex pricing structures will be introduced.

Almost all North American jurisdictions have implemented or are in the process of implementing new energy pricing structures based on Time of Use (TOU) pricing. Customers pay a different rate for electricity based on when they consume it – off-peak, mid-peak, or on-peak – with higher pricing implemented during the highest demand periods. Generally referred to as ‘smart metering,’ submeters now need to account for and encourage tenants to reduce overall energy use as well as when they should reduce it.

Tenants too are getting smarter. Many have realized that they are subsidizing the tenant down the hall and want to pay only for the electricity they use. Additionally, an increasing number of companies are developing ‘green policies’ to reduce carbon emissions, but have no way of tracking their energy use when billed on a per-square-foot basis.

## The times they are a changing

Submeters have been around for a long time but to date very few have found their way into legacy multi-tenant buildings. There are three good reasons for this. First, energy costs historically were not an important issue. Second, installing submeters and associated electrical wiring was expensive. And third, tenants are constantly moving. In an average office building, for example, 35 percent of the walls move in a given year, making it very difficult to maintain accurate allocation information.

The good news is that these hurdles are now much easier to overcome. Increasing energy costs and technological innovation have overcome these barriers to tenant metering. Compact submetering systems can leverage a buildings existing wiring to accurately allocated energy costs. These systems are often the size of a clipboard, require no floor space and, most importantly, no rewiring.

Because metering sensors can clip into existing electrical panels and report their information automatically, building managers can simply update billing information online when a new tenant space is created or new loads need to be measured.

## The Impact

When tenants pay directly for their energy use, overall building consumption drops on average by 20 percent – with many tenants experience between 30 percent and 60 percent decreases in their energy bills. That's an impressive savings that's comparable to installing an entire building automation system or changing all the windows in an office tower – at a fraction of the cost. Put another way, for every 5 buildings that are submetered, an entirely new building can be powered from the savings alone.

## Moving forward

Putting the responsibility of energy costs directly in the hands of those that have the power to control it (tenants, building managers, and other stakeholders) encourages everyone to behave in an efficient manner.

With today's modern IP-based submetering systems, individual tenant metering can be completed at low cost, reducing a building's energy use and increasing its long-term value. Modern submetering systems promise to turn properties into Intelligent Buildings – bridging the energy information gap by easily connecting with building automation systems and IT-based financial and energy management systems, and making consumption data visible to all stakeholders. Individual tenants are empowered to monitor and reduce their energy consumption and building operators and managers have the information they need to make smart operational decisions.

## About the Author

**Gord Echlin** has been Vice President of Sales and Marketing for Triacta Power Solutions, a division of EnerCare Connections Inc., since 2010. Gord has over 30 years of experience in the Information and Communications Technology, Semiconductor, and Clean Technology industries. He has held a wide spectrum of senior business and technical roles, and was President and CEO of Netistix Technologies Corporation. Prior to founding Netistix, Gord was Assistant Vice President of the Corporate Business Group at Newbridge Networks.



# From Research to Action

## From Research to Action I Imagine a World Where Master Data is Created Once and Used Many Times

EPRI Network Model Manager Approach Enables New Reality for Managing T&D Network Models

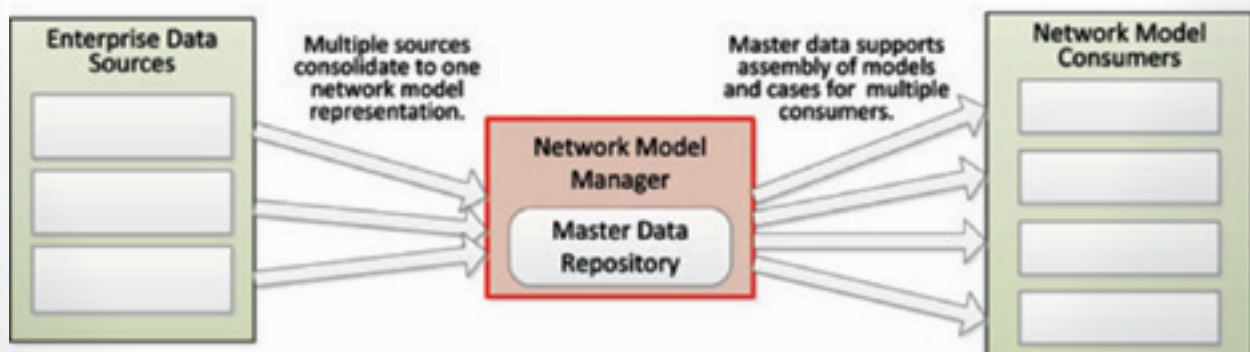
by Pat Brown

### Introduction

As utilities have deployed more and more network analysis applications such as the state estimation and contingency analysis functions of energy management systems, the steady state and transient stability functions of planning application suites, the short circuit calculations of protection software and the congestion analysis functions of market systems, silos have developed; each application frequently has its independent users, its independent model maintenance group, and its individual modeling processes and assumptions. The silos are both technical and organizational, with the resulting lack of coordination reflected in a typical network model data management picture where information comes from a variety of sources in a variety of forms, goes to a number of target systems, and whose exchange is inconsistently triggered by a variety of events. Lacking an overarching or unifying data management architecture, the creation of accurate network models relies on the experience, thoroughness and energy of utility engineers who spend significant amounts of time performing data maintenance in multiple software applications instead of system engineering.

Enter the vision of the Network Model Manager (NMM) - product ID 3002003053 - developed with EPRI and utility insight, where master data is created once and used many times - taking advantage of the International Energy Commission's (IEC) Common Information Model (CIM) interoperability standards - resulting in efficient processes throughout the utility.

The NMM provides a realistic approach to effectively handle network model data, providing a place for managing data from multiple sources going to multiple applications. Using the NMM approach reduces the level of effort to maintain models, improves the quality of analysis, and provides a seamless infrastructure on which new apps can be built; and it can be done today, as exemplified by work in progress at two utilities, American Electric Power and FirstEnergy.







### The NMM Vision - Seeing Beyond the Silos

The NMM approach inserts a Network Model Manager between network model data sources and consuming applications, providing a place where data being provided to network analysis functions can be organized - a place for managing what is understood to be the one source of truth' for network model information. As shown in the figure above, data is received from substation, line and protection engineers, as well as other enterprise data sources, and is stored and managed by the Network Model Manager. The NMM then facilitates the assembly of consistent network models and cases, and their provision to the variety of network analysis applications used by planning, operations and protection engineers.

### Support from a CIM'ple and Effective Data Model

The Common Information model (CIM) - product ID 3002002587 provides a basis on which a coordinated network model maintenance strategy can be built. It defines an organizational approach to network model information that reflects the fundamental nature of complex network analysis data, including:

- The distinction between physical network model data (which changes only with field activity) and case assumption data (which changes with each network analysis study);
- The common need to build network models and cases from building block' data maintained by different entities;
- The need to define prospective' changes reflective of new construction projects at utilities that may or may not be used in studies, depending on the time period being evaluated.

Because the CIM provides a solid and flexible foundation for the effective creation, maintenance and exchange of network model information to support the needs of network analysis, it is the foundation on which the NMM architecture is based.

### Making It Real

During 2013 and into 2014, personnel from across the planning, operations, protection and IT domains at FirstEnergy and American Electric Power (AEP) worked together with EPRI to envision how transmission network model management at their respective utilities, and across the industry, might be streamlined. At both companies, cross-functional teams analyzed existing network model information flows, developing a detailed understanding of data flows and application inter-relationships. The feasibility of a consolidated network model management approach was explored and validated.

The teams articulated potential benefits including improved accuracy and speed of data exchange, reduction in manual efforts for validation and error correction, and the freeing up' of engineering expertise to focus more on system analysis rather than data management. Required NMM functionality was investigated and documented by means of use cases. From this work, the teams developed a high-level roadmap for each utility, and provided guidance on next steps for starting down the path toward implementation.

### Collaboration Works

The cross-work group collaboration that occurred at both utilities allowed the NMM approach - a big picture' solution strategy for Transmission network model maintenance - to be validated. It also illustrated the pervasiveness of the disjoint model maintenance problem at utilities throughout the world and the widespread applicability of an NMM-based architecture for improving the situation.

"It certainly appears we have influenced the industry on a vision for network model management, as evidenced in a vendor road-mapping the functionality," said Donna Bursick, Director, IT Real-Time Operations at FirstEnergy.

Eric Hatter, who works in EMS Applications Support at AEP, echoed Bursick's enthusiasm, "Integrated Network Model Management is no longer a nice to have' idea, but is CRITICAL for utilities who plan to thrive in today's regulatory and competitive environment!"



### Encouraging a Product-Based Solution

The universality of both the network model management problem and its solution strategy set up a true product development opportunity: an industry with a widespread need, a need that could be satisfied by a configurable software tool, a tool that could be sold to many utilities. Recognition of the NMM product niche, however, has been thwarted by siloed thinking; some may not recognize the magnitude of the problem or the feasibility of the solution; others may have difficulty perceiving the potential size of the NMM product market and the full range of functionality such products need to support. The glimmers of interest in an improved network model management would need an industry-wide boost' to allow the NMM product niche to attract serious vendor product investment.

Spurred by decisions on the part of both FirstEnergy and American Electric Power to move forward with network model management improvement initiatives, EPRI launched a Network Model Manager requirements overview project, believing that it would benefit everyone (the utilities, their selected vendors, the industry at large) if the solutions being implemented were viewed as the deployment of a widely useful product that had been intentionally designed to serve the needs of network model consumers throughout the utility organization. The approach taken to encourage the vision was to engage a critical mass of interested participants to help define the essential functionalities a quality network model management tool should have and to share results of the work freely and widely.

### Spreading the Word

Through the collaborative efforts of eight utilities and two vendors, the NMM requirements that had been identified during the American Electric Power and FirstEnergy deep-dive projects were explored, refined and augmented. A collection of common use cases, reflective of typical ways in which a Transmission

System Operator (TSO) or Independent System Operator (ISO) might use a NMM tool in managing its network models, were explored and documented. The use cases led to the identification of eight high-level requirements for a network model management tool:

1. Provides a secure, redundant permanent store for physical network model parts;
2. Manages the identities of network modeling objects in different contexts;
3. Supports multiple workspaces for carrying out NMM operations in parallel;
4. Provides capabilities for users to browse and edit NMM content in variety of ways (graphical, tabular, individual items);
5. Supports the IEC CIM modular concept for assembling network models and network analysis cases;
6. Supports the development of a testing and validation regimen;
7. Provides CIM-based integration services that support integration with other systems without requiring amendment of NMM product code;
8. Supports a data-driven and extensible data model, definable by an accepted information model.

### Happening Now!

The detailed results of the collaborative Network Model Manager Requirements project are available in the Network Model Manager Technical Market Requirements document – product ID 3002003053, downloadable from the EPRI website. Additional information about CIM support for network analysis data is available in a recently published EPRI report, Using the CIM for Network Analysis Data Management – product ID 3002002587, also available from the EPRI website. And webcast recordings of four training sessions on the CIM's support for network model data are available at the UCAIug YouTube Channel - <http://www.ucaiug.org/Lists/UCAIug%20YouTube%20Channel/AllItems.aspx>.



# From Research to Action

## About the author



**Pat Brown**, Principal Technical Lead, Information and Communication Technology in EPRI's Power Delivery and Utilization program, has more than 25 years of experience supporting electric utility control center applications. She is currently engaged in a range of projects leveraging industry standards, including the Common Information Model (CIM), in the deployment of data sharing solutions for transmission. Pat serves as the lead U.S. expert on IEC TC57 Working Group 13 (CIM for Transmission) and as the EPRI liaison to UCA International. She has a B.S. in Architecture from the University of Michigan and is a certified Project Management Professional.

## In Conclusion

The utility industry has an opportunity to significantly improve how it manages its network models. Coordinated NMM architecture-based network model management, underpinned by the CIM data model, provides a feasible and realistic way to efficiently manage network model data originating from multiple sources and going to multiple consuming applications. This approach offers sizable potential benefits in reduced engineering labor and increased accuracy of utility network models. It offers even greater promise in creating the seamless network model infrastructure on which forward-looking T&D applications will be built, and it can be done now.

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# How Schweitzer Engineering Competes Against Global Giants to Attract Engineers to Its Headquarters

By Mary Josephs

Schweitzer Engineering Laboratories (SEL), a manufacturer of sophisticated equipment for utilities and other power systems, is looking to hire scores of electrical engineers right now.

Good luck with that, most recruiters would say, given that SEL is competing against the likes of Google and Facebook, each of which, on any given day, is trying to hire hundreds of electrical engineers, and offering top dollar and the prestige of working at one of the world's hottest technology companies.

But guess what? Despite a shortage of engineers, SEL will fill the 66 engineering jobs listed on its website, as of this writing, and the hundreds more it is likely to post in the years to come. This remarkable success in recruiting – and retention – also comes despite the fact that SEL resides in Pullman, Washington, a city of just 32,000 – half of them students at Washington State University (WSU) – 75 miles south of Spokane, 285 miles from Seattle and 900 miles from Silicon Valley. Talk about raising the degree of difficulty.

Dale Visokey, a managing director at Crist/Kolder Associates, an executive search firm, has been recruiting talent to industrial companies for more than 25 years, including to such out-of-the-way locales as Benton Harbor, Michigan, Versailles, Ohio, and Oshkosh, Wisconsin. “Attracting talent has to be in the DNA of an organization,” Visokey says, and companies located in small markets must go to increasingly great lengths to stack up against brand name employers in major markets. “The companies that draw top talent to these places tend to be remarkable organizations,” Visokey adds.

## What is SEL's secret?

Well, there is no secret; Ed Schweitzer, founder and president of the fast-growing company, which has annual sales of more than \$600 million, gladly shares his HR philosophy and the details of its application:

“We try to run the business the way our moms would want us to,” Schweitzer tells me in an interview. That's his philosophy, in a nutshell; being exceedingly pro-employee – SEL is 100 percent employee-owned, thanks to a series of transactions Schweitzer initiated – gives SEL the devoted workforce it needs to continually innovate and to deliver top-drawer service. And that produces sales growth and healthy profits.

How SEL applies Schweitzer's philosophy will account for the bulk of this article because in the SEL experience there are lessons for organizations of all sizes and across industries.

First, though, a few words about Ed Schweitzer. His mantra may be warm and fuzzy, but Schweitzer is a hardcore engineer, with a PhD from WSU, where he first encountered the study of large-scale electrical systems. Picking up a book about protective relays for a class, “I couldn't put it down,” Schweitzer recalls. He was soon wondering whether these large mechanical devices couldn't be made digital and therefore more reliable and precise. He built one and wrote his dissertation on the subject, founded SEL in his basement and spent years (while also teaching at WSU) patiently persuading the utility industry to take a chance on his small firm and its product.

Today, SEL employs about 3,800, more than 2,000 of them in the Pullman area, and its customers are found all over the world. Here are details of the HR policies that drive SEL's success:

- SEL makes a virtue of its location, aggressively recruiting engineers from Schweitzer's alma mater, WSU; students there get a goodly share of the more than 150 internships SEL has at any one time, and the company winds up hiring more WSU electrical engineering grads than any other employer.
- SEL treats its workforce as a giant networking resource and willingly hires spouses, adult children and other relations of existing employees. It just figures that one smart and motivated person will be related to more such potential hires. What's more, excluding employees' relations just wouldn't work, given SEL's size relative to its headquarters city. When you factor out the WSU students, SEL employs more than one-in-ten permanent Pullman residents.
- Unlike so many U.S. companies, which want to only hire workers already at the top of their game, SEL also looks for raw talent – people it can train and watch grow into more significant roles at the company. Sara Arar came to SEL six years ago with what many employers would regard as a work history ill suited to cutting-edge manufacturing. She'd run a tiny home cleaning service for 10 years, barely scraping by. But she excelled as an SEL assembler, showed initiative in suggesting better ways to do things, took advantage of constant training opportunities, and today supervises 20 fellow workers who make and test printed circuit boards.



# How Schweitzer Engineering Competes Against Global Giants to Attract Engineers to Its Headquarters



Sara Arar

One of Arar and her team's constant projects is to upgrade the manufacturing process from simple hand assembly to more rapid and reliable automated work. When that happens, employees aren't laid off; instead they're trained to run the machines. "Now you're going to be a machine operator," Arar says. "Dignity of work is one of our values."

- Ideas are welcome. From everyone. Devin Griffin, who works on Arar's team, suggested reorganizing the storage of fixtures used to test circuit boards. These equipment are quite heavy and have to be lugged around when needed. Previously stored by number, Griffin suggested the most-frequently-used ones be kept closest to the action, and that the heaviest ones be stored at waist height to avoid back strain. A small adjustment, but Arar figured the change saved her team 90 miles of walking in a year's time and that helped increase circuit boards tested by about one third, to 60,000 a month. Oh, and Griffin was promoted, in part because of this sharp thinking.
- Belief in training and education extends beyond SEL's facilities. The company offers financial support to workers studying for undergraduate and graduate degrees, and also for coursework as varied as knitting or a second language.
- There's money to investigate new ideas, as SEL invests more than 10% of annual revenue (expected to surpass \$1 billion within five years) in R&D. Luis D'Acosta, who succeeded Schweitzer as CEO of SEL last year after 10 years at the company, says the devotion to R&D and to a long-term outlook distinguishes the company. "We have research facilities you just don't see in other private

companies," D'Acosta says. He notes a program that allows front-line supervisors to commit relatively small funds and amounts of worker time to improvement projects. Some are adopted across the company after they're proven on a smaller scale.

- A culture that encourages a healthy workforce: SEL has an onsite medical clinic with nurse practitioners and a physician; a Life Quality Center that includes workout facilities, personal training and nutrition counseling; reimbursement for external gym memberships. We don't have maternity leave specifically. Instead we have short-term leave for all employees. This can also be used for maternity leave but it's not technically maternity leave.
- The Friday Lunch: like any employer its size, SEL is a company of specialists, most of whom work on discrete projects, and workers would have little idea how their labors relate to the overall organization were it not for extraordinary efforts to keep everyone well informed. Since the business was operated out of Ed Schweitzer's basement, there has been a Friday Lunch (originally at the family's kitchen table), where new projects, products and people are discussed. Lunch is catered and everyone – at SEL locations across the country and internationally – stops working to participate and learn.

These policies alone might very well have kept SEL competitive in hiring and in its business, but Schweitzer early on decided to take a more dramatic step: he organized an employee stock ownership plan and in 1994 sold 30 percent of SEL to the Employee Stock Ownership Plan (ESOP). There were just 133 employees at the time. True to his engineer's mind, Schweitzer had been thinking about the best ownership format for SEL to succeed long-term. "The products we make are very serious. Employment is a very serious matter," he says.

In subsequent years, he sold additional amounts to the ESOP, taking it to 49 percent. And then in 2009, Schweitzer sold his remaining stake, making SEL 100 percent employee-owned.

What does an ESOP bring to SEL? Productivity, for one thing. ESOPs outperform similar companies with different ownership formats. That's because workers act like the owners they've become. Conflict is reduced. Waste is avoided. Ideas percolate up. And employees manage themselves and each other to build their shared investment.

## How does an employee stock ownership plan, or ESOP, work?

By Mary Josephs

Typically, a founder/owner, nearing time to sell part or all of the company he or she launched, will consider the options:

- Selling to a competitor, also known as a strategic buyer. These transactions, in some cases, bring the absolute highest pre-tax price for a business because the acquirer often cuts costs deeply at the combined companies.
- Selling to a private equity fund, also known as a financial buyer. These buyers are increasingly similar to strategic buyers, as private equity funds seek to roll up multiple companies in the same industry and then sell the company in an initial public offering or to other investors.
- Selling to an ESOP. This route can often bring the seller a better after-tax return than selling to a private equity fund. That's because federal legislation intended to encourage employee ownership allows the owner of a C-Corporation, selling to an ESOP, to defer capital gains taxes, potentially forever, by reinvesting the proceeds in qualifying securities, namely stocks or some bonds. That saves the seller having to pay combined federal and state capital gains of about 23.5% of sales proceeds, depending on the state.

ESOPs enjoy another major tax benefit. After becoming an ESOP, if a company is an S-Corporation, it pays no federal income tax. As with IRAs and 401(k)s, the tax responsibility rests with the owner-employee, who pays when he or she retires or otherwise withdraws stock. This means that, in the interim, ESOP-owned companies can enjoy superior after-tax cash flow to pay down acquisition debt, invest in plant and equipment or make acquisitions. And founders who sell to an ESOP can participate in this favorable upside; most do so by partially financing the sale of the company, taking back seller notes that also come with stock warrants.

An ESOP also brings significant financial rewards for workers. They typically don't pay for the stock they receive. It's granted to them gradually through the ESOP. SEL aims to add 15 percent of an employee's pay to his or her ESOP account each year. The company has beaten the S&P 500 since the ESOP's founding. And ESOPs overall, recently studied by EY's Quantitative Economics and Statistics Practice (QUEST), have significantly outperformed the S&P 500, delivering their worker-owners an 11.5 percent compound annual growth rate vs. 7.1 percent for the S&P 500 on a total return basis.

That's a big factor in keeping SEL employees around. High levels of employee engagement also allow the company to implement new ideas more swiftly; employees aren't as defensive and it's a safer environment because of the policy to redeploy workers who might be displaced by automation and by gains in efficiency. "SEL has never laid off a single person," says Sara Arar.

### About the author



**Mary Josephs**, former head of ESOP advisory at Bank of America, is founder and CEO of Verit Advisors, investment bankers specializing in ESOPs. She is also author of leading blog on ESOPs and middle market M&A. You can reach her

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# The Next Chapter of the EPA Clean Power Plan

By Jason Symonds,  
Suman Gautam,  
Kristina Kelly,  
and Bert Laube

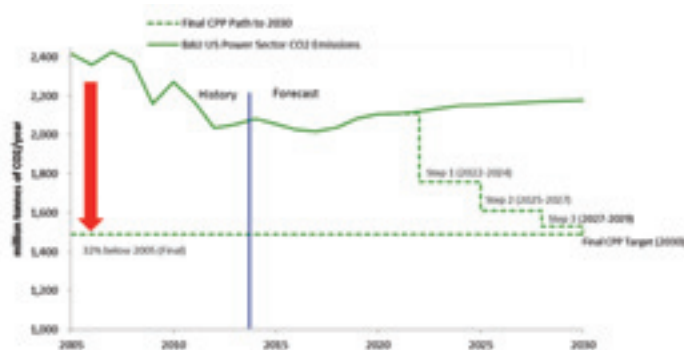
On August 3, 2015, the U.S. Environmental Protection Agency (EPA) announced the finalized language of their Clean Power Plan (CPP). Originally proposed in June 2014, the EPA fielded over four million comments during the several months of the open-comment period set for this rule. The result of this effort is a final rule that still aims to reduce power sector carbon emissions by curtailing the pollution from existing generating units.

What has changed from the proposed to the final rule? What are the immediate implications for stakeholders? What are the next steps in preparing for the CPP's implementation? These are important questions that will define the next chapter of the CPP. This article will explore some of the high-level changes within the final rule. Then we'll look at how the final rules may affect energy stakeholders.

## Timeline

**Figure 1** shows how forecasted emissions in 2030 differ with and without the final CPP. The eight-year interim period from 2022 through 2029 is separated into three steps, 2022 to 2024, 2025 to 2027 and 2028 to 2029. Each time period is associated with a specific interim carbon dioxide emission performance rate.

**Figure 1: Emission Reductions by 2030 under the Final Clean Power Plan**



## Building Blocks

Through the Clean Power Plan, EPA developed emission reduction targets for each state based on current emission levels and potential reduction capabilities determined through EPA's best system of emissions reductions (BSER) for carbon dioxide. The final BSER used for the CPP is based on three building blocks for emission reduction compliance: (1) heat rate improvements from existing coal-fired facilities, (2) increased dispatch of natural gas combined cycle generation, and (3) increased generation from zero-carbon renewable sources such as PV and wind.

**Figure 2: BSER Building Blocks of the Final Clean Power Rule**



Note that nuclear was removed from the third building block, which we discuss further below. And according to the EPA, the previous fourth building block of energy efficiency was removed to circumvent some legal challenges to the rule.

## Compliance Targets

Another change between the proposed and the final 111(d) rule has been the modified carbon dioxide emission reduction targets. These new compliance targets were calculated by using these refined building blocks and regional emissions rates to create national emission targets for fossil steam and natural gas generation.<sup>1</sup> State specific compliance targets took these national standards and used each state's generation mix between fossil and NG steam to derive a compliance target.

Figure 3: Proposed and Final Compliance Targets by State

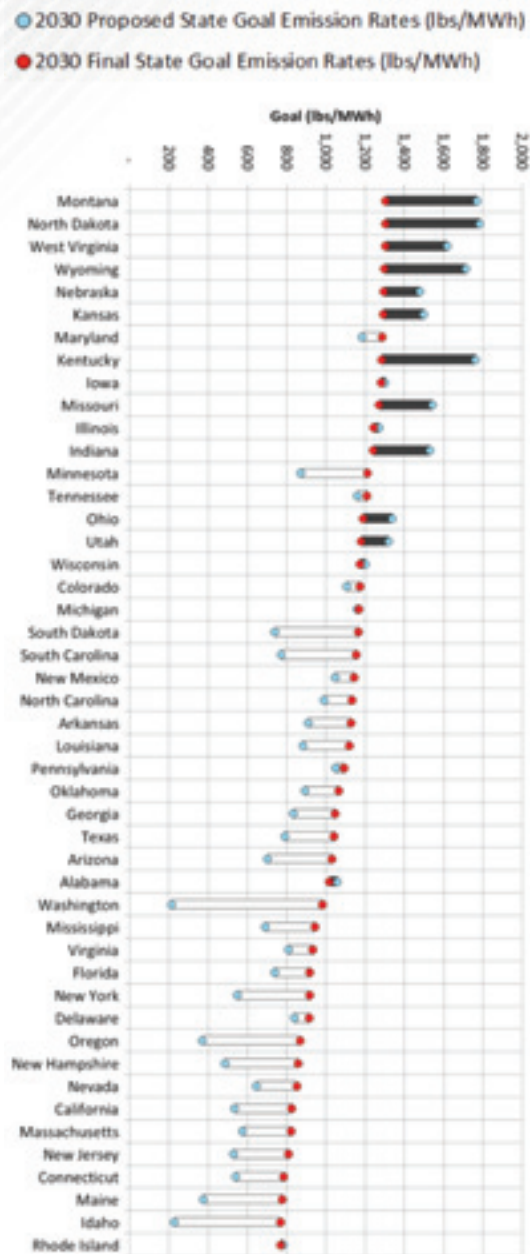


Figure 3 illustrates the emission rate goals (lbs/MWh) for every state, but also which states had the largest change in their goals between the proposed and finalized rule. The blue dot indicates the emission rate target initially proposed, the red dot displays the finalized emission rate target. Dark colored bars indicate states with stricter finalized goals when compared to the proposed rule. Clear bars indicate states that have more lenient goals when making the same comparison.

Montana, for example, has the most lenient finalized target carbon dioxide emission rate. But compared to the proposed CPP rule, it is much stricter now than originally proposed. Washington, on the other hand, had a very strict goal in the proposed rule, but now has a much higher lbs/MWh target for compliance, making it easier to reach.

## What will it mean for stakeholders?

### Stakeholders in Fossil Fuel Heavy States

As illustrated in figure 3, the final rule imposes stricter carbon emission reduction targets on several states. States such as New England, Kansas, Wyoming and West Virginia have been allowed the highest emission rates. At the same time, the final carbon dioxide reductions mandated from those still represent a dramatic drop in comparison to what the 111(d) rule had originally proposed. Many of those states rely heavily on fossil fuel generation, and are pursuing their lawsuit against the EPA.<sup>2</sup>

### Nuclear Stakeholders

In addition, nuclear generation is not counted anymore as part of the baseline, and has been removed as one of the BSER building blocks. This directly impacts five under construction nuclear power plants: Summer 2 and 3 (South Carolina); Vogtle 3 and 4 (Georgia); and Watts Bar 2 (Tennessee).<sup>3</sup> Each of these plants can now be counted toward state compliance, which makes a big difference for the states each of these plants will reside.

### Cap and Trade Stakeholders

Finally, the fact that the EPA provided mass-based as well as rate-based goals, states currently engaged in carbon emissions trading can easily translate their framework towards their compliance. The implications of this is that organizations like the Regional Greenhouse Gas Initiative (RGGI) in the Northeastern part of the US will serve as a functional example of how a carbon dioxide trading market between states can be established. Several states may plan to join the already established RGGI framework, or organize their own.<sup>4</sup>

## Preparation: What should States be doing now?

State plans are due to EPA in September 2016, with a potential extension of up to two years, if requested by individual states. As discussed above, the compliance period begins in 2022 instead of 2020, as proposed in the initial plan.

If the states don't meet the deadline to prepare the 111(d) state compliance plans, EPA will develop a Federal Implementation Plan. The following figure shows the basic components of a 111(d) state compliance plan as stated in the final rule.



Figure 4: Components of 111(d) State Compliance Plan

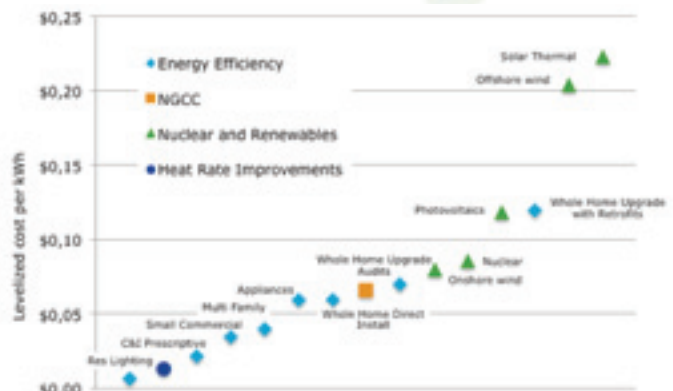


## Pick the Low Hanging Fruit: Energy Efficiency Opportunities

The final CPP rule also includes a Clean Energy Incentive Program (CEIP) to encourage early action by states. The CEIP provides opportunities for investments in renewable energy (RE) and demand-side energy efficiency (EE) implemented in low-income communities that deliver results in 2020 and/or 2021. States meeting the requirements set forth in the CEIP will be eligible to receive matching allowances from EPA that equate to “a total for all states that represents the equivalent of 300 million short tons of carbon dioxide emissions.”<sup>5</sup>

Energy efficiency is not only the quickest path towards compliance; it is likely to be the most cost-effective as well. In figure 5, we compare typical costs of different types of energy efficiency programs with those of other compliance options. Historically, successful energy efficiency programs such as residential lighting or commercial and industrial, have the lowest lifetime costs per kWh. For states and utilities with little energy efficiency program experience, initial costs to develop new programs will likely be higher than what is shown in the figure. However, experience from other jurisdictions suggests that program costs decrease after initial development. Nationally, a typical energy efficiency program costs roughly \$0.16/kWh for the first year, but only \$0.02/kWh over the program lifetime.<sup>6</sup>

Figure 5: Cost per kWh for CPP Compliance Mechanisms<sup>7,8,9</sup>



## Conclusion

There are clear winners and losers from the finalized rule, with nuclear stakeholders and trading systems like RGGI benefiting from the finalized language. States with heavy fossil-fuel generation have emission targets more stringent than originally proposed. Although the CPP has been finalized, it is not out of the woods quite yet. Multiple states still have pending legal challenges against the rule, and as the 2016 presidential election unfolds, there are several scenarios that could halt its implementation. This includes a judicial ruling that the EPA overstepped its authority within the CAA, Congress passing a new law that adjusts the scope of the CAA, or a new president nominating a new EPA Administrator that takes measures to water-down or reverse the current rule. However, as of right now, this policy has been finalized and announced.

Therefore, states are on the clock to meet compliance timeframes, with implementation plans due in 2018, and first reduction targets met by 2022. As evidenced in figure 5, energy efficiency is a cost-effective means to help states meet their compliance targets. DNV GL has extensive experience in both the implementation and evaluation of energy efficiency program portfolios. We are well prepared to help utilities invest in and harvest this low hanging fruit. As a result, states should be thinking about how to move in this direction to capitalize on early opportunities and CEIP carbon credits towards meeting their compliance targets.

## About the authors



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**Kristina Kelly**, a senior consultant in DNV GL's Policy, Advisory, and Research team, has been working at DNV GL since June 2008 and has ten years of energy research and analysis experience. In her current position, Ms. Kelly has managed a number of electric and gas efficiency potential studies and evaluations of the energy and carbon savings attributable to the ENERGY STAR program and clean energy policy support programs funded by the State Energy Program. Ms. Kelly also oversaw the recent analysis of carbon and labor impacts associated with ARRA-funded energy programs.



**Bert Taube** is a Principal Consultant in DNV GL's Policy Advisory and Research practice. He is focused on project developments related to energy efficiency programs, utility load and financial solutions as well as data technology. Bert has spent more than 20 years creating and leading projects for high-voltage power transmission and electric transportation networks as well as Big Data analytics and automation software to serve mission-critical infrastructures.

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# Getting the most from your AMI and MDM Systems

By Bill Schleicher, Director,  
UJSOL an Alstom Company

Many U.S. utilities have completed, or are nearing completion of, their Advanced Metering Infrastructure (AMI) and Meter Data Management System (MDMS) rollouts. With these implementations completing, the next initiative that a utility should consider is how to leverage the investments in these technologies to gain the significant additional potential benefits available. One approach is to take advantage of infrastructure based solutions such as Connect / Disconnect devices, Demand Response hardware support through Zigbee, and Outage Management solutions. In addition, utilities are recognizing that future solutions for optimizing AMI and MDM Systems come from analyzing the vast amounts of data being collected. Let's examine the best strategies for greater AMI/MDM utilization.

Getting the most out of your AMI and MDM systems falls into two categories:

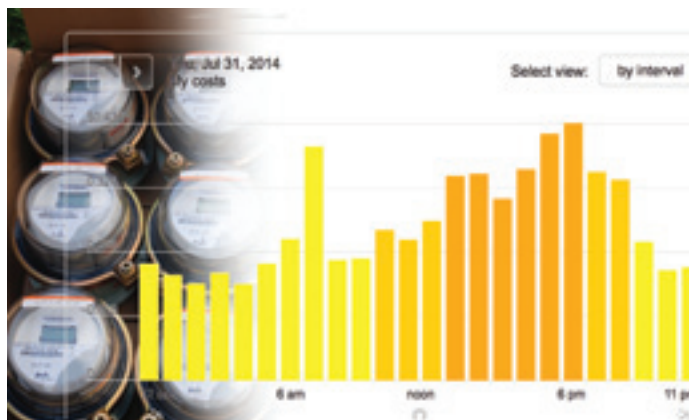
1. Using the infrastructure for additional services and applications
2. Getting more value from the data being captured

The first category is driven by hardware based solutions that will vary depending on the AMI solution implemented and the selected features. The second category is all about efficiently using the data collected.

Leveraging the AMI/MDM Infrastructure	Utilizing the Data Collected
✓ Connect / Disconnect	✓ Asset Management
✓ Demand Response (DR) Support	✓ Demand Response (DR) Support
✓ Pre-Paid Metering	✓ Volt/VAR Optimization
✓ Outage Management Support	✓ Theft and Fraud Detection
✓ Two Way Communications	✓ Net Metering
	✓ Customer Presentment

## LEVERAGING the AMI/MDM INFRASTRUCTURE

The advanced metering infrastructure provides much more than just an automated method to provide monthly billing determinants. An AMI system with smart meters has many other benefits beyond just delivering advanced metering data. The information provided by AMI systems can be used to support improved system operations throughout the enterprise. The AMI infrastructure should be leveraged to optimize the fullest capabilities of the hardware installed.



AMI systems provide volumes of useful data powering applications ranging from consumer portals to engineering studies

The common features to examine include:

### Connect / Disconnect

One of the biggest bangs for the buck is handling all service connects and disconnects automatically through the AMI/MDM system (If your meters support this feature). Automatic connect/disconnect has been implemented at various large utilities and is a great money saving feature. It eliminates the majority of truck-roll costs for simple move-ins and move-outs and for non-payment disconnects. This feature can also be utilized to surgically reduce load and allow Fault Location, Isolation, and Service Restoration (FLISR) transfers to go through.



## Getting the most from your AMI and MDM Systems

For the most effective implementation of this feature, integration of the MDM, Customer Information System (CIS) and the work management systems is required. Even before this integration takes place, a simple report along with a manual process can fill the bill.

### Demand Response (DR) Support

Many MDM systems can support demand response programs, however the level of support available varies greatly between vendors. At a basic level, the MDMS is the data store for historical consumption information and therefore is key for utilities to track the effectiveness of any event or an overall program. In more sophisticated cases, the MDMS can maintain the asset information for any hardware associated with the demand response program. In some cases the MDM can even process requests to control devices such as thermostats, pump disconnects, etc. Most often, the MDMS will work in conjunction with demand response software to manage the events. This allows the DR system to manage the overall response and measurement while relying on the AMI/MDM to handle the actual control of the devices. This eliminates the need for the DR system to know how to talk to each of the endpoint devices.

### Pre-Paid Metering

While pre-paid metering has been popular in the United Kingdom for some time, U.S. utilities have only done minimal investigations into the topics. Some MDM systems have begun to integrate the process of managing pre-paid meters by setting consumption thresholds, monitoring usage against the threshold and alerting at specific thresholds of usage. Implementing a pre-paid metering system does require certain considerations on the part of the utility, including the ability to accept payments around the clock 365 days a year. In addition, the Connect/Disconnect capabilities must be in place on the meters.

### Outage Management Support

Identifying outages and verifying restoration is always a high priority area for utilities. Many AMI implementations offer near real-time support for outage management. What many people don't realize is that when large scale outages occur, the last gasp messages sent by the meters do not always make it through to the head-end system. Network congestion can block a large percentage of the packets from being received. The use of an MDMS can add greatly to this process for the

events received. Many MDM systems can filter known service orders to reduce false positives and to filter momentary outages. Some also can identify high priority or bellwether meters that will provide an indication of a circuit or line problem.

### Two Way Communications

The AMI communication network can be leveraged to provide two-way communication between control center and distributed sensors, controllers and switches. Often times these networks can be used for communicating with substations and feeder devices.



A meter installer works on the final phase of AMI installations

## THE FUTURE RELIES ON BUSINESS ANALYTICS

The second category for greater AMI/MDM utilization relies on getting more out of the data that is already collected. The pure volume of data returned by most AMI systems can be overwhelming. For most utilities implementing AMI and MDM systems, the first order of business is to get the systems delivering the same monthly billing data as before. After the monthly billing is in place, there is a great benefit in taking full advantage of the capabilities of these advanced systems and finding out how to get the most out of the data.

Look at the following areas for getting more from the data you are already collecting:

### Asset Management

Meter data management systems are often used to track assets and their locations. Using historical usage data, MDM systems can also be used to validate installs and to alert when potential issues like meter swaps have taken place and the supporting paperwork has not made it into the system. In addition, telemetry brought back from endpoints and network elements can aid asset systems in predicting future failures by supplying large volumes of near real-time data for analysis.

### Temperature Detection

Many of the new AMI meters can report on ambient temperature at the meter. Temperature data can highlight issues at an endpoint. Causes for a higher temperature than normal include a short in the meter socket or faulty meter. Comparing current temperature to historical values on like days for the same location can be a good indicator of trouble about to happen so that issues can be addressed before they become a larger problem.

### Volt/VAR Optimization

Managing voltages to save energy and reduce peak-driven strains on the grid isn't a new idea. With the ability to measure voltage at all of the endpoints, smart meters can be a key tool in the process. Utilities are starting to make use of these measurements from metering endpoint in order to avoid dropping voltages so low that they start causing problems for customers at the edge of the grid.

### Theft and Fraud Detection

The volume of flags received on most AMI system is staggering. Many AMI operators get quickly overwhelmed by them and then decide since they can't handle them all they will just ignore them. The best way to handle this is to narrow the search by grouping flags or events that together are a sure indicator of an issue. One example would be receiving a power outage followed by a reverse rotation flag on the same meter. This almost surely indicates that someone has turned the meter upside down.

### Net Metering

Utilities commonly send both delivered and received usage channels to the CIS system for billing. Most MDM systems allow the net metering value to be calculated at the MDM and sent as a single value to the CIS.

### Customer Presentment

Globally, in-home displays (IHDs) are projected to have a high installed base for customer presentment, largely due to the UK government mandate to install IHDs with smart meters. In the U.S., IHDs appear to be waning in favor of customer portals and custom energy apps. Portals and apps allow customers to use existing devices like cell phones and computers to access the data. Customers do not have to be at home to access the data. There is no additional cost for the utility to implement these devices. The MDMS can supply most if not all of the data to the customer presentment software.



A consumer checks her energy consumption on a web-based consumer portal

## IMPLEMENTING BUSINESS ANALYTICS TO GET THE MOST FROM AMI/MDM

To get the most of the data coming from the AMI/MDM systems, the utility must first sift through all of the data to decide what data to act upon. Most utilities look to the meter data management system for analysis of data to filter and add a level of intelligence to the data gathered. The key to this is to tailor the filtering into actionable intelligence specific to your utility.

There is no quick and easy solution to this task. Most AMI and MDM systems are designed to deliver the daily or monthly reads to the billing engine. Because of this, the systems' databases are not designed to do complex data analysis, which means that additional hardware requirements may be needed. Data warehouses enable the ability to keep large amounts of data in an environment that provides the needed horsepower to deliver more than just billing determinants.

## Getting the most from your AMI and MDM Systems

Once a utility has the proper environment to operate in, the next hurdle is to understand what to analyze. Business analytics for utilities have traditionally been comprised of business intelligence (BI) for financial and production planning. Today, faced with the prospect of a data deluge resulting from the deployment of smart grid technologies, utilities need to understand the potential for data analytics applications beyond those historic methods. Business analytics, including customer analytics and grid analytics, can leverage AMI and MDM data to improve many aspects of the meter-to-cash process while improving system reliability.

Because most AMI system head-ends only deliver the daily data, MDM systems have become the preferred choice for utilities to manage smart meter data. Over the last couple of

years, the MDM field has undergone radical changes in the tools available to analyze data. The three largest MDM companies (Itron, Siemens and Oracle) have all included modules for Business Intelligence to their products.

### Key Questions to address when implementing Business Analytics

- Who in the organization needs the business intelligence?
- What are the barriers to adoption of analytics for business intelligence?
- Do I have the resources to act on the data results from business analytics?
- How does this data effect existing business use cases and what needs to change?
- Are there configurations in existing systems that need to change?

### FAMOUS LAST WORDS

With the advent of AMI and MDM installations, utilities are faced with the challenge of collecting and processing large amounts of data. In today's environment with more data coming in on a daily basis than ever before, the key to managing data in a positive way is to focus on the actionable intelligence. Look for the data that drives reduction in risk, optimizes loads, and adds value to the customer experience.

Utilities should first look to grab the low-hanging fruit by utilizing the capabilities native to the AMI and MDM systems. This will give time to examine the best path for applying business analytics to the enhanced data now being received and processed by their systems.

Remember to look first at the information you have the resources to take action on and you will get the most value from your AMI and MDM systems.

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# Unique Use Cases for AVL: Why Electrical Energy Fleets Track Their Trucks

By Jenny Malcolm

Automatic Vehicle Location (AVL) technology is no longer in the 'nice to have' category of needs and wants for companies in the electric energy industries; it is a very necessary tool for business intelligence. Advanced AVL systems are being adopted by electrical energy fleets to deploy resources more efficiently, increase safety on the job, reduce fuel costs, and more.

AVL systems have the ability to solve unique challenges for the electrical energy industry due to their adaptable functionality. Some of the challenges electrical have been able to solve with AVL include increasing technician safety on remote job sites, identifying first responders quickly during an emergency, alerting drivers of hazardous job sites, measuring true idle time to reduce fuel costs, and improving response times during power outages.

By selecting an AVL provider that has the ability to adapt its existing functionality or create custom features to solve unique business challenges, electrical energy fleets will unlock incredible ROI and won't want to operate their fleet without it.

## Verify Driver Safety during a Long Stop

Electrical work can be a dangerous job, so it is important for electrical energy fleets to know their technicians are safe while on remote job sites. With the use of an AVL system, fleet managers can verify their technicians' well-being during long stops. Knowing about longer than usual stops will increase safety because it will alert management if a driver may be experiencing an emergency. By setting a long stop alert, managers will receive an alert when a vehicle has been stopped for a longer threshold of time than a job should typically take to complete.



Once management is aware that a technician may be in need of assistance, they can reach out by phone or send a message to their navigation device to see if they need help. If the driver indicates that they are in a dangerous situation, or that they are experiencing maintenance issues with their vehicle, management is able to dispatch police or a nearby first responder to the vehicle's current location.

## Identify First Responders

If a technician is in a dangerous situation or is injured, it is important to have the ability to quickly identify first responders in the area. In this use case, electrical cooperatives need to utilize an AVL system for more than just identifying the closest vehicle to the injured technician; they need to identify the closest vehicle with a trained first responder.

For this unique challenge, electrical energy fleets can work with an AVL provider to create selectable vehicle icons on real-time mapping to distinguish their first responders. Having custom icons appear on the map will allow dispatchers to easily identify which first responder is nearest to the technician in need of assistance.

## Panic Switch

It is a significant safety hazard if a technician finds themselves in a dangerous situation on a job site and is unable to access their cell phone. For instance, if a vehicle catches fire due to a spark from a broken power line and the technician's cell phone is in the cab of the vehicle, they will be completely stranded without a way to call for help.

To solve this challenge, electrical energy fleets can provide a panic switch to their technicians so they are able to notify management if they are in need of assistance. The panic button can be attached to the driver's key chain so it is easily assessable in the event of an emergency. By pressing the panic button, management will be notified that the driver is in need of assistance and can use the AVL system to locate their vehicle's current location to send assistance right away.

## Alert Drivers of Hazardous Locations

Another unique challenge for electrical energy fleets are hazardous work sites. For electrical energy fleets that do not use AVL technology, technicians arrive at a jobsite unaware of what they will find, which is unsafe for the technician and is a liability for electrical cooperatives. To ensure the safety of technicians, electrical energy fleets can use an AVL system to landmark known hazardous job sites.

By creating a landmark, or geo-fence, around the hazardous job site, electrical energy fleets will be able to ensure technicians take the appropriate precautions before entering the job site. Alerts can be associated with hazardous landmarks and sent straight to technicians' cell phones to notify them of what they should be aware of as soon as they enter these geo-fences.

# Unique Use Cases for AVL: Why Electrical Energy Fleets Track Their Trucks

## Monitor PTOs

On the arm of actuated bucket truck, it is dangerous to drive with the Power Take-Off (PTO) switch engaged, which is activated when a bucket is raised for a technician to work on power lines. To increase safety, it is important to verify the arm is lowered all the way back down into secure position while driving. To prevent this dangerous situation, electrical cooperatives can use an AVL system to setup PTO alerts to notify technicians if they are driving with the PTO switch engaged.

## Monitor True Idle Time

Electrical energy fleets that are actively monitoring idle time to reduce fuel costs should exclude 'work idle time' to only receive alerts for 'curb idling,' when a truck is not being utilized for a work function. Since a bucket truck's engine usually needs to be turned on to operate the bucket, idling during this time should not be included in curb idle time. Work idle time can easily be excluded from alerts and reports by selecting the 'exclude PTO idling' option within an alert or report setup. Receiving alerts for curb idle time will notify drivers to turn off their engine, helping electrical energy reduce unnecessary fuel expenses.

## Quicker Response Times During Outages

Advanced AVL systems have the capability to integrate with software systems to enhance the efficiency of day-to-day operations. Companies in electric energy industries can integrate AVL data with GIS mapping, mapping overlays, outage management systems, and more to get the most out of their systems.



By integrating an AVL system with outage management software, electrical energy fleets will increase response times during a power outage. With this mapping overlay, dispatchers can view the fuse or breaker location that caused the outage and the current location of their vehicles, all from the same interface. Dispatchers can quickly and easily choose the closest and best vehicle for the job to ensure their technician gets to the site as soon as possible. This insight will also allow electrical energy fleets to provide more accurate ETAs.

## Additional GPS Tracking Functionality that Benefit Electrical Energy Fleets

Along with these unique use cases for AVL, there are many other benefits to using this technology for electrical energy fleets.

## Reduce Fuel Spend

With the right use of an AVL system, electrical energy fleets will significantly reduce annual mileage with efficient dispatch and real-time location intelligence. By monitoring true idle time, unauthorized usage, speeding, and route efficiency, electrical cooperatives are able to reduce thousands of miles driven and reduce fuel expenses.

## Resolve Customer Disputes

Electrical energy fleets are able to verify or refute customer disputes with an AVL system. Manually tracking job completion is time-consuming and will likely result in the inability to provide proof of service. It is essential to gather some form of job completion to provide proof if needed to prevent lost revenue.

AVL eliminates disputes by providing access to unlimited historical fleet data. If the customer service line receives a complaint that a technician never arrived to complete a service, the agent will have the ability to reject or verify this claim with tangible data. Even if the job took place months back, electrical energy fleets can provide customers with exact dates and times a technician visited the job site and how long they were there.

## Improve Maintenance Management

Managing maintenance has typically been a manual and time-consuming process for electrical energy fleets. Beyond creating unnecessary work for employees, manually checking odometers, run time, and logging services often results in important maintenance being overlooked and other errors, which may turn out to be dangerous and expensive mistakes. Using an AVL system to automate maintenance will ensure all services are up-to-date and create a simple method for tracking maintenance costs.

## Improve Timesheet Accuracy

AVL systems automate payroll to reduce labor hours and prevent time sheet disputes. Unfortunately, employees may pad their hours to get more money on their checks. With AVL, electrical energy fleets know exactly when technicians start their shifts for the day, how many jobs were completed, how long they were present at the jobsite, and when they completed work for the day to ensure all work hours reported are valid.

There are many beneficial use cases for businesses in the electrical energy industries to use an AVL system. The unique use cases presented in this article will help solve specific challenges that affect electrical energy fleets on a daily basis. By selecting an AVL system with the ability to customize its functionality, electrical energy fleets are able to solve their specific business challenges.



### About the author

**Jenny Malcolm** is the Content Marketing Specialist for GPS Insight. She graduated from Arizona State University with a Bachelor's of Communication and is responsible for external marketing communication for all business segments that GPS Insight targets. To learn more about how AVL systems can be customized to solve your unique business challenges, contact GPS Insight.





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# THE BIGGER PICTURE

BY SCOTT FOSTER



## Haiti Today: Is Big Data the Solution to Improving Energy Resources?

Given the current immigration situation between Haiti and the Dominican Republic, it would be remiss not to acknowledge the devastation caused by the 7.0 magnitude quake that hit Haiti in 2010, the effects of which are still omnipresent in the small country. The lives of approximately three million people – at a low estimate – were forever altered. The country continues to struggle in supporting its residents, prompting the move to the Dominican Republic. One of the biggest challenges residents still face is a lack of a stable supply of electricity. In fact, only 20 percent of the country's population has access to electricity, due to its poor state resulting from the 2010 quake. But the problems with Haiti's infrastructure, along with the search for solutions to provide its residents with a stable supply of electricity, began long before 2010.

Prior to the natural disaster, only 25 percent of Haitians had access to electricity services. Most were illegally connected to the power grid, a common situation in countries that suffer from extreme poverty. And even those with access still lacked a stable supply of electricity. So in an effort to rebuild a better Haiti, the country has been looking to solutions like expanding renewables and tapping into solar microgrids. But there are still massive strides to be taken in order to expand electricity distribution throughout the country.

### Strides toward a stronger, more resilient Haiti

Given Haiti's frail infrastructure, the tasks for fixing its debilitating electricity and energy issues have not been easy. Immediately following the earthquake, food shortages and a cholera outbreak consumed most of the limited resources that were available. That said, even with the demands placed on the aid that was provided to Haiti, there has been improvement thanks to initiatives like the Pilot Project for the Sustainable Electricity Distribution (PPSELD) program. USAID funded this program to expand reliable electricity from the Caracol Industrial Park Power Plant to surrounding communities.

This project alone has made it possible for more than 8,600 households, businesses, and government institutions in Caracol, Trou du Nord, Terrier Rouge, and Limonade to be connected to the power grid!

And while this is inspiring, these types of post-disaster projects are just one part of the solution. Organizations like the World Bank are working towards solutions that address the existing problems, so when a natural disaster does occur, those problems are not exacerbated. For example, the World Bank found that the cost of disasters in developing countries has reached around \$1.2 trillion since 1980 – amounting to one third of all official development aid.

This begs the question – shouldn't we be investing in disaster risk management programs that can help developing regions be more prepared for natural hazards?

One way to do so is by leveraging new technologies, especially those that are cloud-based. In fact, many relief agencies are already using cloud-based technologies, such as OneResponse, to coordinate relief during the aftermath of the earthquake. This is a promising approach. What about using the cloud to build a stronger, more resilient Haiti?

### Using cloud technologies and Big Data to strengthen Haiti's infrastructure

Now is an ideal time for Haiti to revamp existing programs and modernize its infrastructure. And, some of the most promising solutions are those made possible by the cloud. The cloud is especially feasible for developing regions like Haiti, because of recent developments in the delivery of sophisticated SaaS platforms. These solutions are more affordable and simple to integrate. By using Hadoop technology, a free, Java-based programming framework that supports the processing of large data sets in a distributed computing environment, data analysis tasks can be spread over many separate processors to deliver a tool that is quick and easy to use.



Cloud data storage can be increased to suit the volume of data and the expected lifetime of the data, providing easy standardization and scalability.

The cloud also enables advanced data visualization to be delivered, supporting a deeper understanding of the data relationships from system to system within an electric utility.

These system visualization techniques are especially useful in rural areas that lack traditional infrastructure identification characteristics. And with many utilities in developing areas lacking access to experienced engineers, it is important to have solutions that can be understood by under-skilled resources. Modern software designs make this possible. They provide a clean, easy-to-understand presentation of complex data sets and relationships that can be used by occasional users, a critical strategy for developing regions due to manpower limitations.

For example, in the case of the PPSELD mentioned above, using cloud-based technologies could enhance the programs already in place. Using a program that collected data analytics on those consuming electricity, one could track peak energy times, and conserve energy output when it's not needed – saving both the power plant and its users money. Further, by harnessing the data in real-time, one could pinpoint where power appears most vulnerable, allowing the utility to spend less time and resources – of which are likely manual and extremely limited – looking for the area that needs to be corrected.

In the case of the Haiti Energie and Florida International University (FIU) partnership, having data analytics would allow them to strengthen their ability to supply affordable solar power and access to electricity in Haiti. Having the tools to correctly analyze and use energy usage data will make it possible to create a broader functioning grid that can expedite the entire country's development and success.

## Setting a solid foundation for the future of Haiti and other developing countries

Haiti is still recovering, a process which won't complete overnight – with or without cloud-based technologies. But as it continues to put one foot in front of the other, the country should make sure its infrastructure incorporates cloud computing technologies. The cloud will be critical in modernizing Haiti's systems so that there is a solid foundation for a future that not only has stable energy, but is resilient in the event of future disasters.

### ABOUT THE AUTHOR

**Scott Foster** is CEO of Delta Energy & Communications and has over 29 years of experience in the energy sector.

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## Secure? Who cares – it complies with the regulations!

Over the last few years I have had ample opportunity to see organizations attempting to implement cyber security in industrial plants and facilities (such as power generating stations) all too often using guidance and best practices borrowed from the IT world. In many of the cases the results would be funny if they weren't just plain sad. Even all these years after the initial FERC call to implement cyber and physical security at the SCADA/EMS facilities that watch-over and control the grid we still are having arguments over what needs to be protected and how to achieve adequate protect. Seems to me that we spent less time (and maybe less money) putting astronauts on the moon back in the 1960s.

### Why has this happened?

Electric utilities and other bulk-power/grid entities continue to be 'under the gun' to comply with the NERC CIP standards, even as those standards are undergoing a lot of debate and discussion. Some entities have made good faith efforts to achieve regulatory compliance; but have not actually ended up making their critical cyber assets all that secure. They may have even expended a lot of time, money and manpower in the effort.

Some entities recognized the risk and liability that a major grid event would represent and invested in the right people and technologies and ended up establishing an adequate level of both physical and cyber security, but their program might not pass a CIP compliance audit due to missing paperwork.

Other entities apparently have a lot of lawyers sitting around and have treated the cyber and physical security regulations as so many legal documents that can be picked-apart and reinterpreted in order to find loop-holes and avoid, or at least delay, implementing much of anything. Watching them send endless requests for clarification and generating tons of paperwork in an attempt to bury the FERC staff is mostly boring and discouraging. I enjoyed watching one generating plant attempt to claim that each of their units was a separate plant so that they could fall under the 300 MW threshold and not apply any cyber protections. We all know how NERC responded to that attempt.

Other entities have handed the problem over to their corporate IT departments, the same people who just a few years back were not welcome in most industrial facilities because of their arrogant, one-size-fits-all approach to cyber security and their dangerous (and potentially deadly) acceptable IT practices that definitely did NOT fit well in an industrial setting. This last group provides me with the greatest number of incredible (but true!) stories.

A lot of those stories come from the fact that industrial facilities are filled with microprocessor-based (digital) devices that don't look, feel or operate like a PC or server running any of the popular commercial operating system, and they can't be monitored or protected in the same manner.



Devices like digital trend recorders, smart annunciator panels, 'smart' transmitters and other instruments, PLCs, RTUs and digital protective relays have blinking LEDs and might even sport a USB port or a memory card slot and an Ethernet NIC. These are generally referred to collectively as IEDs (no, not the kind causing deaths and injuries among our troops in the Middle East) or Intelligent Electronic Devices. IEDs pose a real problem to traditional IT personnel since they are driven to try and apply IT best practices to these devices without putting in the time and effort to find out how such devices actually work. So called 'embedded devices' are very different, in both hardware and software design, from your basic PC or server.

This past year I was witness to a heated discussion between plant I&C personnel and an outside IT consultant involving exchanging data between two separate systems without creating a cyberattack pathway. The I&C personnel had attached a PLC on to each of the two systems and then cross-wired some analog and contact I/O signals between the two PLCs. This allowed the transfer of a handful of process measurements and some operational status flags between the two systems. The IT consultant insisted that this was creating a potential attack pathway between the two systems because "Modems use analog signals and they transmit digital message traffic." It was pointed out that you would have to covertly install some pretty tricky programming into both of the PLCs to make them do this and you would also have to put some interesting programming onto both of the systems to cause them to treat the PLCs as communication devices. And if you had sufficient access to make all that happen then creating a covert communication channel was probably superfluous. (One wag pointed out that it would be much easier to use the contact I/O to send binary messages, but the other I&C folks told him to keep his mouth shut till the consultant left the site.) Needless to say, a lot of time and effort was spent fighting over this issue (which ended up with the I&C folks winning the argument.) Basically the whole problem was caused by the total lack of knowledge of IACS and I&C technology on the part of the IT consultant.

In another case the IT consultant (a different one) was very concerned about a set of panel mounted digital trend recorders because they all had USB ports which could be used to load replacement firmware and to load/save the trend data and configuration settings. He wanted them equipped with mechanical port locks so that the USB ports would not be accessible. The issue was over a new cyber concern called 'Bad USB.' In a PC when you insert a USB device into an open port the device sets its address to zero (0) and raises an electrical signal that tells the PC that there is a new device on the USB serial bus. The PC then queries the device, tells it what actual address to use and asks it to identify itself and what kind(s) of functions it

supports: keyboard, mouse, communications, audio, bulk storage, etc. The PC then goes off to its huge pre-loaded library of registered USB device drivers (and you wondered why Windows needs a big disk drive?) and loads all of the drivers needed to interact with the device. This is called enumeration. The bad USB scenario is having a USB device that looks like a simple "thumb drive" but when plugged-in it tells the PC that it is a keyboard and then sends the PC commands as if they were being typed on the keyboard. Some of those commands would entail copying files from the USB device and installing and running them on the PC (I am simplifying this a bit, but that is the basic idea). A VERY important part of what I just said was 'huge pre-loaded library of registered drivers.' The digital trend recorders have no library of USB device drivers, do an abbreviated enumeration, and were factory programmed to only recognize and talk to USB bulk storage objects and only for basic read/write operations. They had no library of drivers for other USB devices since it makes no sense to plug a keyboard or mouse into the trend recorders. So even though they had USB ports, these were what I call limited-functionality USB ports which, by their nature, would not be vulnerable to a Bad USB attack. Again, the issue here was assuming that a USB is a USB and they all work the same as on your PC. It took a technical discussion with the vendor's engineering staff to confirm that this was the case and that the threat did not exist.

IT folks are very concerned about malware getting into devices and systems and corrupting them. A very reasonable concern since there is a huge and constantly increasing repository of malware and exploits that are designed to attack computers. Getting malware into a system doesn't involve magic. If done remotely this means that the system being attacked has some 'service' (program) that is waiting to receive a connection request from some other program in some other computer out across a shared network (like the internet). Like being a company sales associate waiting to get an incoming call from someone wanting to place an order. To attack the system a hacker would have had to look through the program code of that service/program and find a spot where they can trick the program into blindly accepting a lot of data that will spill over into program memory and replace some of the existing program instructions (something called a buffer overflow attack). For this to work there are several requirements:

- First that the attacker get their hands on the program code for the service they want to attack. Easily done with Windows, Linux, OSX or any of the commercially available software products since anyone can buy a copy of the software. Not so easy with an I&C product running vendor proprietary operating software.

- Second that there be an exploitable flaw in that program code where you can send a lot of extra stuff. Most I&C products support industrial protocols where the protocol messages are strictly defined and where anything deviating will be treated as a bad message and discarded.
- Third that the attacker's inserted program code can call on the operating system of the device/system to do critical things like creating a file, starting a file transfer process, installing a new task, running a program, etc. Fine if you are running a commercial O.S. but unlikely in a smart device where there probably won't even be a file system and definitely won't be user-callable operating system functions.
- Fourth, that you can overwrite existing program instructions with new ones that change the function of the device/system. Not an issue in a PC where all programs, including the OS itself, are running in RAM memory.

But many IEDs have no hard drive and their basic program code is burned into some form of ROM which cannot be easily altered, even if that code is copied into RAM when the device boots up. The point being that many IEDs are not even slightly susceptible to malware that is used against conventional laptops, PCs and servers. I am not saying that you couldn't invest a great deal of time and energy into custom crafting a cyberattack against a digital chart recorder, but is the bang really worth the buck? If you are going to use your one shot at launching a cyberattack on a plant would you squander it making a trend recorder display bad data? The attack would be specific to a given version of hardware and firmware and would become ineffective if firmware were updated. Also rebooting the IED would probably bring it back into normal operation. I have listened-in on endless conversations between I&C personnel (who can't be blamed for not knowing the detailed technical design specifics of every IED they use) and IT personnel who insist that a computer is a computer is a computer and anti-malware must be provided.

Industrial facilities usually do have a lot of PCs and servers that are components of a DCS, PLC or in-plant SCADA system. They are the same devices used by IT for office automation but in such cases they must be looked at holistically, from a system perspective, and not as individual, stand-alone components. This is not to say that many IT cyber security measures can't be applied to such systems. The fact is that all of the major automation vendors have discovered that cyber security is a money-making opportunity to sell more goods and especially services to their installed base. Most IACS systems incorporate some level of self-checking and automatic fail-over. There may be a basic underlying set of message traffic between and among system components used for synchronization and updating and for verifying backup availability and triggering automated fail-over and reconfiguration. Not all of that message traffic is well

documented (or documented at all) by the system vendor. In another case of IT best practices versus IACS reality the corporate IT representative insisted on using internal firewalls to segment the plant automation system LAN to limit attack penetration and block the spread of malware, not a bad practice and even an ISA.99 recommendation. But the IT consultant insisted that any message traffic that could not be documented as being used for an identified and documented application should be blocked by those firewalls. The plant IACS personnel did not have the technical expertise to argue why this might be a bad idea, and in fact initially everything still seemed to work properly. It was only several months later that it was discovered that engineering changes being made on a supervisory workstation were not making their way down into all of the plant systems automatically as they used to in the past. Rather than trying to fight with the corporate IT folks to get firewall rules changed (since that was apparently on par with taking a case to the Supreme Court) the plant people just revised their work processes and configuration management procedures to make a manual transfer of updates to all of the plant systems that no longer received automatic updates. Another instance where lack of understanding of how IACS technology works ended up wasting time and manpower.

I am just about to celebrate my 64th birthday and I have plans to hang up my spurs in the next year. It would be great to see man finally land on Mars before I die. I am not sure that will happen but I am hopeful. It would be fun to see man back on the moon before I die, even if it is the Chinese who are most likely to make that happen. I am less hopeful about living to see our critical national infrastructure achieve an adequate level of immunity from cyberattack before I die, recalling that it is most likely the Chinese who pose the greatest cyber threat to that national infrastructure.

## ABOUT THE AUTHOR

Dr. Shaw is a Certified Information Systems Security Professional (CISSP), a Certified Ethical Hacker (CIEH), a Certified Penetration Tester (CPT) and has been active in designing and installing industrial automation for more than 35 years. He is the author of *Computer Control of BATCH Processes and CYBERSECURITY for SCADA Systems* and co-author of the latest revision of *Industrial Data Communications*. Shaw is a prolific writer of papers and articles on a wide range of technical topics and has also contributed to several other books. Dr. Shaw has also developed, and is also an instructor for, a number of ISA courses and he also teaches on-line courses for the University of Kansas continuing education program. He is currently Principal & Senior Consultant for Cyber SEcURITY Consulting, a consultancy practice focused on industrial automation cyber security and technologies. Inquiries, comments or questions regarding the contents of this column and/or other security-related topics can be emailed to [timshaw4@verizon.net](mailto:timshaw4@verizon.net)

# Weather Integrated Outage Management Helps Utilities Weather the Storm

Guest Editorial ▶

By Keith Hupperts and Shylesh Muralidharan

Utilities today face a myriad of complex challenges – from aging infrastructure to changing regulation and increasing customer demands – but the biggest issue for many utilities is something that has traditionally been hard to predict: increasing severe weather and its impact on infrastructure. In reality, weather's impact on a utility's network further complicates many of the previously mentioned challenges. And the impacts of weather events can be costly from both a financial and public opinion standpoint.

According to studies from UVM, Berkeley Labs, IEEE Spectrum, and the 2013 IDC report, 44 percent of outages and 78 percent of grid disruptions are attributed to weather events. These disruptions hit the U.S. economy each year with a cost of \$20-\$55 billion and have increased 'six-fold in the past 20 years.'

For utilities, being unprepared for tumultuous weather can quickly become a dire situation, as public opinion can damage a utility's reputation after just one storm – particularly if the utility's reaction isn't swift and efficient. Utilities also face increased scrutiny over their power restoration times from regulators.

Aging infrastructure adds to weather and reputation challenges, combined with lagging operations and maintenance schedules, and fewer line crews. Infrastructure replacements are difficult and costly, and many utilities don't have the resources for an infrastructure overhaul.

To combat this perfect storm of challenges, the integration of accurate weather forecasting directly into an outage management system (OMS) provides a serendipitous partnership as an innovative solution to disaster preparation and relief.

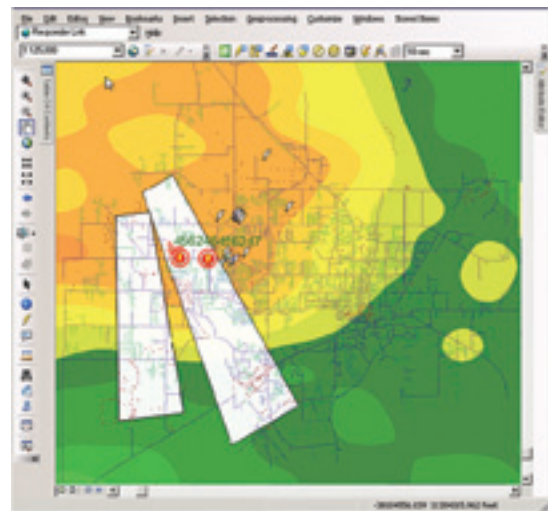
It has become common for a utility to integrate its geographic information system (GIS) – which provides a comprehensive view of network assets and conditions – with an OMS that serves as the lens through which outages are identified and monitored. By taking it a step further and integrating weather forecasting into the OMS, utilities have a whole new level of insight into not just the network, but how forecasted weather may impact asset infrastructure.

This powerful integration gives utilities the ability to plan for forecasted weather events, respond to asset damage, and recover from weather events more efficiently than ever before.

## Plan for crew resources and network assets

Tracking accurate, real-time weather forecasting in relation to the network, allows a utility to better plan for crew needs – ramping up when weather events threaten and staffing lightly when the sky is clear. This agile staffing eases response planning while reducing overall costs.

Knowing when and where a weather event is likely to strike, a utility can identify which critical assets may be in danger and prepare for shut-off and restoration needs. For example, by tracking the advance of a wildfire, a utility can determine which critical assets are in the fire path and prepare for shut-off and potential restoration. As the fire approaches buildings, service can be adjusted to avoid added risk from damaged assets, such as gas explosions. Using up-to-date, advanced network tracing tools within the combined GIS/OMS solution allows the utility to isolate shutoffs, minimizing the number of affected customers.





Armed with weather forecast data integrated with its OMS, a utility can leverage quantified outage prediction to strategically schedule and prepare crews before outages occur and request mutual assistance from neighboring utilities. These preparations mean faster restoration times as well as more efficient staffing.

A utility can monitor real-time weather data in relation to the asset infrastructure and determine when the weather-event has passed and crews can safely get to work. This balance lets crews begin restoring equipment sooner without putting them at risk.

### Reduce restoration time and costs

Similarly, when a storm-related outage occurs the utility can determine with confidence where weather may still be impacting their service territory and route crews around the storm to quickly restore service and reroute supply around damaged assets to keep services online throughout restoration. The ability to precisely control and track service status, in addition to supporting restoration crews, gives utilities an important asset for communicating with customers.



This was a valuable resource during the aftermath of Hurricane Sandy, when millions of customers were left without power. Many utilities provided outage maps on their websites, using information often provided by a utility's GIS. Some utilities even had these maps up and running before Sandy hit, allowing customers to plan and prepare for their expected days without service. On the contrary, utilities who never provided outage information suffered the customer and public relations consequences.

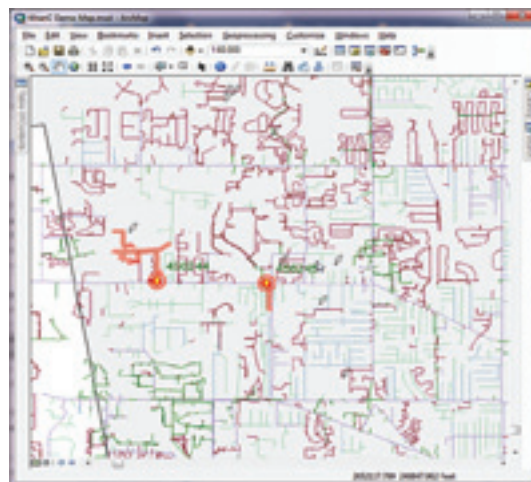
### Informed damage assessment and infrastructure replacements

The prevalence of aging infrastructure combined with fewer line crews and a mandate to do more with less means utilities need to more efficiently identify infrastructure replacements. Historical weather data can provide a utility with the information necessary to easily determine which assets have been most frequently impacted by weather events and strategically target inspection or replacement of those assets.

Combining weather and outage data can assist utilities in improving long-term outage planning by gaining greater visibility into the asset infrastructure and its condition. For example, a utility can use historical weather data to map lightning strikes across the network and identify areas with frequent strikes. By proactively placing lightning arrestors, the utility strategically protects equipment while making the most efficient use of resources. This same lightning strike information can help a utility determine how to prioritize equipment for inspection or replacement to save time, reduce outages and ensure more accurate reporting of outage causes.

### Keep the public informed and on your side

The ability to access up-to-the-minute GIS data on infrastructure, integrated with data on the disaster itself, allows utilities to be proactive in their preparations and mitigation efforts.



As a hurricane, fire, flood, or other weather event approaches a city – and threatens residential and commercial infrastructure – utilities are able to leverage their GIS technology to assess risk to critical infrastructure and prepare for damage related outages and take action on that information. Thus armed, the utility can better communicate with customers to help them prepare for extended outages and keep them informed on restoration progress.

Weather enabled OMS also can be a tremendous asset to the greater community. Utilities can share data from their geodatabase with first responders, fire authorities, emergency management groups and public officials who assist in planning and coordinated responses. With large-scale disasters that require public safety crews to assess a large numbers of threats, sharing accurate data on infrastructure using advanced mapping tools is a great asset to help decision makers triage problems to deploy resources.

One example of this occurred in San Diego a few years ago when fires invaded the area. The public watched as first responders arrived on the scene to protect life and property, but behind the scenes responders were able to create maps of essential infrastructure using utility information and the critical communication infrastructure. As fires approached a primary communication tower, a hub for all the main cellular carriers in the area, emergency personnel knew damage had to be prevented. If the tower went down it would have been a catastrophe, because in addition to losing cell phone service, emergency responders also would have lost their primary communications network. By having the ability to spatially assess the full range of threats and risk levels, responders were able to redeploy and prevent the loss of the tower, essential to the ongoing disaster management effort.

The combination of utility OMS with highly accurate weather forecasting opens many new doors of possibility and implementation of the two systems is easier than ever before. The most advanced systems allow the utility to integrate weather forecasting and OMS with a simple push of a button – eliminating a lot

of the complicated set-up challenges that previously hindered utilities from integrating the two systems. Given that severe weather events will only become more common; having a weather-enabled outage management is an essential tool for any proactive utility.

## ABOUT THE AUTHORS



**Keith Hupperts** is a 17-year veteran of the utility GIS market currently working as OMS product manager for Schneider Electric. As OMS product manager, Keith works to clarify market direction, and how OMS will be used to meet market needs now and in the future.



**Shylesh Muralidharan** is a product manager in Schneider Electric's global solutions business focused on building products for real-time weather data integration into energy industry applications. He has more than 13 years worldwide experience in product management and technology consulting in the energy and utilities sector. Shylesh specializes in strategy and solution design of smart grid technology projects, and generating thought leadership in the field of new energy systems and sustainability.

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