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Smart Electric Power Alliance

GridForward

GRIDWISE ALLIANCE

ubm

WORKING GROUP

2021 REPORT

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SECTION 1:
INTRODUCTION TO THE UBM WORKING GROUP

UBM Webcast Topics

1. Smart Communities
2. The Impact of Changing Utility Regulation on the UBM
3. Utility Strategies for Carbon-free Power Goals
4. DER Monetization Strategies
5. Managing Innovation of the UBM
6. Exploring Grid Investments to Achieve Decarbonization
7. Performance-based Regulation (PBR) in Implementation
8. Equity & Innovation: Ensuring Vulnerable Communities Benefit from Grid Modernization
9. Energy Storage and Its Value to the UBM
10. Defining a Framework for Grid Readiness
11. Stakeholder Engagement and Utility Decarbonization Plans

Over the last 150 years, the electric utility business model (UBM) has been rooted in the electricity company's obligation to serve every customer in its market in return for the opportunity to recover its capital costs, with a fair rate of return on its investments and its operating expenses (OPEX) via regulated rates. This business model is being modernized and the regulatory framework is evolving to accommodate sources of cheaper, safer, cleaner, and more reliable power, coupled with incentives for performance. Utilities are partnering with energy innovators to accelerate competitive engagement with distributed energy resources (DERs), non-wires alternatives and digitalization, and a tangible appetite for removing barriers for these new technologies.

To help utilities address these changes, four organizations joined to sponsor the Utility Business Model (UBM) Working Group; The Smart Electric Power Alliance (SEPA), Electric Power Research Institute (EPRI), Gridwise Alliance, and Grid Forward (The Working Group Collaborative).

The group holds monthly, virtual sessions to discuss important energy innovations that have demonstrated the potential for success in integrating new technology into utility operational processes, planning and designing a model for prudent investment, enabling revenue generation, and meeting policy directives for new utility constructs.

This report synthesizes the learnings from eleven webcast sessions that took place between October 2020 and 2021.

SECTION 1 describes the motivating factors and historical background for business model transformation in the industry.

SECTION 2 focuses on the "what" of business model transformation and describes examples of new UBMs that were discussed throughout the webcasts. This is not an extensive study on all UBM innovations and only represents an overview of what was featured in the first year of the working group.

SECTION 3 discusses the "how" of business model transformation, which includes internal utility practices for innovating and leading business transformation, as well as regulatory aspects that support and drive change in the industry.

SECTION 4 highlights some overarching themes that emerged during the monthly discussions and outlines the next steps for the working group.

THE APPENDIX contains a brief description of each working group session and links to more detailed meeting notes and presentation slides. Throughout this report, references have been made to the specific session where an observation was derived, so that interested readers might find further details.

Drivers of Business Model Transformation

The UBM working group was formed in 2020 to help address the rapid business model transformation underway in the utility industry. This transformation appears to be driven by several factors including decarbonization, economic development, resilience, and new market disruptors.

Decarbonization is the largest driver of change across the industry from upstream generation to downstream energy efficiency in the home. Pressure to decarbonize the energy sector is exerted by both customers and policy stakeholders. As a regulated industry, utilities may be mandated to meet country or state decarbonization targets or many have created their own decarbonization targets in absence of explicit, externally imposed strategies. Decarbonization aligns with customer values and is a motivating factor for early adopters of distributed generation, such as rooftop solar, and utilities are aiming to adapt their operations and business model to accommodate the decentralization of energy assets.

Since the industrial revolution, economic development has been correlated with energy demand and growth in the utility business [1]. Economic downturns and periods of stagnation, such as introduced by the COVID-19 pandemic, put pressure on utility rates and the government may intervene when shortages in the energy supply threaten to stall economic growth, particularly in regions reliant on primary and secondary economic activity [2]. Diversification of revenue streams may protect UBMs during an economic downturn and in the face of emerging technologies, changing economics, and new customer expectations. New services for decentralized renewable production may help to boost investment opportunities during upcycles.

While the principle of resilience has always been a pillar of the UBM, aging infrastructure and changing climate conditions are making it more difficult to predict disturbances and protect the energy system from weather-related events. Regulators and utilities must account for resilience in the design of new UBMs, particularly at the distribution level.

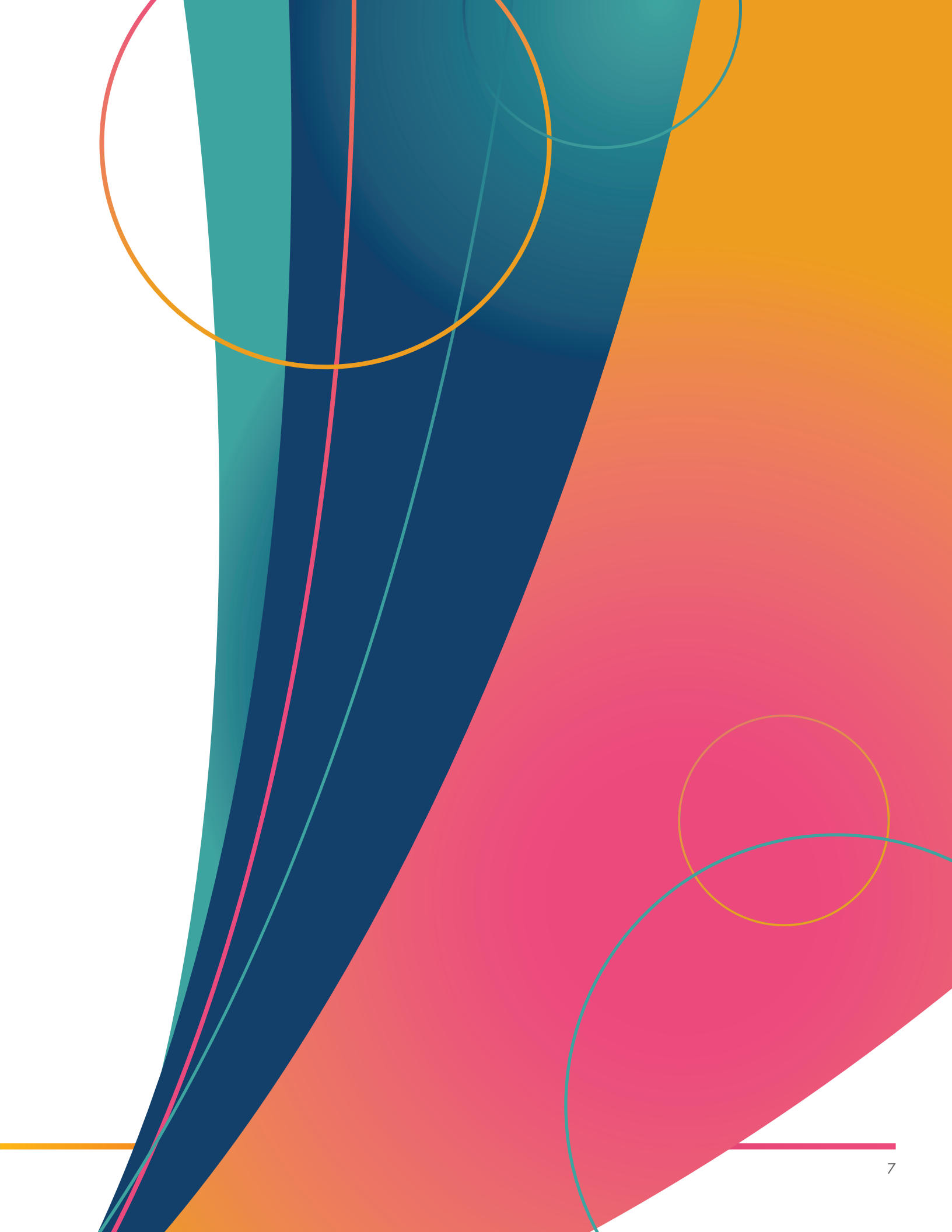
As the above factors influence the utility market, new markets disruptors may enter to fill one or more of the gaps. While there is always a risk associated with business transformation, a non-evolving business model bears its own risk.

The U.K. retail electricity market is dominated by six companies, known as the "Big Six". In just five years, "disruptive" retailers in the electricity market emerged with new propositions, an emphasis on customer service culture, and enabling technologies, knocking off 24% of the Big Six's market share from 97% in 2014 to 73% in 2019 [3].

[1] "The decoupling of GDP and energy growth: A CEO guide." McKinsey Quarterly, April 2019. Available at https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-decoupling-of-gdp-and-energy-growth-a-ceo-guide

[2] "Energy Regulation and Government Interference.", Bennett Institute for Public Policy, Cambridge, November 2018. Available at https://www.bennettinstitute.cam.ac.uk/blog/energy-regulation-and-government-interference/

[3] "New entrants knock the big 6 for six." Energy Retail, Utility Week, September 2019. Available at https://utilityweek.co.uk/new-entrants-knock-big-6-six/



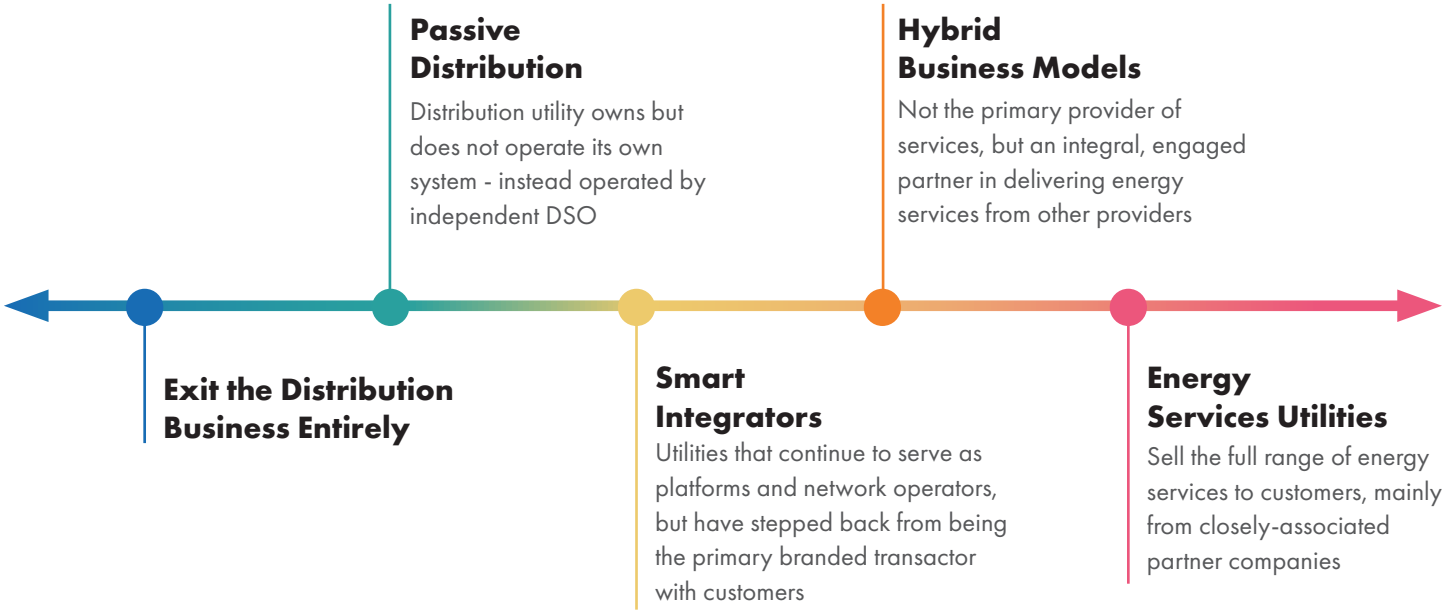


Figure 1: Adapted from Figure 9-3 The Regulated Network Business Model Spectrum from Power after Carbon[4].

Historical Evolution of the UBM [Session 2]

In the U.S., the UBM has been shaped by some key landmark periods in its history.

- In the early 1900s, there was a growing acknowledgment that high fixed capital expenditure (CAPEX) and expensive maintenance of infrastructure creates a natural monopoly in industries like electricity, water, and rail. By 1930, almost all states had enacted some independent commission to regulate public utilities to provide just rates.
- In the 1930s, federal regulation was introduced to complement state authority, creating a dual regulation structure. This was followed by decades of lower rates, innovation, and economic efficiency.
- In the 1970s, economic stagnation and oil shocks put a strain on the UBM resulting in increased prices, stranded assets and a consensus that existing regulation of utilities was not sufficient to protect utility customers.
- From the 1980s to the 1990s, some states began to restructure the UBM by encouraging competition, unbundling transmission and distribution from generation, or introducing retail choice.
- Currently, there is a mixture of restructured models with wholesale competition and retail choice, to hybrid models with regulated monopolies, to traditional, vertically integrated models, e.g., in the U.S. Southeast.

[4] Peter Fox-Penner. Power after Carbon: Building a Clean, Resilient Grid. Harvard University Press, MA, 2020. Ch. 9.

The legislative history of the UBM consistently shows support for experimentalism across states and the importance of learning from different approaches to rate design, CAPEX, regulation, and service offerings. This diversity may lead to greater innovation with help from a coordinated learning approach. Over the last century, the UBM has been transformed in various ways, facilitated by technological developments and agile public utility law.

Spectrum for Regulated Grid Business Models

The traditional business model no longer represents the wide variety of services that are being offered by utilities and sought by consumers. Broadly speaking, there are two strategic directions in which utilities are working to expand their business models:

1. Increasing the geographic span of the utility's service area or by serving an area of population or industrial growth.
2. Selling new services, possibly via affiliates.

The former strategy is closely aligned with the traditional UBM of selling more kWhs and the focus of this working group is largely on the latter strategy. The Regulated Grid Business Model Spectrum (Figure 1) can be used to compare utilities as they transform their service offering and as their regulators shape the business environment in which they are operating [Peter Fox-Penner, Session 2], [4]. There are currently many examples of utilities with a Hybrid Business Model. In the long term, there may be a gradual industry shift towards the Smart Integrator model.

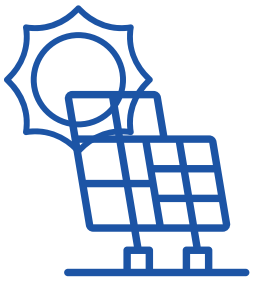
SECTION 2:
THE *WHAT* OF THE UBM

This section summarizes the various projects and case studies involving innovative UBMs that were discussed throughout the webcasts. To facilitate strategic insights, the case studies are grouped by topic. **This is not an extensive study on all UBMs and only represents an overview of what was featured in the first year of the UBM working group.**

Many of these case studies relate to technologies that may have been technically demonstrated, but which are yet to be widely commercialized because scalable business models have not yet been developed. These technologies might still be expected to progress on the learning curve of technology, and therefore experience cost reduction in the future. Government and ratepayer funding has a role in subsidizing pilot programs at this stage, and when costs fall the business model may become sustainable without the need for subsidies.

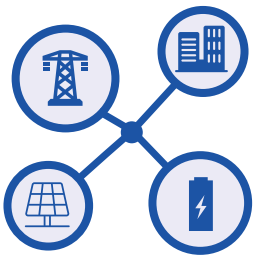
Microgrids

Microgrids have been proposed for coordinated grid control at a small scale i.e., for an individual community which may be either off-grid or grid-connected.



Off-grid Microgrids

The value to the UBM of microgrids for off-grid, rural communities is mostly determined by the avoided cost of building and maintaining infrastructure to connect that community to the grid in comparison to the cost of building an isolated microgrid. There are many examples of existing rural microgrids that meet this value threshold, (i.e., the cost of building an isolated microgrid being relatively lower than the cost of connecting that community to the existing grid). Most of these examples have traditionally relied on diesel generators but the emergence of renewable, distributed generation technologies provides a potential opportunity to decarbonize off-grid microgrids. San Diego Gas & Electric's project at Borrego Springs, California aims to convert the remote desert community from a fossil fuel reliant microgrid to a 100% renewable-based microgrid by 2022 using solar and a hydrogen fuel cell [Session 8].



Grid-connected Microgrids

In comparison to off-grid microgrids, the value to the UBM of grid connected microgrids is more complex as they may contribute to whole system grid balancing in business-as-usual operations and may have the option to island during disruptive events to provide community resilience. The value of connected microgrids is highly dependent on the behavior of consumers and the aggregate behavior of the community in response to price signals, such as time-of-use (TOU) tariffs. In this case, generation is typically an aggregation of rooftop solar, or community-owned solar or wind farms. Southern Company's Smart Neighborhoods project in Birmingham, Alabama exemplified that load peak and usage may be reduced with community engagement and integrated technologies [Session 1].

To develop a microgrid business model, close engagement with the community may be essential to successfully organize the ownership of energy assets, control of the grid, operation of any local energy markets, and the governance and financing of the microgrid.

Topic	Project	Utility/Energy Partner	Business Model Desicription	Session
Microgrids: Hydrogen & Solar	Borrego Springs, California	San Diego Gas & Electric	A microgrid for remote desert community.	8
Microgrids: Rooftop Solar	Smart Neighborhoods, Alabama	Southern Company	A community-scale microgrid, rooftop solar, battery storage, energy efficiency and smart home technologies.	1

Smart Homes

There are examples of utilities diversifying their business model away from kWh sales and introducing services to help design and implement Smart Homes with some or all of the following features.

Improved Energy Efficiency

Electrification of Appliances: Heatpumps, Induction Cookers

Rooftop Solar

Electric Vehicle (EV) Charging Points

Developing these services requires engaging in new partnerships with the construction industry and municipal planning partners. Sacramento Municipal Utility District (SMUD)'s Smart Home program in Sacramento, California found that by engaging builders of mixed-fuel homes into the program, those builders were more likely to then convert those homes to all-electric at a later stage. Therefore, SMUD's program included incentives for builders of mixed-energy homes despite the goal of the program being to develop all-electric homes [Session 1].

Holy Cross Energy (HCE)'s Basalt Vista affordable housing project in Colorado built homes for teachers and local service workers [Session 4]. The project was financed with cost-sharing from the U.S. National Renewable Energy Laboratory (NREL) and the U.S. Department of Energy (DoE). The project built 27 net-zero energy homes with all-electric construction, four of which were Smart Homes with solar photovoltaics (PV), battery storage, EV charging, heap pump water heaters, and air source heat pumps.

One challenge to the widespread implementation of Smart Homes is their reliance on the Internet of Things (IoT) technology and reliable internet connections, which is not yet well established in all regions, and particularly in rural, and lower-income communities. In 2010, extensive investments in broadband access and grid modernization were made in Chattanooga, Tennessee. A recent study shows the estimated economic value to have exceeded $2.69 billion in the ten years following a $220 million investment in the Fiber-To-Home communications network.[5]

[5] Bento J. Lobo, "Ten Years of Fiber Optic and Smart Grid Infrastructure in Hamilton County, Tennessee." High Speed Broadband Project, 2020. Available at https://assets.epb.com/media/Lobo%20-%20Ten%20Years%20of%20Fiber%20Infrastructure%20in%20Hamilton%20County%20TN_Published.pdf

Smart Homes

Topic	Project	Utility/Energy Partner	Business Model Desicription	Session
Smart Homes	Smart Home, California	SMUD	An integrated approch to construction of smart homes	1
	Basalt Vista Net-Zero Affordable Housing Project, Colorado	HCE	27 net-zero energy homes with all electric construction.	4

Energy storage

In strategic pathways to decarbonize the power sector, the wide-scale integration of renewable, non-dispatchable generation necessitates growth in the availability of energy storage in the energy system. This capability could be served by wide-scale adoption and aggregation of individual small-scale storage or investment in utility-scale storage. Utility-scale energy storage is still a technical challenge and it does not necessarily disrupt the traditional UBM as it can be considered another class of energy asset that needs to be designed, built, operated, and maintained. Small-scale energy storage is technically feasible, and utilities are exploring business models that could finance or utilize energy storage at the community, residential, or building level.

The choice between leveraging small-scale storage and investing in R&D for large-scale storage is influenced by several factors:

Cost of aggregating individual batteries in comparison to the cost of utility-scale storage	**Utilization factor of batteries in homes and buildings in comparison to utility-scale batteries**	**Value of resilience for residents, communities, or industrial customers that is associated with individual batteries**

Throughout the UBM sessions, utilities provided examples of novel business models for facilitating the adoption of distributed energy storage in their customer base.

Power+ Program

HCE's Power+ program aims to provide customers with a financing arrangement to acquire Tesla's Powerwall 2 battery energy storage system which purports to provide power for 4 to 8 hours during peak usage or 20 to 40 hours during reduced usage [Session 4]. Batteries can be charged from on-site solar or directly from the grid, which may provide flexibility services to HCE and increase overall system efficiency.

The program is financed under HCE's DER service agreement which means HCE covers the upfront cost of equipment and its installation and members repay at monthly increments over10 years. Monthly payments may be partially offset by ongoing bill credits received for releasing control of the battery to HCE for grid services.

SMUD StorageShare Program

To provide customers with the option to adopt distributed energy storage, SMUD has introduced two models for asset ownership and finance in its StorageShare program:

1. A distributed financing model where the customer buys into the program and SMUD invests their storage share in utility-scale energy storage at a location that is optimal for the system. Participating customers benefit from monthly bill credits derived from related energy cost savings. Each "storage share" represents 1 kilowatt of demand charge reduction savings.
2. A behind-the-meter (BTM) storage model where SMUD maintains 51% of the control of customer-sited batteries that are used for on-site resilience and load balancing during peak hours. SMUD is offering a "Commitment to Operate Incentive" as a one-off payment for signing up to the program.

Topic	Project	Utility/Energy Partner	Business Model Desicription	Session
Energy Storage	StorageShare, California	SMUD	A program to leverage residential storage as a grid asset	1
	SENSIBLE, Portugal	EDP Portugal/ European Comission	A project to enable sustainable energy storage for homes and communities	1
	Power + BTM, Colorado	HCE	A service to finance energy storage option for consumers	4

Energy Equity

Many of the projects highlighted throughout this report have been placed in low-income, disadvantaged communities. Utilities are increasingly choosing to demonstrate modern technological advances in communities that have historically been disproportionately affected by a lack of investment [6]. This provides disadvantaged communities with grid modernization technology at a subsidized cost or no cost by leveraging government grants and R&D funds. At the same time this may demonstrate the effectiveness of important decarbonization technologies, as well as provide potential community health benefits such as improved air quality, e.g., by incentivizing EVs over combustion engines.

As a result of historical investment decisions, disadvantaged communities may inadvertently experience slower economic growth in comparison to regions receiving higher infrastructure investments [7].

[6] "Utilities Investing $766 Million in Underserved Communities." Data Stories, EV HUB, December 2020. Available at https://www.atlasevhub.com/data_story/utilities-investing-766-million-in-underserved-communities/

[7] "The Short- and Long-Term Impact of Infrastructure Investments on Employment and Economic Activity in the U.S. Economy." Economic Policy Institute, July 2014. Available at https://www.epi.org/publication/impact-of-infrastructure-investments/

Energy Equity (cont.)

Grid investments have the potential to provide a direct source of employment, reduce the risk of power interruptions, and attract economic activity including large residential developments and energy-intensive industries. Seattle City Light is endeavoring to tackle energy equity by investing in grid modernization technologies in the low-income Duwamish Test Bed in Seattle, Washington [Session 8]. The project is intending to finance a wide range of grid modernization activities, including substation and line upgrades.

Early adopters of new energy technology are typically from high-income households and can afford the upfront cost of emergent technology at a lesser proportionate effect on their disposable incomes [8]. This pattern can be seen in the adoption of thermal home insulation or energy-efficient home appliances, where the upfront cost of upgrading the home will typically be earned back over the medium term via reductions in energy bills. Similar effects are seen with the adoption of solar panels, where electricity can be sold back to the grid, or with EVs that effectively "pay for themselves" when commuters avoid paying significant costs for gas.

Examples of utility models that share or finance the upfront cost of DER equipment include HCE's Power+ program (which was discussed above). Another example is the Shifted Energy x HECO project in Hawaii, which plans to install 57 grid-interactive water heaters at a low-income community in Honolulu, Hawaii [Session 8].

Salt River Project (SRP) [Session 5] has seen a preference in its customer base for its pre-paid energy option, M-Power. About 15% of SRP's customers opt for this service model, to pre-pay for units of energy with cash, online, or by phone to avoid high energy bills disrupting their household cash flow. Other examples of this business model include PrepayPower, an energy retailer in Ireland, and Rappahannock Electric Cooperative in Virginia, U.S.

Topic	Project	Utility/Energy Partner	Business Model Description	Session
Energy Equity: Grid Modernization	Duwamish Test Bed, Washington	Seattle City Light	A grid modernization project in a low-income area	8
Energy Equity: Water Heaters	Shifted Energy x HECO, Hawaii	Elemental Excelerator	A project to install 57 grid-interactive water heaters at a low-income community in Honolulu, Hawaii	8
Energy Equity	M-Power, Arizona	SRP	A pay-as-you-go energy payment model	5

[8] Nadia Ameli, Nicola Brandt. Determinants of households' investment in energy efficiency and renewables: evidence from the OECD survey on household environmental behaviour and attitudes. Environmental Research Letters, IOP Publishing Ltd, 2015. Available at https://iopscience.iop.org/article/10.1088/1748-9326/10/4/044015

Electric Transport

The global transportation service industry is projected to reach a value of $7.8 trillion by 2027, which represents a compound annual growth rate (CAGR) of 3.4% [9] and utilities are expanding their busines model to the growing electric transportation industry. The electrification of transport is adjacent to their expertise, it will naturally result in additional kWh sold, and the ability to provide vehicle-to-grid (V2G) services and charging networks gives the utility industry further control over the volatility that wide-scale electrification of transport could pose to grid operations.

There are many ways that utilities can enter the transport business and the working group encountered three case studies that demonstrated three different approaches:

1. Engie's V2G project in Italy aimed to harness the battery services of 700 electric cars with bi-directional fast charging [Session 4].
2. Seattle City Light is engaging with many stakeholders to electrify public transport fleets. The advantage of electrifying public transport over residential transport is that they run on regular schedules and therefore use predictable charging times and locations [Session 8].
3. Holy Cross Energy has developed a service to provide residents or commercial members with EV chargers, the upfront installation cost of which are financed under a DER Service Agreement. Under the scheme, community DC fast charging is supported by $150k upgrades and engineering support while transit and school buses are supported with TOU rates, no demand charge, and on-site solar [Session 4].

Topic	Project	Utility/Energy Partner	Business Model Description	Session
Electric Transport: V2G	V2G in FCA plant, Italy	Engie	A project to harness the battery services of 700 electric cars with bi-directional fast charging	4
Electric Transport: Public Transport	Transportation electrification strategic investment plan	Seattle City Light	Electrification of a public transport fleet	8
Electric Transport: Charging Infrastructure	Electrifying your ride	HCE	A project to provide EV chargers to every residential or commercial member	4

[9] "Global Transportation Services Industry." Globe New Wire, December 2020. Available at https://www.globenewswire.com/news-release/2020/12/09/2142054/0/en/Global-Transportation-Services-Industry.html

Customer Platforms

Customer expectations are changing and to maintain customer loyalty develop new lines of revenue, utilities are exploring innovative services they might provide to their customers. Emerging technologies offer opportunities to improve customer experiences and competitive industries have evolved to where automated and more intuitive interfaces are the norm, billing processes require less effort, and tailored usage information is available to customers.

EDP Portugal's involvement with the InteGrid project demonstrated the potential for smart customer interfaces that provide energy usage details, tailored energy efficiency suggestions, and demand response services. The InteGrid platform leveraged a social network approach, allowing neighbors to connect and crowd-source information about energy efficiency [Session 1].

SRP has created an online retail platform where customers can purchase energy-related hardware products such as thermostats, lightbulbs, or EV chargers. This platform supports the Bring Your Own Thermostat program at SRP, and drives installation and upgrading of customer devices [Session 1].

Alectra is developing the "data as a service" business model whereby the goal is to generate insights from customer data and serve it back to its customers [Session 5].

Topic	Project	Utility/Energy Partner	Business Model Desicription	Session
Consumer Interfaces	InteGrid, Portugal	EDP Portugal	Consumer interfaces for energy efficiency and demand response	1
Data Services	Data as a Service, Ontario Canada	Alectra (with City of Guelph)	A platform to unleash hidden value from data and serve it to consumers	1
Retail Platform	Marketplace, Arizona	SRP	An online retail platform for energy products	5

SECTION 3:
THE *HOW* OF THE UBM

This section addresses the factors that influence the speed of innovation in the UBM, both internally (i.e., utility strategy) and externally (i.e., regulatory environment). Innovating the UBM represents considerable industry transformation and is influenced by the combined actions of various agents that can each lead, support, and adapt to change in the industry. This section addresses three drivers of change in the UBM: policy, regulation, and utility strategy.

Utility Strategy

Utilities around the world are recognizing the need for innovating the UBM to support the adoption of new technologies, such as discussed in Section 2. The inertia of the status quo is strong and to lead the change in business transformation, utilities need to connect business model innovation to corporate strategy and develop in-house innovation capabilities.

UTILITY STRATEGY FOR DECARBONIZATION [SESSION 3]

Utilities are developing strategies to achieve carbon-free power goals by or before 2050. To manage and respond to the infinitely expanding arena of stakeholders in decarbonization discussions, utilities must first define their mission and their future business model. Bounding the market scope creates a focus for change and helps define the relevant stakeholders that warrant meaningful engagement. Session 3 in the UBM working group highlighted several lessons learned from industry leaders in decarbonization strategy.

For example, Arizona Public Service (APS) found that the traditional Integrated Resource Planning progress was limiting the stakeholders from creating innovative strategies and accounting for important factors such as policy goals, emerging technology, customer preferences, DER, and flexibility. APS has used broad-stakeholder engagement to develop a Clean Energy Pathway with the aim of increasing the portion of clean-energy generation from 50% in 2019, 65% in 2030, and 100% in 2050.

Customer Stakeholders

A customer-centric approach to services is becoming more prevalent in utility strategies. It is important to recognize that customers may want change, but they do not own it and customer focus groups should aim to understand the customer, and not expect them to tell all the answers. This lesson is evident from Apple, one of the most disruptive technology innovators of this century. Apple ran focus groups for phone development with thousands of people and not one person said he/she/they wanted a camera on the phone.

Financial Stakeholders

For investor-owned utilities, the drive for business transformation comes from investors as well as customers. With increasing divergence from fossil fuels and investment in clean energy from the international finance community, the market is trending towards decarbonization as an attractive investment opportunity. An explicit strategy for decarbonization is essential to attract this investment, alongside the following tactical factors:

- Capital outlay
- Risk of recovering investments
- Cost ownership

> "A lot of times, people don't know what they want until you show it to them."
> - Steve Jobs [10]

UTILITY INNOVATION CAPABILITIES [SESSION 5]

The practice of innovation and developing an effective innovation strategy at utilities is essential to delivering business transformation, and yet many utilities struggle with in-house innovation capabilities. EPRI's Innovation Effectiveness Assessment project has developed a methodology that aims to measure innovation effectiveness at utilities using self-assessment surveys and executive interviews [11]. The assessment is based on three innovation pillars: strategy, structure, and culture.

[10] "The Famous Steve Jobs Quote is Often Misunderstood." Business Insider, April 2019. Available at https://www.businessinsider.com/steve-jobs-quote-misunderstood-katie-dill-2019-4?r=US&IR=T

[11] Global Innovation Effectiveness Project: Final Report. EPRI, Palo Alto, CA: 2021. 3002022727. Available at https://www.epri.com/research/products/000000003002022727

Strategy to Innovate

In 2015 U.K. Power Networks (UKPN) first developed an explicit strategy for innovation, which they have continued to update in 2017 and more recently in 2020 [12]. This ties the practice of innovation to the corporate vision and defines innovation for UKPN, and guides tactical decision making. The strategy also specifies how UKPN will innovate, which includes:

- Sourcing innovation ideas
- Portfolio prioritization and project selection
- Funding innovation
- Innovation delivery life-cycle

While the definition of innovation may differ for any utility depending on its operating region, regulatory environment, and business construct, the activity of developing an explicit innovation strategy remains an important step.

Structure to Innovate

Utilities are finding that existing processes for project funding and prioritization were designed for risk-averse, incremental improvement and business transformation warrants a new set of innovation-based metrics Organizations are recognizing the need for a new set of resources and developing skill sets that have not typically been found in the utility business but will facilitate business transformation and support a rigorous process for turning ideation into commercialization. Therefore, to realize an innovation strategy, explicit structures should be put in place including rigorous processes and appropriate resources to support innovation of the UBM.

Culture to Innovate

Many utilities cite building a culture of innovation as a key barrier to innovation effectiveness and seek lessons learned from successful innovative organizations outside of the utility industry. X The Moonshot Factory (the innovation arm of Google) pursues breakthrough technologies that tackle big problems with novel solutions. There are five principles that the Factory purportedly uses to align business with disruptive innovation:

Think 10X Improvement	Work on the Hardest Part First [13]	Make Contact with the Real World	Fall in Love with the Problem, Not the Solution	Embrace Learning as Oppose to Failure

[12] "Innovation Strategy." UK Power Networks, 2020. Available at https://innovation.ukpowernetworks.co.uk/wp-content/uploads/2020/01/UK-Power-Networks-Innovation-Strategy-2020.pdf

[13] Read about the "tackle the monkey first" analogy on X The Moonshot Factory blog. Available at https://blog.x.company/tackle-the-monkey-first-90fd6223e04d?gi=370de7be0909

Regulation

The UBM and utility regulation are mirrors of each other, and regulation is advancing to drive and support business model transformation. Innovation in a highly-regulated industry may benefit from cooperation to develop regulatory frameworks that facilitate innovation in the UBM. There are several innovation allowances and incentives that encourage the adoption of new technology within a bounded regulatory environment. These mechanisms can encourage innovation for existing utilities but also encourage open competition in an industry that tends towards natural monopoly. For example, in Australia, utilities are obligated to be transparent with data so that other market players have the opportunity to offer a more competitive solution.

PERFORMANCE-BASED REGULATION IN IMPLEMENTATION [SESSION 7]

While all regulatory frameworks leverage incentives to some extent, PBR goes beyond conventional regulation, intending to create a holistic framework that incentivizes utilities to perform efficiently, safely, reliably, and innovatively. In Session 7 of the UBM series, three PBR case-studies were discussed from the U.K., Minnesota, and New York.

RIIO, U.K.

RIIO is the U.K.'s PBR framework whereby "Revenue = Incentives + Innovation + Outputs". Key elements from the initial 2012 design include multi-year rate plans, the total expenditure (TOTEX) approach which combines a portion of utility CAPEX and OPEX into one regulatory asset, the creation of performance incentives, and innovation funds worth about $225 million per year for electricity and gas.

In reaction to the high performance of utilities in RIIO1, RIIO2 is being designed to further challenge utilities and raise the bar again. Key changes in RIIO2 include:

- an increase in the customer share of TOTEX savings (33 to 50%)
- shortening the incentive cycle from 8 to 5 years.
- One of the lessons learned is the difficulty of measuring true performance. For example, discerning whether CAPEX savings are an improvement in the long term from real innovation, as compared to corner-cutting on asset repairs, may be difficult.

Minnesota Public Utility Commission (PUC)

In Minnesota, regulated utilities can already propose multi-year rate plans up to 5 years, e.g., Xcel has a four-year rate plan. The Minnesota performance mechanisms currently in development aims to facilitate improvements under the existing cost-of-service model and to evolve the system rather than overhaul it. In 2019, Minnesota PUC set up a heavy stakeholder engagement process to stand up PBR.

Key outcomes were identified as the focus in January 2019, including three traditional metrics alongside two progressive outcomes:

- affordability,
- reliability,
- customer service quality,
- environmental performance, including carbon reductions and beneficial electrification,
- cost effective alignment of generation and load including demand response, and
- these outcomes were used to engage stakeholders in proposing performance incentive mechanisms (PIMs) in those areas.

New York Public Service Commission (PSC)

New York PSC has implemented a form of PBR as an earnings adjustment mechanism (EAM). This has been a successful tool in helping utilities to align and focus on NY's aggressive climate goals. EAMs allow utilities to earn up to 100 basis points (or 1%) return on equity (ROE) increase a year, and the details negotiated with utilities as part of multi-year rate plans.

NY also has a performance- based framework for driving non-wires alternatives, which is implemented alongside the EAM system. ConEd is involved in the PBR program through outcome-based EAMs and program-based EAMs and has shared a number of lessons learned with the working group:

- EAM has impacted the overall enterprise and has led to fundamental organizational change.
- Peak savings have purportedly quadrupled with the EAM system.
- EAMs have encouraged ConEd to take more risks to achieve ambitious goals.
- EAM facilitated the creation of a new team to address EV connections and customer satisfaction.

Policy

As many regions respond to climate ambitions and economic downturn resulting from the COVID-19 pandemic, governments are releasing large recovery packages to stimulate the economy with investment in clean and equitable energy technology [14]. Engagement between policy-makers and the utility industry can help to drive change that supports the energy transition in an affordable, equitable, and low-carbon manner.

GRID INVESTMENTS TO SUPPORT DECARBONIZATION [SESSION 6]

The American Jobs Plan (AJP), announced in Spring 2021, introduced a $2 trillion investment plan for the nation's infrastructure. Within the plan, a proposed $100 billion investment in upgrading the U.S. electricity grid accelerated efforts within Congress to pass a comprehensive infrastructure package to further define these critical federal investments. The Biden Administration continued to work with Congress and industry, efforts that resulted in the Senate passing the bipartisan Infrastructure Investment and Jobs Act (IIJA) in August 2021.

The IIJA, also referred to as the Bipartisan Infrastructure Package (BIP), includes hundreds of billions of dollars in funding for broader energy sector programs. The GridWise Alliance (GWA) identified that roughly $70 billion of funding from the IIJA would directly support grid related programs within resilience, deployment of technologies to enhance grid flexibility and grid integration of buildings and vehicles, cybersecurity technology and workforce, utility communications, and other workforce development programs [15]. Many more billions of dollars of funding in programs for transportation electrification, clean energy supply chain technologies, transmission planning, energy efficiency, and non-DoE cyber programs were also included. The IIJA further outlined specific support for the development of clean electricity standards, tax credits for transmission infrastructure, rural co-ops transitioning to cleaner energy, EVs and charging infrastructure, and large-scale clean energy demonstrations such as hydrogen and storage.

A substantial influx of federal funding can support business transformation at a large scale. For example, in 2009, the American Recovery and Reinvestment Act's (ARRA) $3.4 billion of federally-funded smart grid investments leveraged an additional $4.5 billion of private dollars. As a result of this public-private partnership, many utilities accelerated their grid modernization plans by up to 10 years or broadened project scopes to benefit more customers [16].

[14] "Policy Responses to COVID-19", International Monetary Fund, 2021. Available at https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19

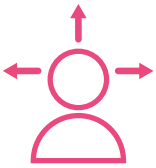
[15] "Grid Investments for Economic Recovery Initiative." GridWise Alliance, 2021. Available at https://gridwise.org/our-tools/#gridinvestments

[16]"Smart Grid Investment Grant Program Final Report." U.S. Department of Energy, Electricity Delivery & Energy Reliability, 2016. Available at https://www.smartgrid.gov/files/documents/Final_SGIG_Report_20161220.pdf

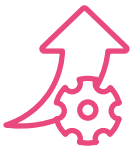
DEFINING A FRAMEWORK FOR GRID READINESS [SESSION 10]

To modernize the grid and achieve administration decarbonization targets, it is important to clearly articulate the specific needs of the industry. In 2019, the GWA has evaluated all 50 U.S. states and the District of Columbia using the Grid Modernization Index (GMI) which ranks progress in grid modernization according to state support, customer engagement and grid operations [17]. Building on those rankings, the Alliance is now developing a framework for grid readiness that states may use to inform decision-making about grid implications. The four pillars of the framework are:

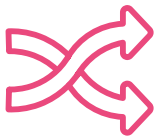
State Policy



Customer Adoption and Options



Grid Optimization



System Redesign and Regional Coordination

The purpose of this framework is to highlight the elements for grid readiness to justify appropriate investments and search for gaps in the maturity of the grid when integrating new energy technologies on both the generation and end-use side of the grid. Self-assessment of grid readiness can be a clarifying activity and important first step for effective strategic decision making. Additionally, the output of self-assessment using the framework could lead to clarification of metrics for the aspects of grid readiness.

[17] "Grid Modernization Index." GridWise Alliance, 2021. Available at https://gridwise.org/grid-modernization-index/#:~:text=The%20GridWise%20Alliance's%20Grid%20Modernization,and%20the%20District%20of%20Columbia.

SECTION 4:
DISCUSSION

UBMs are in an evolutionary stage with lots of experimentation across the U.S. and worldwide and information sharing can help harness the fruits of experimentation and accelerate business transformation across the industry. The pace of technological development and support for industry change is creating opportunities for utilities to transform their business model. Across all geographies and operating constructs, there are some common drivers of UBM innovation including decarbonization, energy equity, technological development, customer expectations, and resilience.

Decarbonization: Decarbonization is a global priority, as illustrated by the Paris Agreement, which asserts its members intentions to limit the global temperature increase this century to 2 degrees Celsius above pre-industrial levels while pursuing means to limit the increase to 1.5 degrees Celsius [18]. Decarbonization is motivated by the public benefits of reducing the threat of climate change while also improving air quality and energy security. Social awareness, investor demands, customer choices, and government targets have encouraged the declaration of utility net-zero pathways around the world. The Biden Administration's goal to decarbonize the U.S. power sector by 2035 necessitates innovation at an unprecedented pace in the industry, and the UBM must adapt to support and accelerate this change. Utilities are responding to these policy signals by developing their own decarbonization pathways and supporting innovation strategies. Technological developments are facilitating the integration of utility-scale renewables and decentralized renewable generation assets, and utilities are experimenting with novel business models that support decarbonization through decentralization without fragmenting the grid.

Energy Equity: There is a growing acknowledgment that utility strategy can and should drive the expansion of energy equity. This perspective promotes the use of local resources to benefit underprivileged portions of the system [19]. The distributional effects of utility strategy are often complex and not immediately obvious. It is important to further understand the implications of decisions from a broader perspective of society and to provide standard frameworks for measuring effects on energy equity. Early planning stages can address issues of energy justice by expanding community engagement activities to include diverse customer groups and ensure that low-income, minority groups are represented. Looking to the future, e-mobility and transportation equity will present opportunities for utilities to effect energy justice in their operating areas. There are several examples of utilities leveraging grant funding for R&D to demonstrate emerging technology in low-income neighborhoods.

Technological Development: The pace of technology development is increasing as we enter the so-called "fourth industrial revolution," dominated by the digitization of cyber-physical systems, such as the energy system. Barriers to technology development are lowered by the big appetite of venture capitalists for cleantech investments, cross-sector integration, availability of a highly skilled workplace, open-source collaboration, and low manufacturing costs. This presents an opportunity for utilities to incorporate emerging technologies into their business models and develop new revenue streams and customer offerings.

Resilience: Resilience has always been an important facet of the regulated utility, and for many years, investment decisions have been based around frequency metrics from statistical probability of a power outage or other weather-related events; e.g., a 1-in-1000-day event. This approach has been successful where there is a clear tolerance rate for disturbances, calculable frequencies for disturbance events, and extensive knowledge of how the grid technology will respond during disturbance events.

[18] "The Paris Agreement." United Nations Climate Change. Available at https:/unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement" https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement

[19] Shalanda Baker. Revolutionary Power: An Activists Guide to the Energy Transition. Island Press, 2021.

With the evolving generation mix, changes to global climate patterns, unprecedented extreme weather events, and increased reliance on electricity for essential services (and therefore a decreasing tolerance for disturbances), resilience is becoming more critical, and less easy to measure. It is increasingly a focus of discussion, with utilities expressing an eagerness to provide services to their customers that increase their energy resilience, such as batteries and solar PV. There is an opportunity to tackle resilience from a regulatory approach and clarify the responsibilities of distribution, transmission, and generation companies in measuring and mitigating resilience disturbances.

Areas for Future Research

The UBM working group has touched on a broad range of issues and has begun to identify the challenges and opportunities for UBM innovation. The topics discussed thus far represent a subset of industry issues. There are many areas for future discussion that have emerged throughout the working group sessions, but have not yet featured prominently in the discussion.

In terms of technological development, the working group will continue to deepen the discussion into monetization of renewables and decentralized energy assets, and begin to expand the conversation along the other dimensions of UBM innovation such as digitalization and service offerings in adjacent industries. Digitalization is a key driver of the energy transition and an opportunity to improve operational efficiency and develop novel customer services and interfaces. The working group has also highlighted the potential for data-driven innovation and the use of shared data to further competition within the industry. Many member utilities have expressed an eagerness to digitalize their business and look to other successful technology industries for lessons learned in this respect. Another area of interest that was highlighted without detailed discussion was the potential to couple services with adjacent industries. There are examples of utilities utilizing extra bandwidth on their private communications infrastructure to provide commercial communications services and generate additional revenue. The potential synergy between communications and utility business is just one example of industry coupling that may provide opportunities for UBM innovation.

There is recognition that the industry can increasingly benefit from wider stakeholder engagement. Particularly, utilities are interested in engaging with other players in the industry to accelerate learning and expand their knowledge and skillsets. This includes discovering best practices in engaging with startups, innovation through financial investment in early-stage R&D [20], establishing pilot programs, and driving insight back to the utility. Essentially, there is a need to understand how the static UBM can transform to make such engagements successful.

The working group consists of utility members from around the world [21] and has featured case studies predominantly from North America and Europe. The UBM is a reflection of many regional factors including socio-economics, geographical characteristics, settlement patterns, and regulatory environments. While a direct comparison is not always possible, there is great value in cross-fertilization of learnings across operating regions. Collaborative learning across operating regions may help address common challenges such as building effective relationships between utilities and regulators, goal alignment, and collaborative decision-making.

[20] "Why US utilities should invest in innovation." Utility Dive, April 2017. Available at https://www.utilitydive.com/news/why-us-utilities-should-invest-in-innovation/441114/

[21] Countries represented include the U.S., Canada, Colombia, Ireland, Poland, Portugal, Sweden, Italy, India, Korea, and Australia.

Regulatory innovation is typically a novel occurrence and exploring global examples can help inform discussions around the use of innovation funds and performance-based incentives. For example, there are a limited number of innovation sandboxes around the world, and learnings can be shared from case studies in Canada [22], Europe, U.K., and the U.S. [23].

Next Steps

Given the level of engagement in the working group and the need for further discussion into UBM innovation, the sponsor organizations have decided to continue the monthly webcasts in 2022, starting on January 25th.

Registration for the working group is available to utility members from any one of the four sponsor organizations; SEPA, EPRI, the GridWise Alliance, and GridForward. To register, please contact Angie Henegar (ahenegar@epri.com) or Laura Crowley (lcrowley@epri.com). Please get in touch if you have further questions about the activities or have suggestions for future discussion topics.

[22] "The Role of Energy Innovation Sandboxes in Getting to Net-Zero." Quest, Canada, 2021. Available at https://questcanada.org/wp-content/uploads/2021/10/Sandboxes-Oct-2021-v3.pdf

[23] "Casebook on Innovative Regulatory Approaches with Focus on Experimental Sandboxes." International Smart Grid Action Network, International Energy Agency, 2019. Available at https://www.iea-isgan.org/casebook-on-innovative-regulatory-approaches-with-focus-on-experimental-sandboxes/

APPENDIX

Session 1

The Impact of Community Engagement on the Utility Business Model

As the technology for smart communities starts to mature, the role of the utility will have to adapt and provide essential services in this energy landscape. This raises questions about how the utility can support communities with the relevant technologies and develop optimal financing strategies for different services, such as trading platforms, microgrid controllers, or community energy management software.

This webcast focused on how utilities can sustain business and engage with customers that are managing their energy needs as a community.

Date: October 27, 2020

Host: EPRI

Panelists:

- Rachel Huang, SMUD
- Miguel Luoro, EDP Portugal
- Neetika Sathe, Alectra
- Phil Markham, Southern Company

Resources: Meeting notes and slides are available here.

Session 2

The Impact of Changing Utility Regulation on the UBM

Business models and regulation are mirror images of each other, and one cannot be understood without the other. Over the last century, utility regulation has changed as a result of economic and technological drivers such as oil shocks in the 1970s. In recent years, business models have started to diverge across the world and the kWh rate-based model no longer fully describes the utility business.

This webcast focused on the history of utility regulation and the future of diverging business models.

Date: December 1, 2020

Host: The GridWise Alliance

Session 2 (cont.)

Panelists:

- Professor Peter Fox-Penner, Boston University
- Professor William Boyd, University of California at Los Angeles

Resources: Meeting notes and slides are available here.

Session 3

Utility Strategies for Carbon-Free Power Goals by or before 2050

The UBM is changing to achieve decarbonization goals, either from government strategy, stakeholder pressure, or internal utility decarbonization pathways. Some utilities have developed explicit strategies to achieve carbon-free power by or before 2050.

This webcast included a fireside chat about the internal actions that utilities have to make to deliver industry-wide changes in the power sector and how to prepare for those changes.

Date: January 26, 2021

Host: SEPA

Panelists:

- Mary "Molly" Bauch, Accenture
- Deanna Siller, The Strategy + Design Shop
- Greg Bernosky, Pinnacle West, and APS
- Erika Bierschbach, Austin Energy

Resources: Meeting notes and slides are available here.

Session 4

DER Monetization Strategies: Value Allocation and Revenue Streams from New Set of Flexible Assets

Distributed resources are accelerating on energy systems across the globe. Many open questions remain about how grid operators effectively integrate these assets. Central among those considerations are the pathways for revenue generation.

In this webcast, we heard from practitioners about the steps they are taking to expand these edge assets at or near the customer premise and the mechanisms they are exploring to scale distributed resources as a viable aspect of their business model.

Session 4 (cont.)

Date: February 23, 2021

Host: GridForward

Panelists:

- Ron Nelson, Strategen
- Angela Long, Portland General Electric
- Bryan Hannegan, HCE
- Doug McMahon, ENGIE

Resources: Meeting notes and slides are available here.

Session 5

Managing Innovation and the Impact on the Utility Business Model

Technological innovations are occurring at an unprecedented rate and utilities are developing strategies for grid modernization to deal with these developments. The vision of next-generation utility structures, customer integration, decarbonization priorities, and service-based economies are resulting in the need for utilities to continually assess business models.

This webcast focused on the role of innovation within the utility structure and how managing innovation is influencing business model discussions.

Date: March 30, 2021

Host: EPRI

Panelists:

- Dan Killoren, EPRI
- Sotiris Georgiopoulus, UKPN
- Hank Courtright, SRP
- Page Crahan, X The Moonshot Factory
- Marie Hayden, Smart Wires

Resources: Meeting notes and slides are available here.

Session 6

Exploring Grid Investments to Achieve Decarbonized Economy Goals

In April 2021, the announcement of the American Jobs Plan (AJP) introduced a $2 trillion investment plan for the nation's infrastructure. Within the AJP, a proposed $100 billion investment in upgrading the electricity grid and $50 billion for resilience, including the grid, set a marker for the level of support the electric power industry can anticipate from the Administration.

This webcast focused on how utilities are responding to the directional markers set by the Biden Administration; defining which kinds of investments in the grid will be most valuable to achieving ambitious climate goals.

Date: April 27, 2021

Host: GridWise Alliance

Panelists:

- Sonia Aggarwal, White House Office of Domestic Climate Policy
- Karen Wayland, GridWise Alliance

Resources: Meeting notes and slides are available here.

Session 7

PBR in Implementation

Changes in the electricity industry are occurring at an unprecedented rate to keep up with changing technology, economics, customer expectations, and public policy. Utilities are looking at new business models to succeed in this environment but new business models may need new regulatory frameworks.

This webcast focused on PBR in implementation, not theory. Is it accelerating innovation and new UBMs to keep up with new imperatives to reduce carbon, increase resiliency, and enable new approaches and partnerships to deliver energy products and services?

Date: May 25, 2021

Host: SEPA

Session 7 (cont.)

Panelists:

- Mike Calviou, National Grid
- Matt Schuerger, Minnesota Public Utilities Commission
- Alex Buell, ConEd

Resources: Meeting notes and slides are available here.

Session 8

Equity & Innovation: Ensuring Vulnerable Communities Benefit from Grid Modernization

For decades, or over a century in some places, utilities have served all customers in their territories, irrespective of any attributes, to connect them on the grid. This obligation to serve in some ways bakes equity right into the fabric of electric grid operators. However, the way we plan, invest, and operate grids has left many disproportionately impacted. There are numerous factors where the grid continues a cycle of impact to vulnerable communities; from a high and rising energy burden, to health and wealth impacts from the location of energy assets, to energy access and especially given the onset of newer electric system capabilities.

This webcast centered on how to measure equity and how to bring the progress of equitable outcomes into focus in the way that grid operators run their organizations to promote empowering all members in their community.

Date: June 29, 2021

Host: GridForward

Panelists:

- Emeka Anyanwu, Seattle City Light
- Jenell McKay, San Diego Gas & Electric
- Aneri Pradhan, Elemental Excelerator

Resources: Meeting notes and slides are available here.

Session 9

Energy Storage and Its Value to the Utility Business Model

Integration of non-dispatchable generation technologies is increasing the importance of energy storage in the energy supply chain. Utilities and other energy players are experimenting with novel approaches to providing energy services including aggregator services, BTM financing, BYO-Battery models, and large-scale energy storage investments.

This webcast addressed the implication of energy storage to the UBM and surrounding regulatory environment.

Date: July 27, 2021

Host: EPRI

Panelists:

- Andrej Gubina, University of Ljubljana
- Ted Ko, Stem Inc.
- Jorge Araiza, Southern California Edison

Resources: Meeting notes and slides are available here.

Session 10

Defining a Framework for Readiness

There are trends at all levels and sectors to reduce carbon emissions. Given the role of electrification in decarbonization, the grid is the platform through which these trends take place.

This webcast focused on how to define what it means for the grid to be "ready" to serve as the platform for electrification and decarbonization, and what components of a framework are expected to be most beneficial to states as they evaluate their readiness to accommodate these changes.

Date: September 28, 2021

Host: GridWise Alliance

Panelists:

- David Terry, National Association of State Energy Officials (NASEO)
- Aurora Edington, GridWise Alliance

Resources: Meeting notes and slides are available here.

Session 11

Stakeholder Engagement and Utility Decarbonization Plans

Changes in the electricity industry are occurring at an unprecedented rate to keep up with new and emerging technology, changing economics, increasing customer expectations, and public policy to address climate change. Utilities are at the center of or expected to lead these changes, transforming their business models to succeed in this environment. Utilities need to engage customers, communities, and other key stakeholders, both internal and external, in the transformation process: they are endeavoring to do this in a variety of ways.

This webcast featured an introduction to SEPA's Utility Transformation Challenge, whereby SEPA set out to undertake an honest, comprehensive assessment of U.S. utility progress towards a carbon-free, modern grid, based on a survey of over 130 utilities representing 63% of U.S. customer accounts last year. The webcast also included a panel discussion with three utilities on their approaches to the education and engagement of a variety of stakeholders.

Date: October 26, 2021

Host: SEPA

Panelists:

- Olof Bystrom, SMUD
- Paul Davis, Platte River Power Authority
- Elizabeth Bennett, Duke Energy

Resources: Meeting notes and slides are available here.

December 2021

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