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*At the recent NARUC Summer Policy Summit, NARUC president Rob Powelson honors former FERC Commissioner Colette Honorable. Subsequently, on August 3, Powelson was confirmed by the U.S. Senate to join FERC. Photographer: PUF Staff.*



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# 2.7 Million Jobs at Stake

We Must Keep in Mind Their Work

BY STEVE MITNICK

**2**.7 million jobs. That's the estimate by M.J. Bradley & Associates of the number of direct jobs in the electricity sector. Check out its report "Powering America" released a couple of weeks ago. And our interview of M.J. Bradley's Paul Allen in September's *Public Utilities Fortnightly*.

The report blows away the myth that there are just four hundred thousand electricity jobs. That number counted utility employees only. There's a lot more of us than that.

Two summers ago, I never imagined I would be editor-in-chief of *Public Utilities Fortnightly*. An economist, I decided to submit an essay to PUF to clear up a widespread and serious misunderstanding about the number of electricity jobs.

My essay "Jobs, Jobs and Energy Jobs" was published in Fortnightly's Spark, its newsletter at the time, on August 11, 2015. My estimate was 2 million direct jobs (not counting the multiplier effect and the millions of induced jobs).

It now appears I undercounted. M.J. Bradley's more comprehensive analysis came in thirty-five percent higher, at 2.7 million.



Why is the large number of jobs in the electricity sector so important? Well, the electricity workforce not only electrifies our economy and culture; its jobs are an essential part of American society. One in fifty-four non-farm jobs nationally are electricity jobs.

Regulatory and policy pronouncements can thus have large job impacts. Just ask the communities of shut nuclear plants or stopped projects.

Which brings us to another myth about jobs in the electricity sector. Our sector is said to be one of the most capital intensive, or even the most capital intensive. This statement is true in a way but misleading in another.

Overall, the electricity sector has a high capital-to-labor ratio. But the ratio is heavily biased by the sector's operations and maintenance side, which has

an extraordinarily high capital-to-labor ratio. Power plants, lines and substations are quite intentionally built to last for decades, requiring minimal manual intervention.

As opposed to the sector's construction side, which has a significantly lower capital-to-labor ratio, when all engineering, manufacturing and construction labor is considered. It takes a lot of people to develop and build a new wind farm, high-voltage transmission system, combined-cycle plant, etc. Including regulatory folks like some of us.

Indeed, the transformation of the power generation sub-sector is driving up job numbers in the short term, but driving down the numbers longer term. Takes a lot of people to put up a new gas-fired or renewable source. But once the connection to load is made, many fewer people are needed than at the coal plant being replaced.

Bottom line. Jobs are at stake, of real people with real families to support, and with real communities that count on them. As we go about our work, we must keep in mind their work. ❖

A stylized, handwritten signature in black ink, likely belonging to Steve Mitnick, positioned above a horizontal line.

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# Electric Vehicle Breakout

Brett Hauser, CEO, Greenlots

BY PUF'S STEVE MITNICK, WITH BRETT HAUSER

**P**UF's Steve Mitnick: Everyone knows about electric cars, and their charging issues and challenges. What's special about Greenlots?

**Brett Hauser:** Greenlots is an energy technology company that provides network management solutions for electric vehicle infrastructure. We believe we have best in class capabilities for driver-facing applications. For example, finding charging stations and being able to access them, as well as site host tools needed to provide pricing, access control, and authentication.

We have also focused on providing robust capabilities around connecting to the grid and grid flexibility, which we don't think other people have done. We've done that to ensure that there is the lowest total cost of ownership or operation.

It's important because the vehicles are coming to market. In 2018-2019, there will be more and more vehicles with Tesla-like range, and Chevy Bolt like-prices, around thirty-thousand dollars. So, we're going to see load growth that resembles a hockey stick on the grid. Being able to manage those electric vehicle loads is absolutely critical.

We have brought fully integrated energy storage capabilities into our platform as well as demand response features for real time load management. Everything that we have done has leveraged open standards, which we believe is absolutely critical to the continued growth of the company and the industry at large.

Proprietary protocols have already had some negative impact on our space as well as others.

If you have proprietary charge stations out there, and that company goes out of business, which has already happened in this space, then those assets are

stranded, and those don't do any good.

As opposed to putting new money towards increasing the overall footprint of infrastructure, site hosts wind up having to put in more capital to replace the old charging stations, and then the relatively new infrastructure is taken out. That's not good for anybody.

One other concern with proprietary EV charging networks is that access to charging information would be limited and in some cases, these proprietary providers would like to charge a fee for this information, which unnecessarily hampers the productivity and cost-effectiveness of the grid. As the lines between the front and back of the meter blur, utilities need a holistic view of the ecosystem so that they can provide ratepayers with the safe, reliable, and affordable power that enables our global economy.

Moreover, we believe that rising tides lift all ships. That's why we think utilities have to actually play a bigger role,



**Utilities have to play a bigger role, because to move EVs mainstream, we need utility investment and experience managing infrastructure.**

because in order to move EVs mainstream, we need utility investment and experience managing infrastructure.

To accomplish electric vehicle mandates and grow the market, everyone has to have equal access to infrastructure. So, that means companies can't only focus on zip codes where they see a clustering of Teslas. Rather, the industry needs to also be concerned with disadvantaged communities, multi-unit dwellings, and places where people are buying a second-hand lease. Utilities are in the best position to



do that, because they have a mandate to provide broad-based safe, reliable, and affordable systems across all socioeconomic classes regardless of zip code.

Furthermore, you've got the automotive original equipment manufacturer, which has the customer relationship, because they're selling the car. Then there is the utility, which is providing the electricity for charging the vehicles. Stepping into the middle of that relationship and trying to propagate a third layer of electric vehicle service providers adds extra costs to the system and fragments the market. That's not going to be good for utilities.

We think there are a lot of reasons why utilities should be owning and operating infrastructure. At the very least they need to have access to all the information that's happening within their territory, so that ratepayers aren't saddled with the costs associated with an inefficient grid.

The electric vehicle really should be an energy resource. So, as the lines blur between what's in front of the meter and what's behind the meter, the utilities need to have the ability to see what's happening behind the meter with electric vehicles.

If they understand what's happening and what's coming, they can make strategic investments to manage that load, and it can be an asset to them.

If they don't make those investments upfront, they wind up being very reactive. Ultimately, they wind up spending exponentially more money, which costs their customers more money than it would have if the utility had been proactive and strategic in thinking about the deployment of infrastructure in the first place.

**PUF's Steve Mitnick:** Haven't there been policy and regulation battles as to whether utilities should be involved in charging? Particularly in California.

**Brett Hauser:** I think it's maybe one step forward, two steps back. I think a lot of it happens when you're looking at the regulatory arena. Yes, there's California, but let's put California aside for a second and



## There's still a lot of education that has to take place. You can't expect regulators to fully understand the impact of electric vehicles on the grid.

look at the rest of the U.S. There's still a lot of education that has to take place. You can't expect the regulators to fully understand the impact of electric vehicles on the grid.

If you look at things by today's standards, adding an electric vehicle to someone's home is going to add approximately sixty percent more energy consumption at that home. So, if you have a subdivision that's been sized for ten houses and you add four electric vehicles, that's like adding two and a half more houses to a subdivision that was only sized for ten.

You have to think about whether you're going to actually upgrade the infrastructure. Maybe instead you're going to use demand response and smart charging programs to be able to curtail when people are charging. So, education is a big part of it.

The other piece of that too is the ongoing service and maintenance of these



systems. Companies are in the business of trying to sell hardware. They sell, then they move on to the next customer.

Unless that previous customer has strategic importance, they're not so concerned with the upkeep and maintenance of that unit. But someone who depends upon having access to that charging station, and the fact that it's going to be operational more times than it's not, needs to have someone in a position to service that. Utilities certainly are in that role. They've been doing that with equipment out in the field since the beginning.

You can look to groups like Volkswagen's Electrify America, which is putting up a charging network worth two billion, and some of those assets, VW will own.

They will also be providing funding for other groups to put up networks. One thing that those funds will be used for is to ensure that every piece of hardware that they put in the ground has a ten-year service and support agreement with it.



Nathan Raith, Manager - Infrastructure Solutions for greenlots, manning the company's booth at the recent APPA National Conference

That is critical as more EV drivers rely on public charging.

**PUF's Steve Mitnick:** I wonder if there is a general problem where these things are installed but they're not necessarily available?

**Brett Hauser:** There's an uneven experience. The charging experience for drivers has to be ubiquitous. It's got to be just like you're pulling into a gas station to get petrol. It doesn't matter which one you go to, you're going to have the same experience.

Most important is having access to a charge station that is working. When a private company buys that charging station for public use, it's going to be an uneven experience.

## There have to be a variety of models from which to choose, and they must have enough infrastructure to charge the vehicles.

It really shouldn't be that much of a secret. From a business case standpoint, putting a charging station in the ground does not make for a positive business model. I can't put a charge station in the ground and then start charging drivers enough to not only cover the basic expense but also start paying down the capital investment.

There are not a lot of cases where that can be done. For-profit companies trying to do that, getting people to buy charge stations on the basis of that revenue dropping to their net operating income, it's not accurate.

That's why groups like the utilities, municipalities, and even the automotive manufacturers have an important role to play.

They understand the importance of this infrastructure being available ninety-nine percent of the time. They are doing things to make sure that that's a reality. They have the capabilities to make sure that's done, and can then hand it over the fence to a third party.

**PUF's Steve Mitnick:** Why do you believe the electric vehicles and charging stations are going to take off?

**Brett Hauser:** There have been a lot of fits and starts with people thinking that the electric vehicle is here and ready to go. I was at a plug-in conference in 2010 where they released the pricing for the Chevy Volt.

Those were the blue-sky days where anything was possible, but then as we got into the reality of selling these vehicles, things didn't happen overnight. There have to be a variety of vehicle models from which folks can choose, and they must have enough infrastructure to be able to charge the vehicles.

You're asking a lot for people to change the way they drive and the way that they fuel. We have to ensure that the fueling is as consistent as what they've done in the past.

If you look to analysts like Bloomberg and Navigant, everyone is predicting EV growth. And if you look to the automotive manufacturers, you see that not all but most of them have said their entire line is going to be all electric by 2019.

They are all coming out with long-range electric vehicles. If you were to look at a diagram of available vehicles in 2010

*(Cont. on page 17)*





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# Conversation with Len Hyman

Author of *Electricity Acts: A Cautionary Tale and Case Study*

BY PUF'S STEVE MITNICK, WITH LEN HYMAN

**P**UF's Steve Mitnick: Why should people read your book about the British electricity market?

**Len Hyman:** Because what happens there generally happens here a little later. You don't have to be a Boy Scout to be prepared. That goes for investors, managers, regulators and consumers.

**PUF's Steve Mitnick:** You mean this topic is relevant to people in the American electricity industry today?

**Len Hyman:** You bet it is. We have a similar economy to Britain's. We use similar fuels. The operational, environmental and engineering issues are the same. We have always shared regulatory ideas. We raise money in the same global market. And I think it's safe to say that the same principles of economics and of psychology apply in both countries.

Sometimes, if you want to analyze how an industry evolves, it's easier to look at the picture somewhere else. You can view events more dispassionately, you don't have any axes to grind, and your analysis won't imply any criticism of the boss's previous efforts. No egos at risk of being bruised.

**PUF's Steve Mitnick:** The book is about history. What does that have to do with where we're going in the future: 2020 or 2030?

**Len Hyman:** Look at it this way. Half the book is about the events that eventually led up to privatization and deregulation, and half is about what happened after

Margaret Thatcher launched the great electricity experiment. We need to understand the reasons for restructuring to assess its success.

**PUF's Steve Mitnick:** Were there any notably quirky things that happened along the way?

**Len Hyman:** First, the British really struggled to develop regulation. They put incentives in place by the mid-nineteenth century. After the utilities discovered how to beat the incentives they tried again and again, and they have now ended up with rate of return regulation in disguise. You just can't seem to get away from return on assets invested.

Then there is the problem of the regulatory compact, which can work against consumers during a time of changing technology. Back in the early nineteenth-hundreds, London, the financial capital of the world, was a terrible place to buy



**In the early nineteenth-hundreds, London, the financial capital of the world, was a terrible place to buy electricity.**

electricity. The city was served by many small, inefficient utilities.

An industrialist from the north offered to put up a few power stations that would produce at a fraction of the cost of the existing utilities. Parliament turned the proposal down because it wasn't cricket to undercut existing utilities that had, in good faith, invested in their plants. Later, when the government decided to operate a power grid throughout the country, it paid off all the nonconforming utilities and their customers. Lesson learned.

The British love affair with nuclear

**Len Hyman** is an economist and financial analyst specializing in the energy and regulated sectors. He was formerly head of utility equity research at Merrill Lynch and senior advisor to investment banking at Salomon Smith Barney.

power deserves a look. British governments either directly built or encouraged nuclear power, no matter what it cost. When they put the nukes on the free market, in the naive belief that nuclear power is just one more commercial line of business, the nuclear generator tanked.

This time around, they pretend that the newest nuclear effort is an ordinary business, even if it's owned by firms controlled by the governments of France and China. But they have set a price for the output that everyone has to take, plus a bond guarantee and Lord knows what else, because the terms of the deal are not public. If we really want to have an operating nuclear industry in this country, we might want to look at the British model.

And, of course, there was the soccer referee who unwittingly crafted the government's technology policy for the industry and thereby managed to inhibit progress for forty years. That's a lesson in government micromanagement that British politicians did not learn from.

**PUF's Steve Mitnick:** Does the future of the regulatory compact still make sense?

**Len Hyman:** That depends on what you mean by regulatory compact. The British removed power generation from the compact. But they subsequently decided to put nuclear, reliability and renewable energy under a different form of regulation, via contracts that fixed prices and forced consumers to buy the output.

They put the wires under an incentive regulatory framework that ostensibly focused on price rather than return. The framework encouraged cost reductions, but over time evolved into a multi-year rate of return process.

Which, incidentally, is what Ingo Vogelsang of Boston University told me would happen, once the utilities had made the easy cost cuts. It looks as if the British can't get rid of regulation, and we may be in the same boat.

The question, though, is timely. We need to maintain a network while the

economy transitions to a low carbon future. I'm not convinced that regulation based on experience provides a return commensurate with the new risks, or alternatively that current depreciation rates are high enough.

Technology will change the business, but we don't know for sure how. And if decentralization and self-generation become the norm, it will become exceedingly difficult to force consumers to pay for the stranded assets at the utility. Nobody could make former trolley car passengers pay for a service they did not use anymore, either.

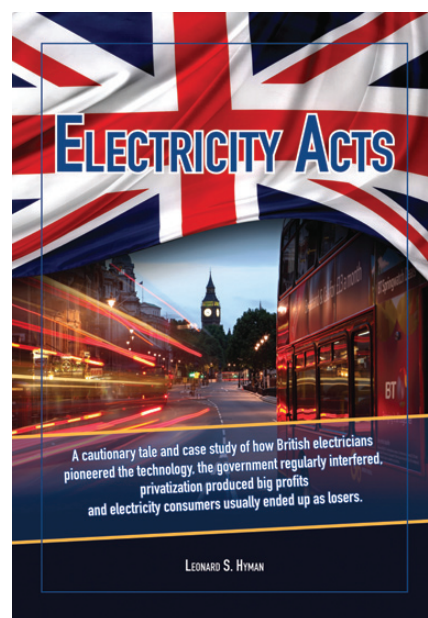
## Now that there are viable alternatives to grid power, utilities may have a hard time charging noncompetitive prices.

I think that, for the moment, we should maintain the regulatory compact, but make it forward looking. That is, give the return on and return of capital required to maintain and modify the network assets. Then, let's see how well the utilities respond to the new environment. Now that there are viable alternatives to grid power on the horizon, utilities may have a hard time charging noncompetitive prices for long, even if they have regulatory dispensation to do so.

I think that it is premature to make dramatic changes in regulation based on too many assumptions about technology. The British demonstrated the folly of rushing to judgment more than once.

**PUF's Steve Mitnick:** Your book suggests that a lot of the changes made over the past decades were meant to address a problem. But they raised other problems.

**Len Hyman:** Yes, that's true to some extent. The medical profession has a term for that phenomenon, iatrogenesis. For instance, the daily market for power



did cause generators to cut costs, but it reduced the chances that they would commit to make a long-term investment. You can't get that signal from a day-to-day market. That's why we must add on all sorts of capacity schemes to get people to invest.

Another example. The British disbanded the Pool, their central market, to prevent price collusion between generators. That price collusion was encouraged by the scarcity of generators. That, in turn, was caused by the government's problems in organizing the nuclear sector. The subsequent price drop pushed the nuclear company to a state of near collapse and the government had to bail it out.

I suspect that the government's neo-liberal ideology led to unexpected moral issues. In the good old days, electric companies operated on a cooperative basis. That was easier in the U.K. because the government owned them all. They tried to act in the public interest, although possibly inefficiently. Thatcherites replaced public benefit as a motive with market price incentives. But market prices are "incomplete contracts" because they do not include all the costs and benefits of the transaction.

For example, a U.K. generator announced it would close plants in an area.



That required the transmission company to make modifications in the grid that temporarily closed off transmission to the area. The generating company, seeing no competitors able to sell into the area, jacked up prices there. It was legal because the new incentive was to make as much money as possible, not to serve the public good. Sounds like Enron?

Social engineers and economic policy makers need to experiment first, rather than acting as if their economic theory is one of the laws of physics.

**PUF's Steve Mitnick:** Why did you write this book?

**Len Hyman:** I was one of the first Wall Streeters to see the possibilities of deregulation. I was part of a Merrill Lynch team that went to Britain to get the privatization assignment and in the process, I met executives, labor officials, regulators, government officials all over Great Britain.

I really wanted to learn why the industry was reorganized as it was, and whether the reorganization, which has become a worldwide model, met its goals, and whether what happened there should inform what we do here.

At the time, I was on an advisory board for an institute set up by Vernon Smith, who won a Nobel Prize for experimental economics. From that association, I concluded that it is better to experiment and find out how people actually respond to incentives, than guess based on neo-classical theory. I knew what restructuring was supposed to do, but not what it did.

I must admit that, in the process

of writing, I've been amazed by how ideological belief often trumps reality, and how well British spin doctors manage to feign sincerity. That's why I spent so much time poring over statistics and industry financial accounts.

Shouldn't people ask: "Hey, did it work the way we wanted it to work?" The purpose of the deregulation movement was to bring greater efficiency into the industry and then count on competition to translate that greater efficiency into lower prices.

## Economic policy makers need to experiment first, rather than acting as if their economic theory is a law of physics.

The restructuring of the British electric industry, as opposed to the simple commercial measures that the government could have ordered at any time if it had the nerve to do so, moved money around from one pocket to another. Consumer benefits, largely, came about by switching fuels and cutting excess staff, not from reorganization and markets.

Privatization and restructuring did push costs down, but in comparison with the enormous changes seen in other industries, I don't think they materialized in the electric sector.

**PUF's Steve Mitnick:** Who's going to love your book and who's not going to love it?

**Len Hyman:** Well, I hope everyone will love it. Especially people who are curious

about how industry restructuring can work, and who benefits. This is a blow-by-blow account. Plus, I wrote the book in readable English, but I included the numbers needed to follow the argument. For those who don't like numbers, charts tell the story.

A lot of people who participated in the great electricity reorganization adventure, me included, might be disappointed by some of the conclusions. The same goes for people who made up their minds based on ideology or classical economic theory.

Just as we had a big constituency in the regulated sector that did not like the idea of deregulation, there is now a constituency of those who may not like the conclusion that deregulation and restructuring fell far short of expectations.

But there is already some academic evidence that restructuring moved money around more than it benefitted consumers. Don't take my word for it. That conclusion may be valid on both sides of the Atlantic. Just look at the numbers.

**PUF's Steve Mitnick:** What impact are you hoping to have with this book?

**Len Hyman:** I'm hoping that people will try to look at industry issues in a more practical, pragmatic manner, as opposed to simply saying, "The theory says this will happen and we are tethered to the theory, so it obviously happened. If the book doesn't show that, there has got to be something wrong with the book."

Of course, you can't make everyone happy. Even if they don't like the book, they'll love the cover. ❖

Will you watch the solar eclipse on August 21? Grid operators shall, since it will cause a sudden decrease and then a sudden increase in solar generation. Even for regions with the most solar penetration, grid operators have assured us that there's sufficient fast-ramping capacity from natural gas and hydro resources to maintain reliable electric service in their regions. For now, for an eclipse in 2017. What about for eclipses in future decades, when solar penetration may be far higher?

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# Conversation with Craig Roach

Author of *Simply Electrifying: The Technology that Transformed the World, from Benjamin Franklin to Elon Musk*

BY PUF'S STEVE MITNICK, WITH CRAIG ROACH

**P**UF's Steve Mitnick: What is the central message of your book?

**Craig Roach:** There are three central messages or takeaways. The first is that we must recommit to investing in the science of electricity. The electricity business was born of great scientific work by Michael Faraday, James Clerk Maxwell, and Albert Einstein, and we've neglected it for much too long.

The second message is that we need to create an arena for a second battle of the currents, a second democratization. The first battle took place when Thomas Edison and his DC system competed with George Westinghouse's and Tesla's AC system. The AC system was the winner of that battle, and became the technology of choice. Today we have interesting people like Elon Musk that are teeing us up for a second battle of the currents, a second democratization.

The third message: we should realize that history can be a great advisor for the future. To change the future, we should understand the past. To understand the past, we should use a wide-angled lens and look at all the factors that drove outcomes back then.

**PUF's Steve Mitnick:** What's the point of the history?

**Craig Roach:** Several chapters in *Simply Electrifying* make it clear why the historical or the wide-angle view matters. You can take nuclear power as an example. It starts out with a wonderful scientific pedigree, and it's based on Albert Einstein's famous equation,  $E$  equals  $MC$  squared.

But science isn't enough to explain the rise and fall of the technology. Today,

nuclear power provides twenty percent of all the electric generation in America. "How did we get to twenty percent?" is a good question.

We know that Einstein's equation was first used for military purposes, to make weapons that ended the Second World War. Soon after, President Eisenhower spoke of making that science work for the betterment of man.

In the 1950s, it all got caught up in geopolitics and Cold War politics. We first used nuclear power to make a nuclear Navy. The famous Admiral Rickover drove this, and he did a fantastic job designing a small-scale nuclear technology for submarines. He did it in a great hurry.

That same technology and that same hurry-up kind of attitude was used for larger scale commercial nuclear power plants. I think people believe today that nuclear power was never really given a



**The AC system made electricity available to and affordable to all. Today, we find ourselves in or near another battle of the currents.**

chance to prove it could be a technology that would be cost-competitive and reliable. We went too fast.

Today, with nuclear no longer being an "official technology" or a "hurry-up technology" people are stepping back and taking another look. They are trying to come up with a technology that is cost-competitive, reliable and safe.

Bill Gates has invested in a technology known as the Travelling Wave Reactor. Others are proposing small modular reactors or SMRs. Trying to avoid the mistakes of the past is why we look at

**Craig Roach** is senior energy advisor at Bates White Economic Consulting and founder of Boston Pacific Company, Inc.



the historical context of how technologies have been chosen.

**PUF's Steve Mitnick:** What you're saying is we should have some new battles. Why is this good?

**Craig Roach:** Recall that the first battle of the currents was Edison versus Westinghouse and Tesla. DC versus AC power. I think they were allowed to duke it out on a level playing field. The right choice was made.

The AC system was the winner, after some major high-profile competition in the late 1800s. That AC system achieved the goal of the day, which was to make electricity available to and affordable to all. Today, I think we find ourselves either in or near another battle of the currents. That's because the goals of the day have changed. We now want things like door-step reliability more than affordability and availability. We want the lights on even if there's a storm that does something to the grid.

We want superior environmental performance and we want Uber-type choice. I think we're entering a second battle of the currents, trying to decide whether the grid, an amazing innovation, is still the right approach to serving those goals.

Should we instead move forward with micro-grids and/or personal power? Personal power would include Elon Musk's combination of solar rooftop technology and his Powerwall storage device. I think we should set up an arena where we have that battle, and may the better technology win.

**PUF's Steve Mitnick:** An influential congressional leader has said we don't need a national energy policy. The economy will figure it out, just like it did with fracking. What do you think about that?

**Craig Roach:** I think we should use the market as much as we can. I agree that the shale gas revolution was a success because it wasn't an "official technology." It was started by George Mitchell, putting his own money and his own time into

finding a source of abundant natural gas.

At the same time, we need government to play the role that it must play. The most critical issue we need the government to decide on is a price for carbon. That's better than having governments subsidize technologies. We need a technology-neutral policy like a carbon tax. Two well-respected Republican elders, Jim Baker and George Shultz, have proposed a carbon tax and regulatory rollback.

**PUF's Steve Mitnick:** Your book is also making a point about the importance of science today.

**Craig Roach:** Yes. Not only the importance of science, but the importance of scientists. For example, Benjamin Franklin is one of our great founding fathers. We know he negotiated the alliance with France, which led to us winning the Revolutionary War.

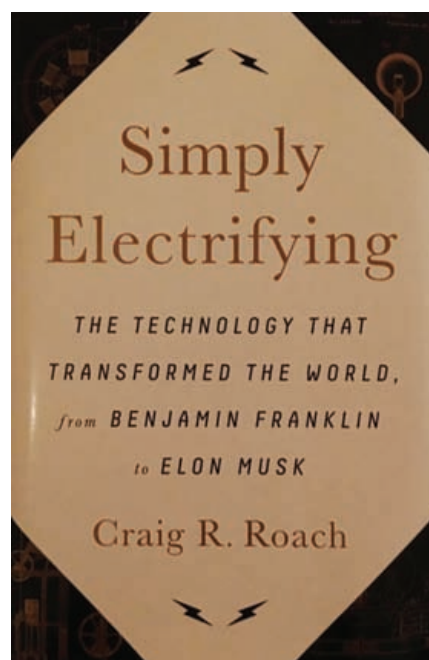
## The most critical issue we need the government to decide on is a price for carbon. That's better than having governments subsidize technologies.

But the great question is, why did the French welcome him, and accept him? It's because he was a world-renowned scientist and his field of study was electricity.

I think we need that same caliber of person going around the world, helping us make decisions about things like global climate change. I think that's why people like Bill Gates and Elon Musk are so important to us.

**PUF's Steve Mitnick:** Why would the average reader of *Public Utilities Fortnightly* want to read your book?

**Craig Roach:** I think it's a remarkable story, with major characters such as Franklin, Michael Faraday, Albert Einstein,



Rachel Carson, and Elon Musk. It involves major events, like the Revolutionary War, the Great Depression, the Second World War, and all the major scientific discoveries that we benefited from.

I think, too, that everyone in the energy business and outside the business is being bombarded by headline news on issues like global climate change and the shale gas revolution. Does nuclear power have a future? Does coal have a future? How can we get more renewables?

This book lays out the full context for making decisions about those issues. It's meant to be a detailed but totally objective study of all those issues.

Ultimately, I hope what it does is help all the executives and regulators in the electricity business make more informed and better decisions.

**PUF's Steve Mitnick:** Why did you put all this effort into writing a book?

**Craig Roach:** I think there really is a need for this kind of book. I haven't found another book that gives a comprehensive view of the electricity business, with all two hundred sixty-five years of history and all the factors that drive real-world events. And it is a book that provides a balanced discussion of the issues that is accessible to all readers. ❖

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# Conversation with Chris Kutarna

Co-Author of *Age of Discovery: Navigating the Risks and Rewards of Our New Renaissance*

BY PUF'S STEVE MITNICK, WITH CHRIS KUTARNA

**P**UF's Steve Mitnick: Please tell us how you came to predict the U.K.'s Brexit vote.

**Chris Kutarna:** Last year, I didn't get a lot of work done. I spent most of June and July explaining to people in North America why I had predicted Brexit.

Then I spent most of November and December explaining to people in the U.K. why I had predicted the election of President Trump. Both predictions, for me, came out of the same perspective, really the same source.

I applied the lens of my first book, "Age of Discovery" to the world we were living in, and tried to see what was going to happen in 2016. The thing that you look for, when you look at our present moment through the lens of history, and through the lens of the Renaissance, five hundred years ago, is social stresses.

The Renaissance was a moment of flourishing genius, of Leonardo and Michelangelo and Columbus and Copernicus. But it was also this moment of flourishing risk. There were dangerous ideas being spread by the printing press, and that yielded a Protestant Reformation that tore Europe in half.

There were populists who tapped a mood of public anxiety about this world that was changing before people's eyes. They were pointing to elites and comfortable leaders in society and saying, "They are to blame. It is their weak and corrupt leadership that just is not able to cope

with the kinds of changes we're going through now. That is to blame."

I was looking through that lens at our present day. I was asking myself, "Where's the analog today? Where are the stresses in our society, in our political systems, created by all of this rapid change around us?"

Where are the stresses that are being discounted, and being ignored, until they're impossible to ignore? When that's the question you're asking yourself, then you know, two months before Brexit, before that vote in the U.K., or six months before the U.S. presidential election, it's actually very easy to predict what the outcome will be.

The broad majority of people were saying, "This can't possibly happen." And because most people thought that way — thought that they could take for granted the stability of the status quo — that made



**I spent November and December explaining to people in the U.K. why I predicted the election of President Trump.**

shocks to the status quo even more likely. I really had mixed feelings about the outcome of the Brexit vote. I voted in that referendum. It didn't go the way that I wanted it to. Yet I also felt somehow justified, proven right, by the outcome.

For me personally, what those two correct predictions last year did was to give me powerful, personal proof that in a time of rapid change and great uncertainty, finding the right perspective to make sense of events is the most important thing.

What is the broad story we're telling ourselves? What is the broad picture that

**Chris Kutarna** is a Fellow at the Oxford Martin School and an expert on international politics and economics. He was a strategy consultant at the Boston Consulting Group and continues to advise senior executives in Asia, North America and Europe.



we see when we look out at the world? Because that broad idea, that's going to determine what signals we focus on, and what signals we ignore. And I think that's why, despite all the social stresses that were right in front of people, that's why most people were shocked by Brexit, and were shocked by Trump's election.

In hindsight, it all makes sense. We see these stresses clearly now. But looking forward, most people were deleting many important signals, and focusing only on the ones they were familiar with.

That can't work. When the world is changing so quickly, we can't expect last year's perspective to be a reliable guide to the future. I think that 2016 helped us all to understand that. We do need to update our mental maps, regularly, if we're going to navigate the time we live in.

**PUF's Steve Mitnick:** Can you bring some of your perspective about the discontinuities during the Renaissance, to the present day?

**Chris Kutarna:** In my undergraduate days, I was an intern at the Canadian Embassy in D.C., working for the secretary of energy. So, I had the good fortune to build some interesting relationships in the energy industry.

Also, it's a gift to have a bit of historical perspective on the industry. You talk now about the changes that the industry is going through. But I remember in 1996, 1997, going to Capitol Hill on behalf of the Canadian government, and taking notes on the deregulation hearings that were taking place.

There was a giant change twenty years ago. You have my sympathies! It's been an exciting and challenging couple of decades. It's been wonderful over the last year to have the opportunity to renew some old friendships with the U.S. electric industry.

**PUF's Steve Mitnick:** Are there lessons that the energy industry can take from the wisdom that we gained five hundred years ago in the Renaissance?

**Chris Kutarna:** In thinking about that question, I can't help but think about Christopher Columbus and his discovery of the new world. That is a pretty good metaphor for what's in front of the energy industry. Leadership in this industry now, so much of it seems to be about setting out on brave voyages whose outcome is unknown, right?

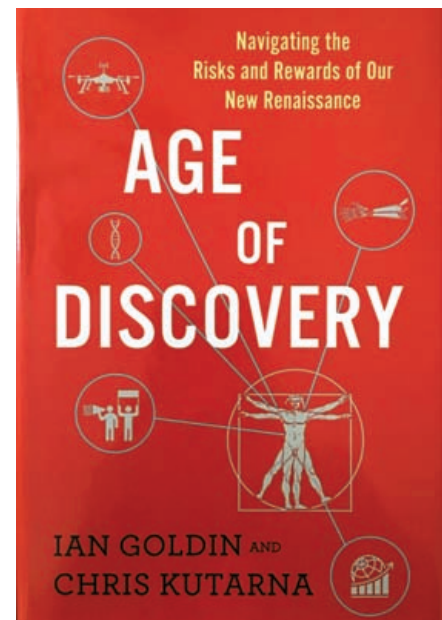
That's exactly what Columbus had to do. Find the best history of Christopher Columbus and page through that book, because I imagine that captains of the energy industry today would find it relevant, nodding their heads a lot as they looked at his story. (To understand Columbus, I recommend *Admiral of the Open Sea*, by Samuel Eliot Morison.)

I've never worked in the energy industry, so I don't know the industry the way someone who works in it has. But I have a broad perspective on how I imagine it is inside the industry now.

## The most critical issue we need the government to decide on is a price for carbon. That's better than having governments subsidize technologies.

I imagine one of the challenges is a kind of culture clash. The clash is between a traditional idea of the industry, which is making investments with very long-time horizons where reliability is one of the most important virtues, and a business and opportunity environment where it seems there's a very different set of leadership skills that are being called upon to thrive. People are now more heavily incentivized to be long term risk-averse.

There are many industries today that are struggling to learn how to "fail fast" and have a "rapid prototype" culture – all of those buzz words. But perhaps



nowhere is the culture clash more difficult than in infrastructure, in utility industries.

Think about it. When Columbus was setting sail, captains had already been sailing the Mediterranean for two thousand years. A whole generation of captains was already sailing down the Coast of Africa into the Indian Ocean.

These were well-established trade routes. Along these routes, being a good captain meant following existing navigation charts meticulously, managing risk, knowing where the pirates were, knowing where the shoals were. And being a very good follower of the accumulated wisdom of many other voyages.

Columbus, though, needed a very different leadership style, which was to say, "Forget about that. I know I can do what's been done. I'm just going to point the bow of my ship westward and let's see what happens." I imagine that he probably also selected a crew that was willing to take that gamble with him.

That's probably one of the first and most basic parallels. What the electricity industry today must think about is: we need different cultures. We need different groups to navigate different voyages.

The trade routes along the Mediterranean and the African coast – they're still hugely important. But if we also want to

embark on voyages of discovery, we're going to need some crews that think differently, act differently, and are measured differently. Otherwise they're just not going to be suited to the task.

Modern energy leaders say, "We know we need to explore distributive generation and we need to work on our smart grid. We will think about how we're going to be less a utility and more of a platform to let customers do whatever they want to transact.

We're going to be the Airbnb of energy, and so on. But at the same time, we also need to maintain the legacy and the reliability. We can't just import startup culture wholesale like they do in Silicon Valley. Our challenge is greater than that."

Ferdinand and Isabella, who funded Columbus' voyage, understood that, and one of the ways they managed that risk is they sent off multiple voyages. They didn't bet the empire on Columbus.

I think making several small bets instead of one big bet has always been a good way to balance the very high risk of trying to discover a new world with the very high reward.

Now, one of the common problems we run into when we start up many different new projects, all of which might lead somewhere different, is we begin to lose sight of the broader narrative. We begin to start things up "just because."

The chief executives that win in this environment will be those who hold onto that broader narrative best. Again, I think of Columbus. As the captain of his ships, how does he maintain his crew's faith that this heading is not crazy. That spending another day, another week, another month going farther along a heading than has ever been sailed before is not suicide. He had a simple narrative. "We know the world is round, right? That means Asia (and her spices) lies not just to the East; it also lies to the West. And if we can be the ones to find that Western sea route, we'll all find tremendous profit." That was the

big picture that people were holding on to.

Now it ended up that Columbus didn't find those spices. Instead, he found something else, something very different that in the long run ended up being much more valuable. That probably will happen again today. Wherever we end up, it will not be where we think we're going.

The farther energy executives sail into unknown waters, the more voices there will be telling them to turn back. So, in addition to setting off on these startup voyages, you need to build and maintain a strong narrative about, "Why are we doing all this stuff?" to hold it all together, and to hold together investor confidence. Otherwise...well, on the high seas, mutiny happens.

## We can't just import startup culture wholesale like they do in Silicon Valley. Our challenge is greater than that.

**PUF's Steve Mitnick:** Do you cast out a lot of nets and hope for the best?

**Chris Kutarna:** You set sail and in front of you there's just blue ocean. Where do you go? Do you go anywhere? Do you zigzag? Do you go in circles? There's no map to tell you where you're going to. You don't know the destination. How do you navigate?

That's the question that every business is struggling with now. You look out at that blue ocean and there are these storms and there are hurricanes and it's a complex environment. I think that what successful businesses, really in any industry, are going to find is that when you set sail, it's not about trying to understand all the complexity, to absorb all the data.

We run into analysis paralysis when we're doing that. It's not about just sending ships everywhere, because then we

run out of resources. It's about setting a couple of smart rules, and navigating by those.

In Columbus's world, at that time, he had no way, no tool, to measure longitude at sea. It was really hard to know how far he had traveled. He set himself a smart rule that said, "I'm just going to sail west. We're going to sail toward the setting sun. What I know about the world that I do understand tells me that if there's something there, chances are I'm going to hit it, so let's do that."

Every industry is going to have the smart rules that cut through complexity for them, but I think that the successful businesses that cut through, they're going to find it now. We sit back, and we figure out there's a lot in the environment, on the horizon, that we don't understand, but what's a good rule?

Maybe it's that we're going to maximize customer empowerment. Maybe it's that we're going to maximize intelligence or the ability to understand what's on the grid, and what's being used for different things.

Again, different industries are going to figure out what it is, but you must craft those rules, just a couple of rules and say, "We're navigating by that. We don't know, so we've got to make bets," and no, it's not about trying everything.

The big bet is really deciding what's the rule that we're going to navigate by. You live and die by that.

**PUF's Steve Mitnick:** What do you want to learn next or do next?

**Chris Kutarna:** That's a question that makes me smile. I feel to some extent like I have been in a writer's cave for the past five years writing this book (*Age of Discovery*) with Ian Goldin while also writing my doctoral thesis. I had two big reading and writing and research projects at the same time. Now that's done.

Here's another sort of lesson from five hundred years ago. When the maps of the world change, when barriers to

discovery fall, it's quite often business that does the first wave of brave exploration. Business leaders figure out what are the new roads and what are the right ways of getting there.

How can we bring back the treasures, the benefits, of these discoveries to everyone else and make it possible for other people to follow in our footsteps? Just think of what's happening on climate change, recognizing that we need to figure out how to decarbonize a lot of our energy generation and to electrify the economy.

You know, at a government level, we can set the stage. But it's really going to take a lot of individual and business enterprise activity, ingenuity, and risk-taking to build a pathway for the rest of society to follow us there.

We live in this rapidly changing world.

One thing we know for certain is that the maps that we carry around in our heads to navigate that world are becoming a little less useful every day as the real world changes.

## When the maps of the world change, it's quite often business that does the first wave of brave exploration.

History says that the business leaders are the chief cartographers of the new world. In my modest way, I think I want to take part in that. I think that one of the first things I need to do, having spent five years as a writer, is raise my digital IQ, get myself to Silicon Valley or another place, where a lot of the digital reconstruction of

society is happening and just understand it a bit more.

Five hundred years ago, if you wanted to become a leading artist in the Renaissance, you had to get yourself to Florence. That one city produced more famous artists than the rest of Europe combined. That's because although ideas flow everywhere and people can travel everywhere, the resources and the special skills and the special culture that generates innovation, tend to concentrate in specific places.

My next step is to find my Florence in the digital realm or the technological realm. Raise my digital IQ. Just be a student. Work someplace where I can learn a lot and then continue to think, "Okay, how can I help? How can I help be a cartographer of this new world we live in?" That's what's next for me. ❖

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## Brett Hauser

(Cont. from p. 8)

and then look at what's to be available in 2018-2019, it is pleasantly shocking to see all these models and makes that are going to be out there and be available.

If you look at the Tesla model 3, four hundred thousand people have signed up, and have put a thousand-dollar deposit down on that vehicle. When these vehicles are out there, and with high-powered charging, which is going from fifty kilowatts to over one-hundred-fifty in some cases, the industry is moving in the right direction. I think Porsche is three-hundred-twenty

kilowatts fast charging.

**PUF's Steve Mitnick:** What is your background, and how are you now leading the charge?

**Brett Hauser:** My background is in private equity. I was very involved with telematics and fleet management solutions for small to medium sized enterprises, companies that have fifty to five-hundred vehicles.

At the time, electric vehicles were just starting to be talked about. But after a successful stint in private equity and helping to roll some of these companies up together, I saw this opportunity for the future.

My son, who's now nine years old, was about two years old at the time. And for me it's about trying to leave the world in a better place.

Electrification of transportation is good for reducing greenhouse gas emissions and global warming, but it's also very relevant for energy independence and infrastructure and job creation.

And we're making a positive contribution to society. We're still in early days. There's still a lot of work to be done, but I have a passion to get us to this electrified transportation future. It will have societal and economic benefits across the globe. ❖

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What's top of mind for industry leaders Jim Torgerson, Ann Randazzo, Walt Haase, Paul Allen, Bob Catell, Kevin Fitzgerald, Sue Kelly, etc.? You'll see when you receive September's *Public Utilities Fortnightly* in about a fortnight from now.



Public Utilities Fortnightly Quant Services

# Monthly Summary Report: August 2017

BY STEVE MITNICK

Editor-in-Chief, Public Utilities Fortnightly

Author, "Lines Down: How We Pay, Use, Value Grid Electricity Amid the Storm"

Sections:

- I. PUF QS Electricity Value Index
- II. PUF QS Zero-Carbon Scorecard
- III. PUF QS Distributed Intermittent Metric

Public data from the U.S. Departments of Commerce, Energy, Housing and Urban Development, and Labor are available to anyone. But quant Steve Mitnick has been compiling components of these data that few noticed or used, years before he became PUF Editor-in-Chief, for unique insightful analyses about utility regulation and policy.

Now, with PUF QS, we provide these analyses to members of the PUF community with site licenses.

For further information, reach out to Joe Paparello, [paparello@fortnightly.com](mailto:paparello@fortnightly.com).



# I. PUF QS Electricity Value Index, August 2017

**E**lectric rates and bills generally increase over time. Sure. But the price of most goods and services, and what we pay for most goods and services over a month or year, generally increases.

Electricity in this regard is no different from any other good or service. There's inflation in our economy. There's growing income, averaged. And with growing income, there are growing consumer expenditures.

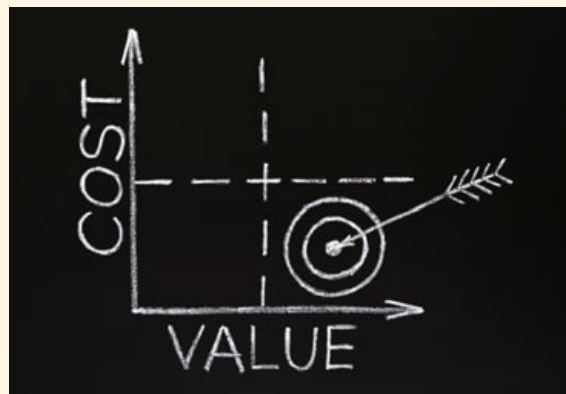
What counts to consumers, or should count, is the horse race. Which horse (good or service) is gaining ground on the others? Which is falling further behind?

Those goods and services that are gaining ground, in their consumer prices or payments, are becoming more expensive. Those falling further behind are becoming less expensive.

Some consumer costs have increased rapidly. Health care and college tuition are prime examples. Some costs have increased but at a slower pace, like housing. Or have decreased, like clothing.

In an economy like ours, with inflation, something becomes more expensive if its price increases faster than the price of everything, averaged. And with growing income and consumer expenditures, something becomes more expensive if what we pay over a month or year increases faster than what we pay for everything.

Let's see how electricity is doing in this horse race of prices and payments over time.



# CPI Electric Rates vs. CPI Inflation

To track the average price of the goods and service that American consumers buy, the U.S. Department of Labor calculates the Consumer Price Index.

There's a CPI for all the goods and services that consumers buy. And there's a CPI for categories of goods and services, including residential electric rates.

Compare the CPI for electric rates with the CPI for all goods and services. Doing so shows if electric rates are increasing faster or slower than the price of other things. And, therefore, it shows if electricity is becoming costlier or less costly to consumers.

The following percentages are easy to understand. 100% means the CPI for electric rates and the CPI for all goods and services increased at the same pace since the Labor Department's base period (the years 1982 through 1984). At 100%, electric rates aren't becoming costlier, and they aren't becoming less costly.

The lower that these percentages are, the slower the CPI for electric rates has risen as compared to the CPI for all goods and services. So, the lower these percentages are, the less costly electricity has become.

*Source: Bureau of Labor Statistics, U.S. Department of Labor. Public Utilities Fortnightly maintains a comprehensive historical and updated data base of the CPI for electric rates, the CPI for all goods and services, and our own analyses of these indices. Sixty-five years of monthly U.S. data. Forty years of monthly regional data.*

## CPI Electric Latest Month – U.S. (July 2017)

# 89.8%

Record High (June, August 1955): 106.7%

Record Low (May, June 2000): 74.3%

Year Earlier (July 2016): 89.0%

Two Years Earlier (July 2015): 90.7%

Five Years Earlier (July 2012): 88.7%

Ten Years Earlier (July 2007): 88.5%

## CPI Electric Latest Quarter – U.S. (Q2 2017): 86.6%

Record High (Q2, Q3 1955): 106.4%

Record Low (Q2 2000): 74.4%

Year Earlier (Q2 2016): 86.1%

Two Years Earlier (Q2 2015): 88.5%

Five Years Earlier (Q2 2012): 86.1%

Ten Years Earlier (Q2 2007): 84.4%

## CPI Electric Latest Year – U.S. (2016): 86.2%

Record High (1955): 106.2%

Record Low (2000): 74.6%

Year Earlier (2015): 88.3%

Two Years Earlier (2014): 87.9%

Five Years Earlier (July 2011): 87.5%

Ten Years Earlier (July 2006): 83.9%

## CPI Electric Latest Month - Northeast (July 2017): 79.0%

## CPI Electric Latest Month - South (July 2017): 83.3%

## CPI Electric Latest Month - Midwest (July 2017): 95.8%

## CPI Electric Latest Month - West (July 2017): 112.9%



# Electric Bills' Share of Consumer Expenditures

The U.S. Department of Commerce calculates the Gross Domestic Product. Since consumer expenditures are around seventy percent of the GDP, the Commerce Department tracks consumer expenditures in extraordinary detail.

The following percentages are easy to understand. 2% means that one-fiftieth of consumer expenditures goes to pay electric bills. 1% means that one-hundredth of consumer expenditures goes to pay electric bills.

The lower these percentages are, the smaller is electricity's share of consumers' budgets. And the larger is the share of consumers' budgets for all other goods and services.

So, the lower these percentages are, the less costly electricity has become. And the wealthier that consumers have become.

## Electricity Share Latest Month – U.S. (June 2017)

# 1.34%

Record High (June 1981): 2.53%

Record Low (February 2017): 1.22%

Year Earlier (June 2016): 1.41%

Two Years Earlier (June 2015): 1.43%

Five Years Earlier (June 2012): 1.51%

Ten Years Earlier (June 2007): 1.49%

## Electricity Share Latest Quarter – U.S. (Q2 2017): 1.35%

Record High (Q3 1983): 2.37%

Record Low (Q1 2017): 1.28%

Year Earlier (Q2 2016): 1.37%

Two Years Earlier (Q2 2015): 1.43%

Five Years Earlier (Q2 2012): 1.52%

Ten Years Earlier (Q2 2007): 1.51%

## Electricity Share Latest Year – U.S. (2016): 1.38%

Record High (1982): 2.27%

Record Low (2016): 1.39%

Year Earlier (2015): 1.44%

Two Years Earlier (2014): 1.49%

Five Years Earlier (2011): 1.56%

Ten Years Earlier (2006): 1.51%



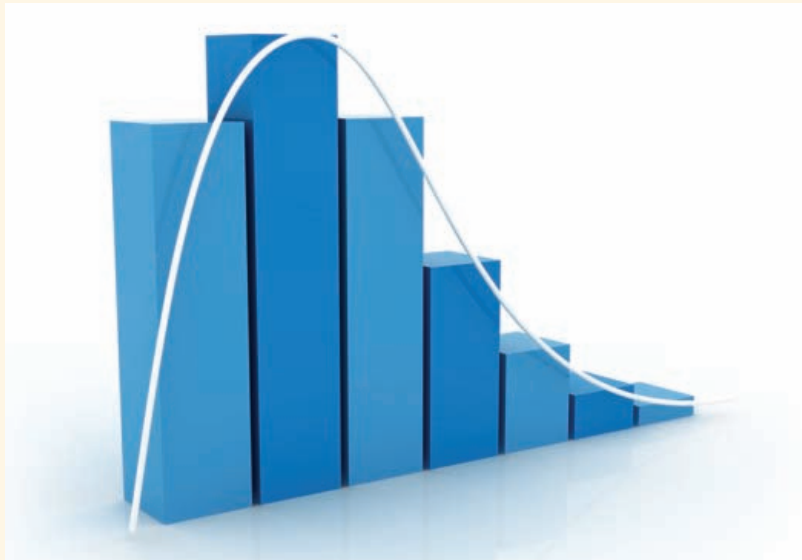
Source: Bureau of Economic Analysis, U.S. Department of Commerce. Public Utilities Fortnightly maintains a comprehensive historical and updated data base of consumer expenditures, and our own analyses of the data. Fifty-eight years of monthly data.

## II. PUF QS Zero-Carbon Scorecard, August 2017

**M**any Americans want their electricity to be low-carbon (emitting little carbon dioxide when the electricity is produced). Some go further; they want their electricity to be zero-carbon.

The industry, responding, is moving to the green grid. It's growing the zero-carbon share of the total. From hydro, nuclear, solar, wind, and other methods of manufacturing electricity that don't emit carbon dioxide. And it's pruning back the high-carbon share of generation, from coal.

How's it going, this gardening of the green grid? Let's see.



# Zero-Carbon's Share of Grid Generation

The U.S. Department of Energy tracks in extraordinary detail the origin of the grid's electricity. Each month, it publishes total electric generation and the breakdown by manufacturing method.

Some of these methods emit carbon dioxide. Coal, natural gas, other gases, petroleum. Some don't. Net. Geothermal, hydro, nuclear, solar, waste, wind, wood.

The Scorecard adds the amount of the grid's electricity produced by the zero-carbon methods. And then calculates their share of all grid electricity.

The following percentages are easy to understand. 25.0% would mean that a quarter of the grid's electricity is zero-carbon. The U.S. grid hit and surpassed 40.0% zero-carbon for the first time in March 2016. At 40.0%, four of every ten kilowatt-hours produced by the grid didn't emit carbon dioxide.

## Zero-Carbon Latest Month (May 2017)

# 39.6%

Record High (March 2017): 41.6%

Record Low (September 1973): 16.2%

Year Earlier (May 2016): 36.5%

Two Years Earlier (May 2015): 34.7%

Five Years Earlier (May 2012): 32.6%

Ten Years Earlier (May 2007): 30.1%

## Zero-Carbon Latest Quarter (Q1 2017): 40.4%

Record High (Q1 2017): 40.4%

Record Low (Q3 1973): 16.6%

Year Earlier (Q1 2016): 38.1%

Two Years Earlier (Q1 2015): 33.6%

Five Years Earlier (Q1 2012): 33.9%

Ten Years Earlier (Q1 2007): 29.9%

## Zero-Carbon Latest Year (2016): 35.1%

Record High (2016): 35.1%

Record Low (1973): 19.5%

Year Earlier (2015): 33.1%

Two Years Earlier (2014): 32.8%

Five Years Earlier (2011): 31.8%

Ten Years Earlier (2006): 28.9%





# Hydro's, Nuclear's, Solar's, Wind's Share of Grid Generation

Here we show the shares of the grid's electricity by four major zero-carbon methods: hydro, nuclear, solar, wind.

The grid's solar and wind are rapidly growing. And, so, their latest numbers are typically record highs or nearly so. Nuclear has maintained a share near its record high for over two decades. Hydro, on the other hand, has been well below its record high in recent decades.



**Hydro Latest Month (May 2017): 9.9%**

Record High (April 1974): 19.8%

Record Low (September 2007): 4.1%

**Nuclear Latest Month (May 2017): 18.9%**

Record High (January 1995): 22.6%

Record Low (January, May 1973): 3.9%

**Solar Latest Month (May 2017): 2.6%**

Record High (May 2017): 2.6%

Record Low (all but six months before March 2012): 0.0%

**Wind Latest Month (May 2017): 6.9%**

Record High (April 2017): 8.7%

Record Low (most months before January 1998): 0.0%

## Coal's Share of Grid Generation

Here we show the share of the grid's electricity by the major high-carbon method, coal. Its share has been at or near a record low in recent years. And around half of its record high set in the 1980's.

**Coal Latest Month (May 2017)**

# 28.8%

Record High (January 1986): 59.8%

Record Low (March 2016): 23.7%

*Source: Energy Information Administration, U.S. Department of Energy. Public Utilities Fortnightly maintains a comprehensive historical and updated data base of grid generation by method, and our own analyses of these indices. Forty-four years of monthly data.*

## III. PUF QS Distributed Intermittent Metric, August 2017

**T**he pages of Public Utilities Fortnightly and discussions generally in the utilities industry often address the growth in distributed and intermittent electric generation and its implications. But how rapid is this growth? And is the pace increasing or decreasing? The answers to these questions can dictate utility strategies and regulatory policies.

The nation's electricity supply, particularly beyond the state of California, remains overwhelmingly grid-scale, more than ninety-nine percent. California distributed generation, alone, is over four-tenths of that narrow one-percent slice.

However, intermittent (weather-dictated) generation can be and is most frequently grid-scale. As a result, while the nation's electricity supply remains mostly dispatchable, nearly ten percent is now wind and solar photovoltaic, and intermittent.



# Distributed Generation's Share of Grid and Distributed Generation

The U.S. Department of Energy tracks in extraordinary detail the origin of the grid's electricity, as stated earlier. Each month, it publishes total electric generation and the breakdown by manufacturing method. Recently, the Energy Department started publishing data on distributed generation to supplement its data on grid-scale generation.

This metric is the percentage of all electricity generation, grid-scale and distributed generation, that is attributable to distributed generation.

The following percentages are easy to understand. 0.5% means that one out of every two hundred kilowatt-hours of our nation's electricity are produced by distributed generation (mainly residential, commercial and industrial solar photovoltaic). When the percentage reaches 1.0% in the next few years, this would mean that one out of every one hundred kilowatt-hours are produced by distributed generation.

## Distributed Latest Month (May 2017)

# 0.8%

Record High (May 2017): 0.8%

Year Earlier (May 2016): 0.6%

Two Years Earlier (May 2015): 0.4%

## Distributed Latest Quarter (Q1 2017): 0.5%

Record High (Q2 2016): 0.6%

Year Earlier (Q1 2016): 0.4%

Two Years Earlier (Q1 2015): 0.3%

## Distributed Latest Year (2016): 0.5%

Record High (2016): 0.5%

Year Earlier (2015): 0.3%

Two Years Earlier (2014): 0.3%

**Residential Distributed Latest Month (May 2017): 0.4%**

**Commercial Distributed Latest Month (May 2017): 0.2%**

**Industrial Distributed Latest Month (May 2017): 0.1%**



# Intermittent Generation's Share of Grid and Distributed Generation

The U.S. Department of Energy tracks in extraordinary detail the origin of the grid's electricity, as stated earlier. Each month, it publishes total electric generation and the breakdown by manufacturing method. Recently, the Energy Department started publishing data on distributed intermittent generation to supplement its data on grid-scale generation.

This metric adds the generation from grid-scale wind and grid-scale solar photovoltaic and from distributed generation solar photovoltaic. Distributed generation wind is presently at a relatively insignificant level.

The following percentages are easy to understand. 10.0% means that one out of every ten kilowatt-hours of our nation's electricity are produced by intermittent generation (mainly residential, commercial and industrial solar photovoltaic). When the percentage reaches 20.0% in the future, this would mean that one out of every one five kilowatt-hours are produced by distributed generation.

## Intermittent Latest Month (May 2017)

# 9.5%

Record High (April 2017): 11.0%

Year Earlier (May 2016): 7.6%

Two Years Earlier (May 2015): 6.5%

## Intermittent Latest Quarter (Q1 2017): 8.6%

Record High (Q1 2017): 8.6%

Year Earlier (Q1 2016): 7.2%

Two Years Earlier (Q1 2015): 5.1%

## Intermittent Latest Year (2016): 6.8%

Record High (2016): 6.8%

Year Earlier (2015): 5.5%

Two Years Earlier (2014): 5.1%

*Source: Energy Information Administration, U.S. Department of Energy. Public Utilities Fortnightly maintains a comprehensive historical and updated data base of generation by method, and our own analyses of these indices. Forty-four years of monthly data for grid generation and three years for distributed generation. The Energy Department started collecting distributed generation data in 2014.*

# NARUC Summer Policy Summit

One of the most important gatherings of the year on utility regulation and policy, NARUC's summer meeting, took place in San Diego on July 16 - 19. NARUC president Rob Powelson, confirmed by the U.S. Senate less than three weeks later to join FERC, led a conference jam-packed with speakers, panels, committee meetings and hallway debates on the industry's biggest challenges. Check out these compelling clips of the CEOs of Dominion, Com Edison, American Water, PG&E, Sunrun and GE Power, and of two speakers at the Critical Consumer Issues Forum session on smart cities.



Tom Farrell, CEO, Dominion Resources



Anne Pramaggiore, CEO, Commonwealth Edison



Susan Story, CEO, American Water



Geisha Williams, CEO, PG&E



Lynn Jurich, CEO, Sunrun



Russell Stokes, CEO, GE Power



David Graham, City of San Diego



Commissioner Mary-Anna Holden, New Jersey Board of Public Utility Commissioners

# House Grid Innovation Expo

And they say Congress never accomplishes anything. Not so! On July 25, the U.S. House of Representatives hosted an exposition of leading-edge breakthroughs in grid technologies. Specifically the House Grid Innovation Caucus co-chaired by Congressmen Bob Latta, an Ohio Republican, and Jerry McNerney, a California Democrat. Wow, Republicans and Democrats working together! Catch here the clips of innovative happenings at Siemens, Xcel Energy, PG&E, Southern Cal Edison, Centerpoint and AEP.



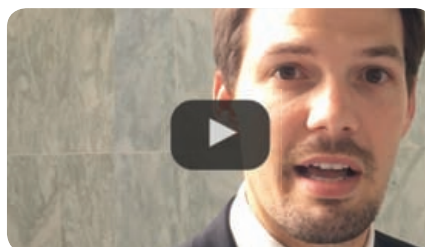
**Farel Becker, Product Manager - Smart Substation Automation, Siemens**



**Dan Lysaker, Senior Grid Modernization Engineer - Advanced Grid Intelligence and Security, Xcel Energy**



**Tom Martin, Manager - Grid of Things, Grid Integration and Innovation, Pacific Gas and Electric**



**Eric Nunnally, Engineering Manager - Grid Modernization, Southern California Edison**



**Timothy Raines, Senior Transmission Accounts Consultant, CenterPoint Energy**



**Ram Sastry, Vice President - Infrastructure & Business Continuity, American Electric Power**



# SEPA Grid Evolution Summit

It was a busy week in sultry mid-summer Washington. The next day found us at SEPA's massive conference on grid evolution. Or revolution? SEPA's CEO opened with her "state of the state" address as if she was governor of a 51st state that had re-imagined the grid. And then there was a steady stream of thought-provoking panels. Couldn't help ourselves. Took a ton of video clips, as you can see for yourself. Including of leading regulators, consumer advocates, Capitol Hill movers and shakers, and technology exhibitors.



Julia Hamm, CEO, SEPA



Congressman Paul Tonko (D-NY)



President Michael Picker, California PUC



Commissioner Travis Kavulla, Vice Chairman,  
Montana Public Service Commission



Commissioner Doug Little, Arizona Corporation  
Commission



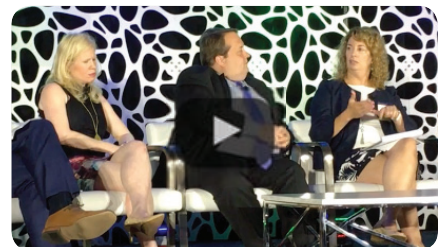
Tom Hassenboehler, Chief Counsel, US House  
Committee on Energy and Commerce



Rick Kessler, Senior Advisor, US House  
Committee on Energy and Commerce



John Kliem, Executive Director - Resilient  
Energy Program, Department of the Navy



Elin Swanson Katz, Connecticut Consumer  
Counsel



Michelle Patron, Director of Sustainability  
Policy, Microsoft



Mark Goody, Manager - Electric Vehicle  
Programs, fleetcarma



Vicki Trees, Director - Marketing  
Communication, Landis + Gyr



# USEA Supply Forum

If it's Tuesday, this must be Belgium. The next day (Thursday actually) featured a doubleheader in DC, starting with a conference of the United States Energy Association. What a lineup! We took video of two heavy hitters. Congressman Joe Barton, the Texas Republican and Vice-Chairman of the Energy and Commerce Committee. And Vince DeVito, Counselor to the Secretary of the Interior, for Energy Policy. Notably, DeVito authored an article in an issue of *Public Utilities Fortnightly* last year. Clearly, publishing in PUF is a smart career move.



Congressman Joe Barton (R-TX), Vice Chairman, US House of Representatives Energy and Commerce Committee



Vincent DeVito, Counselor for Energy Policy, US Department of the Interior



Barry Worthington, Executive Director, USEA

# Natural Gas Roundtable Luncheon

Needed to duck out of the USEA Supply Forum to get to the Natural Gas Roundtable luncheon taking place that same day, July 27. Diane Leopold of Dominion was the guest speaker. She's both CEO of Dominion's gigantic Gas Infrastructure Group and Chairman of the Interstate Natural Gas Association of America. One of the leading voices on the need to modernize the nation's natural gas network, she's passionate on the topic in these video clips.



Talking about natural gas, *Public Utilities Fortnightly* will be highlighting, in the next few issues, the humongous World Gas Conference that will take place in Washington D.C. next summer. Everybody who's anybody in gas globally will be there.

October's PUF will feature an interview with David Carroll, president of the International Gas Union. November's PUF will feature an interview with Dave McCurdy, CEO of the American Gas Association.

The last time the World Gas Conference, held triennially, was held in the U.S. was in 1988. Ronald Reagan was still president!

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# Tapping Nostalgia for Insight and Inspiration

## Powerful Impressions from the 1964 World's Fair

BY ROGER WOODWORTH

**M**y maternal grandparents met across an alley just off Jamaica Avenue in Queens, New York. Mom grew up in the same place. She met Dad at a USO dance. He was stationed at nearby Fort Totten, to help operate the so-called “steel ring” defense system around the city.

One of his army buddies and good friend to this day was John Bundrant. John went on to be an engineer for Public Service Company of New Mexico, retiring in 1988 as president and chief operating officer of electric operations. It's a small world, after all.

The two army buddies worked a gun battalion in Flushing Meadows Park, site of World Fairs in 1939-40 and 1964-65. I came along in time to experience the second one at age nine. The Fair theme was “Peace through Understanding.” Indeed.

### Carousel of Progress

Thanks to Walt Disney, audio-animatronics were prominently featured at the '64 Fair. The Small World exhibit debuted then and has persisted since. Who hasn't floated through the international mix of singing dolls? Or had that song stuck in your head?

The Illinois Pavilion was also memorable. There, a life-like Abraham Lincoln rose from a chair to address the crowd. The eloquence of his words left all in awe.

With GE's generous sponsorship, Disney also crafted the Carousel of Progress.

**Roger Woodworth**, principal consultant at Mindset Matters, helps others align strategies for greater impact. Previously he was vice president and chief strategy officer of Avista Corp. He's chaired Edison Electric Institute's customer service executive advisory committee and was board president of the National Hydropower Association and the Northwest Gas Association.

The production showed the ways electricity has improved life. The audience follows a family from era to era, starting in 1880. An apropos song, “There's a Great Big Beautiful Tomorrow” helps tie the scenes together.

In a span of twenty minutes, audiences witnessed dozens of technological wonders that reliable, affordable energy have enabled. The progress went from lights and radio to ovens, refrigeration, and washing machines, to then-imagined automation.

Literally millions of people have enjoyed the experience. And then it was gone.

Well, not quite gone. The Carousel of Progress attraction was re-opened at Disneyland in 1967. It's been revised from time to time and remains an attraction at Disney World to this day. But GE's sponsorship ended in 1985, in part due to patterns of attendance that showed limited new exposure.



**The story of electric-enabled progress is timeless. It's the story all electric power providers need to keep front and center.**

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### What If?

It would be easy to dismiss the Carousel as past its prime. Yet, the story of electric-enabled progress is timeless. It's the kind of story all electric power providers need to keep front and center with customers, and themselves.

We all know our industry's relevance depends on broad understanding and appreciation for what power provides. Absent this, we're relegated to commodity status perceived as barely a blip in the constellation of value. Rather than fret or concede this fate, how might we act together to elevate this important story, our story?

As one idea, why not team with Disney to leverage Walt's creation into something more? What if we committed to refresh the Carousel and promote it widely? Better yet, what if we applied today's technology to virtualize the Carousel? We could make it an interactive experience and accessible via Internet to billions worldwide.

### The Brightest Show on Earth

We've done it before; that is, we've teamed-up as an industry to tell our story widely. But it has been a while. Last time was during that same 1964 World's Fair with the Tower of Light pavilion.

Imagine twelve one-billion candle-power searchlights shining on a forest of six hundred staggered, aluminum-faced prisms rising to a peak more than a hundred feet. A rainbow of colors bounces off of the specially-treated metal surface.

Imagine people riding swivel seats on a grand turntable, moving them through an eight-chambered theater within the structure. The musical show they experience features audio-animatronic figures led by Reddy Kilowatt and "Uncle" Ben Franklin, telling the story of electricity and the wonders of its benefits.

Imagine one hundred fifty investor-owned electric utility companies volunteering support for this nine-million-dollar effort (seventy-one million in today's

dollars). And imagine widespread positive publicity for sharing the story of technological progress and free enterprise that electricity enables.

No need to imagine; all of this actually happened.

## The effort staked utilities' claim as champions for technological progress and free enterprise.

### How Did We Do That?

Like most things, there was first an instigator, then champions, followed by many supporters.

Kinsey Robinson, then-president of Washington Water Power (now Avista), a three-time winner of the Edison Award, prompted the Edison Electric Institute to organize a World's Fair Committee.

Ernest Acker, then-chair of Central Hudson Gas & Electric Corporation board and past president of EEI, was invited to lead the group. The Committee hosted meetings in New York, Atlanta, Los Angeles, Spokane, Chicago, Cleveland and Boston to invite others to join the effort.

Electric Power & Light Exhibit, Inc., with Garland Landrith as general manager, was founded to coordinate all

aspects of the effort. The Fair site was reserved in 1960. And the Committee screened about a dozen design firms for the project.

"Their objective was an imaginative team to represent an integrated industry story," according to Mr. Landrith. Robinson-Capsis-Stern Associates won the project. Ceremonial ground-breaking was in September of 1962. Seventeen months later, the exhibit was ready to receive visitors from around the world.

Mr. Landrith attributed wide-spread, favorable publicity for "...the extensive activities of the sponsoring companies throughout the country... creating interest in their areas." In other words, the effort was coordinated and cooperative, nation-wide.

### Closing Thoughts

Nostalgia is about fond and wistful memories. Certainly 1964 was a more complicated and challenging time than my younger self understood. Still, in retrospect, the Tower of Light collaboration stands out for good reason.

The effort staked utilities' claim as champions for technological progress and free enterprise. We made good and lasting impressions by telling our own story.

We could stand to do more of that, again, soon. ❖

Germany, Japan and other nations have set aggressive goals for the percent of their electric generation that will be provided by renewable sources. Many want the U.S. to emulate the path these nations have chosen.

The U.S. has a big advantage. We have far greater renewable potential, such as wind in the Great Plains and solar in the desert southwest.

But the U.S. has a big disadvantage too. Relative to countries like Germany and Japan, our land area is immense. Our electric grids cover huge regions. Our greatest load centers are distant geographically and electrically from where our greatest wind and solar farms are.

The distance between Hokkaido, the northern Japanese island with significant wind potential, and Tokyo is around five hundred miles. The distance between the Great Plains and the populous Washington-New York corridor is around twelve hundred miles.



# Sharon Allan a Likely Top Forty Innovator

**W**e received this nomination for the Fortnightly Top Forty Innovators, for Sharon Allan, chief innovation officer for the Smart Electric Power Alliance.

“A familiar name in the public power sector, Sharon has long been recognized for her visionary leadership in development of the North American smart meter market as well as her tenacious advocacy of grid-modernization technology and policy. An industry reporter once likened Sharon to the unsinkable Molly Brown on six cups of coffee.

Under Sharon’s leadership during this past year, the Smart Grid Interoperability Panel team was entrusted by the U.S. Department of Energy to support four of the Grid Modernization Lab Consortium projects. Now, the team is working with multiple national labs and industry representatives to execute on these initiatives.

To help make solar deployments more affordable, Sharon’s team has been spearheading industry participation in the DOE OrangeButton program, which reduces the transaction costs between companies in the solar value chain by standardizing data interfaces...

Today’s systems remain separated by silos, with meter data going to AMI systems, SCADA data to SCADA systems, load control devices to load control systems and so on. This has resulted in much system-to-system integration, plus it requires monitoring and the occasional round-trip as data travels from the field to the enterprise and back to the field again.



**An industry reporter once likened Sharon to the unsinkable Molly Brown on six cups of coffee.**

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OpenFMB facilitates data exchanges closer to the edge of the grid and will thereby enable a more distributed approach to grid management.

Through this past year, Sharon also has supported industry collaboration by bringing utilities together to discuss and chart out their changing system requirements as they face increasingly high penetrations of DERs. She has been leading an effort aimed at helping utilities identify and unify their requirements so that an open dialogue can be had with the industry players who must design technology to meet utility needs.” Nomination by Betsy Loeff.

Seems to us that Sharon is a likely Top Forty Innovator. In November’s PUF, we’ve announced, we’ll publish our new annual list, the Fortnightly Top Forty Innovators.

As we’ve said, everyone making the Top Forty will have distinguished



themselves during the last year, serving the public interest. Invented costless clean electricity generation? That would do it.

Or you could have developed or advanced the adoption of a technology, application, method, regulatory approach, or public policy that has the potential to serve the public interest. Understanding that such projects are predominantly the product of groups of people, rather than lone wolves like Nikola Tesla, a nominee can be an organizational or project leader that urged and stirred action and achievement.

The Top Forty issue in November will be a big deal. Interviews. Photos. Audio. Video. It will highlight some of the most outstanding leaders in our field. Like – perhaps – Sharon Allan. ♦

# A Lot of Hearings: Our Longest Serving Commissioners

BY STEVE MITNICK, EDITOR-IN-CHIEF

**F**orty-three of the hundred ninety-two state utility commissioners have served since the summer of 2010, or longer. So, twenty-two percent of the current commissioners have served at least seven years.

Two have served since January 1989. That's twenty-nine years. Wow. Twenty-nine years means a whole lot of regulatory hearings.

I only counted commissioners from full members of NARUC. Sorry to my friends on the commissions of Guam, New Orleans, Puerto Rico, Virgin Islands, etc. And I rounded up or down to the nearest number of years of service.

I left off the list Commissioner and NARUC President Rob Powelson. He was in his ninth year on the Pennsylvania Public Utility Commission, a string of years now interrupted by his U.S. Senate confirmation a couple of weeks ago to a term at FERC.

Here's the honor roll of longest-serving commissioners:

**29 years:** Bob Anthony, Oklahoma Corporation Commission; Frank E. Landis, Jr., Nebraska Public Service Commission.

**27 years:** David E. Ziegner, Indiana Utility Regulatory Commission.

**25 years:** Rod Johnson, Nebraska Public Service Commission.

**22 years:** Stan Wise, Georgia Public Service Commission.

**20 years:** John W. Betkoski III, Connecticut Public Utilities Regulatory Authority.

**16 years:** Joann T. Conaway, Delaware Public Service Commission.

**15 years:** Foster L. Campbell, Louisiana Public Service Commission; Gary W. Hanson, South Dakota Public Utilities Commission; Harold D. Williams, Maryland Public Service Commission; Doug Everett, Georgia Public Service Commission.

**14 years:** Mark C. Christie, Virginia State Corporation Commission.

**13 years:** Lambert C. Boissiere, III, Louisiana Public Service Commission; Elizabeth B. Fleming, G. O'Neal Hamilton, John E. Howard, South Carolina Public Service Commission.

**12 years:** Joseph L. Fiordaliso, New Jersey Board of Public Utilities; Judith W. Jagdmann, Virginia State Corporation Commission; Dallas Winslow, Delaware Public Service Commission.

**11 years:** Michael A. Albert, Public Service Commission of West Virginia; Chuck Eaton, Georgia Public Service Commission; Edward S. Finley, Jr., North Carolina Utilities Commission; Tim Schram, Nebraska Public Service Commission; Janice W. Wilson, Regulatory Commission of Alaska.

**10 years:** Betty Ann Kane, Public Service Commission of the District of Columbia; Brandon Presley, Mississippi Public Service Commission.

**9 years:** Kenneth W. Anderson, Jr., Public Utility Commission of Texas; Bryan E. Beatty, North Carolina Utilities Commission; Robin Sessions Cooley, Wyoming Public Service Commission; James C. Dimitri, Virginia State Corporation Commission; Lauren "Bubba" McDonald, Jr., Georgia Public Service Commission; Dana Murphy, Oklahoma Corporation Commission; Robert Pickett, Regulatory Commission of Alaska; Eric F. Skrmetta, Louisiana Public Service Commission; Swain E. Whitfield, South Carolina Public Service Commission.

**8 years:** ToNola D. Brown-Bland, North Carolina Utilities Commission; Kenneth C. Hill, Tennessee Public Service Commission.

**7 years:** Ronald A. Brise, Florida Public Service Commission; Twinkle Andress Cavanaugh, Alabama Public Service Commission; John F. Coleman, Jr., Pennsylvania Public Utility Commission; Art Graham, Florida Public Service Commission; Nikki M. Hall, South Carolina Public Service Commission. ♦

# FORTNIGHTLY TOP FORTY INNOVATORS

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Nominate for This November's Fortnightly Top Forty Innovators

Name of nominee for the 2017 Fortnightly Top Forty:

Nominee's organization:

Nominee's innovations (introduced, improved, implemented):

Optional: Nominee team members deserving of a shout-out:

Optional: Nominator's name and contact info (or anonymous):



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