

WORLD-GENERATION

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Statue of Liberty lit up by LED on July 7th.

Photo: Courtesy of The National Park Service

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Dick Flanagan

It is our job collectively to leave the world a better place than the way we found it.

We are very pleased to open this issue with the Statue of Liberty as an example of taking care of one of our national monuments for future generations on page 4.

Tristan Grimbert gives a developer's perspective on today's renewable energy market on page 6.

Lyn Corum explains the utility of the future as it faces revolutionary changes on page 8.

Gilian Corral reports on GE's Minds and Machines 2015 Conference and shares her takeaways on page 10.

Bob Williams introduces a new product for North American coal plants to go 'dust free' on page 12.

Lisa Wood says on page 15 that the electric power industry is working to seamlessly integrate new technologies and devices into the electric grid.

Branko Terzic tells us on page 16 that a key factor to successful mergers of electric utilities is a well-planned approach to the regulatory approval hurdle.

Paul Winters writes on page 18 that BIO's World Congress fosters partnerships to build the \$369 billion in biobased products.

Hareesh Patel explains the findings from the Mercatus Distributed Energy Insight Report and charts the US solar market on page 20.

Alums from the Classes of 2000 return to "Back on Campus" with editorial starting on page 22-24.

World-Gen is a media sponsor for Power-Gen Week and will be distributed in Las Vegas the week of December 8th.

We are renewing our media sponsorships in 2016 as an online publication with show copies: Feb/March 2016 – Class of 2016; May/June 2016 – EEI, Acore/REFF, Intersolar, Power Gen Europe; Sept/Oct 2016 – SPI, REFF West Coast; Nov/Dec 2016 – Power-Gen Week 2016.

We added a third 24/7 news feed, NASDAQ's Globe News Wire, joining PR Newswire, Buffet's Business Wire and MIT's weekly round up from other sites. World-Gen now offers one-stop shopping for all your energy information.

Please visit the media kit on www.world-gen.com for rates and closing dates.

Look forward to seeing you in Las Vegas.

Happy Holidays and Happy New Year!

Dick Flanagan

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LADY LIBERTY GETS FACELIFT

BY DICK FLANAGAN

On July 7th, 150 invited guests and media rode the evening ferry to Liberty Island to witness the Statue of Liberty being lit with Musco’s light-emitting diode (LED) light source. The LED system provides twice the brightness level and reduces energy consumption by 62 percent. The Statue of Liberty National Monument joins The Washington Monument, Mount Rushmore National Memorial, the White House, and the Flight 93 National Memorial featuring customized lighting systems by Musco. Musco custom designed the new lighting solution with precise optics to highlight the aesthetics of the monuments.

The Statue of Liberty’s lighting has changed and evolved with the advancement of technology. The first system was flood lights in 1916; to incandescent floodlights in 1931; mercury vapor lamps in 1944-45; new lighting systems in time for the bicentennial in 1976; and the restoration of the Statue of Liberty and Liberty Island in 1986.

Prior to Hurricane Sandy, much of the Statue of Liberty’s lighting system was housed in below ground light wells. Musco Lighting came to Lady Liberty’s aid after the storm and installed a temporary system which was in place since November 9, 2012.

“After the devastation of Hurricane Sandy, we were honored to bring the monument back to light,” said Joe Crookham, president of Musco Lighting. “With the new permanent lighting system, we continue our partnership with the National Parks and our shared commitment to bringing good lighting practices to the nation’s parks.”

“We are thrilled with Musco’s outstanding donation. The good lighting practices that have been initiated will result in energy efficiency and enhance the experience of millions of people who view Lady Liberty from New York Harbor in the evening hours,” said John Piltzecker, superintendent of Statue of Liberty National Monument and Ellis Island.

GIFT OF FRIENDSHIP

“The Statue of Liberty Enlightening the World” was a gift of friendship from the people of France to the United States and is recognized as a universal symbol of freedom and democracy. The Statue of Liberty was dedicated on October 28, 1886 and designated as a National Monument in 1924. Ellis Island is a former federal immigration station which processed more than 12 million immigrants between 1892 and 1954. A 1965 presidential proclamation added the island to the National Park Service as part of Statue of Liberty National Monument. It now features exhibits and programs illustrating America’s immigration history.

MOUNT RUSHMORE

Musco has had a close partnership with the National Park Service for many years, relighting numerous national parks around the country. Lighting Mount Rushmore presented Musco’s team with several unique challenges, the biggest of which was customizing a system that would project more than 1,100 feet onto the iconic

sculpture, while minimizing light spillage and sky glow.

Advanced optical controls highlight the aesthetics of the monument, while ensuring light is not spilled into the night sky and natural wildlife area. The new system reduces operating costs at the monument with a 90 percent reduction of energy consumption and the elimination of maintenance with Musco’s comprehensive 10-year warranty.

The system dramatically enhances the rendering of the memorial’s fine-detailed sculpture with pinpoint light control, presenting a theater-like impression for the memorial’s over two million annual visitors. The system’s instant on/off/dimming capabilities provide opportunities for special effects during presentations and events.

MUSCO LIGHTING

Musco Lighting is based in Oskaloosa, IA. Musco Lighting has specialized in the design and manufacture of sports and large area lighting solutions around the world. Musco has pioneered systems using metal halide and LED technologies that have made dramatic improvements in energy efficiency and provided affordable ways to control spill light and glare.



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TODAY'S RENEWABLE ENERGY MARKET NEW TRENDS: A DEVELOPER'S PERSPECTIVE



Tristan Grimbert, CEO of EDF Renewable Energy, the North American Renewable arm of Electricité de France, participated in a panel discussion covering market trends at the annual REFF Wall Street conference hosted by Euromoney and ACORE in New York's Grand Hyatt Hotel, June 24-25, 2015. *World-Gen* was a media sponsor and partner. Keith Martin of Chadbourne & Parke moderated this panel.

WHAT IS DIFFERENT ABOUT THE RENEWABLE MARKET TODAY THAN TWO YEARS AGO?

Tristan Grimbert: First, there is a lot more money looking to move into renewable energy. It is not only yield cos. There is an imbalance between the amount of money and the number of projects available for investment.

Second, our business is becoming more and more technical. Being able to deliver on the business plan requires more and more technical knowledge and resources. I am thinking in particular about turbine performance, congestion risk and basis risk. As there is more penetration of renewables, the ability to understand and act on business risk and market conditions is

becoming critical.

The third thing that is different is we have reached a turning point in the last year in the US where we can talk again about carbon pricing and about moving away from subsidies to something that would recognize the cost of carbon. My hope is that, within the next five years, we will move away from renewable portfolio standards and all the subsidies to a truly market-based mechanism for carbon pricing. That is my hope.

WHAT ARE YOUR GREATEST CHALLENGES TODAY?

Tristan Grimbert: Defining a viable business model in the distributed space is a challenge with the lack of differentiation and the repetitiveness and credit issues. A lot of people are moving into that sector. It is very difficult to figure out how to make money. That is one area with which we are struggling.

Another challenge is finding the right balance for spending on the development pipeline in relation to the size of the market when the tax incentives are always on the verge of expiring. Five years ago, there were too many projects under development. I think the wind pipeline was something like 351 gigawatts for an annual market of six to eight gigawatts, so it was 50 years of projects. Today, the number has been reduced significantly.

Lastly, it is a challenge to forecast the price and cost curves accurately. We must take a view on the future price for electricity and the future cost of solar and wind equipment and the future cost of capital. We have been talking about yield cos and their impact on the cost of capital the last couple of years, but at some point the cost of capital will start going back up. You do not want to be caught in a trap where you have offered an aggressive electricity price to win a power purchase agreement and

then the cost of capital goes back up. On the equipment side, we expect the costs to keep falling, but the question is to what extent.

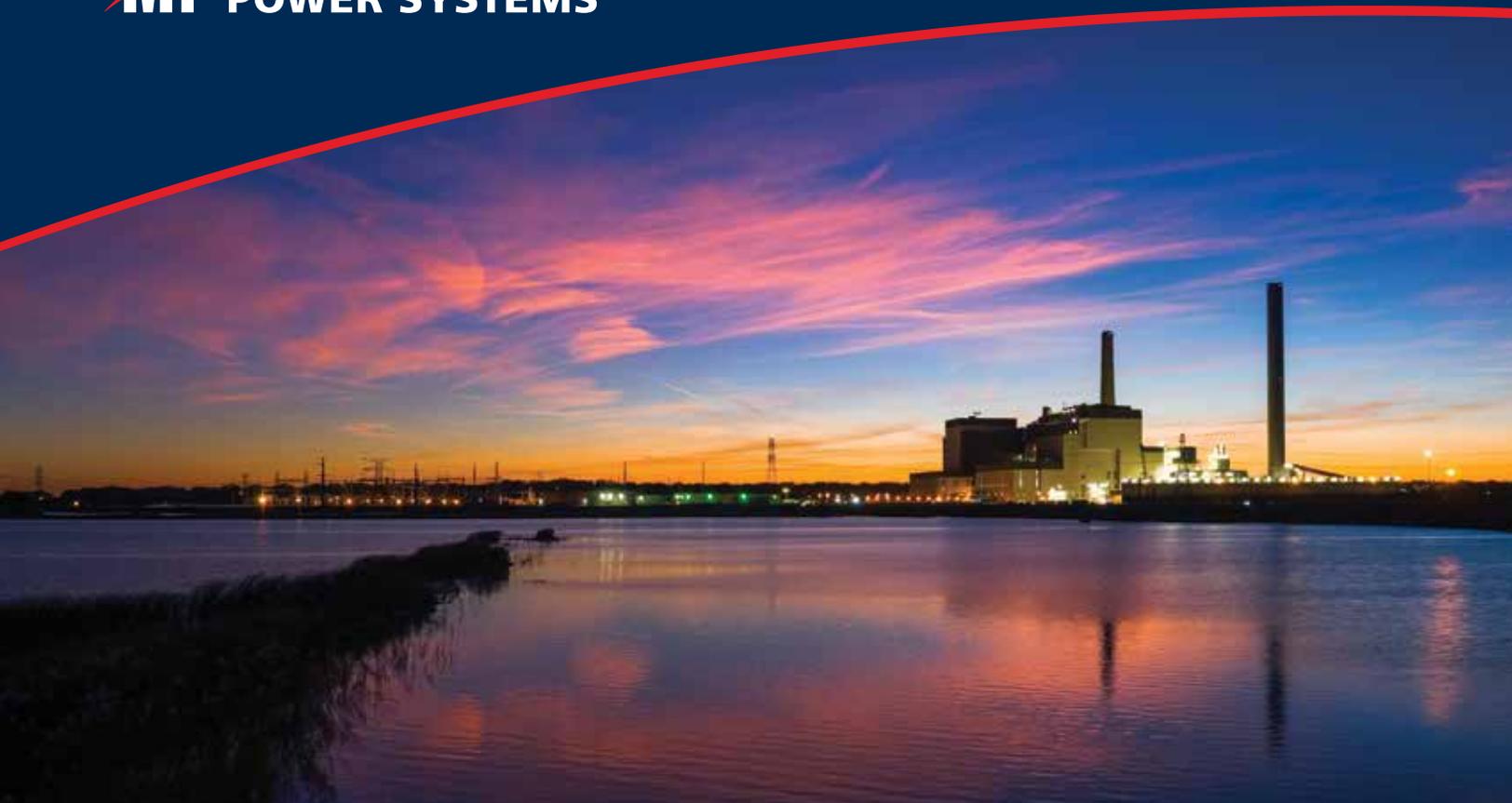
SOMETHING LIKE 38% OF US ELECTRICITY SUPPLY IS FROM COAL. CONSULTANTS EXPECT A THIRD OF THAT TO BE RETIRED BETWEEN 2017 AND 2020, BUT THERE IS A DEBATE ABOUT WHETHER THAT CREATES A LOT OF OPPORTUNITY TO REPLACE THAT CAPACITY. DO YOU THINK THIS IS A GREAT OPPORTUNITY?

Tristan Grimbert: The coal retirements will allow us to keep a market in the range of five to 10 gigawatts of new wind capacity additions a year, and that is critical. You do not need a lot of storage to allow much more penetration of wind and solar. The coal retirements driven by the Clean Power Plan will allow the utility-scale wind and solar markets to continue adding capacity over the next 15 years at the current level. It was suggested earlier that the growth rate is accelerating. I do not think we have an acceleration of the growth rate, but I think we will have stable growth.

LET'S PROBE ON STORAGE. MANY PEOPLE SAY THE WIDESPREAD ADOPTION OF BATTERIES WILL LEAD TO A FUNDAMENTAL CHANGE IN THIS MARKET. DO YOU AGREE?

Tristan Grimbert: We are building a 20-megawatt battery storage project right now in PJM, and we have more in development. PJM does not need a lot of storage in order to be able to manage the intermittent generation on the grid, so that market reached saturation quickly. The potential storage market is about a tenth of the wind capacity: rough calculation, back of the envelope, you need an order of magnitude less capacity in storage than you need in intermittency. Keep in mind that storage is a transmission asset. The more reliable and the more structured the grid, the less you

(continued page 26)



Turn Your Mercury Mitigation Strategy Into A **Triple Play**

Now more than ever, utilities are searching for the most economical path to comply with environmental regulations.

Selective Catalytic Reduction (SCR) catalysts oxidize mercury from coal-fired boilers. While several commercial technologies have emerged in recent years, they often have high capital costs with performance limitations.

Mitsubishi Hitachi Power Systems, the world's #1 supplier of SCR technology, used in more than 750 GW of coal-fired generation globally, developed the Triple Action Catalyst (TRAC) System specifically to address environmental compliance of Mercury, SO_x, and NO_x.

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EXPLORING THE UTILITY OF THE FUTURE

BY LYN CORUM, CLASS OF 2003



The utility business is facing revolutionary changes. Customers are demanding new services, they are installing distributed energy resources including energy storage and they are reducing energy consumption. Furthermore, new technologies being created by start-up companies are offering customers services never dreamed of ten years ago.

All these changes are now putting strains on distribution systems and the utilities most heavily hit are asking that the customers sending power to the grid pay for distribution services. Even the rate of return paradigm is being questioned.

Pushing utilities into the new frontier are independent companies such as Louisville, Colorado-based Clean Energy Collective. It has launched the first shared solar program that provides investor-owned utilities (IOUs) with the ability to rate-base a community solar program. The IOU would offer their solar customers an immediate economic benefit, without non-participant subsidization.

The program provides a utility with the ability to own the solar system so the asset can be included in their rate base. Meanwhile, the federal investment tax credit is monetized and cash proceeds are returned to the utility on a schedule that tracks the associated revenue requirement. Utilities can earn a competitive return and positive net present value from their solar

investment without requiring a cost-shift to non-participants, creating no upward pressure on rates.

The larger independent power companies are getting into the act as well. In an interview with AES managers at Solar Power International 2015 held in Anaheim, California, in September, Robert Masinter, COO of AES Distributed Energy, told this reporter he foresees the creation of new energy networks capable of developing and integrating distributed generation with transmission.

AES created its Distributed Energy subsidiary when it acquired Main Street Power and its 65 MW of diverse distributed generation early in 2015. It has since launched a portfolio of additional distributed energy projects to add to the 65 MW it inherited. “We want to enable customers with solutions, and to be the enterprise partner for change” Masinter said.

EXECUTIVES TALK

At an SPI 15 session, “What Does the Utility of the Future Need to be?” experts addressed the issues utilities need to deal with in their changing landscapes.

Jon Wellinghoff, former Federal Energy Regulatory Commission Chair and now a partner with Stoel Reeves, highlighted what customers can do:

They can install their own generation and energy storage, cut back on electricity use when they receive signals from their utility and put back onto the grid the extra electricity their systems are generating. “They have options that a grid system can take advantage of,” Wellinghoff said.

Wellinghoff argued there is an opportunity for utilities to provide services with other competitors. Speaking at the Climate & Energy Law Symposium at the University of San Diego in November 2014, he outlined his concept of a Distributed System Operator, modeled after the Independent System Operator. The independent compa-

nies and customers alike could transmit, buy and sell power locally. The distribution system operator would still be regulated.

Writing in August 2014, Wellinghoff, with coauthor James Tong, Class of 2014, with Clean Power Finance, outlined the concept. They wrote, “We must examine how competitive markets can best provide multiple grid services beyond simple delivery of electrons. Only then can we proceed to questions about the role of regulated utilities as owners of the distribution grid system, and how to compensate them appropriately for grid ownership and maintenance.”

Edison Energy Group has an eye on this new competitive market and is an example of companies seeking a foothold in the new technology environment. Ron Litzinger, the company’s president, said in the SPI session his company was formed to develop competitive transmission. “Central generation is the last choice for investment,” he said, noting that the distribution network is changing.

Litzinger said, “We feel customers want a networked plug and play grid where power flows two ways.” Furthermore, there is pressure to optimize the spending and operations of the grid and the most cost effective way to control voltage is in the distribution grid. “Execution of good policy is necessary,” he said.

REGULATORY EVOLUTION

Tom Starrs, SunPower’s vice president for market strategy and policy, said in the same session, a tension exists between the traditional cost-plus model and regulatory evolution. Technology is not the driver in and of itself, he said. It causes a regulatory drive to change. In California the driver is decarbonization. In New York, resilience is driving technology choices.

Starrs said, at the end of the day under today’s regulatory construct, you need a distribution grid and you need somebody to provide power at night. It’s the only natural monopoly with today’s technology and will require fixed charges.

(continued page 25)

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Bob Bibb, President / CEO
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PREDIX, GE'S DIGITAL MANIFESTO

BY GILIAN CORRAL

CONTRIBUTING EDITOR, *WORLD-GEN*



Wind farms that talk, self-aware locomotives, connected factories, digital oil fields—once the stuff of dreams, the connected machine has arrived. Just how far will the Industrial Internet of Things (IIoT) transcend business as usual? According to industry leaders at GE's Minds and Machines 2015 conference, the IIoT is poised to be a game-changing market disruption.

"This is the future—the Industrial Internet, what it means for productivity for industrial companies," said Jeff Immelt, Chairman and CEO of GE, "we really are on the cusp of the next productivity revolution for our companies, and we're proud to be a part of it." While the customer internet has had decades to innovate and mature, industry and utilities have been more conservative, incorporating connectivity in fits and starts. With Predix, GE's industrial digital platform, GE seeks to catapult industry into the digital age, and soon, into the cloud. "This power of science, this merger of the digital and industrial world, is really the genesis," Immelt continued. "If you went to bed tonight as an industrial company, you're going to wake up tomorrow morning as a software analytics company."

The IDC forecasts the Internet of Things market to reach \$1.7 trillion by 2020. Immelt predicted the Industrial Internet will be worth double the value of the consumer internet, "mainly because

people can see the productivity benefits." Further, GE's presentation included impressive predictions for the company and value added to the economy:

By 2020, GE will be a \$15 billion software business, and Predix will enable the industrial app economy reach \$225 billion.

By 2030, digital companies will add \$15 trillion to the global GDP.

WHAT'S POSSIBLE WITH THE IIOT

Connectivity is changing how we do business from the plant level to utility scale, from the self-aware locomotive to a transportation network of connected cities. The Industrial Internet has the capacity to not only disrupt individual industries, but entire sectors, such as the energy sector. "Going forward, the world needs more power," said Steve Bolze, President and CEO of GE Power & Water. "50% more power is required in the world in the next two decades. We will spend as a combined industry \$10 trillion to put in that new power and modernize the infrastructure that exists today."

There's enormous opportunity—and challenge—in connecting over 1 billion people currently living without electricity in the developing world, as Bolze noted. In communities that lack utility infrastructure, there's opportunity to bypass the financial and logistical headache of modernizing infrastructure and "leapfrog" ahead to new tech, such as connected microgrids and advances in renewable energy. "The single biggest opportunity for transformation is digitization of the entire energy value chain," Bolze pointed out, which will reduce cost and time to market, decarbonize the industry, and help integrate renewables into the grid.

Immelt offered three magic words to convince industry to embrace the Industrial Internet: "no unplanned downtime." Increased productivity and efficiency savings—this is the fuel that will fire up the

Industrial Internet. Machines connected in real time to each other and the cloud can generate predictive analytics to prevent equipment failures. For the oil offshore customer, this could mean \$5.2 million in savings by preventing just one oil platform failure; for a power generation company, \$1 million can be saved in just one month by increasing efficiency, according to GE's presentation. Through internal case studies, GE has spent years proving its platform, Predix, can deliver efficiency savings and greater productivity for business.

GE LAUNCHES CUSTOMER-READY PREDIX

"Five years ago when we started, we didn't know what the hell this was," Immelt added, but now "our customers can eat it, they can feel it...this is the Industrial Internet." Over the next 12 months, GE plans to establish Predix as an industrial cloud with a focus on asset performance management. GE announced the launch of a customer-ready version of Predix at Minds and Machines with Exelon Generation and PSEG as early customers. Exelon is rolling out Predix across its three fuel classes, launching initially with five projects with a focus on asset optimization.

Companies can take advantage of GE's Digital Twin feature, which creates a digital version of an asset using physics models in the cloud. "This model gets richer with every second of operational data," said Ganesh Bell, CDO of GE Power & Water. Over time, the Digital Twin gets better at predicting failure and improving performance of the asset. Bell announced the launch of the Digital Power Plant, a combination of GE's software defined gas turbine, Predix, and a suite of applications, enabling real time adjustments to market conditions and predictive analytics on a plant scale. In a recent press release, GE estimated its Digital Power Plant technology could save \$230 million per new plant, \$50 million for an existing combined-cycle gas powered plant, with an aggregate of \$75 billion in savings across the power industry.

(continued page 26)



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GOING DUST-FREE

BY BOB WILLIAMS, VICE PRESIDENT
WOLF POINT ENGINEERS & CONTRACTORS

There's a new product destined to make an impact at coal-fired utilities across North America in the coming years. It's the pipe conveyor—so named for how the conveying belt is rolled into a tube—and it can be rightfully considered the conveyor of the future for applications that require spill- and dust-free conveyance of coal and coal by-products, especially ash.

In fact, the pipe conveyor isn't new at all. It was developed in Japan in the late 1970s, but its design was quickly patented worldwide, and though a handful of license partners marketed the technology outside of Japan in the following years, those patents stifled innovation until their expiration in the late 1980s and early 1990s.

But even then pipe conveyors were seen as having high capital costs and therefore considered not cost-competitive with trough conveyors, so most installations were still to be found in Japan, where environmental regulations were relatively strict.

In the last twenty years, however, design improvements have reduced the cost of constructing pipe conveyors—and improved their operation—while environmental regulations on the handling of coal and coal by-products have tightened in many developed and developing countries.

Today there are dozens of pipe conveyor installations in India alone, where both environmental regulations and the need to prevent spillage and other loss of materials have made them a preferred product, used to move everything from coal to alumina to copper concentrate.

Still, one would be hard pressed to find a pipe conveyor at a utility in North America, and many utilities are shutting down or reducing capital investments in coal-fired plants. Minnesota Power, for example, generates 75% of its power from

coal but will reduce the share of coal to just one-third over the next 15 years.

But coal won't be going away anytime soon—it still makes up nearly 40% of electricity generation in the U.S.—and it is widely believed the EPA will continue stiffening regulations on the use of coal and its by-products, especially ash, which will necessitate new technologies in bulk material handling. Conventional trough conveyors will still have a place at utilities, but they simply cannot provide the kind of dust-free containment that will be mandated.

Pipe conveyors, on the other hand, can.

They resemble conventional trough conveyors at the loading and discharge ends, but between the two, idler rollers transition the belt into a tube, effectively eliminating material loss.

Plus, due to their enclosed design, they don't require covers, and they can be fitted with triangular galleries, both of which reduce the amount of steel required in their construction. In addition, they can be fitted with maintenance trolleys instead of walkways, further reducing costs, even down to lighting.

Also, pipe conveyors can go places conventional conveyors can't. They can handle 90-degree horizontal turns as well as 20% steeper inclines. This has the added benefit of reducing transfer points and the costs associated with them. It also makes them effectively the only kind of conveyor capable of negotiating some topographically challenging areas, especially large ones. Pipe conveyors can be built in excess of 10 kilometers in length and operate at 5,000 tons per hour.

Yet only a handful of companies have experience designing pipe conveyors. Wolf Point Engineers & Contractors—a full-service engineering, procurement, and construction services provider for the power, mining, and

Pipe conveyors can go places conventional conveyors can't. They can handle 90-degree horizontal turns as well as 20% steeper inclines. This has the added benefit of reducing transfer points and the costs associated with them.



industrial processing industries, and a division of North Alabama Fabricating Company (NAFCO)—recently entered into a strategic alliance with CKIT, a world-renowned designer of pipe conveyor systems, to offer this technology to North American customers.

CKIT is a Cape Town, South Africa-based materials-handling consulting and engineering company that has dozens of pipe conveyor installations in Africa, Europe, and Asia, including more than 50 in India. CKIT's pipe conveyors move everything from coal and cement to paper pulp and ash.

Indeed, because of their closed design, pipe conveyors promise to make their mark well beyond power generating. They are great for mines, given the frequent need to take tight curves and steep inclines, and they are ideal in any application that requires keeping bulk materials dry—such as grain processing, fertilizer processing, and steel production, to name a few.

So while their use might be more or less mandated in some areas eventually, pipe conveyors are just as likely to be adopted out of practical necessity where raw materials or the environment, or both, need an extra layer of protection.

CKIT's Pipe Conveyor Information Database can be accessed at <http://www.ckit.co.za/secure/conveyor/pipe/indexpipe.htm>

Pretty moving stuff.



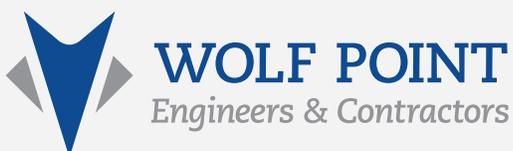
Designing smart and innovative bulk material handling systems isn't all we do. As a division of NAFCO, we at Wolf Point Engineers & Contractors offer unprecedented scheduling flexibility through our in-house steel fabrication and detailing. We also provide peace of mind from seasoned project and construction managers. Plus we deliver dramatic time and cost savings by way of a fully staffed India office.

And now we're leading the way in pipe conveyor technology. By partnering with a world-renowned designer with more than 20 years' experience, we've become one of the first EPC firms to offer pipe conveyors in North America, giving utilities an economical way to move coal ash dust-free.

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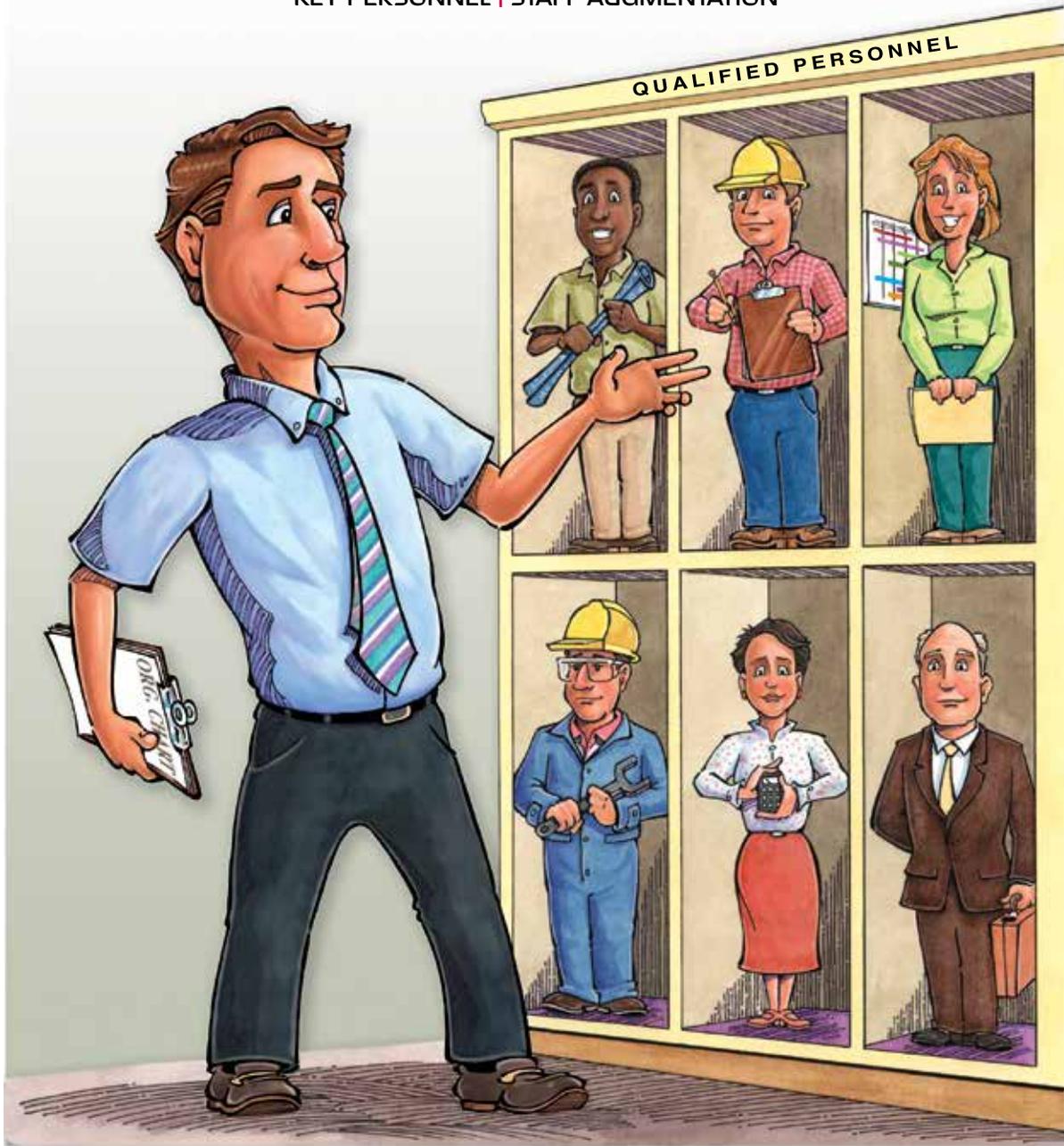
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THE EVOLVING ELECTRIC POWER INDUSTRY

BY LISA WOOD, VICE PRESIDENT
THE EDISON FOUNDATION



We all know that technology develops rapidly. In the last decade alone, we've seen huge advances in mobile and smart technologies. In fact, according to the Consumer Electronics Association, this year Americans will buy 81 million tablet computers (a product introduced just about six years ago), as well as 4 million ultra-high-definition televisions, 11 million smart watches, and 92,000 desktop 3D printers (products introduced just three years ago). It's also projected that Americans will buy 169 million new smart phones just this year—for a total of 481 million over the last three years.

What do all of these things have in common? They are all powered by electricity, and the electric power industry has played a huge role in the evolution of technology. Today, the amount of energy consumed by electronic devices in the average U.S. household has more than doubled since 1980 simply because we all rely on so many more devices for communication, connection, convenience, and comfort.

The electric power industry is working to seamlessly integrate all of these new technologies and devices into the electric grid, constantly upgrading the grid and making it a platform for innovation while also offering consumers more control over their energy use than ever before.

The Institute for Electric Innovation's

(IEI's) recently released book, *Thought Leaders Speak Out: The Evolving Electric Power Industry*, addresses the theme of evolution and innovation with essays from energy industry thought leaders who discuss their perspectives on cutting-edge topics such as the evolving grid, changing customer needs, and the latest regulations in the energy sector.

Bob Rowe, president and CEO of NorthWestern Energy and co-chair of IEI, notes that the electric grid is the essential infrastructure that enables all of our other infrastructures to function. The grid powers our economy and our lives.

DIGITIZE THE GRID

Investments in technology to digitize the grid network have resulted in volumes of data being generated. Increasingly, utilities are partnering with technology companies to unlock value from these data: to operate the grid more efficiently; to connect more distributed energy resources; and to provide more services to customers.

Technology, policies, and customers' increasing expectations have largely driven the changes in the power sector. Just as apps are created and updated daily, customers want the grid to keep pace. Utility companies and the energy sector more broadly are inviting customers to be more vocal about their needs and expectations. Multiple stakeholders have a say in the future of the grid – utilities, regulators, policymakers, customers, and other stakeholders.

Beyond the daily interactions with smart phones and household electronics, the grid enables options and choices in how and where power is generated and used. In one essay in the book, Dennis McGinn, the Assistant Secretary of the Navy in charge of Energy, Installations & Environment, details a first-of-its-kind, hybrid distribution project currently underway to support mul-

tiples types of generation, including renewable energy, natural gas, and backup generation to power a number of buildings and piers at a Naval submarine base – as well as in the neighboring community of Groton, Connecticut. This is a great example of a proactive effort to both maintain and improve grid resiliency.

REGULATION PLAYS A CENTRAL ROLE

In the midst of innovation in the power sector, regulation cannot be ignored. In fact, regulation plays a central role. The regulatory model for electric utilities has remained essentially unchanged for decades. Energy thought leaders, lawmakers, business leaders, regulators, and other stakeholders recognize the need for change and that, ultimately, the role of regulation is to “balance” affordability, reliability, sustainability, and individualized customer services.

Every day, we're seeing more and more examples of collaborations among utilities, technology companies, policy-makers, customers and other stakeholders to facilitate an enhanced and modernized grid. The essays in the book provide examples of some of the efforts underway.

One thing is certain – evolving the 21st century power grid as we continue to provide safe, reliable, affordable, and increasingly clean electricity is a top priority for the electric utility industry.

I believe that our biggest challenge today is how to “evolve” regulation to align with the changing roles of utilities, the accelerating pace of technology, the increasing numbers of providers, and ever-increasing customer expectations.

For more information and thoughts on the evolution of the electric power industry, the IEI book is available at www.edisonfoundation.net.

ABOUT LISA WOOD

Lisa Wood is Executive Director, Institute for Electric Innovation and holds a Ph.D from the Wharton School.

AMERICAN MERGERS: DOING THE TWO-STEP!

BY BRANKO TERZIC



Surprisingly America's electric utilities are not the world's largest in terms of revenues and other measures. Of the 53 investor-owned and publicly traded electric and combination electric and natural gas utilities in the US only 16 have revenues in excess of \$10 billion with the largest revenue of \$29 billion for Exelon, followed by Duke at \$24 billion and Southern at \$18 billion. Compare those revenues to the European giants E.ON SE at \$173 billion, Electricite de France \$95 billion, RWE \$66 billion, Ibedrola at \$44 billion and National Grid at \$22 billion. Thus recently the US electric industry has been consolidating with the number of electric utilities coming down from over a hundred just two decades ago to 53 today.

However, merging US electric utilities has become increasingly more difficult as the process requires "two steps"; the negotiation between the merging utilities followed by formal proceedings before state public service commissions (PSC) and the Federal Energy Regulatory Commission (FERC). As the US electric utilities ownership expands across more states the number of regulatory agencies involved increases, leading to higher levels of regulatory risk for approval of the merger. Nonetheless, successful mergers have been accomplished and a key factor has been a well-planned approach to the regulatory approval hurdle.

In the US both PSC and FERC approvals for a merger involve meeting a "public

interest" standard established by law. This additional regulatory requirement for public utility mergers is not found in the general business environment.

Utility mergers, like general business mergers, begin with the determination of an acquisition price premium over the recent market price of the stock of the seller. A premium is justified in that, in the future, the merged company would produce synergies for which the present value is in excess of the premium paid. This is the same rationale for non-regulated as for regulated companies. There is a risk in any merger or acquisition of overpaying. This is a likely result if the expected merger synergies are not realized, for example.

While many states have a "public interest" standard for merger approval, most regulators, and many intervening parties, expect the merger application to contain quantifiable "benefits" to rate payers (utility industry jargon for monopolized "customers".) The most direct and compelling "benefit" is an immediate rate decrease transferring some of the remaining future synergy to customers immediately after the merger.

Regulators, including this former regulator, have approved mergers based on the finding of other "benefits" as well. These are usually based on some set of unique circumstances at the to-be acquired utility. These have included: improved service quality, lower cost future investment in needed assets, lower financing costs, improved customer service, faster introduction of new technologies (smart grid or renewable energy as examples) and other financial and operational benefits unavailable or more expensive to the acquired utility without the merger. The risk here is that the regulator can demand too much of the future synergy benefit leaving scant or only the most speculative synergies to the acquiring company shareholder.

A corollary to the "benefit" requirement is the regulators' additional demand for what I call "concessions." This category

includes such things as future expenditures on regulator's selected programs, such as weatherization or energy efficiency or charity payments, none of which would be recoverable in the revenue requirement i.e. customer rates. Another type of "concession" would be acceptance of post-merger restrictions such as prohibitions on moving corporate headquarters or release of employees of the acquired company. These all having the effect of lowering the synergy value and it is here that a regulatory strategy must strike a balance between enough concession to win merger approval but not so much as to reduce future synergies below acceptable levels.

There is also the additional risk that a long regulatory process may prove to be too administratively expensive or that the favorable factors, initially driving the merger, may have diminished during the years of regulatory proceedings. Examples of this "regulatory lag" risk causing merger failures are also found in proceedings over the past decade including in proceedings before the FERC where the author served as commissioner.

Recent history in the US is replete with examples of successful and unsuccessful electric utility mergers. A number are in regulatory proceedings at this time and more will come. The lesson is that regulated electric utilities embarking on "doing the two step" merger require not only a competent "corporate acquisition strategy" but also a carefully planned and executed "regulatory strategy" as well.

ABOUT THE AUTHOR

Branko Terzic is a Managing Director at Berkeley Research Group LLC and a Nonresident Senior Fellow of the Atlantic Council's Global Energy Center in Washington, DC.

Terzic has served as Commissioner on the U.S. Federal Energy Regulatory Commission and Commissioner of the State of Wisconsin Public Service Commission.



13th Annual World Congress on Industrial Biotechnology



San Diego Convention Center

San Diego, CA

April 17-20, 2016

EVENT DEMOGRAPHICS

Attendees

Job profile (by title)

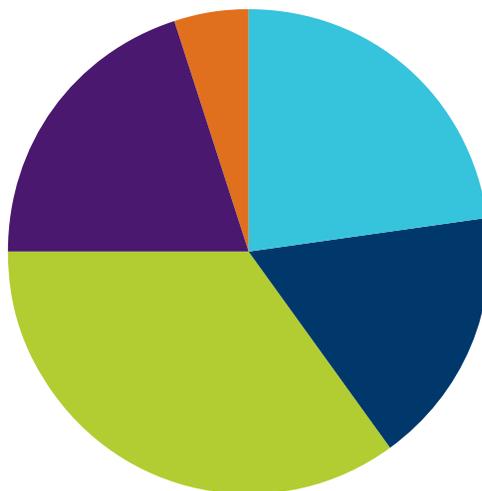
■ 23% C-LEVEL

■ 17% VICE PRESIDENT

■ 35% DIRECTOR

■ 20% ACADEMIC

■ 5% OTHER



Companies Represented

- Chemical
- Biotech
- Biofuels
- End Users
- Feedstock Providers
- Food Companies
- Investors
- Engineering & Consulting Firms
- Academia
- Government Organizations/
Economic Development Groups
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BIO PARTNERS TO BUILD THE BIOECONOMY

BY PAUL WINTERS

DIRECTOR OF COMMUNICATIONS, BIOTECHNOLOGY INDUSTRY ORGANIZATION (BIO)



Executives from 725 biomass, renewable chemical, and biotech companies gathered at the 2015 BIO World Congress on Industrial Biotechnology in Montreal from July 19 through July 22. While remaining the largest international conference for industrial biotechnology companies, the 12th annual World Congress saw an increased focus on business partnering and dealmaking with biomass, renewable energy and consumer product manufacturing companies. The maturation of biotechnology solutions is enabling new products and new economic opportunities under the umbrella of what industry insiders call “the biobased economy.”

“The biobased economy is strong and growing stronger worldwide,” proclaimed Brent Erickson, executive vice president of the Industrial & Environmental Section at BIO, in a speech welcoming the nearly 1,200 attendees. “Today, in market after market, we are seeing growing global demand for [industrial biotechnology] products and a growing understanding that the work we do is the future of manufacturing and energy production.”

Companies have invested more than \$6 billion in advanced biofuel and renewable chemical biorefineries in North America alone, according to BIO’s

research. There will be more than 100 million gallons of cellulosic biofuels coming online in the United States this year. And biobased products already contribute \$369 billion to the economy on an annual basis, according to USDA statistics. The sector directly employs 1.5 million Americans and creates additional employment opportunities for 2.5 million Americans.

Germany’s Nova Institute indicates that biobased polymer production has reached a capacity of 5.1 million metric tons worldwide, representing 2 percent of the global market. This production has a value of about €10 billion. Nova estimates that this capacity will more than triple to reach 17 million metric tons by 2020. This is the fastest growing sector of a growing polymer market, according to the Nova Institute, so the biobased share of the market is expected to double to 4 percent of the overall worldwide market. By 2021, the global market for biobased chemicals (other than polymers) is expected to increase to more than \$12 billion.

“All across the globe, your companies are establishing a firm foothold in the global economy, with new technologies reaching commercial status,” Erickson continued. The rapid growth of the sector is attracting large companies to make investments and form new ventures with smaller biotech companies. “Large global brands owners like Coca Cola, Boeing, Toyota, Nike, Bridgestone, Seventh Generation to name just a few understand the value and the benefits of partnering and innovating alongside your companies,” Erickson concluded.

“The World Congress itself is a reflection of the growing biobased economy and also a contributing driver of that growth,” Erickson said. And as illustration, BIO presented its 2015 George Washington Carver Award to Solazyme CEO Jonathan S. Wolfson. Wolfson started by thanking the

many partners his company has worked with in developing new products, including food ingredients like heart healthy oils and protein powders, personal care ingredients like soaps, branded cosmetic products such as Algenist, and oilfield chemicals and fuels. Solazyme has partnered with large multinational companies such as Bunge, Unilever, Mitsui and ADM.

In accepting the award, Wolfson noted that Solazyme did not set out to create as broad a product line – from food ingredients, to cosmetics, to energy and fuels – with as diverse a set of partners as it eventually did. The company simply followed the paths opened up by the technology. Wolfson asked rhetorically. “What has gotten me out of bed with, I think, a spring in my step almost all mornings over the last twelve years? The answer is that our world needs what we, collectively in this room, are doing. Our planet needs to feed, clothe and fuel over 9 billion people in just a few short decades in a far more sustainable way than it is currently being done.”

The 2015 BIO World Congress brought together executives from across the globe, including representatives from investment firms, government and academia. The 1,200 attendees filled the meeting rooms and halls of the Palais des congrès de Montréal, a venue that attracted large international delegations from Brazil, Holland and Thailand as well as from Illinois, Iowa and Canadian Provinces. One of the primary features of the Congress was the more than 1,400 partnering meetings hosted during the event. The World Congress provides a proprietary web-based tool for attendees to seek and set up meetings with others onsite to discuss potential opportunities for partnerships, venture investments and marketing deals. The one-on-one partnering software saw a 40% increase in use from the 2014 BIO World Congress held in Philadelphia. BIO also announced that the 2016 BIO World Congress on Industrial Biotechnology will take place April 17-20 in San Diego at the San Diego Convention Center.

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WINNING IN A CHANGING ENERGY LANDSCAPE

BY HARESH PATEL



Technological innovation in distributed generation, hydraulic fracking, and renewable energy are fundamentally transforming the market for Independent Power Producers (IPPs) and utility companies alike. While it's a brave new world for energy companies investing in power producing assets, it is clear that the next generation of market winners will be defined by the ability to execute in a landscape that is increasingly competitive and complex.

One characteristic of the changing energy market is the strategic shift amongst utilities and traditional IPPs to reorganize around renewable and distributed generation technologies. At the same time, solar focused companies, in particular, continue to expand their offerings across new technology types, eroding the market share afforded to incumbent power producers. The result is fierce competition for new markets.

In the US solar market the consequence of this strategic repositioning has been notable. Based on data consolidated on over 3000 US solar projects processed in the Mercatus Energy Investment Management (EIM) platform, the Mercatus Distributed Energy Insight

Report shows a thematic decrease in IRR for solar projects seeking financing. Indicating that investors have been eager to fill pipeline, but growing competition means decreased pricing power and a need to finance projects with lower returns.

While the growth of YieldCos has contributed to a lowering cost of capital, and has thereby opened new market segments, the more prominent ongoing effect of the YieldCo will actually be a sustained appetite for new projects, even in the context of tighter margins.

The same report also illustrates that there are limited opportunities for investment in the US Solar market post-2016. Roughly 85% of US solar projects processed in the Mercatus platform have Commercial Online Date targets before 2017, with a precipitous 80% drop in project development between 2016 and 2017. A closing investment window has driven a frenzy of acquisitions while also recalibrating the sights of traditionally US focused companies onto a global stage and across new technologies in order to ensure sustained growth.

Ultimately, the result is that the markets defined by distributed generation and renewable energy are now a battleground for competition between incumbents and newcomers, and it is increasingly occurring on a global scale.

Energy companies that can execute effectively will find themselves in the most favorable positions. Fundamentally, the challenge of investing into power generating assets today is that the market is increasingly complex as competition necessitates that companies invest in smaller projects across a variety of technologies and regions. The result is that companies can no longer make a couple core investments a year but rather, they must hold a voluminous and diversified pipeline of investments.

The companies that execute swiftly and effectively on a large number of projects, while also maintaining the ability to leverage low cost capital, will gain superior pricing power and gain market share. Easier said than done – increasing deal velocity while also reducing risk requires investment processes that are highly efficient and streamlined.

The first wave of differentiation in the new energy economy was defined by technology, the future differentiator will be defined by cost structure, productivity per-employee and velocity to develop and construct or acquire power plants. Industries from automobile, retail and the computer industries have proven that the first to gain a 10% structural cost advantage or time to market have unassailable pricing power and the foundation for business model innovation. Cosco, Walmart, Toyota and Amazon are great case studies to emulate. They used their low cost structure to crush the competition. They enjoy very high market share, the lions share of the profits, and have very enviable market capitalizations. The energy companies that can build an efficient execution machine will be able to navigate a new market that is extremely competitive and increasingly complex.

ABOUT THE AUTHOR

Hareesh Patel, CEO of Mercatus, Inc. has led the evolution of the business strategy, services, and Mercatus' cloud-based Energy Investment Management (EIM) SaaS offering for power producers. Since co-founding the company in 2009 as an energy finance and services organization, he has led the evolution of the business strategy, services, and Mercatus' cloud-based Energy Investment Management (EIM) SaaS offering for energy investors.

Hareesh has completed senior management programs at Harvard Business School and Stanford University Business School and holds a BS in Electrical Engineering from the University of Notre Dame.

State	Project Type	Avg Energy Yield	Avg. Total Installed Cost (\$/W)	Avg. Offtake Rate (\$/kWh)	Avg off-take Escalation %	O&M (\$/W)	Insurance (\$/W)
AR	Groundmount	1,693.50	1.78	0.07			
	Rooftop	1,400.00	2.53	0.14	3.00	0.02	
AZ	Groundmount	1,823.15	2.52	0.08	3.44	0.01632	0.00635
	Rooftop	1,791.45		0.11	1.59	0.01737	0.00907
CA	Carport	1,509.49	2.66	0.10	2.87	0.01802	0.01023
	Groundmount	1,968.22	2.19	0.09	0.69	0.01817	0.00881
CO	Rooftop	1,601.50	2.91	0.12	2.12	0.02112	0.01111
	Ground Mount	1,938.08	2.21	0.08	2.09	0.01719	0.00441
CT	Rooftop	1,609.50		0.10	1.29	0.01589	0.01000
	Carport	1,315.00	3.21	0.13	3.00		
FL	Groundmount	1,313.25	2.06	0.12	2.63	0.01939	0.00947
	Rooftop	1,176.37	3.20	0.10	1.92	0.01684	0.01171
GA	Groundmount	1,470.95	2.20	0.11	1.75	0.01390	0.00836
	Rooftop	1,359.33		0.25		0.02129	0.01306
HI	Groundmount	1,602.68	1.97	0.11	1.21	0.01522	0.00586
	Rooftop	1,434.33	2.33	0.13		0.01641	0.00763
IL	Groundmount	1,469.00	3.40	0.23	1.00	0.02042	0.00833
	Rooftop	1,589.11	4.67	0.23	2.22	0.02483	0.00990
IN	Ground Mount	1,256.00	2.57	0.05	3.00	0.01500	0.00808
	Rooftop	1,209.00	2.22	0.14	3.00		
KS	Groundmount	1,392.84	1.56	0.15	0.60	0.01748	0.00639
KY	Rooftop	1,435.00	2.29	0.12	3.00	0.01800	0.00290
	Groundmount	1,253.36	1.21	0.06	3.01	0.01750	0.00590
MA	Groundmount	1,273.13	2.76	0.10	1.43	0.01571	0.00902
	Rooftop	1,190.10	2.63	0.10	1.99	0.01875	0.00925
MD	Groundmount	1,462.71	1.86	0.07	1.42	0.01628	
	Rooftop	1,268.80	2.61	0.07	2.44	0.01712	0.00980
MN	Groundmount	1,396.29	2.11	0.09	1.63	0.01582	0.00779
	Rooftop	1,368.21	2.41	0.07	1.00	0.01100	0.19768
MO	Groundmount	1,316.00	1.57	0.18	3.00	0.01060	0.00770
NC	Groundmount	1,463.97	2.31	0.08	0.03	0.01621	0.00729
	Rooftop	1,600.00		0.07			
NJ	Carport	1,171.86	2.53	0.11	1.32	0.02370	0.00987
	Groundmount	1,269.25	2.56	0.09	1.36	0.01921	0.00822
NM	Rooftop	1,217.64	2.92	0.11	1.87	0.02107	0.01091
	Groundmount	2,024.60	1.64	0.09	1.92	0.01704	0.00669
NV	Groundmount	2,065.75		0.07	1.97	0.01638	0.00635
	Rooftop	1,798.02	1.87	0.06	2.00	0.01800	0.00265
NY	Carport	1,354.10	2.55	0.16	1.00		
	Groundmount	1,276.03	2.27	0.13	1.33	0.01567	0.00617
OH	Rooftop	1,232.67	2.47	0.18	0.49	0.01834	0.00868
	GroundMount	1,285.02	3.07	0.09	2.55	0.01658	0.00877
OR	GroundMount	1,322.00	2.50	0.07	2.00	0.01367	0.00587
PA	Groundmount	1,293.47	1.97	0.11	2.50	0.01043	0.00517
RI	Groundmount	1,321.00	2.16	0.15		0.01205	0.00472
	Rooftop	1,265.75	2.48	0.21		0.01286	0.00827
TN	Groundmount	1,580.92	2.11	0.06	4.13	0.00840	0.00620
TX	Groundmount	1,894.50		0.06	0.81	0.01418	0.00567
UT	Groundmount	1,942.11	2.11	0.08	2.71	0.01577	0.00574
VA	Rooftop	1,359.90	2.40	0.12	2.57		
VT	Groundmount	1,202.23	2.39	0.22		0.01645	0.00554

The above graph is from the June 2015 Mercatus Distributed Energy Insight Report, which is based on data consolidated from over 3000 US Commercial and utility solar projects processed in the Mercatus Energy Investment Management (EIM) software solution.

BACK ON CAMPUS WITH JULIA HAMM, CLASS OF 2012 MANY VISIONS, MANY ROAD MAPS NEEDED

When you get a group of utility executives together – a significant number of them wearing Hawaiian shirts – unusually frank and insightful conversations can take place.

“There is a clear need for us think about not just the revenue model for the future but what is the business model and value and the product model that utilities are going to offer in the future. We today just offer kilowatt hours, that’s what all of our pricing models are really based on. We’ve got to move to a place where we’re something else, and the something else is a reliability industry; it’s a something that offers real value to customers in a way that at the same time recognizes that they can have differentiated options for different products and services that we offer.”

The setting for the above quote was a hotel meeting room in Honolulu – hence the Hawaiian shirts – where about 20 utility executives were closing out the Solar Electric Power Association’s (SEPA’s) recent fact-finding mission to Hawaii. The person speaking, along with others in the room, had spent the previous three days immersed in Hawaii’s high-penetration solar market – one in three single-family homes here have rooftop panels – and how the islands’ utilities are dealing with the onslaught.

The meeting was also held under ground rules ensuring participants’ anonymity, which encouraged the candid exchange of ideas.

They were all extremely aware of the utility industry’s need to change its internal thinking, business models and customer relations strategies, and they also saw clear connections between what is happening in Hawaii and what they are or may soon be facing in their own home markets.

THE TECHNOLOGICAL-REGULATORY DISCONNECT

Utilities and the regulatory bodies that oversee them think and act in long-term time frames. The solar and cleantech industries – driven by innovation, market competi-

tion and a disruptor mentality – are moving at exponentially increasing speeds.

And the markets are moving with them. The SEPA mission heard from more than one Hawaiian official that the drivers for the state’s recently passed mandate to run 100 percent on green energy by 2045 were as much economic as environmental – reducing greenhouse gases and customer choice, promoting renewables and creating jobs.

The result of the technological-regulatory disconnect, said one participant, is that “utilities end up in situations where we’re saying no. We hear a question like ‘how much (solar) can we take’ and we go into our mode of – well, what are the technological limits of the system, or when do I have to make a big investment? We need to ask ‘What are you trying to accomplish? What is your goal and objective, and how do I help you get there?’ How do we as a company and industry help achieve that?”

Another pitfall of saying no to a specific operational challenge – such as putting 50 percent or 100 percent renewables on the grid – is the potential for backlash when the inevitable technological fix is found, another participant added.

“Utility engineers are great at fixing stuff. The utilities figure it out; we always figure it out.”

“We’ve got to get comfortable not knowing – going in – exactly how we’re going to do it and rely on each of our capabilities to solve problems,” a third participant said. “(With) just stubborn commitment to get something done, we can do amazing things. That’s not utility culture. It’s very careful, very risk averse, very cautious.”

Whatever uncertainties the energy industry now faces, one thing we can know for sure is that the challenges will keep coming, as will the need for multiple, flexible solutions that can be adapted for regional conditions.

Julia Hamm is SEPA’s President and CEO. She can be reached at jhamm@solar-electricpower.org.

BACK ON CAMPUS WITH DAN GIRARD, CLASS OF 2015

S&C’s Dan Girard, Class of 2015, spoke to *World-Gen* during SPI in Anaheim.

One of his new tasks is to focus on the municipal utility market to talk solutions. “We think our overall microgrid offerings and overall solar and energy storage really tie into the needs of the munis and where they want to head,” he told *World-Gen* in an interview at their SPI exhibit.

He went on to say that S&C was just awarded a new project by renewable energy developer, Half Moon Venture (HMV) to supply and build a 7MW energy storage facility for the Village of Minster, a local muni in Ohio.

HMV will use S&C’s 7 MW PureWave® SMS Storage Management System, providing fully integrated storage management and power conversion for 3 MWh of lithium ion-batteries. The system will be tied to HMV’s adjacent 4.2MW solar plant, allowing Minster to further reduce their peak demand charges in the middle of the day. The solar +storage system will be the largest facility of its kind connected through a municipal utility in the US.

S&C also advises clients on battery and solar panel acquisitions. “Our engineers do front-end vetting on both,” he offered.

Like most of the SPI delegates, he wanted to see the ITC subsidy remain past 2016. “I think they need to float it out and continue projects two to three years until it’s done,” he suggested as an alternative.

While S&C doesn’t deal much in the “resi-side,” he sees a robust market in community solar both for munis and large companies investing in the market. “I think community solar is the next wave,” he envisions, especially as the millennials enter the market. “We figure out how much your usage is, and a fee is assessed, much like a service fee in a condo. Another advantage is worry-free maintenance, inverter failure prevention, and interconnects with the utility.”

BACK ON CAMPUS WITH FRED LYON, CLASS OF 2003, TRICON POWER GROUP — THE LYON FIRM

PROACTIVE RISK MANAGEMENT

“MANAGING ENERGY CONSTRUCTION IN UNCERTAIN TIMES”

Only one thing is certain in the 21st century electrical utility industry – more uncertainty. Whether the issues are regulatory, environmental, economic, or political, the players in the industry – utilities, vendors, and contractors – all confront a daily landscape of complex decision making, compounded by a lack of certainty among regulators, politicians, and markets. Managing construction in such an environment is challenging at best, occasionally virtually impossible. The most successful owners, contractors, and vendors anticipate these difficulties and in recent years have implemented Proactive Risk Management, a series of risk safety nets erected throughout the design and construction process, from beginning to end. The three phases should include Commercial Assessment (CA), Project Evaluation (PE), and Dispute Resolution (DR). This article will address the first of these phases, Commercial Assessment. Project Evaluation and Dispute Resolution will be the subject of articles in future issues of World Generation.

Certain features of 21st century construction have not changed much through the years – the rules of engagement between owner, contractors, and vendors are determined by a contract that will increase in importance in direct proportion to the amount of dispute that develops on a project. Successful construction is predicated upon the successful management of risk. Contracts allocate risk (ideally to the party best able to control it). The best jobs are those where the contracts are fairly negotiated, thoroughly understood, and completely respected.

The first phase of Proactive Risk Management is Commercial Assessment, an effort by owner and contractors alike to make sure that as work begins, everyone appreciates the importance of the contract and how its integrated terms and conditions operate both offensively and defensively. Depending upon the scope and size of the job, the owner or contractor will convene a

session of its project personnel, its business development personnel, and usually counsel to review the executed contract between the parties. This is not a page turner – it is intended to be an interactive discussion of how the contract was derived and risk allocated. Ideally hypotheticals are constructed to show the project personnel how and why certain terms and conditions are important and how they operate. The concept came from the contracting community (contractors are called contractors because they use and understand contracts), it use is expanding to all elements of the construction community, including as a best practice among owners.

Only the naïve contemplate a construction project devoid of changes and even claims. How these claims are handled and resolved is determined by the contract and its attendant allocation of risk. The purpose of CA is not to generate claims or defenses, but to acknowledge the reality of their existence and to insure their orderly processing during construction. Scenarios discussed during CA include the consequences of incomplete scope, congested job sites, delivery issues, design changes, frequency of changes, bad weather, and differing site conditions.

The final contract is scrutinized with an emphasis on the important risk clauses. First among equals is the operation of the changes clause with a focus on how delays or disruptions are to be handled and the impact of force majeure events. Also reviewed are payment provisions, order of precedence language, and the changed condition (or differing site condition) clause. Scheduling obligations are important with additional focus on warranty and the operation of the dispute resolution provisions.

Most critical to any CA is a review of written notice obligations. Modern construction contracts are replete with such clauses – “Written notice of a change must be given with 7 days of discovery of the event giving rise to the change or be waived.” Each

notice clause is reviewed and a summary of the requirements provided. Notice is an important part of contractual risk allocation – equally important is that all concerned be on the same page. CA ensures that. The result – a well managed job.

Case studies are a fundamental component of CA. Typical studies reference the contract and pose realistic hypotheticals. Is verbal notice acceptable? Is e-mail an allowable means of contractual notice? If verbal notice is given, can a change order written later affirm what was agreed to orally? If there is not enough craft labor, is that a basis for a force majeure claim? A claim for more time and/or money? If there is an inconsistency in the specs, who is responsible for the financial consequences? A critical run of pipe is not shown on the drawings? Is that always the basis for a claim? Partial lien waivers are required. Do they preclude later claims? The number of issues are virtually infinite, the point is to encourage meaningful dialogue among the project team about the contract and how it will be used to effectively manage risk and ensure project success.

For commercial assessment training to succeed, the parties need to maximize their understanding of how the contract, properly understood, can benefit everyone. A premium upon documentation in accordance with the terms and conditions further enhances the likelihood of ultimate success. And if everyone understands the contract, they are more likely to achieve one of the most important principles of successful construction, real time resolution of disputes. CA is a critical first tool in project proactive risk management – investing time at the beginning of a job to make sure everyone understands the contract will yield disproportionate benefits during the job. Next is Project Evaluation, real time evaluation of how well risk is being managed during the process of construction itself.

BACK ON CAMPUS

IN MEMORIAM — JIM FLANDREAU, CLASS OF 2000

BY JERRY ROBINSON

World-Gen's "Class of 2000" (the inaugural year) included Jim Flandreau, an individual who became one of the Power Industry's most influential people and whose positive impact continues today. My professional relationship with Jim began as friends and neighbors when his company was a fledging endeavor, and grew to a level of partnered investments and shared governance of the organization.

As with most men who lead companies and have "booming" personalities, many stories both positive and negative can be told about Jim's professional and personal interactions. Along those lines, Jim's actions could be either spirit-lifting or cringe-worthy. Jim did not live his life, nor did he run his organizations, from the middle or at a slow pace. He was always at 100% and drilled the message of always putting in the extra effort to get the last 5% out of an individual's personal capabilities.

In fairness and respect to many of us who worked with Jim, it would be inaccurate to state the lessons learned were always easy. Without any disrespect to Jim, some of the most valuable lessons learned included those of the "what not to do" variety.

But, on the whole when considering his impact on the power industry, I believe him so very deserving of an incredible amount of credit. His impact on the staffing industry which supports the power industry was, and continues to be, incredibly positive.

Consider this: More than 15 established, successful organizations serving the power industry are either owned or run by alumni of Jim's companies and training. These companies include true staffing firms, retained search firms, consultancies, O&M providers, and craft personnel service organizations.

The lessons learned during time under Jim's direction remain vivid, timeless, and valuable. His commitment to ensuring that his sales and recruiting staff remained ethical and moral was unwavering. Jim never accepted someone taking shortcuts or mobilizing "just a body." He always wanted only the best candidates submitted, offered, and provided to his clients.

In order to achieve this goal, he instilled a company culture through a formal series of lessons he named "Speeches," and these lessons were a valuable part of the foundational culture. However, they paled in comparison to the unwritten law – work hard and have fun.

And it was fun working within Jim's organizations. The fun occurred on just about a daily basis. Nobody was above the banter, nobody was immune to the kidding, and nobody was excluded from enjoying the environment, which included office casual wear (even before "casual Fridays" were in vogue), daily catered lunches, car washes for employees, in-house chiropractic care, and a long list of benefits.

Jim's impact on the industry included an in-house proprietary software package which allowed candidate and client tracking at a level just now being rivaled by software commercially available. His organization brought together a network of consulting personnel which helped build, commission, and operate many of our industry's best and most successful projects. The company culture promoted a team environment, shared knowledge, and a belief that the product (in this case consulting personnel) should be treated with respect in return for hard work and capability.

Many of the tangible gains made in the supply of personnel to the industry were a direct result of Jim's organizations. While the argument can be made that his

key lieutenants were responsible for the ideas, concepts, and implementation of these advances, the truth is that Jim was able to identify talent and knowledge in others and put them in an environment where they could shine. His team was one of the first (if not the first) power industry staffing firms to invest in advertising, tradeshow participation, sponsorship of industry events, international travel in pursuit of domestic business, paying stipends to key consultants during downtimes, and the realization that consulting personnel needed to be treated as key employees.

Most of us who had the opportunity to work for and with Jim have a bittersweet bag of thoughts and memories. But, I venture to say that every one of us, and the industry at large, is better off for having interacted with him on both a professional and personal level. Now, so many years later, as those who worked with Jim enjoy so much success, it would be foolish not to acknowledge his lessons and impact. As we operate and promote many of Jim's best principles, practices, and lessons, I've grown to realize that if he were still with us today, a very heartfelt "thank you" would be fitting. And, I believe that a thank you would be just as fitting from the industry at large.

OFFERED BY JERRY ROBINSON

Jerry Robinson, Managing Partner for Strategic Contract Resources, LLC (SCR), a provider of defined-term personnel and executive search services for the energy industry. Prior to SCR, Jerry worked with Jim and was responsible for all growth initiatives.

Editor's Note:

Jerry Robinson is an alum from the Class of 2011.

EXPLORING THE UTILITY OF THE FUTURE CONTINUED FROM PAGE 8

If we send the right price signals the customer will have the incentives to respond when prices are low but there is a cultural component, Starrs said. Utility reliability has not been understood by customers.

Litzinger said, however, fixed and demand charges and variable charges are volumetric and that's not the way to go. In other words customers pay the same rate for 10 amps and 10,000 amps. A higher rate for 10,000 amps would send the signal to the customer to be more efficient with their electricity use.

Litzinger sees the following trends: demand is becoming flat and customer preference is for low carbon and more choice.

Jim Spiers, the vice president for technology, engineering and economic analysis at the National Rural Electric Cooperative Association, seems to agree with Litzinger. He said basic rate-based cost service is a blunt instrument. We need to move to market-based, price-based rates to provide the right signals for efficient energy use.

Spiers said there are 930 cooperatives across the country but some have only five to ten staff members. They don't have the budgets or man power to think about or make strategic changes to their grid systems.

Lorraine Akiba is a commissioner on the Hawaii Public Utilities Commission. She spearheaded the writing of a white paper laying out a strategic road map for Hawaii's utilities. The commission is facing the challenge of a small island grid where one-third of residences have solar systems on roofs.

Akiba said in the SPI session the issue is how utilities are to embrace technologies and create public benefits. "We need to properly value the grid services that allow you to turn on your new dryer." She predicted that utilities will become energy business services acting as consultants to customers.

HAWAII PUC LOOKS AHEAD

In the White Paper Akiba referred to, the Hawaii Public Utilities Commission has charged the utilities it regulates, the Hawaiian Electric Co., Maui Electric Company, Hawaii Electric Light Company, Kauai Island Utility Cooperative and Hawaii Gas, with failing to articulate a sustainable business model in light of the evolving electric utility business and the adoption of distributed energy resources by its customers.

"The HECO companies appear to lack movement to a sustainable business model to address technological advancements and increasing customer expectations," the White Paper charges.

The White Paper observed that some mainland electric utilities have begun to define, articulate and implement the vision for the "electric utility of the future." It points out that "it is difficult to ascertain whether the HECO companies' increasing capital investments are strategic investments or simply a series of unrelated capital projects to expand utility rates and increase profits, appearing to provide little or limited long-term customer value."

These are harsh words and reflect the PUC's concerns. It is concerned about network congestion when roof-top solar generation is exporting "uncontrollable" amounts of energy. It says this raises the cost of energy for the two-thirds of the customers who do not have roof-top solar systems.

Furthermore says the White Paper, the PUC is concerned that current electric utility rate structures in Hawaii are not well suited for a future where there are significant quantities of variable renewable energy customer-sited distributed energy resources and increasingly smart grid technologies." They do not send the correct market signals to customers and markets when large electricity supplies hit the grid, the White Paper said.

Unbundled rates and supplemental power supply pricing are two alternatives the White Paper discusses and would prevent shifting utility fixed costs from DER customers to customers without distributed generation.

The White Paper argues that it is now incumbent on the utilities under its regulatory jurisdiction to utilize the guidance out-

lined in the White Paper to develop a sustainable business model "that explicitly governs the companies' capital expenditure plans, major programs and projects submitted for regulatory review and approval."

THE PUC ACTS

Apparently the PUC took the White Paper seriously, because on October 12 it took action to control utility costs and to offer customers more options under its Net Energy Metering program. First, it reduced credits for new rooftop solar owners on Oahu that sell excess power back to the utility from 26.8 cents/kWh to 15.07 cents/kWh. Customers on neighboring islands will see similar reductions.

Customers with new rooftop solar systems will also see their minimum monthly bill increase from \$17.00 for a net energy metering contract to \$25.00.

Customers who have already installed rooftop solar systems or who have submitted applications by October 12 will be grandfathered in at the current rates.

The PUC ordered the Hawaiian Electric Co. to develop a time-of-use rate for all customers so a customer can choose to pay less for electricity during the middle of the day when solar power is at its peak, and more in the evening.

The PUC also created a self-supply program for solar customers who intend to consume all the electricity produced by their solar system onsite and will not export energy to the grid. They will receive expedited interconnection review. These customers will be expected to use energy management and energy storage systems to balance onsite generation with demand. They will therefore have reduced technical impact on the grid, according to the PUC's order.

The PUC will continue its work in Phase 2 to further develop competitive markets for distributed energy resources, including storage.

Energy storage is already a focus for Hawaiian Electric. In August, a \$2.1 million pilot program to install energy storage systems saw its first award go to Milbrae, California company, Stem, Inc.

NEW TRENDS: A DEVELOPER'S PERSPECTIVE CONTINUED FROM PAGE 6

need storage. So, yes, storage is a market for us, and we are in it, but it is a fraction of the solar or wind potential market in terms of capital deployment.

Storage is a diverse universe. We can talk about a battery bought by a residential customer all the way to a pumped storage hydroelectric project or thermal storage facility for a city that is huge in scale. I think it will be all of the above. You need to manage the grid in a way that you can provide some load-shifting equipment or load-following equipment.

The question about battery storage is the timing. The timing depends on the transition to distributed generation. Battery storage at the residential or commercial level is only viable if there is no net metering. Net metering is not viable above a certain percentage of distributed generation because it imposes a cost on the utility. Someone has to assume the storage.

If distributed generation grows quickly, then we will reach the ceiling for net metering and any additional storage will have to be done by the customers.

Storage will happen; there is no question about it. Whether it happens in three, four or five years depends on the distributed generation market.

WHAT WILL BE CARBON'S TIPPING POINT?

Tristan Grimbert: Carbon pricing is the most American way to address global warming. What is more volatile than CO₂? It goes everywhere. It is a global issue, and carbon pricing is the capitalist way to address it. Cap and trade was proposed by Americans, and then it was shut down. Carbon pricing would be a better way than a haphazard mix of subsidies with, for example, a New Mexico PTC and some tax exemptions and different provisions in Arizona. No. Let's price what is creating the problem and, then, if we have to produce massive wind in California or Texas, we will do it because the market is sending the right price signals. It may take some catastrophic climate event, but I have no doubt

it will come because it is the American way to address global warming.

WHAT ARE DEVELOPER RETURNS TODAY?

Tristan Grimbert: Too low. I am not in the business of deploying at the lowest cost of capital. I am in the business of creating value. The cost of capital is one part of the equation, but the job is to find differentiators. It is not the size of the market; it is not the growth; it is how much better you are than your competitors. The returns for this effort are always too low.

SOME OF YOUR COMPETITORS HAVE YIELD COS. DO YOU SEE EDF RENEWABLE ENERGY MOVING IN THAT DIRECTION?

Tristan Grimbert: No, I don't. Right now our business model is that we develop projects for ourselves and we sell up to 50% to co-investors. Sometimes we sell more, and sometimes less. We do tap the market by selling assets. We see yield cos playing in that market, but they are only a portion of that market and there are plenty of investment firms and other people who are trying to deploy long-term capital at competitive rates, so we do not think it necessary to have our own yield co.

We can sell to yield cos or we can sell to people who are not yield cos but have an efficient cost of capital and are looking for long-term investments.

EDF RENEWABLE ENERGY HAS BEEN A BUYER OF DEVELOPMENT RIGHTS TO PROJECTS FROM SMALLER DEVELOPERS. IS THAT PIPELINE GETTING SMALLER, STRONGER, OR REMAINING THE SAME?

Tristan Grimbert: We have done some acquisitions. What is difficult about the development business is that when you think you are 90% done, it means you are only half way through. Getting the project

to be completely de-risked is what really trades value.

Because the market has run faster than anybody expected, and we have been very successful, the pipeline is a little small today. We started about a year ago to rebuild our pipeline. We are doing that partly by acquisition. We may buy a pipeline. We may buy a project. We will keep developing ourselves. The overall supply of new projects is low compared to the appetite of the market. I attribute this to the impending expiration of the tax credits.

SOMEONE ONCE SAID, "NO MISTAKES, NO EXPERIENCE. NO EXPERIENCE, NO WISDOM." WHAT HAVE YOU LEARNED ALONG THE WAY THAT WOULD COUNT AS WISDOM?

Tristan Grimbert: There are so many things that we have learned. Do not be afraid to pay the right price when it is the right project.

PREDIX, GE'S DIGITAL MANIFESTO CONTINUED FROM PAGE 10

JOIN THE REVOLUTION

"To solve the biggest problems in the world, you have to solve the whole problem—across generation, grid, and consumption, bring together hardware services and software for a complete solution," Bell said. "So I want to invite all of our customers, partners, independent software vendors, developers, solution providers across the entire energy landscape, and startups to partner with us, innovate on top of Predix, and solve the whole problem." Predix is more than a platform—it's GE's digital manifesto, urging companies to join in the productivity revolution. GE executives urged business leaders in the audience to test out its beta version and build apps onto its platform, and to take advantage of Predix Cloud once it's launched.



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