



Reimagining success in a data-driven world of utilities

Executive summary

The utilities sector in the United States has been experiencing a digital transformation for the past decade. Utilities have transformed daily administrative and some business operations, but still have a long way to go in digitizing the infrastructure lifecycle.

The COVID-19 pandemic led to a substantial acceleration in this transformation, as businesses in every industry reimagined the way they operate. They've had to manage changing customer expectations and evolve to become more data-driven to meet the challenges of a more digital future.

And the pressure is on to deliver with the passing of the \$1.2 trillion Infrastructure Investment and Jobs Act (IIJA); including \$500 billion for transportation, \$90 billion for transit, \$55 billion for water, \$73 billion for energy, and \$50 billion for overall resilience. Funding has historically been a major barrier to addressing aging infrastructure, and the public will expect significant improvements with this infusion of money into the nation's infrastructure. Much of the IIJA is tied to sustainability, resilience, and righting the wrongs of the past within disadvantaged communities. The key to optimizing every hard-earned tax dollar is investing in digital technology to direct the funding wisely.

As the utilities sector becomes greener and more sustainable, there is a strong push for greater efficiency, cost reduction and reorganization of established operating models. This is driven by rapid digital adoption and the introduction of advanced technology such as artificial intelligence, augmented reality and the Internet of Things (IoT), and the corresponding rise in the volume and variety of data this introduces.

Utilities businesses have a key opportunity now, to reimagine what is possible and evolve to become more connected through data, more responsive, and more agile than ever before. This will help to overcome the biggest challenges in the United States in delivering cleaner energy at scale while achieving greater water security for the future.

Advanced new use cases around design, safety, new service delivery and predictive maintenance are rapidly becoming possible. But to realize these opportunities, organizations in the sector must scale and advance current network infrastructure to underpin a holistic shift to digital services. In many cases, this will require a significant shift in the way utilities are managed and services are offered. The utilities sector, like the architecture, engineering, and construction (AEC) industry, must adopt a data-driven and platform-centric approach to the design, delivery, and renewal of assets under management.

In the United States, we're seeing significant potential for utilities businesses to deliver faster defect resolution, enhanced, more seamless compliance processes and a significant increase in productivity and efficiency. These positive steps are powered by actionable, data-driven insights across lines of business.

With complex new regulatory, safety and environmental challenges driven by the climate crisis already facing utilities, existing issues like departmental silos, legacy data and systems are increasingly difficult to tackle. These pressures, plus the ongoing changes to funding models, mean that shifting to digital is no longer a nice-to-have, it is business-critical to remaining both relevant and competitive.

This guide, *Reimagining success in a data-driven world of utilities*, looks at some of the biggest challenges facing organizations in the sector, and how digital is enabling businesses to unlock the power of data for a more connected, efficient future.

It is designed to help you shape your thinking about where the biggest opportunities lie for utilities businesses like yours, and help you identify constructive, innovative solutions to some of your most pressing challenges.



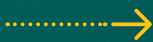


Contents

01 How digital transformation is shaping the energy market in the United States



02 The biggest challenges facing water utilities



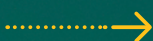
03 Unlocking the power of digital transformation for a more connected future



04 Success story: Jacobs Engineering



05 Conclusion



01

How digital transformation is shaping the energy market in the United States



What are the biggest challenges facing the energy market today?

The US energy market faces the reality of an increasingly disruptive future for consumption and a steady decline in the traditional markets of oil and gas. There is a strong push by utilities businesses to drive greater operational efficiency and increased operational excellence as the sector shifts from traditional fossil fuels to renewable energy.

Global demand for fossil fuels is projected to peak between 2023–2025 and make up just 43% of global energy demand by 2050.¹ While fossil fuel generation continues to produce nearly 61% of the electricity in the United States according to the US Energy Information Administration,² this is declining. New shifts towards an array of smaller-scale, widely dispersed wind and solar generators, grid-scale batteries, and enhanced demand response mean there has been a rebalance in energy priorities.

Managing this change is one of the biggest challenges facing the energy market today, as it looks to transform rapidly to meet changing demands, while transitioning to new operational realities to meet clean energy needs that are growing exponentially.

With this shift to cleaner and more innovative renewable energy sources, there is a strong need to upgrade the US electric grid to accommodate the delivery of energy and input of energy into the network from hybrid sources. At the same time, the energy market is opening up as it becomes increasingly easier to enter the sector.

Agile new competitors, unburdened by legacy infrastructure and increasingly digital in nature, are beginning to take market share from bigger, more established utilities businesses. To compete effectively, utilities must enhance their network infrastructure to achieve greater scalability while supporting digital services to improve customer experiences at every touchpoint.

Methodologies, energy storage and network distribution capabilities, and the technology that underpins them, are evolving at a fast pace too, which has placed a premium on digital, data-driven operations. Businesses that are slow to transform, and too reactive as a consequence, are rapidly being left behind as digital provides connected organizations with new opportunities for growth.

With advanced new technology and efficient operating processes and workflows rapidly becoming the norm, there is a corresponding increase in data volumes and complexity across the sector.

Too many utilities organizations struggle with large amounts of unused legacy data and near-obsolete systems which simply cannot handle a future where IoT, 5G and artificial intelligence (AI) offer ever greater flexibility and speed. This means these organizations need to become faster, more connected, and smarter than ever before.

Managing data lifecycles efficiently to drive maximum value is increasingly important. Businesses need deep insights, real-time, actionable analysis, and advanced capabilities to help drive higher productivity, resolve errors quickly, and run predictive maintenance before potentially damaging issues arise.

¹ McKinsey, Global Energy Perspective 2022, [mck.co/3QjpxCd](https://www.mck.co/3QjpxCd)

² US Energy Information Administration, <https://www.eia.gov/tools/faqs/faq.php?id=427&t=3>



What is driving these changes?

Extreme weather events are contributing to the need for change in the utilities sector. As we shift into an era where increasingly unpredictable weather patterns bring the potential for catastrophic events, utilities businesses must become more responsive and increase predictive capabilities to better manage impacts. These events can cause significant service disruption as well as wide-scale destruction of utility assets that can leave whole regions unable to access critical services such as energy, water, and sanitation. We saw this in action during the extreme winter storms in Texas in 2022. Data is going to play a critical role in key decisions about the viability of utilities and assets following catastrophic events.

New safety, compliance and regulatory requirements have also aligned with rising pressure to improve performance. Utilities have looked to new technologies such as real-time data analytics through IoT and augmented reality (AR) to give staff access to timely asset information, enable predictive analytics of asset portfolios, and remotely guide field workers to tackle outages safely, while minimizing service disruption.

Asset protection, design and building workflows are other areas where challenges are driving innovative approaches and the rapid adoption of new technological capabilities. The industry is seeing a significant increase in the use of advanced building information modeling (BIM) to enable greater insight and control as a way of meeting the need for an efficient energy ecosystem. One that is rapidly becoming more connected and aligned to changing delivery needs while embracing increased knowledge sharing to enhance intelligent collaboration.

Growing and ever-more-complex cyber security challenges are being addressed by utilities themselves, as well as government at the state and federal level. Finally, the rise of advanced use cases and connected ecosystems plays an important part in the shifting energy landscape. Sales of electric vehicles are increasing in the United States, while smart devices, connected homes, and the smart city of the future all require utilities to have greater control over the generation, storage, and delivery of energy.





Where are the opportunities to do things differently?

The pace of technological change within the utilities sector presents exciting opportunities to think differently and reimagine what is possible to overcome some of the sector's biggest challenges. To position for a data-driven future, businesses must become more connected internally, as well as with each other, through enhanced collaboration, information sharing and better data management.

This means driving more transparent planning processes across every area of operations—from network and substation conceptualization to build and design processes—to increase efficiency around every area of energy storage and distribution.

Implementing BIM can help identify a more streamlined, cost-effective, and intelligent design and construction process, while data-driven insights, AI and predictive analysis can enable better planning, asset management and safety protocols. Accelerated transformation and advanced new digital capabilities are enablers of reduced cost, greater efficiency, and increased visibility around business-critical KPIs.

Becoming increasingly digital means better leveraging technology like AR and IoT to improve the safety of workers and teams while enhancing performance, and a move away from entrenched operational silos. Legacy data and systems that still dominate many established utilities hamper greater agility and responsiveness to pre-empt change and new challenges. They must be modernized to drive greater responsiveness, opening opportunities to democratize data through a common data environment (CDE), and enabling increased visibility within a portfolio of assets.

Increasingly, network infrastructure modernization is the key that will unlock potential across a diverse array of use cases within the sector and help drive greater value for both utilities and their customers.

Shifting core operations to the cloud will enable far greater flexibility and stronger information management workflows across everything from the civil infrastructure that supports the assets and substation design to operations and maintenance of the assets.

Utilities across the United States must accelerate this transition to the cloud to facilitate greater operational performance and meet a new generation of energy requirements. If nothing else, this will ensure that data is made available in real time and is the most up to date when critical decisions are required. Doing so will enable data-driven insights, greater visibility across lines of operation, and enhanced employee experiences to drive consistently higher standards of sustainable service delivery.



Executive checklist



New generation of energy means utilities need to reimagine the way they operate.



Investing in digital technology will enable utilities to maximize value from IIJA funding and improve resilience and sustainability.



Utilities must enable greater data sharing to drive increased visibility of asset operation.



Businesses must evolve to meet new safety, compliance, and regulatory requirements.



Enhanced collaboration through better data management can help unlock opportunity.



Utilities businesses are looking to harness technologies such as AI and machine learning to solve challenges.



Cloud information management is critical for utilities to be more efficient, secure, and agile.



02

The biggest challenges facing water utilities



Understanding the growing impact of digital within the water sector

The impact of accelerated transformation across the water sector has been profound and ongoing, with significant changes across key areas of water model flood planning.

The catastrophic and unprecedented flooding of 2022, such as the flood that took out the drinking water system of Jackson, MS, will also drive significant changes to the way land is used and how flood defenses are planned. In the immediate term, there will be changes in flood-resilient infrastructure design and flood emergency response technologies for public safety too.

Digitalization and digitization of the water sector has enabled utility owners to fully understand the breadth of the enhanced asset protection measures and safety planning required, including for treatment plants, pump stations and remote area assets, which have traditionally been complex and expensive to manage and repair.

As water security becomes an increasingly critical element of civil planning, new water infrastructure projects are key to maintaining and growing water pathways and delivery. Increasingly, intelligent design, innovations, and new digital capabilities must come together to help deliver sustainable, efficient long-term solutions. Digital twins—an exact digital replica of a physical asset including all the associated meta- and asset information data—are increasingly being used in the operation of assets. By using digital twins for water, industry professionals are reimagining the way water and wastewater is transported, distributed, and stored.

BIM is also shaping the way utilities operate to enable greater visibility and control with less waste. But even greater efficiency and more collaborative approaches are required to ensure that US water treatment and supply is truly sustainable.

Delivering on future requirements depends heavily on bringing together advanced predictive modeling, intelligent planning and careful asset and resource management to ensure utilities operate more efficiently and collaboratively.

Cities, from Los Angeles to Houston to Washington, DC, are already tackling issues around greater sustainability, conservation, and efficiency of water pathways and the systems that support them.

Technology and innovation have a huge role to play in delivering secure, sustainable water pathways across everything from wastewater management to water purification objectives and storm water harvesting.



What is driving these changes?

While total US urban water use declined over the past decade due to more water-efficient household appliances and industrial processes, the juxtaposition of human population and water availability are at odds with one another.³ This means that utilities and government agencies across the United States need to work more closely together to enable more connected, efficient, and protected water pathways for major cities and rural outposts. Time will tell if IJIA funding seeds further development of regional partnerships as a key opportunity for utilities organizations to align their ambitions with the direction of travel.

By increasing investment in R&D and driving growth through innovative new use cases that represent significant efficiency, design, and performance improvements, utilities can seize new opportunities.

Water and wastewater are, of course, essential services required for every major US city across the country. And because the legacy systems and infrastructure used to deliver these services are constantly in use, preventative asset maintenance and continual monitoring and analysis are crucial to ensuring secure supply with as little wastage as possible.

Building new, sustainable, and reliable infrastructure and networks is a key challenge for utilities in solving some of the most pressing issues around the efficient delivery of reliable water services. Businesses in the sector must look to drive innovation and efficient, sustainable new ideas across everything from water pumping systems to storage capabilities, delivery networks, and reservoir design.

With this push to increase the security and stability of water pathways and systems comes the increased need for utilities to improve workplace safety, as well as continually align with rapidly evolving regulatory changes.

³ USGS, Blue Circle





Where are the opportunities to do things differently?

As utilities accelerate transformation across almost every area of operations, there are opportunities to realize greater efficiency while reducing costs and improving safety.

Preventive modeling for asset planning, structural condition, operation, and intelligent design offers potential for substantial improvements in infrastructure—to be safer, more secure, and reliable.

Information modeling can enable increased sustainability and visibility with greater use of real-time data supporting better water and wastewater management for both urban centers and rural areas.

By accelerating the shift to data-driven, digital-first systems, utilities can create more connected ecosystems too. This opens opportunities for greater data integration, infrastructure collaboration, and increased visibility throughout the water ecosystem.

Executive checklist



Water security and efficient delivery is an increasingly critical aspect of civil planning.



Technology is ready for the changes to flood management that will result from the recent unprecedented flood events.



Asset protection, safety planning, and preventive maintenance are business-critical priorities.



The IIJA is funding an unprecedented number of water infrastructure projects.



Utilities are focused on use cases around efficiency, design, and performance improvements.



Technology platforms and data modeling are enabling the fusion of hardware and software applications such as AR and IoT, and are underpinning greater field safety for utility workers, real-time asset management, and better adherence to evolving regulations.





03

Unlocking the power of digital transformation for a more connected future



Increased productivity and efficiency

Digital is rapidly becoming the operational norm within the utility sector in the United States, given its need for greater capacity, increased productivity, and higher efficiency.

The 2021 Report Card for America's Infrastructure by the American Society of Civil Engineers (ASCE)⁴ promotes the use of asset management best practices that can take advantage of opportunities in the planning, design, construction, and operation of infrastructure to meet the needs of tomorrow. Recommendations for reform include being 'digital by default' in our approach to the creation of the built infrastructure environment. Going 'digital by default' is not simply the digitization of processes, but a complete reimagining of all processes, leading ultimately to better quality and better delivery of services to all stakeholders.

However, for the utilities sector to embrace 'digital by default', acceleration of transformation is required as utilities are at varying degrees of digital maturity. And to leverage the opportunities of the medium to long term, a concerted, collective effort to increase the adoption of digital processes is crucial to delivering on broader ambitions around growth, sustainability, and safety.

In order to drive the required increases in both productivity and operational efficiency, organizations require digital capabilities, workflows, and integrated technology that can enable intelligent transformation. This means bringing together vast amounts of data into a secure, common environment to provide a single source of truth, where departments, teams, and people have access to high-quality insights and analysis.

But utilities cannot simply flip a switch on transformation and hope for the best, and this is where a clear understanding of the true value of transformation is critical. Shifting to a platform model is increasingly the foundation upon which organizations can reduce costs, drive operational efficiency improvements, and become more connected, integrated, and intelligent.

Doing so requires a strategic partner with the expertise and experience of working with large-scale global organizations on cloud-based transformation projects, as well as industry-standard technology that is reliable, trusted, and secure.

Shifting to the cloud is nonnegotiable in today's data-driven world of business. The faster utilities shift to the cloud, the sooner they can improve their asset management programs, deliver better, more precise employee health and safety workflows, and upgrade field labor management initiatives.

With a move to the cloud comes increased operational agility, significant cost reduction, and greater network reliability. This increased connectivity enables greater collaboration across lines of business, breaking down operational silos and making high-value, data-driven actionable insights available to everyone as part of a common data environment.

The result is empowered decision makers and project and engineering teams armed with the visibility, insights and tools they need to excel through enhanced collaboration. Teams can perform to higher standards and operate efficiently with intelligent, seamless workflows designed for real-world scenarios.

A platform model enables utilities to enhance performance across every area of business, from initial product and infrastructure design and engineering processes to increased data integration throughout the entire business, with reliable data lifecycle management to drive greater productivity and efficiency.

⁴ Report Card for America's Infrastructure, American Society of Civil Engineers, <https://infrastructurereportcard.org/>



Platform capabilities for data integration

Moving to the cloud, and a platform model, means embracing the technology, software tools and digital capabilities required to support a data-driven approach, and being able to meet the challenges of a sustainable, connected energy and water future.

Utilities must accelerate their transformation journey and evolve the way they operate to become truly digital-first, turning both legacy and real-time data into actionable insights that underpin intelligent processes, workflows, and decisions.

Digital twins are one way that utilities are already maximizing the value of complex data to enhance business intelligence—integrating BIM data from the very outset of every process to create and share digital twins with building owners and operators.

By making data part of the process from the outset, utilities can increase visibility across lines of business, pre-empt potential challenges, and deliver with greater precision and assurance. This approach enables more sustainable, safer infrastructure and network design with smarter facility management and proactive asset management too. It means that utilities can identify and prevent failures before they become operational issues, and improve both the safety of employees as well as the communities their networks serve. By ensuring every project is digital from start to finish, utilities can improve data lifecycle management and help ensure efficient planning processes.

An increasingly digital future, with better design models and data-driven construction decisions, means utilities can minimize costs and drive greater efficiency of resources. With a CDE and a single source of truth, high-value, deep insights and analysis can also support intelligent predictive maintenance processes and increased data collaboration across lines of business.



04

**Success story:
Jacobs
Engineering**





Jacobs Engineering

Jacobs

The US population has doubled in the last 50 years, and most states face yearly water shortages as a result. An exception to this is Dekalb County. Located in north-central Georgia, the county sees 40% more rainfall than the majority of US states. While that might be seen as fortunate, it's a double-edged sword for Dekalb Watershed Management. To avoid sanitary sewer overflows and other issues, the company partnered with Jacobs Engineering to calibrate the wet weather flows in the county's water system .

Key challenge

With such high rainfall, Dekalb Watershed Management needed a complete overview of the water system, particularly to assess any unseen leaks, illicit water hookups, and rain-derived inflow and infiltration (RDII). Not addressing these issues could have resulted in sanitary sewer overflows (SSOs) and other complications.

On top of this, Dekalb Watershed Management also had to account for changes in groundwater during the wetter months of winter. Traditionally, the RTK method has been used as it's a simple and reliable method of characterizing system response to wet weather. For Dekalb County, however, the heavy rainfall, snowfall, or snow melt would make this method much less reliable.

Solution

In order to manage the impact of the county's rainfall and wet winters, Dekalb Watershed Management decided to partner with Jacobs Engineering to conceptualize a more flexible and reliable way of modeling wet-weather flows.

Rather than rely on the more traditional but less reliable RTK method, Jacobs Engineering used Autodesk solutions to create a comprehensive groundwater infiltration model (GIM). With the GIM in place, the Dekalb team now had the ability to significantly increase the accuracy of its calibration of soil and ground conditions, to simulate antecedent moisture conditions

and the highly attenuated response that occurs from certain rainfall events—something that is often hard or nearly impossible to model.

“Building out the GIM allowed us to dynamically account for increases in groundwater, instead of relying on monthly multipliers during the wetter months...it gave us better results. Now our model is able to keep up with the increase in groundwater.”

Jacobs Engineering⁵

Result

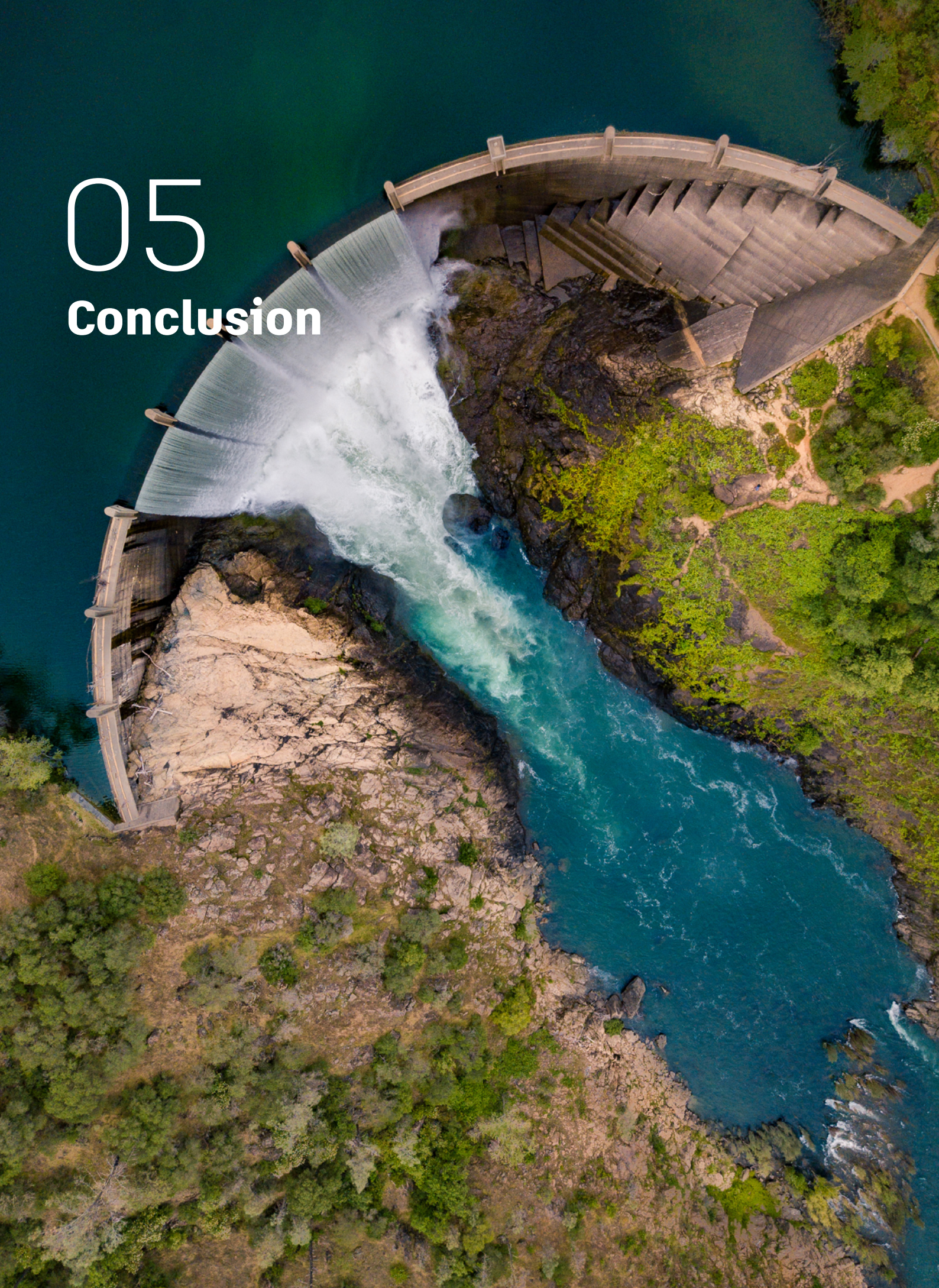
Thanks to Jacobs, the Dekalb team was able to clearly see where the worst water flow problems were located. As an added benefit, it was also able to identify illicit water hookups made by homeowners in the area. Today, the system means Dekalb Watershed Management can dynamically account for increases in groundwater and protect the county's systems from any problems—no matter what the forecast holds.

⁵ <https://www.autodesk.com/customer-stories/jacobs-dekalb-county>



05

Conclusion



A new future for utilities that is connected, efficient, and data-driven

US energy and water requirements are changing fast as increased demand, evolving customer expectations and the increasingly detrimental limitations of current networks and infrastructure create new challenges for utilities businesses.

The accelerating shift to renewables also means that organizations must evolve to fulfil new requirements demanded by a transition from fossil fuels to a more diverse energy model.

The evolution of our energy landscape demands greater operating efficiency from utilities. The water sector must drive operational improvements across every area of its water and wastewater ecosystems to ensure greater security of supply and increased safety, with as little wastage as possible.

To meet the challenges of the immediate future and seize the opportunities to unlock growth, utilities businesses must become digital, connected, and responsive while staying one step ahead of new market entrants who are less encumbered by legacy infrastructure and technology. Moving to a cloud-based platform model is critical for enabling advanced use cases and increasing organizational cohesiveness, while enabling greater collaboration through better use of data.

Key recommendations for business leaders:



1. Utility asset owners are reimagining the way in which they manage their assets. This needs to be consistent across their enterprise.



2. Data is one of the most valuable assets for utility owners. Understanding the genesis and the lifecycle of data is key and will ultimately unlock digital twins for efficiency in operations.



3. There is huge opportunity for digital transformation in the utilities sector—in particular for new and asset-renewal projects.



4. The time for change is now—new sources of energy, an ever-changing climate, and significant and prolonged weather events are placing pressure on utilities to continue to deliver services and strive for operational excellence. Digital transformation and data is the key to unlocking the future of the utilities sector.





Autodesk is already a strategic partner to major utilities businesses across the globe, and brings advanced technology capabilities to support intelligent design, seamless collaboration, and smart automation.

We can enable utilities businesses like yours throughout the United States to reimagine what is possible and to design and create customized solutions with powerful BIM and CAD tools supported by a cloud-based common data environment.



The Autodesk platform facilitates project delivery from early-stage design through to final construction. Visit our [website](#) for more in-depth information about our current products and solutions or [get in touch with one of our experts](#) to discuss how we can help support your business ambitions.





www.autodesk.com

Autodesk and the Autodesk logo are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product and services offerings, and specifications and pricing at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

© 2023 Autodesk. All rights reserved.