

OPTIMIZING UTILITY ANALYTICS

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PEOPLE // ISSUES // STRATEGY // TECHNOLOGY

## Smart Grid, Smart World

➤ **ANALYTICS  
ALL THE TIME**

**THE NEW  
ENERGY  
LANDSCAPE**  
CRANE + YERGIN +  
ROGERS + BUCKMAN

**10<sup>th</sup>**  
ANNIVERSARY  
ISSUE **PART 2**

**RICHARD CLARKE  
ON SECURITY**

**CHRIS BROWN  
ON WIND**

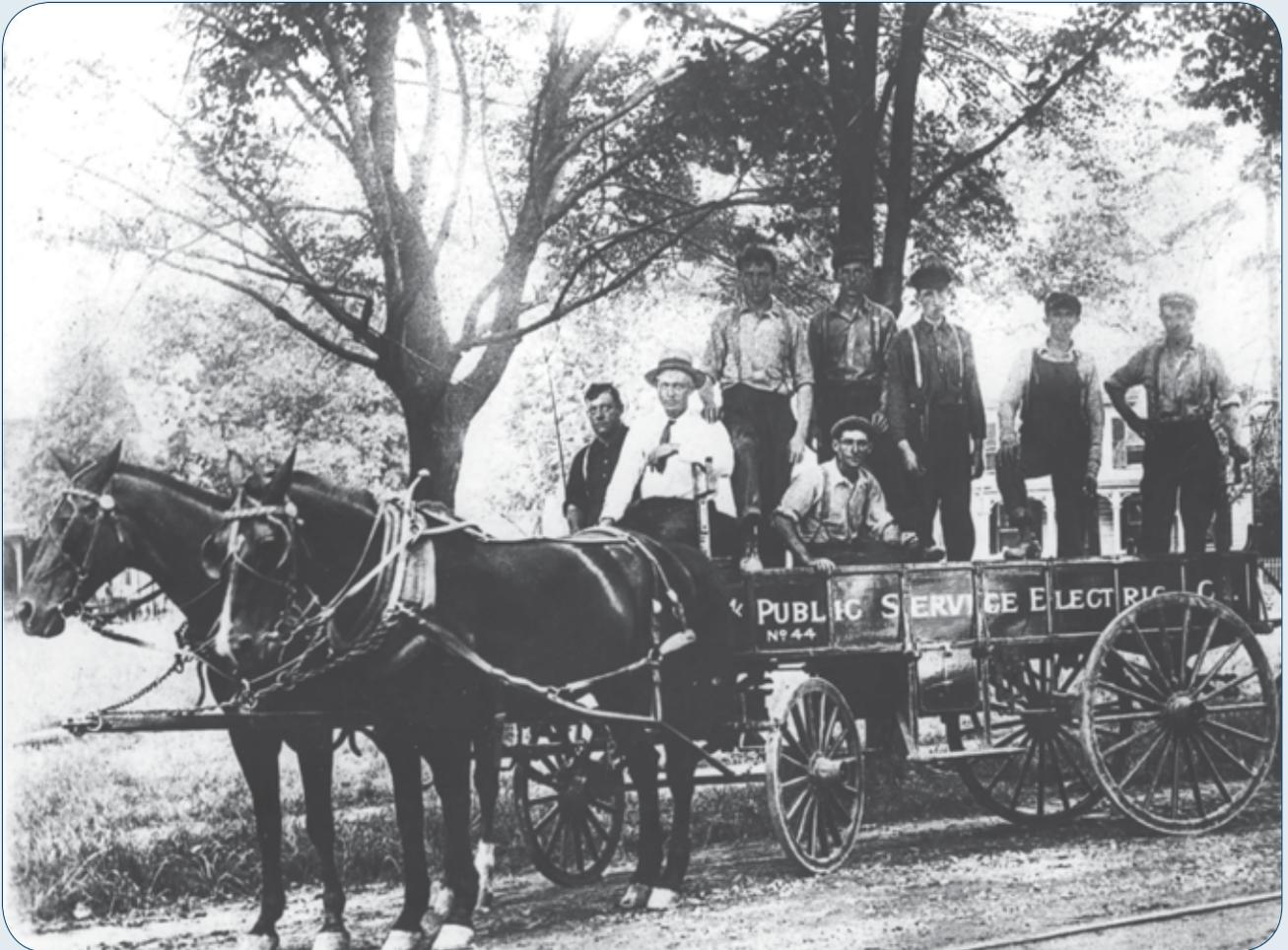


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# BUILDING A NEW GENERATION OF NUCLEAR ENERGY

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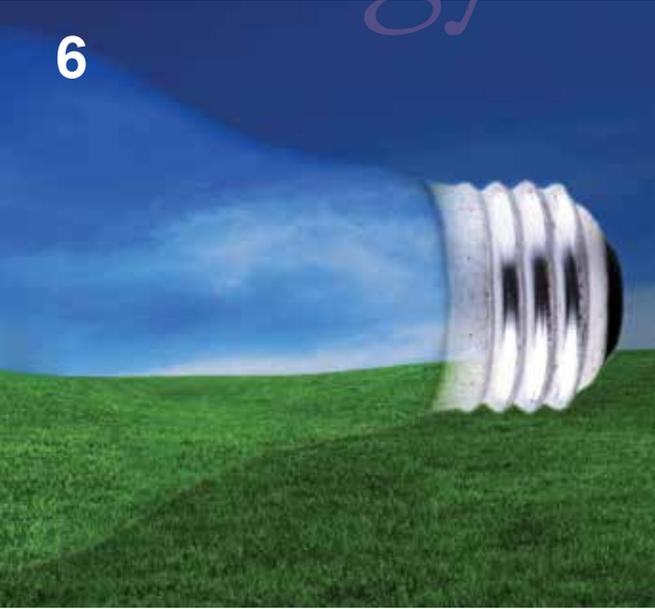


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Westinghouse Electric Company LLC



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# EVERY DAY

MILITARY VETERANS LIKE DOMINION LINEMAN DEVON MCFADDEN ARE REMOVING ONE PROUDLY WORN UNIFORM FOR ANOTHER.

Supporting our military—when they're abroad and when they come home—is an important part of who we are. That's one of the reasons we've helped pilot the national Troops to Energy Jobs program, which links military veterans to jobs in the energy sector. We're proud that our company's commitment to service members and their families was recognized when we received the Secretary of Defense Employer Support Freedom Award—the highest honor given to companies employing military veterans. It's also led to Dominion being named a "Top 100 Military Friendly Employer" five years in a row. But what we're most proud of are the dedicated men and women who've served our country so bravely. We're honored to stand behind them—and work beside them.



# New Beginnings

LEARNING FROM THOUGHT LEADERS

## A NEW YEAR IS ALL ABOUT A FRESH START.

To mark the 10th anniversary of *EnergyBiz's* launch, we approached four preeminent thought leaders and asked them to pen essays about where we have been in energy and where we are headed.

David Crane, NRG Energy president and chief executive officer, one year ago in *EnergyBiz* bemoaned the head-in-the-sand mentality of many in the utility sector. Copies circulated in utility boardrooms.

Now you can read his passionate jeremiad on what he calls "the fast-shifting moral landscape in which we all operate."

Dan Yergin has a deep understanding of the powerful forces shaping and transforming energy. The energy world is fast shifting, Yergin writes for us, and he says "policymaking and infrastructure are struggling to keep up with the changes and to assimilate their meaning."

Jim Rogers, the former head of Duke, is skilled at crafting meaningful messages. He has ventured into Stephen Colbert's lair – and into the Clinton Global Initiative.

He is interested in using new energy technology to enrich the lives of people on Earth who lack electricity. It would go a long way toward addressing poverty and global conflict, and it would create vast new business for diverse energy enterprises.

Writes Rogers, "By pulling from our own experiences, we may bring real light to the remotest areas of the world in a way that sustains all of us."

We also reached out to Fred Buckman, the ex-PacifiCorp chief executive who continues to engage in a variety of energy ventures. It is from that vantage point that he reflects that although the power world may be shifting, in some respects it is headed "back to the future."

Fred writes for us, "Running a utility in the middle part of the 21st century may once again look more like it did in the middle part of the 20th century than it sometimes does now." Raising capital will be crucial.

As an energy expert, invest your time and read their contributions to this issue – and be prepared for a feast!

Ten years is a milestone for *EnergyBiz*, and much has changed, as you can see in this issue. The one constant is the insight and dedication *EnergyBiz brings to key industry executives like you.*

We want to thank you for your loyal readership, your contributions and your partnership. We look forward to being your partner for another 10 years. Watch for some exciting articles on strategy and the incredible changes facing our industry in our upcoming issues. ☒



Mark Johnson  
Co-founder, Energy Central



“The most important questions are the ones we haven’t asked yet.”

– Darby McKee, Analytics Manager

With advanced metering for electricity generating unprecedented amounts of data, Darby and Fred can solve just about any challenge that comes along. From helping utilities conserve resources and predict usage to recognizing and reducing theft, their work is essential to Itron’s commitment to our customers.

According to Darby and Fred, there is no end to what data can do. We’re limited only by our own imagination. We find that pretty exciting, and it’s the perfect way to envision a more resourceful world.

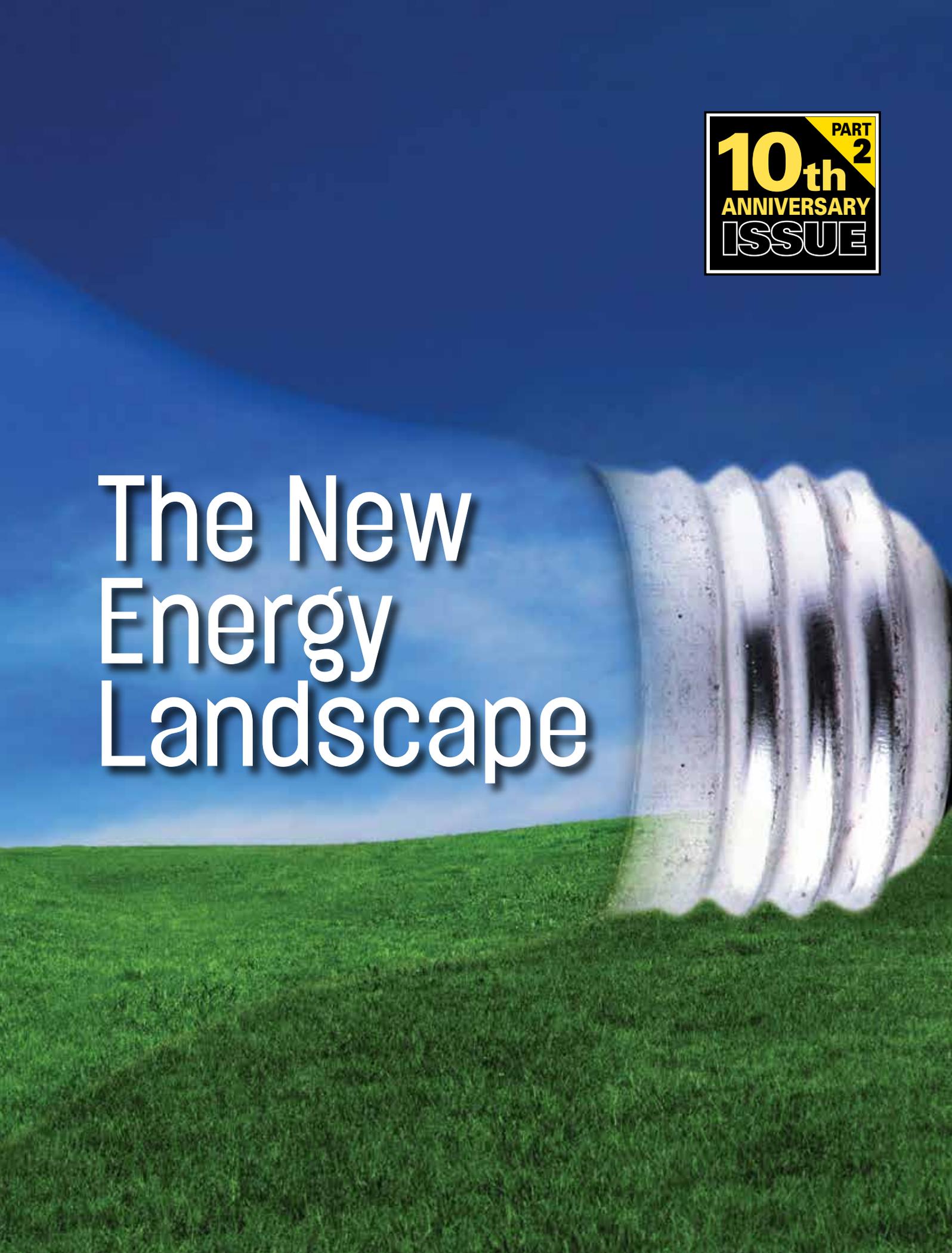
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Darby McKee and Fred Behrmann, Itron Analytics

**10<sup>th</sup>** PART  
**2**  
**ANNIVERSARY**  
**ISSUE**

# The New Energy Landscape



[GUEST OPINION]

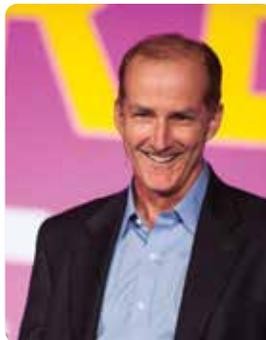
# Carbon Morality

THE NEARSIGHTEDNESS OF INCUMBENCY // BY DAVID CRANE

➤ **TEN YEARS AGO**, when *EnergyBiz* was launched, the American power industry was not experiencing its finest hour. Grippled by irrational exuberance, which manifested itself principally in overpaying and overleveraging when acquiring deregulated power assets, the power industry destroyed billions of dollars of shareholder value.

Worst of all, it managed to destroy value in a way that besmirched the entire power industry's image. The ethical stench that radiated from the carcass of Enron tainted all of us – the Enron-wannabes, the Midwest utilities that set up sexy proprietary trading platforms or the too-many-to-mention power companies that came to grief through ill-considered foreign investment. When you add in the round-trip trading scandal, the misreporting of commodity pricing data and the alleged manipulation of the California wholesale market, the power industry left an indelibly negative image in the minds of regulators and the public.

For those of us who grew up with and believed in the value proposition of the independent power producer industry, worst of all was the fact that Enron was one of *us*. No matter how much Enron in its final years was hyping itself as the “ultimate multicommodity trading platform,” it had started its postpipeline evolution as an independent power producer. Indeed, Enron was our shining light – the IPP that became the belle of the ball.



So when it was made clear to us that our little IPP patch of the industry was the root of all evil, that we weren't the Shire in the utility industry's Middle Earth but, in fact, a small slice of Mordor (call us Mount Doom) – that was hard to take. It was particularly hard at a place like NRG, which in 2004 was emerging from Chapter 11 bankruptcy protection into the wreckage of the power industry and, unlike Enron, NRG was innocent of any criminal malfeasance. Prior to its Chapter 11 bankruptcy reorganization, NRG had not engaged in criminal acts, it was just criminally

stupid in terms of the transactions it had done and the prices it had paid.

We have come a long way in 10 years, as an industry and as a company. We prospered during the robust commodity price environment before the financial crisis and we were sufficiently prudent in our hedging and in our leveraging to survive the commodity price collapse after the Great Recession. The IPP sector has shown it can withstand the extreme price swings of energy commodities, even though we lack the “iron dome” of rate base protection enjoyed by our bigger brethren, the investor-owned utilities.

But I am concerned that trouble looms for the power industry, utilities and IPPs alike, as the ground shifts below our feet in a way that none of us anticipated 10 years ago. I fear that the fast-shifting moral landscape in which we all operate threatens to leave our industry adrift, shunned by the customers we serve and the modern society we enable. I fear that we – all of us – are entering a new era of moral hazard.

Here is my hypothesis: Big corporations increasingly are being held accountable by the frustrated public for intractable societal problems that previously were considered the exclusive domain of public policymakers. But now, realizing the hopelessness of relying on effective action from a government terminally paralyzed by partisan deadlock, the desperate public is looking to the biggest remaining high-functioning institutions to take up the slack. That’s us: corporate America.

In most cases, the societal problem has some link to the business practices of the industry being called to account – like childhood obesity and the fast food industry, fresh water consumption and the beverage industry, personal privacy and the high-tech industry, and child labor and the garment industry. But in none of these cases is the link as direct, immediate or compellingly important as it is for us, the power industry.

The societal issue we own, obviously, is climate change, the mother of all social issues. We are as

an industry – for the sake only of the casual un-

**The American power industry, which consumes over a half-billion ton of coal per year, has left coal’s public image in the hands of the coal industry. Big mistake.**

informed reader perusing this issue of *EnergyBiz* in the dentist’s waiting room – the single largest emitter domestically of CO<sub>2</sub>, as a result of our overwhelming dependence on fossil fuel-based power generation.

We should have seen it coming back in 2007, when the proud and mighty TXU was forced into the hands of private equity because it had ignited a firestorm of controversy by announcing its plans to build 11 new coal plants in the coal-friendly and deeply conservative state of Texas.

After that shot across our bow, things calmed down. The struggle over the future of coal-fired generation reverted to the old normal – industry on one side versus the EPA and professional environmentalists on the other side, with the great majority of Americans seemingly indifferent to the outcome. But in fact, the moral issue has been festering just beneath the surface.

The American power industry, which consumes over a half-billion ton of coal per year, has left coal’s public image in the hands of the coal industry. Big mistake. The coal industry’s expensive attempts to persuade the American public that the emissions from coal plants that are scrubbed but otherwise untreated for carbon emissions constitute “clean coal” have failed miserably. In fact, their ads are so misleading they cast a pall of distrust over the entire industry and, as such, are destined to go down in history as representing one of the most

**NewsFlash**

**EX-IM BANK BACKS INDIAN DEAL**

The Export-Import Bank has agreed to explore options to use up to \$1 billion to fund the sale of U.S. clean energy exports to India.

The bank said it has approved \$353 million of U.S. renewable energy exports to India since 2009.

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ill-advised and self-defeating corporate public relations campaigns ever.

Now, the public discontent is bubbling to the surface. While the professional whiners in our industry continue to rail against the EPA and its effrontery in intending to regulate CO<sub>2</sub> emissions from stationary sources, the real risk to our industry rises elsewhere: from John Q. Public and corporate America itself. NRG has filed comments on the proposed EPA regulations critical of important aspects of the proposed rule, but we do not dispute the merits of the EPA regulating CO<sub>2</sub> emissions from power plants.

Corporations? Are we really at risk of being shunned by our fellow corporations, many of which are dealing with their own moral hazards? Why, yes, in fact, we are. Witness the “space race” among the most influential companies of the modern era – Amazon, Apple, Facebook, Google and Microsoft – to build giant, energy-consuming data centers. Most of them are openly competing with each other to ensure that their data centers are 100 percent powered by clean energy. Some are even making the distinction between clean energy, which simply can be grid power plus renewable energy credits, and “high-quality clean energy,” which means using energy from clearly identified renewable resources enabled by the data center’s demand for it.

What should be particularly disturbing about this is that the one company of the “fabulous five” that has not embraced clean energy data centers – Amazon – was picketed at its headquarters earlier this year by protesters castigating it for its willingness to run its data centers on grid power. Think about that: Amazon is being sent the message from its own consumer constituency that the use of grid power is wrong. Plugging in to the wall is now akin to smoking at your desk. Now, that is a moral hazard.

When it comes to the public, consider the fossil-fuel divestment campaign that’s gathering momentum among university endowments. For many reasons, I’m not a supporter of this divestment campaign, and I’m not overly concerned that it will dry up the pool of equity or debt capital available to our industry, but I’m concerned about one thing: its effect on the hearts and minds of American college students.

If the millions of students matriculating into and graduating out of the American university system each year are being exposed to four years

of constant agitation about morality-driven divestment from fossil-fuel companies, are those students likely to become loyal and willing customers of our industry? I don’t think so.

It’s something for the utilities to think about this year as they rev up their lobbyists and unleash their PR consultants in an effort to eliminate or retard the spread of clean distributed generation like residential solar. You may win the occasional net-metering battle here or the fixed-charge battle there. Electric utilities in Florida may continue to prevail with their canard that distributed solar is not right for the Sunshine State, but make no mistake: By winning these battles – indeed, by fighting them in the first place – you are losing where it really matters. You are losing the hearts and minds of the future generation of Americans. And, by so doing, you are hastening the day when the dominant energy partner for the end-use energy consumer will be companies with no history of fighting against the inexorable rise of the clean energy future and that embrace and enable the consumers’ right to make their own energy choices.

Certainly, we hope to be one of those companies, as do many outside companies currently looking in on our industry as one ripe for the plucking. But not too many other energy providers get it, and I don’t know why. Call it the nearsightedness of incumbency. ☒

*David Crane is the president and chief executive officer of NRG Energy.*

## NewsFlash

### GEORGIA SUN

Georgia is the fastest-growing solar market in America, according to a report by the *Savannah Morning News*.

About 91 megawatts of solar were installed in Georgia in 2013, ranking the state seventh in the nation for new solar capacity installed that year. The state had the largest increase in solar jobs of any state between 2012 and 2013, when employment reached 2,600.

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## Gatherings// Business Edge



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Denver

March  
17–18

Globalcon

Philadelphia

For more information about these and other events, please visit [www.energycentral.com/events](http://www.energycentral.com/events).



(GUEST OPINION)

# An Era of Change

REWORKING GENERATION // BY DANIEL YERGIN

➤ **THE ENERGY WORLD** does not stand still. It is remarkable how much has changed in the industry – and in perspectives – from just a decade ago when *EnergyBiz* launched. It is all the more remarkable considering that major investments in electric power can have a 60-year life, or even longer.

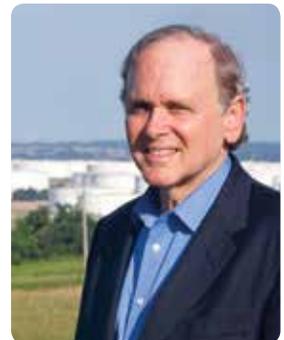
Just reflect: A decade ago, it seemed absolutely guaranteed that the United States was going to become a major importer of liquid natural gas, that oil imports would only continue to increase, and that “peak oil” had finally arrived.

Yet change was already beginning to undermine those assumptions, even if it was hardly apparent. The first steps in what would become a revolution began 20 years earlier, with initial experimentation with hydraulic fracturing in shale rock. It was far from achieving breakthroughs, and it was yet to be combined with horizontal drilling. The effect of hydraulic fracturing

with shale gas didn’t begin to be recognized until 2008, and it took another couple of years for it to become apparent with tight oil.

However, in just a few short years, the effect has become large enough to constitute a revolution. Natural gas output has surged, and it would be surging even more if the demand was there. U.S. crude oil production is up 80 percent since the “peak oil” year of 2008.

Policymaking and infrastructure are struggling to keep up with the changes and to assimilate their meaning. A country shaped by a mentality of shortage, as Energy Secretary Ernest Moniz has described it, is now trying to accommodate a relative mentality of abundance. It’s not an easy adjustment. The prospect



of liquid natural gas exports aroused considerable controversy, but that has now subsided, and the United States will start to become a significant liquid natural gas exporter in little more than a year.

The new argument is about crude oil exports, which are still for the most part prohibited by legislation left over from the energy crisis years of the 1970s. Oil price controls, which were one rationale for the ban on crude oil exports, were abolished in 1981. The economic rationale for letting markets determine what happens is strong. The political calculus is quite different, with politicians concerned about gasoline prices, even though gasoline prices are set off by world crude oil prices, not domestic prices. Passions run deep, especially when the issue is gasoline prices, but 2015 could be the year in which the issue of crude oil exports is resolved.

For years, some had argued that increasing domestic production would be good for balance of payments and energy security. What had been largely unanticipated was how significant it would be for the domestic economy overall.

The effect is becoming clearer and clearer. By 2020, the “unconventional revolution” – shale gas and tight oil – will be supporting over 3 million jobs and generating \$125 billion in additional government revenue. Abundant low-cost energy is also transforming the position of the United States in the world economy, making the United States much more competitive as a place to manufacture. The German government is now expressing alarm about its country’s export competitiveness, given Germany’s high-cost energy in contrast to America’s lower costs. Meanwhile, more than \$100 billion dollars in new investment in U.S. petrochemicals is scheduled, owing to the new energy situation in the United States.

At our CERAWeek conference last spring, I asked former Federal Reserve Chairman Ben Bernanke how to assess the overall economic impact of the unconventional revolution. He replied that it has proved to be “one of the most beneficial developments if not the most beneficial development since 2008.”

For the electric power industry, the choices for new power generation have narrowed. In my book *The Quest*, I observed how government policy pushed utilities to switch to coal in the 1970s and the 1980s. Public policy is now aggressively seeking to squeeze coal’s place in the fuel mix, although that will be a legal and political battle for the next few years. Natural

gas, high-priced a decade ago, has now become, as a low-cost fuel, the default option for new electric power capacity.

The other major change, of course, is in renewables. A decade ago, they were still a fringe, with just \$5 billion spent on renewable power. Now, bolstered by subsidies, regulation and reductions in cost, they represent a significant portion, with about \$32 billion



## The growing share of renewables in power generation creates new challenges.



to be spent in 2014. As much as \$235 billion will be spent on renewable power in the period 2014–2024.

Altogether, in what will be a major reworking of the nation’s electric generating capacity, our projections are that natural gas and renewables will comprise almost all the new generation added in the years ahead. During the next 10 years, the split between them will be just about even, with gas achieving a somewhat larger share during the 10 years following.

The growing share of renewables in power generation creates new challenges. One is the management of intermittency, which becomes more pressing with scale. The second is the distribution of costs between upper-income people taking advantages of subsidies to reduce their dependence on the grid and lower-income people who do not have that choice.

The third is the looming question of distributed generation and what that does to the position of traditional generators and distribution companies. That was hardly a consideration a decade ago, but it is now a preoccupying question for the electric power industry, especially when it looks at what has happened to the power business in Germany in light of its extremely rapid push to renewable power. This is a subject that will gain increasing prominence during the next 10 years. ☒

*Daniel Yergin is vice chairman of IHS. His new book is *The Quest: Energy, Security, and the Remaking of the Modern World*.*



(GUEST OPINION)

# A Profound Inequality

SPURRING GLOBAL ELECTRICITY ACCESS // BY JIM ROGERS

➤ **HAVE YOU VISITED** your doctor lately? Imagine if there was no choice but to be examined by candlelight, or worse, with no light at all – the doctor might have missed something. That’s the scenario for 1 billion people around the world whose health clinics lack electricity.

Imagine attending third grade in a room dependent on natural light. Over half the primary school children in the developing world learn like this, in rooms without power.

My interest in the lack of access to electricity in many countries of the world began with a chance meeting with a young man in a Kenyan village. He was holding a cellphone in the middle of nowhere, with not a power line in sight.

“How do you charge that thing?” I asked.

“I walk three hours to the charging station,” he said.

Wow, I thought. He walks three hours to the charging station – six hours in one day – to charge his cellphone. I can barely stand it when I check into a hotel and find there’s not an outlet conveniently placed next to my bed.

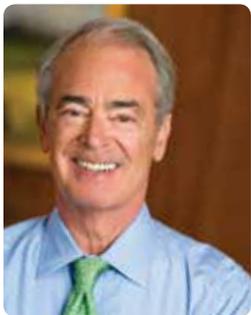
I’ve spent most of my career providing electricity to millions

of people, and I’m stunned by the global statistics: one in six people worldwide lack access to electrical power. That means 1.2 billion people have no Internet, no water pumps, no bright lights to study by. Around another billion and a half people or so have limited access. There’s no question that electricity is the foundation for economic development, education, women’s rights, health and efficient farming. Let’s give

these people the chance to get ahead and take better care of their families. It is a human imperative. I believe that together we can make access to clean and sustainable electricity a basic human right.

There are many fine minds working on this issue in countries all around the world. I approach this as a student with a pretty solid background. No one has cracked the code on how to create access to cost-effective electricity. Moreover, each country has its own unique characteristics that must be understood and respected. Nevertheless, I believe that people from utilities in the developed world have a lot to offer to places that lack access to electricity. I also believe they have an opportunity to help the 600 million people in a few dozen countries in Sub-Saharan Africa, 400 million people in India, and 70 million in Indonesia. Another 1.7 billion people in the world don’t have access to a reliable, 24/7 supply of electricity.

Right now, the United Nations doesn’t consider access to electricity to be a basic human right. This is a bit ironic, because you need electricity in order to fulfill a lot of other designated human rights, such as clean water, education and medical care. The UN has focused on energy for rural areas with its Sustainable Energy for All initiative (SE4ALL). In 2015, the UN will have an opportunity to extend the SE4ALL program





by declaring access to electricity an official human right, and I'm personally going to push for that. I'm also going to push for electricity access to be added to the UN's list of Millennium Development Goals, with the hope that it will help governments of developing countries prioritize electricity access. That's going to change the world for the better.

Access to electricity just grows in importance as the Internet transforms education, banking, employment and political thinking. Electricity allows for the knowledge that's necessary to be an informed and effective member of society in the 21st century. Everyone should have that chance. As Bob Freling, the director of the Solar Electric Light Fund (SELF) wrote: "Energy is essential for life. It is essential for achieving the MDGs. And it is essential for safeguarding a broad range of human rights."

In the United States, the provision of universal access to electricity was considered the greatest engineering achievement of the 20th century by the National Academy of Engineers. Many thought it couldn't be done. Today, many don't believe we can provide access to electricity in the next several decades to 1.2 billion people worldwide. I believe we can.

My first stab at the access challenge was to co-found the Global BrightLight Foundation that has distributed more than 70,000 combination solar lanterns

and cellphone chargers in Rwanda, Uganda, Zambia, Nepal, Peru, Bolivia, Haiti and Guatemala. After starting with a philanthropic approach, we quickly shifted to a market model whereby we recycled the proceeds from sales to buy and distribute more solar lanterns.

Soon after, as chair of the Global Sustainable Electricity Partnership, a consortium of 13 of the world's largest electric utilities, I led Duke Energy and several other companies in GSEP in an effort to bring sustainable electricity to Cochico, a remote village in Patagonia, Argentina. The newly built micro-hydro facility gave a regional primary school access to electricity almost 24 hours a day rather than the four hours a day they previously had from a diesel generator. The children live at the school for three weeks and then return to their homes for one week each month of the school year.

I am writing a book about solving the challenges of bringing clean, sustainable electricity to the 1.2 billion in the world who lack it, to be published next year. I'm also co-teaching, with Tim Profeta, director of the Nicholas Institute for Environmental Policy Solutions at Duke University, a graduate course on the deployment of renewables to the rural poor in Africa, India and Indonesia. The students have a lot of remarkable insights about overcoming the barriers to access. Finally, I plan to use what I've learned to start a social enterprise in 2015 that will spearhead this movement toward worldwide access.

Providing access to power is an enormous challenge. Despite all the innovative ideas and efforts from NGOs, foundations, businesses and governments, a model is still needed that can overcome the barriers to scaling up, which include everything from government interference, technology hurdles, finance gaps and lack of local understanding to ways to ensure routine operation and maintenance of facilities.

I'm still increasingly convinced we can solve the issues, particularly by embracing microgrids, renewable energy from the sun, and emerging battery technologies. Just as in the developed world, we have to deliver electricity in a way that balances affordability with reliability, sustainability and increasingly clean production. By pulling from our own experiences, we may bring real light to the remotest areas of the world in a way that sustains all of us. ☒

*Jim Rogers is former chairman and CEO of Duke Energy, and currently a University Fellow at Duke University. His new book, Brighter, will soon be published by Palgrave Macmillan.*



# What is the Next Generation (NxG) Utility?

BY MIKE BEEHLER

➤ **TODAY'S ELECTRIC UTILITY** industry leadership faces many challenges. They must rebuild and harden an aging T&D infrastructure. They must embrace new technologies sometimes introduced by fast-moving customers or competitors. They must respond to a quickly changing mix of renewable and distributed generation while traditional central plants are forced into retirement by environmental regulation or low fuel (gas) prices. They must face a new competitive landscape where utilities compete for their transmission projects under FERC Order 1000. They must provide reasonable levels of physical and cyber security for assets deemed critical to our cities, states and nation. These challenges (and more) are occurring in an era

of low (or no) load growth with increasing pressure from customers and regulators to maintain affordable rates and from shareholders that demand reasonable rates of return while top line revenues are shrinking.

How will our leadership respond? How will we take an electric grid that has been called *the greatest achievement of the 20th century* to create an even more valuable national asset? How do we plan, finance, design, construct, operate and maintain an integrated grid with buyers and sellers of energy, capacity, storage and other ancillary services “transacting” with one another in a safe, reliable (and resilient), affordable and compliant manner? The answers to these questions will tell us how to achieve the Next Generation (NxG) utility and position our companies



## How will our leadership respond?

for the abundant opportunities of the future.

Burns & McDonnell has engaged with many of our clients over the past year on this subject and offers the following suggestions for the leaders of regulated electric (and gas) utilities in North America:

1. Hire the smartest electrical engineers you can find to operate an increasingly complex integrated grid safely, reliably, efficiently and in compliance. Whether you remain a customer-connected, vertically integrated utility or morph into a distribution platform provider or system operator, the future grid will be complex. Start getting ready today.
2. Build as much T&D as you can, today. Transmission will be competitive. Distribution needs the deployment of advanced technologies that will enable transactive energy on an integrated grid. Start to harden and enhance the distribution system and its telecom backbone to be ready for a new paradigm.
3. Engage your commercial and industrial customers with behind-the-meter service (BTMS) offerings



to be “positioned” against your competition as the *Trusted Energy Service Provider*.

The challenges of the Next Generation (NxG) utility come with opportunity. But, the new paradigms of opportunity require leadership. Burns & McDonnell offers these action items that utility leadership can implement today to position for the opportunities of the future. No one knows for sure when the Next Generation (NxG) utility will come. Will we “know it when we see it?” or will we lead our industry to embrace new opportunities and deliver it?



*Join us on February 26 at 2PM EST to hear retired AEP CEO and Chairman of the Board, Mike Morris, and his opinions on our energy future and what the Next Generation (NxG) utility might look like.*

*Mike Beehler, PE, is a vice president with Burns & McDonnell and has written and presented extensively on reliability-centered maintenance, critical infrastructure security, program management and development of the smart grid.*

(GUEST OPINION)

# Business in the 21st Century

FUTURE TRENDS FOR UTILITIES  
BY FRED BUCKMAN

➤ **FOR A LARGE PART** of my career, it was my good fortune to work in the electric utility business. My start came with Consumers Power in 1967 while I was still in graduate school and ended with my role as chief executive of PacifiCorp in 1998. The electric utility business I see today is quite different from the one I joined in the mid-'60s and even different from the one I left 16 years ago.

In the middle of the last century, growth characterized the electric utility business – growth in demand, growth in overall energy consumption, growth fueled by a build out of high-capital-cost coal and nuclear units, and growth driven by people

moving from central cities to suburbia, requiring massive infrastructure investments.

The nearly overnight change in oil prices followed by massive inflation changed all of that. Not only did growth disappear, but also the cost of building infrastructure changed in ways that created strong resistance to the price hikes

that followed capital investment.

Once utility spending was reigned in, utilities found themselves buying power from third parties, competing with others for the right to build transmission in their own neighborhoods and suffering criticism for burning too much coal and not using enough wind,



solar and geothermal energy to satisfy those more concerned about climate change than energy prices or energy reliability.

If we were to stand on the mountaintop today and look forward, what would we see that could change customer expectations and utility behavior? Two factors stand out. One is the dramatic change taking place in technology. Technology is driving both what we can do with our generation portfolio and with networks used for delivering energy, and it is having a significant effect on demand.

We are seeing the deployment of technology that allows us to manage power flows on our networks. It allows us to interact with our customers at the point of use to help customers manage both the amount of energy consumed and when it is consumed. The price of solar installations and wind farms continues to come down, even as the cost of nuclear and coal stations continues to rise. The efficiency of natural gas installations continues to rise, making the choice of





**Capital demands will be high, and utilities with the most efficient strategies for raising massive amounts of capital will be the winners.**

gas as a fuel more attractive each day.

The implication of this view from the mountaintop is that running a utility in the middle part of the 21st century may once again look more like it did in the middle part of the 20th century than it sometimes does now. Capital demands will be high, and utilities with the most efficient strategies for raising massive amounts of capital will be the winners.

Utilities will be seeking capital to retire coal units and replace them with generation that is more efficient and that produces less greenhouse gas. They will also be investing heavily in networks to improve reliability, reduce congestion, harden the networks against external events and support new movements in population, perhaps back to central cities. They will also become partners with their customers in the ownership of equipment that consumes large amounts of energy. Electric cars and fueling stations, central station heating and cooling, server farms and many other high-usage applications will be at least partly owned

by utilities and managed as a part of overall system optimization.

The old-fashioned way of raising capital to fund these demands is through the issuance of equity and debt. With the cost of debt at historic lows and when a utility's share price is handsomely above its book value, raising capital this way can be accretive to shareholders. Tomorrow's markets, however, will not reward those who resort to old-fashioned ways of raising capital.

Utilities have assets that they can sell or restructure to unlock vast amounts of accretive capital. They can sell the assets outright at highly attractive multiples. They can partner with third parties to hold the assets in joint ventures that both release capital and streamline balance sheets. And they can restructure their vertical integration to create companies with balance sheet strength more aligned with future needs than past practice.

Although all three of these strategies have their unique benefits, it is the second strategy that has the most compelling story. A utility can take an asset that it owns outright and move it into a partnership where it owns a 49 percent interest. It brings in a partner to own the other 51 percent. It leverages the partnership in a way consistent with the asset's cash flow and the creditworthiness of its counterparties. It takes out a significant amount of cash and it moves both the asset and the debt associated with the joint venture off its balance sheet. A new entry is then made for equity in the joint venture. The balance sheet is strengthened, cash is released, earnings are recognized and there is no dilution to existing shareholders.

The underlying story of the first half of the 21st century for utilities is going to be a return to high levels of capital expenditure. They will be modernizing their generation fleet, investing heavily in both transmission and distribution technology and infrastructure, and they will be partners with their customers in the ownership of high-consumption equipment, and distributed generation and network assets. Unlike the previous period of high capital expenditures, it won't be economies of scale that separate winners from losers, and it won't be the economic vitality of the service territory, it will be the efficiency with which capital is raised. ☒

*Fred Buckman is chief executive officer of Powerlink Transmission and former chief executive of PacifiCorp.*

# Resourcefulness in Action

## 2014 Itron Utility Week emphasized collaboration, innovation, and energy and water management

By: Sharelynn Moore, Vice President, Corporate Marketing and Public Affairs

Nearly 1,000 leaders from utilities and companies representing 10 countries gathered at the 32nd annual Itron Utility Week (IUW) conference recently held in San Antonio, Texas. As the utility industry's premier conference focused on connecting people and technology, IUW provides Itron customers, partners and industry leaders with an opportunity to learn, collaborate, discuss challenges and trends, and drive better management of energy and water resources.

This year's conference focused on how utilities can and are putting resourcefulness into action to improve their organizations and communities. Attendees discussed resourcefulness in more than 130 sessions across five

tracks, which included Advanced Measurement and Communication, Analytics and Applications, Data Management and IT, Energy Efficiency and Water Conservation and Smart Grid. The conference was rife with collaboration, conversation and enthusiasm around the latest technology and innovations in the industry and what the future holds.

### Examining Waste in the Age of Resourcefulness

Itron's President and CEO Philip Mezey kicked off the Knowledge Conference portion of Itron Utility Week with

a compelling discussion around resource waste in the industry and called on all utilities to do more while consuming less. The discussion, titled "The Age of Resourcefulness," noted that managing energy and water is critical to ongoing economic prosperity, resource conservation and social wellbeing and that while the industry has made great strides to improve efficiency and resourcefulness in energy and water consumption, there still is more that can be done.



During that discussion, attendees learned that within the U.S., \$13 billion is lost per year due to water leaks and \$24 billion per year from electricity transmission and distribution losses. Additionally, from 2000 to 2011, \$20 billion in natural gas was unaccounted for and never used. If this waste could be reduced by just one percent, approximately \$370 million would be saved. Reducing this waste by 10 percent would save \$3.7 billion, annually.

The utility industry has already been able to decrease waste through the meter to cash process, but if everyone works to reduce waste by one percent from other types of losses, including leaks and theft, it could greatly benefit the industry and economy. There are several key ways to achieve the goal of a one percent and eventually, 10 percent reduction in waste.

- The first is having a visionary and engaged leadership within utilities and companies.
- Second, having technology and services readily available and scalable for utilities is deemed critical to achieving waste reduction.
- Third, collaboration, cooperation and the willingness to share information and technology between utilities – much like the collaboration that happens at Itron Utility Week year-after-year – is key.
- Lastly, the willingness to act, make decisions and make declarations towards resourcefulness is essential.

## Visionary and Engaged Leadership

Several visionary leaders attended IUW this year, including Amy Aussieker, executive director of Envision Charlotte, who discussed how the Envision Charlotte smart city project is fostering innovation and developing a first-of-its kind



program to better manage energy and water. Envision Charlotte is a unique public-private collaboration established to serve as a global model of environmental sustainability for measurable community and economic results. With programs dedicated to air, water, energy and waste, Envision Charlotte is transforming Charlotte, N.C.'s city center into an incubator for smart innovative technological solutions and long-term commitments.

Itron's role in Envision Charlotte is to provide expertise to the water efficiency program called Smart Water Now. Charlotte's water demand is expected to exceed supply in approximately 30 years, and Smart Water Now was created as a program to measure and reduce water consumption by 20 percent over the next five years. The program will aggregate information into a single number, representing total usage, then drive awareness and behavior change to reduce consumption. Envision Charlotte is also working with partners on the waste, energy and air aspects of the program. Measurement technology, such as smart meters and communications from Itron, provide unprecedented insights with near-real-time data. As smart city initiatives continue to expand, the convergence of air, water, waste and energy data under a unified, common platform will simplify this transformation and help shape a sustainable future.

Itron has a long history of building smart energy and water systems and aims to convene city leaders, utilities, businesses and citizens to change the way we understand and optimize the world's energy and water resources. By

leveraging existing networks and accessing information and data collected, utilities are able to manage their systems more efficiently and intelligently. Two great visionary leadership examples discussed at IUW were Itron's recent collaboration with the City of Bismarck, N.D. and Montana-Dakota Utilities Company (MDU). Itron worked with Bismarck and

MDU on a first-of-its-kind public-private partnership where the two utilities are sharing a communications network already deployed with MDU. To this effect, Itron supplied Bismarck with 21,000 water communication modules and associated collection technologies to improve operational efficiencies and streamline meter reading.

Rusty Cunningham, meter services manager at Southern Connecticut Gas Company (SCG) discussed how his company is using Itron services to

standardize its meter-reading platform across SCG and Connecticut Natural Gas, two Connecticut subsidiaries of UIL Holdings Corporation. This new system will allow SCG to enhance customer service, minimize operating costs and reduce its reliance on gasoline driven meter-reading vehicles. The gas company uses Itron® Total AMI to run, manage and maintain its advanced metering infrastructure (AMI) solution. Itron Total AMI provides a complete turn-key network system, including Itron Analytics, security, remote shutoff capabilities and hourly reads. Itron's team manages the utility's data collection system and operations, offloading the burden of day-to-day management tasks and freeing utility staff to focus on gaining more benefits and capabilities from their systems. The offering's model also allows utilities to deploy advanced technology and services at their own pace. As part of this collaboration, Itron manages all aspects of SCG's data collection system and operations. Itron Total is available across electric, gas and water solutions.

## Scalable, Readily Available Technologies

Technology and services are critical to achieving waste reduction. At IUW, Itron experts and partners exhibited technologies and solutions that can help lead to a more resourceful world. Among the technologies on display was Itron's newly announced Smart Load Control solution. The



load control solution features IP-based control devices that communicate to intelligently control and optimize run times on high-energy-use systems, such as HVAC systems, hot water heaters, pool pumps and agriculture irrigation pumps. The load control enables utilities to increase reliability and dispatch speed, while decreasing operating and maintenance costs and can help utilities realize the benefits of smart demand response at scale. This load control solution is a component of the Itron Riva™ platform, which builds on the power of Cisco's open standards IPv6 network and IOx fog computing. Cisco's Rob Soderbery, senior vice president, Enterprise Products and Solutions, was on hand to discuss the benefits of the offering and how edge intelligence fits into the Internet of Things.

Other technologies showcased at the conference included Itron's gas system monitoring product portfolio, which features methane detection, cathodic protection, pressure monitoring and remote disconnect devices to ensure safety and enable resource conservation.

In addition, smart electric vehicle (EV) charging stations showcased the importance of integrating EV charging with the electric grid to maintain grid reliability. Itron's grid intelligence and advanced metrology allows utilities to balance vehicle charging demand with load through consumer incentives, including dynamic rates and charging programs throughout the day.

## Collaboration and Cooperation are Key

Collaboration is a key component to increasing resourcefulness and reducing waste. Several Itron partners attended IUW, outlining their important work throughout the conference. Cisco's Soderbery highlighted Itron and Cisco's collaboration, through which the companies have transformed smart grid technology into an open and interoperable, enterprise-class network for utilities. Soderbery discussed Cisco's IOx fog computing platform and how it provides utilities with a robust ecosystem of edge computing capabilities.

Another partner in attendance was Kathryn Willson, director of Cities Solutions at Microsoft. Willson hosted a session titled, "Smart Grid Leads to Smart Cities - The Impacts of the Grid on Urban Sustainability," with Bob Borzillo, Itron director of strategic alliances at Itron. The two discussed how energy, water and the smart grid are critical to creating smart cities. Willson discussed Microsoft CityNext, a global initiative aimed at empowering city leadership to make cities safer, smarter, healthier and modern. Willson noted the importance of leveraging infrastructure and networks already in place as well as the importance of innovating at a pace that works for each individual city - taking small measured steps to create a smart city. Additionally, she posed that data is infrastructure and suggested that cities utilize analytics to take advantage of data already being collected to identify areas of performance improvement.

In addition, representatives from CEIVA were present at the conference, highlighting the importance of engaging with consumers in ways never before possible. CEIVA has built an integrated platform to help utilities capitalize on the immense potential of smart meters over Itron's OpenWay smart grid network. The centerpiece of CEIVA's approach is tapping real-time smart meter data to capture consumer attention. CEIVA's in-home display blends personal pictures with instant and weekly views of electricity, water and gas use. In addition, they receive unique, thoughtful personal conservation messages and considerate community messages from the utility, notifying them about local events and more. Itron and CEIVA's collaboration

was highlighted in a session led by Bill Jones, director of the Smart Energy Solutions Program at National Grid. Collaboration like CEIVA's with Itron is critical to deliver on the promise of the smart grid by completing the last mile—or last few feet—to connect smart meter information with the consumer.

## Resourcefulness: A Call to Action

As the utility industry works toward creating a more sustainable future, utilities and other industry leaders need to be willing to act, make decisions and take action towards resourcefulness. Throughout Itron Utility Week and in the weeks following, the collaboration and knowledge sharing have been truly inspiring. The utility industry is currently at an inflection point and reducing waste by managing energy and water resources is critical to ongoing economic prosperity, resource conservation and social wellbeing. By working together through leadership, technology, collaboration and actions, we can all create a more resourceful world.

## About Sharelynn Moore

Sharelynn Moore has more than 17 years of experience in the energy and technology sectors. As vice president of corporate marketing and public affairs, Moore is responsible for all global marketing and public affairs activities for Itron, including development of strategic marketing objectives, oversight of internal and external communications and management of external affairs including community investment and government relations.



(GUEST OPINION)

# Legacy Grid, Smart Grid

GRID 3.0? // BY CHRIS L. GREER

➤ **AS UTILITIES AND CONSUMERS** are starting to reap benefits from the evolving smart grid, a partnership of six government and industry organizations is already looking ahead to the next transition – to Grid 3.0. At a roundtable hosted in November by the National Institute of Standards and Technology, participants from across the energy sector launched a planning process that may help shape the grid's future.

This technology road mapping process, which next involves an open workshop scheduled for spring, is identifying the key issues for interoperability expected to influence the direction of our industry. *EnergyBiz* readers will want to follow and join in this effort, and more details on how to participate are provided at the end of this article.



But, first, what is Grid 3.0?

The legacy grid of the 20th century – let's call it Grid 1.0 – is essentially a one-way pipeline that delivers electricity from a small number of sources to a large number of customers. In the past decade, we've seen the emergence of the smart grid, or Grid 2.0, which adds automation and information technology

improvements and permits the two-way flow of both electricity and information.

We're in the midst of a transition from Grid 1.0 to 2.0, and recent progress has been impressive. With more than 43 million smart meters already installed in the United States, electric utilities, service provid-

ers and consumers are using the enhanced levels of information and control to reduce the length of outages, improve efficiency and better balance resources and loads. The recently installed network of more than 1,000 phasor measurement units across the country is using synchrophasor technology to provide system operators with real-time wide-area grid visibility. Smart substation and distribution automation technologies are enabling self-healing groups of distribution system field devices to detect and isolate faults and to automate restoration for unfaulted circuits, further reducing outages and speeding restoration.

The evolution of the legacy grid to the smart grid is ongoing and will continue in the coming years, and we'll see related transformations in technologies, business models, regulations and customer expectations. Plenty of change, challenge and opportunity faces us in the next few years.

While undertaking this work, we should also remember that infrastructure installed today will be in place for many years and must support not only present-day smart grid goals, but also future grid needs. For this reason, we're undertaking a high-level, strategic look ahead to envision the interoperability challenges for Grid 3.0, the grid that comes after the smart grid. In Grid 3.0, for example, the foundational elements of Grid 2.0 may be leveraged and re-envisioned to fundamentally change how the grid is operated and how consumers interact with the grid.





# 3.0

The six organizations undertaking this effort include the U.S. Department of Energy, the Electric Power Research Institute, the GridWise Architecture Council, the National Electrical Manufacturers Association, the National Institute of Standards and Technology, and the Smart Grid Interoperability Panel. Each organization brings its own perspective to the process. At NIST, for example, we are especially interested in standards and interoperability, which are absolutely essential for the success of both Grid 2.0 and 3.0.

As you look around today's energy landscape, you'll see glimpses of Grid 3.0 already taking shape. For example, with Green Button's energy usage information standards as a foundation, entrepreneurs and forward-looking utilities are developing innovative applications and services that were not feasible just months ago. Demand response programs and services, which use the grid as a platform, are playing a growing role in grid management thanks to new developments related to big data, analytics, weather information, and building energy services. And as new types of sensors and controllers are developed, the potential of Grid 3.0 will continue to grow.

At the November roundtable, a variety of stakeholders including utilities, ISOs/RTOs, regulators, federal agencies, manufacturers, and researchers

discussed a wide range of topics. They included integration of distributed devices; business models, market transformation, and human capital; and reliability and resiliency.

For each of these three issues, participants considered what success would look like over the next 10–20 years. They asked what major technical, market, and policy barriers could interfere with achievement of success. And they explored opportunities for overcoming the barriers and achieving success.

If you want to learn more about the Grid 3.0 road mapping project, join our mailing list or attend the open workshop to be scheduled in spring 2015.

Over the next generation, we'll see dramatic changes in how the electric grid serves us as individuals, as organizations and as a society. Some of those changes are already beginning to enter on stage, while others are hidden in the shadows off stage, waiting for creative engineers, executives, and entrepreneurs to call them to life. It's going to be an exciting process, and we invite you to join us in envisioning, shaping and creating Grid 3.0. ☒

*Chris L. Greer is director of the Cyber Physical Systems and Smart Grid Program Office, National Coordinator for Smart Grid Interoperability Engineering Laboratory at the U.S. National Institute of Standards and Technology.*

(GUEST OPINION)

# Utilities May Lead Smart Cities

BOBBI HARRIS, FOUNDER AND PRESIDENT,  
SMART WATER, SMART CITY

➤ **SMART CITY INITIATIVES** are popping up around the globe. Innovative technologies and services support a plethora of “smart” – smart energy, smart building, smart water, smart homes, smart transportation, smart infrastructure, smart governance, smart education and smart consumer. The list may seem to encompass all things, and that would be the point. A smart city initiative crosses many facets of services in order to derive the most value. According to some industry analysts, the

global smart city technology market is projected to be valued at more than \$1.5 trillion in the next five years.

Although some utilities in mature markets face challenges from renewable mandates, federal regulations and integration of new technologies, the evolution of the smart city market has grown with almost limitless

innovation. There is a great appetite for partnerships and collaboration as utilities and technology vendors realize that no single entity can solve this global problem alone.

So who or what is driving smart city initiatives? In some cases, municipal leaders are motivated to have their cities recognized as smart cities. In others,



technology vendors want to drive the conversation. Meanwhile, an unlikely leader is emerging in the smart city dialogue – the utility company.

Why would a water, gas or electric utility want to add programs and technology that would help consumers use less of its product? Would this not cut into earnings? Forward-thinking utility leaders say the answer is to not necessarily use less, but to use the right amount, at the right time, in the most efficient ways. Digital transformations, asset management, distributed renewable generation, microgrids and smarter communicating devices provide utilities





around the world with opportunities for greater innovation. To address the push toward smart city status, utility executives are also addressing new business models, looking for greater operational efficiencies and striving for better consumer engagement – all while attracting inventive workforces.

Utility companies already have led successful smart city initiatives. For example, in California, community benefits resulted from the efforts of the Sacramento Municipal Utility District to automate billing processes, to dramatically shrink the service connect/disconnect cycle time and to provide customer



## So who or what is driving smart city initiatives?

choice in energy programs. In

Olathe, Kansas, the Olathe Public Works Department's smart water initiatives provide smarter infrastructure and greater water and wastewater efficiencies to attract and retain new businesses. In Charlotte, North Carolina, Duke Energy's

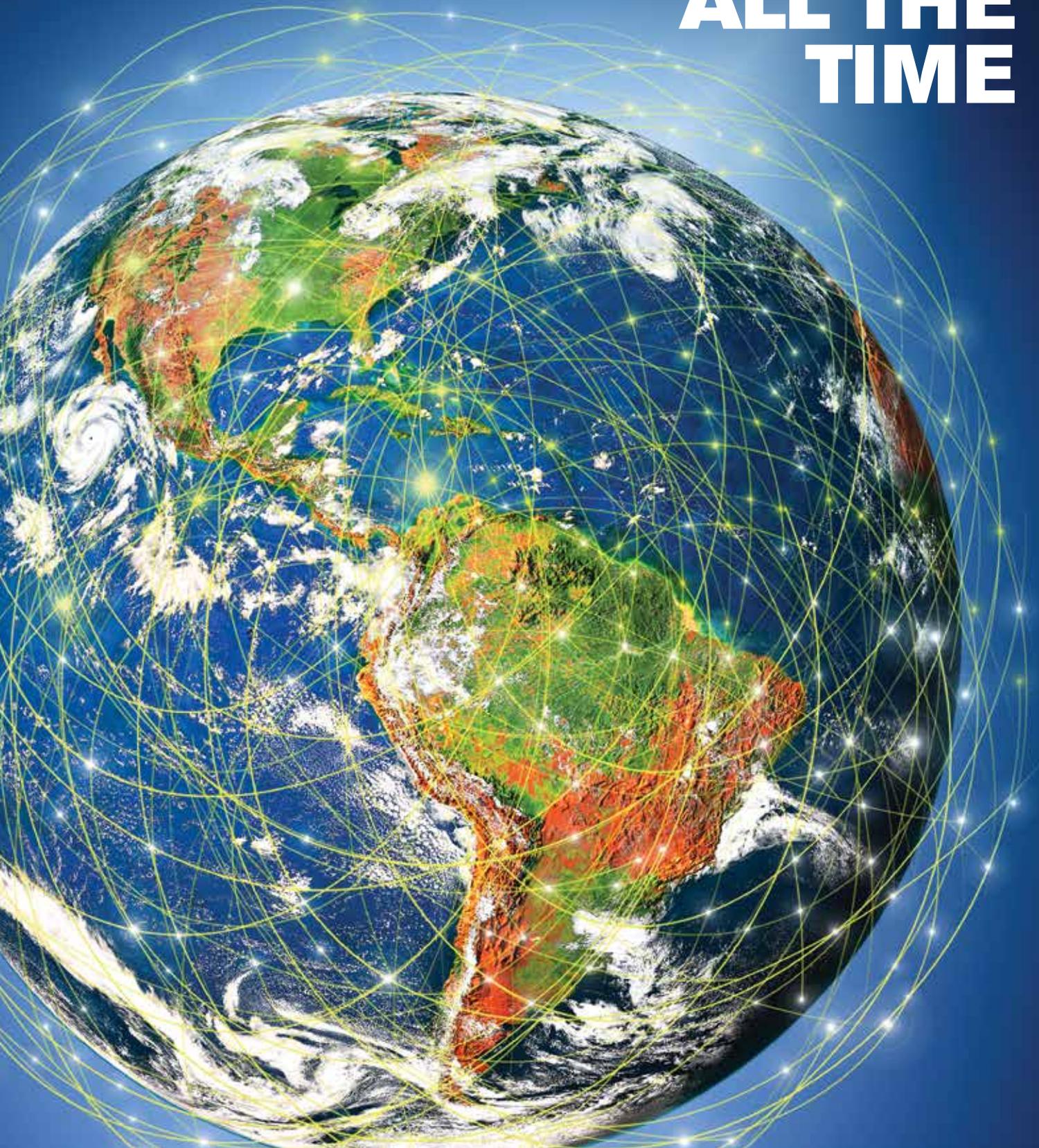
Smart Energy Now program helps to reduce energy consumption in office buildings by focusing on individual consumer behavior.

Ultimately, smart city initiatives will profit many, including utilities, individuals and governments, while protecting natural resources and sustaining future generations, but many more people and companies need to be part of the conversation. Join Energy Central in Charlotte May 12-13, 2015 for the Smart Cities Conference and become part of the community of educators, companies and individual innovators focused on making smart cities a reality around the world. ☒

*For more information on the conference visit: <http://smartcities.energycentral.com>*

# ANALYTICS

**ALL THE  
TIME**



*(GUEST OPINION)*

# From Consumer to Prosumer

A CHANGING ENERGY LANDSCAPE CREATES OPPORTUNITY  
BY JOHN P. MALLOY

➤ **TODAY'S UTILITY BUSINESS** environment is more volatile, more uncertain and more complex than in the past. How do we navigate and plot a strategic course forward in this moving and evolving market?

This is the central question every utility executive must embrace. A couple of simple themes are emerging: the current supply-side-only utility model is under pressure and the demand-side “prosumer” utility space has emerged to allow end-use customers to actively participate in the energy sector.

As an industry, we continue to see more limited load growth that will likely continue to occur as innovative manufacturing reduces energy demand, energy efficiency measures improve commercial structures and residential housing stock, and technology makes options available to consumers that have yet to be fully realized. The market will follow a relatively complex cycle,

but nonetheless infinitely relative to assessing the utility model of the future.

Let's see how this cause and effect could play out. Utility energy sales decline, causing utility revenues to decline, therefore utility return on equity declines. Rate cases ensue, rates rise, and demand-side products and services become more economically attractive for utility customers.

Sales fall faster as demand-side adoption continues to occur at a relatively increasing pace, and then the cycle starts again. Utility energy sales decline, and so on. This vicious revenue cycle would continue until a shift in strategy occurs. That's a brief look at the utility side left unchanged by a new business model.

Let's explore the demand side. Demand-side economics deploy broadly different decision criteria. This



## EDITOR'S NOTE

John P. Malloy recently received Energy Central's KITE Customer Service Leader of the Year Award for a large utility.

is a clear and distinguishable demarcation from the supply-side least-cost economics. We, as consumers, make daily decisions that may not be “least cost” in absolute money terms because we have a wide array of preferences in our product selection beyond just price, from minor decisions like buying higher-priced coffee because of a perceived quality superiority to purchasing luxury automobiles when least-cost cars can get you to the same destination.

Why do we make such decisions? Simply because we are all human and have differing tastes, preferences and priorities. Now back to the utility space.

Technology is converting consumers into “prosumers” at a rapid rate. Some utility customers want to be in the space of self-sufficiency and self-reliance. Although they do not represent the entire consumer population, a growing number of customers desire to own their own generation regardless of whether or not it is least-cost from a traditional utility resource planning perspective. However, customers do not fully understand how to engage in this environment, nor do they want to become experts in the energy field.

The same can be said for electric vehicle charging stations, distributed storage and home security. Currently, third-party suppliers are active participants in this emerging market. They are simply meeting a demand for products and services that customers want and are willing to pay for. They just make the opportunity available and as effortless as possible in order to meet consumer demand.

What is left for the current supply-side utility model? Declining load growth as prosumers enter the market either as community utility service providers or increasing individual adoption. This escalates costs to late end-use adopters, which will speed up their adoption brought on by converging economic parity of alternatives. Third-party providers will increasingly gain a foothold in this service provider space and will be difficult to root out without wide-scale acquisition.

Then, microgrids will begin to become increasingly common infrastructure, which will eliminate the need for grid interconnection. The only unknown aspect of this expected future is the timing of the different adoption components, given what portions of the technology development improve the fastest both from a reliability and an economic perspective.

What is the practical solution for the new utility business model going forward? It is quite simple if we do not get caught up in the belief that this cannot occur or will not occur in the foreseeable future. Harken back to the staunchly held beliefs of the telecoms and the main frame computing giants, among others. Their world changed, as will ours.

Is all this concerning? Only if utilities continue to hold fast to the historically tried and tested supply-side utility model. This should be an awakening call

to seek out new revenue streams to offset demand-side destruction of historic revenue levels. Enter the move from energy supplier to service supplier. Utilities

are better positioned to advance the adoption of demand-side technologies through service offerings than any other entity currently playing in the space. Utility customers would welcome their utility to untangle the deluge of information coming at them and would widely accept the clarity provided by well-thought-out service offerings.

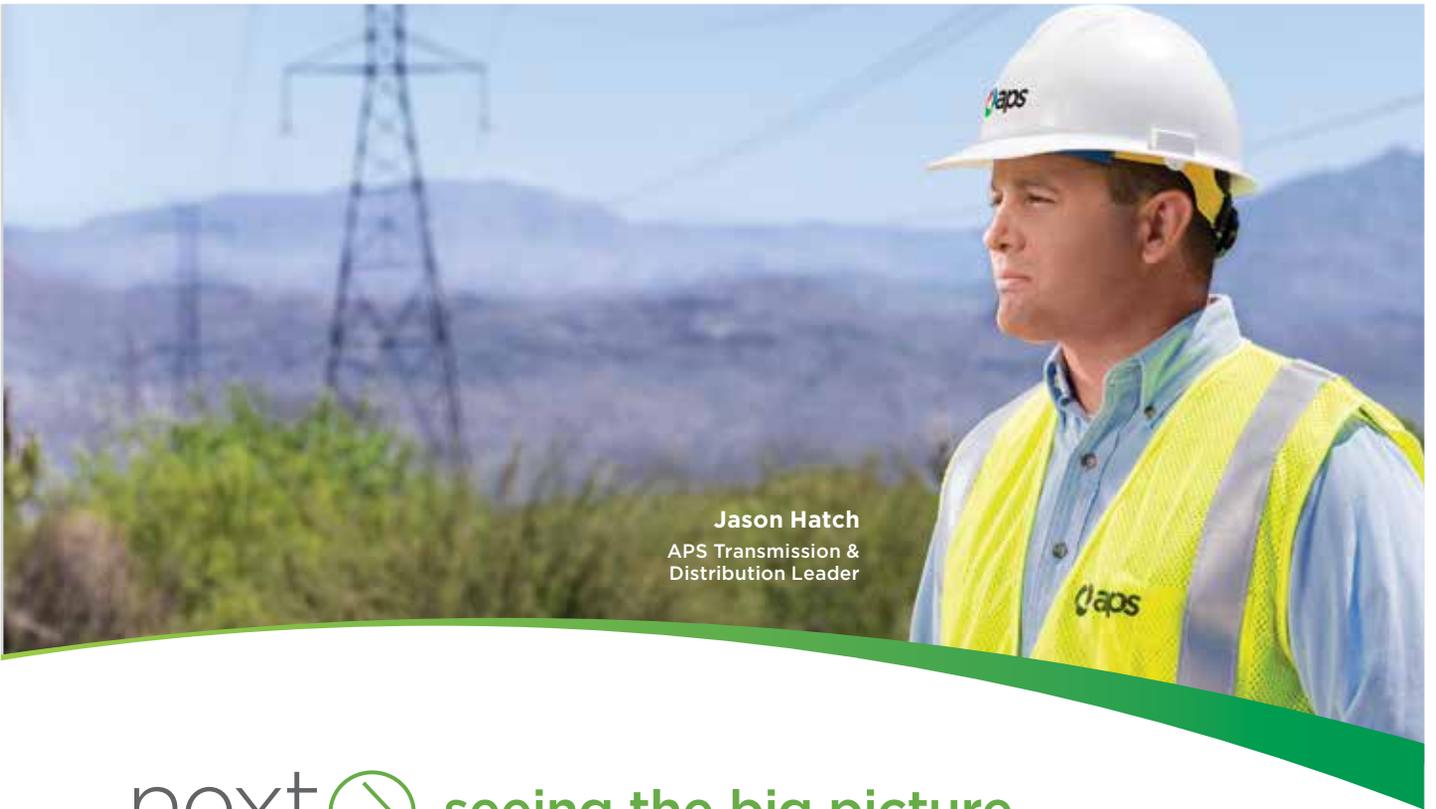
We cannot simply embrace industry change; we must create change and drive the business model of the future or we will simply be dragged through someone else’s design.

Lastly, Bayesian theory suggests the world is made up of constantly changing knowledge, thus we must continue to readjust our predictions as we learn new bits of information. So, why do we hold so fast to the historical model? As an industry, it is time to embrace change and shape our own energy future. ☒

*John P. Malloy is Louisville Gas & Electric and Kentucky Utilities vice president of customer services.*

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**Jason Hatch**  
APS Transmission &  
Distribution Leader

## next seeing the big picture

As Arizona's economy continues to grow with new businesses, new jobs and new opportunities, the state's energy needs will grow as well. And our job – just as it's always been – is to look at the big picture so we can plan and meet customer needs with smarter, cleaner energy.

### So, what's next for Arizona?

#### Grid innovation

*We're making bold efforts now that include investing millions to modernize the electricity grid to power new innovations and allow for more renewable energy for our customers. But with everything that's changing in energy, one thing isn't – the reliability our customers count on.*

#### Cleaner energy

*Arizona's energy mix is becoming increasingly cleaner through innovative technology, including upgrading plants to run more efficiently with cleaner burning fuels like natural gas. Between now and 2029, we plan to meet our growing customer energy needs with zero to low emission resources.*

#### Solar leadership

*As of 2014, we generate enough solar to power over 200,000 homes – more than 15 percent of all our customers. We're finding smart and cost-effective ways to maintain Arizona's solar leadership by investing in nine community-scale solar projects statewide.*

Next is a commitment to powering our state's economy and creating a sustainable energy future. And with significant investments in Arizona's electricity grid, advanced new technologies and cleaner, more efficient power plants – next is happening right now.

The future of energy is bright.  
See what's on the horizon at [aps.com/next](http://aps.com/next)



*(GUEST OPINION)*

# Toward a Self-Healing Grid

ANALYTICS TODAY AND TOMORROW // BY LENA SMART

▶ **DATA ANALYTICS HAVE** been part of the utility industry for decades, giving companies the information they need to run plants safely. This data holds great value, as it allows us to maintain our extremely high level of safety, and more effectively generate and deliver power to customers.



The information also allows utilities to upgrade and adapt our technology to embrace the analytics race for real-time data. Unfortunately, change cannot be rushed in the utility industry.

As chief information officer and former chief information security officer at the New York Power Authority, the nation's largest state power utility, my background in cy-

bersecurity allows me to see the bigger picture and analyze the risk of opening that door much more studiously.

There are sectors of the economy where results are subjective and well-suited to analytics, so we see data analytics offering suggestions on items to buy, or people to date, or movies to watch. In sectors where fraud detection or behavioral analysis on a massive scale are needed, as in the utility industry, even the nascent capabilities of data analytics seem useful, but perhaps sometimes offer a false sense of security. This is because data analytics focuses on

optimizing existing processes, which can be of value under current conditions, but which has the potential to cloud the broader picture or even lead to complacency about future needs.

The energy sector has long dealt with competing priorities; that is, the tradeoffs between delivering high reliability and the inefficiencies associated with redundancy and readiness to satisfy peak demands under worst-case conditions.

As we look at data analytics, we may ask ourselves what problems do we have where data can offer useful insight, unlock opportunities we would have otherwise abandoned for lack of insight, and alert us to risks and opportunities we otherwise wouldn't know about.

Many vendors are starting to offer "predictive analytics" tools, which pull information from existing data sets to determine patterns and predict future outcomes and trends. This is an exciting opportunity for the industry to be more proactive in the management and maintenance of grid equipment. A representative from GE, for example, at its recent Minds and Machines conference, told a story concerning an oil rig that the company was monitoring with predictive maintenance tools. GE uncovered a problem with a piece of

## EDITOR'S NOTE

Lena Smart recently received Energy Central's KITE CIO of the Year Award for a small utility.



equipment that was about to fail and notified the owner, which saved several million dollars in downtime. That is where analytics tools basically pay for themselves — predictive proactive maintenance resulting in minimal downtime and cost savings.

At NYPA, analytics help us provide a high level of service to our customers and protect our assets. We can plan for the future, help grow New York state's power grid, and provide existing and potential customers with data that can help them plan for their future. Predictive analytics

on the grid will improve response times to outages, and — more importantly — get the electric utility industry to the stage where we can replace equipment before it fails.

Another example of how data analysis provides benefits is the NY Energy Manager (NYEM), which is New York state's first energy management network operations center. NYEM was recently introduced by NYPA as part of New York Gov. Andrew M. Cuomo's BuildSmart NY program to reduce energy use 20 percent in public facilities by 2020. Data analytics allow NYEM — which is operated by NYPA at the Colleges of Nanoscale Science and Engineering at SUNY Polytechnic Institute in Albany — to provide real-time data on energy use to more than 3,000 public facilities across the state with the potential to serve even more. Participating facilities can improve building energy performance, lower the state's utility bills and reduce greenhouse gas emissions. The data analytics gathered by NYEM will allow government building operators to be better informed when planning for future energy use needs. NYEM can also provide technical expertise and ongoing training to participating organizations for managing their facilities.

NYPA also uses analytics to look for weather patterns, allowing us to optimize the operation of our power plants and transmission lines. Trend forecasts are used by the New York Independent System Operator, a not-for-profit corporation responsible for operating the state's electricity grid, to anticipate energy supply and demand and facilitate grid optimization.

While data analytics can be extremely helpful, they are not infallible. Data analytics can't replace a human's intuition or interpretation of the numbers. Despite that limitation, however, continuing developments in data analytics will allow utilities to predict the impact that changing supplies and demands, such as electric vehicles and renewable energy sources, will have on existing equipment. We can take data and produce information that will allow us to improve the system with a more holistic approach. Today, most of the energy industry is relying on equipment to tell us about outages after the fact. The future grid should be a self-healing network, with predictive analysis used to proactively manage the electric grid's assets. ☒

*Lena Smart is New York Power Authority vice president and chief information officer.*

*(GUEST OPINION)*

# The Role of Analytics at Large Utilities

REVOLUTIONIZING OPERATIONS // BY ANDREW VESEY

➤ **ITS 2:30 A.M. ON A JULY NIGHT,** and a powerful storm is rushing through your utility service area. It causes a tree to fall on a medium-voltage distribution line. As the utility manager responsible, you are now working through an outage.

You ask, “How many customers are affected? Where is the tree? How can I get a crew there? Is the surrounding environment safe for customers and crewmembers? Why did this particular tree fall on the line? Is it our trimming regime? Is this within expected ranges? As a leader, what should I do tonight? Next week? Next year?”

Thanks to advances in utility analytics, leaders can obtain useful answers to these questions and make informed decisions before, during and after an incident such as this one. In this hypothetical, but all-too-real, tree-related outage, advanced outage management systems, automated dispatch and work management systems, distribution automation capabilities, and asset management planning processes are all supported with information from advanced analytics. This ensures the use of an appropriate amount of resources and helps such outages become less frequent and shorter.

From this vantage point, it is hard to believe that for most of the 20th century, the electric utility infrastructure was operated and managed without utilities knowing much about its usage or the state of its assets. At that time, utility analytics focused primarily on planning for future growth. Provided with limited knowledge about the infrastructure, yet focused on reliability, utilities overbuilt. Outages were largely mysteries until

enough customers called from the same neighborhood. The overall efficiency of electric service and the nature of the power being provided were secondary and nearly inaccessible to analytics.



It is important to note that how utilities operate the electric utility infrastructure is critically important to the economy and to people’s quality of life. The U.S. Department of Homeland Security identifies energy, particularly electricity, as the one sector of the 16 critical infrastructure sectors on which the other 15 depend. In short, electricity serves a foundational role for all infrastructures in our society, so the smarter and more effective utility management can be, the

greater the benefit.

Fortunately, in the last 15 years, the utility industry has seen exponential growth in data about its infrastructure, driven by the adoption of wholesale electricity markets, distribution management systems, smart grid solutions and, more recently, consumer-based technologies. Similar data trends in other industries have driven the development of scalable IT platforms, which are providing utilities with powerful analytics capabilities.

More recently, utility analytics are extending beyond the reliability imperative to support other goals of cost reduction, sustainability, safety and customer engagement. For example, analytics solutions are delivering customized energy reports for customers to

## EDITOR'S NOTE

Andrew Vesey recently received Energy Central's KITE Operations Leader of the Year Award for a large utility.



compare their usage with that of their peers on a regular basis. This allows customers to be more engaged in their energy usage, and it is expected to encourage greater adoption of smart home solutions.

In addition, real-time distributed solar performance analytics provide information that improves distribution automation processes and daily load and generation forecasts, allowing this organic form of infrastructure to be integrated into the overall performance of the electric grid.

When it comes to energy efficiency, analytics-driven conservation voltage reduction is improving system efficiency and reducing peak demand by more tightly managing voltage levels on distribution circuits. CVR, combined with distribution automation, helps utilities meet reliability, cost and sustainability goals simultaneously.

With fleet management, analytics applied to fleet telematics reduce vehicle maintenance, improve fuel economy and encourage safe driving.

Predictive maintenance benefits from analytics as asset management dashboards provide near real-time health and criticality information to transmission and distribution operations managers. Advanced analytics solutions in utilities' wind businesses predict with precise timing the need for turbine maintenance. The dashboards and analytics allow for the optimal deployment of capital while improving reliability and performance.

Actionable insights are allowing management to drive investment toward the maximum benefit to customers and other stakeholders in nearly all aspects of utility operations. Electricity will continue to serve in its foundational role in society, and advanced analytics will play an increasing role as the electricity industry is challenged to maintain and improve reliability while improving sustainability. ☒

*Andrew Vesey is AES chief operating officer and executive vice president.*

**(GUEST OPINION)**

# Optimizing Utility Analytics through Thought Leadership

JOEL SHARRER, MARKET DIRECTOR, UTILITIES...ENERGY CENTRAL

➤ **DATA ANALYTICS FOR UTILITIES** is no longer a future-tense topic for the industry. It is no longer a question of *can* your utility benefit from analytics tools, but how well is your utility implementing its analytics program. Today's analytic leader must demonstrate an expertise in understanding data and advanced analytics while using cutting-edge tools to drive business decision-making. The tools are being developed to maximize utility assets, and the Utility Analytics Summit provides the opportunity to harness the expertise of analytics visionaries while providing real-world solutions.

The utility industry is uniquely positioned to translate big data analytics programs into increased grid reliability, improved customer service and optimized internal business processes. Through the Utility Analytics Institute (UAI), Energy Central is committed to harnessing the potential of analytics by bringing together innovators from both inside and outside the utility industry to design analytics platforms capable of solving even the largest utility analytics hurdles. The Utility Analytics Summit represents the pinnacle of thought leadership for the utility industry and provides a unique forum for guiding utilities beyond the theory of analytics and toward establishing robust analytics programs that return real value to both internal and external stakeholders.

Investments in grid modernization have provided utilities with unprecedented access to immense and growing

volumes of data. Effectively using that data is what allows utilities to truly make good use of the investments they've already made in advanced metering, communications networks and distribution-automation technology. Through different analysis methods, utilities are using their previous grid investments to make the grid more resilient, secure and efficient while meeting the needs and changing expectations of the utility customers.



Paired with the opportunity to meet, share and learn from innovators in the industry, the Utility Analytics summit provides an unparalleled educational program with dedicated case studies of how utilities are designing both company-wide analytics roadmaps and individual pilot projects as new technologies emerge. This year's Summit will include sessions designed by utilities to enhance analytic adoption in an evolving and often-challenging business landscape. Research will be presented on visual analytics, geospatial and situational intelligence, work process management, analytics resourcing strategies, using the capabilities of the Internet of Things, securing data and protecting

privacy, and a host of relevant case studies illustrating how to make analytics a strategic priority for your utility.

We invite you to join us in Phoenix March 3–5 for this year's Utility Analytics Summit ([www.utilityanalyticssummit.com](http://www.utilityanalyticssummit.com)). This premier event for utility analytics leaders will help develop the capabilities and experience to deliver the answers and move the industry forward. ☒

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# Boom and Boon

EXECS TOUT GAS UTILITIES' OUTLOOK // BY MARTIN ROSENBERG

**ENERGYBIZ** What forces are shaping your industry, and what issues worry you the most?

**ARRIOLA** The biggest issues facing us in California are environmental restrictions and regulations that are continuing to come into place. We're trying to strike a balance within the state, especially from the business perspective, of making sure that improvements to the overall environment are done in a smart, feasible, cost-effective way. But there definitely is a difference of opinion on how to get to the end result. In many cases the government and the agencies responsible for regulating the climate control objectives are picking winners, and natural gas is not necessarily one that they want to see succeed in the long term. That's one of the biggest challenges that we have.

**LAROSSA** On the gas side of the business we've seen about a 5 percent increase in customer usage. About 4 percent of that growth has come from folks just using more of the product because it is so much cheaper. The environmental impacts and how we actually walk through those challenges are shaping our industry. You



## LEADERSHIP ROUNDTABLE

### PARTICIPANTS

**John Somerholder**  
AGL Resources chief executive officer

**Carl Chapman**  
Veteran chief executive officer

**Ron Jibson**  
Questar chief executive officer

**Jeff Shaw**  
Southwest Gas chief executive officer

**Dennis Arriola**  
Southern California Gas president and chief executive officer

**Ralph LaRossa**  
PSEG president and COO

**Scott Prochazka**  
CenterPoint Energy chief executive officer

**Scott Morris**  
Avista chief executive officer

have some folks who are trying to stop the growth of the Marcellus Shale gas extraction from an environmental standpoint. Another issue is the ability to attract a qualified workforce. It's not as easy as folks might think with unemployment the way it is.

**JIBSON** Tax laws, those kinds of things that are not necessarily intended to impact our part of the industry, often do in an indirect way. Another area that we're all focused on is physical and cybersecurity.

**CHAPMAN** One issue in particular that we have a lot of concern about is just the continuing rise in the cost to the customer. We still are stacking a lot of cost on the customer. At the same time, there's a lot of rising electric rates because of environmental controls, and in certain parts of our territory the same is true of really significant costs on water and waste water.

**SOMERHOLDER** Last winter when it was cold, you had the polar vortex, and we really saw no significant impact on customer bills because of it. Prices did go up a little bit, but the gas in the ground was low-cost. That was really good. But the real challenge is that the environmental



Left to right: Carl Chapman, Scott Morris, Scott Prochazka, Ralph LaRossa, John Somerholder, Dennis Arriola, Ron Jibson and Jeff Shaw.  
Photos by Michelle and Vince Morales

community really does not see gas as the only solution or as a big part of the solution. That's where the battlefield will be over the next couple years, in my opinion.

**SHAW** One issue that seems to be consuming an enormous amount of time at our company is pipeline safety. We as an industry need to be participating with the federal government to help shape new rules. Another issue is developing succession plans and making sure that we have the right people behind us to continue the initiatives that each of our companies have.

**MORRIS** The uneven economic recovery is an issue. It's difficult to continue to have the capital spend that we're having when we're having customer growth at 1 percent or less. It's going to continue to put price pressure on our customers, and that is something that we have to be creative about. How are we going to continue to think about growth for our company?

**PROCHAZKA** One concern is the pipeline integrity and safety issue. We've got to be, as an industry, aligned and focused on it. Another issue is rate design. With the increased spend that's occurring, traditional ways of getting recovery through rate proceedings lag too much. Mechanisms and approaches that allow for more timely

and complete recovery of these investments are going to help us address some of the growth needs and some of the replacement needs.

**CHAPMAN** Every company is facing additional spend for safety and reliability.

**JIBSON** Regulators are recognizing and understanding that in order to have a safe system and to have the pipeline integrity that we need, they have to provide mechanisms for us to be able to not take on the risk of that investment.

**LAROSSA** Our annual capital spend is \$1.9 billion. Regulators have all seen that, whether it was the blackout of 2003 that drove electric transmission spend or Superstorm Sandy, which impacted both gas and electric infrastructure in our service territory, there's a need for upgrades and they have found a way to give us access to the capital.

**ARRIOLA** For us, over the next five years we're going to have capital expenditures of about \$6.2 billion. One-third of that is for pipeline safety.

**ENERGYBIZ** **How do you grow your business and promote efficiency at the same time?**



SOMERHOLDER



CHAPMAN

**LAROSSA** There's a potential for growth there. It doesn't quite offset the loss in sales. That's a conversation I think we need to have as we go forward with the regulators.

**ARRIOLA** In California our rates are decoupled, so there's not a perverse incentive to go out and have the customer buy more gas. As we're able to educate customers on how to conserve energy, it doesn't hurt us from a profitability standpoint.

**ENERGYBIZ** **How do you counter negative perceptions of natural gas as a fossil fuel?**

**LAROSSA** The Sierra Club recently filed suit in the New York Supreme Court to stop a rate-based solution for a conversion of a coal plant to natural gas.

**JIBSON** We've always had issues we've dealt with that we have to be proactive on. We are a fossil fuel, but we're a much better fossil fuel than others in meeting environmental concerns. It behooves us to continue to work with the environmental groups and to show them facts, and then we'll get good decisions.

**ARRIOLA** Sometimes industries can categorize the environmental community as very monolithic. There are very different organizations out there – there are some that are much more focused on science and using new technology to get answers before they start to drive solutions.

**ENERGYBIZ** **Are you pursuing new business models?**

**PROCHAZKA** Most of our focus is on growing the investment that's needed to serve customers as they're using gas today. I really don't see our model going away

from the focus that we have today and looking for another solution to be the focus going forward. I firmly believe in the gas delivery systems that we have today, and that we can make these very efficient systems, we can make them very tight systems, and we can make them meet the needs of customers. Most of our business is right in the heart of the country. We serve Louisiana, Oklahoma and Mississippi as well as Texas and Minnesota. We are not seeing a rapid adoption of alternative forms of electric generation that could be powered by gas.

**CHAPMAN** We continue to evaluate opportunities related to distributed generation projects. We are very focused on growth opportunities.

**MORRIS** We owned a fuel cell company for well over a decade, and we recently sold that business. The adoption rate of that technology just wasn't taking off.

**ENERGYBIZ** **Do you think the technology is just not there yet?**

**MORRIS** We've not seen it. We weren't focused on the residential market. We were focused more on the backup-power solution marketplace. The industry has a lot more opportunities to use solar and other distributed generation technologies – and use natural gas as a backup fuel.

**JIBSON** The abundance of natural gas that we have today has opened the doors for us to look at other ways to utilize natural gas. You're seeing more applications and companies getting into the transportation side of the business. We're looking at ways to branch out with non-regu-

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lated companies as well as building infrastructure within our regulated businesses. More fuel-switching from coal to natural gas provides that opportunity for us to find ways to supply long-term natural gas supplies to the power generation market. We have 30 compressed natural gas stations that were built by our regulated utility in Utah. We have five stations outside of Utah and we're building an additional five from Connecticut to California. It is a different business model than we're used to in our industry. We're putting capital up front and the returns come on the latter part of a five-year plan.

**PROCHAZKA** Instead of actually being the owner and the operator of stations, we have partnerships with many people who are doing that. We've got partnerships with 28 different facilities now, and then we've got several more that are coming on in the coming years. We also have a gas transportation fleet of 85 vehicles and we're adding another 35 this year.

**ENERGYBIZ** Can CNG grow to 5 percent of your revenues?

**JIBSON** The potential is there for that.

**PROCHAZKA** Yes.

**ENERGYBIZ** Are there other innovations in your business?

**MORRIS** We just acquired a smaller service territory that serves Juneau, Alaska. One of the drivers was the opportunity to serve natural gas to southeast Alaska; the communities there have very high power rates. If they don't have hydro, they're all-diesel generation.

**ARRIOLA** We recently received regulatory approval to offer compression services behind the meter.

**SOMERHOLDER** In some cases we're investing in CNG stations, in other places we're providing compression services, and in other places we're providing service to someone else who's investing in the CNG stations. We're really happy as an industry to do whatever it takes to build the market so that we get more adopters. If someone refuels a gas vehicle at home in Atlanta, that's about the same load in a year as the home. That's a good margin for us where we really could make a significant difference. Ultimately, it may be a really important part of our business if we have success on the home refueling lines.

**ARRIOLA** If we could push more gas through our system, it helps bring down rates for everybody, which makes our fuel and our service more competitive.

**ENERGYBIZ** The ocean of shale gas remains a game changer, does it not?

**LAROSSA** We have announced a 9 percent gas rate reduction for customers in our service territory. It was driven by our pipeline capacity and the ability to move gas from Marcellus Shale into New Jersey.

**JIBSON** Distribution companies are seeing the benefits of the abundance of natural gas. It's great for manufacturing, commercial use and residential use. But if prices stay too low for too long, you really stifle the ability for producers to be out producing natural gas. It creates an environment where pipeline companies are having a hard time



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finding growth opportunities. Most projections are that the price will stay low for an extended period. It's already stayed lower longer than most of us expected.

**PROCHAZKA** Technology continues to allow gas producers to extract at lower and lower costs and greater efficiencies. I can't see how we're going to be faced with a sustained increase in gas price in the near future or even the medium term. We're seeing customers respond to that sustained low gas pricing. We used to see almost steadily a 1 percent per year reduction in usage on a use-per-customer basis but that has started to level out.

**MORRIS** At our utility, 35 percent of our electric generation is from natural gas, so it's been wonderful for our electric customers as well.

**ENERGYBIZ** **What are your top regulatory concerns?**

**ARRIOLA** We're waiting for an update in pipeline safety rules. We want to make sure that they're clarified and have a reasonable implementation time. We also need to coordinate with the states because some states seem to get ahead of others.

**JIBSON** One issue concerns hydraulic fracking. If federal regulations come down that affect every state the same, it could be very detrimental to independent producers. It should be state-regulated, state by state.

**SHAW** Sometimes hysteria can rule the day and get in the way of good facts. We've got to be very vigilant.

**ENERGYBIZ** **What about concerns about greenhouse gas emissions and its ramifications?**



**SHAW** Well, you've heard everything from the earthquake potential from fracking to contamination of the water supply. New York doesn't permit fracking. So you have to be very vigilant. I can't emphasize enough how important it is that the American Gas Association is advocating for us and keeping an eye on what's going on in politics.

**ENERGYBIZ** **How is information technology transforming your business?**

**CHAPMAN** The ability to understand more about the customer from the data we gather is really important. It's not going to be in the traditional way of thinking and interacting with the customer. That's got to be the focus.

**ARRIOLA** We're in the process right now of installing 5.8 million automated meters. They don't have the same sophistication that a lot of the smart meters have on the electric side. But we're going to have new information and new data that we need to figure out how to use to help our customers be more efficient. We will have the communications systems up and running to figure out how we can evaluate and monitor our physical system more effectively. There's a lot of new applications that maybe we haven't even thought of.

**PROCHAZKA** We're installing about 3.3 million meters. We'll be done this year. We are doing a pilot with fixed communications that will help us understand how we can exchange data at the customer premises and monitor what's going on with the system better than we have been able to in the past. There are some new technologies coming out for leak detection that I think are going to change the industry in terms of how robust the leak detection is



LAROSSA

around your service territory. New technology is going to generate a tremendous amount of data, and gas utilities have to be able to utilize that data to create response plans.

**MORRIS** We're looking at a smart city concept where we'll be able to measure everything from electricity, gas, water and even parking. We are partnering with some predictive analytic companies so that we can really understand data to figure out ways to better serve customers and utilize the grid.

**LAROSSA** The technology may leapfrog the meter and go directly to appliances. Customers may really want to know about the efficiency of their furnace, water heater, gas fireplace and pool heater. That may drive us in a different direction.

**ENERGYBIZ** Will there be more mergers and acquisitions of gas utilities?

**LAROSSA** I don't see the same financial drivers that they get in a deregulated market that they get on the electric generation side.

**PROCHAZKA** I agree. There are risks associated with the regulatory process of making that happen.

**ENERGYBIZ** What is the pre-eminent communications challenge this industry faces?

**SOMERHOLDER** It is the tremendous benefit the natural gas industry can provide to the economy. Natural gas has provided a tremendous benefit and it's not just a short-term bridge to something else. It's a foundation for many years. We have a 100+ years' supply of natural



PROCHAZKA

gas and we really need energy policy in place that will support natural gas for a long time. The economy and the environment will be better as a result.

**ENERGYBIZ** After Hurricane Sandy, there was a lot of interest in using microgrids to make the grid more secure.

**LAROSSA** The application of microgrids in certain places makes sense. We want to make sure that we identify what it's costing for that backup and try to find solutions so that we can make it economical for hospitals and critical infrastructure to stay up and running during storms like that.

**ENERGYBIZ** Scott, you have an electric business and a gas business. Which gives you the most fits?

**PROCHAZKA** Which child do I like least? That's always a tough question. They each have their own challenges. On the gas side, the challenge is the need for continued investment in infrastructure while knowing that you're fighting flat usage or customer growth rates in some territories. We work hard to mitigate that through the management of operations and maintenance expenses.

**ENERGYBIZ** Jeff, how do you reconcile the pressures you are under in this state versus what you have to do in other states?

**SHAW** Fortunately, California's only 10 percent of our business, and we are the tail on the dog in California, there's no doubt about it. As our big-sister utilities go in California, so goes Southwest Gas. We keep a close eye on policy developments and how they might impact us. ☒

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# “Gathering Revolution: What the Future Holds for Utilities and their Customers”

**R**evolution or not, some things naturally resist change. First among those is the customer’s expectation that the lights will go on at the throw of the switch.

That fundamental dynamic – a natural consequence of industry progress from the industrial revolution to this day – is built into the fabric of modern life. We assume power. We assume it will be available – safely, instantly and without interruption. We also assume it will be inexpensive to obtain.

We are, quite simply, an energy society. We are not an energy-optional society.

Does that reality translate into a harmonious relationship of common understanding between utilities and their customers? To a notable extent,

yes it does. By and large, customers get what we do and why they need us to keep doing our work.

It gets more complicated over questions of how we do our work.

There was a time, not so long ago, that the “how” of our work centered on reliability and the cost to the customer. Generation inefficiency was never received well – and still is not.

However, these days the public discussion flares more over the sources of energy supply. Say the word “coal,” for instance, and be prepared for a debate over the relative merits and drawbacks of fossil fuels – including oil and to a lesser extent, natural gas.

Over the past decade, a growing consensus has emerged that greenhouse gas emissions, to which

fossil fuels contribute, must be addressed with shifts toward less damaging alternatives.

That is happening. The U.S. Energy Information Administration says that the number of coal-fired power plants dropped more than 11 percent from 2002 to 2012. That trend is likely to accelerate. The development of renewable sources of power continues apace. Exceptional progress has been made over the past decade.

But consider this: There is no precedent in human history to indicate that we can transition from one type of energy supply system – in our case from hydrocarbons to renewable energy sources – either quickly or inexpensively. A rational assessment of physics, engineering and economics tells us it will take decades and trillions of dollars of investment to move to a low-carbon, green energy-based world.

None of which lessens the desire among a growing number of customers to see this happen – immediately and with no bother. This creates a dilemma both complex and impossible to ignore.

The energy industry is faced with a paradox and a major challenge: To simultaneously retain the public trust, continue to meet customer demand in ways that are safe, reliable and affordable – and do so with evolving green energy options that do not always meet accepted standards of reliability and cost effectiveness.

Success in the years ahead will rest upon our ability, as a nation, to achieved previously unmatched levels of public and private sector cooperation, leadership and technological innovation as we work to address our collective energy needs and environmental concerns.

It is not so much a matter of “buying time” (though that is an aspect of it) as it is communicating clearly and persuading customers that we are steadily and unequivocally moving in the direction they desire us to travel.

*Thomas F. Farrell II is chairman, president and CEO of Dominion, one of the nation’s largest producers and transporters of energy.*

# More Effort Required, More Spending Needed

HEIGHTENING GRID SECURITY // AN INTERVIEW WITH RICHARD CLARKE

**ELECTRIC UTILITIES AND** the energy sector must develop and execute multiyear strategies to heighten security against physical and cyberattacks. That will require power rates to climb, according to Richard Clarke, one of the nation's pre-eminent security experts and the former National Coordinator for Security and Counterterrorism for the United States. He recently talked with *EnergyBiz*. The exclusive interview, edited for style and length, follows.

**ENERGYBIZ** Are you impressed with the efforts to date by the government and utility industry to address grid security?

**CLARKE** I don't think we are very secure today. But we are better than we used to be. The Federal Energy Regulatory Commission and the North American Electric Reliability Corp. have taken some steps in the last few years that are actually doing something meaningful. It's a very difficult problem. It's very hard for state regulators to come to a decision to raise rates in order to pay for cybersecurity. There are a lot of other competing priorities.

**ENERGYBIZ** If these policies are successful and there is never a cyberattack, how do you justify the expense?

**CLARKE** People don't see a problem. It's the Y2K problem. I was involved heavily in Y2K at the White House. After it was all over, people said to us, "Gee, you spent all this money. You got the private sector to spend all this money and nothing happened." We said, "Yeah, well, nothing happened because we spent all this money." They said, "Well, you can't really prove that." When you are trying to take serious and costly action to prevent something that has never happened before, it's very difficult to persuade people to do that.

It's prevention of something that you cannot quantify in terms of an actuarial table. Now after it happens, people just open the bank vault and give you all the money in the world.

**ENERGYBIZ** But would a terrorist or a foreign nation's strike on our electric grid would vastly eclipse the economic and psychological impact of the 9/11 terrorist attacks?

**CLARKE** It depends on the attack. But I think the potential is there for significant economic damage, because what we are talking about is not simply turning out the lights. Destroying pieces of equipment on the grid could take months to replace. With 9/11, we had the airline industry down for four days. We had Wall Street closed for seven days. But if you are talking about a major attack on the electric power grid, you could have large sections of the country down for a prolonged period if what was destroyed in the attack were things like generators. We don't have them in surplus.

**ENERGYBIZ** Do we need to be more concerned with a physical or a cyberattack?

**CLARKE** Well, physical attacks tend to be geographically limited. So if you look, for example, at the physical attack on the Metcalf substation in California, it only affected the Metcalf substation. One actor, with a physical attack, can only be at one place at one time. In a cyberattack, one actor can be in many places at the same time and do damage across a broad geographic area.

**ENERGYBIZ** Do you think a group like ISIS has the capability of pursuing something along these lines?

**CLARKE** I don't think they have the capability. But



they appear to have a vast amount of money. There are lots of people in the black cyberunderworld who have very sophisticated capabilities like nation states who might be for hire. A terrorist group, unlike a nation state, has nothing to lose. A nation state might be deterred from attacking us. But a terrorist group might not be. If a terrorist group got enough resources to buy an attacker, that could happen. But we have not seen a terrorist group yet to date do a cyberwar attack that causes damage, disruption or destruction on a significant level.

**ENERGYBIZ** Are there important steps that the president needs to take that are not being taken?

**CLARKE** Yes, there are many. The president's been trying, but Congress has not passed any of the bills that he wanted it to pass. A cyber bill passed the House this year but it doesn't do a great deal. It mainly codifies the authorities of the Department of Homeland Security. There is a great deal more that needs to be done. The president has tried to do some of it with executive orders. So, for example, he created the U.S. National Institute of Standards and Technology cybersecurity framework through an executive order. That's useful. But he hasn't gone the next step and used his regulatory authority to make companies apply the NIST framework.

**ENERGYBIZ** As the power grid moves from analog to

**digital control, it becomes more vulnerable and potentially more resilient. As this transition takes place, are the necessary precautions being taken?**

**CLARKE** It's very hard to put the necessary precautions in place. Sure, analog is safer. There is no doubt about it. But we can't live in an analog world, and you can't hold back the tide of technological progress. The question is, can you do that smartly? I would be surprised if it were being done in a highly secure way because nothing in this country is highly secure against cyberattack. We've seen the U.S. Department of Defense's networks and the networks of banks that spend hundreds of millions of dollars a year on security – all penetrated.

**ENERGYBIZ** The banking system has been held up by some as an example of where utilities need to go. Do you think they are more advanced than utilities?

**CLARKE** The large national and international banks are. The regional banks are not. But even the large international banks have been repeatedly attacked successfully.

**ENERGYBIZ** Are you working with utilities to identify threats and develop strategies to address them?

**CLARKE** I don't have any utility clients at the moment.

**ENERGYBIZ** Tom Fanning, the CEO of Southern Company, helps lead the utility sector efforts with the government to address security issues. He said critical infrastructure should not be linked to the Internet. Is that feasible?

**CLARKE** Yes, it is. He's absolutely right. The problem is that if you can air-gap control networks from corporate networks or from the Internet, they don't stay air-gapped because contractors, vendors and employees then do things that create bridges back to the company network or the Internet. Even if a control network is completely, successfully air-gapped, a determined person can probably still get into the control network with physical penetration of one thing on the network. With an electric power grid, it's very hard to prevent physical access to any object on the network because objects are so widely distributed and they frequently stand alone without any guards and without much in the way of physical security.

**ENERGYBIZ** There have been reports that China and Russia have attempted to penetrate our grid. What does that tell us about wars of the future?

**CLARKE** Russia and China probably are pinging the

power grid. That doesn't mean they are planning a war. It means they just want, like every other good military in the world, to be prepared in case their bosses ever ask them. For a country to attack the United States and do significant damage, they have to believe that they have nothing to lose. Russia and China are very unlikely to go to war with the United States. But if you look at countries such as Iran or North Korea, there are credible scenarios where a kinetic war, a conventional war, might break out. Neither one of them can do much damage conventionally to our homeland. The Iranian missiles won't reach the United States. But they both have the capability of launching cyberattacks against the United States. With a nation state that has nothing to lose, I would expect cyberattacks would be a part of such a war.

**ENERGYBIZ** **Would we be prepared for such an attack?**

**CLARKE** I don't know how sophisticated they are. They have made attacks that we know about that were not that sophisticated, but nonetheless were successful. That's one of the problems with cyberwar. You don't really know in advance of the war how capable the other guy is.

**ENERGYBIZ** **If a terrorist group, Iran or North Korea attacked our power grid, would they hit one city or attempt to bring the whole national grid down?**

**CLARKE** It's very hard to take the whole national grid down. If they were trying to attack the power grid, it would end up being localized. But it depends upon their degree of sophistication.

**ENERGYBIZ** **So what would you say is the most urgent thing that needs to be done? What are the one or two things that should be addressed immediately?**

**CLARKE** We need to have every electric power generation and distribution company come up with a multiyear plan for improving its cybersecurity. Rather than telling them what to do, have them come up with the plans, then review them at the state or federal level. Then, once you've got an agreement on a multiyear plan, fund it. That probably means state regulators have to increase the amount of money that companies can charge. The rates probably have to go up. No one wants rates to go up. But I think that's realistic. The federal government probably needs to buy and store, in emergency supplies, the things that might be destroyed in a cyberattack and cannot be readily replaced because they don't exist in surplus. We might want to warehouse and stockpile a couple of things that would be, or could be, destroyed in a cyberattack and for

which we don't have any spares laying around.

**ENERGYBIZ** **Would you say an assault on the power grid is likely in the next five years?**

**CLARKE** I never talk about likelihood. This is not automobile insurance. With this kind of stuff, there is no actuarial table. It doesn't happen often enough, thank heaven.

**ENERGYBIZ** **Are other countries ahead of us in addressing this in Western Europe, or is Japan?**

**CLARKE** No.

**ENERGYBIZ** **So it's an open frontier. Nobody really has the gold standard?**

**CLARKE** Yes. Defense is very hard. Some countries like Singapore, Israel, Estonia and South Korea have thought about taking over the controls of their cyber-systems by, in essence, disconnecting the country from the rest of cyberspace in a period of cyberwar. They would pull the plug on the connectivity with the rest of the world. We can't do that. China might be able to do that. But we certainly can't.

**ENERGYBIZ** **Why can't we do it?**

**CLARKE** We have too many connections. We don't live in the kind of command economy where the government has that authority. Nobody wants to give the government a kill switch where it can kill the Internet. That's a very bad idea from a civil liberties perspective. It would also be probably almost impossible to do technically. We don't have that kind of defense that some smaller countries can do.

**ENERGYBIZ** **Do you think the public is aware of all of these issues to the extent they need to be?**

**CLARKE** The public is very aware that there are problems with cybersecurity in general. They have all read about Target being hacked. Every time they pick up the paper they read about somebody being hacked or some actress's naked photos being acquired. They know that cybersystems are inherently insecure. What they don't know is that all of our critical infrastructure, whether it's gas, oil, trains, aircraft, electric power or telecommunications – all of our critical infrastructure runs on systems that are controlled through cybernetworks. Most of those cybernetworks are about as secure as an actress's naked photos. This is true even in companies that get it right and spend a lot of money. In this business, the offense has a huge advantage over the defense. It's very easy to get in and very hard to keep people from getting in. ☒

# The Export-Import Bank Should be Reauthorized

BY JEANNE LOPATTO

*Vice President, Government & International Affairs*  
Westinghouse Electric Company

**THE EXPORT-IMPORT BANK** of the United States is the country's official export credit agency. Its mission is to assist in financing the export of U.S. goods and services to international markets, thus helping to maintain and create U.S. jobs and a stronger national economy. With Ex-Im Bank support, U.S. exporters can compete on the basis of price, performance and service. Since it was created in 1934, the Ex-Im Bank has been a vital institution promoting U.S. exports, and has enjoyed longstanding bipartisan support. President Reagan heralded it as enabling U.S. businesses to "compete vigorously throughout the world," and President Obama stated it will help thousands of U.S. businesses sell their products and services abroad, and is a key factor toward his goal of doubling exports.

The stop-gap measure taken by the U.S. Congress in September 2014 to reauthorize the Ex-Im Bank for nine months was welcome. Yet the lack of long-term reauthorization is hurting U.S. businesses. Many international competitors are state-owned or heavily subsidized with the advantage of strong project financing from their governments, which is not the case for their U.S. counterparts. This can often mean the award of significant contracts — and accompanying jobs — to non-U.S. businesses. This may hold especially true for those businesses competing in the high-capital-investment energy industry.

The U.S. economy has been recovering on the strength of U.S. exports. Over the past five years of recovery (2009-13), U.S. GDP increased an average of nearly 2.5% per year, driven by 9.5% growth in exports. Additionally, U.S. exports rose almost 44% to a record \$2.3 trillion in 2013 and now represent 13.5% of



GDP, the highest in a century. Equally important, U.S. exports account for approximately 10 million U.S. jobs — most are in the critical sectors of the U.S. economy, including energy exporting.

The Ex-Im Bank does not replace private financing. It is a complement to it, accessed when the private sector is not willing or able to risk its capital in certain emerging markets where U.S. goods and services may be sold. The Ex-Im Bank's track record in evaluating such risks is commendable, as its rate of default is lower than many commercial institutions with a loss ratio below 0.2%.

Ex-Im Bank operates at no net cost to U.S. taxpayers. In fact, fees generated from its transactions help reduce the federal deficit. Last year alone, these fees totaled \$1 billion in revenues paid to the U.S. Treasury. In this way, Ex-Im Bank loan guarantees represent high-quality financing for overseas buyers that pays a return to U.S. taxpayers.

Ex-Im Bank provides a measure of certainty in a very uncertain global marketplace. It levels the playing field for U.S. businesses forced to compete with state-controlled competitors overseas. And it pays dividends for U.S. taxpayers, in terms of good-paying jobs and a return on their tax dollars. It should be treated in accordance with its value to our country.

**With Ex-Im Bank support, U.S. exporters can compete on the basis of price, performance and service.**

# Building an Interoperable Ecosystem

EASING DATA ACCESS // BY MARTIN BURNS

➤ **OUR GOAL IN** the Green Button Initiative is to provide electricity customers with easy access to their energy usage data in a consumer-friendly and computer-friendly format, and to develop an interoperable ecosystem for utilities, manufacturers and consumers worldwide that want to manage and improve the efficiency of energy usage. Because of its simplicity, Green Button is well on its way to becoming the common currency of energy usage information for the energy sector.

Although it's impossible to predict what creative applications will emerge in the coming years, a number of uses are already becoming popular. Utilities are using Green Button for customer engagement programs and efficiency programs. Residential, commercial and industrial consumers are using Green Button for virtual energy audits, benchmarking resource usage and validating efficiency goals. Other sectors, including gas and water, are looking at implementing Green Button, expanding its use beyond just the electricity sector.

Many ingredients go into creating an ecosystem. As an example, have you used a Wi-Fi connection at some point in the last month? At an airport, a coffee shop, or in your home? If so, you've been taking advantage of a thriving, interoperable ecosystem with a vast number of products and services. To build one of these ecosystems, just start with an interoperable standard (IEEE 802.11 in the case of Wi-Fi), add testing and certification authorities (via the Wi-Fi Alliance), recruit adopters and manufacturers, educate consumers and engage the creativity and innovation of entrepreneurial individuals and organizations. And hold on for a wild ride.

According to the Wi-Fi Alliance, which was established in 1999, Wi-Fi is in 25 percent of homes worldwide, and about 2 billion Wi-Fi devices were

sold in 2013.

During the past several years, we've made a great start on setting up just such a scenario to support a Green Button ecosystem. Eight pieces are in place – specifically, an interoperable standard, testing and certification authorities, services, utilities, government partners, international participation, manufacturers and app developers, and tools for developers. Here are some details:

For the interoperable standard, the underlying Green Button standard is the North American Energy Standards Board's Energy Services Provider Interface REQ.21, augmented by additional implementation agreements and profiles developed within the Utility Communications Architecture International Users Group.

To provide testing and certification authorities, UCalug established its Green Button Certification program, supported by Underwriter's Labs and the American National Standards Institute.

Services provided by Green Button data come through a utility portal and streaming through application programming interfaces.

As for utilities, after an initial launch in 2012 by the three large investor-owned utilities in California (Pacific Gas & Electric, San Diego Gas & Electric, and Southern California Edison), 48 utilities and electricity suppliers serving more than 59 million homes and businesses across the United States now support Green Button.

Among government partners, the White House Office of Science and Technology, the National Institute



# Building the Sustainable Utility of the Future

BY RALPH IZZO

➤ **FOR MORE THAN 100 YEARS**, utilities have played an essential role in providing universal access to the benefits of safe, reliable and affordable energy. It's remarkable how far our industry has come in navigating through a period of unprecedented change even while recognizing that the pace of change will continue to accelerate.

There are many signs of progress. Competition has improved performance. Nuclear plants that ran less than 70 percent of the time a few decades ago now run above 90 percent, providing abundant, emissions-free energy. Meanwhile, shale gas is fueling a manufacturing resurgence and lowering bills for consumers. In addition, companies like PSEG are showing it's possible to clean the air and

power the economy via a range of efforts to meet environmental requirements and promote renewables.

While this is hardly a static picture, it's not nearly as dynamic as it should be. Three important changes are needed to support universal access to energy that is safe, highly reliable, low-cost and environmentally advantaged in the 21st century.

First, utilities and their regulators must forge an even closer partnership if America's energy infrastructure is to be modernized and fortified to support not only day-to-day reliability, but resiliency against extreme storms or other threats. We must make every effort possible to put the adversarial structure around regulation behind us. I'm convinced

this can be done in ways that provide greater predictability for the huge capital investments that need to be made while maintaining appropriate safeguards for consumers.

Second, the utility of the future will need to excel not

only in providing energy, but also by helping customers use less energy — resulting in lower bills — and improving the environment. Energy efficiency investments have the potential to produce vast consumer savings. As we invest in reliability and resiliency, both of which come at a cost, helping to offset this through energy efficiency is more important than ever.

Currently, the U.S. lags many other developed nations in energy efficiency. Utilities can be instrumental in closing the energy efficiency investment gap — producing wins for our customers, the environment, our employees and shareholders. However, these benefits won't be realized unless they are shared. Regulations should seek to create winners of all.

Third, utilities can play a key role in ensuring that renewable energy is increasingly developed in ways that are affordable in the short term while helping secure our energy future over the long term. Solar energy shouldn't only be available to people who can afford to put solar panels on their roofs. Grid-connected utility solar projects like those my company is building on landfills provide the benefits of clean energy to all customers at less than half the cost of most rooftop solutions. This is a societal equity issue that can't be ignored.

Our customers depend on electricity more than ever. Our challenge is to become even more responsive to their needs, while doing so at a reasonable cost and with less impact on the environment. With the continued support of our dedicated workforce, I'm confident we are up to the test.

*Ralph Izzo is chairman, president and CEO of PSEG, one of the nation's largest diversified energy companies.*



**Energy efficiency investments have the potential to produce vast consumer savings.**

of Standards and Technology and the U.S. Department of Energy have co-led the Green Button Initiative on the federal government side. Additional federal agencies are learning to leverage Green Button. For example, the General Services Administration conducted a pilot program and has a road map for using Green Button in energy management of its portfolio of properties, and the Obama administration has announced its intent to further expand the use of Green Button across all federal facilities. The Environmental Protection Agency is incorporating Green Button capabilities into its highly successful Energy Star Portfolio Manager benchmarking service, making it available nationally.

Representing international participation, in Canada, Ontario is implementing Green Button across the province, and about 60 percent of the province can now access the first component of the standard, "Download My Data." London Hydro and Hydro One are piloting the second component, "Connect My Data."

With regard to manufacturers and app develop-

ers, NIST and the Green Button team have worked to broadly provide technical information and support for adopters of Green Button technology, including the vendor community as vendors integrate Green Button into their product offerings. In addition, DOE has sponsored numerous hackathons and challenges to further engage developer communities.

Meanwhile, NIST has worked with its partners to develop tools to support the developer community, and they are freely available for commercial and noncommercial use through [greenbuttondata.org](http://greenbuttondata.org). These include development tools, APIs and operational Green Button servers for experimentation and validation.

We invite you to join us. For more information on how you can participate in the Green Button interoperable ecosystem, please visit [www.greenbuttondata.org](http://www.greenbuttondata.org). ☒

*Martin Burns is a researcher at the National Institute of Standards and Technology.*

(GUEST OPINION)

# Microgrids for Resilience

AN OPPORTUNITY, NOT A THREAT // BY KRISHNA V. PRASAD

➤ **IMAGINE A LARGE STORM** moving into an urban city area – soon, many utility customers will lose electric service as the electric utility's assets are affected by flooding, wind or other disruptive forces of nature. Imagine that, instead of spending valuable time trying to figure out how to operate the network in islands by isolating the damaged areas, a utility could seamlessly and immediately transition into such a state of operation using a predefined, microgrid-based operations method for the particular power grid. Many utilities see microgrids as a threat. Instead, microgrids can be a key element of a strategy that builds more resilience into the distribution grid by intelligently honeycombing the utility's territory into numerous microgrid cells linked together by smart technology.

The objective of microgrid-based operations is to

maximize the number of customers served under all conditions. View a service area's distribution network as a number of concatenated, contiguous microgrids. By definition, microgrids are islands whose gross generation and demand are in balance so that they can continue operating reliably even though the service area of which they are a

part may be experiencing an imbalance that causes some portions of the service area to be blacked out. For example, the total service area may consist of 100 microgrids, 20 of which are knocked out in a storm, while the remaining 80 microgrids continue operating on their own. In usual circumstances, if power were to flow in or out of any of the microgrids,





the electric circuit's damage would have posed constraints that would not apply during the outage. It may be noted that microgrid operation during an outage differs from the normal grid operating condition, which optimizes as much as possible renewable integration and stability. The grid would thus have two different operating modes: integrated operations and microgrid-based operations.

The key challenge in building a microgrid-based operations program is that the microgrids must be defined in real time, based on existing network conditions, in order to cover the entire service area, which means microgrids must be designed with soft boundaries. For this to be accomplished, the network's planning, building and operating philosophies must be transformed to reflect adequate consideration of the outward flow of energy from the service points to the network supply points, instead of the other way around as is usually done.

This transformation of the electric grid is particularly achievable with the increasing use of distributed generation, distributed storage sources including plug-in hybrid electric vehicles and demand response programs, together with increased intelligence from the network through smart meters, intelligent electronic devices and two-way communication between the service points and network operation centers. Aggregated consumption during disasters needs to be commensurate with the distributed generation averaged through use of storage for the microgrid-based

operations threshold.

As utilities transition from using a day-ahead balanced grid to using a more transactive energy framework and methodology, regulatory and policy frameworks that are being put in place can help facilitate a microgrid-based operations approach. With embedded intelligence in the devices and distributed generator storage and the needs of bidirectional grid, the grid's operational systems have to evolve toward having more distributed intelligence and situational awareness. While utilities make this evolution, they have to keep aware of the visible adjacency of microgrid-based operations.

Information and operations technology systems are already transforming to meet the needs of the renewable integrated grid. It would only require overlaying a specific context and feasibility condition on the integration to make microgrid-based operations possible.

Microgrid-based operations hold the promise for online, real-time, dynamically defined microgrids so whenever an event affecting the distribution service area occurs, the network would be automatically operationally broken up into the predefined microgrids in order to extend electric supply to the maximum number of customers. The restoration regime can follow the microgrid-based operations approach and bring the grid back into integrated operation once the damage is managed and mitigated.

Because the distribution utility can also plan its maintenance with the advantage of microgrid-based operations, the network would be maintained with fewer outages and more flexibility. Microgrid-based operations need not be viewed as disruptive, but instead it could be a corollary of the integrated mode of grid operation necessitated by the profusion of distributed generation into the grid, once it is planned and operated appropriately. ☒

*Krishna V. Prasad is with Tata Consultancy Services.*

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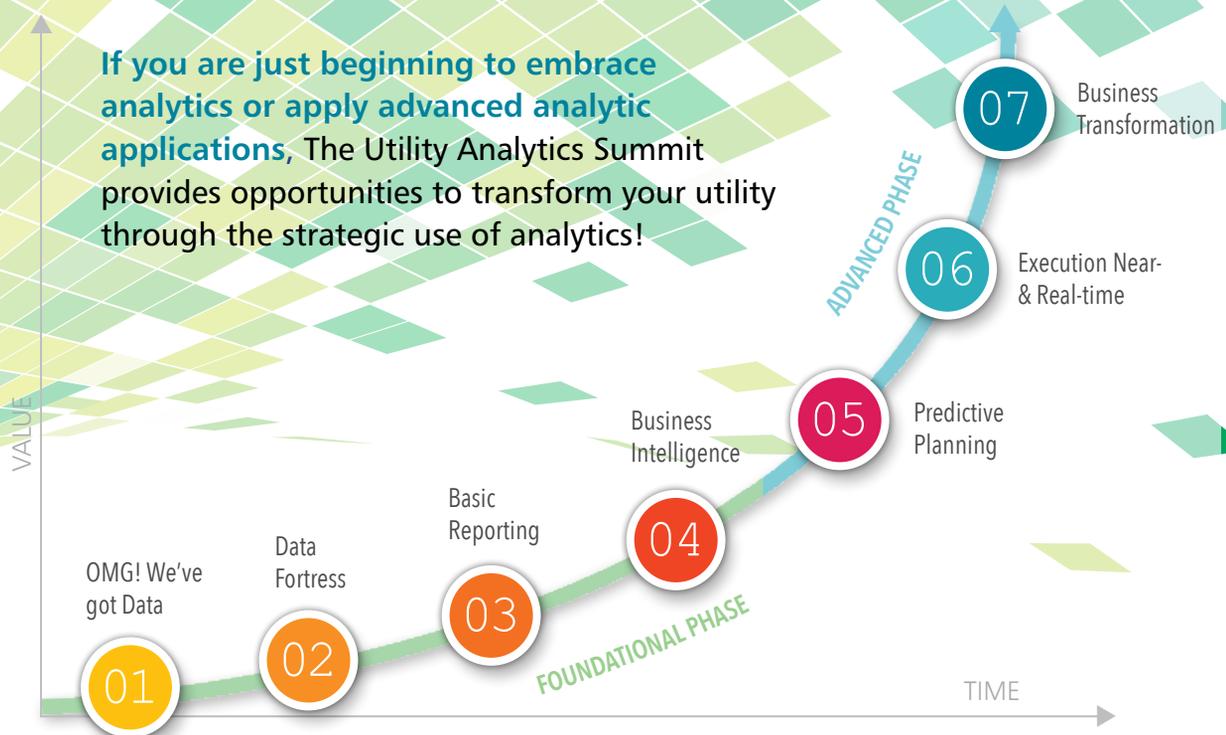
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# Robust, Mature Wind Business

VESTAS – HUNGRY YET HUMBLE // BY MARTIN ROSENBERG



Chris Brown has been steering Vestas Wind Systems' North American operations as it pivots to thrive in a more mature wind industry by being both hungrier and humble. He joined the company as president in late 2012.

Brown has known challenges, having served as chief operating officer for the City of Detroit, which filed for bankruptcy in 2013. Earlier, he was executive vice president of DTE Energy, running the unregulated side of the business and trading.

*EnergyBiz* recently sat down with Brown for an extended conversation about his company and the future of wind energy. His comments, edited for length and style, follow.

**ENERGYBIZ** What is the state of wind generation in America today?

**BROWN** We're going to probably see some of our largest manufacturing and construction of wind projects in the next two years. We've had kind of record orders in 2013 and we're on pretty good track for 2014. We're driving the cost of energy down. You can't produce electricity at a gas generation plant at below \$20 a megawatt-hour. If you include the production tax credit value to the third-party investor and look at \$40 or \$45 per megawatt-hour, that's economic in 75 to 80 percent of the jurisdictions in the United States. There are places in California where PV is probably beating wind. I'm not worried about that competition. I'm thinking about what's going to be the future of the U.S. Environmental Protection Agency 111-D regulations on greenhouse gas emissions. Where does that go as we go forward? How does the Southeast look at power? Do we take the windy areas of the country and provide transmission

at a large scale? What's next in generation?

**ENERGYBIZ** What innovations are you looking at in your business?

**BROWN** We've peeled off service and said that's a separate business. Service on the asset management side has continued to grow.

**ENERGYBIZ** What are some of the negative perceptions of wind generation?

**BROWN** There is a perception perhaps that wind is not cheap. That's a wrong perception, too. Every energy source has been incentivized. If we start to make a level playing field, wind can compete with anything. Unfortunately, wind tax subsidies have to be renewed every two years. But if you look the next 10 years of run-life, we're still decreasing our costs. Other generation industries aren't. Those industries are actually going up in cost as a result of mine issues, violations or potential carbon taxes.

**ENERGYBIZ** Does wind still need to have a production tax credit?

**BROWN** I would certainly be in favor of not having a PTC if we have a level playing field. Let's have that debate about what the national energy policy is. Are there incentives for nuclear or are there incentives for solar? Do we need certain subsidies in certain regions? Let's not say, "Okay, we'll do a two-year extension but we won't review the other mechanisms."



Let's have that debate about what the national energy policy is.



Chris Brown, president, Vestas Wind Systems North America. Photo courtesy of Vestas Wind Systems

**ENERGYBIZ** Let's say we get a level playing field. How much will wind generation grow as a percentage of total power generation?

**BROWN** In Denmark, I think, wind is at about 30 percent. In most jurisdictions in the United States we are at 6 or 7 percent, maybe going to 8 percent of generation production. Xcel Energy, based out of Minneapolis and Colorado, is at 30 percent. Wind blows from Texas all the way up to Minnesota. Let's figure out how to get the most productive yield out of that. Some policymakers may say the amount of wind ought to be 22 percent in California. Really? It ought to be, "Here's where we can get the 38 percent penetration because it's economic when the wind is at 9 meters a second. And in the states that don't have any wind but they have sun, okay, let's use solar." Maybe they don't have either and need to use nuclear. But we haven't had that conversation. It's been public utility commission-centric and state-centric.

**ENERGYBIZ** What's been your biggest problem with the last few years at Vestas?

**BROWN** Currently, it's getting enough qualified manufacturing talent in our factories.

**ENERGYBIZ** You've downsized and now you can't find the employees?

**BROWN** Yes, we've been really challenged to get the numbers to ramp back up. We're aiming to have 2,800 employees in Colorado at our four factories.

**ENERGYBIZ** Who are your biggest customers: utilities or independent power producers?

**BROWN** Well, it's both. We also supply to developers, people who are selling to utilities. We sell to pretty much everybody.

**ENERGYBIZ** Is transmission being built at the pace that you'd like to see?

**BROWN** In some jurisdictions it is and in some it isn't. The Anschutz Exploration Corporation is interested in building a large wind generation facility in Wyoming that puts power into California. That requires transmission. From Oklahoma's windy areas, Clean Line Energy Partners is trying to put power into the Southeast and Northeast regions.

**ENERGYBIZ** What is your view of microgrids?

**BROWN** They are not enough. They may be sufficient in 50 years, but they're not sufficient now.

**ENERGYBIZ** There is a move toward microgrids to increase reliability.

**BROWN** There is a lot of hype around battery and storage technology. Elon Musk wants to put in a \$5 billion facility. That's fine, but what percentage

is that going to be of the total installed generating capacity in the United States? Very small.

**ENERGYBIZ** What do you think state regulators least understand about wind?

**BROWN** The cost of wind energy. It is coming down. It will continue to come down. There's a perception that we're still in the 1980s and 1990s of 40 cents per kilowatt-hour. It's just not true. That's where I don't think the regulators have totally embraced it. Some of the regulators totally get it.

**ENERGYBIZ** What kind of business innovations are you seeing?

**BROWN** The financial side of the business is starting to mature. You see it with yield cos. There are great companies that are saying, "We're going to pay this much of a yield out, and we're going to distribute it all to shareholders and they're going to get it straight-

away." I think that as an instrument has been very effective for participants that are developing projects in the wind space. They've gotten to scale, and they've gotten to a return for their investors that's been material. If you didn't have the scale of what we're doing now, you could have a yield co. A yield co has to have assets to feed.

**ENERGYBIZ** Any other innovations?

**BROWN** We're now saying we will guarantee megawatt-hours at a price. We didn't do that 10 years ago. Now we're financially underwriting these contracts. That's different.

**ENERGYBIZ** Do you see an opportunity to bring wind power to the 1.5 billion people without electricity?

**BROWN** Yes; "Wind for Prosperity" is a program we've been working hard at for quite some time. If you're paying 52 cents a kilowatt-hour for diesel generation and you're having pirates steal the diesel generation, and you're polluting your local environment, how do you figure out how to put a smaller generating facility in and be economical? How do you take some of the inefficient installed wind capacity that you have in mature markets and transfer it to emerging markets? There's a real opportunity in some of the emerging markets.

**ENERGYBIZ** What's the Vestas corporate culture today, and has it changed over the years?

**BROWN** We're learning how to compete. I'd say we're trying to be hungrier and more humble. I think that in the past we were growing revenue without profitable growth. We are going to change the world, and we're going to do it in a way where it can make money. When we saw the variability of energy and demand going up and down, it required us to be much more mature. So we've grown up some. We've become better business people. We've gotten closer to the knitting of our business. I think we've been more commercial. Three of the values that are important to us are accountability, collaboration and simplicity. We've tried to make the business simple to understand. We used to have some pretty lofty revenue and profit targets. We've been humbled on some of that. When you get kicked, you got to get up and say, OK, here's how you're going to make it happen on a day-to-day basis. I think we've increased maybe that little bit of fear, and that's been good. ☒

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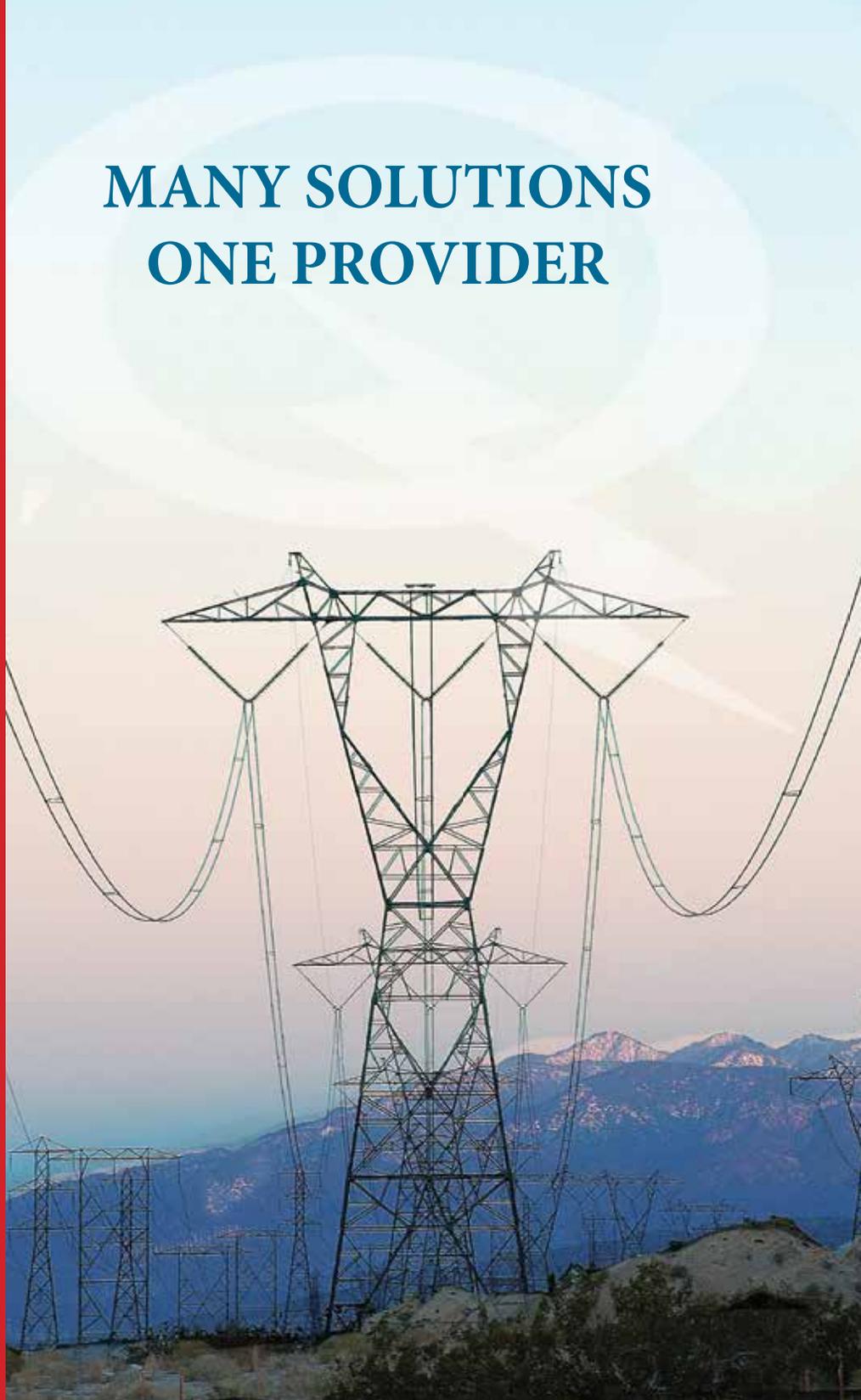
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