PUBLIC UTILITIES FORTNIGHTLY

PUF 2.0

JUNE 15, 2017

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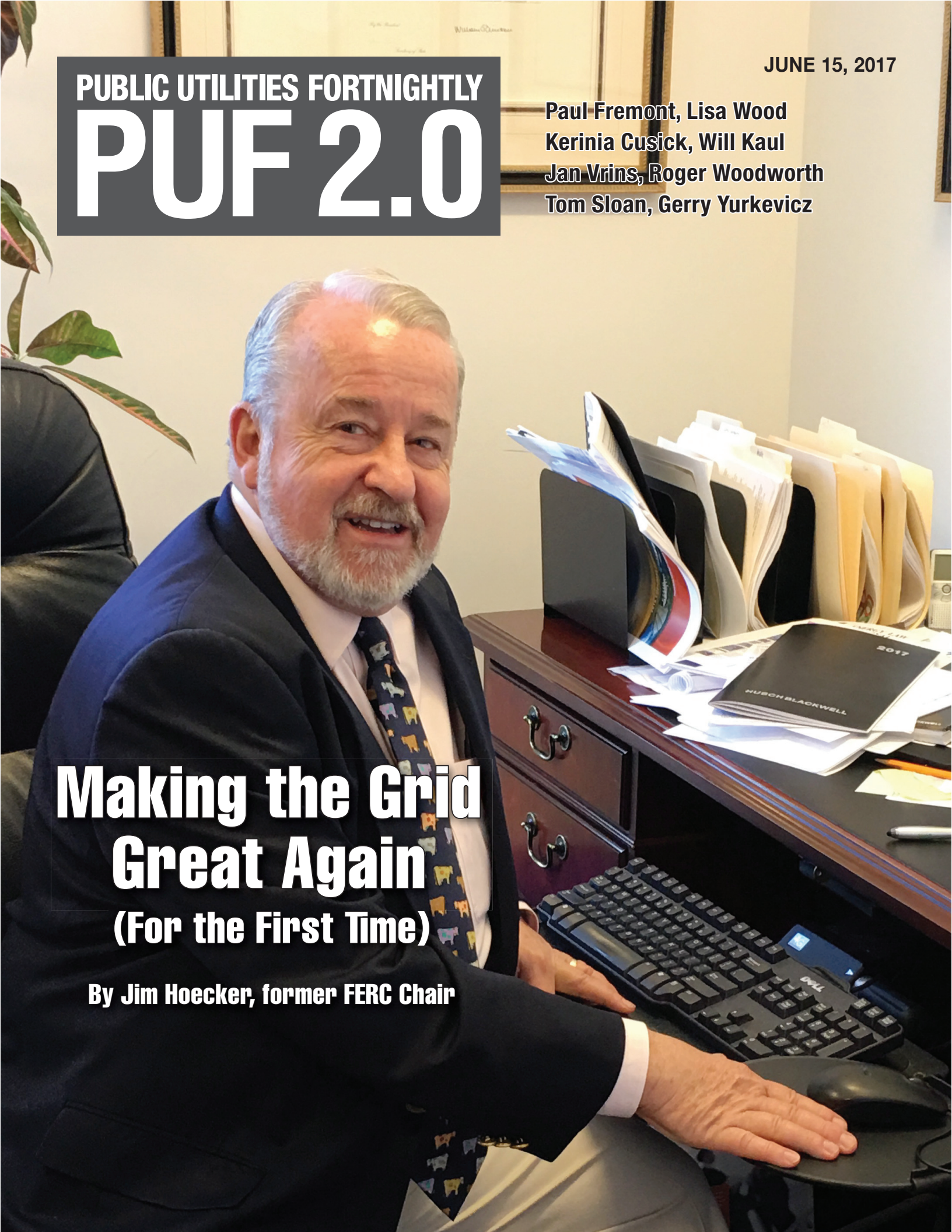


Making the Grid Great Again

(For the First Time)

By Jim Hoecker, former FERC Chair

In PUF, Impact the Debate

PUBLIC UTILITIES FORTNIGHTLY
PUF 2.0

Inaugural Issue

June 15, 2017 • Volume 1, No. 1

Cover photo: Former FERC Chairman Jim Hoecker. Photographer: PUF Staff

Innovate Thyself

PUF Transforms, Expands, Multiplies

BY STEVE MITNICK

If you word-search the pages of *Public Utilities Fortnightly* for the verb innovate and its various forms, you'll get plenty of hits. In our industry, among others, innovating is what you should do, or must do, or are doing. Innovate or die.

From Latin, novus is new, novare is make new, and innovare is renew. Utilities, responding to digital developments, disruption from competitors, and demands from customers, are revved up to renew.

And so are we. Our company, Public Utilities Reports, was founded by some of the leading innovators of their day, Owen Young and top utility execs and regulators, in 1914. That was a hundred and three years ago. Sheesh!

Our magazine, *Public Utilities Fortnightly*, was founded fourteen years later. The new President of the United States, Herbert Hoover, did not yet know his term was destined to have an unhappy ending. That was eighty-nine years ago, a good long while for sure. It's past time. Let's innovate!

To innovate successfully, you need to know what you're about. Essentially, *Public Utilities Fortnightly* is about impacting the debate. Utility regulation and policy

Utility regulation and policy have been and will be hotly contested. PUF is the forum to have at it.

have been and will be hotly contested. PUF is the forum to have at it.

Or, as in the Romeo and Juliet fight between the Capulets and Montagues, "have at thee, coward!" Though debates within the pages of PUF should be more civil.

So PUF is transforming, expanding and multiplying. We do this with a singular purpose, to further empower the best thinkers on utility regulation and policy to impact the debate.

We're transforming. We've introduced PUF AV. The AV stands for audio and video. You can make your point with an article or essay, as always. And then you can really make your point, emphatically, with a punchy audio or video. Check out my short vids at the fortnightly.com web site. Or turn to the PUF AV page in this inaugural issue of PUF 2.0.

We're expanding. We've introduced PUF QS. The QS stands for quant services. Based on my years of research on the value of electricity, members of the PUF community will now be receiving each month our unique insightful analyses of trends in customer value and the grid.

We're multiplying. We've introduced PUF 2.0. That's what you're reading now. You'll be receiving two PUFs per month rather than one. We're fortnightly again. Well, kinda. Alas, the Gregorian calendar.

And, in another of our innovations, we're putting an even greater spotlight on innovation. Turn to the Nikola Tesla Corner page of this issue. There you'll see the ground rules for our new annual list, the Fortnightly Top Forty Innovators. Nominate someone you admire. Maybe one of our readers will nominate you. We'll publish the first Top Forty this November. ❖

Making the Grid Great Again (For the First Time)

New FERC's Unfinished Grid Agenda

BY JIM HOECKER

The last and only time that FERC added four commissioners at approximately the same time was 1993. That was when my colleagues Bailey, Massey, and Santa and I were confirmed to join Chair Moler at the Commission. The arrival of that "Dream Team" – thank you, Senator Johnston! – presaged a decade of sweeping changes in federal electricity policy.

Following Congress' modest suggestions in the Energy Policy Act of 1992, our pro-market pro-transmission reforms were a foregone conclusion (difficult as they were). We sought to replicate the open access and market innovations of Order No. 636 for interstate gas pipelines, build on growing ideas about regional power markets and the old power pools, and recognize the competition legacy of PURPA. Order Nos. 888, 2000 and (later) 890 and the interconnection rules remain keystones.

But today, unlike 1993, there is no fresh policy guidance from Congress or an Order No. 636 to use as a benchmark. So, readers may legitimately ask, what may we expect from the four fresh faces due to take their places at FERC, probably before year's end?

Readers of *Public Utilities Fortnightly* can rest assured that our new federal regulators will be fully employed. The Commission's rates, projects, and policy making outboxes are plenty full. Acting Chairman LaFleur has used the hiatus in agency business to fill the record with comments and analyses on several important electricity and natural gas issues. And, of course, there's always the backlog.

Jim Hoecker was a Commissioner, then Chairman, of the Federal Energy Regulatory Commission. He now practices energy law in Washington D.C. with Husch Blackwell LLP.

New Commissioners might well ask: what now? This is ground on which a "former" anything, much less a former FERC Chairman, should fear to tread. But, here are some pointed suggestions anyway.

I would argue that attending to the state of the nation's electric transmission infrastructure must be a top priority for two obvious reasons. The President and Congress are clearly looking for action on critical infrastructure, and there's none more critical and important to building a dynamic economy over the next quarter century than the grid.

Moreover, a succession of Commissions has driven a pro-transmission agenda for two decades now, but not nearly to completion. While it is worthwhile debating what has and has not been achieved, this is a time to look forward.

A little context would be valuable. Then let me telescope this discussion.

Substantial parts of the grid were becoming positively geriatric. Today, we still lean on lines, towers, and substations dating from the forties, fifties and sixties.

Major parts of the 2005 Energy Policy Act were a recognition by Congress that domestic electric infrastructure was woefully inadequate to support the competitive markets the Commission had launched in the 1990s. Competition created stress, reliability was threatened and transmission line relief events (that is, dropping load to keep the system up) had skyrocketed.

Since 1980, transmission investment had declined precipitously as returns became anemic and capital migrated

elsewhere. As a result, substantial parts of the grid were becoming positively geriatric. Today, we still lean on lines, towers, and substations dating from the forties, fifties and sixties.

I am proud that the Dream Team voted consistently for dramatic regulatory innovations. But neither the structural changes occurring in the industry nor the implications of a more highly integrated, digitized grid infrastructure were fully appreciated or even foreseeable. Even by 2005, competitively-priced renewable resources had not yet exerted meaningful pressure on transmission or other public policies.

Therefore, in retrospect, Congress' efforts to promote backstop siting, authorize FERC to incentivize transmission, and encourage interstate compacts and coordination of federal permitting of transmission facilities were destined to be stillborn, despite considerable "sturm und drang" and bureaucratic effort.

FERC's struggle to reconcile transmission incentive rates with the just and reasonable standard tended to diminish FERC's interest in Congress' directive and thus the effectiveness of those incentives. Not surprisingly, the robust investment in transmission projects over the past decade, largely comprised of incremental additions and upgrades justified by reliability concerns, has now begun to flag.

All that would be forgivable, were it not for the projected increase in the electrification of our economy over the next two decades, the profound changes coming to the generation mix, and the onslaught of new technologies. And hence the need for major investment in an expanded, integrated, highly flexible transmission superhighway.

That's where this policy debate is headed. But it's not clear who will pick up the baton. For now, with infrastructure back on the national agenda and FERC's pro-transmission legacy at stake, there are two main courses on FERC's plate.

First, by sending Opinion No. 531 back to the Commission for a re-justification, the D.C. Circuit Court of Appeals has presented FERC with a golden opportunity. It can take the long view of the need for stable and adequate transmission equity returns – returns that are predictable, not so subject to the repetitive attacks, and far less volatile than those we have witnessed in the past five years.

Base returns on equity have eroded significantly under the recent applications of FERC's discounted cash flow methodology. This despite the decision in Opinion No. 531 to set base returns on equity between the midpoint and upper end of the zone of reasonableness.

No. 1000 was a woefully inadequate attempt to address interregional planning. Now it's best to stick a fork in it. It's done.

Such outcomes are justifiable only if transmission is treated as a cost to be avoided, rather than as risky thirty- to forty-year investments in infrastructure assets that integrate bulk power markets, make competition possible, and create a range of benefits to customers and regions which are today undervalued or, worse, ignored.

Uncertainty dogs investment and increases costs, serving consumers poorly. It is sown by serial return on equity complaints. It is magnified by methodological switches like FERC's change to the two-step growth rates at a time when interest and bond rates were at historical lows, depressing the resulting returns. Doubt about the validity of IBES as the sole source of data for short-term growth rates persist, due to its lack of standardization.

In addition, FERC's historical selection of proxy groups to establish the zone of reasonableness is looking less defensible in light of the tendency of merger and acquisition activity to prejudice rates on the low side by eliminating the most attractive companies from the pool of comparables.

Since the two-stage DCF produces results (besides litigation) that are inherently volatile, and often unrepresentative of either capital costs or market conditions, a thorough reassessment is in order. A different set of capital attraction challenges can affect merchant developers of transmission but regulatory certainty is always needed to mitigate risk there as well.

The second infrastructure priority is wrapped up in Order No. 1000. Its deferential approach, and its failure to take seriously the need for interregional transmission has slowed or halted movement toward a more integrated grid. Six years after its adoption, Order No. 1000 has done little or nothing to advance interregional coordination, including cost allocation.

Should we counsel patience and resignation because interregional and regional coordination and planning are still in their infancy? My client, the trade group WIRES, sees a more urgent need to strengthen the grid interregionally for public policy, economic, and reliability purposes. It views Order No. 1000's underachievement as primarily a sin of omission. The continuing patchwork of different planning models, assumptions, scenarios, eligibility criteria, and thresholds for joint evaluation of candidate projects is surely evidence that FERC has some distance to travel before achieving even what I perceive to be its own goals.

This and a score of other issues discussed in last year's technical conference, raise the question whether Order No. 1000 should be re-opened and its processes strengthened. In my view, Order No. 1000 was a woefully inadequate attempt to address interregional planning. However, we can certainly learn from its unusual trajectory. Now it's best to stick a fork in it. It's done. Let's move on to fix what's wrong,

(Cont. on page 16)

Valuation and Leverage

We talked with Paul Fremont, Mizuho Americas' Energy Analyst

STEVE MITNICK, WITH PAUL FREMONT

Paul Fremont joined Mizuho Americas LLC from Nexus Asset Management in February 2017. Prior to that, he spent fifteen years as a managing director covering nineteen domestic U.S. utilities with the Jefferies equity research team.

PUF's Steve Mitnick: On behalf of your firm, you write frequent analyses of utilities and energy companies. What are you covering in those analyses?

Paul Fremont: Aside from covering the names in depth, we're also trying to provide a broader perspective. We want to allow investors to better understand how the sector works, and how to fit their analysis of these somewhat different companies into the bigger picture. Utility companies operate under a regulated profile compared to other sectors; they have significant differences.

One of the missing components in pure P/E evaluation is that it doesn't adjust for debt.

PUF: You're not the only ones analyzing the companies. But you probably feel you've got some different, unique, and valuable approaches. What would you say those are?

Fremont: Let's start back in the 1980s and 1990s. Investors had initially focused on yield as their primary valuation metric. As you move forward in time, late 90s through today, investors have shifted their primary focus to pure price to earnings (P/E) analysis to value regulated electric companies.

P/E analysis makes sense to a certain degree, because the regulatory formula targets a certain level of net income. So the rate setting mechanism is really sensitized to net income. It's much less sensitized to cash flow.

One of the missing components in pure P/E valuation is that it doesn't adjust for debt. What we said in a piece that we published in mid-April, "Factoring Debt into P/E Utility Valuation," is basically that utility investors can do better.

We think they are right to focus on earnings. P/E is a very good starting point, but why not put everybody on equal footing with respect to financial risk and leverage, and therefore allow investors to make a more balanced comparison of the companies in our universe?

Since some companies use a lot of debt, and some companies use very little debt, we believe that you can account for some of the valuation differences just because some companies are more leveraged than other companies.

PUF: What you're saying is, "Sure that might be the case, but within our group the difference in how much the firms are leveraged is really significant, and needs to be accounted for?"

Fremont: The leverage differences are really not noticeable at the operating utility level because in most rate cases, the regulator will establish a fairly narrow range of allowed debt and equity levels in the cap structure.

Where the differences really kick in are those electric utility companies with holding company structures, where the holding companies can borrow. They borrow and infuse that money as equity into the operating utility.

PUF: These analyses are of course really useful for investors, but our readership includes regulators and utility leaders. How are your analyses valuable for those constituencies?

Fremont: Within the context of regulatory jurisdictions, back leverage is viewed

differently by different regulatory bodies. In some jurisdictions, there is an attempt to normalize based on what the consolidated debt ratio is, versus what the specific ratio is at the regulated entity.

For those companies, or for those regulators, they believe that there is an additional cost to customers when holding companies actively use leverage as part of the equation. From a regulatory perspective, there may be some intellectual argument that looking at back leverage, or holding company debt, is a reasonable adjustment to make in the rate setting process.

With respect to the companies, I would say all the managements are very sensitive in terms of how investors make their investment decisions. Where debt has played a limited role in the past ten or fifteen years in driving valuations, that could change going forward.

Also, the company management may need to take that into consideration when they decide on what leverage structure is best for the company. If all investors look at is pure P/E analysis, you can essentially manufacture accretion by back levering at the holding company level and infusing that debt as equity. You can get four percent or so earnings accretion.

If investors knew where the markets would continue to value purely based on P/E, then there's a reward that the market would potentially put on your stock for employing more versus less leverage in your cap structure.

What we're suggesting is that if investors change their valuation approach and adjust their price target by subtracting parent debt per share, then company management may have less of an incentive to add leverage into the equation.

PUF: Before you all put these analyses out, what goes into them? Do you have sort of a generic model for all companies?

Fremont: The starting point here is, what's a reasonable valuation approach? Because the utility companies today are in many respects conglomerates. Many of them are involved in both regulated and non-regulated businesses.

> **Some of the valuations are different just because some companies are more leveraged than other companies.**

When you put together a sum of the parts approach for each of them, it quickly becomes apparent that for non-regulated businesses, the starting point is usually an approach that takes into consideration the amount of debt in setting a price target.

So for instance, enterprise value to EBITDA essentially deducts out the debt per share. That would be a typical metric for what you could call non-regulated generation: for midstream gas investments, and for a whole host of investments by utility companies including retail and renewables.

When you set up a sum of the parts analysis it becomes striking. There is no adjustment that's being made for the incremental debt that sits at the holding company that one would appropriately allocate against the regulated businesses.

PUF: You must have some people helping you.

Fremont: Right now it's me and one associate. So we could definitely use more help.

But we do have detailed forecast models for each of the companies, and our coverage universe. We have separate valuation models we have built to set what we consider to be reasonable price targets.

PUF: What's your background?

Fremont: Many years ago I worked at one of the credit rating agencies, at Moody's. One of the things we did was develop a production cost model on every power plant in the country, looking at the deregulation of the generation portion of the business in many states throughout the U.S.

At the time, our standard cost report was the most requested report that Moody's had put out to date. Most of the questions on our report came from the equity side as opposed to the fixed income side. I determined early on that maybe it might be more interesting to be on the equity side, and when I left Moody's, it was to take a position at Salomon Smith Barney. Again, it was working as an equity analyst helping to cover electric utilities with Bill Tilles, who was at that time a lead analyst.

PUF: Do you have any other observations for our readers?

Fremont: After taking a two-year sabbatical on the buy side, I think that adds an entirely different perspective. I think that really has sharpened and differentiated my approach towards looking at these companies. ❖

Smarter Energy Infrastructure, Smarter Energy Future

IEI's Latest White Paper

BY LISA WOOD

The electric power industry is leading a profound transformation that is being driven by a number of factors – technology, policy, and customers. The technology revolution in energy is a given! Technology changes what we can do, how we do it, and what it costs – and the energy grid is no exception.

The U.S. electric power industry is investing more than a hundred billion dollars each year in smarter energy infrastructure to enhance the reliability, resiliency, and security of the energy grid. Those investments will help integrate and manage more renewables, distributed energy resources, and other devices and improve the efficiency and optimization of the energy grid.

The Institute for Electric Innovation's latest white paper, "Grid Modernization Technologies: Key Drivers of a Smarter Energy Future," discusses electric company investments in smarter energy infrastructure from the substation to the customer meter. They are largely digital technologies that are the building blocks of the future energy grid.

For example, today, more than seventy million digital smart meters are deployed across the U.S., giving more than fifty-five percent of all U.S. households more control and flexibility over their energy use.

Lisa Wood is vice president of the Edison Foundation and executive director of the Institute for Electric Innovation, IEI. At IEI, she collaborates with a management committee of more than twenty electric company CEOs and a select group of technology companies, and provides thought leadership on current issues, trends, and innovation in the electric power industry.

The technology upgrades to the distribution grid that electric companies have made over the last ten years have avoided millions of power outages, saved millions of customer dollars by improving system operations, and changed the way electric companies communicate with their customers.

Advanced energy grid technologies allow electric companies to automate important parts of distribution operations to improve reliability and resiliency and to improve outage management and restoration times.

Outage management systems, for example, combine geospatial information systems, customer information systems, and an automated call handling system to prioritize and direct service restoration crews in the field. That enables them to get power back on faster and more cost-effectively.

Electric company investments in digital technologies also ensure the seamless integration of DERs and enable two-way power and information flows, which enhance grid-edge visibility and diagnostics.

More than seventy million digital smart meters are deployed across the U.S.

They are paving the way to leverage DERs as energy grid assets.

For example, smart inverters enable intelligent control, aggregation, and dispatch of DERs such as private solar photovoltaics and battery energy storage when capacity or ancillary services are needed.

Digital energy grid technologies also have profound impacts on the way electric companies deliver power to homes and businesses. In addition to enhancing resiliency and reliability and integrating and managing more DERs,

(Cont. on page 13)

Common Storage Misperceptions

Costs, Competitveness, Technology

BY KERINIA CUSICK

Grid-connected battery storage is both a relatively new industry and a complex product. Its versatility naturally leads to confusion when trying to understand its applicability. Additionally, the rapid pace of change within the industry leads to misinformation and misperceptions.

Misperception #1: Battery Storage Costs Will Decline at Same Rate as Solar or Wind

Much has been written about the rapid decline of solar and wind costs, particularly in the last decade as costs have fallen dramatically. As the volume of installed solar costs doubles, costs decline by twenty to twenty-five percent.

This "learning rate" trend has been documented in many industries from aviation to electronics. As the volume of units produced increases, improvements in manufacturing processes, standardization, product redesigns, and automation all lead to cost declines.

Both wind and solar spent decades in slow growth mode, remaining a niche product used in very limited applications, struggling to build scale. But grid-connected battery storage is benefiting from manufacturing scale that has already been achieved in different industries, electric cars and consumer electronics.

The electricity generation and distribution industry should anticipate that cost of stationary grid-connected battery storage will drop even faster than solar or wind. Grid-connected storage is benefiting from the manufacturing advances being made for other sectors.

Almost ninety-seven percent of grid connected storage in 2016 was Lithium Ion. Figure 1 shows projected use of Lithium Ion battery storage in 2013 and 2020. One can see that grid-connected storage is a small percentage of the total Lithium Ion sales in 2013. Consumer electronics (such as laptops) and electric vehicles are the majority.

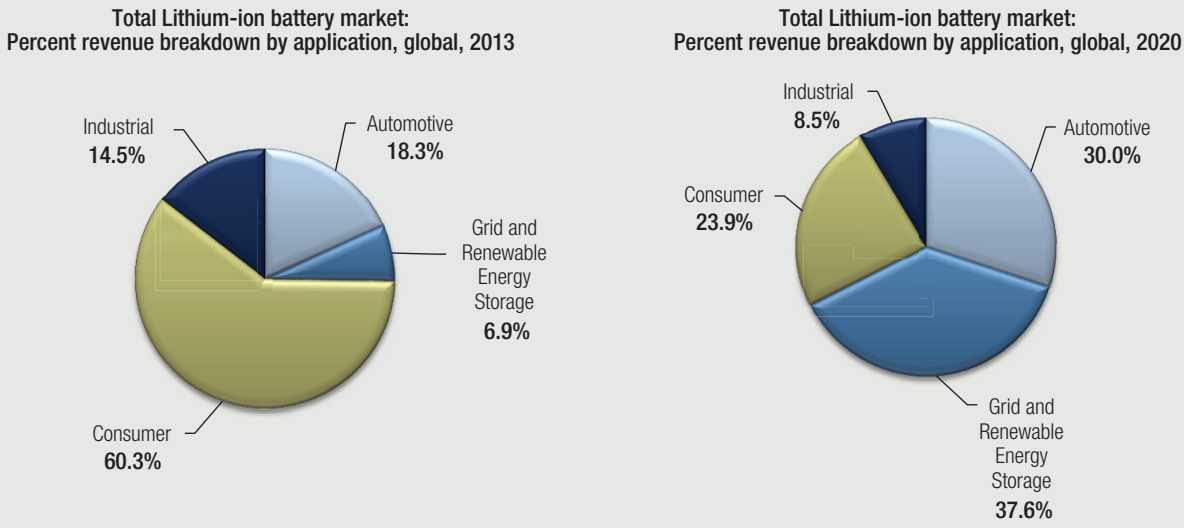
The cost competitiveness of energy storage cannot be distilled to a single metric, such as dollars per kilowatt-hour.

Most analysts project this will change in the next few years. Some project grid-connected storage driving the market by 2020.

Based on data published by the International Energy Agency, the number of electric cars on the road is beginning to achieve rapid growth. In 2015, there were one and a quarter million electric vehicles on the road, driven in part by a sudden spike of these vehicles in China, which is quickly matching the U.S. in market size.

Kerinia Cusick has worked in renewable energy and energy storage since 2008. During that time, she developed renewable energy projects, lobbied on renewable energy legislation, participated in electricity regulation cases, developed strategies for state government procurements of renewable energy, and advised private clients on solar procurement (as well as go-to-market strategies). Kerinia also co-led a team responsible for developing and executing a two-year strategy to launch a world-wide solar company into energy storage. In that role, Kerinia led greenfield development of solar and storage projects in California, participated in M&A to procure operational assets, led storage financeability, and supported joint development of storage-only projects. Most recently, she co-founded Center for Renewable Integration, developing policy solutions to integrate renewables onto the grid without impacting reliability.

Fig. 1 **Historical And Projected World-Wide Use of Lithium Ion Energy Storage**



Tesla has been focusing on building high end electric cars in the U.S. BYD Auto in China is concentrating on lower-cost models.

It can be difficult to calculate the size of the automotive battery storage market currently deployed worldwide. The size of batteries installed in cars ranges significantly. The total range is estimated between ten and twenty gigawatt-hour.

In contrast, the total installed capacity of grid-connected energy storage in the U.S. is three hundred thirty-six megawatt-hour. It is a small fraction of world-wide automotive capacity.

This is also particularly relevant due to the potential application for using a secondary market electric vehicle battery in grid storage applications. Most of these manufacturers have established secondary market sales channels for their batteries. Generally, the batteries are available for a fraction of their original cost.

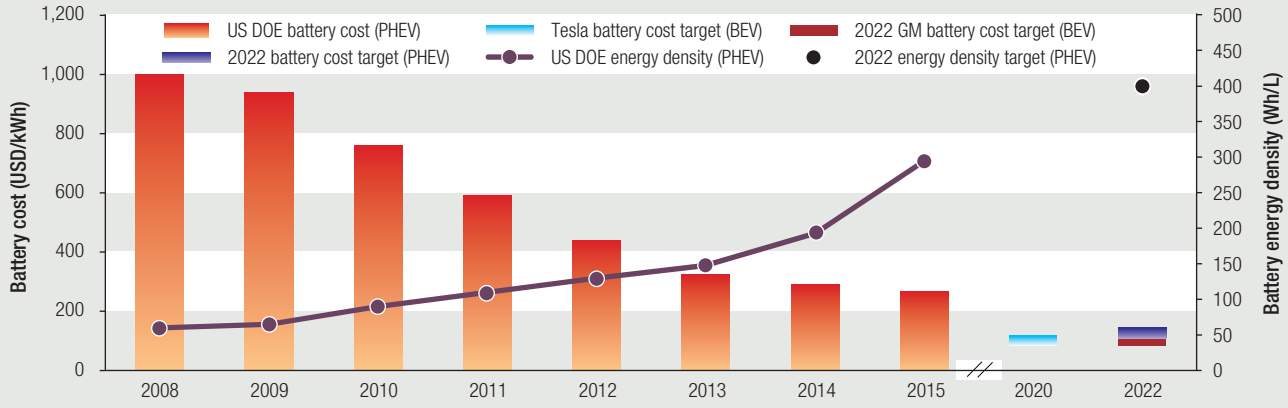
Some electric vehicle companies, such as Mercedes Benz, have decided to directly enter the grid connected energy storage market. These companies are not just limiting themselves to participating via a secondary market channel.

IEA projects electric vehicle Lithium Ion battery costs of a hundred dollars per kilowatt hour by 2020. But with the growth of consumer electronics and grid-connected battery storage, cost declines might be even faster, far outstripping the declines of solar and wind. See Figure 2: Current and Projected Battery Cost.

Misperception #2: Battery Storage Won't Be Cost Competitive in Foreseeable Future

Battery storage is a flexible asset that can provide capacity, ancillary services, and energy, or be used as a transmission and distribution asset. It can be installed on the customer's side of the meter to provide load shifting, reduce peak demand,

Fig. 2 **Current And Projected Battery Costs**



Notes: USD/kWh = United States dollars per kilowatt-hour; Wh/L = watt-hours per litre. PHEV battery cost and energy density data shown here are based on an observed industry-wide trend, include useful energy only, refer to battery packs and suppose an annual battery production of 100,000 units for each manufacturer.

Sources: US DOE (2015 and 2016) for PHEV battery cost and energy density estimates; EV Obsession (2015); and HybridCARS (2015).

participate in wholesale markets where allowed, and provide backup power in the case of an outage; particularly if combined with a local generation asset such as solar.

On the utility's side of the meter, it can be used to provide voltage control, peak capacity, energy, ancillary services, and defer transmission and distribution upgrades. There are a number of additional ways that energy storage could be used, beyond the ones listed, some of which are either not currently allowed by regulations, or are simply not practical given current technology.

Figure 2 shows that Lithium Ion battery costs in 2015 hovered around two hundred fifty dollars per kilowatt-hour, and are projected to drop to a hundred dollars per kilowatt-hour in 2020. At those price points it can be tempting to come to the conclusion that battery storage will never be cost competitive.

That analysis assumes battery storage is only being used as an energy product. Energy is measured in dollars per kilowatt-hour. In day-ahead or hourly markets, energy costs will typically drop in off-peak hours, and increase during peak hours such as early evening in the summer.

With zero fuel costs, wind and solar are most competitive when purchased under long-term contracts, which amortize the capital costs. Due to variable fuel costs, energy from natural gas is cheapest when purchased under short-term contracts.

Competitive energy contracts for wind, solar and natural gas can range from thirty to seventy dollars per megawatt-hour, depending upon location and contract terms. Clearly, at one hundred dollars per kilowatt-hour, battery storage isn't cost effective as an energy product.

Capacity is measured in dollars per kilowatt per month (or the equivalent, such as dollars per megawatt per year, or dollars per kilowatt per day). It ranges from a low of approximately one cent per kilowatt per month in some MISO zones to fifteen dollars per kilowatt per month in NYISO congested areas.

In high density areas, the cost to deliver electricity can spike even higher. For example, California requires its utilities to meet a local capacity requirement and procure capacity for specific zones, often through confidential bilateral contracts.

> **A lot of research is being done to develop new chemistries better suited for energy applications, where a low cost per kilowatt-hour is critical.**

In California, these have led utilities to exceed their commission-required targets for energy storage, contracting with storage assets simply based on cost-competitiveness. California does have a state-wide incentive for energy storage, which boosts the competitiveness of energy storage, but it can only be applied to a fraction of total project costs.

Ancillary services markets include several products, one of which is frequency regulation. Typically grid operators procure between half of one percent to one percent of their peak load to provide minute to minute load balancing and maintain the U.S. grid at sixty hertz. More recently, FERC required independent system operators to create a market for fast frequency regulation, and compensate those resources at a higher price point, given that they deliver a higher value service.

A significant percentage of installed U.S. battery storage is located in PJM, strictly to provide frequency regulation. Very few of these projects benefitted from any incentives, and were built simply based on the economics and cost competitiveness of energy storage.

Figuring out the cost-competitiveness of battery storage and the price points at which it is cheaper than other resources can be complicated. Batteries can be automatically controlled to provide multiple services.

For example, a commercial behind-the-meter battery in PJM could be used daily to shift load from high time-of-use rates to low time-of-use. On anticipated peak days, it could be used to reduce peak load, thereby reducing demand charges.

And, during off-peak hours, the battery could participate in the PJM frequency regulation market. All of these value streams stack one on top of the other, and can make energy storage cost competitive.

In short, the cost competitiveness of energy storage cannot be distilled to a single metric, such as dollars per kilowatt-hour.

Misperception #3: Battery Storage Technology Still in Testing Phase

While Lithium Ion batteries comprise the vast majority of grid-connected storage projects to date, that doesn't mean research isn't underway to develop new technologies. Because of its use in the consumer product and automotive sectors, Lithium Ion is simply the one technology that has progressed out of the lab and into full commercialization, and major companies such as Panasonic, Samsung, and Tesla are backing their products with warranties that can be used for financing purposes.

Designed primarily to meet the requirements of the automotive or consumer electronics industries such as laptops, Lithium Ion batteries are designed to charge quickly, provide thousands of charge-discharge cycles, and provide high energy density in order to fit into a laptop or a car.

Lithium Ion works well in some grid-connected storage use cases, specifically ones that require thousands of charge-discharge cycles like frequency regulation

(an ancillary services application), and demand charge management (a capacity application). A lot of research is being done to develop new chemistries better suited for energy applications, where a low cost per kilowatt-hour is critical, from advanced alkaline to flow batteries and others.

However, at this point, most of these chemistries remain in the lab, with limited deployments in geographically remote applications such as powering cell phone towers or train track signals. Third-world

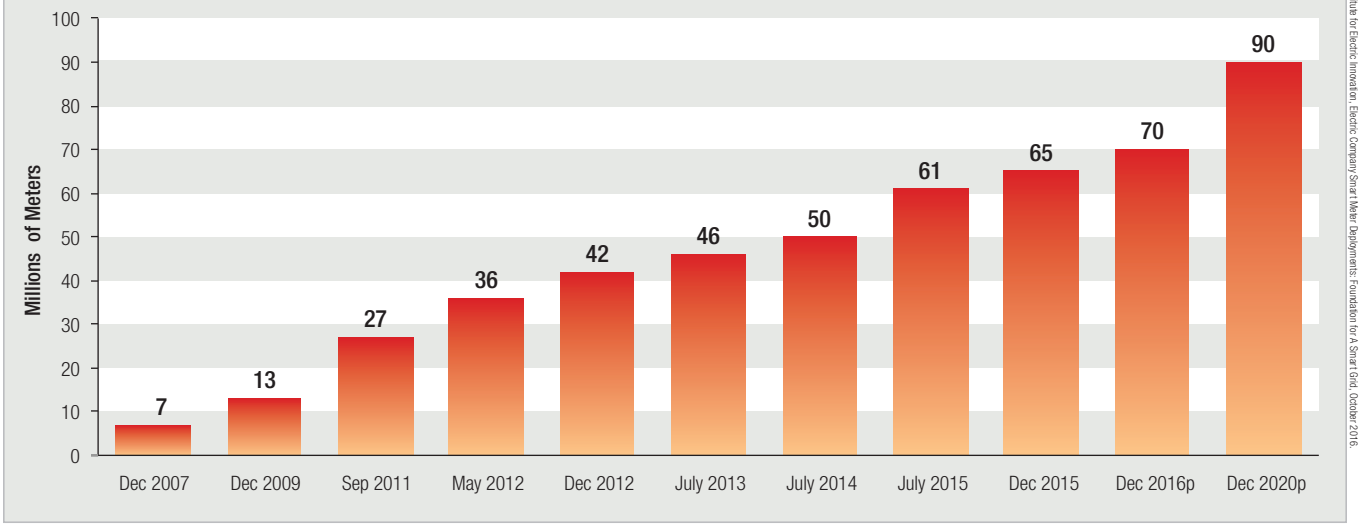
Lithium Ion cost declines will continue in the automotive sector, and spill over into grid-connected storage.

micro grids, which only require a slow trickle charge during the day, typically from solar, and a slow discharge at night, are well suited for lead-acid batteries.

As of the first quarter of 2017, lead-acid and Lithium Ion are the two chemistries in the U.S. that are considered "shovel ready." And able to meet the requirements imposed by most lenders providing project financing, such as a product warranty backed major firm.

While it is too soon to tell if a new chemistry will emerge from a lab to become a leading technology for energy applications, it is clear that Lithium Ion cost declines will continue in the automotive sector. This will spill over into grid-connected storage. ❖

Fig. 1 Smart Meter Installations in the United States Pass 70 Million; Projected to Reach 90 Million by 2020



Source: Institute for Electric Innovation, Electric Company Smart Meter Deployments: Foundation for A Smart Grid, October 2016.

Lisa Wood

(Cont. from p. 9)

intelligent grid devices optimize energy grid operations by improving situational awareness.

For example, power line monitors on the distribution grid assess real-time power line and power quality conditions to detect anomalies such as overloading or line sagging and address them before they become problems.

As the electric power industry invests in technologies to make our energy infrastructure smarter, the role of data analytics is crucial. One of the most important uses of data analytics today is in leveraging asset-level intelligence for predictive maintenance and proactive replacement of critical energy grid infrastructure. Additionally, data analytics are used today to manage outages, integrate DERs, and provide customer solutions.

The electric power industry continues to pave the way toward the smart grid of the future. It is critical that technology investments deliver cost savings and operational efficiencies today and be flexible enough to accommodate the changing conditions of tomorrow. By investing in smarter energy infrastructure and partnering closely with technology companies, electric companies are delivering a smarter energy future.

The white paper is available at www.edisonfoundation.net. ❖

Thirty-Eight Years: Great River's Will Kaul

We talked with Will Kaul, Great River Energy's Vice President and Chief Transmission Officer

STEVE MITNICK, WITH WILL KAUL

Will Kaul, Great River Energy's vice president and chief transmission officer, retires July first after thirty-eight years of service at one of the nation's largest generation and transmission cooperatives. Great River serves around one-third of the people of Minnesota. Kaul has been a leader in the extensive transmission program CapX2020. He was also a founder, director, and past president of WIRES, the group that promotes investment in the transmission grid.

PUF's Steve Mitnick: Please tell us what you're doing or transitioning to doing, now.

Will Kaul: My last official day here at Great River Energy is July first. And then I'll have a contractual relationship with GRE for about six months after that.

The big project I've been working on for the last couple years, that I will continue to work on, is grid modernization at GRE. GRE is a not an integrated utility. It's a generation and transmission business; and we also have twenty-eight distribution members.

Because a lot of the action is at a distribution level, we've had a grid modernization team that's made up of GRE people as well as members, trying to chart our course forward.

PUF: Can you say a word about Great River? It's not a small operation.

Kaul: Great River Energy is the nation's fourth largest G&T. We have four billion dollars in assets and about a billion dollars in revenue every year. We have about thirty-six hundred megawatts of generation and about five thousand miles of transmission lines.

We're the second biggest utility in Minnesota, next to Xcel.

PUF: What were you doing for the company?

Kaul: I've been here for thirty-eight years. In 1999, two smaller G&Ts decided to consolidate operations and form Great River Energy.

At that time, I was named the vice president of transmission. Up until then, I had other kinds of responsibilities. I started out as an environmental specialist at one of the predecessor companies and eventually became director of generation and transmission services.

It was a big change for me to get into transmission in 1999. Since then, a lot of my time and effort has been devoted to expanding the regional grid with the CapX2020 initiative and participating in the creation of a wholesale market from scratch. It was a pretty amazing thing to be a part of, especially for someone with a dusty old econ degree.

PUF: You said that you were involved in bringing CapX2020 before the commission. Does that mean that, even though your organization is in the cooperative world, that you interface with the public service commissions?

CapX2020 was a pretty amazing thing to be a part of, especially for someone with a dusty old econ degree.

Kaul: We're not rate regulated, but we're regulated with respect to certificates of need and routing permits – that kind of thing – and all environmental regulations.

PUF: What were the biggest things that you did in those thirty-eight years? Would you count CapX2020, as one of them?

Kaul: CapX2020 was probably the big one. That came about at a very uncertain time in terms of transmission expansion.

We'd had a series of failed efforts to get organized around transmission in

this region, prior to the creation of the CapX2020 initiative.

Finally, after a transco effort had failed in late 2003, I had a hallway conversation with someone at Xcel and we decided to go the old-fashioned route, which was let's just get together and collaborate on a solution. We formed the CapX2020 organization in the spring of 2004.

I chaired the CapX2020 organization from the very beginning, in 2004, until last December. Early on, I often referred to it as a faith-based organization, because we didn't really know how it was going to get paid for.

We didn't have tariffs for cost recovery for large regional expansion projects at the time.

MISO's planning process wasn't mature yet, the tariffs were under development. But we knew that we had an obligation to serve. And we knew that investment was badly needed.

We also knew we had a great opportunity right then. The east coast blackout was fresh in everyone's mind, and the California blackouts were just a few years earlier. Renewable energy development was becoming a big deal here in this part of the world.

We had a great wind resource that needed to get to the market, and an aggressive renewable portfolio standard in Minnesota to achieve. So, all those things came together and supported the concept of a grid expansion. When we brought it to the commission for a certificate of need, the package had five projects, two billion dollars of investment, and eight hundred miles of line.

There was essentially no opposition. We had the support from the environmental community. We had support from the regulators. We had support from everybody.

We took a two-pronged approach. We had a vision for grid expansion, based on a scenario planning/project portfolio approach, and had a proposal for regulatory reforms that needed to happen to be successful.

We took the reform proposal to the legislature, and got everything we asked for, including formula-based rates for the investor-owned utilities. Up until then, the investor-owned utilities were reluctant to make investments in transmission because of regulatory lag.

The formula-based rates allowed them to recover costs as they spent the money. It reduced the overall cost of the projects, benefitted customers, and made transmission an attractive investment for IOUs.

> **There's going to be a transformation on the distribution level that is also going to mean a lot more competition.**

With our vision for grid expansion and regulatory reforms in hand, the table was set. All we needed to do was execute.

The routing process was a big challenge. But it all worked out in the end, because we had built a strong base of political support, and took the time to work with landowners and accommodate their needs the best we could.

We got it through. We got it done, on time and under budget.

PUF: Being in the industry for thirty-eight years, you've seen a lot of changes. How is the industry now, relative to where it was almost four decades ago?

Kaul: That's an interesting question. Our industry is in a forty-year total transformation and we're in year twenty. The last twenty years have been all about wholesale markets and competition at that level.

We started with a bilateral transaction environment and a grid that didn't support efficient trading. Now we have a very efficient, liquid market. We have the ability for new generation to interconnect and deliver to the marketplace as the resource mix evolves.

That's a total transformation of the wholesale electricity market. That is really a big deal. The next twenty years is going to see more evolution of the wholesale market.

On the distribution side, I think we're going to see something that parallels what we saw on the wholesale side. That will include a lot of new players, like Amazon, Google, Tesla, Solar City, and Direct Energy.

Those companies have access to our retail customers. There's going to be a transformation on the distribution level that is also going to mean a lot more competition.

I think we're going to see the industry move away from being a commodity business to more of a service business. Utility business models likely will need to change to compete.

It will always be, in large part, a commodity business. But, energy services are going to become a much larger part going forward.

PUF: How did you get to this place? Did you have a great mentor, or a big turning point?

Kaul: I ask myself that question from time to time. I've never been qualified for any job I've ever had. I'm an economics major. But I had a strong interest in environmental matters from back in the sixties and seventies when I came of age.

That was an era when every city in the country had a big brown cloud over it. And there was smog and all kinds of air pollution problems like acid rain.

I got an internship at the Minnesota legislature for the Natural Resource and Agriculture Committee. That led to a job working for the Minnesota Environmental Quality Board which had responsibility for routing transmission lines and siting power plants. And that led to getting hired by the cooperative as an environmental specialist to develop a compliance program for a new coal plant just going on line.

Gradually, I started getting more responsibilities there. The CEO at the time,

Julian Brix, believed in me and gave me some responsibilities in the transmission area. That was an important milestone in my career.

About five or six years later, when we formed Great River Energy, I was named the transmission vice president.

Another person believed in me. This time it was Jim Van Epps, who was the first CEO at GRE.

Those are important turning points in my career, and two very important people who believed in me.

PUF: Was your job fun? Were there some funny or memorable times?

Kaul: I happen to have the best job in the world. It's because of the basic mission that we have, providing essential services to people on a non-profit basis.

I love the mission. I love the business model, being a cooperative. I love the people. I've had a lot of fun. And that's a requirement, as far as I'm concerned, when you come into work.

But I did have a comical experience one time. I was asked to testify before the U.S. Senate Energy Committee by Leon Lowery, who was the Chief of Staff. He wanted the committee to hear about the success of the CapX2020 project.

> **I noticed my toothpaste tasted a little funny. It turned out I was using hydrocortisone cream. So, I guess I was a little nervous.**

This was back in 2008 or 2009. I went to Washington, D.C. to testify. I was on a panel with T. Boone Pickens and some others.

I was nervous. But I was also very excited. I practiced in front of a mirror to make sure I had my five-minute statement down pat.

I woke up the morning of the hearing, and while brushing my teeth I was thinking, "I feel pretty darn good. I think I'm ready for this. I think I'm well prepared." Then I noticed that my toothpaste tasted a little funny. It turned out I was using hydrocortisone cream. So, I guess I was a little nervous.

I got to the hearing. T. Boone Pickens was there. There were klieg lights. The hearing room was packed. All these reporters and the press were there.

He got up, and gave a song and dance. It was really a big deal. A lot of questions. When he was done, he left the room.

Then Committee Chairman Bingaman called for a break. But when they reconvened the hearing, everyone had left. It was me and three other panelists and two senators. That was my moment of fame. ❖

Jim Hoecker

(Cont. from p. 6)

supply what's missing, and set as a goal a genuinely integrated grid that will stand up to the demands that dynamic future developments will place on it.

Of course, there's precious little that FERC can do to ameliorate the principal dysfunction affecting transmission, which arises from the historical but now-impractical allocation of regulatory authority among federal, state, and other governments. The planning, permitting, and building of grid infrastructure will continue to take three times longer than the equivalent process for natural gas pipelines.

Getting to the heart of the problem for which transmission infrastructure is the poster child, President Trump's chief economic advisor Gary Cohn recently opined, "Time is money. The cost of infrastructure goes up dramatically as time goes on in the approval process." Well said. ❖

Senior Counsel Linda Walsh and former FERC Chairman Jim Hoecker having a laugh, likely having to do with Order No. 1000, in their offices at Husch Blackwell.

Public Utilities Fortnightly Quant Services

Monthly Summary Report: June 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.

I. PUF Electricity Value Index, June 2017

Electric 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's growing consumer expenditures.

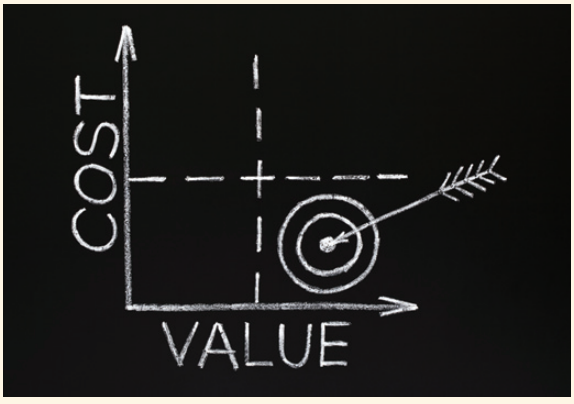
What counts to consumers, or should count, is the horse race. Which horse (good or service) is gaining ground on the others? Which is falling further behind?

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.

CPI Electric Latest Month – U.S. (April 2017)

86.5%

Record High (June, August 1955): 106.7%
Record Low (May, June 2000): 74.3%
Year Earlier (April 2016): 86.3%
Two Years Earlier (April 2015): 89.2%

CPI Electric Latest Quarter – U.S. (Q1 2017): 85.8%

Record High (Q2, Q3 1955): 106.4%
Record Low (Q2 2000): 74.4%
Year Earlier (Q1 2016): 86.7%
Two Years Earlier (Q1 2015): 89.8%

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%

CPI Electric Latest Month – Northeast (April 2017): 75.9%
CPI Electric Latest Month – South (April 2017): 78.2%
CPI Electric Latest Month – Midwest (April 2017): 86.7%
CPI Electric Latest Month – West (April 2017): 108.8%

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.

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. (April 2017)

1.35%

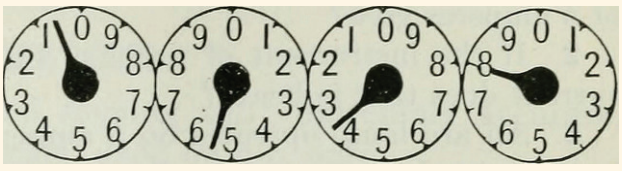
Record High (June 1981): 2.53%
Record Low (February 2017): 1.22%
Year Earlier (April 2016): 1.36%
Two Years Earlier (April 2015): 1.44%

Electricity Share Latest Quarter – U.S. (Q1 2017): 1.28%

Record High (Q3 1983): 2.37%
Record Low (Q1 2017): 1.28%
Year Earlier (Q1 2016): 1.34%
Two Years Earlier (Q1 2015): 1.51%

Electricity Share Latest Year – U.S. (2016): 1.39%

Record High (1982): 2.27%
Record Low (2016): 1.39%
Year Earlier (2015): 1.44%
Two Years Earlier (2014): 1.49%



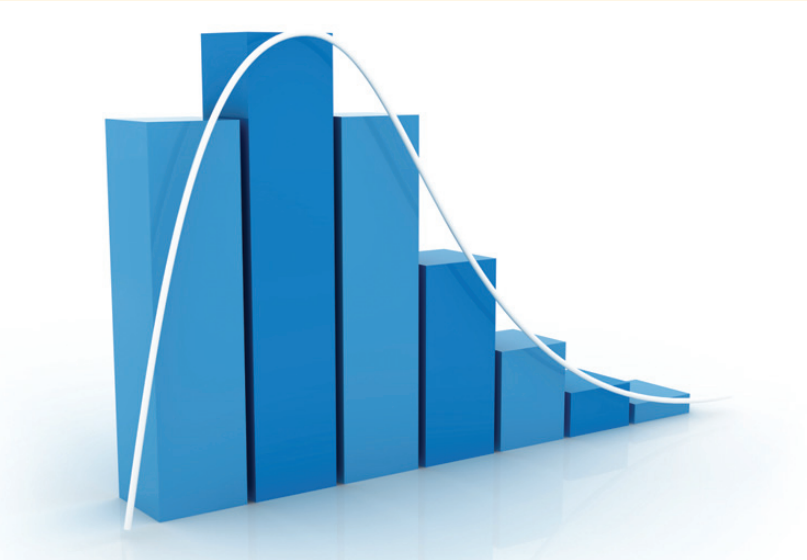
Source: Bureau of Economic Analysis, U.S. Department of Commerce. Public Utilities Fortnightly maintains a comprehensive historical and updated data base of consumer expenditures, and our own analyses of the data. Fifty-eight years of monthly data.

II. PUF QS Zero-Carbon Grid Scorecard, June 2017

Many 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 (March 2017)

41.6%

Record High (March 2017): 41.6%
Record Low (September 1973): 16.2%
Year Earlier (March 2016): 40.9%
Two Years Earlier (March 2015): 34.8%

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%

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%

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 (March 2017): 9.5%

Record High (April 1974): 19.8%

Record Low (September 2007): 4.1%

Nuclear Latest Month (March 2017): 20.5%

Record High (January 1995): 22.6%

Record Low (January, May 1973): 3.9%

Solar Latest Month (March 2017): 1.4%

Record High (March 2017): 1.4%

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

Wind Latest Month (March 2017): 8.1%

Record High (March 2017): 8.1%

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 (March 2017)

28.2%

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, June 2017

The 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 (March 2017)

0.6%

Record High (April, May 2016, March 2017): 0.6%
Year Earlier (March 2016): 0.5%
Two Years Earlier (March 2015): 0.3%

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 (March 2017): 0.4%
Commercial Distributed Latest Month (March 2017): 0.2%
Industrial Distributed Latest Month (March 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 (March 2017)

9.9%

Record High (March 2017): 9.9%
Year Earlier (March 2016): 8.5%
Two Years Earlier (March 2015): 5.6%

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%

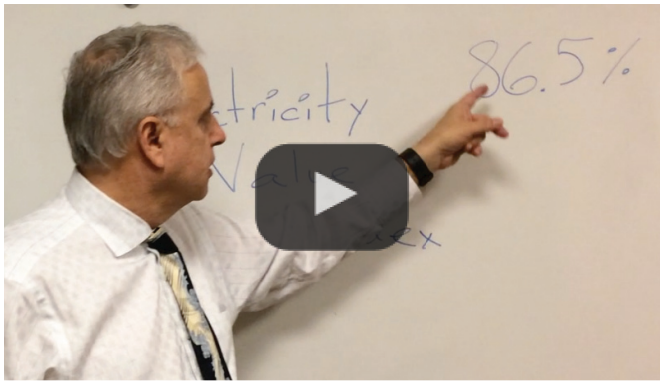
Source: Energy Information Administration, U.S. Department of Energy. Public Utilities Fortnightly maintains a comprehensive historical and updated data base of generation by method, and our own analyses of these indices. Forty-four years of monthly data for grid generation and three years for distributed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

Public Utilities Fortnightly Audio and Video: June 2017

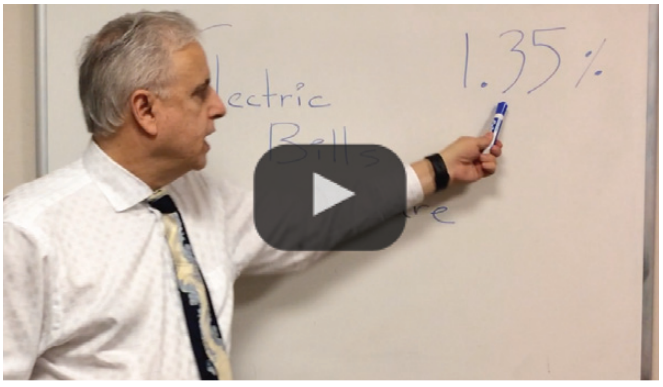
Every issue of PUF 2.0 will have this page, with brief audio and video recordings, providing our contributors additional avenues to impact the debate on utility regulation and policy. And the PUF team an engaging and entertaining platform to communicate our features like PUF QS.

46 seconds. See From the Editor in this issue. Public Utilities Fortnightly has been around for 89 years. Sheesh! It's about time. We should innovate too.

55 seconds. See From the Editor in this issue. Public Utilities Fortnightly is transforming, expanding and multiplying. With PUF AV, PUF QS and PUF 2.0.



51 seconds. See PUF QS in this issue. April's Electricity Value Index is 86.5%. That's how "slow" residential electric rates have increased compared to the Consumer Price Index.



40 seconds. See PUF QS in this issue. April's Electric Bills Share is 1.35%. That's residential electric bills as a percent of consumer expenditures, near the all-time low.

Smart Cities, Energy Transformation

Opportunities and Challenges for Utilities

BY JAN VRINS, ERIC WOODS, AND MARCEL VOLKERTS

The development of smart cities and the transformation occurring in the energy industry have much in common. Both developments are rooted in changing customer demands and rapid technology innovation.

There are also shared drivers related to the advancement of the clean energy agenda, including responding to climate change and the transition to a low carbon economy, the possibilities offered by distributed energy resources and the digitization of energy products and services.

While cities represent only two percent of global land use, they are responsible for around eighty percent of global gross domestic product. They are also responsible for around seventy percent of the world's energy use, and roughly the same percentage of greenhouse gas emissions.

With urbanization accelerating, cities move to the forefront of global action on climate change, and the impact of urban innovation programs on the future of the energy sector cannot be ignored.

Today, a significant number of U.S. cities are promoting smart city initiatives. They are setting carbon reduction and renewable energy targets, while implementing clean energy programs supported by initiatives like the Smart Cities Initiative, the Department of Transportation's forty-million-dollar Smart City Challenge, and the Envision America program, as well as other government and private-sector funds.

City leaders are recognizing that an integrated energy strategy is a crucial factor in delivering improved city services, increasing sustainability, and driving economic development. The mayor of Chicago recently announced that public buildings in the city would be powered by a hundred percent renewable energy by 2025. He also made it clear that he sees this bolstering the city's role as a leader in the clean energy industry and signifying its determination to build a twenty-first century economy.

The energy sector is, of course, also going through a series of profound changes. It is driven by new technologies (including smart grids, digitization, and the Internet of Things) and the shift to renewable and distributed energy sources. This transformation is creating a much more complex energy market that offers greater choice for how energy is generated, supplied, and consumed.

JAN VRINS

A significant number of U.S. cities are promoting smart city initiatives.

Navigant characterizes this transformation as the emergence of the Energy Cloud. This model represents the shift away from centralized energy generation and distribution toward a highly distributed, networked, and dynamic grid in which technology-rich platforms such as integrated DER, connected buildings, transportation-to-grid, smart cities, communications superhighway, IoT, and transactive energy platforms are emerging.

As with smart cities, the energy transformation is entering an important new phase as technologies mature, competition intensifies, and traditional ways of

Jan Vrins is the leader of Navigant's global Energy practice. He advises energy and utility executive leaders on developing and operationalizing their strategy to achieve sustainable excellence. **Dr. Eric Woods** is a research director at Navigant, leading the firm's comprehensive smart cities research. **Dr. Marcel Volkerts** is an associate director at Ecofys, a Navigant company, focused on urban energy and smart energy systems.

doing business are disrupted. In parallel, new cross-sector technologies and market platforms are developing. They will create new businesses and value streams but also introduce even more radical disruption.

Utilities should not approach the emergence of smart cities with a business as usual attitude. New forms of urban energy production and consumption challenge traditional utility business models while at the same time they present a wide range of new opportunities.

In this article, we examine the interplay between these two waves of innovation – smart cities and the Energy Cloud – and suggest how utilities can put themselves at the heart of smart city programs.

Working with Cities to Shape the Energy Future

The changes associated with the energy transformation are creating a space for cities and communities to become more actively engaged in the energy ecosystem. Cities are seizing the opportunity to work with utilities and other stakeholders in the creation of new urban energy systems and solutions.

One the most obvious ways that cities are influencing these developments is in the push toward a hundred percent renewable energy as part of ambitious plans to reduce carbon emissions. San Diego, San Francisco, Vancouver, and Portland, for example, are among a growing number of North American cities that have committed to a hundred percent renewable energy target.

These cities are setting targets for their utilities to shift to clean energy. Even more significantly, they are encouraging residential and commercial clean energy solutions through programs to support solar PV, storage, combined heat and power systems, and other community energy schemes. This push toward local clean energy will accelerate even more quickly as adoption of Energy Cloud platforms supporting electrification of transportation, building-to-grid, and more increases.

This shift to distributed clean energy solutions threatens a large segment of traditional utility business. It also presents an opportunity for diversification, as there is a clear role for utilities that can support the expansion of local distributed energy programs.

ERIC WOODS

Support for renewables and new demand-side programs increase the pressure on utilities.

Notably, cities need to ensure that the benefits of innovation in the energy sector are made available to all, including the least advantaged. Community solar programs, for example, are now being developed by more utilities to meet this goal.

In addition, as distributed energy expands, so will the opportunity to implement community-based microgrids and virtual power plants. There may also be opportunities to offer white-label and back office energy services to small local sustainable energy companies that have ties with the community, but lack the resources or experience to act as a full supplier.

Cities are also actively working to transform demand-side energy consumption. These initiatives include building energy efficiency programs, encouraging the development of heating and cooling networks, building energy management solutions, electric charging infrastructure, and the introduction of smart street lighting.

The drive to greater building energy efficiency in cities provides utilities the chance to offer additional services for energy optimization, energy retrofits, combined heating cooling and power, and advanced energy management services to both public sector and commercial building owners.

Collaboration between city departments and local energy utilities to improve energy efficiency also enables retrofit and rebate programs to be targeted at the most appropriate residents, businesses, and communities.

The city of Seattle, for example, has a goal of reducing energy consumption of public buildings by twenty percent by 2020, compared to 2008. Duke Energy has worked with other stakeholders in the Envision Charlotte programs to reduce the energy consumption in sixty-one of the city's commercial buildings by nineteen percent.

In the process, twenty-six million dollars in energy costs and fifty-seven thousand tons of carbon dioxide emissions were saved or prevented. Vancouver is targeting zero emissions from any new buildings by 2030.

Street lighting is another area where significant savings are being made. It can also be a beachhead into other smart city services. The introduction of LED street lighting can reduce electricity consumption by up to fifty percent, and the additional intelligent controls can provide another twenty to thirty percent in savings.

New York City expects six million dollars annually in energy savings from replacing its two hundred fifty thousand street lights with LEDs and a further eight million dollars in maintenance costs savings. San Diego's recently announced smart street lighting project is expected to save the city 2.4 million dollars annually in energy costs.

It is estimated that over fifty percent of street lights in the U.S. are owned by utilities. The need to increase the efficiency of those lights is a good example of the changing priorities for utilities as they work with cities to reduce their energy consumption.

Like city managers, utilities are also recognizing that lamp poles are valuable assets that can be a platform for a range of intelligent services including electric vehicle charging, mobile communications, and other smart city applications.

Cities with ambitious carbon reduction goals realize that transportation is one of the most difficult areas to address. The need to reduce emissions, as well as the need to improve urban air quality, is making cities strong proponents for the electrification of transportation.

Electrification is only one element in the transformation of urban transportation over the next decade and more. These vehicles (cars, trucks, taxis, bikes, and buses) will increasingly be autonomous, connected, and shared. They will also be part of new mobility as service platforms and innovative business models.

Many utilities are already active in urban electric vehicle programs, but this can be a first step to other service offerings and new partnerships. Working with local utility SDG&E, San Diego is positioning itself to be the electric vehicle capital of the U.S., and sees adoption of EVs as a vital element in its energy and carbon reduction strategy. Transport electrification is also a core element of the Columbus Smart City program supported through the Smart City Challenge grant.

Support for renewable generation by city authorities and new demand-side programs increase the pressure on utilities to deliver infrastructure that can integrate these new resources in a manageable way and accelerate other innovations.

Navigant Research expects the global market for smart energy solutions for smart cities to grow from nearly thirteen billion dollars in annual revenue in 2016 to more than twenty-seven billion dollars by 2024, representing a cumulative investment of a hundred and ninety billion dollars.

Cities are already the focus of extensive smart grid pilots.

They are demonstrating the increased control, flexibility, and integration made possible by a digital infrastructure for grid monitoring and management.

MARCEL VOLKERTS

Cities are collaborating with utilities where possible, but are also willing to challenge them.

Chicago is working with ComEd and its partners to develop a Smart Grid for a Smart Chicago that will eventually see four million smart meters deployed.

In addition there will be smart grid upgrades to the city's electricity network.

Adaptation to the impacts of climate change is also important. For this reason, resilience is increasingly seen as a key attribute of a smart city. A resilient city needs to understand the complex web of interdependencies between its physical, informational, and social systems.

Electricity networks are at the heart of these interconnected infrastructure and institutional systems. After the experience of Hurricane Sandy, New York is looking to increase the use of distributed generation alongside other grid and market innovations. That will provide an energy infrastructure better able to cope with future events on that scale.

Smart Cities and Energy Cloud 2.0

These diverse energy-focused programs are coming together with a more integrated and strategic view of urban energy requirements and provision. Consequently, cities are increasingly proactive in their approach to their future energy needs and willing to intercede in local energy markets.

They are collaborating with their local utilities where possible, but are also willing to challenge them and, if necessary, look to alternative providers and partners.

Utilities, of course, are already expanding their renewable portfolios, investing in smart grids, supporting energy efficiency programs, and developing new services and business models. The Navigant white paper, *Navigating the Energy Transformation,* examines these developments; they are creating a new ecosystem of platforms that will shape the Energy Cloud 2.0.

These platforms break down established silos and recombine technologies and services to offer industry players the opportunity to harness new value streams. Smart cities will be responsible for some of the most ambitious and challenging of these platforms, spanning energy, water, buildings, transportation, and diverse public services. Energy issues are woven through this complex fabric, and utilities should be in a prime position to meet emerging city requirements.

As cities reach a critical mass of DER and demand-side innovation, they will need partners who can provide advanced integration, aggregation, and orchestration services. They will also need help navigating the possibilities offered by further waves of innovation. Those are associated with transactive energy

systems, blockchain technologies, and the increasing use of machine learning and other advanced technologies for energy management.

The role of digital system orchestrator for the new urban energy ecosystems should be an obvious one for the local utility – but there will be strong competition from a host of new players eyeing this opportunity.

How Utilities Can Shape Smart City Development

To benefit from the development of smart cities and to play a leading role in their evolution, utilities need to ensure their strategies are aligned where possible with those of the city. In our assessment of smart city programs globally, Navigant has identified five common factors for successful smart cities. Each of these factors presents an opportunity for utilities to establish their own place in these new urban ecosystems.

Strong leadership: The leading cities have not only produced a guiding vision for a smart or future city, they are also embedding these ideas into their programs for service improvement and capital investment. Utilities need to be engaged in local smart city stakeholder groups and leadership teams and participate as active players in their development. Utilities bring unique capabilities and experience to support these programs.

A focus on local priorities and strengths: Each city has its own priorities in terms of social, environmental, and infrastructure challenges, as well as distinct strengths in terms of its history and resources.

Successful smart city programs build on those assets to develop a unique smart city vision that is aligned with local needs and goals. Utilities need to work with cities to define a future energy roadmap embedded in local realities. They can help chart a viable program for a city to turn ambitious energy and emissions targets into reality.

They also need to demonstrate how energy-related services are connected to a wide range of city priorities such as social inclusivity, economic development, and environmental improvement.

> **There will be strong competition from a host of new players eyeing this opportunity.**

Community engagement: One of the biggest challenges for the further development of smart cities is increasing the direct engagement with citizens. Cities need to work with local communities in all aspects of their smart city programs, from initial strategy to project design, deployment, and data collection.

A smart city strategy that does not engage with local communities has little chance of long-term success. Utilities have a unique connection to all city residents, which could provide a strong basis for furthering community goals as well as helping utilities improve and redefine their customer relationships. Utilities should also ensure that existing and new community energy projects are recognized as part of any smart city program.

Developing a new collaborative ecosystem: Smart city solutions can only be delivered through a network of partnerships. The leading cities are notable for their ability to bring together public sector agencies, the private sector, and academia to address new challenges.

Utilities should be key players in these emerging smart city networks and can be catalysts for new types of collaboration in the energy sphere. These new networks are also a key element in developing new services and business opportunities in the city of the future.

A data-driven transformation: The rapid growth in the number of sensors and other intelligent devices deployed across the city landscape is creating an immense amount of new data that city departments need to manage and exploit to the benefit of all.

Smart cities are looking at how they can better use that data to improve services and boost innovation. Energy data is a valuable element in any city data platform, and utilities should be proactive players in shaping new data exchanges and markets.

The emerging vision is of a smart city that integrates large and small-scale energy initiatives and solutions, including major infrastructure investments, city-wide improvements in energy efficiency, and DER.

In the process, cities will become clusters of smart energy communities that can exploit the benefits of new energy systems. To achieve this, cities and communities will need partners to develop and manage this complex network of energy innovations, services, and resources.

These requirements offer immense opportunities to utilities as they help cities drive productivity improvement and economic development from energy, transportation, and technology innovation. ❖

When Super Heroes Clash

When Policy and Practice Don't Match

BY ROGER WOODWORTH

Did you catch the movie Batman versus Superman: Dawn of Justice? If not, you can probably guess the storyline. Two super heroes are dedicated to saving the world from all of its ills.

While the purpose they share is similar, their methods are distinctly different. They're slow to understand each other and are naturally suspicious. The friction between them becomes intense, causing them to work at odds.

But each new encounter yields fresh insight. Perspectives change. Paradigms shift. And in the end, they align forces to achieve greater things for humanity than either could do alone. Roll credits and outtakes.

Hope versus Reality

A similar story plays out in real life, starring legislators and regulators. Both are well intended, with what should be complementary efforts. But like our super heroes, their methods are distinctly different. Friction and costly misalignment is too often the needless result.

You know how this show goes, too. With each new election cycle, representatives come together to reflect their constituents' current values, will, and imagination. Aspirations for better things ride high. An energy future that's cleaner, more efficient, and affordable is near the top of every official's list.

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.

So, they pass new laws. Policies to mandate efficiency of appliances and buildings. New standards for more renewable energy generation. Incentives to encourage what's in favor and taxes to dissuade what is not. Each new policy carries with it directives to government agencies to develop new regulations.

But one thing legislators rarely do is rationalize the new policy directives with the old. Nor do they offer clear guidance to the implementing agencies about tradeoffs that may be required. So, the bureaucracy is left to fend for itself. And fend it does.

The very term "bureaucracy" is telling. Coined in 1818 by French economist Vincent de Gournay, the word combines a French term and Greek suffix to describe the "power of the desk." That power manifests in new regulations.

The new processes and permits, monitoring and reporting requirements, fees and penalties are additive. What had been remains and the burden builds. Tradeoffs

Good intent goes awry when different agencies interpret policies in different ways.

are made. Uncertainties are left to the courts for interpretation. And costs rise.

The root of the problem seems obvious. Good intent goes awry when different agencies interpret policies in different ways. The following six examples, minus detailed explanations, serve as symbols of this problem.

Cases in Brief

Remember the many early wind turbines at Altamont Pass? Those initial facilities were built with support of the federal investment tax credit. The credit paid for construction, not operation. No wonder that it became a graveyard of inoperable plants.

Then there's the federal production

tax credit. This credit fixed the investment tax credit problem by tying the tax benefit to actual generation of energy. Problem is, that tie incents operation without regard to system dynamics, power demand, environmental conditions, or other requirements.

Cost shifts, negative spot market pricing, minimum instream flows, and more can all come into play.

Energy efficiency is another topic where policy and practice don't always match. For example, most state policy makers and regulators expect utilities to promote the efficient use of energy. Regulators often use a Total Resource Cost test to determine the prudence of expenditures. Other social benefits from efficiency are valued at zero.

This caps efficiency far below what might otherwise be achieved. While the demand of utility regulation is satisfied, a cleaner, more efficient and affordable energy future is missed.

In the realm of transmission, you'll recall the Northeast blackout of 2003. About fifty-five million people were affected. The costs included eleven deaths and about six billion dollars.

In response to legislators' outcry about transmission system reliability, FERC boosted the return on equity it would allow, to incent upgrades. Nice. But Congress did nothing to relieve restrictions on transmission over lands managed by other Federal agencies.

In 2007, Oregon passed the Business Energy Tax Credit – without any caps. Regulators quickly wrote the rules to implement the new policy. And it worked. The generous incentive attracted many solar projects and companies to the state.

Sadly, after receiving the credits, many scaled back, halted construction, went bankrupt, or were later found to not qualify. So there went over a billion taxpayer dollars.

Here's one more example for good measure. The California energy crisis of 2001 wasn't what then-Governor Pete Wilson thought he was signing into law in 1998. With zeal to restructure energy markets, utility divestiture of generation plants was mandated. But the new law harbored an unexpected consequence.

The divesting utilities were barred from entering new power contracts of more than one year in duration. That single proviso moved a massive amount of energy demand from a stable, long-term condition to the spot market.

Peak power prices rose from forty-five to fourteen hundred dollars per megawatt-hour. The U.S.'s then-largest utility, Pacific Gas and Electric, went bankrupt. And the system-wide event cost to everyone involved was about forty-five billion dollars.

Closing Thoughts

Good intentions and different methods can and do collide. The unintended consequences can be costly, even disastrous. That's why everyone and everything is better off when past practices are amended to align with current policy intent.

Superheroes are most appreciated when they work together. We should expect and encourage the same of legislators and regulators. ❖

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Strike While Iron Hot

This Is Not an Election Year

BY KANSAS REPRESENTATIVE TOM SLOAN

Most state legislatures are, or soon will be, adjourned for the year. Except for a few states, legislatures only meet a few months a year and then the legislators return to their homes, businesses, and private lives.

As a legislator who was formerly employed as a government and community affairs representative by a petroleum company, I have experience in trying to educate legislators. And, as a legislator, I am willing to be educated.

Maximize Your Opportunities

I have previously written that electric utilities generally do not invest enough effort in educating legislators on at least three topics. Among them: how the electric system operates, that is, how electricity is produced and delivered, what is the value of fuel diversity, what impacts power quality. As well as other factors related to the infrastructure and processes of operating a utility.

Other topics include how public policies and technological innovations impact utility operations and system reliability: that is, how state distributed generation and energy efficiency/conservation programs impact system operations and reliability.

Finally, what issues do you see on the horizon that keep you awake at night? What is the short and long-term impact on system reliability and energy costs associated with reduced reliance on coal and nuclear generation?

For most state legislators, this is not an election year. That means we have time to spend with our families, to work, and take vacations, but also to learn. View the summer and fall as opportunities to educate legislators and regulators. Let them get to know the people who actually keep the lights on, and let them know how you are working to contain costs and maintain reliability.

Do not speak only with legislative leaders and committee members. You need the votes of a majority of legislators. You need Republicans and Democrats, urban and rural residents, college – and college of hard knocks-educated, pro-business and pro-environmental protection.

Look beyond today. I encourage you to educate legislators about such topics as how a significant increase in rooftop solar units can impact system operations, how storage devices can alleviate most of those problems, and how storage costs should be handled in statute.

Address how infrastructure opportunities such as compact transmission towers improve system efficiencies, improve view-sheds, improve economic opportunities and provide rate stability to help consumers.

Discuss with legislators how flat or declining energy sales must be addressed to ensure system reliability and provide sufficient financial returns to meet the expectations of operators, shareholders, bondholders, municipal officials, patrons, and other stakeholders. Explain that there will be increasing system operational costs because of distributed generation,

You need Republicans and Democrats, urban and rural, pro-business and pro-environmental.

Rep. Sloan was elected to his 12th term in the Kansas House of Representatives. He serves on DOE, FCC, and EPA advisory committees and has hosted FERC Commissioners in Kansas. He focuses on energy, telecommunications, and water policy interactions in Kansas and nationally.

energy efficiency incentives and generation costs shifts and how you will minimize their impact on rates.

Suggest how specific alternative revenue streams can require those customers causing or benefitting from investments to adequately cover them.

Go Where Angels Fear to Tread

While you are discussing operational and policy issues, think boldly. All infrastructure projects require public review and multiple government agency approvals. These approval levels may include several state agencies, local governments, and federal agencies. While at the state level it is difficult to address federal agency impediments, you may have opportunities to streamline the project review, approval or modification and construction phases.

Many states have approved construction work-in-progress rates, but this is just the proverbial tip of the iceberg related to streamlining the approval process and recovering investments earlier.

When reviewing infrastructure applications, there generally is no one state agency empowered to resolve inter-agency or inter-government disagreements. There is also no organization empowered to address inter-state or federal-state-local government agency conflicts.

Intra-state Infrastructure: Is this summer the time to develop a coalition of infrastructure interests within a state? The coalition might develop legislation to create an intergovernmental mediation or arbitration agency with the authority to standardize and resolve agency conflicts. These could include resolving conflict over objectives, timelines, project evaluation criteria, public hearings, and rights-of-way considerations.

Interstate Infrastructure: Similarly, is this the year to develop an interstate process to accelerate infrastructure development? The Council of State Governments developed a proposed Interstate High Voltage Electric Transmission Line Siting Compact. It is intended to facilitate the review, approval or modification and construction of interstate transmission lines, including across federal agency-managed lands.

The proposed compact comprehensively addressed roles for states, federal government agencies, tribal governments, and public hearings. It included sections on process, timelines, applicant pre-submission conferences, and more.

> **You have six months to capture our imaginations, educate us, and prepare us to help you.**

The Obama Administration attempted to streamline federal agencies' infrastructure application review processes, but with minimal success. Perhaps a variant on the proposed Council Compact could be proposed by members of Congress, at your suggestion, as a means of expediting approval and construction of necessary infrastructure across state lines.

As the electricity marketplace evolves due to customer demands, technological innovations, aging infrastructure, flat demand, and other factors, now may be the time to be truly innovative in how utilities address the infrastructure approval process. This could be a worthy topic for discussion with your state and federal legislators.

Use Trips and Events

Most state legislatures belong to the National Conference of State Legislatures and the Council of State Governments. Both have national meetings and subject-specific task forces; the Council also has regional organizations with regional task forces. Sponsor field trips. I visited AEP's Mountaineer Carbon Capture and Sequestration pilot project, as a way to educate energy policy leaders. Provide speakers on vital and emerging issues.

Most legislatures do not provide funds for legislators to travel in state or regionally for educational opportunities. Most legislators will use personal or campaign funds to cover such costs if the potential reward is great enough in terms of information to be gained and the uniqueness of the location.

Most legislators are asked to speak before civic groups. While often the requested subject is what is going on at the legislature, a brief dialogue on how the electric system works and what challenges are faced would be an excellent presentation for a Rotary or Kiwanis Club meeting. That also gives the legislator an opportunity to convey that he or she is working on issues with long-term importance to the audience members. You can help develop such presentations.

Conclusion

You have six months to capture our imaginations, educate us, and prepare us to help you meet the economic and operational challenges on the horizon. Talk with your key legislators and your allies, such as other utility executives, labor unions, and contractors, about how best to collaboratively meet the challenges of maintaining system reliability and affordability in environmentally friendly ways. While at the same time meeting public policy requirements, customer expectations, and technological opportunities.

Identify, develop, and promote legislation that will enable you to anticipate and meet challenges. Then you will not need to scramble for help when it is time to respond to changes in market, technology, or political conditions. ❖

Buy Small, Win Big

Smaller Utilities for Next Deal

BY GERRY YURKEVICZ

You don't need me to make the case for investing in U.S. utilities. The goodness of utilities is well known: good infrastructure business, good regulatory support, good opportunities to expand rate base, and good upside – especially with gas. This is why investors have been snapping up utilities at every opportunity for more than a decade.

Billion-dollar utility deals grab the headlines, such as the AltaGas' purchase of WGL Holdings earlier in 2017 for 8.4 billion dollars. While the case for buying big is relatively easy to make, I believe that investors should continue to look to smaller utilities for their next deal. In my view, these smaller utilities represent great long-term investments and have fewer management challenges for the buyer.

Moreover, there is substantial value to capture. Oliver Wyman estimates that the small utility opportunity is worth about fifteen billion dollars. And it can deliver annual earnings exceeding seven hundred million dollars.

But those that are looking for a deal should consider moving fast. The smaller utility market is shrinking. Various strategic as well as financial investors have gobbled up several small utilities in recent years, such as Delta Natural Gas, Mobile Gas, Gas Natural, and Arkansas Oklahoma Gas.

That said, there are still plenty of opportunities out there for any smart buyer who wants to invest for the long term. And if you need further convincing, here are four reasons why I believe there is still a lot of benefit to thinking small.

More small opportunities: There are still more than a hundred potentially lucrative small utility acquisition opportunities out there. Some are whole companies. Others are unloved or orphaned among larger corporate parents. While still others represent carve outs and unique situations. By comparison, realistically, there are fifteen to twenty-five future mega-deals to be done.

More upside: The bigger and more complex it gets, the harder it is to improve. Our analysis of completed acquisitions over time suggests that smaller takeovers are more likely to yield faster rate base growth and greater improvement in earned return on equity than bigs.

Easier to get approval: The recent approval issues with the NextEra/Oncor and Great Plains/Westar mega-deals continue to highlight challenges. Smaller deals often get through the regulatory approval process quicker with fewer permanent scars.

Fewer negotiation, social, and management team issues: Dating and marriage are easier with smaller utilities.

To be clear, I'm not saying that buying small is the perfect solution. All else being equal, I would prefer EBITDA of a billion, not ten million dollars. Utility buyers outnumber sellers by a wide margin, even for small deals. Small utilities are not cheaper than large. Both now require similar premiums and multiples.

The number of smaller opportunities will continue to fall. Further consolidation is inevitable. However, the juice is still worth the squeeze with small acquisitions. ❖

The juice is still worth the squeeze with small acquisitions.

Gerry Yurkevicz is a partner in the energy practice at Oliver Wyman, focusing on utility strategy, mergers and acquisitions, performance improvement, and transformation. He can be contacted via gerry.yurkevicz@oliverwyman.com.

Fortnightly Top Forty Innovators

The great Nikola Tesla was a ceaseless innovator. Tesla's arguably the inventor of radio. The Supreme Court was persuaded of this when they overturned Marconi's patent. Tesla's effectively the inventor of our alternating current electricity system. Talk about a game-changer. If not for Tesla, the band AC/DC would have needed a different name.

M.I.T. professor John Trump (President Trump's uncle) wouldn't have been hired by the F.B.I. during World War II, if not for Tesla. Professor Trump's assignment? To determine whether Tesla, before dying, had invented the death ray.

Public Utilities Fortnightly is innovating too. See the From the Editor column in this inaugural issue of PUF 2.0.

One of our innovations is, well, to shine a spotlight on innovation. Each month, on this page, Nikola Tesla's Corner, we'll profile outstanding innovators in our industry. And, this November, we'll publish our new annual list, the Fortnightly Top Forty Innovators.

We're not going to do all the work. Rather, we'll look to you, to nominate innovators you admire. Maybe readers will nominate you.

Here's the ground rules. First off, we expect our annual list will be diverse. There'll be innovators from utilities, commissions, consumer advocates, associations, professional firms, vendors, and elsewhere.

Everyone making the Top Forty will have distinguished themselves, during the last year, in serving the public interest.

Everyone making the Top Forty will have distinguished themselves, during the last year, in serving the public interest. That could be through inventing costless and clean electricity generation. That would do it.

Or they 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, the 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. So, in nominating a man or woman, be sure to tell us something about what makes them a top innovator. Even if the individual is well-known, like a company exec or a commissioner.

A common question is whether the Top Forty will be very similar or very dissimilar from one year to the next. We expect there shall be a few prominent individuals who make the list every year for a few years running. Like a David Owens, the now retiring executive vice president of the Edison Electric Institute. Or a Ted Craver, the recently retired chief executive officer of Edison International. Or an Ernie Moniz, the previous U.S. Secretary of Energy.

We also expect that most of the list will be less prominent individuals, who'll make the list one year, and yield their spot the next to a deserving successor. Perhaps twenty or more of the Top Forty will be newbies each year.

So, what are you waiting for? Send us your nominations, to Steve Mitnick. My e-mail address is mitnick@fortnightly.com. ❖

Industry Names We Miss

We miss them. Like old friends that moved on. Where are they now?

The names of utilities that, not long ago, each served hundreds of thousands or millions of homes and businesses. They built and operated hundreds of power plants. Their execs were industry leaders.

Here's our list of twenty-four. Who am I forgetting?

Allegheny Power System
Carolina Power and Light
Centerior Energy
Central and South West Corp
Central Illinois Light Company, CILCO
Central Illinois Public Service, CIPS
Cincinnati Gas and Electric
Cinergy
Cleveland Electric Illuminating
COM/Energy
Conectiv
Florida Power
General Public Utilities, GPU
Gulf States Utilities
Illinova Corp
Integrys Energy Group
Long Island Lighting Company, LILCO
Middle South Utilities
Montana Power
New Century Energies
Pacific Power and Light
Savannah Electric and Power
Union Electric Light and Power
Western Resources

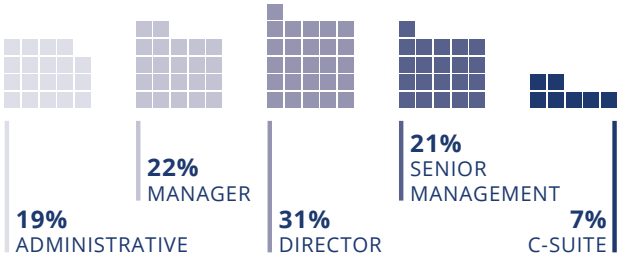
They're gone now. Though memories of them remain. ❖

The community that's changing the electric power industry...

50+
UTILITIES

20+
STATE
REGULATORY BODIES

ATTENDEE **JOB LEVEL:**



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70+
SPEAKERS &
THOUGHT LEADERS

... and the education that's driving smart electricity forward

50+
HOURS OF
EDUCATION

38+
HOURS OF
NETWORKING
OPPORTUNITIES

THE MOST IMPORTANT
ELECTRIC INDUSTRY TOPICS:

- Grid innovation
- Consumer engagement
- Information technology
- Rates and regulations
- Asset deployment
- Utility business models
- Retail & wholesale market design