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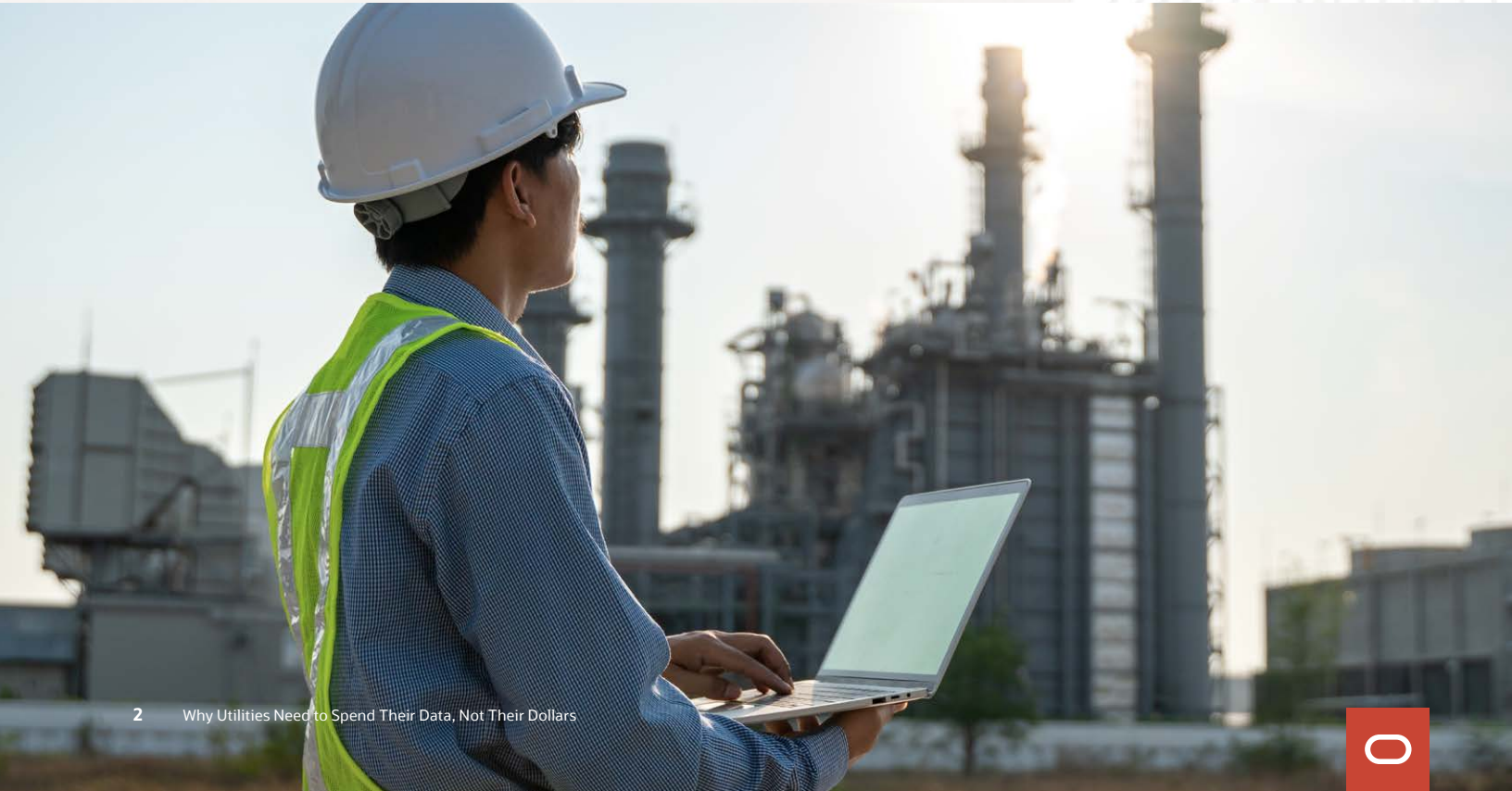
Why Utilities Need to Spend Their Data, Not Their Dollars

Technology innovation and better information
are vital to success in four key areas.



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Capacity challenges, the pressures of climate change, technology innovations, and heightened customer expectations are turning the old, somewhat predictable utilities model upside down.

Electricity providers are spending billions of dollars to update their facilities. They're shutting down coal-burning plants and replacing them with solar and wind farms. They're modernizing their distribution networks to accommodate the growth of electric vehicles (EVs). And they're trimming trees, moving electrical lines underground, and taking other preventative measures to alleviate the impact of increasingly unpredictable weather events.

"There's not enough dollars in the world to do all the things that we need to do, but there's loads of data, so spend your data, not your dollars," advises Mike Ballard, vice president of industry strategy for Oracle Energy and Water.

Utilities are starting to "spend data" in several ways. By analyzing data from smart meters, weather sensors, and energy sources, they're better able to predict power generation and demand patterns and optimize their grids accordingly. They're also using data to track and measure the impact of distributed energy resources (DERs) controlled by customers and third parties, such as rooftop solar panels and wind farms.

Operating in an industry whose people are retiring faster than they can be replaced, utility companies are also using data-driven applications to attract, retain, and retrain skilled workers, as well as improve worker safety. They're also analyzing data to help customers reduce energy and water usage and—in a bid to build more personalized, profitable relationships—advise them on the rate plan that aligns best with their consumption patterns.

Modern utilities are engaging more deeply with their customers in general by, for example, recommending the most cost-effective time to charge their EVs, offering seamless solar/DER connections, and providing total care service plans for electric appliances and systems. That kind of customer relationship will be key for long-term profitability, but the data that's generated will be even more valuable.

In the four chapters that follow, we explore these and other data-driven industry priorities in more detail.

1 Modernize aging infrastructure and systems

Aging infrastructure is a major stumbling block for utilities, as countries simultaneously attempt to forestall or mitigate infrastructure-related disasters and grow their electric grid to support skyrocketing demand.

One of the biggest concerns with aging infrastructure relates to safety. When malfunctioning assets cause wildfires, explosions, or flooding (or worse with nuclear plants), utilities must respond quickly to restore power and assist the affected community in recovering. Rigorous disaster response plans are of paramount importance.

Then there's the issue of insufficient capacity. Beneath the threat of climate change and the enticement of new alternatives to gas-guzzling machines—electricity-powered vehicles, appliances, lawn tools, and the like—lies an uncomfortable truth: The legacy electric grid isn't prepared to handle the ambitious net-zero carbon goals set by governments, regulators, and utilities. Meanwhile, the number of power-hungry data centers is growing rapidly.

Utilities are approaching the capacity challenge from different angles.

- They're investing in smart grid software to match electricity supply with demand in real time while helping control costs. Smart grids use sensors and smart meters to enable two-way communication between utilities and their customers' energy devices. The benefits include bidirectional communication and control of devices, more efficient power distribution, and better management of blackouts and other power disruptions.
- They're also replacing old meters in customers' homes with smart meters, which generate detailed information on customer energy consumption patterns. With this data, utilities can develop programs that motivate consumers to reduce their electricity and gas use during periods of high demand.

For example, an electrical power grid company in Asia uses smart meter data to alert customers when they're reaching their target energy usage level. In addition, the smart meters track how much rooftop solar energy customers use so that they can divert excess energy to other homes.

Smart meter data can also reveal when a customer has bought an electric vehicle. With that information, utility customer service reps can further engage with the customer by advising them on the most cost-effective and energy-efficient times of day to charge their vehicle. “Customers have to become active participants in the grid,” says Allison Salke, senior product marketing manager with Oracle Energy and Water. “They can’t just be consumers—utilities have to encourage us to use our behaviors to lessen the strain on the grid.”

- Electric utilities are upgrading their infrastructure with sensors to monitor far-flung equipment and distributed power sources, enabling technicians to prevent failures before they occur. Sensors embedded in equipment at the grid edge can “talk” to each other, quickly locate faults, and, using AI, address those faults without guidance from a central control room. In situations where, for example, a fallen power line might start a wildfire, the sensors can de-energize the line in microseconds.

Ultimately, there’s not enough money in the world to fix all the aging infrastructure, Ballard says. “We’ve got to use data and digitalization and automation to mitigate this issue, in addition to the physical work of replacing and maintaining it,” he says. “If you have limited resources, you have to start doing the job smarter.”

America’s Infrastructure Gets a C-Minus

For the first time in 20 years, US infrastructure is out of the D average range. Here are the grades in several categories.

Rail: **B**

Energy: **C-**

Drinking water: **C-**

Waste water: **D+**

Storm water: **D**

Dams: **D**

Source: 2021 Report Card for America’s Infrastructure, American Society of Civil Engineers. Grades are based on capacity, condition, funding, public safety, future need, and other criteria.

2 Invest in sustainability and renewable energy—while ensuring uninterrupted service

The transition to renewables has upended the way utilities forecast the energy available at any given time. Large utilities used to predict the volume of power coming from a set number of power plants. Now, they may be balancing hundreds of thousands, or even millions, of DERs that provide fluctuating power levels based on sun, wind, and other weather conditions and the time of day.

These DERs are assets that generate, store, or consume energy, and they're usually placed near the point of consumption. They include rooftop solar panels, personal wind turbines, and battery storage. For example, some EVs, including the Chevy Bolt and the Ford F-150 Lightning, allow owners to use the vehicle battery as a generator, as it carries enough charge to keep the power on for about three days in a typical home (or up to 10 days for highly energy-efficient homes). Although the shift to renewable energy is sometimes seen only as a response to climate change, it's also crucial to expanding the capacity and ensuring the stability of the grid.

For example, a gas and electric company in the southwestern United States takes advantage of the region's sunny weather to meet a significant portion of its load through customer-owned solar DERs. Currently, the utility manages DERs responsible for 2 gigawatts of energy—enough to power about 1.5 million homes. The utility faces a challenge in understanding where DERs are connected and how they impact demand. It uses an energy distribution management system to see all generation resources on its grid, and it creates output forecast models for each DER asset and customer load based on cloud cover. Usually, a DER belongs to a single customer, but a 2022 US Federal Energy Regulatory Commission order declared that bundles of DERs, such as groups of home solar arrays or EVs, can send power to the grid.

As the use of renewables grows, utilities are implementing grid-level energy storage to meet power demands when the sun isn't shining or wind isn't available. These storage systems let

utilities capture energy when it's abundant and release it during peak consumption periods. Currently, most stored grid-scale energy comes from pumped-storage hydropower, where water is pumped into reservoirs and then released to generate electricity when needed. However, this type of power generation is location-dependent. As a result, utilities are starting to look to grid-scale battery storage, which can be located anywhere, in almost any configuration.

Several factors are driving the switch to renewable energy. Power generation and heating, combined, are the single largest source of greenhouse gas emissions, generating more than 15 billion tons of CO2 annually, according to the US Environmental Protection Agency. To reduce these emissions, governments and utilities are investing trillions of dollars every year to shift energy generation from fossil fuels to more renewable sources. Globally, new laws and regulations are making it much more difficult and expensive for utilities to develop and maintain their coal- and oil-fueled infrastructures.



Conversely, governments worldwide are incentivizing utilities to invest in renewable energy. For example, the US Bipartisan Infrastructure Law, passed in 2021, allocates funding for renewable energy in four key areas: \$21.3 billion for clean power delivery, \$21.5 billion for clean energy demonstrations, \$6.5 billion for energy efficiency and weatherization retrofits, and \$8.6 billion for clean energy manufacturing and workforce development. Following passage of



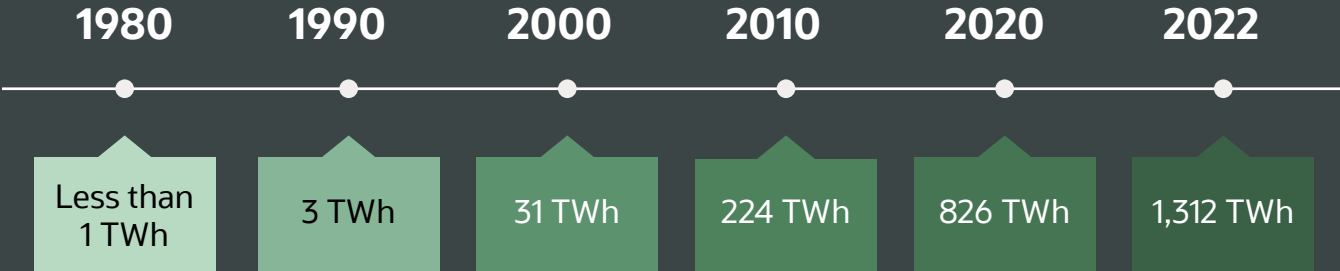
the law, the US Department of Energy (DOE) launched an initiative to speed deployment of transmission lines to connect citizens to cleaner, cheaper electricity while improving grid reliability.

Elsewhere, the Australian government has budgeted AU\$20 billion for grid and infrastructure modernization and AU\$600 million to support decarbonization of industrial facilities, according to the Australian Department of Climate Change, Energy, the Environment, and Water. In Germany, the 2022 Renewable Energy Act abolished the surcharge consumers paid for renewable energy. This was initially to lower electricity prices and encourage consumers to move to electric vehicles and heating systems. However, it has subsequently provided some relief from the high energy bills caused by Russia’s war with Ukraine, which led Russia to halt gas exports and Germany to embargo Russian oil imports.

In addition to these regulatory pressures and incentives, shifting demographics play a huge role in electric utilities’ move to renewables. Even controlling for gender, education, and political identification, younger adults are far more likely than older ones to prioritize renewable energy development, according to research published in the US National Library of Medicine. As a result, utilities must cater to a customer base that increasingly insists on renewable options.

Solar and Wind Power Take Off

Estimated terawatt hour increases generated by these sources since 1980.



Source: Energy Institute, Statistical Review of World Energy (2023)



3 Attract and engage customers in a competitive utilities marketplace

Until fairly recently, consumers had little choice but to buy electricity from their regulated monopoly provider. Other than when paying the monthly bill or experiencing a power outage, they spent little time thinking about their local utility.

Now, customers have more choice in the form of private energy providers and their own power-generation capabilities. This competition makes it even more important for utilities to build closer, more personalized relationships with their customers. And that starts with collecting and analyzing data to understand what customers want and need.

With the growing prevalence of smart meters—85% of US homes will have them by 2025, according to analyst firm Smart Energy International—utilities have much more information about customer usage patterns than ever, and they can use that data to help customers cut costs while supporting a stable energy grid.

At the same time, utilities need to understand how customers actually want to engage with them, whether by tracking their energy usage via a mobile app or speaking to a real person to find a new rate plan. Most consumers want automatic bill payment and immediate notifications of power outages. An electrical utility in Australia uses a system that generates outage maps in real time, keeping customers informed on its mobile app, website, and social media channels and reducing call center inquiries in the process.

Utilities also use the data collected through customer interactions to create more personalized and relevant communications and marketing. They're even using behavioral science to understand individual customers' priorities and needs.

For example, Rhode Island Energy, which was already offering EV customers a rebate to encourage off-peak vehicle charging, reached out to customers to educate them on the impact of shifting their charging times. In response to this initiative, the company says, it realized a nearly 10% reduction in on-peak EV charging. "You can launch large, expensive campaigns," Ballard says, "but if you're not understanding the behaviors and responses of

individual groups of customers, then it doesn't matter how much you spend—they're not going to change their actions."

Understanding customer priorities and influencing their actions can benefit utilities, both financially and in meeting their sustainability goals. "Utilities have set ambitious net-zero carbon emission goals. Influencing customers to act—on a scale we've never seen before—is critical to achieving those targets quickly and affordably," says Paul McDonald, senior director for Oracle Energy and Water's Opower group. "A lot of people recognize the challenge and want to take action. It's our job to make it obvious and easy for them to do so."

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Mike Ballard

Vice President of Industry Strategy, Oracle Energy and Water

Increasingly, utilities will use AI to improve customers' call center experience. AI engines will track agent-customer conversations and surface relevant information, such as interest in new rate plans, how-to information about a particular smart thermostat, and even apps that customers can use to find the best rate for their home or business. By providing the right information at the right time, utilities can become trusted advisers, helping customers identify opportunities to save money and protect the environment. "If you promise somebody that they're going to make \$200 a year by signing up for a program, you want to make sure that's a real number," Ballard says. "They need to benefit. Otherwise, they'll disengage."

As utilities transition to renewable energy, they can't ignore the question of affordability. The US Department of Energy characterizes about 44% of US households as low income,

with an “energy burden” (the percentage of gross household income spent on energy costs) three times higher than non-low-income households. Unfortunately, many low-income energy consumers don’t know where to look for support.

Utilities are getting proactive, using the customer data they’re collecting to support customers with low to moderate incomes. For example, Baltimore Gas & Electric (BGE) not only offers customers rebates, discounts, and energy use assessments, but it also guides eligible customers to state-run energy assistance programs. BGE introduced a program to help nearly 200,000 customers who were eligible for financial assistance but hadn’t yet applied, sending them personalized home energy reports and connecting them with energy and financial assistance programs. Customer feedback shows that 80% of BGE’s customers find that information to be useful.

Energy Consumers Save the World 37.5 Terawatt Hours

Customers of utilities using Oracle Opower software participated in energy efficiency programs that resulted in 37.5 TWhs of energy savings and the avoidance of 18.3 million metric tons of CO2 emissions. That’s equivalent to:



The energy needed to charge **2.2 trillion smartphones**



CO2 emissions produced by burning more than **100,000 railcars of coal**



Greenhouse gas emissions avoided by recycling **792 million bags of trash**



Carbon sequestered by **303 million tree seedlings** grown for 10 years

Source: Oracle Opower, using equivalencies from the US Environmental Protection Agency

4 Develop a skilled, tech-savvy workforce

Utilities worldwide are having trouble attracting and retaining employees.

In the United States, for example, industry employee turnover rates are the highest they've been in almost 20 years, especially for technical and specialized jobs, according to a 2023 survey of 41 electric and natural gas utilities by the Center for Energy Workforce Development (CEWD). In 2022, the latest year for which CEWD data is available, more than 7% of sector employees left their jobs for reasons other than retirement, up from about 6% the year before. Per a 2023 report from the US Department of Energy, more than 80% of utilities employers say it's somewhat or very difficult to find qualified workers.

In the United Kingdom, workforce advocacy group Energy & Utility Skills is no more optimistic. The group predicts a serious workforce shortfall in the sector over the next 10 years, with an estimated 221,000 vacancies due to retirements, people shifting industries, and the crucial addition of thousands of new jobs.

Clean energy specialists, engineers, technicians, and electricians are among the skilled workers in shortest supply, as are workers with emerging-tech skills such as data science and AI. Among the reasons for these shortages: inadequate training programs, retirements of skilled workers, and insufficient awareness of and interest in utility industry jobs among young people.

Smart industry leaders are responding to this shortfall by improving how they attract, engage, and develop their employees. The latest human capital management applications, for instance, can help utilities identify job candidates most likely to fit in, perform at a high level, and stay at their organizations. Such software tools can also help utilities simplify the application and onboarding process for job candidates, giving individuals the kind of seamless experience they're used to with consumer apps on their mobile devices.

The best employers understand their employees' aspirations as well as which skills they have and which they lack. Employers are using this knowledge to guide employees into continuous learning, professional development, training, and certification programs, particularly in

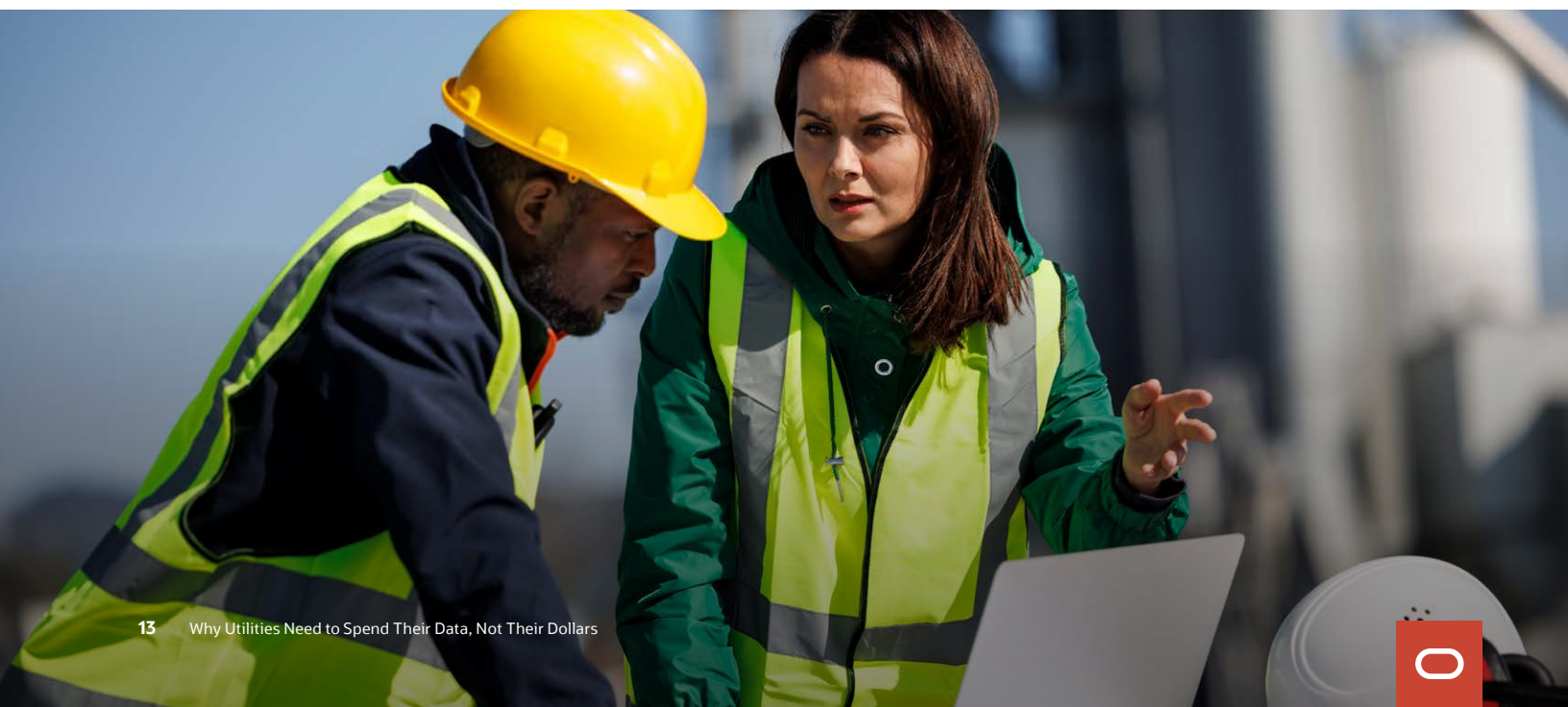
relevant emerging technologies. Employers are trying to reduce turnover by staying more engaged with their people through regular surveys, personalized career roadmaps, and curated learning playlists.

In the US, the Bipartisan Infrastructure Law is ramping up government support for utility worker training. For example, the DOE is investing up to \$72 million to expand its energy workforce educational centers across the country, and it's working with community colleges to provide students with technology training internships at DOE laboratories and facilities.

Another way to attract and retain workers—and one of the most welcome industry changes in recent years—is to improve worker safety. Although many workers are in control rooms or at desks, many others are in the field or in massive power stations, where the work can be dangerous. In the US, about 2,400 linemen are seriously injured and 42 are killed on the job each year, according to data from worker association Lineman Central.

Some of the innovative safety measures developed for the construction industry can benefit utility workers, too. For example, operations managers can use images from laser scanners, camera-equipped drones, and even smartphones to create substation site maps. Managers can designate particular areas as off-limits to workers who lack specific training or aren't wearing the necessary safety gear, and then alert workers in real time if they're about to go into a restricted area.

The same technologies can be used in the field where power poles are falling over or certain areas are flooding. Remote inspection images from the affected areas are sent to a command

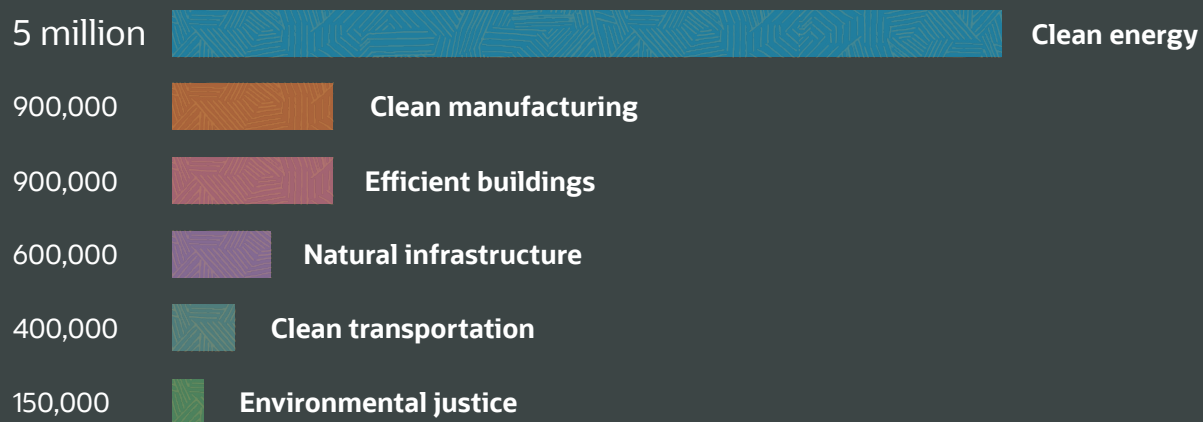


center and to workers in the field, who can then take the necessary precautions and quickly locate points of failure. Utility managers can also use mobile workforce management software to assign a safety routine and vehicle inspection checklist to field workers, based on their specific work and vehicle assignments, before they begin new tasks.

Another challenge facing utilities is the growing worker demand for more job flexibility—even for roles that can't accommodate work from home. "They've seen that there's this revolution going on, they want to be part of it, and they're demanding more from their employers," says Rocky Mitarai, Oracle vice president for human capital management product marketing. One of the key ways utilities are providing that flexibility for frontline workers is by enabling them to use mobile devices to perform certain tasks from just about any location.

Clean Sweep

More than half of the jobs the US Inflation Reduction Act is projected to create are in the clean energy sector.



Source: Political Economy Research Institute at the University of Massachusetts Amherst



How can Oracle help?

Oracle is the only technology company that provides a comprehensive portfolio of cloud-based applications to help utilities manage their projects, capital assets, specialized devices, and front- and back-office processes. Underneath these applications is a cloud infrastructure with strong security, advanced analytics tools, and the highest-performing database for a variety of workloads.

Utilities trust Oracle Energy and Water solutions

- [Oracle Utilities Customer Care and Billing Cloud Service](#) lets utilities connect customer care, billing, and metering data to better manage customer service interactions and offer new services, such as special billing rates for consumers who shift their energy use to off-hours.
- [Oracle's advanced metering infrastructure](#) improves utilities' billing accuracy, gives them visibility into customers' power consumption, and uncovers device issues, leaks, and energy losses. By providing customers with personalized insights on how to cut their energy use, utilities can help them cut costs while improving their own network reliability.
- More than 100 utilities are using [Oracle Opower](#) software to provide home energy reports, alerts, and self-service capabilities to help customers reduce their energy usage, carbon footprint, and operations costs.
- [Oracle Utilities Live Energy Connect](#) lets utilities monitor, manage, and gather data in real time from the interconnected systems and devices on their smart grids, helping them increase system efficiencies and meet regulatory requirements.
- [Oracle Utilities Work and Asset Management](#) helps utilities manage the performance and costs—and prolong the life—of all capital assets, including pipelines, substations, electric cables, and solar panel arrays.
- [Oracle Utilities Network Management](#) helps utilities monitor and control diverse energy networks and extend visibility down to customer-owned grid-edge DERs, all while providing a simple, cohesive user experience across multiple platforms.



- [Oracle Field Service](#) gets utility work crews where they need to be and equips them with preconfigured sets of service steps and visual guidance, while allowing dispatchers and managers to monitor their work in real time.
- [Oracle's capital asset lifecycle management capabilities](#) help utilities plan, execute, and improve the safety and reliability of capital projects while meeting carbon neutrality goals and maximizing return on assets.

Utilities trust Oracle Cloud Infrastructure

[Oracle Cloud Infrastructure](#) (OCI) is the underlying infrastructure for all of Oracle's energy and water applications. Utilities rely on OCI to improve the performance of applications that boost efficiency, save money, reduce risk, enhance quality, and foster environmental sustainability. Embedded AI/ML algorithms help make it easier to build, automate, and scale new applications and data platforms. Key OCI services include the following:

- [Oracle Autonomous Database](#) is a fully automated service that makes it easy for utilities to develop and deploy application workloads, regardless of complexity and scale.
- [Oracle Analytics](#) uses machine learning and natural language processing to help increase productivity without compromising security or regulatory compliance.
- [OCI integration services](#) can connect any application and data source to help utilities automate end-to-end processes and centralize project management.
- Utilities can use [OCI migration services](#) to move their most important applications—such as billing, finance, and customer systems—to the cloud, with automated migration configurations that match on-premises architectures.
- Regulations can constrain utilities' ability to move to the cloud. Oracle supports the widest range of [hybrid cloud options](#).

Utilities trust Oracle Cloud Applications

Utility companies rely on the integrated suite of Oracle Cloud Applications to manage their key front- and back-office processes and operations.

- [Oracle Customer Experience](#) helps utilities streamline and personalize customer service interactions with AI-powered digital assistants. It also helps utilities promote energy conservation and efficiency programs.
- [Oracle Fusion Cloud Human Capital Management](#) helps utilities recruit, onboard, develop, engage, and retain highly skilled workforces.
- [Oracle Fusion Cloud Enterprise Resource Planning](#) gives utilities fast and secure access to financial data, including procurement and core accounting, and empowers them with AI-driven reporting functions.
- [Oracle Fusion Cloud Enterprise Performance Management](#) supports utilities in strategically planning, tracking, and reporting on financial and operational processes that are vital to achieving their goals. And the software is increasingly used by utilities to plan and track their sustainability initiatives.
- [Oracle Fusion Cloud Supply Chain & Manufacturing](#) is increasingly being adopted by utilities to help build resilient supply chains and better manage their procurement and sourcing processes.





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See how Oracle Energy and Water helps utilities improve energy efficiency, automate management of networks and assets, and cut costs.

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