

GENERATING CHANGE: UTILITIES AND RENEWABLE ENERGY



How Mobile Technology Supports Renewable Energy Workforces
UTILITIES WHITE PAPER

Future investments



Utilities look to the future with renewable energy

Utilities are turning to renewable energy sources as alternatives to fossil fuels and as a cleaner and more sustainable solution to meet increasing energy demand. As the renewable energy market continues to grow, utilities must adapt to a changing landscape to remain competitive and relevant and comply with state and federal mandates.

This white paper explores the challenges and opportunities facing utilities in the renewable energy market—particularly wind and solar—and examines innovative new business models. Finally, it considers how rugged mobile solutions can help utilities manage predictability and variability from renewable energy sources, monitor output and transmission, and maintain and repair these fast-growing assets in the office and the field.

Drivers for utility investment in renewable energy

Wind farms, solar panel arrays, hydrogen power, battery storage complexes, and hydrogen and biomass fuel all make up the fast-growing renewable energy resources segment.

A combination of factors is encouraging utilities to diversify their portfolios with renewable sources to meet increasing demands for power.

Environmental concerns. The effect of relying on fossil fuels has led to environmental degradation and impact on climate change has been significant—rising temperatures and more severe natural disasters—highlighting the urgency of transitioning to clean, renewable energy sources.

Technology innovations. Utilities can now capitalize on technological advancements that help make renewable energy sources more accessible and affordable, including more efficient, durable and affordable solar-panel and wind-turbine design; larger, more powerful offshore wind farms; improved large-scale battery storage and more.

Regulatory pressures to replace older energy sources. In 2022, President Biden's administration set the goal of achieving a carbon-free power sector by 2035, which will require utilities to make a significant increase in renewable energy deployments and phase-out of coal and natural gas power plants. At the state level, 22 states plus the District of Columbia and Puerto Rico have targeted 100% clean energy goals—all by 2050.¹

Competition in the marketplace. As more companies turn to renewable sources, competition for consumers increases. Renewable energy sources enable utilities to offer customers a broad range of cost-effective power alternatives.

The renewable energy industry is growing fast.

24%
of U.S. utility-scale electricity generation came from renewable sources such as solar, wind and hydro power in the first six months of 2022—up 10% from just a decade ago.²

342%
growth in demand for renewable energy workers by 2030.³

1. Table of 100% Clean Energy States. Clean Energy States Alliance (2023) ►

2. In the first half of 2022, 24% of U.S. electricity generation came from renewable sources. U.S. Energy Information Administration (September 9, 2022) ►

3. Renewable-energy development in a net-zero world: overcoming talent gaps. McKinsey & Company (November 4, 2022) ►

Managed sustainability



Challenges faced by utilities investing in renewable energy

Utilities' enthusiasm for adopting renewable energy sources is tempered somewhat by the obstacles they face adding them to their portfolio mix. High capital costs, grid modernization, digital transformation and regulatory uncertainties are familiar utilities challenges. Renewables add their own layers of complexity.

Infrastructure investment costs. Even though costs have come down significantly in recent years, renewable energy projects can carry a high price tag by requiring

significant upfront investment by utilities, even though the payoff through lower operating costs and increased energy independence can offset these costs over time.

Intermittent power production. Solar and wind, where some of the most promising advances are happening, are often intermittent and variable energy producers. Smart grid technology can help utilities manage the variability of renewable energy sources and ensure grid stability and reliability for their customers by using real-time energy consumption and production data to balance supply and demand, forecast generation and plan for excess energy storage.

Matching demand with variable energy sources

Managing the uncertainty of renewable energy production is critical to a stable grid, especially as utilities move to net-zero carbon emissions and 100% clean energy. Grid-scalable battery storage systems are built on units (mostly lithium-ion batteries) that can safely charge and discharge thousands of times and make it possible to cost-effectively store energy during production peaks to match periods of high demand. By the end of 2021, total installed grid-scale storage capacity worldwide stood at 16 GW, with the United States, China and Europe leading the market. More growth is needed. If the world is to achieve net-zero emissions, installed grid-scale battery storage capacity will need to expand to 680 GW by 2030.⁴

Grid integration and complexity. Integration methods manage the variable production of renewable sources to maintain system stability and reliability as well as increase overall system efficiency and flexibility. Adding distributed energy sources such as solar and wind farms to the grid creates operational complexity as well as technical integration challenges that must be resolved and managed.

Security. In a report published in 2021, the U.S. Government Accountability Office found that the power grid's distribution systems are increasingly at risk from cyberattacks. Bad actors can use multiple techniques to attack industrial monitoring and control systems,⁵ and utilities must be prepared to secure both physical and digital assets to protect the grid.

4. Grid-Scale Storage. International Energy Agency (September 2022) ►

5. Electricity Grid Cybersecurity. U.S. Government Accountability Office GAO-21-81 (March 18, 2020) ►

The power of partnerships



Market design and regulation. Policies and regulations that incentivize and promote renewable energy can accelerate the transition. The Inflation Reduction Act of 2022, for example, offers clean energy tax credits, financing to reduce fossil fuel emissions and incentives to build a domestic clean-energy supply chain.⁶ However, potential regulatory uncertainty in the future can significantly impact utilities' long-term planning or investments.

Public expectations and behavior. In a poll by American Clean Power, 93% of U.S. voters say that clean energy is important to the nation's energy future.⁷ Nevertheless, some segments of the public may be resistant to renewable energy projects, especially those planned in or near residential areas. Utilities can engage in public outreach to counter concerns about noise, visual impacts,

effects on wildlife and threats to traditional energy industries and jobs.

In addition, consumers are becoming less reliant on utilities as they generate and distribute more of their own power. Utilities need smart solutions to understand consumer usage patterns so they can better manage their own services and provide insight to their customers.

Unique partnerships are creating new business models and services

The incentive for clean energy is increasingly cost-efficient. Decentralization, demographic changes and digital transformation are helping to accelerate the transition. Other economic benefits include jobs creation, growing energy independence and decreasing dependence on the volatile fossil-fuel markets.



Panasonic's renewable-powered factory of the future

As part of its commitment to the RE100 initiative, Panasonic's factory of the future at Kusatsu, Japan, combines Tesla Megapack energy storage, solar technology and hydrogen fuel cells to power clean-energy manufacturing from renewable resources. An energy management system uses artificial intelligence (AI) to swap between resources as needed, minimizing the energy required from the nearby grid operator.⁸

6. How states and utilities can capitalize on the biggest clean energy legislation in US history. Utility Dive (August 31, 2022) ►

7. Most Americans support expanding solar and wind energy, but Republican support has dropped. Pew Research Center (June 8, 2021) ►

8. Panasonic Tests Renewable-energy Powered Factory of the Future. EE Power (January 9, 2023) ►

Renewable business models



Renewable energy investments also offer utilities opportunities to create new revenue streams. By collaborating with environmental groups, localities and private businesses, utilities can develop new business models and innovative solutions to help supply affordable, reliable energy. A few examples:

- **Partnerships**—with transportation, hospitality, retail, healthcare and education to provide integrated energy solutions or value-added services. For example, utilities can install electric vehicle charging stations at retail locations or manage solar power and energy storage systems for large medical centers.
- **Sales of renewable energy certificates (RECs) or carbon credits**—to customers or other entities who want to reduce their greenhouse gas emissions or support clean energy development.
- **Green tariffs**—a pricing structure that allows eligible customers to source up to 100% of their electricity from renewable sources or community solar programs that allow customers to subscribe to part of a shared project.
- **Energy management programs**—demand-response services or smart grid solutions to help customers manage energy consumption and costs and reduce peak demand on the grid.
- **Virtual power plants**—aggregate distributed-energy sources that can be managed as a single entity to supply grid services such as frequency regulation, voltage regulation and support, or capacity reserves.
- **Selling excess renewable energy generation**—by taking part in wholesale electricity markets or ancillary services markets.
- **Energy storage systems**—such as batteries can help manage the variability of renewable energy sources and ensure grid stability and reliability.
- **Microgrids**—that run independently of the larger grid for backup power and to support critical infrastructure during emergencies.

Win-win partners in energy

Here are just a few examples of how utilities are creating innovative partnerships and new revenue streams.

Retail power arrays. An international retailer promotes clean energy by example via solar panels at 20 retail and distribution facilities in 13 states. The systems were designed, engineered and built by the sustainable energy solutions arm of a major utility and supply approximately 20 megawatts of power (enough to power more than 2,000 homes a year). The utility conducts ongoing monitoring and maintenance as well as troubleshoots issues to enhance system performance.⁹

EV home charging installations. Maryland electric vehicle (EV) owners can now get a home charging station installed by their utility company. A home services team reviews charger compatibility with a customer's home; handles installation permits, inspections and paperwork; and provides warranty services for a year.¹⁰

Virtual power plant programs. A large urban utility has joined forces with a smart grid solution provider to offer solar power plus battery storage systems to homeowners. The aggregation of hundreds of solar-plus-storage homes creates a "virtual power plant" that can help utilities reduce demand and relieve stress on the electric grid during peak periods without adding or upgrading energy infrastructure. Participating homeowners earn incentives that lower the cost of their solar-plus-storage systems.¹¹

9. Ikea. Duke Energy Sustainable Solutions (n.d.) ▶

10. EV Charger Installation. Constellation Energy Resources (n.d.) ▶

11. Swell Energy launches virtual power plant program for homeowners in Queens, New York. Solar Builder (March 17, 2021) ▶

Digital strategies



Digital transformation is helping utilities meet sustainability goals

To cost-effectively transition to renewable energy sources, utilities must develop digital strategies that generate high-quality data to help streamline management of a more complex system. While utilities already use plenty of data, taking advantage of AI and advanced analytics platforms can enable better monitoring and more nuanced operational control across a decentralized power grid. With improved data, utilities can better manage predictability and variability, monitor output and transmission, forecast demand, predict equipment failures and report on compliance and other metrics.

Obstacles to managing and servicing renewable energy deployments

As more and more renewable energy installations are built in remote or hazardous locations, they need to be managed and maintained by a workforce that can navigate tough working environments. Like other utilities workers, the renewable energy workforce faces obstacles with:

- Transmitting data to and from the field in real time
- Lack of the data integration and analysis needed to effectively monitor output and transmission across the grid or effectively manage variable production
- Inefficient manual processes such as work-order management and outage ticketing
- Lack of visibility into critical job, customer, and billing information
- Access to technical information
- Ineffective communication and collaboration
- Difficulty managing remote workers

Managing variable energy sources

As telemetry data flows into operations or service systems from sources such as wind turbine towers, utility operators can monitor and track key elements critical to producing the expected output.

Production below certain thresholds may require power to be allocated from other sources to meet demand across the grid. When production is higher, energy can be diverted into storage for later use. In addition, by using fault prediction software and data that tracks mean time between failure (MTBF) of assets, field and office managers can develop plans and templates for maintenance schedules, supply part inventories and create user work schedules to ensure operations run at peak performance. Flexible mobile solutions enable a highly dynamic workforce to manage resources and activate the right support and service workers as quickly as possible to keep energy flowing efficiently.

Asset maintenance and repair

When it comes to servicing energy sources like wind and solar, renewable deployments have their own unique requirements. For example, wind farms take up a lot of space (1.5 acres for each 2-megawatt wind turbine)¹². The turbines can be 400 to 500 feet tall with a diameter of more than 360 feet. At that size, most are built in remote areas or offshore to minimize disruption to communities. To perform maintenance or repair a turbine, crews may travel several hours to remote and highly technical installations, locate and climb to the repair area, and then work long hours outdoors in the weather du jour to resolve the issue. They must be equipped with highly mobile tools that perform flawlessly every time—even when they are perched on top of the nacelle.

12. How much land is needed for wind turbines? Sciencing (May 10, 2018) ►

Energy farms



Utility-scale solar energy systems maintenance

Utilities workers and contractors servicing solar farms provide ongoing maintenance and repair on panels, generators, storage batteries, load regulators and the inverter connection to the electrical grid. Typically located in rural areas, utility-scale installations are huge and can have hundreds or thousands of solar panels that need regular cleaning and visual inspection. Field service teams work outdoors but also may have to operate in tight interior spaces to connect panels to the electrical grid, check wiring and switches, and confirm fittings and cables are secure.

Did you know? Golmud Solar Park in China is the largest solar farm in the world with 7 million solar panels that generate 2.8 GW of capacity.¹³

How rugged mobile technology help renewable energy workers

Given the variable needs of solar- and wind-generation sites, rugged mobile technology can equip a highly active workforce with the equivalent of a "mobile office" that transitions easily between office and field environments. Rugged mobile technology can increase worker productivity by streamlining workflows, automating processes and making critical information available in real time. Here's how a rugged mobile office can help renewable energy workers:

Access to real-time production data. An operator continuously tracking production data from renewable energy monitoring systems can immediately identify output that isn't meeting expectations and quickly make necessary adjustments—even from the field. Managers can also analyze mean time between failures (MTBF) to predict equipment failure and order maintenance as quickly as possible to avoid unplanned downtime.

Remote equipment monitoring. An operator can use real-time system performance data to remotely identify an issue with a renewable asset. The closest field repair team working in the area receives a dispatch call and work order from the operations center, assigning them

to repair the equipment. While the crew is en route to the tower, the operations team forwards updated technical information and schematics about the failed component and sends a request to logistics to stock a new replacement part for inventory.

Data collection and analysis. Analysis of data captured during routine inspections and from the systems monitoring output and transmission can identify patterns in production, linking them to external events such as weather conditions or internal issues such as equipment malfunction. On site, maintenance and repair crews can capture diagnostic data in real time that helps pinpoint the repair for the specific equipment. For new projects such as site assessments, feasibility studies and impact studies, project managers and engineers can gather real-time data in the field and transfer it to a central office database.

Collaborating and communication. Workers can reach out to colleagues from the jobsite via videoconferencing for help from more experienced techs during a challenging task. They can use their laptops and tablets to access training from anywhere and field inquiries from business or government customers more efficiently.

Mobile office



The purpose-built rugged mobile office

The ideal mobile office is a laptop or tablet that delivers enterprise-level connectivity, communication, functionality and accessibility. It must be durable enough to withstand rough handling, accidental drops, moisture, dirt, grease, vibrations and extremes in weather and temperature. Batteries must have power to last through the work. Screens must be viewable in bright sunlight, responsive while wearing gloves and yet avoid interference from rain drops.

Equally important, the reach and reliability of wireless connectivity is critical. Spotty or failed connections leave workers without access to detailed information such as work orders, repair guidance, schematics or the use of specialized diagnostic tools. This can have a major impact on worker productivity as well as effect energy service.

Most consumer-grade devices are unable to fit these requirements, causing headaches and frustrations for field service and utility teams. Rugged laptops and tablets can stand up to the work environment. Powerful next-gen processors and graphics make these devices capable of processing large amounts of data, images and video feeds in real time. Heavy-duty antennas and multiple cellular and connectivity options support reliable connections and minimize network disruptions.

Panasonic Connect provides customizable rugged mobile solutions that can streamline renewable energy management, maintenance and repair

At Panasonic Connect, we understand how renewable energy investments are transforming utilities operations. We offer a range of software, professional services and Panasonic TOUGHBOOK® rugged mobile devices to help you design the best solution for renewable energy applications.

Panasonic reliability and support

Panasonic Connect is rated measurably higher than other rugged vendors for device performance and functionality as well as customer service and technical support.¹⁴ That combination of hardware performance and innovation plus customer service and engineering support sets Panasonic Connect apart from its peers and helps ensure that your renewable energy workers are equipped with the best possible rugged mobile solution for their specific application.

Software

Our ecosystem of partners and software for utilities-specific applications include:

- **Utilities workforce management**—a software suite for mobile workforce management, automated vehicle and worker location, mobile GIS, meter reading, and smart grid deployment operations
- **Regulatory compliance**—electronic logbook software for power, water and waste treatment, and oil and gas companies that aids regulatory compliance by consolidating data from automated instruments, maintenance management systems, and supervisory control and data acquisition (SCADA) systems with digitized data such as shared documents, spreadsheets and logbook information
- **Operations management**—mobile, web and automation solutions seamlessly integrated for more efficient management of water treatment plants, power companies, oil and gas, and more
- **Resources management**—a portfolio of smart networks, software, services, smart meters and sensors to help utilities better manage energy for the people they serve

Service and support



- **TOUGHBOOK Smart Essentials (Smart Service Suite for Utilities)**—a cloud-based software tool providing real-time, actionable insights into the health and utilization of your mobile infrastructure, including devices, applications, batteries, cellular, Wi-Fi, SIM cards, disruptions, reboots, operating systems, patches, hotfixes and much more
- **CORE Asset Management**—provided at no added cost, CORE provides real-time management of all the assets in an agency's fleet in one place, helping agency IT departments stay ahead to minimize productivity loss due to repairs, warranties, upgrades or software roll-out

Professional Services and Support

Our robust service options can help you plan, select, test, deploy, and manage your solutions with ease and confidence.

- **Kitting and deployment**—We can help you get your TOUGHBOOK mobile computers into the field quickly and ready to work. Our deployment services include kitting with third-party accessories such as network adaptors, straps/holsters and expansion modules.
- **Vehicle mounting and installation**—We offer custom in-vehicle mounting solutions and installation services for a wide range of vehicles. This can help simplify installation planning and management, maximize worker productivity, and ensure easy serviceability.
- **Mobile device management**—We can help you monitor, manage and update devices in house or remotely with mobile device management software.
- **Security enhancements**—We can help you protect your TOUGHBOOK devices and data with security applications that implement layers of log-on authentication, remotely lock a stolen or lost device,

and remove partial or all data and comply with industry regulations.

- **Strong warranties and add-on repair services**—You can rely on a robust basic warranty as well as extended warranty services and augmented services, such as accidental damage coverage, 24-hour "hot swap" or exchange service, or even on-site support to minimize downtime.

The TOUGHBOOK Advantage

Panasonic Connect works with you to deliver a rugged mobile solution that can help renewable energy service workers meet the challenges and demands of the job. Our TOUGHBOOK devices include rugged laptops, 2-in-1 devices and tablets that provide:

- **Rugged durability**—that meets military standards (MIL-SPEC) and ingress protection (IP) standards for withstanding bumps, dust, dirt, vibration, extreme temperatures, spills and accidental drops in a physically active environment.
- **Industry-leading reliability**—based on a comparison of device failure rates that shows TOUGHBOOK rugged devices are 72% more reliable than other rugged devices.
- **Ease of use**—with common forms and features users are already familiar with and functionality geared specifically toward utility crew need, such as rain-sensitive touchscreens that users can use while wearing heavy gloves, large programmable buttons for common applications and display options that enable users to read the screen in sunlight or darkness.
- **Long battery life**—so that workers don't have worry about charging a battery during the day. The battery will last for an entire shift and can be extended with a hot-swappable optional second battery.

Panasonic Green Impact



- **Reliable and proven accessories**—from leading partners designed to work specifically with TOUGHBOOK mobile devices and to help make using your device easier and more convenient.

Accessories include vehicle mounts, docks, adaptors, chargers, styluses, antennas, routers, mobile printers, and hand and shoulder straps.
- **Reliable, consistent connectivity**—the kind you need in middle of a solar farm or on top of a wind tower. TOUGHBOOK devices feature wireless options including Wi-Fi, 4G LTE, 5G and Bluetooth® with powerful embedded antenna modules that provide connectivity even where signals may be blocked by industrial buildings and large machinery.
- **Environmentally responsible hardware and services**—include TOUGHBOOK devices with modular design that enable your device to be retrofitted for new applications without buying a new machine.

Rugged mobile devices stay in service significantly longer than consumer-grade counterparts, contributing to less landfill waste, and our printed circuit boards (PCBs) can often be repaired rather than replaced. We also offer a recycling program to help you safely and responsibly manage your end-of-life devices.

A greener, cleaner future with renewable energy

As power generation becomes more complex and distributed, utilities investing in renewable energy sources are laser-focused on developing innovative, reliable installations that can be managed with a skilled workforce and the right technology tools. Our rugged mobile solutions are critical tools in your efforts to create a more sustainable future by helping to streamline the management, maintenance and repair of your portfolio of renewable power generation resources across geographic regions.

Panasonic Green Impact: EV batteries

As a global corporation, Panasonic is committed to driving change toward a more sustainable planet. Our technologies and products are creating new ways to do things that are better for the planet and bring long-lasting quality of life and impact on society.

As one of the world's leading suppliers of EV batteries,¹⁶ Panasonic is working tirelessly to lower costs and increase production to help make the transition to cleaner, more sustainable vehicle technology. We support multiple EV initiatives including a state-of-the-art manufacturing site at the Tesla Gigafactory 1 in Sparks, Nevada. Panasonic also broke ground on a new factory in De Soto, Kansas, in 2022 with full-scale production planned for March 2025¹⁷.



16. The Top 10 EV Battery Manufacturers in 2022. Elements (October 5, 2022) ►

17. Panasonic Breaks Ground on EV Battery Factory in Kansas: New Details. InsideEVs (November 6, 2022) ►



TOUGHBOOK FOR GREENER UTILITIES

Learn more how TOUGHBOOK can help renewable energy workers become more efficient and productive.

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