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SMART ENERGY DECISIONS

THE VOICE OF THE CUSTOMER

Insights from the 2017 Innovation Summit

Collectively, we have the power to influence great change

An important theme that emerged from the 2017 Smart Energy Decisions Innovation Summit is this: If harnessed, the collective power of the commercial and industrial energy management executives attending the event, and by extension the broader C&I readership of Smart Energy Decisions, has the potential to influence significant change in the industry.

The overall spirit of collaboration and shared purpose during the summit was inspiring. Both energy managers and suppliers acknowledged the success of the event in their evaluations:

- **93% of energy management executives said they are very likely or likely to attend in 2018.**
- **94% of suppliers said they are very likely or likely to renew their participation in 2018.**

We'd like to thank the Smart Energy Decisions Advisory Board for their counsel in shaping the Innovation Summit. Their invaluable input helped us create a unique event developed by the industry for the industry.

Finally, we'd like to thank the Founding Supplier Sponsors of the Innovation Summit who helped make the event possible. By supporting the event and developing thoughtful boardroom case study presentations, they demonstrated a commitment to driving innovation in energy management and renewable energy sourcing in commercial and industrial markets.

It's a privilege to serve our readers and we're excited about kicking off plans for the 2018 Innovation Summit that will take place February 25-28, 2018 at the Barton Creek Resort & Spa in Austin Texas. You can request an invitation to the event by visiting Summit2018.SmartEnergyDecisions.com.

Thanks for your readership and engagement.

Cordially,
John Failla
founder & editorial director
john@smartenergydecisions.com

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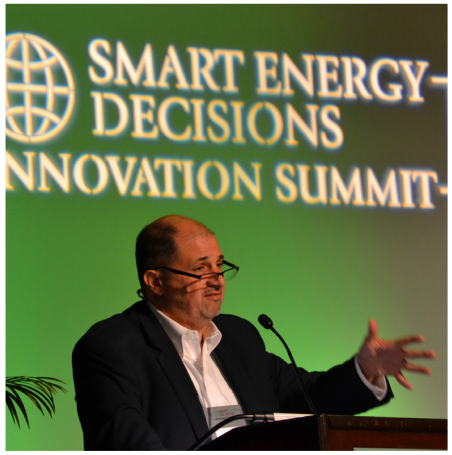
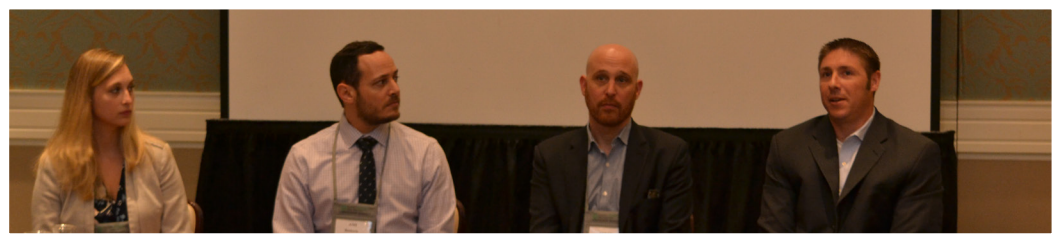
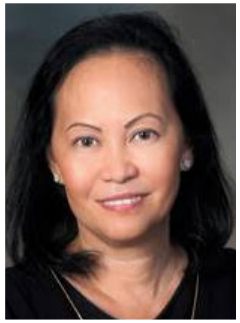
Snapshots from the inaugural SED Innovation Summit

In the year leading up to the 2017 Smart Energy Decisions Innovation Summit, across the corporate energy management landscape all roads lead to us to two major themes: The role of the corporate energy manager has grown increasingly complex, and the confluence of factors, including the dramatic shift in the energy industry more broadly, is creating an environment where corporations are more focused than ever on their energy use. The following pages contain edited excerpts from some of the Summit's most memorable presentations, panels and conversations.





Panel: Strategies for energy procurement in deregulated markets



Gayle McCutchan, vice president, commodity sales, Calpine Energy Solutions (moderator)

Rowena Striff, energy manager, Lockheed Martin

Michal Shepard, director of energy and engineering, Harris Teeter

MCCUTCHAN: The key is really preparation, and preparation entails addressing the key buying questions head-on. Number one: How do I know when to buy? Number two: How do I know what term or how long to buy? Number three: How much do I buy? In other words, how much quantity do I want in a fixed price? How much quantity should I have exposed to index markets? And finally, performance. How do I measure my performance? How well did my strategy perform? The questions, as you can imagine, have a variety of different answers, but they're driven by two key factors. First, your organization's risk tolerance and objectives. Second, what's going on in the market? Understanding past, present and future market trends.

So, let's turn the question over to Rowena. How does your organization address the question about when to buy?

STRIFF: Actually, you know, all those four questions are really, in my mind, very interrelated in terms of when to buy. Unless we all have a crystal ball, we kind of have to try to anticipate things and understand what is our risk, our opportunity and our budgets. And making the timely decisions, the best decisions you can make with the information you have available to you. And so, also looking into how far you're looking into buying. So, if you're, I look at things in different strategies of going into, really far into the foreign markets and anticipating where the global challenges are in the commodities, your local regional and your U.S. situation, there are so many things that are

now coming into play to help you understand when to buy.

You have to look far forward into the future, but still you have to pay attention to the present. So, looking at your opportunities of where shale gas prices are going, or how resource adequacy is happening in your power markets, because power's not something that you can store like you can with natural gas. So, a lot of that comes into play, and so does the weather. A lot of times, perhaps I've bought far into the future, but then when I go into what is actually happening a month ahead, maybe I'm seeing a curtailment or certain resource issues, which happens in Texas with all the economic growth happening. So, when to buy is really good in understanding how you also do things on a historical level. Have I done better historically, and how is it comparable to that?

So, it does play into a lot of those aspects and understanding your risk and your opportunity and how much you can have budget certainty. How much of that is important to your company? Because

otherwise you can just buy all you can, and you're done. But, it's never really done. To really make the most of this opportunity, you have to really pay attention to it not just far in the future, but also in the present.

MCCUTCHAN: And something you said earlier, Rowena, which was you're constantly looking at the developments. You're reading the press releases, and you're keeping an eye on it. You aren't just going into the market at one time every year or every other year and procuring 100% of your needs.

STRIFF: Yes, and so much plays into it. Energy has become so much more fun and exciting in that respect, because you have renewable energy now, you have [liquefied natural gas]. The game has changed for the U.S. and how we look at things. Years ago, OPEC used to be about the only thing determining how our markets were going to be, and maybe the weather. Now you have shale gas and renewable energy and also markets and economic growth, and that all comes into play. That's what makes it so dynamic. You don't just always know when to buy. It's something you always have to watch for and make the most of that opportunity as well.

MCCUTCHAN: Let's move to our next buying question, which is: How do you know how long to buy? This is your term. Michal, tell us a little bit about your experience and what you look for in answering this question.

SHEPARD: I think this really gets back to kind of what the business rules for your particular business is. I know that in the supermarket industry we're a little different than most, but we run on pretty thin margins, so buying forward is a new aspect for most supermarkets. Especially from the perspective of risk tolerance. In my organization, I know my executives never heard about risk tolerance, especially in utilities. So, how do you present that to your senior management?

"**You have to look far forward into the future,** but still you have to pay attention to the present. So, looking at your opportunities of where shale gas prices are going, or how resource adequacy is happening in your power markets, because power's not something that you can store like you can with natural gas." – **Rowena Striff, energy manager, Lockheed Martin**

How do you get their buy-in to buy forward to secure at least part of your electric load, if not all of it, on a go-forward basis?

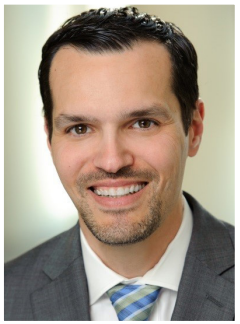
So, really and truly, it's combining both a sales tactic to get your buy-in from your senior management, along with budget certainty. And I'll tell you that with success, over time, you get that buy-in pretty well from your senior management. And, really, it's business rules. They have the largest stake in the business and maybe your legal department says, hey, we don't want to sign any contracts past 2019. You have to bring them the data, the analytics, to say, hey, if we do this, we can secure going forward at a cost to the business.

MCCUTCHAN: Thanks, Michal. So, you have to be a salesperson, internally.

SHEPARD: Absolutely. Every guy in here that works for a company is a salesperson.

Panel: Innovative models in renewable energy sourcing



Amy Poszywak, content director, Smart Energy Decisions (moderator)

Mary Curtiss, global head of energy and sustainability, corporate real estate, HP

Steve Skarda, global climate and energy leader, Procter & Gamble

Michael Barry, head of sustainable business operations, Bloomberg LP

POSZYWAK: We were hoping that you could all talk to us about an model or strategy that you've used for a project that has worked well for your company and that you've seen success with, or learned some lessons from. Steve, do you have an example? We know P&G recently signed a PPA for 80% of the output from the Tyler Bluff Wind project in Texas.

SKARDA: Sure. There are two examples, one is that virtual PPA and the other is a combined heat and power project, but what I'll do is I'll talk a little bit about both and what made them work.

I've shared this message with other audiences before, but I will reiterate that it has not been easy. It was really hard. In fact, when I started my role in 2011, people were telling me it couldn't be done, referring to our achieving 30% renewable energy in a way that was good for our business. We were actually committed to doing it in a way that was good for our business, We didn't want to just go out and spend incrementally if we didn't need to at the time. We needed it to be good for us.

Those two projects had some similarities to them. One is that it takes a ton of perseverance for us to get to where we are today. It was not easy. The Albany biomass project, we laugh about it now, but that project was dead at least ten times through the course of that project. We kept hitting roadblock after roadblock and just when we'd think we were done, we'd take another look, think of another way around the challenges, and we got through it.

The second is, I find that it takes some courage. Going off and doing something like a virtual PPA in a large company that is fairly conservative in how we approach decisions means being willing to get outside of our core business and do something different. I always felt very appreciative that we had a finance team and leadership that was willing to go off and take a risk, because it was definitely a step way outside of our comfort zone.

> **"Going off and doing something like a virtual PPA** in a large company that is fairly conservative in how we approach decisions means being willing to get outside of our core business and do something different."
>
> – **Steve Skarda,** global climate and energy leader, Procter & Gamble

And lastly, collaboration. These projects required help. It was interesting, especially the Albany project, we started trying to figure the project out all on our own. We thought, 'we're engineers, this is a problem and we can crack it.' That was, I don't want to say silly or foolish, because ultimately, our approach helped us determine what the unique elements were that we needed to drive it, but at the end of the day there were a lot of parties involved in all of those projects, whether it be the wind farm with Altenex and EDF and now Southern Co. or our project in Albany was enabled by a developer, Sterling. And then ultimately Constellation, who's building it, and Georgia Power. Today, actually, in terms of how our strategy has evolved the most, I think early on we were really trying to figure it out on our own. Today we're looking to leverage more of the resources of our partners.

BARRY: At Bloomberg, together with our partner EnterSolar, we cut the ribbon on a 1.5 MW solar project in Queens, New York, in September 2015. This project is unique because it uses a remote net metering tariff available in New York that enabled us to locate the system on a warehouse in Queens and move the credit to our headquarters in Manhattan. It's a form of community-scale solar. The Rocky Mountain Institute's (RMI) Shine project defines community-scale solar as projects between 0.5 and 5 MW. They are connected to the distribution grid with the monetary credit for the energy "wheeled" away to a utility customer (businesses or households) that has contracted the renewable energy.

It's a great project for Bloomberg. A: it is close by, in New York City. B: by using remote net metering projects we are able to take advantage of the utility tariff, reducing the price risk typical in a virtual PPA (VPPA) on the wholesale market.

Locating renewable energy right in our "backyard" brings great benefits to the community. As community energy programs expand,

I am looking at projects where Bloomberg can take half the energy and the other half can be sold to people in the community. I think it's a great way for companies to engage their community.

I was looking at Bloomberg New Energy Finance data from the beginning of the year, and about 80% of U.S. corporate PPAs by megawatts have been signed by 20 companies. So there's been a lot of activity, but it's mainly done by the large companies you hear about all the time. There are still a lot of small companies that want to bring renewables into their portfolio and I think community solar-type programs are a great way to do that. As mentioned these programs can be local, close to your energy load, and the risk profile is a lot different than a VPPA. The issue is that the programs are different for each utility. According to the RMI, about 14 states plus the District of Columbia now have a community tariff. They're all different. Some may or may not be lucrative, but for those companies looking for renewable energy projects, I think it's something worth investigating with their utilities.

"There are still a lot of small companies that want to bring renewables into their portfolio and I think community solar-type programs are a great way to do that."

– **Michael Barry,** head of sustainable business operations, Bloomberg LP

Keynote: Energy life cycle management at General Motors

Rob Threlkeld, global manager of renewable energy, General Motors Co.

When I look at our renewable energy and energy efficiency efforts and successes, the biggest lesson learned is you really need to set a goal. We would not be where we are today if we didn't have energy intensity reduction and renewable energy procurement goals. These commitments engage our leadership and enable us to incorporate the goals in our annual business plan and other longer-term plans and strategies. Building a vehicle requires a long-term strategy, and we're mirroring some of that product planning process with our sustainability goals.

I've linked a lot of our renewable targets around our process for product planning so everyone is thinking in the same way instead of trying to come up with a new model. I try to link our renewable and energy efficiency goals with our day-to-day operations in the assembly plant.

Whether you're a supermarket chain or in the tech industry, we likely share a lot of commonalities with our sustainability goals: reducing consumption and increasing our renewables. So here's some advice I have.

LOOK INSIDE. I look at myself as an energy enabler. My focus is getting the finance, treasury and accounting folks to understand that working together as a team will help us be successful in this space. So when we move forward with a project, they'll not only understand the financial implications but also the broader company impact and

the importance of renewable energy initiatives to our shareholders, stakeholders or customers. When the communications team develops a package for a PPA, for example, all that information gets funneled down to finance so they actually understand how the news is positioned and what the impact will be to the company. Whether it's a quote from our CEO or our sustainability director, we want all teams to understand how sustainability advances are as important for our company as building vehicles for our customers. Emphasizing the whole communication value is an important component.

I work with legal and accounting in the same way. I share the reasons for the business decision and show them "here's why it makes a

lot of sense for us to do this." I try to get as many people and functions involved as possible so they understand our motivations, strategy and the business benefit, and avoid any issues down the line.

BUILDING NEW FINANCIAL MODELS. I've been looking at this a lot. As the market evolves, ask yourself: Are there ways that we can be smarter in the way we finance renewable projects, whether it's through treasury or our accounting policy? Is there a way to streamline the process to make it similar to how other functions in the company manage financials?

PHONE A FRIEND. I can't tell you how helpful that has been in this space. There are a lot of folks that are in a similar trajectory for procuring renewables and taking similar paths. What can you do to really help advance the use of renewables? Collaborate with the energy suppliers. It really is a true, collaborative partnership environment, and I can't stress that enough. Everyone is looking at reducing energy consumption and increasing their use of renewables; it's a pretty common goal. So, there's a lot of opportunity to collaborate in that space.

DON'T DISCOUNT THE DISCOUNTS. Similar to your vehicle; you walk into the dealership, you want to get a discount. Well, if there are discounts in the renewable space, you want to make sure you maximize them. They're there for a reason. Use them. They'll increase your returns and strengthen the business case for procuring renewables.

"I **try to get as many people and functions involved as possible** so they understand our motivations, strategy and the business benefit, and avoid any issues down the line."

– **Rob Threlkeld,** global manager of renewable energy, General Motors

Keynote: Best practices in aligning energy management and sustainability teams

Bill Hoenigmann, global category manager for energy, Becton, Dickinson and Company

We participated in an EnerNOC study that PricewaterhouseCoopers did recently. Results came out in August of 2016, and they said companies that have a rigorous energy management program have:

1. **A global energy strategy with cross-functional accountability,**
2. **Time-bound goals,**
3. **A connection between consumption activities and the Procurement function,**
4. **An integration of corporate energy management and risk management into the capital strategy; and**
5. **Energy as a metric.**

So, how do we do this?

GLOBAL ENERGY STRATEGY WITH CROSS FUNCTIONAL TEAMS. Sustainability, Procurement and continuous improvement teams work together. I'm the Procurement guy and I work with the folks on the demand side on almost a daily basis. I sit on the Continuous Improvement/Lean/Six Sigma leadership team for Energy. Employees from facilities operations, research and development and sustainability sit on my corporate procurement category team. I am also part of the energy steering team within the Global Sustainability group. We share best practices. We communicate with each other as well as to other areas of our organization that employ energy.

When we're devising strategy, we include finance and legal on those

teams, whether it's a category team or energy steering team. We focus on the areas that are outlined here.

AMBITIOUS TIME-BOUND GOALS. These are our 2020 sustainability targets. We have had sustainability targets published with our annual report since 2010. Initially goals were set for 2015, using 2008 as a baseline. In 2015 we established 2020 goals. We only had six goals for 2015. We've added more for 2020. I (Foreign exchange neutral).

A little more detail. This is what BD published with the 2020 goals with the last annual report.

CONNECT CONSUMPTION ACTIVITIES WITH PROCUREMENT and focus on risk management in the capital strategy. We follow a process: to define the objectives, gather data. (We are a data driven, analytical company.)

> **"Connect consumption activities with procurement** and focus on risk management in the capital strategy. So, we follow a process to find the objectives, gather data."
>
> – **Bill Hoenigmann,** global category manager for energy, Becton Dickinson and Co.

Then finding the best option within several options. In implementation: setting priorities, project planning, execution, measurement and verification. But that's all project management. It's the communication and the sharing that we do between ourselves and out to other groups within the company that I think we do better than most.

ENERGY AS A METRIC. They didn't pay me to say this, but we use Schneider Electric's Resource Advisor™ as the single source of truth for the company. They do sustainability reporting, energy management and procurement services for us and in another couple of months they'll actually do invoice processing in North America. Presently, all of this information comes from our shared service centers and from individual plants. They send invoice copies to Schneider Electric who does reconciliation and then posts the information into our database. We have data that goes back to 2008, enabling us to trend energy use and costs by site, by business, by segment, by the company as a whole.

You can see the polar vortex there in 2014. We can focus exclusively on something like greenhouse gas reduction and look at that on a companywide or business specific or a site specific basis.

The journey to get here has taken us ten years.

I actually worked on a one-off project in 2006 when I was supporting capital equipment within Procurement at the time. We did the first BD contract for our Canaan, Connecticut site in the deregulated market. Before that, we had never negotiated a contract in the deregulated market.

In 2008, we had already started our Continuous Improvement, or CI, program. CI, Lean and Six Sigma at one point were three different initiatives operating simultaneously and in parallel. Those were brought together in about 2001 into one group. Still called Continuous Improvement/Lean/Six Sigma. In 2008, they carved out energy focused projects into Atlas teams. So I can go to an internal database on a Sharepoint. I can sort for the term "Atlas" and I'll see 100 different projects that are going on around the world, specifically in energy

management as part of the CI Initiative.

In 2009, BD established an Office of Global Sustainability. They engaged Summit Energy, now Schneider Electric, for sustainability reporting. We set 2008 as our baseline. In 2010, we published energy management standards that we based on ones employed by Johnson & Johnson. Later in 2010, we published our first formalized 2015 sustainability goals. We met five of those six goals in 2015 and then established new goals for 2020.

Corporate Procurement was a little behind the curve. We didn't establish the position that I'm in until 2011, but we've done some good things since then. We achieved 80% of the 2015 sustainability goals by 2013. So, we were well on our way.

We had a little discussion earlier today in one of the table meetings that "competition is a good thing" especially when you've got the data and you can compare plants within a business or businesses between each other. It generates a lot of good internal competition because everyone wants to win. They want to do better than that other company, and it's driven a lot of very good results.

In 2013 BD did our first wind energy agreement, in Nebraska. At first, it was like pulling teeth and it took over 12 months to get an agreement signed.

In 2015, we reestablished and broadened the 2020 goals. A 2030 vision was approved by the executive committee and, ultimately, our board of directors.

Another program that's worked very well for us is that Global Sustainability has a capital set aside. We've got about 2% of capital that is managed by the Office of Global Sustainability to support sustainable energy programs; anything from an LED relighting to equipment replacement, including occasionally solar panels on a roof.

BD does this in a way that is kind of different. We have a goal which is a hurdle rate of a five-year payback or better. If we can get a five year pay back or better on a project, something like an LED lamping project in Puerto Rico, then it moves forward without Global Sustainability participation. If it's got a 6-1/2 year payback timeframe, the project must go to Global Sustainability and a case for funding must be made.

Global Sustainability may or may not invest in the project. If they do, they bring the payback down below five years to 4.9 years. The balance of the capital is picked up by the business and they move forward with it with a small proportion picked up by Global Sustainability. It's worked very well and GS is actually getting more money to invest next year.

So what are we doing next? Raising the bar. We think we're doing very well, but it's never good enough. So, we've got a couple of things going on. Take a project in Germany as an example. When I'm doing a request for proposal BD combines procurement objectives with sustainability objectives. We have three manufacturing plants in Germany, and brought the demand together in a single bid. When we went out to bid we asked, 'what's your best price,' and then 'what's your best price for 100% renewable energy?' We could have reduced the price by 10% if we were satisfied with brown power. But, we reduced the price 8% with 100% renewable power.

Even though BD's goal for global sustainability is 50% renewable around the world, certain locations are going 100% and offsetting certain other sites that can't get to the 50% level.

Additionally, sustainability programs are being extended to newly acquired businesses. St. Patrick's Day 2017, was the two-year anniversary of the biggest acquisition by BD in 120 years. We bought a company called CareFusion out in San Diego increasing our revenue from $8 billion to $12 billion. They were a medical device manufacturing company with nine businesses. Sustainability programs and the continuous improvement Atlas Energy program have been extended to all of their teams.

On the demand side we're also looking at energy management maturity. Basically evaluating all the sites around the world, putting together individual site master plans for energy management that includes their capital plan over the next five year and how they are going to invest in new assets that reduce their carbon footprint, reduce their energy profile, and help us get to those 2030 sustainability goals

"**So what are we doing next?** Raising the bar. We think we're doing very well, but it's never good enough."

– **Bill Hoenigmann, global category manager for energy, Becton Dickinson and Co.**

Keynote: Cutting edge strategies in energy data analytics

David Reid, global energy and productivity leader, Celanese Corp.

SMART ENERGY DECISIONS INNOVATION SUMMIT

What I'm going to talk about, and what I'm going to share today, are some of the analytics tools that we use at Celanese really to make good decisions, to find new energy reduction opportunities and to get results that drive bottom line value in our organization. To me, it's all about getting that value from the data.

I'm sure everyone has a little bit different perspective on what data analytics is. In the conversations in the last couple of days, I've heard a lot of different things. So you may recognize some of the things that we're doing at Celanese that I will talk about, and you may be using many of them, but I also hope that you can get some ideas that will help you in your organization.

Related to energy, we're primarily an energy consumer. Energy's one of our largest non-raw material costs. We've got multiple processes in our 38 plants. We've got multiple sites. Large sites, small sites, integrated sites, part of larger industrial complexes. And a lot of variation in our sites. Of our 38 sites, ten of them use 95% of the energy, so those are obviously the ones we focus on.

We've got a strong history of energy reduction and energy management within Celanese. In 2016, we've reduced our energy intensity, the amount of energy we use per pound or per ton of production by, 8.5% since 2013 and by 34% since 2005. In 2016, we saved the equivalent of about 5.5% of our energy costs with energy productivity projects using some of the tools that I'm going to be talking about today. So, energy is a really important and complex aspect of our manufacturing process.

Let's talk a little bit about data. We all see and manage just a ton of data. An incredible amount of data is available to us today across the organization. We're bombarded every day. But, it's not just about collecting the data but doing something of value with it. You've got to turn it into value. The amount of data is only going to get worse, or better, whichever way you want to look at it. We're going to get more data with things like the Internet of things.

I read an article where Elon Musk said that we're looking towards seeing a closer merger between biological and digital intelligence. What he was talking about is because we're seeing so much data and have to manage it, we're going to have to get better and faster at handling that data. In the industry we get data from our plants, from our instruments in the plants, process data, our data historian systems. You add that to the business information, things like suppliers and customers, financial data, people and, again, you end up with a lot of data.

Not all this data is energy, but we do have a lot of energy data also: things like usage and supply and pricing. But is it all important? Is it usable? What can we do with it? How can we use this data to our benefit?

We've all got limited resources, limited people in the organization, so using this data to get us good information to make good decisions is critical. So we're drowning in data, but we're starving for information.

> **"The key point for me is that all data and methods are not created equally.** The strategy for using them is based on business and operating context, how mature your programs are, what resources you have, and whether it makes sense to go to the next level."
>
> – **David Reid,** global energy and productivity leader, Celanese Corp.

What I'm going to talk a little bit about today is some of ways that Celanese turns energy data into usable information to reduce our cost, our environmental impact and to drive bottom line value in our organization. I'll discuss some of the analytics tools that we use and the strategies that we developed that leverage data in our facilities to reduce energy.

Are all energy data analytics tools and methods created equally? I'd answer no to that question. We have to ask ourselves: What level of analysis makes sense for our company? What resources do I have, and what's the value proposition that I'm getting from the data? We can't just blindly look at the data. Do I do advanced analysis when I haven't even done some of the basics? And maybe I just need to keep it simple. Because when you look at the tools, the analytic tools that we use in Celanese, there's a definite hierarchy starting at the bottom with the foundational methods. These are the basic blocking and tackling that give you that foundational understanding of energy use and cost in your company.

Then we move up to the basic level, and this is where we start to prioritize the most important drivers of energy and develop that continuous improvement mindset using methods like Six Sigma. Then as we become more experienced or mature, we move to more advanced techniques that help us understand the complex interactions between the data that affect energy use, and then build some tools that get engagement from more levels of the organization.

The top of the pyramid is what I call the leaders' tools. These are the tools we go to when the other methods are exhausted. These methods are typically more complex and much more resource intensive.

The key point for me is that all data and methods are not created equally. The strategy for using them is based on business and operating context, how mature your programs are, what resources you have, and whether it makes sense to go to the next level. To me, there's not much sense in doing the leader type tools when you

haven't got the foundation in place.

The more advanced methods are looking for the complex interactions between the data. What are the connections and the relationships within the data? We're looking for things that maybe are not expected intuitively or that we can't see from the basic level of analytics. So, we use tools like multiple regression to correlate and quantify the effect of multiple parameters on energy. We develop these energy curves to understand how energy varies with multiple parameters such as production rate, product mix and even ambient conditions. So, these tools are also used to identify the influence or quantify the influence of these input, to understand which ones are the most important to go after to optimize.

One of the ways we're using energy curves at Celanese is to develop these dynamic key performance indicators so we know at any condition where the optimum is and where we should be running. So, when I go to the plants I often hear, well, energy was high last month because — whatever reason. Maybe the production rate was low, or it was colder than normal. But, now we know by using these energy curves where we should be running no matter what the conditions are and we can benchmark ourselves.

The highest level of analytics that we're using in Celanese I call the leader level. These are the analytic tools that are used when we get diminishing returns on some of the other tools. These methods, as I mentioned, are more complex, they're more resource intensive, and they're also more of a black box to operations people so we've got to be very careful about gaining their acceptance and trust of some of these tools. Otherwise, they'll just bypass them.

One of these leader type tools is model predictive control, MPC or APC advanced control. What this does, what MPC does, is take those energy curves and the dashboards that we showed a few slides ago and closes the control loop so it basically automates the control and uses multiple inputs to control multiple outputs. And really the

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>
> – **David Reid,** global energy and productivity leader, Celanese Corp.

> **"Celanese uses all of these energy data analytic tools that transform the data that we got, all this energy data**, into usable information to reduce our costs, drive environmental improvement and driving bottom line value to the organization."
>
> – **David Reid,** global energy and productivity leader, Celanese Corp.

goal then is to maximize profit. Instead of relying on people to make those adjustments that we talked about before with the dashboards, this tool automates the control and adds further inputs for things like business and process safety constraints. So, using these tools allows for a more consistent and best practice response. Moving from the comfort zone where maybe the operators like to run the plant, to where the magic happens and we are optimizing profit and safety.

As I mentioned before, some of these leader type tools are very resource intensive. In Celanese, these MPC and APC tools are done by Ph.D.'s working for our APC team. So, very resource intensive.

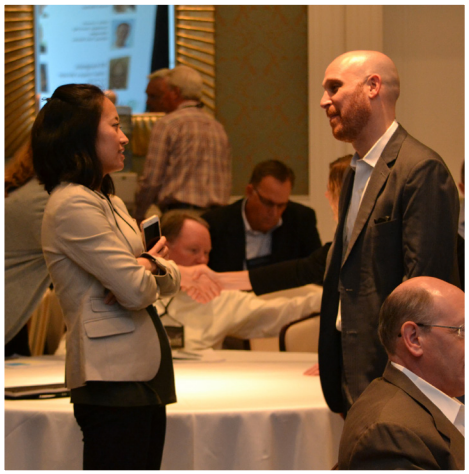
In Celanese we also found that typically when we were looking at energy use and cost, we were looking in the rearview mirror at the end of the month, either when we got our energy bill or we put together our key performance indicators, and by then it's too late to do anything. It's already happened. It's in the past. Some of these analytics tools help us look forward.

We've talked about many different types of analytics tool, we've talked about a lot of data, and we've talked about some of the things that we use in Celanese to optimize energy use. We all have a lot of data, but there's lots of different tools available as well. But, what are the right ones to use?

I believe there's a hierarchy of tools that you can use that can be used to fit the company needs, the resources and the value added for analyzing the data. From blocking and tackling at the foundation level to the more sophisticated tools like Six Sigma at the basic level, to analyzing those complex interactions and modelling using some of the advanced tools and finally up to the predictive systems or enterprise level leadership tools.

Celanese uses all of these energy data analytic tools that transform the data that we have, all this energy data, into usable information to reduce our costs, drive environmental improvement and bottom line value to the organization.

Snapshots from the inaugural SED Innovation Summit



Panel: Challenges and opportunities in energy storage

Peter Kelly-Detwiler, principal, NorthBridge Energy Partners (moderator)

Aaron Daly, global director of energy management, Whole Foods Market

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Art Justice, vice president of energy and sustainability, Cinemark

It's astonishing to me how quickly the whole storage technology is moving. Headlines from just the last few weeks suggest that battery prices for lithium ion out of China could fall by as much as 30% next year because the Chinese government is taking subsidies away from EVs and the battery manufacturers there, one of whom intends to build a gigafactory as big as Elon Musk's factory by 2020. They'll be building 80% of the new manufacturing capacity in China next year. This is a global market, just like solar is, and it's moving very, very quickly. We're lucky to have some early adopter practitioners here that are the ones on the bleeding edge, putting this stuff in behind the meter.

Now, this whole industry is by no means done in terms of its technical innovation. Just as we're seeing solar panels increase in efficiencies from 18% to 20% to 23% to 25% conversion, we're seeing storage becoming more efficient, more capable as they solve some of the technical challenges, some of the chemistries and so on. There's a lot of research still coming out of the laboratories, and the costs keep falling. So, we are by no means done with the technologies that we'll be seeing coming into the markets. In the next five years, we might even see solid state lithium ion come in, which is even more energy dense, and holds the promise of being potentially even more cost effective. And then we have flow batteries and other technologies out there, and ice, etc. So, there's a lot of different ways to store energy; not just a box with a battery in it.

So you're both early adopters. You just mentioned the advantage or the desire to be first. What is the advantage in being one of the first ones to put a toe in the water? What do you get out of that?

JUSTICE: Well, we get a little recognition in our industry and we also want to kind of bring our industry along. Our industry really is kind of a laggard when it comes to energy efficiency. We have other, as an industry we have other focuses. So, we made the decision to do some things and kind of help our industry or push our industry in that direction.

KELLY-DETWILER: We were talking at lunchtime about some of the value you're getting out of this as well. Can you explain a bit to the audience what pushed you in that direction?

> **I think the most important aspect of it from my point of view... is that these technologies,** they start out as pilots, they start out as sort of interesting projects that we can implement in one or two places, but as that technology evolves, as prices go down, they become more and more relevant to our business model.
>
> – **Aaron Daly, global director of energy management, Whole Foods Market**

DALY: Absolutely. I think our experience is very similar to Art's in the sense that our industry as a whole is not moving headlong into this. We like to stay out ahead of our industry in terms of technology adoption for various reasons, publicity being one of them. But, I think the most important aspect of it from my point of view and from our team's point of view is that these technologies, they start out as pilots, they start out as sort of interesting projects that we can implement in one or two places, but as that technology evolves, as prices go down, they become more and more relevant to our business model. We don't want to be in the position when they do of trying to figure out what's going on. So, by taking a few piloted, or targeted rather, projects early on, we get not just the benefit obviously from the economics and from the publicity and other things, but we also get the learning, and I think that sets us up well so that when things start to improve from a market potential point of view, we're there ready to take advantage of it.

KELLY-DETWILER: Art, what kind of projects do you have on the ground right now?

JUSTICE: So our first two projects, two installed projects, are two Tesla battery systems that we did in California. We have a 400 KW system and a 600 KW system. Those have been operating for a few months. Those are both mounted outside. Looks like a utility transformer.

KELLY-DETWILER: In a parking lot?

JUSTICE: Yeah, to a couple parking spaces and that's where they are. And then we're right now in the process of beginning to install some smaller systems inside. An electrical room or a projection booth.

KELLY-DETWILER: What's the advantage of doing the latter?

JUSTICE: We're really just experimenting and seeing which one is best for us. But, in some cases it's space. We may have space restrictions outside that don't allow for that. So, it's in one case we own the building. That wasn't an issue. On one of the projects, we had a landlord so we had to work through the landlord to get permission to install it. When you're going inside it's pretty easy just to do it.

KELLY-DETWILER: And your main target is cutting demand charges?

JUSTICE: Yes. That's what we're doing right now.

KELLY-DETWILER: Because you've got one of these classic, customer driven air condition load curves.

JUSTICE: Exactly.

KELLY-DETWILER: You mentioned to me, Aaron, that you've got a similar perfect bell shape type of a load which some people just drool over. If you're using a battery, peakier is better, right? Because you want to be able to concentrate as much energy in that needle curve as you can. So, how do you think about sizing it when you're putting the projects together?

DALY: That's a great question. We've taken kind of the opposite approach from a scale point of view. Early on our first battery deployments had been pretty small. Anywhere from 20 to 100 KW in size. Those have been targeted at peak shaving. I'd like to say we have a huge peak shaving opportunity but, as you just illustrated, our load profile is very bell curve oriented and so it's much more conducive to a load shifting approach and we're putting a couple of projects in right now that sound similar. A little bit smaller than what Art has done, but with the same concept in mind that we can actually just take our peak and move it off peak. So, that'll be great. But right now, all of the systems that we currently have live are looking just at the top 10% of our demand in levelling that out.

KELLY-DETWILER: How many projects do you have now on the ground?

DALY: Well, I was just counting before the talk here. We have nine operating sites and they are right now all in that sub-100 KW range. And we have two, as I mentioned, larger load shifting sites that are in development right now, as well as another dozen or so sites that are in the smaller range, but with a slightly different focus. The sites that we have coming up are going to be paired with rooftop solar. So, the approach there will be to firm up that demand reduction and in many respects the operations of it are similar, but we got to look at the solar production and our usage and try and meter those together with the battery. So, that'll be a fun project.

KELLY-DETWILER: Which markets are you involved in right now?

DALY: You know, the obvious markets right now are the California IOUs. That's been the easiest place. That's where most of our batteries are. That's where a number of the ones that were in development are. We also have battery, a couple of batteries behind Sacramento Municipal Utility District, which is publicly owned. And we were able to work collaboratively with them to make that work because their rate structures do not; they're not favorable towards the economics of batteries in the same way that the investor owned utility rate structures are. We've also done some projects in Hawaii. We're looking at projects in New York, in Ontario, and I believe that there are a number of other markets that are going to open up here shortly.

KELLY-DETWILER: What about you Art? Where are your projects?

JUSTICE: We're strictly California right now.

KELLY-DETWILER: I was at a conference once where I mentioned to a panelist on storage, 'oh, are you still in the ghetto of California?' And I meant it flippantly and someone really took umbrage. But, how do you get beyond California sometime soon and what does that heat map look like to you?

JUSTICE: New York is definitely on the map. We've looked at some other areas where there were what appeared to be higher demand charges, but it just didn't pencil out. So, New York would be next on our radar.

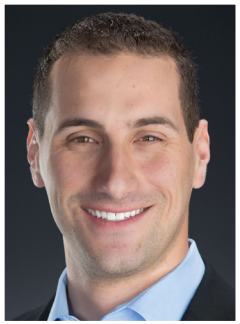
KELLY-DETWILER: And that's the main thing you look at is the dollars per kilowatt/month demand charge? Is that your main target?

JUSTICE: Right now that's our focus, yeah.

KELLY-DETWILER: If you're reducing your exposure to those demand charges, presumably a utility wouldn't enjoy having someone providing less revenue to them on a go forward basis. How does that relationship look when you're dealing with utilities, and what does that coordination process look like from a technical perspective? What do you have to do to let the utility know you now have this asset that's capable of moving power around?

JUSTICE: Well, obviously we had to interconnect in California and that was a challenge. I thought they had done other battery projects before ours, but it seemed like they hadn't. So, it really took a long time to get the interconnection. So, you know, there was no push back and no animosity I don't think, it was just they were learning.

Views from the top (Q&A): The fight for energy independence, lessons from Nevada



Amy Poszywak, content director, Smart Energy Decisions (moderator)

Adam Kramer, executive vice president of strategy, Switch

POSZYWAK: To start, it would be great if you could just tell everyone a little bit about your company and its energy needs broadly.

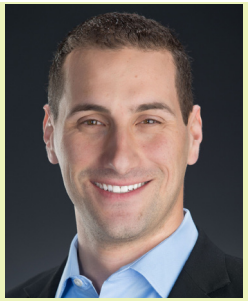
KRAMER: Absolutely. First and foremost, at Switch, we are the technology sustainability company. We truly are a tech company that focuses on the infrastructure that runs the Internet and at the same time, we have focused on doing that in the most sustainable way since our inception. In fact, that's the reason that our founder and CEO has more than 260 patents on data center design himself, because the sustainability of the Internet was so important. We spent the first decade or so really working how we could create the most efficient data center environment. Since 2013, we began really focusing on how we could create a 100% renewably powered energy load.

POSZYWAK: Switch was one of the first companies to pursue exiting NV Energy service. What prompted the decision to do that?

KRAMER: Well, our CEO had met with the former CEO of NV Energy in about 2013 and told him that we wanted to pursue 100% renewable energy. He told him that this was of the utmost importance. But, the request was ignored.

Then, later that same year, Apple moved into northern Nevada. If you are not familiar with Nevada, there's actually two service territories that are both serviced by NV Energy, but they're separate balancing authorities because they used to be separate companies. So, the northern Nevada load brought in Apple and Apple used the first green rider tariff in northern Nevada – a totally separate market, for all intents and purposes.

After that we sat down with the new leadership in NV Energy — this was following the acquisition by Berkshire Hathaway of NV Energy — and said we would like to have a green rider tariff in southern Nevada. We had been trying to go after this for about two years. The bottom line that was we wanted it, and we wanted to find a way to get it done as quickly as possible. What my CEO told [NV Energy President and CEO] Paul Caudill was he'll give you 30 days



"**Our CEO had met with the former CEO of NV Energy in about 2013 and told him that we wanted to pursue 100% renewable energy**. He told him that this was of the utmost importance. But, the request was ignored."

– **Adam Kramer,** executive vice president of strategy, Switch

to come up with this tariff. Otherwise, we are going to pursue direct access in southern Nevada. One of the interesting things is all of those companies you had listed prior are clients of Switch, so we pointed out to NV Energy that if we file to go direct access, our other clients would follow behind us. They're going to ask what we're doing, they're going to ask why we're doing it, and they're going to want to follow.

We said it would be best to give us a green rider tariff, or we'll go on our way and do this. We didn't get the tariff and we did file for our direct access and immediately afterward, of course, MGM, Sands, Wynn and others were calling wanting to talk to us about direct access and asking us, 'How does this work? Why are you pursuing this?' So, we moved forward as we said we would, and, as they say, the rest is history. The other companies unbundled from NV Energy. However, we were denied our direct access case and ability to unbundle from the utility at the time, but late last year we were granted our appeal and we were finally allowed the ability to unbundle from both the northern and southern load.

So, in the next few months Switch will officially be an unbundled customer here in Nevada and buying our energy on the wholesale market, and we are quite excited about that.

POSZYWAK: Certainly, a hard fought victory. So, while that's going on, you are also working on this Energy Choice Initiative which is the ballot measure that passed by voters in November. As Switch was the creator of that Initiative, could you tell us a little bit about how that came about?

KRAMER: Yes. Actually, taking a step back, our logo is the karma wheel and illustrates our belief that if you put good energy into the world, good energy comes back. We really believe that if Switch has the ability to pursue direct access, and in Nevada (under the current statute, only companies who consume 1 MW of power or more on an annual basis can pursue direct access) every Nevadan deserves that right to direct access. So, we worked in partnership with the Las Vegas Sands and we created the Energy Choice Initiative. It is a constitutional amendment that explicitly prohibits exclusive franchises and energy monopolies and guarantees energy choice to every single Nevadan. It's quite simple.

It also requires the legislature to create an open and competitive retail energy market by 2023. What's interesting is that the question is, in fact, the most successful ballot initiative in the history of the State of Nevada. Not only did it garner 73% of the vote, it actually received the most number of raw votes for any ballot initiative in the history of the State. So, wildly successful.

And it's the reason that the Gov. Sandoval has created the Governor's Task Force on Energy Choice. Now, legislators, large commercial and industrial users, consumer protection, environmental groups and other different stakeholders are being called on to work on legislation that can be introduced in the 2019 legislative session that will create the open energy market that we all assume will be required under the Nevada Constitution.

POSZYWAK: Allow me to play devil's advocate for a minute and say there are critics of electric deregulation who argue that the policy hasn't actually brought benefits to customers and, in some instances, created bigger problems than those it was intending to solve. Perhaps most famously in recent months, Kenneth Rose, who is an independent consultant and a senior fellow in economics at the Institute of Public Utilities at Michigan State University, recently wrote for The Wall Street Journal: '[W]hat deregulation has delivered so far is retail and wholesale price volatility which has created considerable tumult for buyers and sellers of power. When customers have complained, understandably, about price spikes, regulators and legislators have responded with price controls. When prices subsequently dropped, power sellers cried foul and in some cases received subsidies. Such concessions prevent the market from functioning well and have created a version of deregulation that doesn't work for anyone.' What would you say to those arguments that are critical of deregulation?

KRAMER: Well, I think first and foremost, the points that are brought up there are points that we are trying to address, because I think what's most important is that there have been mistakes made in the past. But that in no way is an indication that open, competitive retail energy markets don't work on a larger basis.

For example in the State of Michigan, where Switch recently expanded into, 10% of the market is open and competitive and you

have very happy customers who are participating in that. In Nevada, you have customers like Switch who are pursuing direct access because we know that the market works and we know that access to the market is competitive. You can also look at California and see the kind of restructuring they've done over the last couple years, as everybody has been learning — it has been a learning process — and you can see the success that is starting to come out of that market. I believe California last year estimated ratepayers who were able to use direct access saved $100 million. You really see these savings start to come about.

I think that the secondary point to that is ... to only factor in cost as a reason for open energy, or for an open competitive regional energy market, is a bit short-sighted. I think you're seeing more and more companies like Switch or MGM, who are pursuing more and more renewable energy options in the renewable makeup, the portfolio they pursue may be well above and beyond what is currently offered under the RPS or by the incumbent utility.

So, it's not just about access to lower cost energy. It's also about access to an energy portfolio that fits the company's own goals. I think that you have to look at all of those factors when you're assessing what the total value proposition is from an open competitive retail energy market.

POSZYWAK: When working through all of this in Nevada, Switch has aligned itself with a good number of other large C&I energy users all kind of working toward this common goal. What has that collaboration been like for Switch?

KRAMER: It's been absolutely incredible. The collaboration is really made up of the largest employers in the state who are making up more than 40% of the entire workforce. What's really great is not only are we aligned in what the best interest is for our companies but also what's in the best interest of all of our employees because our employees are Nevadans. Our employees make up a very large percentage of the entire workforce in the state.

There's been great collaboration on how we can work together to make sure that we are protecting ratepayers of every class and that we're doing the kind of work that's going to help promote renewable energy and sustainability policy throughout the state. This is the kind of policy that's going to promote economic development, not just allow the companies that are here in Nevada to grow, but also that is going to attract other companies to Nevada because we want to have the most progressive energy policy in the country.

We want the policy where when site selectors are making decisions about where they're going to grow their business, that in addition to all of the things that make Nevada so great are absolutely top tier, we can add the ability for a progressive energy market on top of that. That will really help close a lot of deals. We think that's a great thing for the state, and there's really a unified vision behind that.

SMART ENERGY DECISIONS
INNOVATION SUMMIT

EDITORIAL AND RESEARCH
Amy Poszywak
845.743.4043
amy@smartenergydecisions.com

SPONSORSHIP AND MEDIA
Melia Durban
347.974.3820
melia@smartenergydecisions.com

GENERAL INQUIRIES
John Failla
914.574.5709
john@smartenergydecisions.com

WWW.SMARTENERGYDECISIONS.COM