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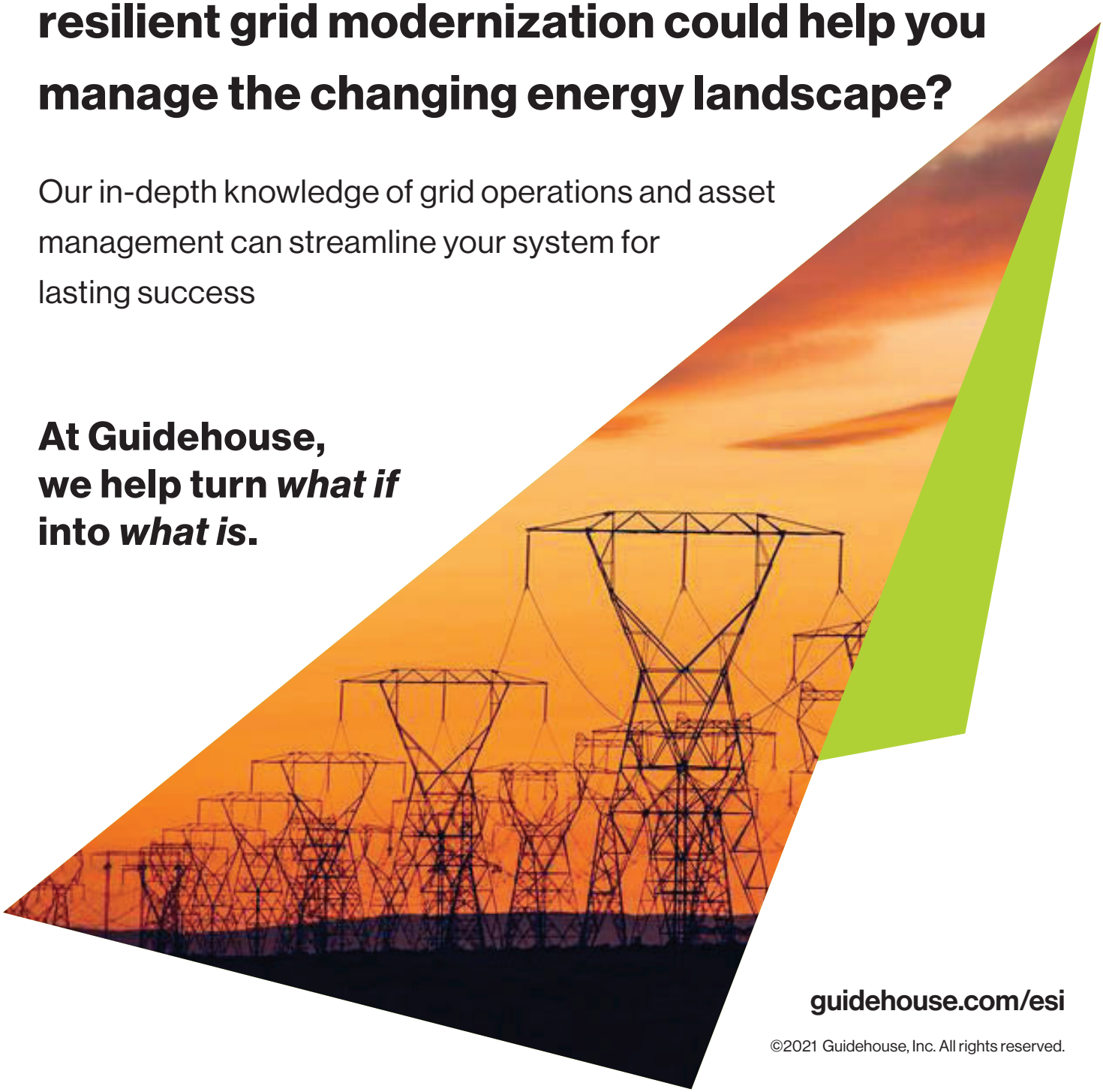

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PUBLIC UTILITIES FORTNIGHTLY®
Impact the Debate

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Cover drawing by PUF artist Dennis Auth illustrating the power industry's transformation and decarbonization.

Fourteen Months and Net Zero

What's Changed About Changing?

BY STEVE MITNICK, EXECUTIVE EDITOR

Look at what has happened in fourteen months. Just think back to the beginning of this bout with a contagion, to late March of twenty-twenty.

A fair number of the investor-owned utilities had committed to cutting their carbon dioxide emissions. And doing so quite considerably. Some of their major customers demanded it. As did some of their major investors. As did some of their state officials, reflecting public sentiment concerned about climate change with large majorities in the polling across the political spectrum.

Now think about where we are at this moment in time, fourteen months hence. In late May of twenty-twenty-one, as this issue of Public Utilities Fortnightly went to press, virtually every investor-owned utility has committed to cutting its carbon dioxide emissions. And not just quite considerably but so much so that the drive to net zero emissions has become the norm in our industry's plans.

What I just said is well worth repeating. The drive to net zero has become the norm in our industry's plans.

This development literally takes your breath away. Especially when you consider that just a couple of years ago, the consensus was that net zero was a real reach. Not only that. The consensus was that net zero couldn't possibly become a reality until we were well into the second half of this century.

Feel free please to point a finger at this writer too. Four decades and counting in utility regulation and policy didn't count for much in my prognostications. While I was confident the industry should, could, and would cut emissions severely, I never imagined that we'd plan for and commit to eighty, ninety, and then a hundred percent clean in the foreseeable future.

Something must have happened in these fourteen months to speed up the industry's run to low emissions into a sprint to no emissions. So what was it that changed about changing the carbon footprint of generating electricity in America?

Well, for one, we entered the fourteen months with one President of the United States and exited them with a different one, a man much more determined to drive the country to near net zero emissions rather soon, and then to it, not that much less soon. His prose from the bully pulpit and his plans and policies have seemingly stirred the cultural dynamics on climate change.

The drive to net zero has become the norm in our industry's plans.

For another, we entered the fourteen months with rapidly improving economics for a range of non-emitting generation options (relative to emitting options), and exited them with remarkably compelling economics for non-emitting options. This trend has greatly simplified the decisionmaking behind closing older coal-fired generating plants in particular.

And for another, the drive to net

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zero in electricity generation has been accelerated by the drive to electrify our drive, literally, our cars, trucks and buses, by the vehicle manufacturers. For if our grid's carbon intensity continues to be eight to nine tenths of a pound of carbon dioxide per kilowatt-hour, it's hard to make the case for electrifying transportation. But if we cut our grid's carbon intensity to seven, then six, then five, then four tenths of a pound, etc., electrifying transportation is transformed to a slam-dunk case.

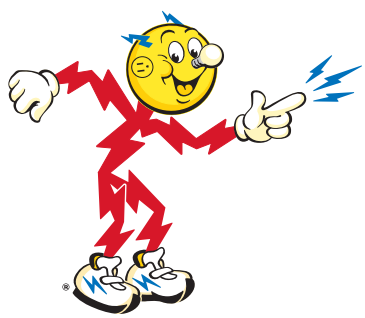
Like I said, the consensus of a couple of years ago was that net zero was a real reach and realistically far off in time. The consensus has clearly changed. Now many industry leaders are convinced that net zero is in reach, possibly as early as this century's midpoint, and perhaps a few years earlier than that.

> The consensus of a couple of years ago was that net zero was a real reach and realistically far off in time. The consensus has clearly changed.

I think we can all agree that it's been a long fourteen months dealing with Covid. Much has been lost. Much has been forgone.

Though this weird interregnum has had a few side benefits. You know, like time to catch your favorite program on Netflix. And time to toss a new plastic toy to your dog. And, also, time for net zero to transform from a slogan to an industry strategy.

P.S.: A special shout-out is appropriate. This annual issue of PUF on the state and future of power is made possible by the support of Guidehouse. PUF



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Transforming Utilities and Customers

Utilities and customers are increasingly collaborating to accelerate decarbonization. Exelon Utilities CEO Calvin Butler and Howard County Executive Calvin Ball discussed their collaboration with the PUF team. As did Portland General Electric CEO Maria Pope, Oregon Health & Science University chief administrative officer Connie Seely and Praxair Linde director of energy & USIG integration Christian Lenci.

That utilities and energy companies are decarbonizing is obvious as we have watched in wonder lately as the numeric goals have grown seemingly exponentially. But why stop there?

Utilities and energy companies are partnering up with all kinds of organizations to lead us on the pathway to cleaner air. These collaborations are limited only by the imagination, as when there are emissions, there is a job to be done, and a companion to be had. PUF looked to a couple of these imaginative couplings to see what the future holds, realizing there are sure to be more.

In Oregon, a gigantic healthcare organization and the largest industrial gas company in the world teamed up with Portland General Electric, and CEO Maria Pope has a lot to say about those two environmentally successful partnerships, as does Oregon Health & Science University CAO Connie Seely and Praxair Linde director of energy & USIG integration Christian Lenci. In Maryland, affluent Howard County, home to some three hundred and thirty-one thousand individuals, saw its Howard County Executive Calvin Ball join up with Baltimore Gas and Electric when Calvin Butler still was BGE CEO. Now, Exelon Utilities CEO Calvin Butler and County Executive Calvin Ball discuss the meaningful path to decarbonization the two Calvins have embarked on.

Exelon Utilities CEO Calvin Butler and Howard County Executive Calvin Ball

PUF's Steve Mitnick: What are your organization's goals in the transformation to a cleaner economy?

Calvin Ball: We took office in Howard County at the end of 2018. Shortly afterward, during 2019, we established a performance management system to benchmark and track our goals. We set ambitious goals to reduce the government's greenhouse gas emissions with what we call HoCo DASH, Data Analytics and Statistics Hub.

That included a new goal to reduce greenhouse gas emissions of county government operations to five percent below 2010 levels by 2030. We want to reach zero emissions by 2050.

We are implementing strategies and targets such as, obtaining twenty percent of the power needed for local government operations from renewable sources, reducing petroleum fuel consumption in the county's fleet by twenty percent, and reducing electric use of county government facilities by twenty-five percent.

We've already made tremendous progress on energy conservation, working with BGE on building the tune-up and energy conservation measures, installing energy efficient heating and cooling equipment, and implementing the energy cap, which we're in the process of.

Calvin Butler: When you look at Exelon's mission, we're committed to powering a cleaner and brighter future for our customers and communities. Then it goes to, how do we effectuate that, how do we make that happen?

Our utilities are located in and serve major cities, some in areas that are among the most dense, such as Philadelphia, Baltimore, Chicago, Atlantic City, Wilmington, and D.C. Howard County is a significant player from not only a population standpoint, but also in economic growth development.

Howard County said, we want to be a leader. Other municipalities, cities around the country, are looking at it, saying, why aren't we doing this with our home utility?

– Calvin Butler

We are committed to standing with the majority of our customers who want cleaner air and want us to take action on climate change. We can only do that by setting meaningful and practical goals that further our work in combating climate change. This is the right thing to do.

Similar to County Executive Ball, we've put some ambitious actions in place. Let me just run off a couple. One, we have said we're going to reduce our operations driven emissions by at least fifty percent by 2030 and support our customers in reducing their emissions through access to clean and affordable energy solutions.

Another major example is we announced we're going to electrify thirty percent of our combined vehicle fleet by 2025 and fifty percent by 2030. I'm pleased to tell you that the first milestone is close to being met and the second is clearly in our sights.

Electrification is integral to Exelon's plan to create a cleaner economy. It helps meet environmental goals, reduces carbon

footprints, brings healthier air to our communities, and creates opportunities through job creation and reduced energy costs.

Another important goal is achieving equity in clean energy. We are building a smarter, cleaner, energy grid and are working to reduce local air pollution to improve the health of the communities we serve.

We are especially recognizing need in the communities of color, which disproportionately suffer from the effects of poor air quality. The bottom line is everyone must have access to clean transportation options, breathe cleaner air, and have opportunity for jobs in this new clean economy.

PUF: Is there cooperation between the County and Exelon? How are you collaborating, and how do you view that from your standpoint?

Calvin Ball: It's a pleasure to be here with Calvin Butler, who is a leader, a visionary, and has always helped steer the company toward collaboration. Through the years, we've partnered with BGE-Exelon, to move the county and state forward.

Howard County was the first county to work with BGE-Exelon on EV charging stations. We've worked together to install twenty-nine and more are underway. We're replacing all county streetlights with high efficiency LED.

I'm proud that we're replacing all of our LED lights across the county. This is a bold step and a collaborative project with BGE, that's been converting the streetlights they own within Howard County to LED.

We contracted with BGE to replace the county owned lights. This project started January 2021, and a thousand streetlights have been upgraded.

Switching all ten thousand county streetlights to LED will allow Howard County to reduce electricity use by over two hundred and twenty-five thousand kilowatt-hours per year and reduce greenhouse gas emissions by three thousand and forty-five metric times over the project. That's an equivalent carbon emission reduction of planting fifty thousand trees.

We're also working to ensure that families are educated through programs like EV Smart, or EmPOWER. We're staying connected with BGE customers, participating in quarterly meetings for large customers in Howard County and building a cleaner and greener culture. We have some of our Howard County Public School System electric buses in a pilot program, beginning soon.

Powered by electricity, the two zero emission vehicle ZEB school buses and charging stations will replace two diesel powered vehicles currently in use. BGE-Exelon has been a strong partner, and that partnership has been a great example for our state, region, and country.

PUF: Calvin Butler talk about how you're collaborating and cooperating with Howard County and other places too.

Calvin Butler: It's important to know what the County Executive wouldn't share with you is he had been in the office not even a couple of weeks. I had the pleasure of being a CEO at the time, I stepped into his office, and we talked about what was his agenda.

I knew on his platform, he was talking about being environmentally conscious, climate goals, and so forth. We asked, if we have an opportunity to work together, would you be interested? He said, absolutely. These conversations started years ago, but it's important to note, we started these conversations with many others. But Howard County said, we want to be a leader.

If you can understand what that means by being a leader, you're first, but you also take some risk of the unknown. If you're a leader, you set the pace and the standard for everyone else. I give credit to the County Executive in Howard County for stepping up. He gave you a couple of examples and let me piggyback off of the buses.

BGE-Exelon has been a strong partner, and that partnership has been a great example for our state, region, and country.

– Calvin Ball

That's important to note because, several years ago BGE was the first utility in the nation to utilize all electric buses. We were using them to shuttle our employees back and forth, and the reason was we wanted to be an example to others.

When our conversation with Howard County materialized and kept developing, we talked about that. This is what we've learned, but now being able to partner with Howard County in this effort, guess what? We get to see it in a larger program.

We get to collect data and use it as a lab to continue to build off what we were doing in shuttling our employees back and forth. That's partnership. That's where you sit back and say, what else can you do?

The charging stations was one, the LED light replacement was another, but the buses go to that transportation of the electrification sector to drive it and sit back and say, now we're making a broader impact in all of our communities, and we can take that to the next level.

That's what I'm excited about. The partnership is beginning, but it's a deep one, and this is what I also know. Other municipalities, cities around the country, are looking at it, saying, why aren't we doing this with our home utility? What has been the holdup? Because, again, Howard County is leading by example.

PUF: County Executive, where's this all going in the next five to ten years?

Calvin Ball: In Howard County, as Calvin Butler thoughtfully and graciously noted, the environment is a priority. We see it as

something we are not inheriting from previous generations but are protecting for future generations.

We've become a cleaner county, signed the Paris Climate Agreement, and are the first county to join up with the Working Lands Challenge. In the next year, we're going to be creating a new climate action plan so we can target the actions to fight climate change.

We're going to be updating our General Plan, and we're going to have new focuses on climate adaptation, resiliency, equity, and social and environmental justice. We're going to continue to increase our solar capacity within Howard County through a solar power purchase agreement that will build twenty-four megawatts of new solar.

Beyond that, we're going to continue our energy efficiency. We're going to continue embracing renewable power, such as through microgrid planning, increasingly looking at those microgrids to increase reliability and continuity of the critical public safety functions of local government, and prioritizing resiliency so we improve on being ready for emergencies exacerbated by climate change, such as flooding or power outages.

We are excited about our vision, about building upon the foundation of being an environmentally friendly county and continuing to be environmental leaders for our state and nation.

PUF: You have to worry about schools, the budget, and healthcare, and more.

Calvin Ball: The environment should permeate every decision we're making. Whether it's in Howard County planning fifty thousand trees, or looking toward EVs, we should be looking at how we are being more environmentally friendly. This is embedded in how we do business in Howard County and we build this better brighter future for current and future generations.

PUF: Calvin Butler, where's this going in the next five or ten years?

Calvin Butler: We're just getting started. For our foundation, we set an aggressive goal on electrifying our transportation fleet but then we have our "Path to Clean" efforts to reduce our greenhouse gas emissions by fifty percent from our 2015 base.

We understand that is the foundation and over the next several months, I expect to come to you and others and let you know our goal is much more aggressive. That's where we're going. That's where we are committed to getting with our customers, with our communities.

Community solar is going to be key in our underserved communities. We must be part of that solution and help drive our regulators and legislators in coming up with ways to get it enacted.

– Calvin Butler

The bottom line is over the next five to ten years, we will continue advocating for equity in the health and well-being of communities we serve. That's going to be the core underpinning of everything we do.

If asked, what are you doing to that end to help get there right now, we're currently in a pilot with other organizations to sit back and talk about your drive from D.C. to Kansas. We're looking at what we can do across the Mid-Atlantic in creating charging station pipelines.

Charging stations with all the utilities. It was said, Exelon Utilities you don't have to do this alone, you can partner with other utilities and regulatory bodies and get this done across the Mid-Atlantic, and because our footprint is so large, why not be a part of this collaborative effort to get there?

Two, we're partnering and building out ride share programs. We'll initiate that in low to moderate income communities. We know private enterprises won't go there on their own. They have to be taken there by legislators, regulators, and utilities. That lays out the blueprint for our next five to ten years and beyond.

PUF: It's a little harder for Exelon because you are one of the cleanest utilities to begin with from your nuclear power.

Calvin Butler: With our new nuclear power plants, we generate slightly above twelve percent of all clean energy that's produced in the United States. When you look at our standards, you do not get to the standards that we talk about as a country going net zero without nuclear energy.

That is what we're seeing. Everyone is in love with solar and wind. It's part of the equation, but you don't get there when the sun doesn't shine and the wind's not blowing. You need that baseline of energy, which nuclear provides to guide us there.

The Biden administration has realized that, so the conversation is real now, but we have to continue that discussion, move us beyond and say, let's get these programs and plans put in place, and save our nuclear plant, but more importantly, build a zero-emission economy and drive it forward.

Looking at the intermittency of solar and wind, in 2020 or even the first quarter of 2021, our nuclear plants ran ninety-four and a half percent of the time. That's the best in the world in terms of the run ratio for our plants, which are operating at world-class levels. We'll continue to make the case that they're an important part of the solution and overall equation.

We're expanding community solar, making it more accessible, especially to different socioeconomic incomes, making it so when families are thinking about basic needs, putting food on the table, we can all thrive because it's acceptable to have clean energy technologies.

– Calvin Ball

PUF: What advice would you give to utilities, counties, or cities around the country as to, here's what Exelon and Howard County have been doing. Here are some things you can look at that might work too.

Calvin Ball: First is building upon a solid foundation. One of the first things that we did once I became County Executive was to create pillars. These pillars are the seven pillars upon which our administration is built. Those pillars include things

like having ready and successful students, and safe and engaged communities, but also one of our pillars is a clean and sustainable environment.

It's important to have that as a foundation and then build communication on collaboration, on being goal oriented, such as doing our part to address climate change, continuing to increase that support for renewable power and increase it beyond the fifty percent state standards.

We not only aspire for more, but in that aspiration, we inspire others to do more and then we're expanding community solar, making it more accessible, especially to different socioeconomic incomes, making it so when families are thinking about basic needs, putting food on the table, we can all thrive because it's acceptable to have clean energy technologies, and that makes it easier for others.

We're continuing to engage with our utility partners early on in the process so we can do these things together, because only together will we accomplish the big, meaningful things.

PUF: Calvin Butler, what advice could you give?

Calvin Butler: We recognize that all of us in the utility industry take responsibility for the grid very seriously. At our core, we are about safe operations of the grid. We should be thinking about how we take that same grid founding fundamental principles and say, let's think about all segments of the communities we serve and how we can lean in and impact the quality of their lives.

I believe that by supporting the expanded adoption of EVs, while also providing incentives and customer rebates to encourage easy use is something a utility can step into and with a straight face, be in that space.

No one will sit back and think they're only doing it for increasing their usage on their grid. They're doing it for the quality and the life of the communities they serve. We believe that reducing the transportation emissions is critical, but I also believe to get there, there are a few things I would say to roll out to them to facilitate our jurisdictions in driving clean energy solutions.

Our utilities need to be doing a few things. One, consider the role of distributed energy resources, DER, like battery energy storage and what it can do, how it can play a part in addressing grid needs.

Microgrids are critical as we continue this journey to a clean society, investing in systems that allow for advancing grid monitoring control and automations that also better allow for service reliability as more DER is attached to the grid. We must be part of that conversation. There are catalysts to that modernizing and investing in the grid to increase hosting capacity. That is important as we work to increase resiliency.

In light of the increased instances of severe weather, Ellicott City in Howard County, had its hundred-year storm two years in a row. You can no longer sit back and say, oh, that is a fluke.

Those storms are occurring more regularly, and we have to be prepared for them as utility companies. We must be part of delivering on the distributed energy resources. I love the fact that the County Executive talked about community solar.

Community solar is going to be key in our underserved communities. We must be part of that solution and help drive our regulators and legislators in coming up with ways to get it enacted.

Partnerships are key. The school bus program is just one example. We're proud to be working with Howard County. We consider it as one of our communities, but it's also one of our largest customers.

I sit back and say, I'm no longer CEO of BGE. I'm so proud of the BGE team, Carim Khouzami as a new CEO, and the leadership team stepping in, not missing a beat, and working with the County Executive because it's that important to us. ❍

Portland General Electric CEO Maria Pope, OHSU's Connie Seely and Praxair Linde's Christian Lenci

PUF's Steve Mitnick: What are your organization's goals in the transformation to a cleaner economy?

Maria Pope: Our ambitious goals reflect our customers' expectations and the values of the communities we serve. We aim to reduce greenhouse gas emissions associated with the power we serve customers by at least eighty percent by 2030, from 2010 levels, with an aspirational goal of zero greenhouse gas emissions by 2040.

In doing so, we remain laser focused on reliability and affordable electric service for all customers. To meet these goals, we will touch every part of our business, from power generation to the vehicles we drive, to how we operate on buildings.

PUF: Connie, you help run a huge hospital center, with research, students, and more. What are your organization's goals, as far as the transformation to a cleaner economy?

Connie Seeley: OHSU is one of Oregon's largest employers

The partnerships we have with OHSU and Linde are an example of all of us working collaboratively to bring the best technologies and thinking together in order to make a difference for all of our businesses, customers, and the region.

– Maria Pope

and the largest employer in the city of Portland. All in with our learners, we're over twenty-three thousand people.

While our primary mission is the health and well-being of Oregonians, teaching and scientific discovery, we have the ability to leverage our buying power and the economic engine that is OHSU, and we do that because we care deeply about human health. When we talk about a greener economy, the underpinning of that is the health of human beings.

PUF: Christian what are your organization's goals in the transformation to a cleaner economy?

Christian Lenci: Our company, Linde, recently merged with Praxair – becoming the largest industrial gas company in the world. Our company's mission is literally making our world more productive. It describes what we do.

I've been with Linde for thirty-five years, and these things were important back then and even more important today. We solve other people's environmental and sustainability problems. By using elemental products, like hydrogen instead of natural gas or oxygen instead of air, we help our customers decrease their environmental footprint.

We're the largest global producer of hydrogen and are actively involved in leading the change to a hydrogen economy. We are investing over a billion dollars in decarbonization projects between now and 2028, with greater than one third of our annual R&D budget going to decarbonization.

During that same time period, we're working to achieve thirty-five percent in greenhouse gas reductions and doubling our use of carbon free energy. This is a core part of who Linde is, and part of our long longstanding value proposition focusing on sustainable growth with customers and in the communities in which we live.

PUF: What are your plans for the transformation? How are your organizations collaborating and working together, including with Linde and OHSU?

Maria Pope: The communities we serve are diverse and dynamic. Partnerships with leaders, such as OHSU and Linde, are essential to delivering the benefits of clean energy while keeping prices affordable and maintaining reliability.

For several years, PGE and OHSU have partnered to enhance reliability that's critically important to their medical center, especially during the challenges of a pandemic. We've worked with OHSU on everything from solar installations to stand-by generation, to infrastructure and resiliency solutions.

Understanding the critical medical research and power quality needs of OHSU led to innovative solutions. It's truly been a partnership and we've redefined how we think of each other's equipment, so that we can deliver the highest levels of reliability.

We're working with Linde to utilize the scale of their energy usage and ability to curtail operations during critical periods. Essentially, Linde will help PGE with overall grid stability and resiliency with their flexible load, and everyone will benefit. We also look forward to working with Linde on further hydrogen development to take decarbonization to the next level.

Our partnership is not just important in terms of green energy,

but also in terms of the overall economy and development of our region, as both Linde and Portland General serve some of the largest and fastest growing customers in the region.

These are just two examples, and we're working with many other customers on partnerships that meet their unique needs and drive to a decarbonized economy.

PUF: How are you working with PGE and other organizations in the community in collaborating and trying to take advantage of what everyone can bring to the table?

Connie Seeley: It goes without saying, reliability is number one. We are a level one trauma center. The community relies on us to operate at our fullest potential, whether there's ice or a windstorm, and PGE has been masterful.

We have some old infrastructure and we're on the top of a hill with two access roads. In terms of the topography and the logistics of maintaining our plant, there are always unique challenges, and PGE is right there with us in every moment in the pouring rain or whatever's going on to make sure the lights are staying on and we can do what we do best.

It isn't just about Portland. Oregon is a rural state and with PGE's help, we have partnered and invested in renewable resources in rural parts of our state. In Morrow County, the new solar facility will provide us with renewable power and support the local economy.

This is not my lane. Vaccines are more my lane. We rely on Maria and her PGE team to help us meet our goals of resiliency, reliability, and green power.

– Connie Seeley

PUF: Talk about how you've been working with PGE and some of these other companies.

Christian Lenci: I've been working with Maria and her team here the last couple of years, and frankly I'm impressed. They have options for us in the renewable space, including an innovative program called Clean Wind, where companies like ours are able to take part in the public purpose charge and self-direct it to renewable power choices.

PGE also offers the Green Future Impact Program and is gearing up for phase two. We've already put our name in.

An important area for us is energy efficiency, where we are literally doing the hard work of getting under the hood of our plants, and physically decreasing our environmental footprint. It's difficult but very satisfying work. I'm impressed with Oregon's energy efficiency programs that help Linde make that happen. The Energy Trust of Oregon is doing a fantastic job.

PUF: What's your vision for how far this'll progress in the next five years to ten years?

Maria Pope: Today, there is a close working relationship with our customers. They challenge us, as you can hear from Connie and Christian, to be more agile, more responsive, and to unlock synergies that meet all our needs.

At PGE, we're driving solutions and achieving better results for customers. Over the next five years, the rapid growth in renewable energy and distributed energy resources with advances in battery storage and hydrogen will be impressive.

We will continue to see the integration between energy generation and the distribution system with energy use. Additionally, our customer service and reliability will be digitally integrated for seamless customer experiences, enhancing reliability for OHSU, and growing clean energy supplies for Linde as they serve the region's rapidly growing tech sector.

Utilities and industrials can work together and help create the change. You've got to put aside old paradigms and you need support and openness from your utilities and regulators because the solutions here are going to be different.

– Christian Lenci

Over the next ten years, we are expecting dramatical changes. As technology advances, we will make the move to net zero and real time integration of all sources and uses of electricity.

Customer energy use and generation will be seamless and go hand-in-hand with dynamic pricing for the overall market integration. We'll widely use AI, machine learning, and automation to anticipate customers' preferences, overall grid stability needs, and deliver a truly interconnected clean energy future.

PUF: Connie, what's your vision for the next five years to ten years? How do you see this collaboration and the transformation, decarbonization going? Are you optimistic?

Connie Seeley: I am optimistic. It's a bright future. PGE has been a fantastic partner. First and foremost, as you've heard me say, it will always be about resiliency and reliability. We have to operate in a dependable way.

We will always be looking for greener, better, and more efficient ways to buy power. We will grow and we're an economic engine for Oregonians. We will bring new buildings online and we'll be looking to PGE to help us think through how we build out the grid.

This is not my lane. Vaccines are more my lane. We rely on Maria and her PGE team to help us meet our goals of resiliency, reliability, and green power.

PUF: Christian, in the next five or ten years, how do you see this going?

Christian Lenci: Both Linde and PGE share a strong desire and commitment for a clean energy future. Maria mentioned, and she's right, that we're exploring ways to use our inherent demand response capabilities that exist in our plant designs to help decarbonize the electric grid, both in Oregon and elsewhere. As a part of that, we have recently announced an expansion at our Hillsboro plant to help increase that demand response.

We're trying to come up with new ways of looking at how we get the customer side, the demand side versus supply, into the electrical grid equation. That has been historically challenging in the West.

I also expect to see a new pipeline of energy efficiency opportunities in the next decade with the Energy Trust of Oregon, and that's going to continue to reduce our energy intensity as we grow.

PUF: What advice would you give to utilities and other major customers of utilities across the economy as far as how they can collaborate and work better in this transformation?

Maria Pope: Climate change is having a real global impact, and greenhouse gas emissions must be dramatically reduced on an economy wide basis. It's going to take all of us together working in partnership.

The new reality requires agility and a willingness to pivot and think differently. The partnerships we have with OHSU and

(Cont. on page 55)

NARUC Summer Policy Summit

July 18-21, 2021
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NARUC President Paul Kjellander invites you to join us in Denver for a meeting that features thought leaders, regulators, industry, consumer advocates, and others for an agenda that's practical and educational.

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** Safety guidelines will be in place to reflect prevailing government policies and health protocols.*

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WEC Energy Group Commits to Aggressive Environmental Goals

Conversation with WEC Energy Group CEO Kevin Fletcher,
COO Scott Lauber,
and SVP Beth Straka
on their May announcement

Aggressive may not have been a word associated in the past with the Midwest, but those days are over. WEC Energy Group is aggressive with its environmental goals announced in early May. It has found a way to keep reliability and affordability intact while pursuing, yes, aggressive decarbonization goals.

Not only did WEC Energy Group slash carbon dioxide emissions more than fifty percent below 2005 levels at the end of 2020, but it committed to a sixty percent reduction in carbon emissions by 2025 and a further eighty percent reduction by the end of 2030.

That feels, like, tomorrow. How will it get there, PUF wanted to know, and so talked with major players who are making this happen. Enjoy this discussion with WEC Energy Group CEO Kevin Fletcher, COO Scott Lauber, and SVP Beth Straka.

PUF's Steve Mitnick: May 4th you made a distinctive commitment. What are the most important aspects of this commitment and plan?

Kevin Fletcher: We announced one of the strongest environmental goals in the utility industry. We plan to reduce carbon emissions from our electric generation sixty percent by 2025, compared to 2005 levels.

We had previous goals as other utilities have, and as a result of our approach and creativity, we found we've been able to meet those goals and exceed them. We also took a deeper look at what we're able to achieve with current technologies. To that end, we set the more ambitious 2025 goal.

We've also established a goal of an eighty percent carbon dioxide reduction by the end of 2030, compared to our 2005 levels, and our 2050 goal for our generation fleet is to be net zero carbon. The beauty of this plan is that we can do what we just laid out, our sixty and eighty percent goals, with existing technologies.

As we plan for a bright, sustainable future, our priorities can be summed up in three words – affordable, reliable, and clean.

PUF: Can you fill in some of the blanks as far as the existing technologies you're going to apply and invest in?

Kevin Fletcher: I've been privileged to be in this industry for over forty years. When I say existing technologies, I mean leveraging the change in technologies that we've seen in the last decade.

Solar and battery storage are two examples. To now see those technologies at much reduced price points is amazing. Solar certainly provides what we need at a time when the sun is shining, but we need backup.

Blending battery storage with solar and wind, along with our current technologies will allow us to meet our 2030 goal. We are also retiring older, less efficient generation and replacing them with more efficient natural gas technology.

Scott Lauber: When you think about the technology and how far we've come in the last ten years on cost and performance, it continues to improve. We were able to achieve a little over fifty percent carbon reduction last year compared to our 2005 baseline. We have seen good progress, which gave us an opportunity to relook at where we're at and set new, industry leading goals.

The beauty of this plan is that we can do what we just laid out, our sixty and eighty percent goals, with existing technologies.

– Kevin Fletcher

The frigid temperatures we experienced in February showed just how important reliability is in our business. Reliability comes through fuel diversity. By adding solar, wind, and battery storage, along with efficient and clean gas plants, we're able to achieve these goals with the operations we currently have and maintain the reliability our customers depend on.

The capital plan we announced through 2025 is not banking on anything new. As technology continues to evolve like carbon capture, we'll evaluate those opportunities.

Kevin Fletcher: We are actively engaged with the Electric Power Research Institute (EPRI) and the Gas Technology Institute (GTI) Low Carbon Resources Initiative. We're one of the members that got involved early on.

We're looking at the current technologies like solar and batteries, but also ones that need to be in place for the future like carbon capture and others. The focus of the initiative is to accelerate the development and demonstration of new low- and zero-carbon energy technologies.

At the end of the day, to get to where we need to be to hit our 2050 goal, for us and our peers, new technologies have to be a part of it.

What we have to be smart about is making sure we've got the right generation diversity moving forward. We're going to be aggressive with technology, but we're also going to be smart about it. At the end of the day, our responsibility is to make sure that the gas is flowing and electricity is available to our customers. That's our first and foremost responsibility.

Beth Straka: Speaking of flowing gas, don't forget that a little more than a third of our business is natural gas distribution. We also identified and announced a new opportunity for our methane reduction goal.

We announced one of the strongest environmental goals in the utility industry. We plan to reduce carbon emissions from our electric generation 60% by 2025, compared to 2005 levels.

– Kevin Fletcher

It is especially important from an investor's perspective, because it seems that many of the ESG oriented funds, including index funds, are considering your overall exposure to coal.

– Beth Straka

We set a new goal of net zero methane emissions from natural gas distribution lines by 2030. We are going to achieve this by continuing to upgrade our gas delivery networks, and also by incorporating some renewable natural gas in our system.

PUF: What's the motivation? Why are you all so passionate about this commitment and plan and the related investments and actions you're taking?

Kevin Fletcher: Ultimately, it's our responsibility to provide our customers with the energy they need, and we take that very seriously. We want to do it in a way that's affordable, reliable, and clean.

With current and future technology advancements, we're able to reach our goals and meet the needs of our customers. It is an exciting time to be in the utility industry. To leverage technology and engineering creativity in a way that helps society and satisfies what our customers are asking for.

Let me underscore this – customer satisfaction and reliability are our bedrocks and it's a strong foundation. If our customers are asking us for affordable, reliable, and clean energy, then we will deliver.

We aggressively are going down this path because, number one, it's the right thing to do. Number two, we have the ability and the capability of doing so.

Scott Lauber: When you think about where we are with the technology and the performance, it turns into a win on several fronts. It's good for the environment. It's good for customers because we're lowering our fuel and operating costs. It's making an investment for shareholders by improving the climate, having a better cost structure and adding fuel diversity.

When you look at every box that you want to check, it's positive in every direction.

Beth Straka: In 2020, we launched our priority sustainability issues, recognizing that if we provide an informed sustainability strategy, that will in turn drive long-term business value.

Our priority sustainability issues are a reflection of many key stakeholders. Certainly, our customers are important, but

The capital plan we announced through 2025 is not banking on anything new. As technology continues to evolve like carbon capture, we'll evaluate those opportunities.

– Scott Lauber

Scott also added in another important stakeholder group – our investors. They're driving a lot of this, too. We're hearing from them, and they have their own sustainable priorities.

Kevin Fletcher: It also lines up well with what our state jurisdictions are interested in. The beauty for us is that the path that we're on is the path we chose because it's the right thing to do.

If you look at our goals, they support national and international efforts, including the Paris Climate Agreement. It ties in not just locally, but globally to what investors and customers are looking for.

PUF: It sounds like you'll be able to do clean, but also cost efficiency and resilience and do it almost building each onto the other.

Kevin Fletcher: It has to be done that way. The decisions we make when we retire plants and introduce new technology have to be done in a way that is cost effective and meets our customers' reliability requirements. I feel good about our direction, and I'm proud that we've announced some of the strongest environmental goals in our industry.

Beth Straka: It is especially important from an investor's perspective, because it seems that many of the ESG oriented funds, including index funds, are considering your overall exposure to coal. We took a look at our asset base by business type, and currently we're around seventeen percent coal generation.

We're looking at our capital plan that incorporates a number of new, regulated renewables, and are continuing to invest in renewable infrastructure investments as well. Our coal-based assets will be less than ten percent by the end of 2025.

Kevin Fletcher: We're confident we can achieve the milestones that we've talked about while continuing to be a leader in reliability, customer satisfaction, and financial performance. PUF

Lightning Round on Power's Future

A baker's dozen of Guidehouse's experts hit their buzzers and answer our questions:
Hector Artze, Mike Bianco, Dan Bradley, Margot Everett, Derek Jones, Michelle Fay, Dan Hahn, Robyn Link, Chris Luras, Danielle Vitoff, Ted Walker, Karen Wilson and David Workman

What impact will ESG have on the utility enterprise over the next decade?

How can the industry more effectively meet evolving societal, shareholder, and board expectations?

What tangible steps can utilities take today?

Ted Walker: Utilities can leverage ESG to evolve in two different but related ways:

As strong ESG-focused enterprises to investors and regulators, and as ESG partners to meet the changing demands of their customers and communities.

Shareholders and company boards are demanding that utilities adopt strong ESG positioning across the organization. Guidehouse research has shown that investor-owned utilities with strong ESG plans and roadmaps have higher, and in some cases more stable, valuations than those that do not. An ESG strategy will need to build tangible enterprise value; utilities with ESG plans that are merely window dressing will be highly discounted.

Utilities are trailing commercial and industrial as well as municipality, university, school, and hospital customers in developing ESG plans. By positioning themselves as partners in ESG, utilities can work with these customers to develop and provide more optimized solutions.

Utilities can take these tangible steps:

Internalize ESG – Use an ESG plan as a cornerstone for building a next generation decarbonized and decentralized utility (think 2030 and beyond), one that moves toward decarbonizing, is active as a strong community and social partner, and governs itself with high standards and metrics;

Collaborate – Be active in conversations with customers, regulators, legislators, and other stakeholders to ensure that the utility ESG plan is holistic and relevant to each group;

Build customer solutions – Develop innovative solutions that will support customers in achieving their own ESG goals (such as facilitate the electrification of a customer's transportation fleet);

Partner – The path toward decarbonization is not one that any single entity, including utilities, can take on their own. Utilities should look for like-minded partners that act as force multipliers. ❍

You have a short elevator ride alone with the chief executive of a major utility. What would you want to tell him or her?

Dan Hahn: Change is here. We encourage CEOs to think about the three following key questions as they relate to the role of utilities:

Your customers – What are you doing to help your customers decarbonize and address climate challenge risks?

Your shareholders – What are you doing to help drive enterprise value specifically through environmental, social, and governance (ESG) strategies?

Your employees – What are you doing to empower your employees to drive your organizations' decarbonization, sustainability goals, and objectives?

These questions can be addressed through strategic planning, science-based targets, decarbonization efforts, journey mapping and governance, and processes to manage the roadmap initiatives and benchmark outcomes. How well you address these three challenges will define your organization's legacy. ❍

How have events over the past year (COVID-19, Texas power crisis, etc.) changed the utility industry's strategic priorities? What can utilities do to improve resiliency and business continuity readiness?

Hector Artze: To say that the events of the past twelve months have had a major impact on the priorities of utilities is an understatement. With COVID, utilities had to, in short order, focus on transitioning operations to a remote working environment.

They did so while facing significant revenue decline related to the corresponding economic slowdown, which in turn put greater focus on the need for new processes to drive operations and maintenance (O&M) cost reductions.

In the midst of the COVID-19 pandemic, many utilities and their customers were affected by extreme weather and climate disasters. Across the U.S. alone there were six hurricanes, one tropical storm, wildfires that burned more than ten million acres, heat waves and drought,

and the recent Texas winter storm, among others. This underscores the need for risk assessment and system resiliency investment planning.

What can utilities do to ready their organizations for future disruption? Beyond implementing new processes to support an increasingly remote workforce and drive lower O&M costs, utilities need to develop weather and climate change impact analyses to quantify the risk to their assets and operations, identify mitigation solutions, and develop resiliency investment and implementation plans.

Growing interest from investors, utility regulators, and the U.S. Securities and Exchange Commission in quantifying and reporting on the impact of climate related risks to physical assets will require utilities to incorporate more granularity in their climate impact risk models, which will need to be increasingly incorporated into integrated systems planning processes. ❍

What do utilities need to do to position themselves to succeed under the Biden administration, including accessing potential green stimulus funding, infrastructure spending, clean energy legislation, and new priorities at the U.S. Department of Energy, Environmental Protection Agency, and Federal Energy Regulatory Commission?

Karen Wilson: The energy industry plays an important role in federal, state, and local government agendas to achieve a clean energy economy and zero net emissions while increasing jobs, equity, and green innovation.

Achieving a more resilient national infrastructure requires integrated effort between the public and private sectors. Entities should consider leveraging new combinations of incentives, carbon capture credits, expanded grants, loans, and direct public investments to achieve their ESG and decarbonization efforts.

However, these will likely come with greater requirements for accountability, transparency, and responsibility both to advance racial equity and support underserved communities across the country as well as develop resiliency investment, implementation, and disaster mitigation plans. ❍

How will utilities' relationships with their customers change over the next three years? How can utilities get ahead of this change? What lessons should utilities take in terms of remote customer engagement?

Dan Bradley: The growing importance and acceleration of digital transformation and ESG are ushering in a new business environment. To meet the evolving demands and expectations of customers, utilities need to rethink their strategy and organizational capacity to execute the next iteration of the utility business: integrating and orchestrating distributed assets into a more complex and decentralized energy system with the customer at its core.

To get ahead of this change, utilities will see:

Customer experience becomes a growth strategy to provide customers a modern experience and connect them with a suite of solutions and partners that can address their needs;

Customer programs expand to include whole building and mobility solutions that support customer decarbonization and ESG plans;

Virtual power plants become a core model for utilities to integrate and aggregate distributed assets to deliver value to customers and flexibility to the grid;

Equity, inclusion, and opportunity become core values that help to ensure the energy transition provides affordability and opportunities for all customers;

Organizational culture and values enable a workforce and enterprise that is increasingly focused on impact, outcomes, partners, and delivering value to customers to meet these new sets of needs.

The lessons from the ongoing COVID-19 pandemic demonstrate how quickly change can occur in a crisis. It has taught us that the speed of change isn't always linear; it sometimes is exponential. Success in this new business environment relies on utilities relentlessly adapting their relationships with and offerings for customers. ❍

What immediate actions can utilities take to benefit from trends in electrification in transportation and buildings?

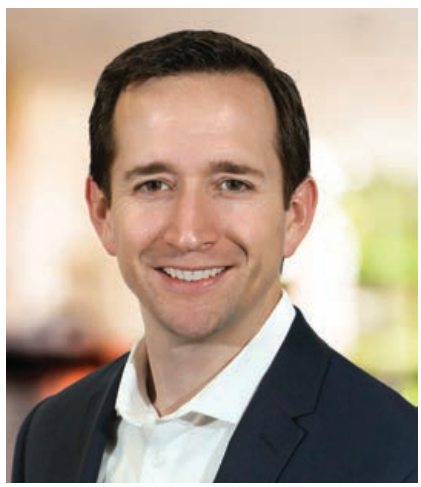
Derek Jones: Global consumer demand grows daily for electrified facility and mobility solutions that address climate, equity, and commercial needs. The rise of electrification in buildings shows no signs of slowing soon.

It's no secret that the evolution of mobility power trains that use fuels beyond petroleum and are increasingly automated, connected, electric, and shared present a universe of opportunity with limitless possibilities.

Key electrification trends include: Funding opportunities for regional infrastructure from new federal policies;

Hastened investment activity from capital markets; and

Full premise customer electrification opportunities for facilities and fleets, corporate investment in mobility and building electrification initiatives to meet ESG goals.



As these trends accelerate, market actors will move fast to stack new electrification value streams in their new and active business models. Utilities are at the epicenter of this acceleration and are well positioned to benefit if they keep pace and develop partnerships with other actors at the local, national, and global levels.

Utilities poised to benefit from this acceleration will plan with a bias for action, maximization of data analytics from activity inception to operation, and delivery of customer solutions in concert with – not reactive to – federal and capital market activities. ❍

How can gas utilities preserve their business value as society transitions from fossil fuels? Is hydrogen a good opportunity for them to diversify?

Danielle Vitoff: The most cost-effective and resilient decarbonized future energy systems include critical roles for gas system infrastructure, low carbon fuels, and by extension gas utilities.

The role of gas utilities within the decarbonized energy system becomes increasingly important as biomethane and hydrogen are incorporated and used within the energy mix.

Preserving gas utility business value is not just about investors; it is critical to the achievement of decarbonization goals. Achieving these goals will require participation from gas utilities as well as forward-looking policy and regulation to provide open pathways for the needed utility transformation.

To maintain the pathway to viable business models, gas utilities need to:

Own their impacts, including transparent reporting on Scope 1, 2, and 3 greenhouse gas emissions;

Establish long-term targets that align with climate science.

Gas utilities also need to:

Aggressively pursue a comprehensive portfolio of greenhouse emissions mitigation opportunities from energy efficiency to the development of biomethane and hydrogen;

Instead of fighting against electrification, refocus their energy on delivering complementary approaches to electrification particularly for hard-to-electrify sectors (such as, shipping, maritime, and aviation).

To deliver on this future, gas utilities will need to be proactive in engaging politicians and regulators to:

Align strategies with the ultimate goal of carbon reduction instead of picking winning and losing technologies and solutions;

Provide cost-recovery mechanisms for the decarbonization of the fuel supply – for example, provide regulatory structures for green tariff programs to support the introduction of low carbon fuels;

Align the assessment of future energy system impacts across the useful life of assets so that utility operators can structure planning processes to deliver on carbon reduction goals.

Change is coming quickly to the gas utility sector, a sector that has not navigated disruptive change in recent history. Gas utilities will have a choice: be an integral component of the decarbonized energy system or risk being displaced by others who embrace transformation. ❍

In light of the SolarWinds hack and other cybersecurity threats, what should utilities do to protect IT and OT systems and digitally enabled physical infrastructure?

Chris Luras: Utilities must adopt a comprehensive risk management approach to understand and mitigate cyber risk to their facilities and operations. This begins with assessing and identifying critical distribution equipment (such as equipment that is critical to the reliable operation of major cities) and enhancing the cyber and physical security processes and controls for those identified assets.

Implementing top security methods to avoid bad actor access is also imperative. These methods include employing strong identity and access management using multi-factor authentication, implementing least-privilege principles, ensuring software is up to date and configured securely, and segmenting mission-critical systems and continuous monitoring.

The workforce needs to be trained, prepared, retooled, and instilled with a culture of cybersecurity in which everyone in the organization bears responsibility, as most successful cyberattacks result from human error.

The fundamental role of the utility is to provide safe, reliable, and uninterrupted electrical service to the end customer. Protection of this service is paramount to the success of the utility and involves a combination of people, technology, and operations working in a coordinated way to ensure secure delivery. ❍

What will the utility of the future look like in 2030? How will it be different from today's utility?

David Workman: Utilities will evolve more in the next ten years than the previous one hundred. Moving toward 2030, energy providers will continually learn from the significant advancements across global industries and harness the digital capabilities and process improvements to drive smarter, more efficient opportunities for reliable, clean, safe, and affordable power to consumers.

The shift toward electrification and greater penetration of clean and distributed energy resources (DER) will be a driving force to reduce carbon emissions with continued improvements in energy efficiency.

Renewable energy resources will make up much of the energy generation market share along with DER, storage, and two-way power flow capabilities to mitigate the impact of increased demand from electrification.

EVs will become the norm, and utilities will have modernized grid infrastructure to accommodate advancements in technology and processes to address the increased demands. Regulators will recognize the need for clear and balanced policies that address safety, reliability, and efficiency that mutually benefits the utility and consumer.

Customers will expect more choices, greater intelligence, and integrated interaction with the energy providers to manage energy use more efficiently at disaggregated levels. Additionally, energy providers will continue to move toward customer centricity and provide seamless interaction capabilities to drive Amazon-level customer self-service capabilities. ❍

What role can utilities play in their customers' quest to decarbonize? How have utilities shifted more decarbonization choices to their clients?

Robyn Link: Utilities have long brought clean energy and low carbon solutions to their customers through energy efficiency initiatives. The energy efficiency playbook that has served utilities and their customers well is the foundation for the next generation of decarbonized solutions. Utilities can leverage the existing energy efficiency playbook and expand decarbonization initiatives in the following ways:

Customer solutions – Utilities can continue as the trusted advisor of energy efficiency solutions and grow relationships with their energy efficiency partner network. They can become the orchestrator of clean energy solutions by creating marketplaces that drive innovation, attracting top solution players, rewarding based on actual performance, and encouraging solution flexibility to best meet customers' decarbonization goals.

Customer segmentation – Utilities can strengthen engagement and action by understanding the specific needs and goals of various customer types. Developing enhanced customer journeys, buyer personas, and dedicated utility resources – carbon advisors – will help focus low carbon opportunities specific for each utility customer.

Digitization – Utility customer engagement platforms provide a kilowatt-hour lens into energy efficiency recommendations, energy use and costs, and usage highlights and alerts. Configure these platforms to leverage carbon data and abatement recommendations to customers.

Evaluation, measurement, and verification (EM&V) – Utilities can adopt energy efficiency EM&V best practices and structures to establish baselines and track and measure carbon targets for customers as part of the utility's overall EM&V efforts. ❍

How has risk management changed? What can utilities learn from other industries?

Mike Bianco: Risk management for utilities will fundamentally change after COVID with the recognition that we cannot allow a failure of imagination to prevent us from worst-case scenario planning and preparation.

Examples include: Expanded scenario planning – Utilities realize that future scenarios need to reimagine black swan events such as the pandemic by asking the question: What is our response to events and scenarios, such as a global pandemic, that fundamentally alter business plans and normal ways of working?

Broader view of employee and customer safety – The pandemic has required utilities to revisit and broaden their perspective on approaches toward employee and customer safety, such as remote work policies and updated safety protocols for field staff.

The utility role in community – Utilities provide a public good, powering our economy, businesses, and homes and are critical to the stability and health of

society. Crisis management, community and related stakeholder outreach and coordination, connect/disconnect services, and virtual contact centers are just a few examples of where utilities will plan differently in serving their communities going forward.

Utilities would also do well to apply lessons learned from other industries including:

Going digital – Providing a seamless, touchless customer experience is paramount (such as e-commerce companies and grocery stores, which have reinvented the customer experience via online shopping with options for curb-side drop-off and door-to-door delivery). Utilities will need to build platforms and tools to offer more engagement options and seamless customer experience, along with supporting a remote, more distributed workforce.

Being nimble and responsive – The restaurant sector was one of the hardest hit by COVID-19. In response, many restaurants reinvented themselves from providers of high-end dining to let-us-be-your-kitchen models with contactless delivery of fresh, ready-to-prepare meals. The food and beverage industry's ability to quickly reinvent, react, and adapt offers lessons on creating new ways to respond to customer needs. ❍

Hector Artze is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment. He assists clients with crafting their smart grid strategy and leveraging the integration of new and existing technologies to transform businesses and organizations. With a professional career that spans more than twenty-two years in the electric utility field, his expertise includes contract negotiations, process improvement, asset management, distribution operations, emergency restoration processes, evaluation and implementation of information technologies for electric utilities, major accounts management, government contracting, energy conservation, quality improvement, and construction services.

Mike Bianco is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment. He brings more than twenty-six years of combined experience in information and operational technology strategy, engineering, program planning, systems integration, and consulting experience with a variety of industries including energy and utilities, semiconductor manufacturing, banking and investment, and city and state government. His innovative technology solutions and consulting services have supported utilities in their move to the digital grid and in tackling grid modernization strategy and implementation, transformational program planning and delivery, IT/OT systems integration, telecommunications engineering and build, grid security and compliance, and grid operations analytics.

Dan Bradley is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment, working across the utility, investor, and manufacturing sectors. His most notable recent work centers on his role as director-in-charge of REV Connect, where he is helping the State of New York advance its Reforming the Energy Vision (REV) goals through a first-of-its-kind program that facilitates partnerships between innovative companies and utilities. He has authored dozens of articles on emerging energy markets and technologies and has spoken at numerous industry events. In 2019, he was recognized by Consulting Magazine as one of the Top 25 Consultants.

Margot Everett is a director in Guidehouse's global Energy, Sustainability, and Infrastructure segment. She is an industry leader in developing modern utility pricing solutions, helping clients transform their pricing structures to improve transparency, promote new technologies, and maintain cost-based economic principles. She has nearly thirty-five years of experience in energy policy and market issues, analytics, and strategy, with expertise in electric and gas rate design, cost allocation, load forecasting and research, and market, credit, and enterprise risk management.

Derek Jones is a director in Guidehouse's global Energy, Sustainability, »

What are the major regulatory changes you see in the next three years? How can regulators support more aggressive innovation from utilities and optimize outcomes for all stakeholders?

Margot Everett: Utilities will face increasing pressure to contribute to and enable the achievement of decarbonization goals across multiple sectors. They will need to do so while keeping rates affordable to further accelerate the adoption of non-carbon technologies for other sectors (such as transportation).

A deliberate and fundamental shift in how utilities operate in the space between energy resources and end-use customers is anticipated, and hence how regulators evaluate and monitor these activities.

As more utilities implement ESG strategies and commit to twenty- to thirty-year carbon reduction pledges, integrated resource planning will need to include future risk of certain resource types as well as enabling – and even incenting – involvement of customers to help transform and optimize the grid at the lowest cost.

Regulators should work with utilities to enable the following: Create a risk-adjusted integrated resource plan (RAIRP) that balances short- and long-term risk (such

as, extreme weather events, volatile fuel prices, and carbon taxes or costs) related to asset investments;

Incorporate carbon reduction targets into utility RAIRPs to create additional focus on decarbonizing generation fleets.

Regulators should also work with utilities to:

Increase focus on how a utility's plans will withstand both shocks (such as, weather events) and shifts (such as, carbon taxes) and test that the long-term viability of investments will not lead to stranded costs or higher than expected average costs to customers;

Revisit customer programs and pursue alternative pricing options to improve grid utilization and encourage customers to consume when low carbon resources are in abundance;

Encourage cost-effective programs that include incentives for customers to invest in technology to allow for utility control of behind-the-meter resources and incent peak shifting or conservation;

Evolve the regulatory mindset on traditional rate design as utilities reconsider how to allocate costs and design rates to incent consumption during low carbon periods;

Reduce carbon in electricity production and keep electricity prices affordable, which is paramount to the transition of natural gas, diesel, and gasoline to electricity to enable and accelerate decarbonization across multiple sectors. ❍

and Infrastructure segment with more than fifteen years of experience in the transportation and energy sectors. His multi-disciplinary expertise includes a deep knowledge of transportation and distributed energy resource market ecosystems, U.S. regulatory and policy environments, and program design and implementation. He manages market assessment, adoption forecasting, load research, business case analysis, regulatory strategy, and program implementation.

Michelle Fay is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment, supporting clients as they implement transformational programs. She brings more than twenty years of experience in planning and delivering complex and innovative programs for utilities. Her expertise includes program and project management, organizational change management, account management, process and performance improvement, grid modernization, energy efficiency, and analytics. She has led several grid modernization programs, managing and overseeing strategic program management offices, with a focus on realization of benefits and reduced risk.

Dan Hahn leads Guidehouse's Energy Providers practice within the company's global Energy, Sustainability, and Infrastructure segment. As a partner, he oversees a global team of industry and key account professionals that collaborate with utilities and energy companies, providing a broad set of strategy and transformation solutions as they navigate the energy transition. With 25 years of industry experience, he supports clients transform across multiple industry sectors in the areas of operations, digital, strategy, and technology.

Robyn Link is a director in Guidehouse's Energy, Sustainability, and Infrastructure segment where she leads the Utility Commercial & Industrial solution. With more than seventeen years of experience, her focus is to successfully drive, accelerate, and deliver organic growth for both established and early-stage businesses within the energy sector. She has partnered with over eighty utility companies in North America to create and deliver new, transformational load management and customer engagement solutions that drive results and resolve significant business challenges for utilities. »

What types of companies should utilities look to partner with to future-proof their business models? Auto, tech, telecom, other?

Michelle Fay: With the increased focus on decarbonization and ESG investing, there is no shortage of new entrants challenging the traditional utility paradigm. Companies such as Google, whose core business has been technology, are crossing over into what has traditionally been the exclusive domain of utilities.

Traditional technology companies are investing in transmission and DER and developing innovative solutions to provide customers with access to clean, low-cost electricity, further disrupting the status quo and challenging the utility's business model and customer retention.

How can utilities respond?

Retain and provide value to customers and shareholders – Utilities need to be looking for ways to go beyond collaboration and develop an ecosystem of mutually beneficial partnerships to accelerate the clean energy transition and drive revenue growth for all parties involved;

Technology companies are key partners in this process, as they have the ability to quickly innovate to test and deliver new solutions at scale. Utilities can bundle these solutions with traditional commodity services, which increases customer value while creating additional revenue streams for both partners;

Engage automakers – Many utilities are already working with automakers to align infrastructure needs with EV availability and adoption. Utilities have an opportunity to expand beyond this collaboration and combine forces to provide bundled offers, vehicle-to-grid integration, and fleet conversions. These solutions can further accelerate the EV transition, make the interconnection and conversion process seamless for customers, and generate additional revenue for both parties;

Partner with the public sector – Utilities need to develop partnerships with state and municipal public entities to evolve policy and standards that will enable and incentivize the infrastructure improvements needed to support evolving customer needs and future business models. These entities also play an important role in ensuring that social justice goals are integrated fully into the clean energy transition. PUF

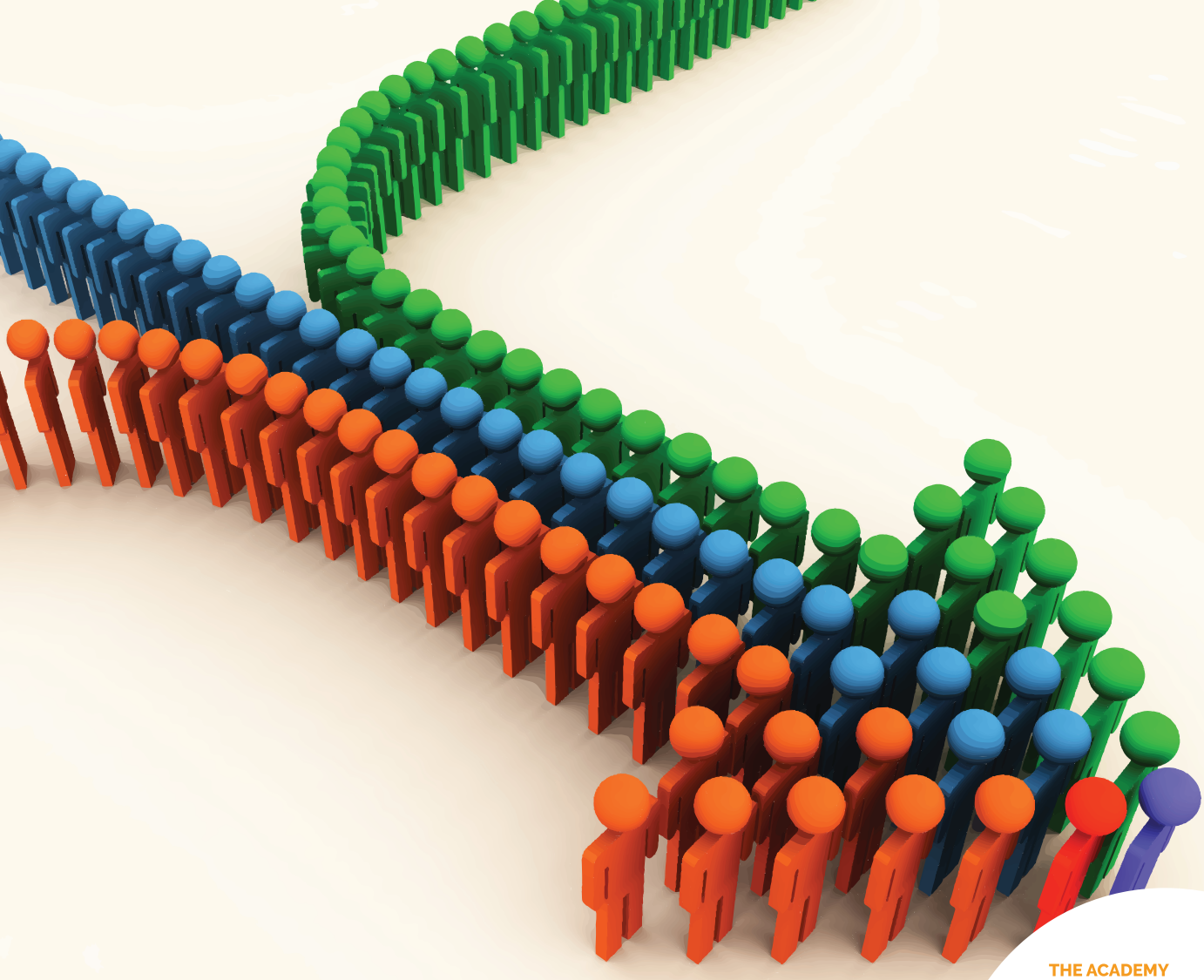
Chris Luras is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment. With over seventeen years of energy industry experience, he leads the Risk, Compliance, and Security solution, working with utilities on all aspects of NERC reliability and security compliance, cyber and physical security, risk management, and resiliency. Specifically, he leads the development, management, and execution of tools and services aimed at cyber security, security compliance, risk management, internal controls, and process and program improvement within the energy sector.

Danielle Vitoff is an associate director in Guidehouse's global Energy, Sustainability, and Infrastructure segment. She supports companies, cities, and utilities in developing low-carbon strategies, including greenhouse gas footprinting, target development, risk and opportunity assessments, and implementation support. She is a LEED Advanced Professional and a TRUE Advisor.

Ted Walker is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment and key leader in the strategy, policy, and regulations team. He has over twenty years' experience working with and for premier energy companies to develop and plan for strategies that diverge from their "business as usual" mindset. His content focus areas include distributed energy resources, alternative transportation fuels (including electric vehicles), non-commodity products and services, digital customer transformation, innovation strategy, emerging technologies, and M&A. He has authored and contributed to several thought leadership pieces, analyzing various aspects of the utilities industry.

Karen Wilson is a partner in Guidehouse's global Energy, Sustainability, and Infrastructure segment and the leader of the Public Sector and NGOs practice. She guides government agencies in improving their services to customers and citizens by reducing risk, optimizing assets, and achieving results that stand up to scrutiny. She provides services to the U.S. Departments of Transportation, Interior, Agriculture, Commerce, Energy, NASA, the GSA and other federal agencies, NGOs, and other governments. As a certified facilitator, she is also passionate about strategically charting courses to help teams and individuals succeed.

David Workman is a director in Guidehouse's global Energy, Sustainability, and Infrastructure segment, specializing in assisting his clients with data through analytics solutions, including governance, architecture, design, automation, reporting, data visualization, and analytics to drive operational insights and strategic business objectives. He has significant experience with data strategy, business intelligence, and business process transformation across a range of industries with a utility focus. His experience also includes the development of full lifecycle implementations for a comprehensive suite of data improvement solutions.



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A New Administration Sets a New Tone on Energy Transformation

Conversation with the Energy Department's
Acting Assistant Secretary
Pat Hoffman

With a new administration comes new challenges and opportunities, as ambitious goals were set forth including a carbon pollution free power sector by 2035 and a net zero economy by 2050. But it is the people charged with getting America to its decarbonization goals that PUF finds fascinating.

PUF was fortunate to have a conversation with the DOE's Acting Assistant Secretary for the Office of Electricity, Pat Hoffman. She has an impressive resume and shared words of wisdom as to the strategic and policy directions this all important government agency will be taking as we move forward to make the air cleaner for everyone. This is a discussion you must listen in on.

PUF's Steve Mitnick: The Biden Harris administration has high priorities in energy. How is the Department of Energy engaged in pursuing these goals?

Pat Hoffman: It's an exciting opportunity and time to be at the Department of Energy. The Secretary is quite engaged in driving some of the goals. Let's first talk about those.

President Biden has laid out an aggressive strategy for combating climate – one hundred percent clean energy by 2035 and the net zero economy by 2050 are significant goals. He's also prioritized the new Office of Energy Jobs, which will help the Department define some energy related job opportunities.

When we look at Building Back Better through the lens of job creation, the President is targeting forty percent of the benefits from certain federal investments to flow to disadvantaged and forgotten communities. That means energy justice is a priority.

But now in my space, I've worked on building a plan for the future of the electric grid and at how we invest in our electric infrastructure to be both clean and resilient.

There are challenges to doing both, and we recognize it. Investment in both the transmission and distribution systems are required and the Department of Energy is in an important strategic leadership position to guide these investments. We recognize that transmission will help provide access to clean energy across the United States and support areas of demand growth, as well as high demand utilization.

As the country continues to electrify buildings and vehicles, the distribution system is going to require investment. We are excited to be a part of the Jobs Plan as we invest in our electric system.

We also recognize that resilience must be part of the discussion. The recent polar vortex – in Texas – is a stark reminder of how the system must be built so we have the capacity to respond to a wide variety of weather and other events.

Technology is the key to enabling the future and provides the opportunity to build jobs and drive domestic manufacturing. Those are some of the key things we're excited about as part of the Department of Energy's engagement to achieve the Administration's goals.

PUF: There are several huge challenges in energy. Those include resilience, cybersecurity, decarbonization, development of renewables, transmission capacity, electrification, natural gas, nuclear, hydrogen, off-shore, and research and development. How is the Department of Energy addressing some of these challenges and what is the biggest priority?

We recognize that transmission will help provide access to clean energy across the United States and support areas of demand growth, as well as high demand utilization.

Pat Hoffman: There are many challenges represented within those subjects. Let's first talk about resilience. Resilience must encompass an all hazards thinking, and it comes down to thinking about risk and risk mitigation.

Whether we're talking about climate, cybersecurity, or weather conditions, we need to think about how we evaluate the system and what risk are we willing to accept versus mitigate – how do we stress test the system to determine its capabilities and limitations.

That gets to the heart of our conversations, of balancing affordability, risk mitigation, and then preventing extreme hazards from affecting the system. But this is about people. It's about supporting consumers in the United States and allowing them to have affordable electricity and have lights on, on a regular basis.

Within the Office of Electricity, I've been looking at a three-pronged approach for transmission and integration of renewable generation.

We should be upgrading and increasing the capacity of our existing infrastructure. Where can we squeeze some more capacity? Can we look at dynamic line ratings, power flow control? As you look at interconnection studies, how do we upgrade the connection points so we can allow more generation to come online? Are there simple things, such as reconductoring, that we can do?

The second approach is, can we build some new capacity with the existing rights of ways? Can we use existing rights of ways permitted for rail and highways – things that will minimize not in my backyard – and the permitting and siting issues that go along with building transmission.

The third one, is developing new high voltage DC segments. We have to develop the capability to analyze the transmission plans that are out there and define where we need to fill in the gaps.

We want the grid to be an enabler, a platform that allows a variety of technologies to thrive. The grid is a complex environment. We are going to have to bring consumers, regulators, and policymakers together so they can understand some of the challenges in this space.

Going back to the lessons learned from the polar vortex and ERCOT, how do we strengthen some of those seams so we can minimize impact on consumers during extreme weather events?

Energy storage is also critical. We need all types of energy storage. We recognize energy storage provides different services to the electric grid. One of the major gaps is long duration energy storage.

We need to develop energy storage technologies that can capture the timeframe between the ramping that storage provides to longer duration energy storage. We want to look at the next generation of technologies in energy storage. I know that ARPA-e has some interesting projects in this space.

We recognize that cost is still a primary factor in getting energy storage deployed. The question is also how do you value energy storage? We've had these conversations around energy storage and how to evaluate it for years, so can it be considered a system asset, as well as be a support to consumers.

There is a huge opportunity in the grid space for sensors and machine learning. Visibility will be critical as we get more distributed energy resources on the system. It will also provide keys to unlocking flexibility in operating our system. As we look at sensors, we're looking at asset management, health of equipment, and operating the system differently.

It was during Hurricane Katrina that we were able to operate a subset of the system with phasor measurement units. How can we continue to use sensors as an innovative way to operate the system moving forward?

And we cannot lose sight of the importance of grid cybersecurity. We've got to be aggressive around cybersecurity and work to increase our maturity level and posture in the cybersecurity space. The Department's Cybersecurity, Energy Security and Emergency Response (CESER) organization is well structured to move aggressively in addressing these issues.

We have to have better situational awareness. We're going to have to look at cybersecurity tool deployments. The most important thing is the ability to detect and conduct forensics analysis. We need to develop these capabilities at scale and decrease the timeline for discovery. How can we analyze data collectively across the industry?

We're going to have to broaden our partnerships with industry and universities. This will be a great opportunity to expand our cybersecurity workforce and build new skillsets in the advanced computing world of machine learning and AI.

The last area is emphasizing supply chain testing. As we buy products, we need to consider supporting domestic manufacturing. We are also going to have to support vulnerability testing, as well as network architecture.

We have a strong foundation to build on with respect to quality assurance of the physical aspect of supply chain products. Now we are going to have to get into the software side and look at quality assurance.

Ultimately, we need to continue to keep pace with the ever changing cybersecurity environment.

Across the Department, we also have efforts in renewable technology development. Although this isn't my area of expertise, I do want to highlight some of them.

Secretary Granholm, along with the Secretaries of Interior and Commerce announced a national goal for development of thirty gigawatts of offshore wind by 2030. This is an exciting opportunity to capitalize on greenfield development.

We'll have to build the associated transmission infrastructure, and we're looking at the potential capital investment in the United States. But we're also looking at the jobs and support for communities from an offshore wind perspective.

The Department through the Office of Energy Efficiency and Renewable Energy has also announced new targets to cut the cost of solar by sixty percent in the next ten years. This means technology innovation, and supporting manufacturing, as well as driving costs down.

Electrifying transportation is exciting. But with electrification, whether it's the buildings or transportation area, coordination with the electric grid and advancements in the distribution system will be critical.

To evolve the grid, do we really want to flatten the load duration curve and react all the time or do we want to think about whether demand response and energy storage in a home with electric vehicles can shape that curve? We're looking at AI, machine learning, and at pattern behavior. Technologies offer a lot of opportunities.

PUF: As you're working at upgrading existing transmission lines, do you see federal agency coordination as a method to halt the state versus federal conflicts where you can't site new transmission on federal lands, as there's not much in Utah except federal lands.

Pat Hoffman: Coordinating across the federal agencies is going to be important so we can look at energy corridors and see where it makes sense to work to minimize siting and permitting issues.

We're going to have to evaluate our options for building transmission moving forward. It will also require coordination among the federal agencies and the states.

There is no easy solution when it comes to land and land utilization strategies. One of the things we have to think about is taking a holistic approach and having conversations with the states so everyone can see the value and benefit of building transmission.

PUF: NREL did a study on moving power between eastern and western grids. Is that something you're going to look at again?

Pat Hoffman: We are going to take a hard look at transmission planning and scenario analysis.

We're going to continue to build out the capability to do some of that scenario analysis so we can tap the renewable resources available in different regions of the country and bring them to the marketplace.

That will be part of our strategy moving forward. Transmission planning's going to be critical from that perspective. We will have to consider different scenarios. Each region is different, but multi-state regional transmission is not being built.

We recognize that siting, permitting, and cost allocation are challenges. Now we're asking how we can best support solution sets that will help us overcome some of these challenges, because it is a requirement for a clean energy future.

PUF: Where do you fit in among these efforts and how do you work across the organization on a day-to-day basis? What's your typical day like?

Pat Hoffman: I am currently Acting Assistant Secretary for two organizations, the Office of Electricity and the Cybersecurity, Energy Security Emergency Response Office, so I focus on two things.

This will be a great opportunity to expand our cybersecurity workforce and build new skillsets in the advanced computing world of machine learning and AI.

First, the evolution of the electric grid with respect to reliability and performance and second, how do we improve its security and resilience? I tend to think of myself as a strategist in nature.

I have three priorities.

Number one is to develop a plan and a strategy to address the challenges that we've talked about with technology solutions.

Second, we've got to create public-private partnerships. The Department can't do this alone. We must tap the expertise at the National Laboratories and industry in order to address the challenges and risks facing the nation.

Those are two core elements, but in addressing both of those elements, the third element emerges as the need to educate the next generation workforce. We're going to figure out how we can bring innovation in the workforce and get graduates from colleges and universities excited about being in this industry.

When I go back to our successes with grid modernization and advancing information technology through the American Recovery and Reinvestment Act, we've created an excitement around the grid space. This is the future.

Whether it is advanced power electronics, sensors, or the next generation control systems, I want to continue to stimulate that excitement in my organization and in the industry. The service within this industry and at DOE is impressive, and I thank everyone for their support during disaster response to restore power to the American people, as well as their investment in the grid of the future.

(Cont. on page 55)

EEI 2021 Global Electrification Forum

Part II

Highlights from this spring's EEI International Programs event:

ATCO president electricity Melanie Bayley, EDP Group CEO Miguel Stilwell d'Andrade, EDP Innovation CEO António Coutinho, EEI executive vice president Philip Moeller, EPRI CEO Arshad Mansoor, Fortis CEO David Hutchens, Guidehouse Netherlands-based partner Benjamin Grunfeld, Hydro One CEO Mark Poweska, PSEG CEO Ralph Izzo, Rhode Island PUC commissioner Abigail Anthony, SGN UK-based non-executive director Laura Sandys, UK Power Networks CEO Basil Scarsella, New Zealand's Vector group chief executive Simon Mackenzie.

And on Earth Day at the conference, the special remarks of Charles, Prince of Wales.

PUF brings you here the second part of coverage of EEI's Fifth Annual Global Electrification Forum, Destination 2050: Pathways, Inflections, Crossroads, Convergence. PUF brought you the first section in the May issue, as this two-week, international coming together, was so massive, it needed lots of pages.

This virtual Forum is the annual flagship event of EEI's International Programs, convening leaders from around the world to explore critical issues and megatrends shaping the global electricity industry. It is indeed exceptional, as seen by the distinction of the speakers as the Global Electrification Forum celebrated its fifth anniversary.

In fact, in this special issue, you will find remarks by His Royal Highness, the Prince of Wales, invited by EEI's VP for International Programs Lawrence Jones. Listen in to more of what took place as the world converged at the Forum.

Harnessing Digital Technologies

The growth of smart-grid infrastructure, decentralized generation, and improved data systems for grid maintenance represents the electric power sector's digital transformation. This digitalization trend has vast implications, with the internet of things, robotics, virtual and augmented reality, machine learning, and artificial intelligence redefining how the industry trains workers, operates the grid, and interacts with customers. This panel focused on digital transformations in the electric power sector and its challenges.

Moderator and CEO, Electric Power Research Institute, Arshad Mansoor: When we look at that decarbonization and electrification pathway, which makes electricity more valuable for the society as the dependence on electricity grows, whether it's heating in the U.K., or electric transportation, how does digital technology play a role? It will continue to play a role. But what does this decade show us?

Basil at U.K. Power Networks, I've heard you talk about safety and customer service. How do you see digital technologies playing a role?

CEO, U.K. Power Networks, Basil Scarsella: U.K. Power Networks is the electricity distributor here in the U.K., in the London area, East and Southeast of England. In short, we deliver electricity to some 8.3 million domestic, industrial, and commercial consumers.

The focus for our organization is safety, customer service, reliability, and importantly, employee engagement. The networks are critical to the transition to low carbon. Unless we get safety right, we believe it's going to be difficult to get everything else to where we want it to be. We focus a lot on safety and customer service.

As the network and society becomes more digital, as we see customers interacting with their network more than ever, and working remotely, then safety and customer service become more critical.

We look at data as an asset, whether it's financial data, asset data, customer service, or customer data. You need to have accurate data, but if we fail to have the right technological skills, digital skills, and the right culture in the organization, there's always a risk that safety and customer service will suffer.

We see the digital transformation as an opportunity, but at the same time as a risk, because unless we get the right employees, and have the right employee commitment, then the safety and customer service we provide to 3.3 million customers is going to suffer. The focus we believe is right and continues to be increasing as we move more into a digital world.

Moderator and CEO, Electric Power Research Institute, Arshad Mansoor: Simon, how do you see broadband digital being part of the electric utilities' thinking and strategy?

Group CEO, Vector, Simon Mackenzie: At Vector, we provide all the electricity distribution networks across Auckland in New Zealand, the largest city. We have a portfolio of companies ranging from smart metering to gas trading, gas solutions, microgrid development, and operations across the Pacific.

Data is going to be king. Data is an asset. Will you have privacy loss? How do you see this data being controlled by each entity? Without free form data flowing, you're not going to get to the ultimate power of digitalization.
– Arshad Mansoor

We started our fiber journey about twenty years ago, where we were developing IP strategy across our network, and building that, we put out fiber to most of their connection points across the network.

Off the back of that, we identified the opportunity to provide those services to

primarily major customers. This was not only the electricity distribution services, but also fiber connectivity to, in our case, primarily business customers, whether it's mobile operators, offshore carriers, or other Telco retailers.

We've expanded as we provide backup to a lot of cellular operators in New Zealand. We're seeing now 5G rollouts with collaboration about how the 5G rollout can work on the fiber network as well as hosting it on some of their assets.

We look at it as an integral part of our business. We're not a retailer. We provide what's called Layer 1, Layer 2 services. We're being integral to digitalization of our network but also part of our customer service proposition, which is critical in two ways. We're seeing that people are wanting options to the primary carrier here, which was previously Telecom New Zealand and is now Spark.

They have diversity of options and fiber, and what we're connecting a lot more to now are our investments and batteries across our network and other devices that need to be IP connectable.

Moderator and CEO, Electric Power Research Institute, Arshad Mansoor: Benjamin, give us some sense on the megatrends in the next five to ten years on digitalization as it relates to electric utilities. What are some projects Guidehouse will be on in digitalization with utilities?

Partner, Guidehouse, Benjamin Grunfeld: When we talk about trends in digitalization, we use the term digitalization to characterize it now and talk about a lot of things, but it goes back quite a way to the early smart grid initiatives in each of the countries that are represented here. We work with utilities in the Middle East, across Europe, in Canada, the U.S. and Asia. Everyone's at different stages of grid modernization.

These are the aspects of digitalization that are focused on the asset. We're taking what were analog devices on the grid and upgrading them to digital, making sure we have sensors and visualization capabilities built into the grid and into the infrastructure and upgrading the equipment, assets, and infrastructure.

Regulation needs to continue to change. Recovering investments as we traditionally do over 45 years in the U.K., it's simply unacceptable when technology is going to be at a date, within some cases, 2 or 3 years, but on average, between 5 and 7 years.
– Basil Scarsella

This is where there are tie-ins to the regulatory framework in terms of how important is it that we know as the utility, that a refrigerator is smart and connected, and the door's been open, to decisions we're making about the grid.
– Benjamin Grunfeld

That shifted with fiber rollout and fiber investments going back ten to twenty years, that shifted to communication infrastructure. That's the next trend in this evolution. We're starting with the asset, then focusing on communication backbones, being able for these assets now that we've got digital readouts and data being created in digital form from all these assets, then how do you get them to talk to each other? Also, how do you get them to talk back to the offices, back to the engineers, and back to the control room, in a way that's effective?

When we look at the trends, both of those still have a long way to go when we think about the power and utility sector. There's a lot of the grid that is largely analog, that's largely manually operated by power or gas. There's still a lot to happen in that space.

When we look forward, we're seeing the continuous evolution from assets and communication into data, but also the processes that are enabled off that data. How do we start to digitalize the function that the utilities carry out internally, or functions of asset system planning, or functions of customer service provision, or something as simple as bill payment which in some parts of the world you have to walk into a door with your bank check and pay your utility bills?

If you were to take a test overall of where the power sector is or where the utility sector is on its digitalization journey relative to other industries, we wouldn't score very well on the whole, I think. There's still a long way to go in terms of completing that transition to a digital industry.

Moderator and CEO, Electric Power Research Institute, Arshad Mansoor: António what do you see as some of the innovation opportunities and maybe challenges on digitalization?

CEO, EDP Innovation, António Coutinho: The energy transition is a challenge that takes digitalization as a key component. Our industry is affected two ways with digitalization. On one side, this is a general trend in terms of how

our processes can be improved from an efficiency standpoint, and how can we make better use of data.

The world is going to be electrified, the world is going to be decentralized, and it's going to be renewable with all the intermittencies. We need to deliver electricity with the same level of reliability that we have today.

We are going to have to orchestrate a lot more assets, assets that we don't control in a way that delivers the power when we switch on and turn off the lights and the miracle continues to be there. The only way we can do this is through digital technologies. These are the changes that are fundamentally changing our industry.

Innovation is working the same way. One side is a key – traversal business trends. On the other side is going to be a key component of our industry because the energy transition is changing the way we generate and consume energy or power energy in thirty years, and we are going to redo everything that took a hundred and fifty years to get here.

It's more than technology. The technology to deliver the carbon neutrality exists today. What is different is, how do we make the change? How do we make all these investments? How do we enroll customers to manage their flexibility?

This decentralization of the industry creates a problem of the transactional ability of the industry that is going to increase. We need to increase the workforce to deliver all these goods, because as the industry gets distributive, it's more labor intensive.

How do we train these people? How do we acquire these people into this workforce? These are new areas, not just of digital, but also of innovation. We need to build new business models with these significant changes.

We recently made a strategic market update, where we pledged to invest twenty-four billion until 2025. We committed an investment of two billion in digital and innovation to bring the energy transition.

Moderator and CEO, Electric Power Research Institute, Arshad Mansoor: We know how to build an infrastructure that lasts for forty or sixty years, but we maintain them. That's a core competency. We're entering this world of digital where maybe ten years from now, twenty to thirty percent of our investment is on the digital side, with a different lifetime expectancy.

Our industry is affected two ways with digitalization. On one side, this is a general trend in terms of how our processes can be improved from an efficiency standpoint, and how can we make better use of data.
– António Coutinho

It's not going to last eighty years. The fundamental business phases, the regulatory process has to change on how you amortize that. As a network operator, Simon, and Basil, give some insight on how you see this future of utility going where we're investing in digital technologies, more so than in transformers, wires, and poles.

CEO, U.K. Power Networks, Basil Scarsella: You're right. We'll continue to build assets that last forty to sixty years, but there's going to be a number of assets and a lot of investment on new technologies and digital, which will last a lot shorter than we're used to for the traditional assets.

Regulation needs to continue to change. Recovering investments as we traditionally do now, over forty-five years in the U.K., it's simply unacceptable when technology is going to be at a date, within some cases, two or three years, but on average, between five and seven years.

In the U.K., we've moved on from a rate base regulation to an incentive-based regulation, which in short, we are incentivized to deliver the commitments we've made to the customers at the lowest possible cost, safely as always. At the same time, that enables us to earn incentives by over delivering the commitments in critical areas such as reliability, and customer service. There's a good example where the U.K. regulatory regime has evolved.

As we move forward, we've got distributed generation, decarbonization, and investment in technology. Regulation needs to continue to evolve. I'm confident that's happening as we speak. Whether regulation evolves as quickly as technology and as the energy system, that's going to be a challenge. But that's a challenge we all face and I'm sure the regulatory regime will continue to evolve.

Group CEO, Vector, Simon Mackenzie: Our focus has been around looking at digital technologies for quite a long time now. It's an integral part of our business. We start with how we manage our networks to what we call probabilistic AI. It's about using artificial intelligence connected to devices to grow better utilization from assets.

The regulators will look at, you can't continue to build in a deterministic mindset. Through significant amounts of data and machine learning, artificial intelligence, integrated into digital platforms, we are completely changing the way we think about the capital intensity of the business through augmenting traditional network management with those digital platforms. We're orchestrating a completely different way of running the system. What does this mean for us to achieve that?

We've collaborated with a number of global companies, and have a strategic alliance with AWS, for example, on what we call the new energy platform. We're co-developing digital platforms with Amazon, and we've built with Israeli

company mPrest, platforms that we're utilizing to connect batteries, EV chargers, consumer products, and homes. That's all being orchestrated in conjunction with what we call the traditional network solution. That's challenging for regulators to be able to keep up with the trends.

We're starting with recognizing that customers want choice and options in orchestrating them primarily on digital platforms that bring together data analytics, customer choice, and connectivity to customers to make those choices.

For regulators one of the biggest challenges is, how they have the scope sets to understand what the capabilities of the digital platforms are, and what that means to the objective of providing reliable service, safety, and security to customers?

Moderator and CEO, Electric Power Research Institute, Arshad Mansoor: Data is going to be king. Data is an asset. Will you need free exchange of data so we can do a data driven decision making at an optimum level?

Will you have privacy loss? Will you have people thinking, if I'm a thermostat manufacturer, or a smart technology, I have access to the customer, and I have the data, but that data is essential to offer energy services, and to operate the grid.

How do you see this data being controlled by each entity? Without free form data flowing, you're not going to get to the ultimate power of digitalization.

With global companies we have a strategic alliance on the new energy platform. We're co-developing digital platforms to connect batteries, EV chargers, consumer products, and homes. That's in conjunction with the traditional network solution. That's challenging for regulators.
– Simon Mackenzie

Partner, Guidehouse, Benjamin Grunfeld: You need to think about the data in two ways. There's like a grid door, in front of the meter data that the utilities are generating, collecting, analyzing, and incorporating in their decision making and in the processes.

That has some different characteristics and challenges, then let's call it behind the meter or customer specific data, what comes out of a smart phone app that a customer signed up to, or what comes out of an automated smart home system or an energy management system that someone's installed in their building or in their household.

The power sector doesn't need to reinvent the wheel here. Look at the proliferation of information and data, and companies like Google or NASA, or companies in your home already that know more about you than you know about yourself.

It's being managed. There are privacy laws, and companies are generating that information. It is being protected in the sense that data that's collected by one company is used as a competitive advantage.

This is where there are tie-ins to the regulatory framework in terms of how important is it that we know as the utility, that a refrigerator is smart and connected, and the door's been open, to decisions we're making about the grid.

There are some things that need to be shared, need to be accessible, and we need to manage the privacy and protection around that. There's the competitive element of what happens in the home, what happens behind the meter that produces different outcomes.

It's creating innovation and driving innovation in that space. The utilities in the sector will find a way into that. There are ways to, generally speaking, protect customer information, personal identifiable information, the commercially sensitive information. ❍

Evolving Business and Regulatory Models

With the energy grid transitioning into a more decentralized, digitized, and decarbonized system, regulatory models are changing to reflect the evolving role of electric companies. Energy and utilities companies are considering new services and offerings to expand their business models.

Given the changing regulatory and policy landscape, how will these companies of the future operate? How are regulatory models and markets evolving to incorporate new technologies and objectives into the energy system? Panelists seek out answers. Enjoy these excerpts.

Moderator and Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute, Philip Moeller: We're in a period of great transformation. We are an industry that is the most capital intensive and is a lifeline industry. If people don't have electricity, they might not live.

While we manage this transition from what was a fairly staid industry to one that's evolving dramatically, we not only have to look at new business models, but how those business models evolve. Dave, what's your takeaway of the state of play and what intrigues you in terms of evolving regulatory models?

CEO, Fortis Inc., David Hutchens: It is refreshing to see that the entire world

is pointing in the same direction. At the end of the day, everybody is looking at 2050 and saying, net zero by 2050 has to be the goal.

It's early days from a technology standpoint, because the follow-up to that goal is, we don't know how we're going to get there yet. The regulatory models have to be flexible enough for us to adjust, bring in new technology, look at how to design and incorporate new technology into the regulatory structure, and how to get recovery for those assets.

A couple key areas will be the focus of regulation going forward. The first is a stronger focus on performance-based regulation. Outcome focused is common in Canada, but not quite as much in the U.S.

We use it for all kinds of things. Customer metrics, we might use it for nibbling around the edges of environment like energy efficiency standards, what you get measured by and that can go into your PVR structure, but we haven't seen it take root in carbon reductions.

That's going to be key going forward, to have that flexibility so you can to some extent, leave it, mostly, up to the companies, and in the individual jurisdictions to figure out what works best for them and their portfolio in order to reduce greenhouse gases. At the end of the day, that's what it's all about. To start measuring that is important.

The others are some non-standard investments around the edges. Electric vehicle infrastructure is a prime example in Canada and in the U.S. We are the ones who have access to the capital that if you want to build out a transportation, electrification, infrastructure plan, we're the folks to call, because we know how to do that. All that is just an extension of our systems to provide infrastructure for transportation.

The most important concern is the view on the integration of the energy systems. At the end of the day, you have to have the reliability and resilience of your electric grid as you become more dependent on it.

If you think, as a regulator you're going to be able to regulate these 50 million actions and assets, you're going to fall over. It's the moment of pivot of change. I propose we need perimeter regulation, which is based around risk.
– Laura Sandys

With the electric vehicle conversation, not only are you having things you normally use electricity for, but now you're adding mobility to that equation. The importance of the grid, and the security, resiliency, and reliability are paramount.

We're having particularly in the U.S., a couple of wake-up calls recently, that makes us pay attention to the integration and reliance of one system on another. We need to be focused on, how do those pieces come together, because we're talking about electrifying more of our economy.

If you're not looking at, how do you make that resilient from a fuel supply – and I used fuel loosely, that's renewable natural gas, hydrogen, whatever that might be – you have to make sure you have all of those integrated to provide resilience.

Non-Executive Director, SGN & Energy Systems Catapult, Laura Sandys: We are now moving to fifty million actions and assets, because an EV can do two actions, and we have about thirty-eight million cars in the UK. You can no longer process regulate. You have to, what I would call, perimeter regulate.

That creates rules that you must never ever break, but allow, in many ways, companies to come to the outcome solutions that are carbon outcomes, that are consumer outcomes, and that have cost outcomes. If you think, as a regulator, you're going to be able to, effectively, regulate these fifty million actions and assets, you're going to fall over.

It's the moment of pivot of change. I was Deputy Chair of the Food Standards Agency, and it had the same problem where it was regulating every cafe. It changed its regulatory model to shape around risk and became a risk regulator rather than a process regulator.

That particular dimension is going to be important and changes the focus away from licenses to outcomes and strong penalties as well. I propose we need perimeter regulation, which is based around risk, which is driven and incentivized to outcomes.

Moderator and Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute, Philip Moeller: Commissioner Anthony, you have the tough job, now. It might be worth explaining that you have regulatory procedures and guidelines, but you're also subject to state legislation that sets those guidelines for you. That's part of the equation. What are your thoughts?

Commissioner, Rhode Island Public Utilities Commission, Abigail Anthony: Without firm policy, whether that policy comes from your state legislature or federal government, in the absence of firm policy on climate, it's hard for utility regulators to act on climate.

When you do have a firm policy, like in the U.S., most states have renewable portfolio standards, or renewable electricity standards. That makes it easier for the regulator to put the utility in the game but, in the absence of those policies, we can just act around the edges.

We can use tools like performance incentives, and we can adopt an avoided cost in carbon when we're doing a cost

benefit analysis. But those are marginal. Here's an example – most new England States, including Rhode Island, are restructured.

We send our distribution utility out to the market to contract for power, or we ask them to contract through bilateral contracts. But our law, at the state level, requires that bilateral contracts between the utility for renewable power have to be better than the market. They have to beat the market.

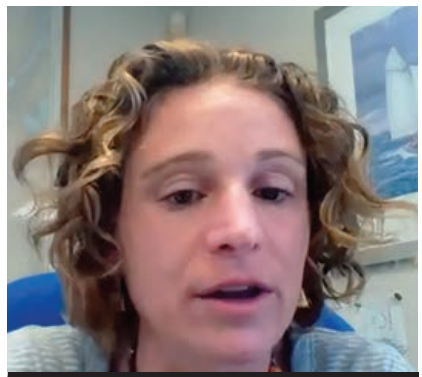
Without a strong price signal on carbon emanating from either state or federal policy, it's hard for those contracts to beat the power market prices. Regulators can liberally interpret law, but that doesn't get us anywhere near the goals we need in order to address climate change at the most transformative levels.

There isn't a regulatory model that's going to solve climate change. Even if FERC were to pass a carbon tax that is only affecting the power sector, it still doesn't address the transportation sector. In New England, we have a lot of fuel for heating, but it doesn't address other large sources of emissions.

Moderator and Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute, Philip Moeller: People will say, regulators need to be bolder, and take more chances, but if things go wrong, the people who were saying that are not going to get the blame, the regulators will.

On newer technologies, and rolling those out to customers as empowering agents of energy consumption, what's your approach? Where's your comfort zone? What can industry do better to help you in those tough decisions when it's risky, and the rewards are there, but there's potential for failure?

Commissioner, Rhode Island Public Utilities Commission, Abigail Anthony: My general orientation toward risk, and I don't know that this changes from topic to topic, its most regulators are approaching risk and it's the foundation of utility regulation



Utilities are seeking pre-approval of cost of new technologies, which shifts all financial risk from the utility to ratepayers. That might cause hang-ups when it comes to investments in technology that would allow customers to better manage demand.
– Abigail Anthony

to match risk and reward just like investors do. We want to make sure whether it's the utilities or the customers who are going to be exposed to risk that their reward, they might realize investment is commensurate with the risk they're taking on.

One phenomenon I experienced in Rhode Island is, often the distribution company is seeking to shift a lot of the financial risk of new investments onto the customers. They ask for grid modernization proposals, for example, and the utility will not advance a lot of technologies that fall under that grid modernization umbrella without having pre-approval of that investment, or that cost from the regulator.

Pre-approval means the utility is shifting the decision making about whether this is a necessary or prudent investment from themselves to the regulator. In my view, this is what the utilities' job is.

Their job is to make prudent and necessary investments in their distribution system. That's why they have executives, engineers, and power system experts. I don't have that expertise. The most convincing way for utilities to make a business case proposal to regulators is to put some skin in the game first.

What we're seeing is that utilities are seeking pre-approval of cost of new technologies from regulators, which shifts all financial risk from the utility to ratepayers. That might cause hang-ups when it comes to investments in technology that would allow customers to better manage their demand or for the utility to have better visibility and control of the distribution system down to the end user level.

Moderator and Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute, Philip Moeller: Laura in the U.K., you've done some forward-thinking, and risky regulation that has evolved from times where people were happy with it, then got less happy, but it was transformational. What are your thoughts on how to empower regulators to take more risk and whether that's necessary?

Non-Executive Director, SGN & Energy Systems, Catapult, Laura Sandys: In some ways, we need to all grow up together. It's not just regulation that's living a little in an old-fashioned world, it's also the sector too.

In the UK, the majority of risk is socialized. If you do not have companies who are properly risk-managing, and are, in many ways, competitive in how they risk-manage, everyone becomes quite sloppy.

All of the cost ends up with the consumer. I've just done something called re-costing energy where we're looking at the system again, and a key plank of this is to ensure that companies own the risks and that they don't just pass it through the system. That's important.

What, in some ways, the regulators need to do is, to understand that the value is moving to the system management aspect rather than the commodity. That changes the nature of regulation, and we'll need to promote flexibility in demand side, but that then requires a whole new range of regulation in consumer protection.

The regulatory models have to be flexible enough for us to adjust, bring in new technology, look at how to design and incorporate new technology into the regulatory structure, and how to get recovery for those assets.
– David Hutchens

People will say, regulators need to be bolder, and take more chances, but if things go wrong, the people who were saying that are not going to get the blame, the regulators will.
– Philip Moeller

Moderator and Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute, Philip Moeller: You do have the advantage of being, essentially, one market. Dave, you're in so many jurisdictions, so many business models where there are different elements of risk. You've got to allocate billions of dollars of investment every year. How do you take this topic and manage it, given the diverse portfolio Fortis has?

CEO, Fortis Inc., David Hutchens: What you posited was a question that says, how do you innovate in a risk-averse environment? That's the situation. Regulators are risk-averse, and utilities are risk-averse. We were brought up in utilities to say, the last thing you can do is take risks, because at the end of the day, we're the most important industry there is.

We are the life-plug of the economy. Nothing works without our electrons, if we circulate around the economy. When you're at that mantle of reliability, resiliency, security, and you're always talking about those things, the idea of taking risks doesn't necessarily come right off the tongue.

That risk balance between whether you socialize it or whether you take it on within a utility or a company, that varies by jurisdiction, by business type, business model, regulatory structure, all of those things.

I would bet that most utilities, particularly now, are looking at ways to, not only grow their own utilities, and I don't mean that from a capital standpoint, or revenue, or profit, I mean, growing it from, how do we serve more of our customers, more of the energy needs on the planet, through clean energy?

When you look at it from that lens, what we need is that balanced risk and return. This is usually where it gets sideways. That's where we, as utilities, might come to a regulator and say, we're willing to take a little of this risk. If it goes well, we keep the money. If it goes bad, we'll basically eat it.

You've got to have the ability to have success when you're taking that risk to tie that risk in return for the things that are above and beyond the risk level you would normally do within your portfolio. If you don't do that, if you can't have that conversation, if you can't figure out how to allocate that risk, you're not going to get anything done.

Moderator and Executive Vice President, Business Operations Group and Regulatory Affairs, Edison Electric Institute, Philip Moeller: Thoughts on how a good, substantive, thorough, and meaningful discussion about how regulation plays as part of worldwide efforts in carbon reduction?

Non-Executive Director, SGN & Energy Systems Catapult, Laura Sandys: In the U.K., our regulator is not responsible for carbon. That is changing and has been passed, the legislation for net zero becomes a national law.

It is driving change a lot. The regulation is going to have to start moving into the users. The industrial sector is driving into heat, where we've got a major problem, because we're all carbon-based heating systems. The regulation is going to have to allow, in many ways, the speed of deployment about innovation, and we need to fail quickly.

There are quite a few pilots at the company. I'm a non-executive director in a gas network and we're putting in some pilots in Scotland for hydrogen into people's homes, green hydrogen. There is a huge opportunity, for smaller companies as well, to innovate and profit from the transition.

I also work on the just transition issue, and it is complicated. In the U.K., you will have to spend money on changing your car and changing your whole heating system. I don't know how many people on this call have got twenty to thirty thousand just sitting around waiting to energy-efficient their home and change their car. The question that has to be asked is, who will pay?

We're going to have to create the mechanisms by which we can allow it, and I would propose it was best to do this through service contracts rather than commodities. We're going to be moving far away from commodity prices, hitting consumers. I can see different business models having to unlock those capital assets. ❍

A Conversation Celebrating Earth Day

Remarks by HRH Prince Charles, The Prince of Wales

His Royal Highness, the Prince of Wales launched his Sustainable Markets Initiative last year at Davos, with the goal of engaging the private sector to take the lead in accelerating the transition to a sustainable future. Next, he announced the Terra Carta, a living, breathing document, forming the foundation of a sustainable future. He spoke on Earth Day, and here are the highlights.

Through the Terra Carta, and with support of my Sustainable Markets Initiative, we are developing decarbonization roadmaps across industry verticals, working with countries on their transition plans.

– His Royal Highness Prince Charles, the Prince of Wales

His Royal Highness Prince Charles, the Prince of Wales: I am delighted to join you for the Global Electrification Forum. I'm afraid however, that we are fast running out of time to rescue this poor old planet.

We desperately need the ingenuity of the power industry to bring solutions to the table, while helping to advance that implementation and scale. This is why I'm so encouraged by the opportunity to engage with the power industry and the members of the Edison Electric Institute.

As we move to a clean energy future, the power industry would assume even greater importance, not just because the demand for electricity will increase, but because alternative sources of energy will be required for clean, reliable, baseload power. The power industry has the potential to play a critical role in the production of clean fuels, such as ammonia and hydrogen. Molecules that provide stable long-term energy storage and zero carbon fuels for industry and commercial transportation.

Increasingly, businesses are expected to be responsible global citizens delivering returns, not only for shareholders, but for society and for nature. After nearly forty years of working on these issues to raise awareness of the critical need to tackle the twin threats of climate change and biodiversity loss, I've seen a dramatic shift in the engagement of the private sector and private finance over the past two years.

Businesses and investors are finally beginning to recognize that building a sustainable future is the growth story of our time. To seize this incredible opportunity, we must start pulling in the same direction, aligning country transition priorities with those of industry and investment.

This accelerated and catalytic approach lies at the heart of my sustainable markets initiative, and recently launched Terra Carta. After an intense year of convening the global private sector, there are fundamental ways the power industry can play a helpful part of the solution.

While there is no single silver bullet, progress is being made, and a range of solutions are increasingly available. I would like to outline some specifics that could be advanced with your help.

First, we must rapidly accelerate the research and development production and adoption of clean energy solutions and systems. Second, we need to cut the time required to develop and deploy new technologies, moving from decades to years and preferably months.

Third, we must invest at scale in practical projects to demonstrate the feasibility of new technologies. Fourth, we must develop credible independent roadmaps aligned with net zero, which accelerate the delivery scale-up of infrastructure, investment, and policy.

Fifth, we must integrate net zero, disclosure of climate and nature related impacts, and ESG standards and metrics into capital allocation and business decisions. Sixth, to accelerate the solutions to some of the most complex challenges we must set up co-locating multidisciplinary teams made up of industry, academia, and government.

Seventh, we need to educate consumers about the technologies that are emerging

so they can help fuel the demand. Finally, we must acknowledge that sustainable solutions are technically possible.

Through the Terra Carta, and with support of my Sustainable Markets Initiative, we are developing decarbonization roadmaps across industry verticals, working with countries on their transition plans. We are also identifying how technology and investment can catalyze solutions at scale, and in a way that can shift our trajectory toward a more sustainable future.

With the right investment and people, we can dramatically accelerate our efforts. To achieve this, my Sustainable Markets Initiative is building task forces with coalitions of the willing, to drive the agenda forward.

The world urgently needs your help. Your ingenuity, practical skills, and ability to find solutions matter more than ever. You all have a vital role to play as we develop and scale the technologies, which would impact future generations. ❍

Leadership in Uncertain Times

Energy and utilities companies must navigate the convergence of several crises including pandemic, climate, and economic, as the world continues to recover from COVID-19 and begins to confront the challenges ahead. During this session, panelists shared perspectives on risk management under uncertainty, and how leaders can turn inflection points and disruptions into opportunities while moving through a transformational decade.

Moderator and Executive Editor, MIT Sloan Management Review, Elizabeth Heichler: The past year has been challenging for business leaders. Tell us about a great internal challenge you've had to grapple with, as well as significant external challenge.

CEO, EDP Group, Miguel Stilwell d'Andrade: It has been a tough year but if I had to choose one thing that I am particularly proud of it's this. We were able to keep all of our people safe and healthy throughout this year. That was a challenge.

It's certainly something that was unforeseen and was tossed at us, as a global economy and as a set of companies. We were able to react quickly within less than a week, to get more than seventy percent of our people working from home and continue to run the business.

We provide energy to over ten million customers globally – Europe, the U.S., and places like Brazil. We're able in a short amount of time to get everyone home. We're keeping thirty percent of our field force on the ground and are able to quickly ramp them up and give them the necessary safety gear. We've kept everyone working also on this new shift paradigm.

We took advantage of it being a tough year to rethink the way we're doing business, to take it a step forward, and be ambitious about the goals we are setting for ourselves as a utility.
– Miguel Stilwell d'Andrade

I'm interested in perspectives on having had to pull that plan down from the shelf. Are there any learnings about how you've had to prepare business continuity going forward?
– Elizabeth Heichler

Globally, we have the infrastructure in place, both from an IT perspective and technology. That was something we were particularly proud of as an organization. We were able to keep driving the business forward and we had a good year as a company. We revised our business plan and are doubling our growth and renewables globally.

In the U.S. we committed to going all green by 2030. We committed to going coal free by 2025. We took advantage of it being a tough year to rethink the way we're doing business, to take it a step forward, and be ambitious about the goals we are setting for ourselves as a utility.

CEO, Hydro One, Mark Poweska: It's about how our people stepped up. I'm proud of the people in the organization, and the pandemic presented a lot of challenges to companies, ours included. It's important for communities we operate in to support customers, and I was proud of the creativity our team came up with.

We were the first utility in Ontario to offer a pandemic relief program for our customers. We returned all the security we have from our business customers. We gave their deposits back to them. We launched a Connected for Life program,

which is a promise to our customers not to disconnect them.

Later, we had a percentage of our workforce that had to go home. We had to worry about keeping the rest of our workforce, who was still out there, safe amongst uncertainty around what the protocols were. That presented challenges because at the beginning we were all learning along the way.

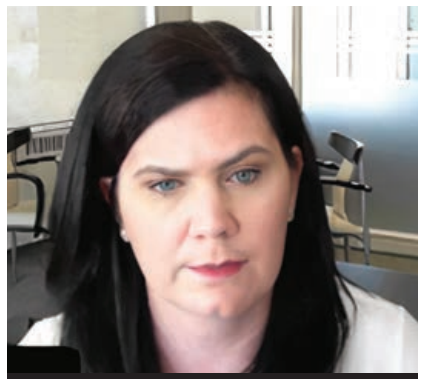
That presented communication challenges with our employees, being spread out over hundreds of communities. We overcame it through the use of technology and innovation. It is about how the Hydro One team kept up for customers and communities including First Nations.

President, Electricity, ATCO, Melanie Bayley: We're in Canada. The ATCO Group of companies is involved in many businesses, energy infrastructure, both electric and natural gas utilities, structures, and logistics, and we are headquartered in Calgary, in Alberta. I look after our electric utility in Alberta, the Yukon, and the Northwest Territories in Canada's North.

In Alberta we are in the heart of Canada's oil and gas industry. Decarbonization efforts are significant in our country like they are in many places in the world, but today the oil and gas sector remains a significant contributor to Canada's GDP. Being a utility with our footprint in Northern and Southeastern Alberta, a significant amount of the load on our system comes from the oil and gas sector.

I give all that context to set the stage for the challenges we have because, when the pandemic hit, we were dealing with the same health crisis everyone's dealt with, so I won't repeat that, but we had a sudden change in the supply demand mix for oil; a massive oversupply of oil when planes weren't flying, and cruise ships weren't running anymore.

We had negative oil prices in Canada and the oil and gas industry marginally shut in, so at the same time we are experiencing these real pressures from the pandemic and over people going home,



We had a sudden change in the supply demand mix for oil; a massive oversupply of oil when planes weren't flying, and cruise ships weren't running. That created an intense amount of fear. What we did is to lean into our purpose, which is keep the power on.
– Melanie Bayley

we had our largest customer segment very suddenly, almost overnight, drop off.

It's not as doomsday as I make it sound. The prices did recover through the summer last year and we're in a good place now, but that experience created an intense amount of fear and uncertainty in the people of our organization.

At the same time, we are asking them to completely turn things on in their heads and go do their jobs quickly in a different way. Either you're working from home or you're still out in the field, but here are all the new protocols you have to follow to do your work in the field.

This session's about leadership, so I won't focus on the strategies and our tactical approach to that demand destruction, but more about that uncertainty that people feel, and what it takes to pull them along with you and remain positive and optimistic in the face of that kind of challenge.

We focused on being there with our employees to the greatest extent we can in a situation like this, where we are on screen with them, we have a plan, are a part of it, and together we can do this.

We can get through this. That's what I'm most proud of, is that we did. We were able to keep our employees with us. Many of them, their spouse, friends, and families were being laid off or furloughed, who work in the oil and gas industry, so there was a lot of trepidation.

What we did is to lean into our purpose, which is keep the power on, but seemed like the one thing that we can do to help keep normalcy in people's lives when everything else was not normal.

Leadership needs to always be grounded in our purpose and living through your values. We all work for corporations that have likely strong values. We're not all going to have the same values, but leaning into that is what gives, at least for unscathed employees, a sense of confidence, as we went through the uncertainty.

CEO, PSEG, Ralph Izzo: While we have all sorts of procedures, manuals, and practice sessions to handle major events, I don't think anything can prepare an organization for something that was as far reaching in its consequences.

There was not one aspect of our operations that wasn't affected, whether it's a nuclear refueling outage, or getting the SEC documents out, nor was there ever anything in our rehearsals that would have anticipated the duration of something like this.

I see tremendous breadth in terms of functions affected and time frame. What I'm proudest of is the fact that we kept the lights on, and we kept the gas flowing, with sadly, unfortunately, health impacts that mirrored the population. I wish we'd done even better than that, but I'd leave it there.

Moderator, Elizabeth Heichler: I'm interested in perspectives on having had to pull that plan down from the shelf. Are there any learnings about how you've had to prepare business continuity going forward? Of course, plans never match up to reality.

A lesson I take away is, we need to get some of those other plans and take a closer look at this learning experience because we might need to roll out some of those real probability, high consequence plans involving health and roll this one into it.
– Mark Poweska

What we learned is the value of having a standing cross-functional emergency crisis management team. That's having depth at every one of the positions. What we didn't expect to find in terms of the value of having depth is, people get tired.
– Ralph Izzo

CEO, PSEG, Ralph Izzo: What we learned is the value of having a standing cross-functional emergency crisis management team. That's having depth at every one of the positions. The depth was originally designed with the expectation that at any point in time, if the team is made up of some number of people in the low double digits, that one or two folks won't be around, and that of course turned out to be true. What we didn't expect to find in terms of the value of having depth is, people get tired.

If you're meeting every day for three hours and you're doing this for fourteen months, you better have depth there, because over the course of fourteen months you need some rotations. After that, the script had to be edited and modified for circumstances.

CEO, Hydro One, Mark Poweska: All of us have emergency management structures in place. I don't think any of us contemplated they would be in place for a year and a half. We had to adapt them. Because of the nature and the criticality of this industry, we do have to put planning in place. We practice things. Our pandemic response plan is low probability of high consequence events like this.

You write a plan. You put it in place. You kind of look at it. I don't think we ever thought we would have to pull it off the shelves, frankly. What you learn is, it's good to have a starting point, but absolutely, you have to adapt it along the way.

A lesson I take away from that is, we need to get some of those other plans and take a closer look at this learning experience because we might need to roll out some of those real probability, high consequence plans involving health and roll this one into it.

It has challenged the normal way of thinking of emergency management structures and protocols, because most of the plans are not set up for being replaced. Imperative for us was that there was clarity in what the principles and the goals were, that we're making decisions along the way, because everything changed quickly.

We set two principles. One is to protect our employees, and the second is to continue to energize our customers in Ontario, and that allowed us to drive decision making now so we'd be more adaptable to changes along the way.

CEO, EDP Group, Miguel Stilwell d'Andrade: It shows that some of these contingency plans are kept in a drawer, and you expect never to use them. Over the last twelve months, we had not just COVID, but we had a cyberattack, fortunately without any serious consequences.

We also have over a thousand megawatts of wind power down in Texas, and we got the polar vortex. In the same twelve months we've had all these extreme events, which you don't expect to have.

The polar vortex was an extreme event. Cyberattack is not an extreme event, but when you get hit by one, you're not a hundred percent prepared, or you hope you're prepared, but you're not at all sure how things are going to react.

It shows that having resilience built into the system, having prudent risk management, redundancies built in, that's important, particularly for critical infrastructure, for companies that are managing such an important infrastructure of the economy.

If you don't have resilience, if you don't have prudent risk management, you get hit by what seems to be a once in a hundred-year type of event, but they do happen. It shows that it pays to prepare, and in that sense, fortunately, it's gone well so far. PUF

The Producer Price Index shows the average price residential consumers paid for electric service rose 2.1% over the 12 months ending April and for natural gas service rose 12.7%. For commercial consumers, average price for electric service rose 3.9% and for gas service rose 18.8%. For industrial consumers, average price for electric service rose 1.7%, for gas service 29.9%.

PUF Annual Pulse of Power Survey

How You Answered Eight Questions

By Mackinnon Lawrence, Brett Feldman, and Hannah Davis,
Guidehouse

Against the backdrop of pervasive disruption, it is no surprise that the ways utilities operate and interact with stakeholders are changing. As the 2021 Guidehouse and Public Utilities Fortnightly State and Future of the Power Industry executive survey shows, COVID-19-related constraints combined with a rapidly evolving market landscape accelerate these changes.

The influx of market players into the power sector increasingly engaged stakeholders, and proactive customers with connected devices and assets are forcing utilities to reevaluate their strategic priorities. The changes that occurred within the last year alone are proof that utilities can react to these disruptions and prepare for the utility of the future.

Utility Resilience Takes Center Stage after a Challenging 2020

An unprecedented combination of events occurred in 2020 and early 2021. We faced a combination of major weather and climate events including wildfires and deep freezes with associated blackouts, hurricanes, tropical storms, heatwaves, and droughts. We are enduring a pandemic that upended energy consumption patterns and traditional work during the corresponding economic slowdown.

We also experienced one of the largest cyberattacks on critical utility infrastructure. These events accelerated resilience planning across the power industry.

When asked about the pandemic's long-term impacts on utilities, nearly 60% of survey respondents indicated that the shift to remote work and enabling technologies for utility workings would be the most long-lasting.

This sentiment echoes the Guidehouse 2020 Executive Pulse survey which was fielded during the height of the coronavirus outbreak. In this survey, 86% of executive respondents indicated that their organizations would not return to a mostly centralized work environment post-pandemic.

These results, taken in the height of the pandemic and almost one year later, suggest that the strategies developed in response to the pandemic portend a new way of working moving forward.

The other responses about the pandemic's impact were split evenly between a shift from commercial and industrial to residential load (22%) and a shift from urban to suburban and rural load (20%). These results suggest that although a shift in electricity consumption patterns was noticeable, they are expected to return to the pre-pandemic status quo and that enabling the remote workforce is more significant.

Once considered unachievable in many parts of the utility business, remote work quickly became the reality in 2020 as utilities developed innovative processes and mechanisms to engage and support their customers while maintaining reliable service.

Investment in operational flexibility and solutions focused on protecting workers' health and safety were also a priority, which included integrating more digital and advanced technology solutions.

Some of these solutions include virtual customer engagement strategies that protect employees and customers, as well as the use of drones for inspections to limit the number of workers in the field and maintain social distancing practices.

These results, taken in the height of the pandemic and almost one year later, suggest that the strategies developed in response to the pandemic portend a new way of working moving forward.

Stay at home orders, remote work and learning, and closure of nonessential businesses caused a drastic shift in residential, commercial, and industrial load shapes in 2020. As a result, utilities are rethinking engagement strategies to support residential customers, including the following:

Discontinuing power shutoffs; Alerting customers of high bills and usage; Implementing virtual home audits; and Focusing on direct marketing of customer energy efficiency and cost-saving programs.

At the same time, an increase in extreme weather events has led to increased pressure from regulators and stakeholders for utilities to invest in resiliency planning efforts, incorporate climate impact analyses, and develop mitigation strategies.

According to the 2021 survey results, over half of respondents (54%) found that resiliency due to increasingly extreme weather events is the biggest challenge to utility operations from climate change, while 30% of respondents reported that intermittent renewables were the biggest challenge.

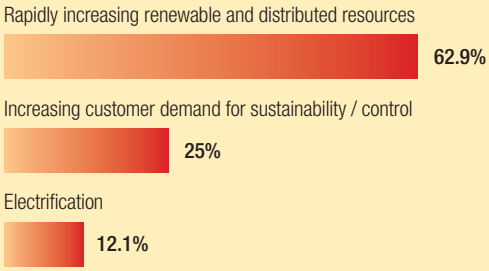
Mitigation efforts, along with investment in resilient infrastructure, were highly ranked by respondents in the 2020 State and Future of the Power Industry survey as well, underscoring the urgency with which utilities need to act.

Securing the electric grid from physical attacks and cyberattacks is also a high priority for the power industry, according to the survey results. In a definitive answer, 86% of respondents indicated that between cyber and physical security, cybersecurity is the bigger risk to utilities.

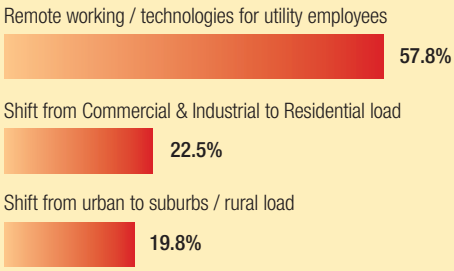
Attacks on the grid are evolving, becoming more frequent and

DISRUPTIONS

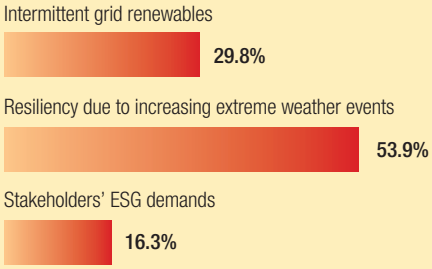
Q1. Which is most disruptive to the utility business model?



Q2. What will be the largest long-term impact from COVID on utilities?



Q3. What is the biggest challenge to utility operations from climate change?



malicious. Recent ransomware attacks such as the attack on the Colonial Pipeline and the 2020 SolarWinds attack emphasize the need for robust cybersecurity solutions, especially as utility operations become more flexible and distributed.

Guidehouse Insights anticipates the North American market for utility security could reach $436.8 million by 2029. Increased knowledge of what data, devices, and systems exist, and where, when, and how they communicate is essential for utilities to secure systems and networks.

Utility risk management practices will continue evolving to account for and address the highlighted risks of cybersecurity, climate change and extreme weather events, pandemics, the remote workforce, and increased market competition. Cyber and physical threats loom large for utilities over the next decade and require increased vigilance.

DER Proliferation and the Continued Disruption of the Utility Business Model

The proliferation of distributed energy resources (DER) and clean power are, and will continue to be, a disruption to the traditional utility business model. Mirroring the results from Guidehouse's 2019 and 2020 State & Future of the Power Industry studies, close to two-thirds (63%) of survey respondents in the 2021 survey indicated that the proliferation of DER will have a demonstratable impact on the utility business model and that there are no signs of this changing.

Guidehouse Insights' analysis indicates that DER deployments will outpace centralized generation on a global scale over the coming decade by a healthy margin. By 2030, Guidehouse Insights anticipates that DER capacity additions will be nearly twice that of new centralized generation capacity on an annual basis.

Increased DER uptake and participation is also expected as a result of the Federal Energy Regulatory Commission Order 2222, which intends to remove barriers preventing DER participation in wholesale energy markets. Overall, survey respondents were less concerned with increasing customer demand for sustainability and control (25%) and electrification (12%) as disruptive trends.

Although seen as a disruption, if orchestrated at scale across market participants, increasing DER penetration can be an asset to the industry by enabling more dynamic power markets.

Orchestration of diverse, distributed assets will require a shift away from siloed, top-down approaches. Increasingly, Guidehouse expects greater coordination across supply and demand stakeholders as well as stronger coordination and integration between distribution and transmission systems.

Integration platforms that can aggregate, optimize, schedule, and provide settlements for a multitude of fast transactions are required to enable this future and maintain a flexible, reliable, and balanced grid.

Utility investment is expected to increase steadily in advanced grid management systems, including distributed energy resource management systems (DERMS). Guidehouse Insights anticipates that the North American market for DERMS reaches $720 million in 2029.

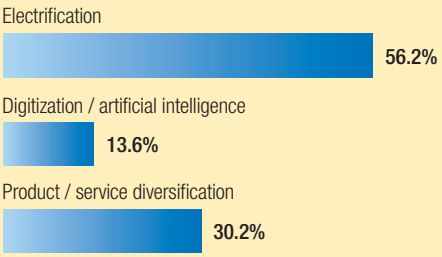
Additional investment in utility automation, digitalization, and other advanced software like blockchain and AI will grant utilities greater visualization into the grid edge while providing diverse products and services for customers. Continued deployment and growth of these markets is expected. The global energy blockchain market is expected to grow at a compound annual growth rate of 66.9% by 2030.

Focusing on North America, the market for virtual power plants is anticipated to reach $1.67 billion in 2029, a significant increase from 2020.

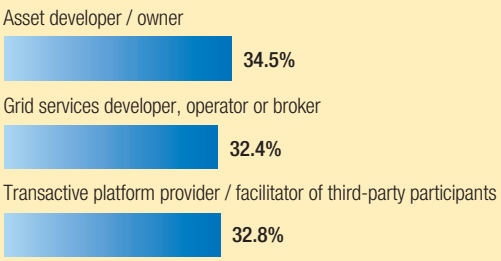
Although DER pose an operational threat to disrupt the utility business model, emerging non-energy competitors pose

Business Strategies

Q4. Which should utilities most embrace for sustained growth?



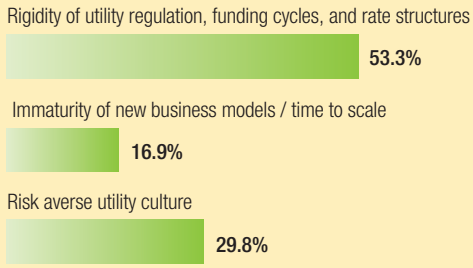
Q6. What is the most attractive utility business model for distributed resources?



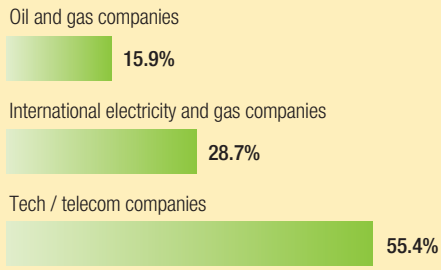
Challenges

Q5. Which is a bigger risk to utilities?

Q7. What primarily prevents utilities from investing in new business models?



Q8. Which potential competitors pose the biggest threat to utilities?



An increase in extreme weather events has led to increased pressure from regulators and stakeholders for utilities to invest in resiliency planning efforts, incorporate climate impact analyses, and develop mitigation strategies.

an external threat to how utilities do business with customers. Technology and telecom companies pose the biggest threat to utilities according to 55% of survey respondents, a decrease from 2020 results. 29% of respondents pointed to international electricity and gas companies while 16% cited oil & gas companies as the biggest threat.

Compared to 2020 State and Future of the Power Industry survey results, there was a large increase in the number of respondents who felt that international electricity and gas companies posed a threat as potential competitors.

Since 2019, oil & gas companies consistently have been seen as the least threatening (14%) despite major investments into the power sector. According to Guidehouse's Energy Cloud Investment Tracker, since January 2020, energy markets have seen the largest investments and acquisitions by global utilities in terms of transaction value.

The 4Q 2020 $8 billion investment by Berkshire Hathaway in Dominion Energy's gas and transmission business bolsters this fact. Of total investments and acquisitions since January 2020, Europe is leading the way, followed by North America.

As customer and stakeholder demands increase around environmental, social, and governance (ESG) initiatives, reliability, and monetizing distributed assets, utilities face pressure from competitors to provide services that meet these demands.

The rapidly evolving energy as a service market, which Guidehouse Insights anticipates representing $278 billion in revenue globally by 2028, is among the highly sought-after market opportunities where utilities will face fierce competition and pressure to succeed. In this environment, it is increasingly critical that utilities coordinate with technology providers and relevant stakeholders.

Business Strategies Going Forward

Competition and disruption in the market will force utilities to shift their strategies and uncover new growth opportunities to

(Cont. on page 56)

Two Rising Stars in Portland

Conversations with Portland General Electric's Quintin Gaddis and Kellie Cloud

PUF readers know we love staff at all our member organizations. PUF digs deep to give insight to how staff got there, what they do, how they do it, and what advice they have. When a utility like Portland General Electric allows access to two rising stars that help make all the wonderful work happen, PUF wants to know more. You want to listen in on these two engaging talks with Kellie Cloud and Quintin Gaddis, who are sure to be around for a long time and sure to go far.

Quintin Gaddis

Senior Manager, Substation and Meter Operations

PUF's Steve Mitnick: Before coming to Portland General, you went into the Air Force, and now you're in the Air Force Reserves. What led you to join the Air Force?

Quintin Gaddis: I had two uncles in the Air Force. They loved it. One retired from the Reserves. Both of them got their education through the Air Force. I was at a time in my life when I was looking for structure and wanted to move forward, grow, get out there, and be challenged. I followed the same path they did. They got everything out of the Air Force they possibly could.

PUF: You earned an associate degree first in electrical engineering technology, a bachelor's in avionics, then an MBA.

Quintin Gaddis: Yes. I pursued my education because it was honing some of the skills I already had. I always want to know how something works, and I want to grow.

When I got into management, I didn't know about budgeting, but I wanted to learn. All of those opportunities were learning experiences and they helped me. That helps me now in the day-to-day, in work, and in life.

PUF: What was your job in the Air Force?

Quintin Gaddis: I was an aircraft mechanic initially. I worked on the C-5. In the Reserves I became a flight control specialist on the C-141 and the C-5. After that, I moved into the Air National Guard, got into civil engineering, and then moved back to the aviation side.

PUF: The C-141 and C-5 are not small planes.

Quintin Gaddis: Yes, they are large cargo planes. I was on the C-17 as well. The C-5 right now is one of the largest ones that we have – mostly in the Air Force Reserves. The Command C-17 kind of took the place of the C-141 and the C-5. It was an exciting experience.

That big airplane became a city, so when I look at my electrical industry career, everything that I deal with in a substation or in my career was all on that airplane.

PUF: What led you to the utilities industry?

Quintin Gaddis: It was by accident. I realized once I got into the industry that everything from the Air Force had provided a foundation. I applied for an officer commission in the Air Force when I was at the McChord Air Force base in Washington, and then I needed to get home. That's kind of what got me into the Reserves. I started working for a company called Air Products & Chemical.

When I thought about a power plant, I thought about an aircraft engine turned upside down, essentially. I was part of building our substation for one of the plants. I thought, wow, once this is over, I'm going to utilities.

I realized the concept of the air separation profession was closely associated to how an aircraft engine operated. I started learning how to run the plant and then learned more about the substation piece within the industry, the electronics, and controls, it just kept going back to my aviation experience.

I realized that the power industry was nothing but an aircraft engine. When I thought about a power plant, I thought about an aircraft engine turned upside down, essentially. To me, that was a power plant. I was part of building our substation for one of the plants. I thought, wow, once this is over, I'm going to utilities.

I was intrigued by the project I was on with substations. I talked to a few people who said, you live in Dayton, so why don't you go talk to Dayton Power & Light?

Dayton Power & Light gave me an opportunity and I latched onto an individual named Steve Clemans who became a mentor. He helped me bring everything together and allowed me to take everything I had from the military, Air Products, and my career, and put it together within the industry.

That got me interested in getting my certification, and then being a system operator.

I grew from there.

Everything I do starts with safety. With safety, it's having great training to perform the job. There's structure behind everything I do, along with policy and procedure. I got all of that from the Air Force.

PUF: You're the senior manager of substation and meter operations, and utilities is one of the most critical positions. Talk about what you've done at Portland General Electric and what your job is like.

Quintin Gaddis: My job is absolutely amazing. It changes every day. It's safety first. My job is to ensure that the group I have does our job with safe and efficient power transformation from the power plant all the way to the customer.

Along the way there, from substations, there's that protection we are responsible for. Any time you have a car that hits a pole, or you have a tree that's laying on a limb, we're responsible for that protection at the substation to operate and ensure there isn't any further damage within the infrastructure, whether it's burning down a line or continuing or causing a sustained long-term outage.

We ensure any time there's an outage, the protection schemes we implement isolate the outage to a small section to prevent large quantities of people being out. There are a lot of things that go into it from the power plants.

We're in the power plants, and the power stations. We work with the apparatus out on the distribution lines. We work with everybody from our system operating group. I was a system operator, so it's great to be able to communicate with them about line operations.

It's one of those jobs where there are multiple things we're responsible for within the industry. It's an exciting opportunity, and every day is different. The people are what make it special.

PUF: You had maybe a little too much excitement in February. I don't know if you like cold weather, but you had tough weather. How did that go?

Quintin Gaddis: We did have a tough time. With the historic storms that we had here, our system was challenged. The customers were put in a situation where they had to trust us. They had to trust us to do everything we could to ensure we got the power back on for them so they could get their lives back to normal.

Everything I do starts with safety. With safety, it's having great training to perform the job. There's structure behind everything I do, along with policy and procedure. I got all of that from the Air Force.

It reminded me why I came into the business. Every day was tough. We didn't have a lot of happy customers because it was all about the human element. But they understood what we had to do to make the system right during the restoration process.

We were challenged, but this is what I signed up for. There's a lot of pressure in the job. But it's all about doing everything I can for the customer, for the people I support on my team, and ensuring that the infrastructure remains in the best condition.

February was challenging, and it was something I wouldn't want the customer to have to endure again. When mother nature comes in, you're always thinking about the customer. But if we face that kind of challenge in the future, I will step up again and again. That's why I stay in this position.

PUF: What's the most rewarding about your job at Portland General Electric?

Quintin Gaddis: It's all about supporting the great people that work here. They are here supporting the customer. It's an exciting career. I've had some wonderful experiences.

Being able to watch, whether it's a new apprentice that comes in, learning a craft, or seeing how we get the lights back on and restore our customers, and the smiles we see from the customers. It's all about the people.

PUF: Do you have advice for young people just starting out, or for veterans joining the civilian work force?

Quintin Gaddis: First, you have to believe in yourself and in the skills you know that you have. You can't give up. For veterans, everything you go through, from basic training or technical school, to learning the job you're going to do for the military, that's more challenging. That was also more challenging for me than anything.

You can't give up. It's about making sure you do it the right way. There are a lot of challenges you go through in the industry.

Not everybody will like what you do, but as long as you like what you do and continue to do it the right way, eventually people will appreciate it and that will keep you coming back. ❍

Kellie Cloud

Senior Director, Engineering Services

PUF's Steve Mitnick: You have an important job at Portland General Electric. Talk about it.

Kellie Cloud: I'm the Senior Director of Engineering Services at PGE. I have three primary business units reporting up through me.

One of them is the power supply engineering services group. That team primarily supports our generation facilities, designing capital improvements, and supporting maintenance and compliance activities for our generation fleet.

It includes mechanical engineers, electrical engineers, and civil engineers. They're also responsible for dam safety, fish plans, welding certification, land surveying, and technical functions to keep our generation healthy.

The other business unit is grid asset engineering, and that team is primarily responsible for designing capital improvements to our transmission and distribution system, including substations and telecommunications.

The third one is asset management. They use analytics and do planning studies to develop projects, and report on our reliability. We've got geospatial information systems and analytics on that team. There's a group of maintenance engineers and operations engineers focused on supporting operations and monitoring the health of our system on a day-to-day basis.

With asset management, they may be planning capital projects, but they do not do the detailed design work for capital projects. They are focused on operations and planning activities, as well as associated NERC compliance.

PUF: What is a typical day like?

Kellie Cloud: I spend a lot of time in meetings with my peers, homing in on our priorities, what our risks are, and charting a path forward through a large number of challenges. I'm helping remove roadblocks.

My current focus is around resilience. We experienced two unprecedented storms, a wildfire event, and an ice storm in February.

I'm helping coordinate a cross functional team to define resilience for our organization in terms of customer and community outcomes. We're making sure as we plan the grid, as we define our design criteria for our generating facilities, that we understand our community's needs, and our changing environment. We're doing root cause assessments on some of those failures during the ice storm and working on wildfire mitigation.

We're making sure as we plan the grid, as we define our design criteria for our generating facilities, that we understand our community's needs, and our changing environment.

Eventually we'll look into the Texas energy crisis to make sure specifications for our generation facilities address changing climate. That's a big focus, figuring out how we move forward and engage with our community and prioritize that work in light of everything else we have point on.

PUF: What were you doing during these two events?

Kellie Cloud: During the Labor Day wildfire, I was a part of our incident command structure. I was a deputy incident commander. I had played other roles in our incident management teams in years past, but I've been transitioning to the incident commander role.

For the February storm, I served as incident commander and we took shifts. I typically do day shift and one day I would be fully on duty as the incident commander setting our objectives and approving external communications, and then on the other days I would balance my day job and support the other incident commander.

PUF: How did your background lead to this role?

Kellie Cloud: I was the director of our substation operations prior to this. That was a combined business unit. Half of my employees were engineering, and the other half were field construction and maintenance crews.

At the time, we had a different organizational structure. I oversaw the grid asset engineering part of my current org, as well

Leadership has slightly different challenges and comparing my style of communication to my male peers, occasionally people reacted more strongly to my direct communication styles than they did when my male peers were similarly assertive.

as substation operations, so it was a combined engineering and operations unit. Prior to that, I was a senior manager over the operational technology functions, focusing on telecommunications, SCADA, and protection.

I grew up in Portland but went to college at Trinity University in Texas. As a liberal arts school, Trinity emphasized teamwork and communications, even in their engineering program, which prepared me for leadership roles. Right out of college, I worked for Brown & Root for a short time in the oil and gas industry. I started out as an instrumentation engineer and that work was super fun.

Designing oil platforms is like a giant puzzle, but that was not what I wanted to do long-term, especially since at the time, most of the work was not domestic and it was difficult for women to have opportunities to work in the field, on site.

I came back to Oregon and stumbled into the electric utility industry. I was hired by a small firm to do an instrumentation job on a hydroelectric facility, but the job was canceled, so they reassigned me to a substation project. I learned on the job how to design substations.

PUF: As leader of broad engineering groups, is it is true that most of the people you were supervising were of one gender as opposed to the other?

Kellie Cloud: Going all the way back to college, it was normal for me to either be the lone woman or one of only a couple of women in my classes. That became the norm for me.

It didn't make me uncomfortable in college, although I did take note of it as I moved into the workforce. I've generally been supported by my male peers. I think back to my first ride-along with a field technician. As soon as I came to PGE, I needed to go out in the field and spend time with the guys doing the work.

There was some resistance to welcoming me. There had been a prior female supervisor of that field team who may not have been ready for the leadership opportunity. I was told clearly that I came in in her wake and I would have to work hard to earn the trust of my field counterparts because there was this idea, at the time, that women were being given opportunities without the proper background and training. I knew I had an uphill climb as far as building trust and proving I was worthy of the opportunity.

I did not know at the time that I was a diversity hire. I learned, probably ten years later that I had very little competition for my first engineering job at PGE, simply because I was a woman, and my hiring was expedited. That was a shock and was somewhat disappointing.

On this first ride-along, the tech looked at me and said, I don't know what you're doing here. I don't have time to entertain you. You can sit over there. I spent the entire day helping him with his job, marking up drawings for him, which is a tedious task.

By the time that technician retired, he was calling me probably twice a week. I was his trusted technical resource. I had a great relationship with the field technicians, but I had to work hard to earn that trust.

Leadership has slightly different challenges and comparing my style of communication to my male peers, occasionally people reacted more strongly to my direct communication styles than they did when my male peers were similarly assertive. It looks different, and it's perceived differently from women.

There have been some challenges, and throughout my career I've focused on delivering value and proving my worth. But as I mentor other women, their experience is different. What they should be expecting, I think is different.

PUF: For younger women, just starting their careers, what do you tell them?

Kellie Cloud: Unfortunately, there's no silver bullet but definitely don't dim your own light just because someone makes you feel bad. Work hard and deliver results to earn trust. Where I've been doing some soul searching is thinking about some of the compromises I made along the way that I would not recommend they make.

Early in my career, I wore a skirt, and a man commented on it. I didn't wear a skirt to work for ten years after that. Today, I would advise a woman in that situation to say something, if not to the man, then to their manager or someone from HR in order to communicate how that made her feel. At the time, I just took it and changed my behavior.

As I work with women who are seeking leadership roles, understanding where we need to be focused on our behavior versus where we can be advocates for ourselves and for our peers, it's different than when I started out. I was advised to behave and act and dress like a man. I don't believe that's necessary today. PUF

Transforming Utilities and Customers

(Cont. from p. 14)

Linde are an example of all of us working collaboratively to bring the best technologies and thinking together in order to make a difference for all of our businesses, customers, and the region.

PUF: Connie, what advice would you give to utilities looking at this thinking we'd like to work with our medical centers, like they're doing in Portland.

Connie Seeley: One of the great things about our partnership with PGE is we both recognize we're essential service providers. The work never stops and we're always on call. We have a saying in OHSU, everyone needs to work at the top of their license.

That's exactly the same way PGE embraces its work. We push each other. We challenge to explore, what are the best opportunities?

One of the great things about PGE, the foundation of our partnership, is understanding what its goals are and PGE wanting to understand what our goals are, so we can then identify where are the synergies and places where we can partner and get to where we want to go together.

PUF: Christian, what advice would you give to the utilities as to how to work with big users, big customers like yours, to drive down our emissions and reach goals together?

Christian Lenci: The answer is collaboration. Like many aspects of society, we have a lot more in common with each other than we realize, and industrial and electric utilities are no exception.

We're both capital intensive. We make decades-long investments. Change is difficult. Utilities and industrials can work together and help create the change.

For New York, we signed a fifty-year agreement that helped build the Niagara Power Project and created the funding to make that happen. In the same way, we have a unique opportunity to make well considered, smart decisions working together, not only for our future generation mix, but also for our environment.

It's not easy. It takes active listening and new ways of thinking. You've got to put aside old paradigms and you need support and openness from your utilities and regulators because the solutions here are going to be different – or they should be different.

We strive for this collaboration with other utilities around the country. PGE and Linde are off to a great start, but we can do more here and elsewhere. We look forward to building that future. PUF

New Tone on Energy Transformation

(Cont. from p. 33)

PUF: How do you work with the many stakeholders?

Pat Hoffman: Sometimes it can be challenging. We must listen to people's opinions. We need to understand there are multiple ways of looking at a problem and be able to bring stakeholders together.

We want the grid to be an enabler, a platform that allows a variety of technologies to thrive. The grid is a complex environment. It is not an easy subject. We are going to have to bring consumers, regulators, and policymakers together so they can understand some of the challenges in this space.

How do we balance all of the system requirements from an ancillary service, a ramping, a black start point of view? How do we evaluate the need for capacity and energy on the system? How do we do stress test to ensure the system is resilient?

We have great expertise at the National Labs, and we lead by example at the Power Marketing Administrations. We are ready to partner and make progress to enabling a better future. PUF

(Cont. from p. 49)

remain profitable, meet regulator and stakeholder expectations, and retain customers. However, utilities face several challenges in driving innovation and adopting new business models.

The majority of survey respondents (53%) indicated that the rigidity of utility regulation, funding cycles, and rate structures are major barriers for utilities hoping to invest in new business models.

Even as utilities quickly upended traditional processes in response to the pandemic, 30% of survey respondents still believe the risk-averse utility culture is a large inhibitor to business model innovation. This culture is changing as the risk of inaction grows, but it will take time as the old utility guard retires and new people with fresh perspectives come in.

Meanwhile, just 17% of respondents pointed to immaturity of new business models and relative time to scale as inhibitors of new business model investment.

Only one-quarter of major utilities in the U.S. have made progress in developing future-oriented business models, according to Guidehouse's 2020 Energy Cloud Readiness Index study. The same study found that only one in ten utilities have done so proactively with little outside pressure from regulators, customers, or competition.

With the proliferation of DER, interest in ESG and a decarbonized future, and increased market competition, utilities will need to develop strategies to overcome these barriers and find growth opportunities through new business models.

Utilities are already actively deploying new business models. These include energy as a service, subscription-based retail services, electrification, and various models for distributed resources such as transactive energy.

Of the potential business models for distributed resources, survey respondents were evenly split as to which was most attractive (one-third of respondents selected asset developer or owner; one-third grid services developer, operator, or broker; and one-third transactive platform provider and facilitator of third-party participants).

Support was slightly lower for transactive platform providers than what was reported in the 2020 State and Future of the Power Industry survey. Since January 2020, global utility investments and acquisitions have centered on utility scale generation, zero-emission mobility, data analytics platforms, and distributed generation.

Of the 2021 survey's respondents, 56% reported that electrification was the most promising opportunity for sustaining utility growth. Investment in electrification is well-positioned as a pathway for sustained growth for utilities as focus on decarbonization increases and utilities seek out solutions to curb declining revenues.

Recent ransomware attacks such as the attack on the Colonial Pipeline and the 2020 SolarWinds attack emphasize the need for robust cybersecurity solutions, especially as utility operations become more flexible and distributed.

Through utility partnerships, electrification in buildings and transportation can help reverse declining load while also offering a suite of new products and services for customers.

Meanwhile, 30% of respondents indicated that new and diverse products and services should be embraced as a priority. With the influx of DER, shift toward ESG, changing stakeholder demands, and investment in electrification, new customer products and services will accompany these changes and help expand relationships.

While utilities faced countless challenges in the past year, this year's State and Future of the Power Industry survey demonstrates that the industry continues to embrace change while evolving to meet new challenges head-on.

Given the complexity of disruption across the industry, utility executives will need to remain flexible and vigilant as they navigate an increasingly clean, distributed, mobile, and digitalized future. PUF

The June 2020 special issue of PUF on the state and future of power led off with conversations with five key change agents of the utilities industry, Jennifer Wischnowsky of Ameren, Ram Sastry of American Electric Power, Chris Gould of Exelon, Roger Kranenburg of Eversource Energy, and Keith Dennis of the National Rural Electric Cooperative Association. The June 2019 special issue on the state and future of power led off with conversations with eight state commission chairs, Jeffrey Ackerman of the Colorado Public Utilities Commission, Dallas Winslow of the Delaware Public Service Commission, Paul Kjellander of the Idaho Public Utilities Commission, Brien Sheahan of the Illinois Commerce Commission, Jason Stanek of the Maryland Public Service Commission, Megan Decker of the Oregon Public Utility Commission, Gladys Brown Dutrieulle of the Pennsylvania Public Utility Commission, and Kara Fornstrom of the Wyoming Public Service Commission.

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Illustrating the Latest Data on Residential Electric Bills

Consumer Expenditure Survey Highlights Income, Age, Community, and Regional Differences

The gold standard on residential electric bill data, the federal government's Consumer Expenditure Survey, has just been updated by the U.S. Bureau of Labor Statistics, on the twenty-ninth of April, for the twelve-month period through June 2020. The extraordinary credibility and comprehensiveness of the CES comes from the huge sample size of approximately twenty thousand American households, the extreme detail and care of the surveyors (including in-person visits and expense diaries), and its long track record since the early nineteen-eighties. While the last three months of this twelve-month period through last June were affected by the pandemic, the impact on this latest data seems to be minimal.

Here the PUF team illustrates big takeaways on the comparison of the electric bills of high income households versus low income households, older households versus younger households, rural households versus urban households, and households in the south of the country versus those in the west. Figure 1 shows that even though high income households tend to have considerably higher electric bills, electricity's share of their household expenditures is considerably lower than that for low income households. Figure 2 shows that electric bills tend to be a bigger burden on older households but not by that much. Figure 3 shows that rural households tend to pay much more for their electric service than do central city households in both absolute terms and as a percentage of their total expenditures. And Figure 4 shows that households in the south census region tend to pay significantly more for electricity than do households in the west census region, where the summer climate that drives air conditioning usage is milder. PUF

FIG. 1 LOW INCOME VS. HIGH INCOME

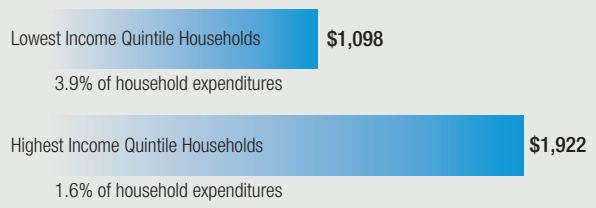


FIG. 2 OLDER VS. YOUNGER

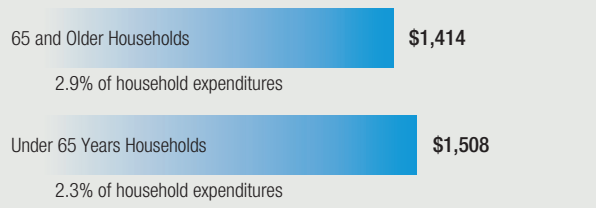


FIG. 3 RURAL VS. URBAN

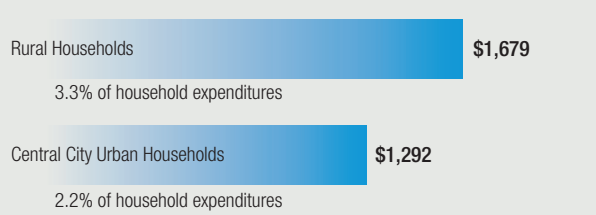
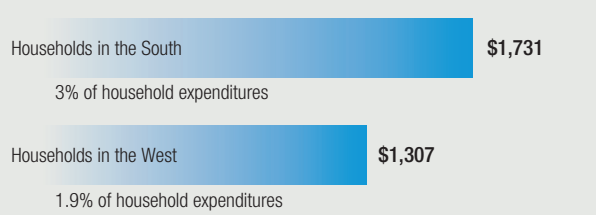


FIG. 4 SOUTH VS. WEST



Residential Electric Bills, 12 Months Ending June 2020

Source: Consumer Expenditure Survey, U.S. Bureau of Labor Statistics, Data Published April 29, 2021

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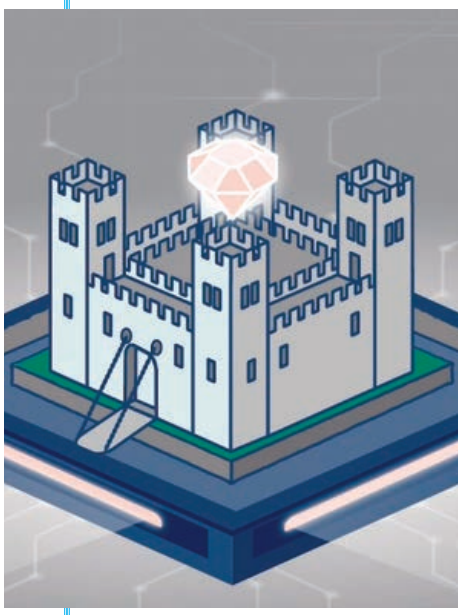

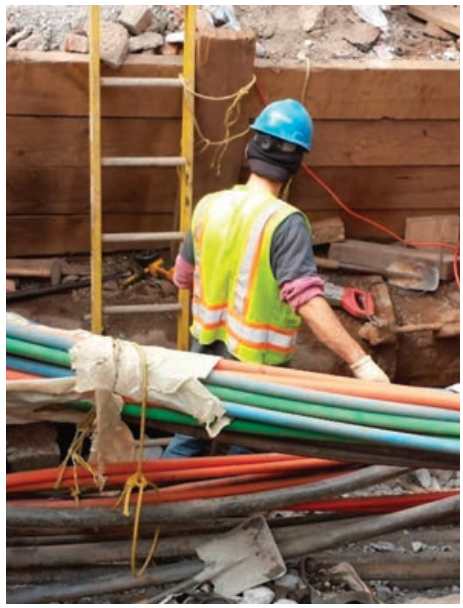

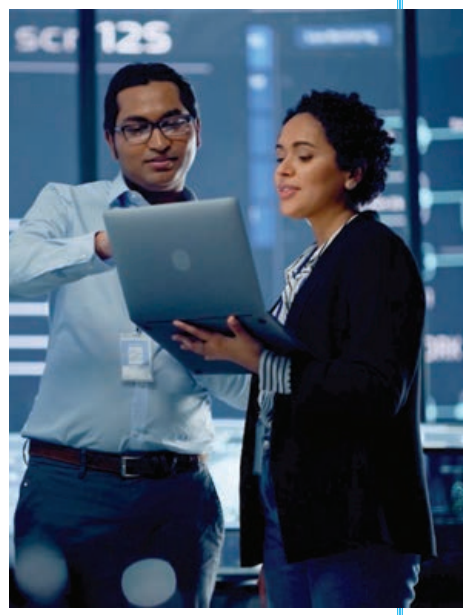

Cybersecurity 101 for Everyone
Selective Undergrounding Strategically
In Cybersecurity, It Takes a Neighborhood
Decarbonization Cluster-by-Cluster
Selective Undergrounding in the Sunshine State
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