

PRIMER—
AN INTRODUCTION TO
ENERGY RESILIENCE

PART I OF THE BEYOND THE MEGAWATT RESILIENCE SERIES



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A NOTE ON TERMINOLOGY In defining next-generation energy procurement goals, large energy customers have adopted various criteria for the types of energy to procure, including renewable, carbon-free, carbon-neutral, zero-emission, etc. While each definition includes a slightly different set of resources and can vary across organizations, they share a common goal to reduce greenhouse gas (GHG) emissions and help achieve a carbon-free energy system. This document uses the term “carbon-free” throughout for the sake of conciseness, but these strategies are applicable to any of these goal definitions.¹

Additionally, this document uses the terms “energy” and “electricity” interchangeably throughout to refer to the procurement of electricity, rather than other forms of energy (such as methane gas or petroleum fuels).

¹ For the purposes of this paper, “carbon-free” refers to resources that have zero GHG emissions resulting from generating electricity, including solar, wind, hydroelectric, certain kinds of geothermal, nuclear, and fossil or biomass fuels equipped with carbon capture and storage (CCS). This definition does not account for life-cycle emissions from these resources.

OVERVIEW

The Energy Resilience 101 series provides clean energy customers with a fundamental understanding of energy resilience and the key stakeholders responsible for ensuring continuity of business operations in the face of increased hazards. The series discusses strategies for strengthening resilience within an organization and aligning resilience with clean energy procurement goals.



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OBJECTIVES OF THIS RESOURCE

PURPOSE — The purpose of “Part I: An Introduction to Resilience” is to provide energy customers with a basic understanding of energy resilience and how it may impact or be impacted by their clean energy procurement.

INTENDED AUDIENCE — Energy customers of all types, sizes, and experience levels. Whether a customer is in the process of formulating an energy resilience strategy or looking to increase resilience across their portfolio, this primer will help frame energy resilience challenges as an impact of clean energy procurement.

HOW SHOULD YOU USE THIS PRIMER? — This primer begins with an introduction to energy resilience. It outlines the importance of energy resilience to business continuity, particularly in the context of a changing climate and power grid. Information in this primer aims primarily to introduce energy customers to the role that energy resilience may already play, or could play, in their energy procurement. As Part I of a multi-primer series, this primer should be used as a tool for developing a vocabulary around energy resilience and its relationship to clean energy procurement.

ABOUT THE **BEYOND THE MEGAWATT RESILIENCE SERIES**

The Beyond the Megawatt Resilience Series provides clean energy customers with a fundamental understanding of energy resilience and the key stakeholders responsible for ensuring continuity of business operations in the face of increased hazards. The series discusses strategies for strengthening resilience within an organization and aligning resilience with clean energy procurement goals.

PART 1 OF THE BEYOND THE MEGAWATT RESILIENCE SERIES ADDRESSES THE FOLLOWING QUESTIONS:

- 01.** What is energy resilience and why is it important?
- 02.** Who is responsible for energy resilience?
- 03.** How can clean energy help energy customers achieve their resilience goals?

Future editions of the primer series will address key issues in the evolving energy resilience space, including:

- Addressing how energy customers can replace diesel generators with cleaner on-site alternatives.
- Highlighting the importance of community resilience and coordination with local utilities for resilience planning.
- Protecting energy supply chains from economic and geopolitical shocks.



WHAT IS ENERGY RESILIENCE AND WHY IS IT IMPORTANT?

RESILIENCE IS A SYSTEM'S ADAPTIVE CAPACITY TO MAINTAIN CRITICAL FUNCTIONS THROUGH DISRUPTIONS.

Energy resilience focuses on preparing to deal with long-duration power outages, minimizing their impact when they occur, and restoring critical company functions quickly if they fail. Companies are investing in resilience more than ever, given a rapidly evolving threat landscape. Organizations that prioritize energy resilience can more reliably maintain business operations and reduce commercial risks, such as loss of revenue associated with power fluctuations and outages.

EXTREME WEATHER EVENTS, CYBERATTACKS, AND GEOPOLITICAL CONFLICTS ARE INCREASING IN FREQUENCY AND INTENSITY, THREATENING THE STABILITY OF THE ELECTRIC GRID.

According to the National Oceanic and Atmospheric Administration's tracking of billion-dollar weather disasters, the United States has experienced 89 such events in the last five years, totaling approximately **\$788.4 billion in costs**. Winter Storm Uri resulted in \$80 billion–\$160 billion in damages and caused over two-thirds of Texans to lose power in February 2021. In 2019, public safety power shutoffs in California prompted multiple investor-owned utilities to preemptively cut power to more than 3 million residents because of threats to the electric grid from wildfires; the **"value of lost load"** for Pacific Gas and Electric Company alone was estimated to be \$10 billion. Such severe weather events are becoming more frequent; the annual average number of **billion-dollar disasters** was 17.8 in 2017–2021, compared with 7.7 between 1980–2021.



Cyberattacks **increased** by 125% year over year between 2020 and 2021, when companies with annual revenues from \$1 billion to \$9.9 billion accounted for 54% of ransom and extortion victims. Meanwhile, the war in Ukraine has rocked energy markets globally, demonstrating how geopolitics can directly impact the energy transition.

POWER OUTAGES COST ORGANIZATIONS BILLIONS IN LOSSES EACH YEAR IN THE UNITED STATES.

Beyond economy-wide damages, power outages have real implications for an organization's bottom line. A 2016 study estimated that the **average total cost per minute** of an unplanned outage for data centers in the United States had grown from \$5,617 in 2010 to \$8,851 in 2016 — a nearly 58% increase in six years. Similarly, according to one energy service provider, **one hour of downtime** can cost manufacturers more than \$5 million. All organizations will benefit from considering how their presence on the grid can both contribute to and be adversely affected by energy instability events, regardless of their respective energy resilience needs.

WHO IS RESPONSIBLE FOR ENERGY RESILIENCE?

EVERY ORGANIZATION IS AT RISK FROM LARGE-SCALE POWER OUTAGES, BUT THERE IS NO ONE-SIZE-FITS-ALL ENERGY RESILIENCE APPROACH.

Energy resilience requirements and solutions will vary depending on various factors, such as the type of organization, the location of its facilities, and the specific functions that it defines as critical. The table below shows three examples of how requirements and solutions may change depending on the type of organization.



ORGANIZATION	EXAMPLE ENERGY RESILIENCE REQUIREMENT	POTENTIAL SOLUTION
Big-Box Retailer	May require on-site resilient energy systems for refrigeration to keep food fresh during power outages	Installation of distributed roof-top solar photovoltaics (PV) and battery energy storage
Large Tech Company	May operate data centers around the world and require large-scale off-site and on-site resilient energy systems to maintain uptime and ensure that the critical services that rely on them can function	Partnership with other large energy users and collaboration with local utilities to finance large-scale energy storage projects in strategic regions
Manufacturer	May be sensitive to small flickers in power quality and may require systems to guard against momentary electrical events that could damage critical equipment	Installation of uninterruptible power supply units for circuits that support critical loads

ENERGY RESILIENCE IS TYPICALLY “OWNED” BY MULTIPLE PEOPLE OR BUSINESS UNITS WITHIN AN ORGANIZATION.

From chief operating officers responsible for prioritizing business operations, to emergency managers responsible for an organization’s disaster response plans, to facilities managers tasked with maintaining backup generators, many individuals within an organization hold a piece of the energy

resilience puzzle. Chief resilience officers and dedicated resilience teams that coordinate across departments are increasingly common. In other companies, resilience responsibilities may be widely distributed across departments. A first step for clean energy customers interested in resilience is to identify colleagues in their organizations with responsibilities related to energy resilience and connect with them to understand how they can embed resilience into their energy procurement.



HOW CAN CLEAN ENERGY HELP MY ORGANIZATION STRENGTHEN ITS ENERGY RESILIENCE?

CLEAN ENERGY CUSTOMERS ARE UNIQUELY POSITIONED TO ALIGN CLEAN ENERGY PROCUREMENT AND ENERGY RESILIENCE GOALS.

Clean energy customers and sellers have led the way for widespread deployment of renewable energy across the United States. They can play a similar role with clean energy for energy resilience, building on established expertise, practices, and networks.



CLEAN ENERGY CUSTOMERS CAN SUPPORT ENERGY RESILIENCE AT CRITICAL FACILITIES.

Current energy resilience approaches rely heavily on diesel generators for backup power. During longer-term power outages, diesel generators face high failure rates and fuel supply challenges. Clean energy systems paired with battery storage can integrate with — or

replace — traditional backup power systems while cutting air emissions. Clean energy systems can also generate additional revenue during non-emergency conditions, whereas traditional backup power systems typically cannot.

CLEAN ENERGY CUSTOMERS CAN SUPPORT NEW BUSINESS MODELS FOR CLEAN ENERGY AND RESILIENCE.

Clean energy customers have pioneered innovations in clean energy procurement, such as virtual power purchase agreements (VPPAs) and “24/7 clean” VPPAs. Procurement innovation can also help drive clean energy for energy resilience. There are emerging business models in which clean energy for energy resilience can be procured on an “as-a-service” basis, similar to VPPAs. There are also models in which on-site and resilience clean energy projects are blended under VPPAs with green power purchases from larger off-site projects. Clean energy customers can help validate and scale these and related practices.

ENERGY RESILIENCE CAN BE A “VALUE-ADD” RATHER THAN AN ADDED COST FOR CLEAN ENERGY PROJECTS.

Energy resilience is traditionally viewed as an additional cost for clean energy projects because the value of resilience is notoriously difficult to quantify and there is no simple or agreed on method that is widespread across the industry. Companies are increasingly focusing on resilience as a strategic priority. The alignment of clean energy purchases with resilience may unlock demand for projects that deliver multiple co-benefits.

FROM CARBON-FREE PROCUREMENT TO CARBON-FREE CONSUMPTION

The CEBI Beyond the Megawatt Resilience Pillar was established to bring energy resilience to the forefront of clean energy procurement. While energy resilience is continually evolving, the need for collective action is more apparent than ever. Future editions of the Energy Resilience Series will help clean energy customers untangle increasingly complex, interdependent energy resilience issues, such as:

Clean On-Site Backup: How do we replace diesel generators with cleaner alternatives?

Engaging Communities: How can energy resilience investments increase community resilience?

Energy Resilience Criteria: How does energy resilience criteria fit into clean energy procurement and contracts?

Supply Chain Resilience: How can we protect energy supply chains from economic and geopolitical shocks?

Working with Utilities: How can we communicate with utilities before and during energy disruptions?

Supporting Grid Resilience: Can we use clean power procurement to shape the development of projects that support the health and function of the power system?



Valuing Resilience: How do we bring resilience onto the balance sheet and communicate it to leadership?

Policy and Market Levers: What combination of policy and market mechanisms can best support a pivot to resilient energy systems?

The CEBI Beyond the Megawatt Resilience Pillar acknowledges the need for industry collaboration around resilience in clean energy procurement. To learn more about the Resilience Pillar and join the Resilience Working Group, visit <https://cebi.org/programs/beyond-the-megawatt> or contact Erin Brousseau at ebrousseau@convergestrategies.com and Ornella Nicolacci at onicolacci@cebuyers.org.

THANK YOU!

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