# Top 10 Trends Driving the Utility Industry in 2021

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27 January 2021

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Published 27 January 2021 - ID G00740162 - 42 min read

By Analysts Zarko Sumic, Nicole Foust, Ethan Cohen, Lloyd Jones, Sruthi Nair

Initiatives: Energy and Utilities Digital Transformation and Innovation

Climate concerns and grid edge disruption are forcing structural changes in the utility sector. As the industry undergoes a deep redesign and addresses pandemic implications, this research helps utility CIOs develop a forward-looking information and technology strategy for the sustainable future.

## Overview

### Opportunities

- New technologies challenge existing providers and invite new entrants and players from adjacent markets. But they also create opportunities for new products and services that can leverage existing infrastructure to deliver new value to existing and future customers. Utilities that are agile in embracing and adopting new technologies and can quickly pursue opportunities they introduced will position themself for growth during challenging times ahead.

- The need for operational resiliency across business functions, technology and service delivery has never been greater for utilities. In this asset-intensive sector, organizations that deliver highly digitized business capabilities and enable flexible work for critical operations in a composable way have the biggest opportunities to smoothly navigate through a decade of deep redesign.

- By leveraging advanced capabilities to monitor distributed assets and complex business operations via technologies such as IoT, advanced analytics, AI models and orchestration platforms, utilities can gain competitive advantage and position themselves as relevant players in transforming markets.

### Recommendations

CIOs focused on energy and utilities digital transformation and innovation should:

- Track developments in new technologies areas (both on utility and customer scale), and track corresponding energy policy and regulatory frameworks. Set scenario flags to trigger appropriate actions.

- Deliver resilient operations by emphasizing modularity and adopting composable application architecture.

- Increase focus on acquiring talent, improving sourcing and deployment of IT capabilities in IoT, advanced analytics and AI.

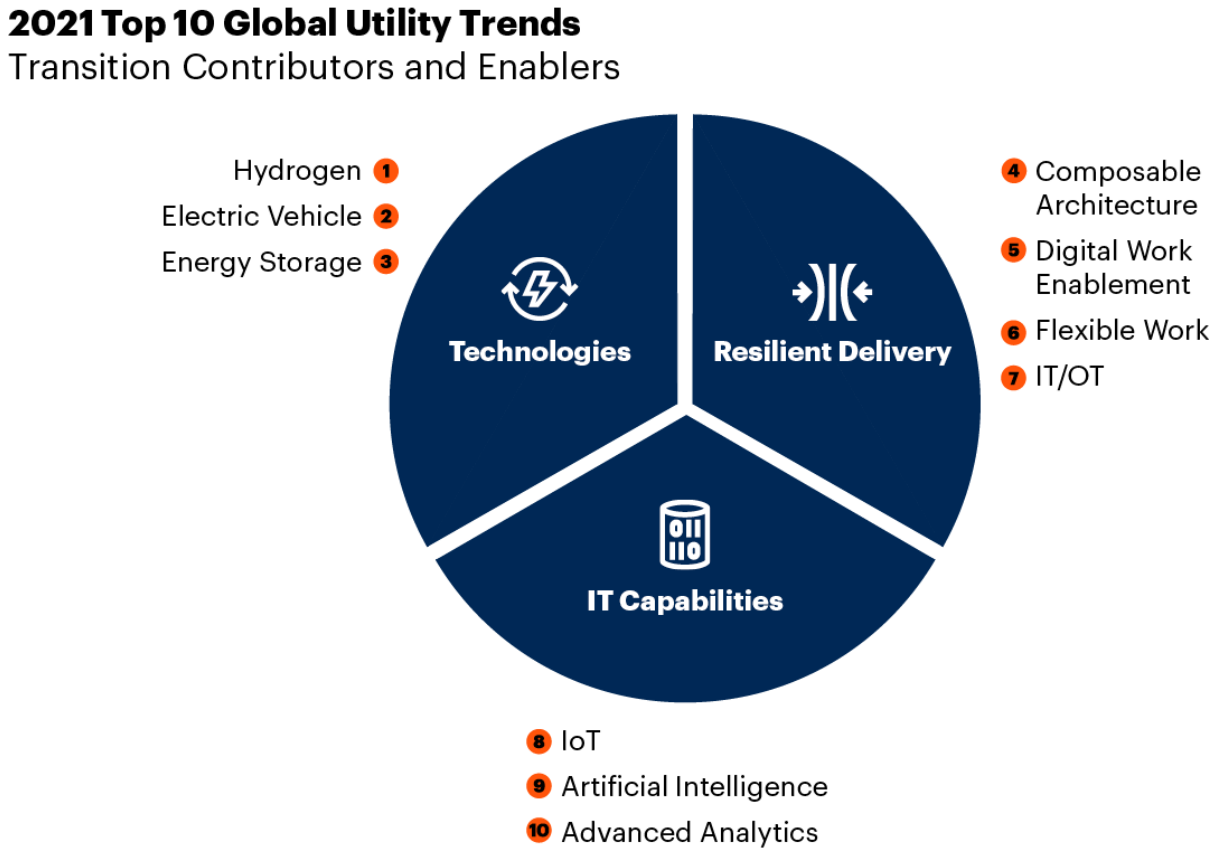
## What You Need to Know

The impact of the energy transition and the upheaval resulting from the global pandemic are setting the stage for a distinctive and new business and operating environment for utilities. The sector that has been traditionally recognized for its business stability, reliability and predictability is now facing a decade of deep redesign that pervades every aspect of the business. Regulatory frameworks, business and operating models are changing requiring utilities to develop new ways of thinking, new skills and capabilities. New energy technologies are emerging, at utility scale and at the grid edge alike, forcing utilities to revisit their business strategies. At the same time, these technologies are shifting consumer behavior and changing consumption patterns.

Utilities are impelled to increase resilience while maintaining productivity and efficiency. They are forced to quickly shape-shift to adapt to the new realities. They have to do it, both to survive disruptions and to leverage opportunities brought by a decade of deep redesign. And this is all happening during a pandemic, when service continuity is paramount, giving the new meaning to operational resilience.

As a utility technology leader, you must confidently compose the future for your organization in the midst of unprecedented turbulence — the future that requires your organization to be both agile and resilient. This is where utility trends for 2021 fit in. They can help you set your priorities, explore technology investment directions and compare your position to others in the industry. We've selected these trends for their promise to facilitate your journey through a decade of deep redesign. Trends fall into three themes — technologies, resilient delivery and IT capabilities (see Figure 1).

## Figure 1. 2021 Top 10 Global Utility Trends




Source: Gartner
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Trend Profiles

| Technologies Trends | Resilient Delivery Trends | IT Capabilities Trends |
|---|---|---|
| Hydrogen Holds Promise, but Challenges Are Still Ahead | Composable Architecture Provides Resilience and Agility Required During Turbulent Times | Utilities Accelerate IoT Initiatives to Aid Operations Improvements |
| Electrification of Transportation Will Invigorate the Energy Transition, but Not Without Pain to Utilities | Digital Worker Enablement Improves Utility Operations Resilience | Enterprise Advanced Analytics Drives the Peak Wave of Utility Digitalization |
| Storage Comes in to Save the Day by Tempering Intermittency and Firming Energy Availability | Flexible Work Improves Performance and Builds Utility Resilience | Scale in Utility AI Investment Expands Benefits and Value |
| | Accelerated IT/OT Convergence Improves Utility Asset and Network Performance | |

As a utility organization travels from responding to disruptions created by the confluence of energy transition and COVID-19 to exploiting opportunities to driving growth, it must focus on three areas forming the themes of 2021 top utility trends:

- Technologies. The global drive toward sustainability puts emphasis on new forms of energy resources that are easier on the environment, such as hydrogen on the provider side, and new types of demand, such as electric mobility on the consumer side. These new technologies are impacting the existing delivery infrastructure by reducing controllability and impacting reliability, and subsequently increasing overall business volatility. They also put existing commodity provisioning under pressure, forcing development of new business and operating models, with the consequential impact on utility IT and OT systems.

- Resilient delivery. This theme isn't about short-term adjustment or "bouncing back" to a prior state following a pandemic; it is about being able to nimbly adapt in an ongoing dynamic business environment. The underlying assumption in resilient delivery is that volatility in the utility sector will persist. Hence, it's vital to have the talent, capabilities, techniques, operational processes, architecture, tools and applications to constantly and dynamically adapt to evolving business patterns during a protracted period of change. This means organizations must be composable with modular, adjustable and autonomous components. They must use technologies and leverage technology domain integration to achieve sustained resilience. Business and IT processes must be automated — and digitalized, in particular — when it comes to work and asset operations.

- IT capabilities. This theme focuses on contributions that IT can make in addressing energy transition and pandemic-created challenges and opportunities. To have a deep understanding of the business and operational environment and be able to anticipate and respond to the change require timely insight into operating parameters of critical assets or business processes. A clear example of IT contribution to operational resilience and agility is leveraging Internet of Things (IoT)-acquired data and converting them into actionable insight through advanced analytics (AA). Artificial intelligence (AI) models and orchestration platforms can provide improved capabilities to identify complex operating patterns, anticipate failures and trigger preemptive corrective actions.

Trends and technologies don't exist in isolation — they build on and impact one another. In combinatorial innovation, trends can combine to create a whole that it is larger than its discrete parts. The trends can also reinforce one another to enable an adaptable and resilient business and technology foundation. Trends can also blend in unexpected ways creating an intermix of challenges and opportunities that must be evaluated and acted on. This is the overarching theme for the importance of recognizing and evaluating trends, that they are an indicator for the shape and character of utility business in the future.

## Technologies

### Hydrogen Holds Promise, but Challenges Are Still Ahead

*Analysis by Zarko Sumic, Lloyd Jones*

**SPA:** By year-end 2030, hydrogen will be the fastest-growing energy resource in G20 countries.

**Description:**

A hydrogen economy is a vision of an energy production, delivery and consumption infrastructure based on hydrogen as a carbon-free energy carrier, which plays an important role in the transition to a clean energy future. The hydrogen economy encompasses all aspects of hydrogen-based energy, including production via electrolysis (green hydrogen), production from fossil fuel with $CO_2$ emissions (gray hydrogen) and production from fossil fuel with $CO_2$ captured and sequestered (blue hydrogen). [1] It includes hydrogen delivery and energy conversion infrastructure such as fuel cells (for transportation and on-premises electricity generation) or combustion via existing (but retrofitted) gas turbines.

The renewed interest in a hydrogen economy is driven by its promise to accelerate and ease the transition to a clean energy future by:

- Partially leveraging existing energy delivery and conversion infrastructure

- Acting as a large-scale energy storage medium for the grid as well as across adjacent energy sources and sectors, such as oil and gas, transport and aviation

**Why Trending:**

The creation of a comprehensive hydrogen economy, a vision that has been around for several decades, is now getting a significant boost from a growing number of government policy measures and numerous large-scale commercial projects initiated by incumbent energy providers. A few examples are:

- EU Hydrogen Strategy for a Climate-Neutral Europe, projecting hydrogen share in energy mix growing from less than 2% to 14% by 2050
- Spain commitment — as a part of an EU-wide policy initiative — to bring 4GW hydrogen electrolyzers online by 2030
- Saudi Arabia $5 billion investment in green hydrogen facility for futuristic city of Neom
- Korea and Japan hydrogen-related investment with focus on hydrogen fuel cell vehicles
- $16 billion investment in Asian Renewable Energy Hub in Western Australia with 50 TWh of clean energy largely converted to hydrogen for local and international markets
- BP Orsted joint investment in 50 megawatt electrolyzer facility
- Hydro Quebec investment in 90 MW electrolyzer

According to BloombergNEF (BNEF) there are over $90 billion of hydrogen projects in their global pipeline and dozens of hydrogen electrolyzer projects with 50 GW capacity. Renewable hydrogen in Europe alone could require 180 to 470 billion EUR.

**Implications:**

Hydrogen can play a major role alongside electricity in future low-carbon economies, with the versatility to provide mobility, power system, heat and industrial services. Whether or not hydrogen becomes the energy carrier of choice over the next several decades or delivers specific energy services, it definitely has a role to play in future energy systems.

The technical and safety challenges of economically producing, transporting and using hydrogen are large, but so is the recent increase in R&D funding and financing of commercial projects. Economic hydrogen production and safe energy-dense storage are key challenges. Current hydrogen production (approximately 96%) is based on steam reforming using conventional fossil fuels. If combined with carbon capture and sequestration and natural gas as a source, it produces more sustainable blue hydrogen. However, the energy content of the produced hydrogen is less than the energy content of the original fuel. A small but increasingly growing portion is produced by electrolysis using electricity and water. Though energy efficiency is still low, electrolysis can play a major role in the use of hydrogen as a large-scale storage media to address intermittency of an increasingly decarbonized electric energy sector.

According to the World Energy Council, the success of hydrogen economy [2] depends on multiple factors, including:

- Adopting the long-term energy strategies and cross sector collaboration
- Employing sustainable production with economic viability and less-carbon-intensive alternatives to steam methane reforming and coal gasification
- Building an international hydrogen market and trade on a global scale
- Achieving cost-effectiveness by leveraging large scale government commitments
- Developing hydrogen infrastructure including points of production, transmission and delivery network with refueling stations

**Actions:**

- Include hydrogen to your strategic disruptors list by monitoring developments in hydrogen markets, regulation policies and production and storage technologies, and setting scenario flags.
- Form partnerships across energy sectors to leverage unique skills and resources to advance your starting position in the hydrogen economy by adopting it to your risk appetite.
- Explore the readiness of your IT portfolio to address hydrogen economy requirements.

**Further Reading:**

Hype Cycle for Digital Grid Transformation Technologies, 2020

### Electrification of Transportation Will Invigorate the Energy Transition, but Not Without Pain to Utilities

*Analysis by Zarko Sumic, Sruthi Nair*

**SPA:** By year-end 2026, EV charging (both service and energy) will constitute 30% of net new revenue for Tier 1 utilities in developed economies.

**Description:**

Electric vehicles (EVs) use battery-stored electricity to power one or more electric motors or traction motors for propulsion. These are recharged by connecting the vehicle to public or private charging infrastructure. Continued R&D efforts to develop battery technology for longer driving ranges are crucial to make EVs a viable alternative powertrain technology for passenger and commercial vehicles.

From a utility perspective, electric transportation can offer growth opportunities for utilities in mature energy markets. By controlling/influencing charging via different commercial programs, utilities can use EV batteries as intermittent energy storage to:

- Act as a buffer for daily variations in energy consumption.
- Address flexibility needs to counter renewables’ intermittency.

These can lessen the pressure on utilities' resource and infrastructure capacity, providing additional societal and environmental benefits such as deferral of investment in new delivery capacity and $CO_2$ emission reduction.

**Why Trending:**

EVs play a critical role in meeting environmental goals by reducing $CO_2$ emission in the transportation sector. The International Energy Agency (IEA) Sustainable Development Scenario outlines investments in electric vehicles as one of the key contributors to decarbonizing our energy future. According to the IEA Global EV Outlook 2020 report, sales of electric cars topped 2.1 million globally in 2019, surpassing 2018 — already a record year. [3] Electric cars, which accounted for 2.6% of global car sales and about 1% of global car stock in 2019, registered a 40% year-over-year increase. IEA estimates that by 2030 the number of EVs will reach almost 250 million. Consequently, EVs are quickly becoming one of the largest flexible loads on the grid in many countries.

**Implications:**

Ambitious policy announcements have been critical in stimulating the EV rollout in major vehicle markets in recent years. Countries leading in electric mobility use a variety of measures, such as:

- Fuel economy standards coupled with incentives for zero- and low-emissions vehicles
- Economic instruments that help bridge the cost gap between electric and conventional vehicles
- Support for the deployment of charging infrastructure

Increasingly, policy support is being extended to address the strategic importance of the battery technology value chain.

However, not everything is rosy about electric vehicles, and their deployment is not simply "plug and play" for electric utilities. In order to capture digital transformation opportunities EVs can offer, utilities need to get much better visibility of EVs and their charging patterns.

EVs are an example of energy technology consumerization, in an area beyond the meter that utilities are challenged to embrace. Due to EVs "nomadic" nature as a roaming appliance, it is important to identify and track EVs whenever and wherever they connect to a utility network. That requires a "handshake" between utility metering and customer-facing IT and operational technology (OT) systems with consumer technology (CT), such as onboard vehicle information systems or charging provider IT/OT/CT systems. This is something that energy utilities' legacy systems are currently challenged with, and also requires business collaboration with other participants in electric mobility markets (car manufactures and charging providers). Utility IT leaders must:

- Modify or develop new IT applications.
- Collaborate with broader automotive transportation ecosystems.
- Utilize an independent service provider that will address business and technology requirements including power provisioning, vehicle and user identification, metering and billing.

Most utility EV pilot projects are exploring vehicle-to-grid (V2G) models that provide utilities some level of control of the charge/discharge process. Although this approach provides the most benefits to utilities and alleviates the stress on the infrastructure from charging loads, it is not convenient to customers and may deter EV adoption. In addition, providing a utility with the ability to tap into batteries as distributed storage, while appealing from a utility standpoint, is not yet economically attractive, as it may erode battery capacity and shorten battery life without providing adequate financial benefits to EV owners.

**Actions:**

- Over the short term, focus EV initiatives on small-scale pilots designed to measure the impact of EV's on local distribution systems, and on establishing business processes and technologies to support EV charging.
- Create different EV adoption scenarios and analyze impacts of different scenarios on your existing physical infrastructure (such as feeders and transformers) as well as IT and OT applications, such as distribution management systems, metering and billing.
- Explore digital platform models and accompany technology such as a blockchain role in the EV charging ecosystem.

**Further Reading:**

Hype Cycle for Digital Grid Transformation Technologies, 2020

Predicts 2021: Automotive and Smart Mobility

Hype Cycle for Connected Vehicles and Smart Mobility, 2020

### Storage Comes in to Save the Day by Tempering Intermittency and Firming Energy Availability

*Analysis by Lloyd Jones, Zarko Sumic*

**SPA:** By 2025, new storage installations will exceed 30% of new generation capacity.

**Description:**

Energy storage solutions feature a wide array of technologies, from super capacitors through a range of battery technologies, to superconducting magnetic energy storage (SMES), compressed air energy storage (CAES) and the already proven pumped hydro storage and upcoming green hydrogen. Energy storage solutions play an essential role in the transformation of energy provisioning. Prosumers will become more effective at self-service across a range of needs. Some will sell power; others will trade services back to the grid. Grid-scale energy storage deployment will impact wholesale energy operations, providing more delivery flexibility and impacting contract designs. All these changes will require improvements to grid engineering and operations applications, metering and control systems, and customer-facing applications.

**Why Trending:**

Although price and energy sources are market forces, energy availability is the issue for customers and providers. A prominent use case is driven by the rising overall share of intermittent renewable resources, creating an oversupply at midday, driving down the marginal value of energy at midday. Conversely, a shortage of solar over the evening peak will drive price peaks triggering affordability issues for some segments of the market. Price volatility will need to be managed through energy storage. Energy arbitrage will become a key utility capability to manage customers' exposure to price volatility.

As climate impacts become more apparent, governments around the world are adjusting policy and adopting more aggressive net zero timelines. [4] A cost-and-policy-driven shift is already underway, moving utilities away from the legacy generation fuel and technology mix of dispatchable fossil-based resources such as coal and gas. Fossil fuel is being displaced by lower-cost, policy-favored, intermittent renewable resources. The deployment of intermittent generation has implications in the energy systems' resilience. Creating the operational flexibility needed to manage the grid and address commodity volatility issues will drive a range of options across policy, market creation, demand response and investment in storage-based solutions. Battery storage, with its fast response curve, makes it an ideal flexibility resource candidate both in front of and behind the meter. In addition, Wood Mackenzie is forecasting that U.S. utility scale battery power will grow from 1.2GW in 2020 to 7.5GW in 2025. [5] National Renewable Energy Laboratory (NREL) is forecasting an accelerated rate of cost performance improvements — suggesting that between 2018 and 2030 there can be an additional 45% reduction in the cost performance curve.

The emerging hydrogen economy is shining a ray of possibilities on the electrolysis of water to generate green hydrogen both as an energy surplus off taker and as high energy density fuel for storage for use in energy-intensive industries such as processing, transport and aviation.

**Implications:**

Battery storage costs have fallen by over 80% since 2010. [6] However, 2019 saw the installed energy storage shrink for the first time by 30% year over year, highlighting the technologies early stage status and reflecting safety issues in Korea. [7] The price performance improvement rate from Bloomberg NEF of 18% year-over-year reduction shows no sign of abating. Recent innovations such as water-based zinc/bromine redox flow batteries (ZBBs) offer cost reduction and energy efficiency > 80%, and support the forward cost reduction trend. [8]

Policy shifts to remove subsidies in the form of net metering and feed in tariffs are retiring energy export incentives, signaling customers to do their own energy management and arbitrage. This will drive customers to purchase energy storage solutions to use their own production and reduce exposure to electricity price volatility. Policy and market design can free up customer-owned storage investments to trade as virtual power plants on the wholesale market at a lower average cost point.

At the utility scale, debate rages on the ownership of utility storage with different models under consideration depending on jurisdiction. The European CEP allows wires companies to own and operate storage in exceptional circumstances, while Australia, with its high levels of renewable energy (RE) penetration, allows wires companies to own and operate storage under certain conditions. On the other hand, in the U.S., California regulator California Public Utilities Commission (CPUC) has mandated three investor-owned utilities to buy 1.533 GW — a mandate that they have exceeded. [9]

Independent power producers (IPPs) are benefiting from a policy shift toward solar-plus-storage auctions which is incentivizing developers to colocate storage at renewable energy sites as this stabilizes production and firms up capacity. Examples are a number of hybrid energy projects such as Kennedy Energy Park (Queensland, Australia), Advanced Clean Energy Storage (Utah, U.S.) and Ile de Sein (Brittany, France).

While the EV market is enjoying exponential growth rates, vehicle to grid projects and ability to tap into EV batteries as a utility scale storage, seem to be stuck at proof of concept — with much to be learned about behavior, control and engagement, and improved economic benefits for EV owners.

**Actions:**

- Begin a utility-scale battery demonstration project, to experiment with control and operations approaches.
- Integrate and test intelligent operations use cases across ADMS, SCADA and the battery controller.
- Investigate algorithmic trading of your storage into the balancing market that can seek to maximize its arbitrage value across primary, secondary and tertiary reserves.

**Further Reading:**

Hype Cycle for Connected Vehicles and Smart Mobility, 2020

Hype Cycle for Digital Grid Transformation Technologies, 2020

Resilient Delivery

## Composable Architecture Provides Resilience and Agility Required During Turbulent Times

*Analysis by Zarko Sumic, Nicole Foust*

**SPA:** By year-end 2026, 30% of Tier 1 utilities will use composable architecture to reposition their IT applications from “built to last” to “built for change.”

**Description:**

Composable business architecture is a framework for the digital Industrial Age to maximize the ability to build, assemble and reassemble business elements to rapidly seize market opportunities and respond to disruption and threats while being resilient. Composable business elements can be found in most aspects of business. Some include the whole or parts of business capabilities, products, services, partnerships and teams, and interoperable assets. The scope of the framework spans across customer engagement, ecosystem partnerships and operations.

A key aspect of digital technologies that affects all areas of business is the ability to compose and recompose various elements of business capabilities rapidly and inexpensively. A business design that allows for such composability is necessary to both capitalize on opportunities and address threats from continuous disruption. Composable business is enabled by composable application architecture composed of packaged business applications that can be dynamically reassembled to achieve desired business outcome or support new business or operating models.

**Why Trending:**

The energy transition is driving a “decade of deep redesign” in the energy sector, forcing utilities to adapt at an accelerated pace of business change, never seen before. During turbulent times ahead, organizations that are built for change will be better positioned than those that are built to last.

**Implications:**

The traditional energy provisioning business models (either regulated or a competitive) are now being supplemented by new business models such as peer-to-peer, virtual power plant platforms or even a universal basic energy model (see Predicts 2021: Get Ready for the Energy Transition). To better deliver on new business opportunities and respond to challenges, utilities must be agile while also resilient. However, an organization’s ability to change is often limited by the state of their application portfolio, which historically for utilities has been bloated, difficult to change and created by somebody else, and aligned to the strategy of the past. To operate under different and new business models at the same time — application leaders need to modernize the application portfolio to make sure the applications can reconfigure and operate at the pace of business change.

A composable enterprise can adapt to the pace of business change through the assembly and combination of packaged business capabilities (PBCs). PBCs are application building blocks that have been purchased or developed. They take the form of an autonomous encapsulated software package, designed as a building block for assembly of custom application experiences.

PBCs as a building block of a composable business architecture will have different granularity:

- Basic PBCs, which deliver a limited business service behind an API
- Data service PBC, which deliver analytical insights (such as headless API provided by vendors)
- Mini application PBCs, which encapsulate business entities

By using PBCs, the utility application portfolio will transform into a collection of packaged business capabilities that will be clustered based on the context in which they operate.

Traditionally, an application vendor would create a commercial off-the-shelf (COTS) product with fixed capability that a system integrator (SI) may configure during implementation to an individual utility company needs based on a strategy at a particular point in time. However, to meet rapidly changing business requirements, utilities will need to move toward a portfolio of packaged business capabilities and legacy COTS with exposed API. By leveraging a composable apps technology platform utilities will be able to quickly compose custom assembly of PBCs to support each and every business model that they will either want to pursue or be forced to pursue. By doing so utilities will become composable enterprises resilient and able to navigate disruptions, regardless if it is brought upon by energy transition, a pandemic or other.

Actions:

- Identify capabilities required for different energy provisioning business models, and adopt composable enterprise architecture to address all of them as needed by the appropriate custom composed assembly of packaged business capabilities.
- Begin migration toward composable business architecture enabled utility enterprise by evolving applications in your portfolio, from their current state of inflexible, monolithic applications, toward a portfolio that is more modular and adaptable to business change.

**Further Reading:**

Predicts 2021: Get Ready for the Energy Transition

Quick Answer: What Is Composable Business Architecture?

Future of Applications: Delivering the Composable Enterprise

5 Steps to Improving Utility Resilience

Gartner

## Digital Worker Enablement Improves Utility Operations Resilience

*Analysis by Nicole Foust, Sruthi Nair*

**SPA:** By year-end 2023, 40% of utilities will have enterprise wide deployments of tools and solutions to support digital field workers and enable operations improvements.

**Description:**

Mobile and remote working is the new normal. Digital worker enablement includes the tools and technologies that support employee capabilities in a mobile and remote environment. However, digital workforce enablement is more than simply replacing older mobile tools. It’s equally about digital optimization and capabilities to leverage and manipulate information such as location, IoT/OT/energy technology (ET) and consumer energy technology (CET) data, and expert real-time guidance to streamline work and improve efficiency and quality of decisions.

**Why Trending:**

The COVID-19 pandemic has changed the nature of work dramatically, with impacts across utilities that will be felt for decades to come. This has compelled utilities to evaluate their field workforce processes in light of digitization opportunities, with more effective virtual collaborations, robust security and edge technologies to support and standardize digital workers. As a result, utilities are accelerating their ongoing digital optimisation, shifting to a more near-time business-operations-centric approach. Field operations dynamics include the need to:

- Better align and advance work management and asset management capabilities
- Streamline, standardize, improve and ensure environmental and worker safety and operational efficiency
- Continue to enable visibility and collaboration opportunities reducing work and operations siloes across the business
- Better equip and connect the workforce to include taking into consideration aging workforce and increasing number of less tenured personnel

With this, utilities are increasingly finding the need to further evaluate capabilities and technologies that aid operational improvements across the enterprise. These include technologies such as wearables, field mobile products, IoT, cloud, augmented reality (AR)/virtual reality (VR), AA and AI, to name a few (see Top Technologies to Address Work Flexibility Needs in the Utility Sector During the COVID-19 Pandemic and Beyond).

**Implications:**

Utilities have been enabling mobile work for the past 20 years, but recent events have lifted the bar with real-time, anywhere requirements to provide better and more streamlined access to information, systems and collaboration.

Mobile technology has been one of the most innovative and fastest-growing technology areas in the past decade, mainly as a result of the rapid growth in consumer technology and applications. However, in contrast to the consumer technology world, in an industrialized and heavily complex operations environment such as in utilities, these changes do not happen overnight. Utilities are in a transition phase with better enabling digital workers to meet current and future workforce changes.

Advancements in IoT capabilities, cloud delivery and the emergence of newer mobile technologies, and edge capabilities are driving a reevaluation of utility industry OTs. Utility CIOs can leverage advances in mobility to improve digital enablement of field crews — to dynamically deploy and optimize field resources. This is especially the case as it relates to large-scale service restoration operations. To meet these challenges and changing requirements, utilities must:

- Integrate and upgrade back-office systems.
- Ensure dynamic enterprise systems for field work management that are able to efficiently and optimally dispatch crews.
- Employ asset management systems that can properly:
    - Coordinate materials to worksites as situations dictate.
    - Optimize availability and reliability of assets and reduce maintenance spending in preventing failures that impair service delivery.

Utilities should develop a long-term approach to digital worker capabilities by assessing the workforce, operations, processes and technologies. While in this transition phase, utilities will encounter additional challenges and opportunities. For example, utilities must build a field workforce culture that's conducive to work, with process changes supported by digitalized capabilities based on actual worker- and team-level preferences. While delivering on worker and team capabilities, utilities must also ensure optimization and scalability across the organization, implementing tools and technologies that can easily be reconfigured to meet changing work dynamics.

**Actions:**

- Develop a realistic roadmap for digital worker enablement by identifying critical applications, processes, operations and teams that will benefit from tools and technologies.

- Evaluate your digital workforce enablement technologies in light of capabilities that can be unlocked with newer, more comprehensive technologies such as mobile field applications, wearables, IoT, analytics and cloud.
- Ensure a comprehensive digital enablement worker strategy by conducting a gap assessment between current capabilities and future state.

**Further Reading:**

Flexible Work Practices Improve Utilities' Operational Resiliency

Utility Mobile Workforce Management and Horizontal Field Service Management Systems Provide Different Capabilities to Utilities

Top Technologies to Address Work Flexibility Needs in the Utility Sector During the COVID-19 Pandemic and Beyond

### Flexible Work Improves Performance and Builds Utility Resilience

*Analysis by Ethan Louis Cohen, Sruthi Nair*

**SPA:** By year-end 2022, more than 20% of utilities will have permanently changed most employees' primary work locations, using a mix of home, field and office.

**Description:**

COVID-19 accelerated utility digital transformation, driving new capabilities in flexible working. Utility business and technology leaders are changing the composition of work, the configuration of business processes and the structure of operations to not only optimize efficiency but also deliver requisite resilience.

**Why Trending:**

The location of work is shifting. There is little doubt that remote work will endure as a fixture of the post pandemic business environment. Across industries, 48% of employees will work remotely after the pandemic, compared to 30% prepandemic.

The dynamics of work are evolving, with redoubled emphasis on performance, quality and safety. Utilities are revising and streamlining roles, workflows and sources of talent and capability. This has created some short-term improvement but has also made for fragile systems. Organizations are now redesigning their work culture for antifragility with as much focus as they do for efficiency.

Utilities, equipped themselves to operate more flexibly in field work, office work and mission-critical operations during the pandemic. Now they are in the process of expanding their flexible work activity by scaling and further evolving flexible work programs to lower costs, improve performance and mitigate some risks including workforce availability.

**Implications:**

Antifragility isn't just about differently enabling work on the premise of being able to cope temporarily or to snap back to a prior condition. Gartner defines resilience as the ability of an organization to resist, absorb, recover and adapt to business disruption in an ever changing and increasingly complex environment and rebound and prosper. Following the pandemic, utilities will have to focus on becoming more resilient by rapidly adapting work on the fly to unimagined disruption.

Work-from-anywhere requirements prompted by COVID-19 have accelerated some back- and front-office digitalization via adoption of new employee collaboration technologies and engagement platforms. Utilities will need to design remote and flexible work capabilities, keeping in mind the opportunities and challenges around work augmentation and automation technologies. Work-from-anywhere also means charting a detailed, long-term roadmap considering processes, tools, technologies, training and a cultural shift.

While revising skills and roles, utilities must also prepare to execute new work design with implementation and execution capabilities. Changing skills and roles while meeting enterprise cost, performance and continuous improvement requirements will be on par with the change management needed for a major enterprise capability upgrade. Improving skills and evolving roles will take more than a conventional assessment and alignment resource management. Utilities have a wide variety of work types, locations and conditions. Meeting resource needs will be a balance of cost-, risk- and performance-based allocation that is continually adjusted for the ebb and flow of work and work flexibility needs.

**Actions:**

- Make informed decisions about people, process and technology changes by triaging work in the context of critical utility work prioritization. Then, develop tools that support critical prioritization for work types across the organization.
- Identify work and business process issues by mapping lean and agile business design and analysis frameworks onto existing processes. Use this analysis to initiate hacks and to scope investments in technology that improves new ways of working.
- Measure current conditions and determine what is requisite to achieve desired performance in work efficiency, flexibility and resilience then providing technology and tools to measure work through time study, work sampling, analytics estimating and predictive modeling to optimize.

**Further Reading:**

Top Technologies to Address Work Flexibility Needs in the Utility Sector During the COVID-19 Pandemic and Beyond

Flexible Work Practices Improve Utilities' Operational Resiliency

2020 Future of Work Hidden Trends

Remote Work After COVID-19

Building Organizational Resilience Is a Strategic Imperative

### Accelerated IT/OT Convergence Improves Utility Asset and Network Performance

*Analysis by Lloyd Jones, Ethan Louis Cohen*

SPA: By 2025, 40% of new monitoring and control systems in the utility sector will use IoT to enable intelligent operations.

**Description:**

Utility plant and network assets are subject to extreme weather, physical and cyber events, where rapid detection and response positively impact system resilience and a speedy turn to normal operating conditions. Accelerated convergence of the traditional siloes of OT and IT design and operations can improve utility asset and network performance, increase resilience and enable intelligent operations.

**Why Trending:**

Utilities are adding sensors to the grid and to establish asset contexts (for example, environmental conditions and/or asset conditions), with IoT-based devices to augment traditional OT controllers and sensors.

As assets are digitized by sensors, digital technologies — such as digital twins — could intelligently monitor, operate and eventually automate physical infrastructure management.

Digital twins are emerging across assets, plants, networks and systems, increasing enterprise flexibility, reducing risk and cost.

As assets digitalize, the convergence of IT/OT is becoming a common trend across utility organizations, unlocking significant benefit and new capabilities.

**Implications:**

Utility network resilience requires the combination of operational, environmental and system data along with analytics and increasingly AI to monitor, control and orchestrate the utilization of assets. The collection, validation, analysis and transformation of data into insights and decision support entails aggregating disparate data from the field, from the front and back office, and even from situational intelligence and other external sources carried across networks and into utility operational systems (such as SCADA) to enable network setpoint and control decisions. The traditional, siloed approach to IT and OT data collection, aggregation, communication and application integration leaves both significant new capability and value off the table. Leaders have already introduced historians to preserve SCADA data points, and are leveraging this data in back-office applications that are not time critical, such as triggering usage- or condition-based work requests.

Combining operational field and equipment data from IoT and OT time series datasets creates operational insights that can be embedded in operational systems and back-office IT applications to improve coordination and performance across business areas such as:

- Planning
- Work prioritization
- Maintenance
- Staffing

The use of operational data creates context and awareness that can be ingested by machines and subsequently embedded into new operational solutions, spanning from simple event and trend detection to operational decision support and, eventually, automation.

Like IT, OT has a history of legacy proprietary protocols that measure and operate equipment and plant performance. In the past, air-gapped, obscure legacy protocols created an illusion of OT security through obscurity. However, as legacy OT kits are retired and replaced with IP-enabled devices, the potential attack surface will increase. The IEA reports the number of significant cyberincidents nearly trebling between 2016 and 2019. [10] The accelerated convergence of OT and IT provides utilities with both a challenge and a very important opportunity to redesign for the cyber-physical security requirements of digital industrialization.

**Actions:**

- Implement a design authority to oversee IT/OT architecture and product standards and to make the convergence and between OT and IT feasible and pragmatic.
- Reduce risk through an aligned OT/IT architecture with common security and disaster recovery approaches and standards.
- Enable a convergence of IT/OT operational capabilities by investing in IoT and AI platforms that reduce signal latency to create a common enabling environment.

**Further Reading:**

Implement a Design Authority to Deliver Improved Asset Value Supported by an Asset Management System

How Utility CIOs Can Use Intelligent Operations to Achieve Resilience During the Energy Transition

Facing New Threats — Cyber-Physical Systems

OT Security Best Practices

## IT Capabilities

### Utilities Accelerate IoT Initiatives to Aid Operations Improvements

*Analysis by Nicole Foust, Lloyd Jones*

**SPA:** By 2024, 50% of utilities will have progressed in their use of IoT to build dynamic capabilities to optimize processes and improve decision making.

**Description:**

Internet of Things (IoT) is a core building block for digital business and digital platforms. IoT is the network of dedicated physical objects that contain embedded technology to communicate and sense or interact with their internal states and/or the external environment. In addition, IoTs can enable data convergence and alignment across the utility value chain and technology domains: IT, OT, CET and ET. However, these transformation initiatives also highlight key challenges for IT and OT (and increasingly CT), including governance, security and privacy, standards and the need for a unified strategy and architecture.

IoT is becoming a key value creator in four areas:

- Enabling new business models
- Optimizing asset management
- Automating operations
- Digitalizing the full energy value chain from fuel source to kWh

**Why Trending:**

IoT is a digital business enabler. IoT — an ecosystem that can touch and transform assets and products, communication protocols, applications, data, and analytics — continues to expand at a rapid pace across the utility ecosystem as IoT enables convergence across disparate silos. As utilities continue to progress their digital maturity, they need to examine business capabilities that, when digitalized, will improve operational performance, unlock the value and create opportunity.

**Implications:**

The operating conditions for utilities are changing due to the impact of ET, with a focus on building more dynamic capabilities to address aging assets and workforce. Consequently, operational activities are in flux, which requires utilities to revisit and redesign work and asset management.

Ignoring synergies and opportunities across ET, OT, IT and CET will lock organizations into legacy business models, operating philosophy and costs. Utilities need to find operational improvements so that they can be more agile and reduce their cost footprint.

The mantra of “sense, decide, act” drives alignment across business silos. By coordinating energy needs across an expanding and increasingly diverse ecosystem, utility organizations are shifting from an ad hoc technology-centric view of IoT to monitor an assets performance in favor of a more business-operations-centric approach. However, most current IoT projects are focused either on industrial IoT solutions for improving asset performance or commercial IoT systems (general purpose) that are in the domain of engaging customers and addressing integration with prosumers.

**Actions:**

- Get ahead of potential challenges by building a unified business strategy and architecture to support IoT investments and initiatives.
- Establish an IoT center of excellence in IT as a standard service offering across all lines of business.
- Evaluate how IoT can augment operations improvements across the enterprise by working with business leaders to identify use cases and data requirements which meet business goals across the energy value chain.
- Incorporate IoT into your digital business ambition by educating business stakeholders on the potential of IoT, and then collaborate to identify opportunities to expand existing and pilot new uses of IoT.
- Source support from your IT and OT business unit leaders by tasking them to jointly create a roadmap of how IoT will interact with and augment technologies and enterprise systems across IT, OT, CET and ET. This will ensure effective and efficient integration and maximize opportunities in alignment with business objectives.

**Further Reading:**

How Utility CIOs Can Use Intelligent Operations to Achieve Resilience During the Energy Transition

How Utility CIOs Can Deliver Business Value With Digital Twins

Market Guide for Enterprise Asset Management Software

The Energy Transition Question: Do We Need the Grid?

## Enterprise Advanced Analytics Drives the Peak Wave of Utility Digitalization

*Analysis by Sruthi Nair, Ethan Louis Cohen*

**SPA:** By year-end 2025, utility spending on advanced analytics (AA) will double as organizations adopt intelligent operations.

**Description:**

Utilities have long embraced data-driven decision making for optimizing certain operations. However, utilities and analytics are misnomers, resulting in struggles with consistent reporting and have concurrent analytic ambitions that are succeeding in select silos. Data analytics is already improving utility asset performance, and is beginning to progress operations including customer engagement, commodity management and supply chain. Significant advances in technology and changes enabling a business-outcome approach has pushed the focus to analytics targeted at increasing productivity, efficiency and agility. Additionally, utilities are recognizing that AA is critical for delivering autonomous or semi-autonomous examination of data to discover deeper insights, make predictions or generate recommendations. This will enable utilities to achieve strategic goals and address mission-critical priorities. The requisites for utilities to become cost and performance optimization leaders sets the stage for broader and larger investment in enterprise AA.

**Why Trending:**

- The digitalization of utility operations and digital work in particular are driving the expansion of analytics and the kinds of analysis and decision support that are needed across the enterprise.
- Many concurrent new use cases including flexibility markets, distributed energy resources, prosumerisation, EVs, storage and energy management systems into the utility grid demand improved decision-making and operational performance. These new use cases are elevating demand and pushing the boundaries of predictive and prescriptive analytics
- IT and OT convergence promises many transformational opportunities in the asset-intensive utility industry, but face serious challenges with aging assets and infrastructure.
- Focus on business benefits and the expectation of value from data-driven insights and better performance from analytics has reached a zenith, but ROI has been hindered by data acquisition and data management challenges.

**Implications:**

Decision support and the integration of business context analysis for the insights produced by AA is itself becoming an important subject and new area of utility business capability and competence. Scaling AA has a necessary counterpart in systematizing analytics, which requires deep collaboration across technology groups and the business.

AA requires new technical competency and innovation. Some technical challenges hinder the deployment of AA with sufficient portability and agility to be relevant across the enterprise. Technology leaders and analytics teams need to become well-versed in analytics infrastructure containerization and adept at expanding configuration management and orchestration capabilities.

Additionally, as utilities plan to look beyond gathering insights from datasets, the emphasis must be on algorithm library management and enterprise-level data management. The groundwork for automated access, governance and standardization of data, visualization and predicting/prescribing next best actions must be laid for scaling enterprise-level AA.

AA use cases for utilities were previously limited to select operations (production planning and asset management). The application of AA can now be explored and exploited in support functions, with a focus on business value and not just the sum of all current requirements. Utility business and technology leaders need to take a portfolio view and negotiate which enterprise AA initiatives contribute the most to an overall vision of what data and analytics should do for the organization.

While planning to expand the use cases of AA, utilities must initially stick to their existing solution and expand organically for specific use cases. If the current solution cannot extend and expand as per requirements, utilities must look for turnkey solutions that align to their business and technical goals and not vice versa (keeping in mind the growing offerings provided by AA market solutions). A case-to-case basis approach needs to be proactively taken to assess the impact of AA on different business goals and then accordingly democratize the applications of AA across the enterprise.

**Actions:**

- Maintain a persistent focus on enterprise business value for AA, while at the same time experimenting with new techniques that are aligned with use cases that will be needed in the future.
- Evaluate the business case for enterprise AA, seeking to identify the portions of the investment that are precursors for supporting AA and are primarily for the development of models. Prioritize investment in models that are supportable with existing delivery capability for near-term benefits capture and value optimization.
- Reassess your data and analytics delivery model, evaluating how successful the organization is at keeping control over the advanced models that are in production versus developing new models. Where gaps are recognized, invest in supporting additional scale in order to increase enterprise benefits and value.

**Further Reading:**

Advanced Data and Analytics: What Do Leading Organizations Do?

Assessing Containerization for Advanced Analytics Initiatives

How Utility CIOs Can Use Advanced Analytics and AI to Improve Load, Price and Weather Forecasting

### Scale in Utility AI Investment Expands Benefits and Value

*Analysis by Ethan Louis Cohen, Nicole Foust*

**SPA:** By 2025, 50% of enterprises will have devised AI orchestration platforms to operationalize AI, up from fewer than 10% in 2020.

**Description:**

Increasingly, utilities create more business value by focusing on productionalizing AI in operations and scaling AI orchestration for hundreds or even thousands of AI models across the enterprise, versus piloting tens of use cases in discrete parts of the organization.

**Why Trending:**

Defining and obtaining ROI for discrete AI is very difficult because disconnected AI is a gambit. Broad-scale AI operationalization is of high interest to utility organizations for problem solving that can be applied across wide-ranging business and operations issues.

Utility technology leaders have too often and mistakenly overstated the virtue of discrete AI models and have missed the chance to scale AI, which is requisite to address the biggest issues in utility business and operations.

The future of both business and technology groups will depend on AI diversity and broad-based knowledge, capability and innovation. Reinforcing existing operational siloes and failing to exploit organizational knowledge is antithetical to utility fundamental needs for lower cost and risk and higher performance and ability.

**Implications:**

Niche AI models targeting sharply bounded use cases often fall short of business expectations, can short circuit ambition for further AI development and can magnify the problems of at scale AI implementation. Many AI models will fail but far more will succeed, particularly as AI development teams increase their skill in deployment, and, more poignantly, as the organization is increasingly able to integrate and orchestrate AI for more AI.

By investing in operational AI infrastructure and enabling AI orchestration, utilities are better positioned for achieving future value. While most utilities are developing AI, few are achieving significant business gains. With the growing awareness that the biggest issues with AI are not technical, but rather a gap in how to scale AI across the enterprise and capture value. Utilities need to operationalize AI by following the intelligent operations model that creates a framework of investment and related benefits that can be reused and leveraged across operations, particularly asset operations and service delivery lines of business.

The majority of utilities are planning to use a combination of build, buy and outsource to acquire AI, productionalization and orchestration. The ability to integrate these AI production and delivery modes will become the most valuable skills and capabilities in the organization, and will not be owned by IT. Likewise, in AI, scaling will be of the most difficult and expensive capabilities to source outside of the organization or to build quickly and effectively internally without focused investment beginning now.

**Actions:**

- Begin evaluating AI orchestration capabilities that IT can offer as a service by viewing it as a framework for what options the organization has and the trade-offs it will make as it brings the components of AI scaling together. Don't view AI orchestration as a tool.
- Collaborate with business leaders, particularly utility asset and product owners, to make important decisions about the operating model for AI including people, process and technology changes. Look at the issue of scale and the cost of earning a return on AI. Then, develop the first iteration of AI scale across delivery models; build, buy and outsource.
- Design and widely share an enterprise business case for AI. Make the business case costs and benefits detailed enough to highlight the challenges of discrete AI development and the virtue of scale and operationalization. Ideally, everyone in the enterprise will gain a sense for how impactful AI will be and an intuition about the ingredients that will make exponent AI technology a driver of exponent business value.

**Further Reading:**

Predicts 2021: Operational AI Infrastructure and Enabling AI Orchestration Platforms

AI Operationalization in Energy and Utilities

How Utility CIOs Can Best Plan for Artificial Intelligence

## Evidence

This research was developed using a combination of evidence including information from analyst interactions with energy and utility companies and technology providers from 1 January 2020 through 18 December 2020, as well as analysts' secondary research.

[1] Hydrogen Production: Electrolysis, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy.

[2] Hydrogen Global, World Energy Council.

[3] Electric Vehicles, IEA.

[4] Energy White Paper: Powering Our Net Zero Future, GOV.UK.

[5] Global Energy Storage to Hit 158 Gigawatt-Hours by 2024, Led by U.S. and China, Greentech Media (GTM).

[6] A Behind the Scenes Take on Lithium-Ion Battery Prices, BloombergNEF (BNEF).

[7] Energy Storage, IEA.

[8] New Technology Improves Next-Generation Aqueous Flow Batteries, SciTechDaily.

[9] Energy Storage, California Public Utilities Commission (CPUC).

[10] Power Systems in Transition, IEA.

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