

RENEWABLE MICROGRIDS

Learn how large energy users can deploy renewable microgrids to protect themselves from operational disruptions caused by power outages while managing utility costs and reducing their carbon footprint.



Shell
ENERGY

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RENEWABLE MICROGRIDS

PROMOTING RESILIENCE & REDUCING CARBON EMISSIONS WITH RENEWABLE MICROGRIDS.

INTRODUCTION

Power outages are on the rise, and grid resiliency is a growing concern. The Department of Energy estimates that power outages cost U.S. businesses as much as \$169 billion dollars in losses each year.¹

The increasing number and intensity of severe weather events is a leading factor. Physical and cyber attacks are another growing threat.² And aging grid infrastructure complicates system management: In 2020, 34% of non-weather-related U.S. power outages had no identifiable root cause, with design and management errors as the leading factors behind the rest.

These metrics signal a need for grid infrastructure updates. With this need comes an exciting opportunity: to rethink the grid and re-examine outdated concepts in power delivery that no longer serve the energy users of today.

Businesses need more than just a reliable energy supply – they also need to better manage their utility costs and demonstrate increased sustainability. Fortunately, many of the same solutions and technology used to positively impact an organization’s energy costs and carbon footprint can also contribute to improved resiliency and reliability of the grid as a whole.

Distributed energy resources (DERs) – i.e. physical or virtual technology typically deployed behind the meter of an individual energy customer – are prime examples.⁴ More large energy users seek DERs to increase the reliability of their grids and power supply while also reducing carbon emissions and cutting costs.⁵ A recent Wood Mackenzie report predicts that cumulative DER capacity in the U.S. will reach 387 gigawatts by 2025.⁶

This white paper explores renewable microgrids, a type of DER solution combining local microgrid infrastructure with onsite renewable generation. Learn how renewable microgrids can support grid resiliency – while helping to protect individual commercial, industrial, institutional, or government facilities against outages and help position them as leaders in the energy transition.

¹ <https://infrastructurereportcard.org/wp-content/uploads/2020/12/Energy-2021.pdf>

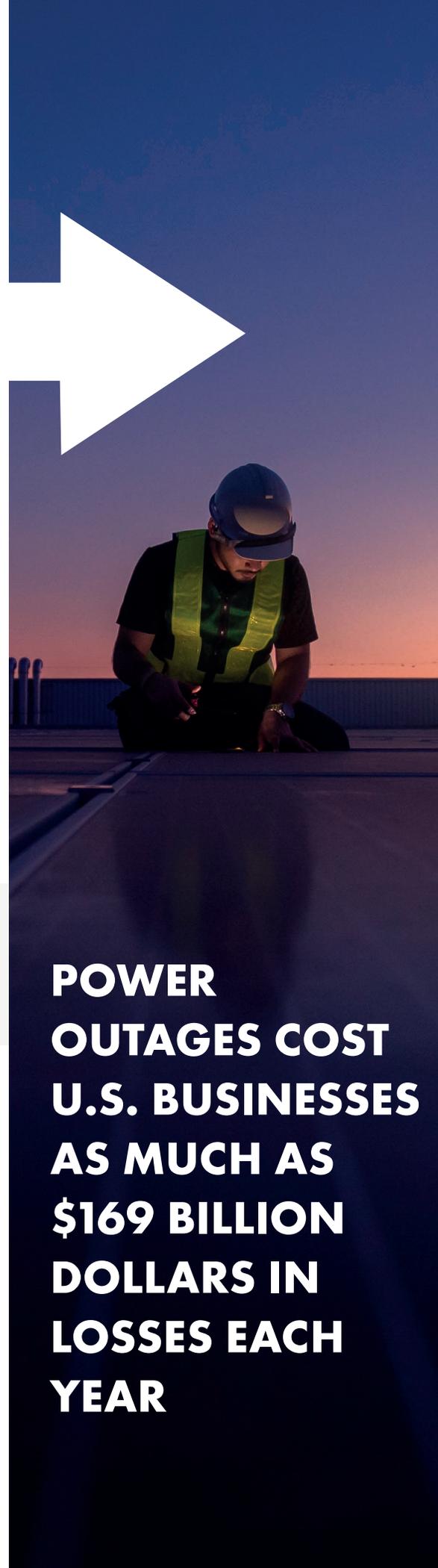
² https://rmi.org/wp-content/uploads/2020/07/reimagining_grid_resilience.pdf

³ https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2021.pdf

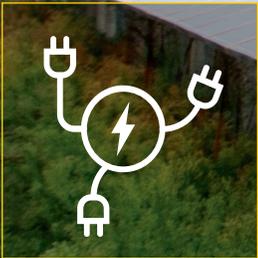
⁴ <https://blog.aee.net/distributed-energy-resources-101-required-reading-for-a-modern-grid>

⁵ https://www.smartenergydecisions.com/upload/research_+_reports/sed_state_of_distributed_energy_resources_study_12-2020.pdf

⁶ <https://www.woodmac.com/our-expertise/focus/Power-Renewables/der-outlook-us-2020-execsummary>



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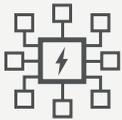


PART 1. **MICROGRID** **DEFINITION &** **HOW IT WORKS**

WHAT IS A MICROGRID?

A microgrid is a localized, standalone power grid that can function independently from the larger grid. Because they can operate when the main grid is down, microgrids promote resiliency while ensuring a reliable power supply for their users.

If the larger grid experiences an outage, disturbance, or another kind of demand response event, the microgrid can continue powering local users while shielding the larger grid from additional demand, or function as a grid resource for faster recovery.⁷



HOW IT WORKS: SYSTEM & COMPONENTS

A microgrid is made up of interconnected loads and their associated DERs within clearly defined electrical boundaries. An indicative system for a renewable microgrid would encompass onsite solar generation and energy storage infrastructure, the local controllable load, and microgrid controls for managing exchanges with the main grid.

A microgrid acts as a single controllable entity with respect to the grid, and can operate in two distinct modes: grid connected (normal conditions) or island mode (power outage conditions). The ability to operate independently from the main grid is what differentiates a microgrid from other DER solutions, and it's why microgrids can offer a higher degree of resiliency and outage protection to both end users and grid operators than alternatives such as onsite generation and storage.



MICROGRIDS FOR BUSINESS & INSTITUTIONS

Microgrids that serve commercial and industrial energy users commonly have the following attributes:

- Located at the customer load: Single-customer microgrids are located wholly within one grid-connected customer's site, facility, or campus. There are other types of microgrids that can serve multiple users or off-grid facilities, but most businesses will need a single-customer microgrid due to location, industry, and accounting need.
- Onsite generation: Microgrids rely on self-generation from onsite solar system, natural gas generators, fuel-cell generators, and/or other generating technologies.
- Smart optimization: Microgrids enable dynamic shifting of the energy load, helping to optimize electricity consumption in response to grid signals and energy pricing. Smart microgrids therefore offer businesses additional cost incentives and can help alleviate energy management tasks through automation.

⁷ <https://www.veloengineering.com/news/microgrid-design>

PART 2. **MICROGRID RESULTS/ CASE STUDY**



WHAT OUTCOMES CAN RENEWABLE MICROGRIDS ACHIEVE?

RENEWABLE MICROGRIDS BENEFIT THE ENERGY USER, THE GRID OPERATOR, UTILITY, AND ENVIRONMENT THROUGH INCREASED RESILIENCY, UTILITY BILL SAVINGS, AND SUSTAINABILITY. BUSINESSES MAY RECEIVE FINANCIAL BENEFITS FROM ALL THREE AREAS.



Resiliency protects critical business operations during outages or shutoffs, avoiding expensive loss of labor, product, or material due to loss of power. On average, a single 3-4 hour power outage costs a business between \$10-20K in lost productivity.⁸



Increased sustainability can signal value to investors and consumers, who increasingly seek to support businesses with ambitious emissions reduction goals.⁹



Utility bill savings can be achieved through demand charge reduction, time-of-use-rate arbitrage and demand response programs.



⁸ <https://www.fmgenerator.com/blog/the-business-cost-of-losing-power>

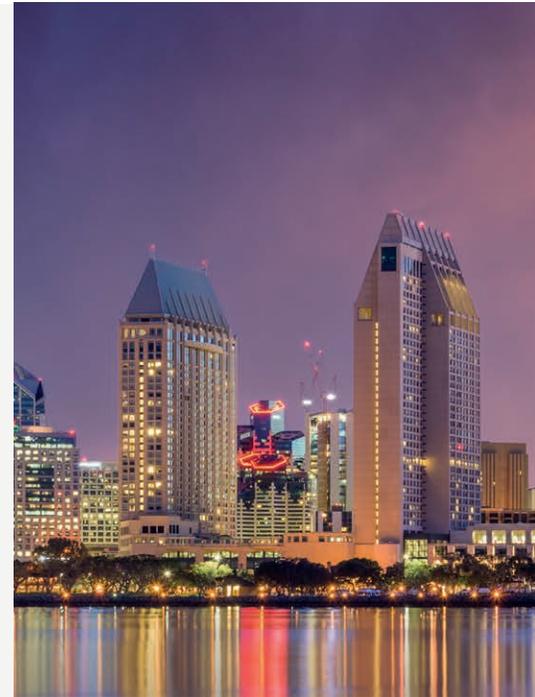
⁹ https://www.ey.com/en_us/power-utilities/why-investors-are-putting-sustainability-at-the-top-of-the-agenda

WHAT OUTCOMES CAN MICROGRIDS ACHIEVE?

CASE STUDY // CITY OF SAN DIEGO

Shell's target globally is to become a net-zero emissions energy business by 2050, in step with society's progress in achieving the goal of the UN Paris Agreement on climate. We intend to meet our customers' demand for cleaner energy, in step with society.

We also have a global target to reduce absolute emissions by 50% by 2030, compared to 2016 levels. This covers all emissions in scope 1, which come directly from our operations, and in scope 2, from the energy we buy to run our operations (on a net basis which allows for carbon capture and storage, as well as nature-based solutions as a last resort).¹⁰ The City of San Diego is an example of Shell Energy helping decrease Scope 3 emissions by enabling customers to lower their carbon footprint.



CHALLENGE

In 2015, the City of San Diego adopted a Climate Action Plan with the goal of eliminating half of all GHG emissions in the city by 2035.

To achieve this goal, the city needed an integrated renewable energy solution that would help them reach their targets, deliver cleaner energy, and create operational resiliency.

The region being prone to extreme weather events, outage protection was a prevailing concern.

SOLUTION

Shell Energy has worked with vetted technical partners to design eight microgrids at critical facilities for the City.

Under normal operating conditions, microgrids are connected to the grid and are primarily powered by on-site solar and energy storage.

During grid outages, the microgrids electrically disconnect and continue operating on power supplied by solar generation, energy storage, and backup generators.

The energy infrastructure project is financed through an Energy-as-a-Service commercial model, so it does not impact the City's CapEx.

OUTCOME

The city's increased adoption of on-site renewable generation is a major step toward its emissions reduction goals.

As the state of California continues to face power outages, Shell Energy's solutions offer the city greater resiliency against unexpected disruptions.

By adding battery-backed microgrids to key municipal buildings, the city will reduce building emissions and generate cost savings of ~\$6 million from reduced electricity costs over 25 years (assuming San Diego Gas & Electric rates increase by 4% a year).¹¹

¹⁰ <https://www.shell.com/energy-and-innovation/the-energy-future/our-climate-target.html#iframe=L3dYmFwcHMvY2xpbWFOZV9hbWJpdGlvb18>

¹¹ <https://microgridknowledge.com/san-diego-microgrids-shell-new-energies/>

PART 3. **SHELL ENERGY** **OFFERING**



SHELL ENERGY'S RENEWABLE MICROGRID OFFERING FOR CUSTOMERS IN CALIFORNIA

California is one of the regions hardest hit by grid disruptions and rising utility costs, and Shell Energy offers an innovative Energy-as-a-Service solution to help commercial and industrial facilities deploy and benefit from microgrids efficiently.



RENEWABLE & RESILIENT ENERGY INFRASTRUCTURE OFFERINGS

Integrated Energy Solutions Provider with market and energy expertise

- Shell Energy helps to simplify the net-zero emissions journey for customers through a deep understanding of the energy markets and wide spectrum of supply and sustainability solutions.
- As a DER provider and integrator, Shell Energy optimizes energy resources at the load, site, cloud, and market levels. We can integrate single or multiple supply and behind-the-meter solutions tailored to each customer.
- As a leading marketer of electricity and other energy commodities to wholesale and retail customers throughout the United States, Shell Energy is well-positioned to unlock and share incremental project value with customers through greater participation of DERs in wholesale markets.

Long-term operations and asset management

- Operating a renewable microgrid is complex. Shell Energy has the technical capabilities and resources to ensure operational excellence.
- Shell Energy's operations and maintenance (O&M) services ensure that the assets are well-maintained for maximum performance and coverage under warranties. Additionally, Shell Energy provides customer support through system health monitoring, resolution of monitoring alerts, warranty administration, compliance reporting, and site inspections through in-house support and external partners.
- Over the life of the services agreement, Shell Energy will help cost effectively manage the energy system to meet a customer's evolving energy needs.

Energy-as-a-Service contracting and financing

- Shell Energy offers Energy-as-a-Service contracts that allow businesses to realize the expanded capacity and resiliency benefits of a renewable microgrid infrastructure without upfront capital expenditures.



PROCESS & DEPLOYMENT

Partnership with Best-in-Class Microgrid OEMs

- Shell Energy partners with industry-leading partners to deliver reliable and cost-effective energy solutions.
- Shell Energy and partners perform site assessment and analysis, followed by design, procurement, installation and commissioning.
- Microgrid deployments in California can take approximately 9-18 months to complete.

ABOUT SHELL ENERGY

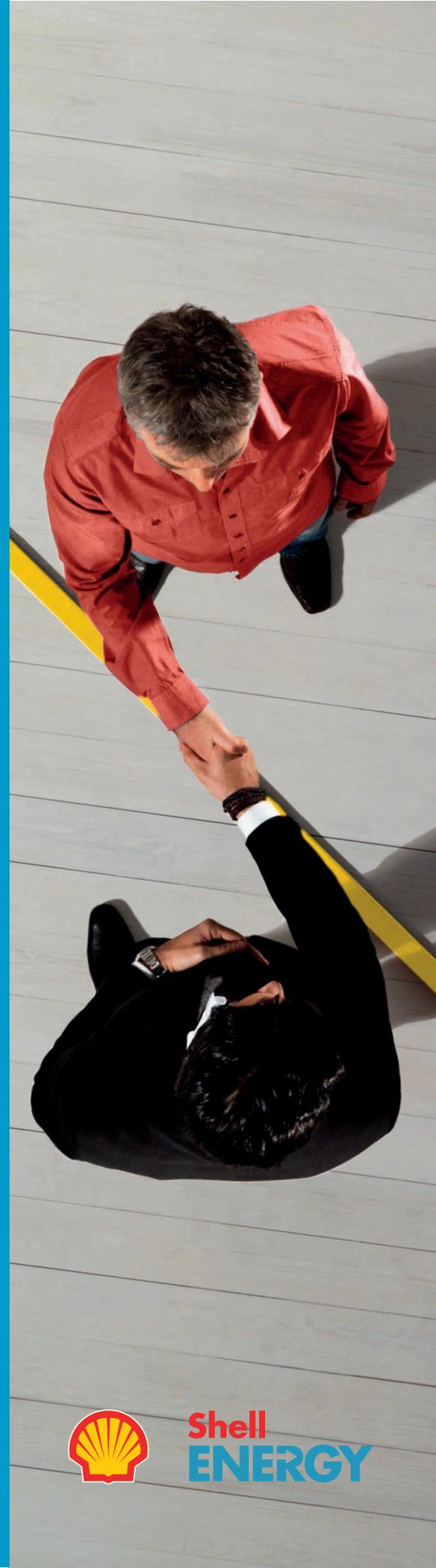
Shell Energy is the public-facing brand for those Shell businesses that offer a comprehensive suite of tailored products and solutions, including: rapidly growing capacity, trading and technical expertise and smart energy solutions, serving customers across the commercial and industrial sectors.

With the scale and expertise of Shell behind us, we're a global leader in innovation across the entire energy value chain – from generation, trading, supply, to behind-the-meter solutions. Shell Energy is your guide, making it easier to manage day-to-day energy needs while increasing efficiency, reducing cost, and advancing your decarbonization goals.

Shell Energy has the resources and vision to meet the evolving energy needs of customers today and tomorrow, working toward a better energy future.

LEARN MORE: [SHELL ENERGY SOLUTIONS](#)

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