



## TWIN GLOBAL CHALLENGE SESSION

# The Future of Energy – To a Cleaner, More Distributed, Customer-Centric System

September 17th, 2019 | Chicago Connectory

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## Introduction

TWIN Global is an annual convening of innovation and growth leaders from across sectors and geographies. Challenge Sessions, a central part of the TWIN experience, are designed and facilitated working sessions where curated participants discuss topics of common interest. The goals of these Challenge Sessions are to inspire thought, spark discovery and connection, and imagine a path forward on the topic by engaging a broad range of perspectives and stakeholders.

On September 17, 2019, 26 invite-only participants gathered at the Chicago Connectory to discuss the global energy transition as part of TWIN Global. Participants included visionaries from inside and outside the energy sector, with representatives from

industry leaders such as Exelon, Edison International, Dominion Energy, ConEdison, and Shell, as well as other pioneering companies across multiple sectors, premier academic institutions, think tanks, incubators and investors driving change in the energy industry. Through a combination of keynote perspectives, panel discussions, and collaborative breakouts, the diverse group of participants discussed the exciting future of energy – the implications for climate change and distributed energy resources, the traditional utility business model and the changing regulatory landscape.

The following document summarizes speaker and panel highlights, identifies insights and themes from discussions throughout the session, and provides implications and recommendations for a path forward.

### Session Lead:



### Session Sponsors:



### Challenge Session Leaders:

Paul Donnellan Partner, Clareo

### Summary Author:

Wiles Kase Consultant, Clareo

# KEYNOTE ADDRESS HIGHLIGHTS



AMY FRANCETIC, MANAGING DIRECTOR, ENERGIZE VENTURES

- ▶ Amy kicked off the day with a keynote presentation on venture investing in new energy. She detailed how venture capital firm Energize Ventures approaches investments in technologies that make energy and industry more affordable, reliable, and secure. Energize invests under the thesis that profitable digital solutions are capital-light, integrate hardware and software, and scale from energy applications to use-cases in other industrial verticals to capture additional revenue streams.
- ▶ Francetic stated that Energize Ventures explores six application layer verticals within its investment thesis: data analytics, energy storage, distributed energy, mobility, cyber security, and operational efficiency. The steady reduction of computing costs—combined with healthy IoT spend forecasts among utilities, oil and gas companies, manufacturers, automotive, and logistics companies—creates a tailwind for investing in these data-heavy solutions at the intersection of physical assets and digital applications. Francetic posed a challenge to energy entrepreneurs and engineers: given that data from energy and physical assets is no longer scarce, and machine learning and artificial intelligence skillsets are now table stakes, how can you extract value from data to improve outcomes for customers?
- ▶ Francetic also highlighted trends emerging in the six verticals and pointed out areas that still need development. For example, consumer tech solutions have not yet translated successfully to the energy sector (e.g., there's yet to be an "Uber" of peer-to-peer consumer solar energy trading), and blockchain solutions for energy use-cases are not investible yet. On the other hand, edge computing represents an area of rapid progress and promising solutions underpinned by several macro trends.
- ▶ Additionally, in the absence of federal policy, Francetic has seen private institutions increasingly internalize climate costs in their own products. Insurance providers, financial institutions, asset owners and others are taking climate impacts into account & actively seeking adaptation or mitigation solution. Companies that facilitate the internalization of climate costs are an attractive new area of investment. Francetic labeled this emerging product/service category "climate capitalism."

*"We're seeing a resurgence in funds to serve this market. We counted \$3 billion in energy venture funds since 2016—and growing."*

*"There is a ground shift happening in terms of innovation. This is a really exciting time to be investing."*

## Discussion and Takeaways from Keynote Speaker

Clareo partner Paul Donnellan moderated a discussion with Francetic on the factors that make certain energy subsectors attractive for venture investors.

Francetic was bullish on the cybersecurity industry writ large, which has seen significant momentum and has been buoyed by the successful IPOs of more mature cybersecurity companies. Within the energy sector, cybersecurity products often protect internet-connected physical assets and equipment rather than information. Energy cybersecurity firms have had success in growing revenue and exiting through acquisition by larger tech and cybersecurity firms. While battery storage developed more slowly than expected, Francetic believes it remains an attractive market. She also highlighted the electric vehicle (EV) and mobility markets as good areas for investment, citing the profitability of a highly utilized EV charging company.

Francetic explained that a consistent constraint for consumer energy solutions continues to be the fractured State regulatory environment, which hinders the scale and expansion of promising technologies outside of the regulated market for which they were developed. Francetic pointed out that other countries, such as Japan and Australia, have national energy regulations that encourage scaling new energy technologies.

When looking at exit opportunities for digital energy venture investments, Francetic believes the field of acquirers extends beyond utilities, with large software companies like Google and Microsoft investing in the space. Companies in the oil and gas industry are also sophisticated buyers with appetites for digital solutions, as many of them were early investors in digital applications for their physical assets.

# PERSPECTIVES ON THE UTILITY OF THE FUTURE

## FUTURE OF ENERGY

REPORT OUT  
DECEMBER 2019



**DREW MURPHY, SENIOR VICE PRESIDENT, STRATEGY AND CORPORATE DEVELOPMENT, EDISON INTERNATIONAL**

- ▶ Murphy asserted that climate change will become the single most urgent factor in defining the goals and incentives for the future of energy, especially in the electric utility market. While California's power generation sector can do more to reduce carbon emissions, the transportation and building sectors (residential, commercial and industrial) are the dominant sources of emissions. Murphy pointed out that more than half of the state of California's greenhouse gas (GHG) emissions comes from the transportation sector alone. As a result, significant reductions in emissions will need to be made in those sectors to achieve California's 2030 decarbonization goals.
- ▶ Murphy believes the carbon contribution of other sectors creates a mandate for utilities to make major improvements to the grid to support a number of important industry transitions: intermittent renewable generation, increased loads from electrification of other sectors like transportation and the built environment, and the novel load profiles from those sectors. The future of energy runs through the utilities sector, he said.
- ▶ In tackling the large-scale change required of the grid, utilities possess clear advantages, such as existing customer trust, established regulatory relationships, and grid infrastructure that reaches nearly every home and business in developed nations. But they also need to consider customer preferences to avoid being displaced. He believes there is no guarantee that grid decarbonization will not dislocate the electric utility, especially if the utility ignores changing consumer behavior and preferences for decarbonized, reliable, low-cost, personalized power. Utilities need to anticipate how customers will interact with the grid in the future, he said. Many customers simply do not care about the brand of their electricity – they care about outcomes.

*“Everything we use will likely become electric. With that, needs and wants will change as consumers begin to expect to buy a phone or car and have power come with it – seamlessly.”*



**PHIL NEVELS, DIRECTOR, INNOVATION AND PARTNERSHIPS, EXELON UTILITIES, EXELON**

- ▶ The large-scale changes that utilities face—from climate change to new entrants in technology and DER—will force utilities to redefine the value they provide to customers, according to Nevels. Among the services utilities currently provide, new entrants will compete not only in generation and in new products and services behind the meter, but in traditional utility monopoly positions such as transmission, retail energy, and even distribution.
- ▶ Nevels stated that utility challenges and opportunities are often one and the same. Evolving technologies, policy, and customer expectations are the three most important factors that utilities need to consider. Technologies have the potential to disintermediate the utility or reduce consumption of electricity, but can also become an opportunity if the utility can participate in delivering these technologies that consumers are demanding.
- ▶ Nevels noted that new entrants, such as Google, seek to define value irrespective of the utility or use utility infrastructure to capture value without compensating the utility. The challenge for utilities will be to encourage new entrants to leverage utility infrastructure to create customer value without compromising the utility business model. Finally, utilities also face the challenge of simultaneously meeting changing customer expectations while maintaining equal access and affordability.
- ▶ Given these three critical unknowns, Nevels suggested that utilities' value can no longer be “the kilowatt-hour.” Instead, utilities must redefine value, which Exelon conceptualizes as “connected communities.” The company buckets the key areas of value for connected communities into reliability, electrification & decarbonization, resiliency & security, and DER & consumer choice. To deliver in these four areas, the company's core business model will remain the same—invest in assets that produce a return—but the scope of asset investment will expand. Importantly, this redefined value is not limited to utilities, but includes new entrants and a broad range of stakeholders in the connected community.

*“21st-Century electric utilities are victims of the 20th-Century business model that made them successful.”*



**MARK WEBB, CHIEF INNOVATION OFFICER,  
DOMINION ENERGY**

- ▶ Webb asserted that carbon dioxide will be the single defining metric governing decisions in the utility industry moving forward. Win-win scenarios aren't ubiquitous in the path towards decarbonization. Challenging shifts are required to drive toward carbon-centric goals. However, Webb pointed out that some win-wins do exist, and when they appear, they should not be squandered. For instance, the electrification of school buses provides healthier air for school children (versus diesel school buses) and creates load for utilities and new business for EV charging companies.
- ▶ Webb also noted that the decommissioning of nuclear plants has negated the carbon benefits of all solar power installed since 2000. Additionally, the opportunity to reduce transportation's impact on emissions via electrification is a clear win-win for both climate goals and electricity providers. Reducing carbon on the grid is a critical and urgent step—especially in markets where fossil fuels still make up a large portion of the energy mix. Transitional fuels like natural gas can play an important role in states where coal still dominates grid energy; in Utah, for example, vehicles running on LNG produce fewer GHGs than electric vehicles.
- ▶ Non-electric solutions like LNG may also help clean up the shipping industry, another key driver of global emissions. The 15 largest cargo ships in operation today produce as much sulfur and nitrogen pollution as the global fleet of light vehicles. Converting maritime shipping to LNG or even electric power would produce co-benefits of reducing both sulfur and nitrogen pollution and carbon emissions.

*“The drive toward decarbonization requires challenging transformations. But some win-wins do exist, and when they appear, they should not be squandered.”*

## Discussion and Takeaways from Utility Perspectives

Clareo partner Paul Donnellan moderated a discussion with the utility panelists that focused on utility risk profiles and their ability to adapt to a rapidly changing environment. Murphy noted that the nature of utility regulation in the United States makes it challenging for electric utilities to nimbly assess the capability of new technologies and business models. Because of the uncertainties and complexities of new technologies (such as EV charging and DER integration, among others), Murphy said utilities look for opportunities to partner with technologies where regulators are comfortable and there is less risk. Where utilities are restricted from risky investments, third-party technology providers assume the risk of commercialization.

The panelists noted that changing the regulatory and risk-reward paradigm for utilities—all the way from how utility markets are structured to how utilities develop human capital internally—will help utilities meet the challenges they face. Webb cited Dominion Energy's efforts to create a culture of innovation among its employee base by challenging its employees to bring forward innovative ideas and providing them with the process and tools to do so. Nevels made the case that utilities like Exelon need to re-evaluate the concept of failure by celebrating the learnings from new projects, partnerships or products, even if they are not successful. Because of the lower probability of success for innovative initiatives, Nevels said utilities need to increase the number of innovative initiatives (smaller, iterative investments and experiments) to achieve a healthy innovation portfolio. Murphy explained that it is incredibly important that utilities teach employees that innovation is not undisciplined and needs to align with the strategy of the company. A key challenge for innovation in the utility, according to Murphy, is getting people to collaborate by working across disciplines and teams.

# TECHNOLOGIES AND NEW BUSINESS MODELS FOR THE FUTURE OF ENERGY



**MICHAEL WASIELEWSKI, PROFESSOR OF CHEMISTRY,  
NORTHWESTERN UNIVERSITY**

- ▶ Carbon-free electricity production and reducing transportation emissions are key pieces needed to satisfy climate goals, and certain forms of transportation need energy dense storage. For example, Wasielewski noted, it is almost impossible to fly commercial aircraft on batteries – the industry is not advanced enough for those applications yet. Solar and wind energy also need technical, not just policy, advancements in energy storage solutions (especially charge/discharge cycle improvements).
- ▶ Wasielewski stated that carbon capture needs greater attention (the oil & gas industry is the only major player investing in the space). One promising carbon capture process is using solar energy to catalyze the formation of fuels by reacting with CO<sub>2</sub>. Wasielewski believes that replacing coal with natural gas as a generation fuel is a good outcome, as it produces the same amount of energy but half the carbon. But, he said, that can only be a transitional fuel. If the electricity continues to come from fossil fuels, it's not doing much to advance our energy system. The expansion of nuclear power needs attention too, as it is relatively safe and clean.
- ▶ Wasielewski believes big data and IoT applications in the energy industry will cause consumer concerns about the privacy and security of their data. This is somewhat of a public perception problem, which the industry can address by ensuring safeguards and building consumer trust.
- ▶ Wasielewski ended by repeating selected thought-provoking predictions for energy in the year 2030, published by the World Economic Forum: the fossil fuel lobby is a thing of the past in 2030; the biggest challenge in the future is not technology but letting policy and finance catch up; investments in renewables will quadruple (to \$1.2 trillion); and public engagement in energy will soar through rapid increases in community energy ownership.



**JEREMY NIEDERJOHN, DIRECTOR OF BUSINESS  
DEVELOPMENT, CONEDISON BATTERY STORAGE, CONEDISON  
CLEAN ENERGY BUSINESSES**

- ▶ Niederjohn reminded the audience that, while already garnering significant attention, battery storage is still a nascent technology that is expected to grow by a factor of 12 within five years. Important factors in its growth will be storage's flexible-use cases, diversity of the technology itself, and the business model for storage assets.
- ▶ The size, growth, and structure of the battery storage sector resembles the nascent solar industry, with important exceptions being the numerous benefits battery storage can provide. Additionally, monetization strategies for battery storage are different than solar, and rules change from market to market more so than for solar. Niederjohn stated that battery storage's numerous use-cases will result in multiple successful storage technologies, and this success may be uncomfortable for energy-system stakeholders who aren't used to contending with multiple new technologies.
- ▶ The business model for developing storage assets is also important for accelerating the adoption of battery storage, Niederjohn stated. How can developers make the transaction with the off-taker turnkey while still controlling for the risk developers assume by owning the asset over time? Contracted cash flows and capped merchant risk are a must, he noted. The industry has made advancements to address these uncertainties through long-term utility procurements, unique tariffs, and state incentives.

*“Energy storage is already all the hype, but it's still a nascent market expected to grow by a factor of 12 within five years.”*



# TECHNOLOGIES AND NEW BUSINESS MODELS FOR THE FUTURE OF ENERGY



NED HARVEY, MANAGING DIRECTOR,  
ROCKY MOUNTAIN INSTITUTE

- ▶ Harvey opened with a reminder that “unknown unknowns” will likely play a large role in the future of energy, so it is important to focus on less-established technology opportunities – these have the power to either create or destroy value in the energy system. He pointed to four such trends: demand flexibility, the capital light energy business model, the concept of convergence (hydrogen and other dense fuels changing the form factor of energy), and the rise of customer-centric energy.
- ▶ According to Harvey, the technology and cost of demand flexibility are reaching levels where one could control the demand side of energy better than we ever thought possible, and the technology and cost factors will continue to improve. What happens to the energy value-pool, Harvey asked, when it is cheaper to change the demand for energy than it is to add new supply?
- ▶ He posited that the single biggest impact in global energy has come from the capital-light business model being applied to traditional energies, not just renewables. US unconvensionals like shale oil are now “capital-light” businesses, allowing energy developers to tap reserves and redelpoy production assets at a fraction of the cost of conventional fossil fuels. Harvey challenged participants to consider what happens when a capital light energy system can be brought to developing economies instead of traditional billion-dollar energy production systems.
- ▶ Vehicle electrification breaks down a hard barrier between two established paradigms: fuels as the solution for energy-intensive use and electricity for energy-light use. Harvey noted how a large EV fleet would allow us to move energy around in time, space, and form like never before; for example, electric buses moving school children from place to place in the winter could act as battery storage in the summer. Harvey stated that when we get to a hydrogen economy, which could happen in the next 5-20 years, hydrogen would become an incredible asset for entirely breaking down the barrier between energy-intensive fuel use-cases and energy-light electric use-cases, allowing energy to move easily across time, space, and form.
- ▶ Harvey heralded the rise of customer-centric energy and the “prosumer,” highlighting experiments in Australia. Supply incentives exist in Australia, leading to an incredible amount of renewables. While the market lacks a regulatory environment that can move these assets of energy production around or do anything innovative with them, retail choice allows companies to do truly innovative things with new business models and technologies like peer-to-peer energy trading. This could offer a model for the US and Europe, and potentially countries in Eastern Africa and Southeast Asia following that.

“Energy forecasts do okay with the known unknowns but a terrible job trying to anticipate the unknown unknowns, which can drive material value creation and destruction.”

“What happens to the energy value-pool when it is cheaper to change the demand for energy than it is to add new supply?”

# TECHNOLOGIES AND NEW BUSINESS MODELS FOR THE FUTURE OF ENERGY



**CHRISTOPHER BUDZYNSKI, DIRECTOR, UTILITY POLICY, EXELON UTILITIES, EXELON**

- ▶ Budzynski noted that the traditional utility business model is under pressure from four technology groups: renewable resources, energy storage, electrification, and energy efficiency. The central challenge for utilities in seizing the advantage with these technology opportunities is that the pace of technology innovation is moving faster than the pace of regulation and policy, Budzynski said. This requires utilities to have broader conversations and collaborate with an expanded set of stakeholders, such as community organizing bodies and regional transportation organizations.
- ▶ Budzynski stated that transportation is not as simple as it used to be: customers now go through more complex transit processes—from car-to-train-to-scooter in one trip. EV growth requires expanded charging infrastructure. Whether an individual customer has an EV or not, the proliferation of EVs benefits every utility customer by reducing costs for everyone. With that said, Budzynski also noted the importance of affordability to ensure that those who cannot afford a new technology do not carry the cost burden.

*“What is challenging is really that technology is moving so fast that regulation and policy cannot stay on pace with innovation.”*

## Discussion and Takeaways from New Technology and Business Models

Mark Werwath, Clinical Associate Professor and Director of Masters in Engineering Management at Northwestern University, moderated a discussion on topics ranging from EV charging infrastructure policy and battery storage contracts to affordability and the role of cities in the future of energy.

Budzynski and Harvey agreed that because the first wave of EVs does not have vehicle-to-grid charging capabilities, we either have to wait for the next generation of EVs or for advancements in retrofit devices—potentially driven by owners of large EV fleets—that enable the capability. Grid charging infrastructure also needs to improve to accelerate EV adoption. A first step is getting consumers comfortable with owning and driving EVs.

Harvey also asserted that cities are and ought to be at the center of EV and grid infrastructure conversations. The energy community has looked to policies from the past to find a path forward. Instead, Harvey believes we need to rethink the way we approach policy. For instance, in the oil and gas industry, the concept of zero-sum reserves dominates; innovative policies for urban public-private partnerships could allow cities to tap the capital of the largest oil and gas investors to rethink the energy future with those “reserve-like” assets built out in cities, constituting the future reserves of urban activity and enabling cities to make energy accessible to our city systems.

With the highly flexible nature of battery storage assets, use-cases change dramatically over the life of a storage contract (and as storage achieves deeper market penetration). Niederjohn discussed flexible contracting models seen in New York, where RFPs consider every possible use-case of an energy storage asset, but the RFP is written around the most robust use-case. Developers are exposed to risk in not knowing which use-cases will pan out over time but are also hedging by entering multiple RFPs that can focus on different use-cases.





**JILL ANDERSON, SENIOR VICE PRESIDENT, STRATEGIC PLANNING  
AND POWER SUPPLY, SOUTHERN CALIFORNIA EDISON**

- ▶ Anderson sees efforts to maintain customer centricity falling into two categories: listening and engaging. Southern California Edison (SCE) surveys customers after every transaction (thousands of surveys daily) to better understand customer expectations. They've found that convenience during utility interactions is the most important factor for customer happiness: when customers have to wait three seconds before a website loads, they abandon it; customers expect the utility to know the purpose of a customer-generated phone call without asking.
- ▶ Interestingly, surveys also indicate that 70% of customers nationwide care about climate change, but they don't care enough to convert that preference into action on renewable choices when there's a price premium. SCE's green-only energy rate suffers from very low subscription. Other indicators lag behind climate goals in California, too: there are over 600,000 EVs on the road (roughly half the EVs in the US), which will need to accelerate quickly to achieve what SCE believes is necessary to meet the state's GHG-focused targets of approximately 7.5 million EVs within 10 years; five to 10 percent of homes have all electric space and water heating, and SCE forecasts that will need to grow to 33 percent of all homes across California by 2030.
- ▶ In an effort to close these gaps, SCE engages customers so they understand that their choices can help the state reach ambitious climate change goals. While the customer's action will be the key driver in addressing climate change, the utility's engagement enables the decision to, for example, switch to an EV or electrify homes and businesses.
- ▶ Anderson stated that in both listening to and engaging customers, the utility must reconsider its definition of risk. Utilities tend to wait for solutions to be perfected before commercialization, which restricts the utility's ability to serve customers, given the rapid pace of change of customer preferences. For example, voice recognition, smart speakers, and home displays will be in the majority of US homes in 2022; in order to remain relevant to customers, utilities must experiment with new business models and partnerships in order to deploy products and services compatible with these kinds of fast-moving technologies.

“Where our customers are now, they're moving too fast for us to start with perfect.”

“In California, utilities once owned the market for energy efficiency and demand response solutions; today, new entrants own the customer relationship and utilities are their partners.”



**ERICA BORGGREN, VICE PRESIDENT,  
CUSTOMER SOLUTIONS, COMED**

- ▶ Utility customers are in need of trusted information and guidance regarding unfamiliar technology options like solar, EVs, and community solar, which creates both a mandate for the utility to address a customer education need and an opportunity to evolve the utility business model. By helping customers to understand and connect with third-party products and services, utilities create value for customers and third parties alike. Borggren offered utility provision of community solar marketplace and subscription billing services as examples - opportunities to reduce customer confusion while charging developers for those services in order to offset overall utility customer costs.
- ▶ Cost remains the primary lens through which customers make clean energy choices, and one key approach utilities can take is to better "stack" the value of technology investments to lower the upfront cost of those choices. For example, a smart thermostat can help customers reduce or shift usage and avoid carbon - and yet today many utility programs value and incentivize only one of those aspects. For utility programs, designing across funding silos to reward the full efficiency, demand response, and carbon avoidance value of an action or device would help mitigate customers' upfront costs.

*“Utilities can be in the way or on the way to a clean energy future. By innovating around how we enable future energy options for customers, we can make sure it's the latter.”*

### Discussions and Takeaways from Customer Centricity

Cheryl Martin, Principal at Harwich Partners, moderated a discussion on the policy-technology split and its effect on the utility's ability to meet evolving customer expectations.

Borggren stated that making small investments in white-label solutions allows utilities to act quickly while gaining experience in a given area before scaling or evolving the capability. Anderson went on to suggest that one strategy for closing the policy-technology gap is for utilities to reevaluate internal guidelines for engaging regulators on innovation investments. Given the pace of technology adoption, utilities may need to get comfortable making early investments in fast-moving opportunities that have a positive benefit-to-cost ratio.

Anderson stated that to enable customers' transition to the energy technology of the future, utilities can start by focusing on intermediaries: supplier and dealer networks. When customers begin the journey of purchasing an EV or an EV home charger, it is critical for car dealers to understand EV features, benefits, and incentives; likewise, the pool of electricians needs to know how to install a home charging unit. Utilities must also make it financially attractive to customers to adopt new energy technologies.

Borggren noted that utilities must strike a balance between delivering what customers know they want already and delivering new products and technology that customers do not yet actively demand. Thoughtful timing of new product offerings and marketing communications impacts the success of nudging customers towards innovative technology—simply putting something new in front of customers will not make them want it more. Utilities already have great data—they need to use it to predict what emerging solutions customers are aware of and ready to adopt.

# FUTURES AND CHALLENGES

After a thought-provoking morning session, Challenge Session participants reconvened in the afternoon to discuss insights and challenges to realizing the benefits of the new energy future. The following are some key themes from that discussion.

## THEME

### *Decarbonization will transform the energy market*

Absent clear federal climate policy, strong mandates for decarbonization from states, cities, and corporations will continue to dictate investment and policy decisions across the energy sector, spurred by the urgent need for climate mitigation actions. To meet aggressive decarbonization goals by 2030 and beyond, technology adoption (e.g., mass adoption of EVs) must be accelerated while simultaneously maintaining affordability and equal access. The first 50 percent of carbon emissions progress will come from low-hanging fruit that represent profitable business and technology advances. The second half of the decarbonization journey may require even more disruption than the first half.

## THEME

### *The Future of Energy needs a portfolio of energy generation and storage technologies, a more distributed grid, and a digital layer to manage it*

In meeting the challenge of decarbonizing the energy sector this century, technology poses both a barrier and an opportunity to unlock tremendous value. Encouragingly, we are experiencing a renaissance in energy technology venture investing, bolstered by tailwinds from the capital-light business model, the ability to draw revenue from sectors outside of energy, and attractive exit opportunities.

Still, we need greater progress across a variety of fronts to achieve goals for decarbonization while at the same time providing safe, reliable and affordable energy to all. Focus areas include:

- Accelerating energy-dense, carbon-free energy storage, be it hydrogen fuels, batteries, or other technologies;
- Improving EV adoption and charging infrastructure for both light and heavy-duty vehicles;
- Advancing storage and DER by utilizing a flood of IoT data and software solutions to aggregate storage and create virtual power plants;
- Prioritizing carbon capture, which oil and gas companies are taking a strong lead on;
- Expanding nuclear, driven by increased R&D and venture capital to explore methods of prolonging the life of existing plants or reducing construction costs for new plants.

### THEME

*Utilities must accept new entrants and tolerate greater risk to thrive in the rapidly changing energy market*

Utilities face rapid change from every direction: from climate change to technology (renewables, storage, DER, electrification, efficiency) to changing customer expectations to novel competition in former “monopoly” services like transmission, distribution, and generation. And the regulatory nature of the US utility often conspires to slow down adaptation.

To keep pace, utilities must welcome new entrants while designing relationships that reward the utility for their investment in the assets they own. Utilities are already engaging in broader conversations with community organizing bodies and regional transportation organizations, which improves utilities’ ability to adapt quickly. They are also partnering with technology companies to speed up technology adoption and share risk in a way that satisfies regulators. As a part of that realignment, utilities will need to alter their corporate culture to reward learning from failure in the appropriate settings. Legislators and regulators also need to lean into their role as drivers of innovation by designing policy that allows and encourages the utility to move more nimbly.

### THEME

*The utility industry must redefine value to remain relevant to changing customer expectations*

Driven by a proliferation of ultra-convenient consumer technology, customers have come to expect personalization and “one-click” convenience. Utility customers will also change from energy consumers to energy producers via DER and community ownership of solar energy. One thing won’t change, though: customers will continue to seldom think about their utility, let alone kilowatt-hours. Therefore, the utility must redefine the value it provides to include services that provide personalized benefits and outcomes, not just electrons.

Utilities can anticipate customer needs by listening to customers and engaging them to help consumers understand the changes they will see in their energy system. Utilities can keep pace with technology by accepting more risk, acting ahead of regulatory approval, and collaborating with third-party technology partners, starting with white labeling and then building tech capabilities in house. For instance, utilities may begin to own more EV infrastructure: rather than limiting utility involvement to traditional utility services like providing time-of-use rates, how might utilities create new business models that drive EV adoption and transportation electrification?

# THE PATH FORWARD

Out of the discussion of key challenges to achieving the group's vision for the future of energy, two key themes emerged for a path forward.

## *Reforming the Utility Market: New Market Structures Are Needed to Accelerate Decarbonization of the U.S. Economy*

To make progress in decarbonizing the energy sector by 2030, the U.S. needs a regulatory model based on environmental objectives to supersede the traditional regulatory benefit-cost analysis. The US needs carbon pricing on a national level. State initiatives help, but issues as complex and large as climate change need broader structures to scale innovation economically. Political will, resulting from customers and utilities banding together, must drive the development of this market.

## *Innovative Solutions for 2030 and Beyond: Linear Progress in Technology Advancement and Adoption Is Not Sufficient*

Harnessing the power of new technologies to decarbonize the grid, our transportation system and buildings will require new, cost-effective solutions that have not yet been invented (e.g., hydrogen, advanced nuclear), and more rapid adoption of the technologies that we have available now (e.g., renewables coupled with energy storage and electric vehicles). This will require more capital flowing into energy tech, and more rapid experimentation and implementation by a new mix of industry players to find those solutions and drive costs down to the point they can be adopted broadly across the energy value chain. Utilities must adopt new methods of innovation and identify new sources of value for their customers. Together, new market structures, advanced energy solutions, and more nimble, adaptive utilities can help realize the vision of a cleaner, more distributed and customer-centric energy system of the future.

# PARTICIPANTS AND SPONSORS

## Participants

|                     |                                   |
|---------------------|-----------------------------------|
| Paul Donnellan      | Clareo                            |
| Wiles Kase          | Clareo                            |
| Satish Rao          | Clareo                            |
| Erik Birkerts       | Clean Energy Trust                |
| Paul Seidler        | Clean Energy Trust                |
| Erica Borggren      | ComEd                             |
| Jeremy Niederjohn   | ConEdison Clean Energy Businesses |
| Mark Webb           | Dominion Energy                   |
| Emil Avram          | Dominion Energy                   |
| Drew Murphy         | Edison International              |
| Amy Francetic       | Energize Ventures                 |
| Chris Budzynski     | Exelon                            |
| Brian Hoff          | Exelon                            |
| James Schulte       | Exelon                            |
| Phil Nevels         | Exelon                            |
| Cheryl Martin       | Harwich Partners                  |
| Mark Platshon       | Icebreaker Ventures               |
| Elizabeth McGee     | Intel                             |
| Michael Wasielewski | Northwestern University           |
| Mark Werwath        | Northwestern University           |
| Jose Antonio Cepeda | Republic of Ecuador               |
| Ned Harvey          | Rocky Mountain Institute          |
| Serhat Cicekoglu    | Sente                             |
| Akilah Leblanc      | Shell                             |
| Jill Anderson       | Southern California Edison (SCE)  |
| Elizabeth Kocs      | UIC Energy Initiative             |
| Melissa Albrecht    | UL Ventures                       |
| John Simidian       | Zero G Colony                     |



## About The World Innovation Network

The World Innovation Network (TWIN) is an invitation-only community of innovation and growth leaders from across sectors and geographies. In addition to other activities, TWIN convenes annually for a summit in Chicago from 25 countries and all sectors: business, government, non-profit, the arts, academia, defense. Our group includes leaders at the most senior levels of their organizations, as well as select individuals making differentiated impact around the world.

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## About Clareo

At Clareo our mission is to help businesses adapt and grow. We help leaders adapt their businesses and create new ways to grow in rapidly changing markets. Together, we build the plans and capabilities that deliver results. Our clients choose Clareo when they want bold new ideas fueled by a network of leading global experts. Working alongside our clients, we create compelling strategies that lead to action.

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## Thank You

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# SIGNALS FROM TODAY

## CUSTOMER CENTRICITY

gtm: October 30, 2018

### How Utilities Are Combining Voice and Analytics for Customer Engagement

Wood Mackenzie estimates that 65 million homes in the U.S. will own at least one standalone voice assistant device by 2023. Utilities are looking to engage their customers by combining voice technology and advanced analytics. Early utility forays have involved communicating basic information... [New approaches] rely on partnerships with third-party vendors, whose customer analytics solutions allow utilities to go beyond generic information and tips to communicate personalized insights to customers.



Forbes August 12, 2019

### What Will Drive Utility Revenue When Electricity Is Free?

With both customer satisfaction and utility revenues on the decline, utilities are facing daunting challenges to their business models. The real cost drivers in the future may come from optimizing energy service with things like batteries, microgrids and peer-to-peer trading networks. In the foreseeable future, flat electricity rates may be the norm, or electricity might even become entirely free as services become the primary source of utility revenue.

CleanTechnica April 3, 2019

### California Community Choice Aggregators Bid for Partial PG&E Takeover

The eight CCAs from Northern California “urged state regulators to take action to restructure PG&E as a ‘wires-only’ company— moving it out of the retail energy business so PG&E management can focus on managing the company’s transmission and distribution system, which has been the source of billions of dollars in damage to communities.”

Forbes December 18, 2018

### What U.S. Energy Companies Can Learn From European Utilities

Choosing an energy provider in Europe is similar to choosing a cell phone carrier in the U.S.; the EU allows European residents to switch providers, and [pending new regulation] within 24 hours. Since this means facing the risk of losing customers daily, European utilities must place more emphasis on customer retention through engagement. This model encourages a culture of customer engagement and consumer choice.



UTILITY DIVE August 27, 2019

### Rocky Mountain Power to operate largest US residential battery demand response project

Each of the 600 apartment units will come with efficient appliances and a Sonnen battery — powered by solar panels on top of all 22 buildings in the complex. Once fully operational, the utility says Soleil Lofts will be the largest residential battery demand response project in the country... “This has never been done before. It is a completely purpose-built community, owned by the developer but the utility is completely managing the solar and battery resources.”



gtm: June 05, 2019

### Starbucks Buys Aggregated Wind and Solar Portfolio With Help From LevelTen

Starbucks announced another large-scale renewables deal, with enough power to supply 3,000 of its U.S. stores, which draws from three different plants located in three states... Analysis showed a significant reduction in value at risk from the portfolio approach vs. sourcing from any one of the projects in the portfolio.

# SIGNALS FROM TODAY

## ENERGY TECHNOLOGY

## FUTURE OF ENERGY

REPORT OUT  
DECEMBER 2019

THE WALL STREET JOURNAL. August 16, 2019

### Giant Batteries Supercharge Wind and Solar Plans

Government-owned utilities and companies are buying batteries that can be larger than shipping containers. A configuration of Tesla Inc.'s new utility-scale batteries can hold enough energy to power every home in San Francisco for six hours.

 **CNBC** August 27, 2019

### The 'world's most powerful' tidal turbine secures funding from Scottish government

The developer described the unit as a floating turbine that "can be towed, installed and easily maintained." It is made up of a 73-meter long "superstructure" that supports two 1 megawatt (MW) turbines on each side. It's estimated that ocean energy could potentially contribute roughly 10% of the European Union's power demand by 2050, according to the European Commission.



 August 28, 2019

Cambridge startup claims breakthrough electric car battery that can charge in 6 minutes

It's something we heard before, but the difference here is that they claim that they can commercialize the new battery as soon as next year. "This is a new kind of powder that allows you to recharge in six minutes, not 45 minutes. This includes a car, so your electric car is almost as easy to charge as it is to refuel conventionally."

 August 02, 2019

### This new solar technology can be printed or woven into fabric

This new source of sustainable energy - with its low energy payback time, portability and flexibility - can also be formed into threads and woven into fabrics, bags or building materials. Perovskite solar cells have made stunning progress within a short timeframe at the laboratory scale.



Perovskite - the mineral behind a new generation of solar cell technology.

 **UTILITY DIVE** July 10, 2019

### 'Opportunities everywhere': NREL study shows mass potential for storage to provide peaking capacity

The study concluded that every region across the country offers the potential for peaking capacity needs to be met by short-duration, four-hour battery storage systems. "The results show significant potential for energy storage to replace peaking capacity, and that this potential grows as a function of [solar] deployment."

 August 29, 2019

Exelon Is Exploring Nuclear Power Plant Hydrogen Production

A first-of-its-kind project, the nation's largest nuclear power generator could demonstrate an integrated hydrogen production, storage, and utilization facility. It could shed light on a new and potentially lucrative revenue stream for existing nuclear power plants, and boost their economic competitiveness and relevance within organized markets.

 **UTILITY DIVE** August 22, 2019

### 'Nearly all' high voltage EV charging stations lose money: Report

It is a "chicken and egg scenario." Greater access to direct current fast charging (DCFC) charging stations will help accelerate EV adoption, "but DCFC charging stations will currently lose money every year until increased EV adoption results in more charging customers each day."

Sources: Elektrek, MIT, Clean Technica, Washington Post, Vox, The Atlantic, Autoblog, CB Insights, Pymnts.com, Inside EVs



# SIGNALS FROM TODAY

## UTILITY OF THE FUTURE

**Bloomberg** August 26, 2019

### Sometimes, a Greener Grid Means a 40,000% Spike in Power Prices

Texas power prices jumped from less than \$15 to as much as \$9,000 a megawatt-hour this month as coal plant retirements and weak winds left the region on the brink of blackouts during a heat wave.

**The Washington Post** May 6, 2019

The Cybersecurity 202: A cyberattack just disrupted grid operations in the U.S. But it could have been far worse.

It's the first time a digital attack is known to have interfered with electrical grid operations in the United States. And it was due to a relatively basic hack, raising the specter of what might happen if a sophisticated bad actor chose to launch a far more powerful attack, say, with the intent of shutting off electricity for millions of people. A 2015 report by the University of Cambridge... estimated a major grid attack in the United States could cost up to \$1 trillion.



**Wood Mackenzie**  
A Verisk Business

June 27, 2019

### Decarbonising US power grid 'may cost US\$4.5 trillion'

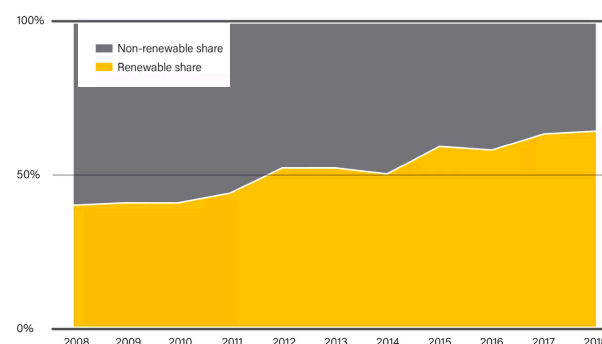
The challenges of achieving 100% renewable energy go far beyond the capital costs of new generating assets. Most notably, it will need a substantial redesign of electricity markets, migrating away from traditional energy-only constructs and more towards a capacity market."

**Vox** June 26, 2019

Despite all the progress, we're still struggling to hit the climate emergency brake.

Global carbon emissions were up 1.7 percent in 2018. Subsidies to fossil fuels were up 11 percent between 2016 and 2017. This is all bad news... But the good news: The shift in the electricity sector has effectively become unstoppable. Globally, more renewable energy capacity has been installed than new fossil fuel and nuclear capacity combined, for four years running.

Share of Renewables in Net Annual Additions of Power Generating Capacity, 2008-2018



**Forbes** May 23, 2019

### Are Microgrids Powered By On Site Green Energy The Next Big Thing?

Given the spate of natural disasters and the impact that they have had on delivering electricity, microgrids are gaining in popularity. They offer a Swiss-Army knife of possibilities – everything from greater reliability to cleaner power to economic development. Bloom Energy built a 2.5 megawatt power system in nine months. And the company says that its capacity factor – actual output in relation to its nameplate capacity – is 90% compared to about 25% for solar energy and 40% for wind power. "We are converting the chemical energy from methane in a single step to electricity. "It is far more efficient. Compared to the U.S. grid mix of energy resources, we reduce emissions by 50%," says Asim Hussain VP of commercial strategy for Bloom.

**gtm:** March 4, 2019

### New Illinois Bill Targets 100% Renewable—Not Just Clean—Electricity by 2050

The Clean Energy Jobs Act specifically states that utility procurement plans "shall" include "cost-effective renewable energy resources" equal to a minimum percentage of each utility's load for all retail customers. The state currently gets about 8 percent of its energy from renewable energy resources, and existing law calls for reaching 25 percent renewables by 2025. Meeting 45 percent of the state's electricity needs with renewables by 2030, as the new legislation stipulates, would require deploying an estimated 24,000 megawatts of new solar and wind.

Sources: The Verge, ZDNet, Fast Company, CNBC, Divvy Bikes, BigThink, WSJ, Crunchbase