



PowerSecure



Demystifying Microgrids

Truth About Microgrids and Distributed Energy

Table of Contents

- 02 Myth 1: Microgrids Cannot Be Used as a Capacity Resource to Support Utility Capacity Needs
- 04 Myth 2: Microgrids Are Complex to Implement and Difficult to Operate and Maintain
- 06 Myth 3: Microgrids Can Only Address Localized Resiliency Needs
- 08 Myth 4: Any Type of Distributed Energy Resource (DER) Can Be Used to Power a Microgrid
- 12 Myth 5: Microgrids Cannot Be a Low-Carbon Solution

HEADQUARTERS

4068 Stirrup Creek Drive
Durham, NC 27703
919-556-3056
info@powersecure.com

HR INQUIRIES

919-556-3056
careers@powersecure.com



Microgrid.

Depending on your position, this simple term might inspire a few different reactions:

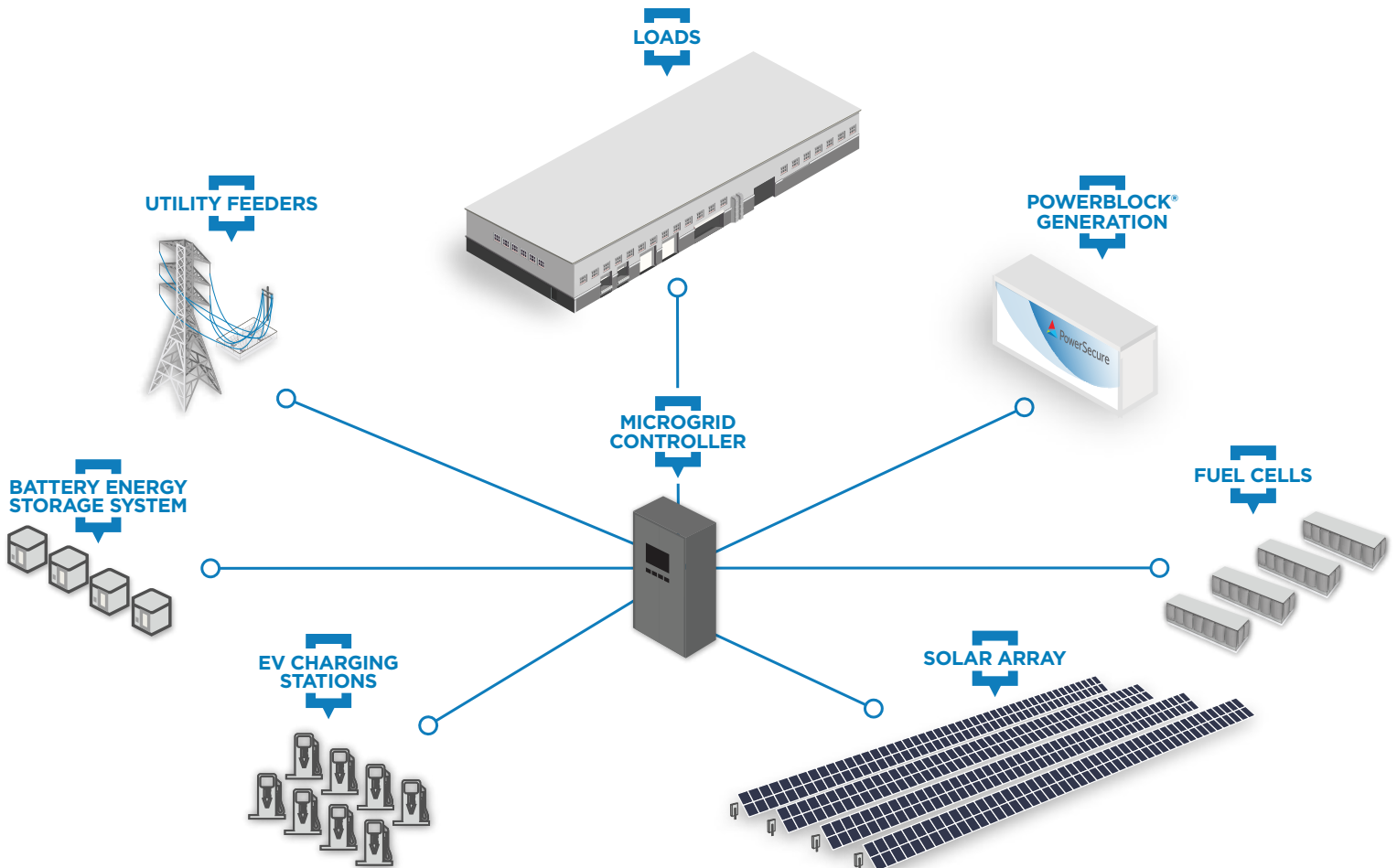
Appreciation.

Curiosity.

Confusion.

As today's energy needs grow, microgrids have emerged as a leading solution to meet the growing demand for resilient, efficient power. Yet, myths and misconceptions continue to surround these innovative technologies despite their positive impact and rapid advancements. From doubts about their ability to support utility capacity needs to misbeliefs about their carbon footprint, these misconceptions often overshadow the true value microgrids bring to modern businesses, utilities, and emergency services.

We will tackle some of the common misconceptions about microgrids and the distributed energy resources that support these systems. This guide will explain the truth behind the myths and provide examples of how microgrids are reshaping grid usage in the US. Whether you're a utility leader, business owner, energy professional, or simply curious about the future of power systems, this series will equip you with the knowledge to understand the potential of microgrids.



Myth 1: Microgrids Cannot Be Used as a Capacity Resource to Support Utility Capacity Needs

To start this series, we are exploring the myth that microgrids cannot be used as a capacity resource to support utilities. This may have been true in years past, but technological advancements and energy options have changed how microgrids can support grid stability, peak demand reduction and renewable energy integration. Microgrids are no longer isolated systems but dynamic tools capable of addressing increasing capacity challenges.

How Did this Myth Start?

The myth that microgrids cannot be used as a capacity resource stems from outdated perceptions of their capabilities and the types of energy resources used to power them. Early distributed energy systems were viewed as niche solutions for remote areas or backup power during outages rather than tools for large-scale utility support. Concerns about reliability, scalability, and integration with centralized grids contributed to skepticism.

High upfront costs and limited economic incentives further fueled negative perceptions. Legacy grid systems were designed for centralized generation, making integration with distributed resources seem complex and unfeasible, but we will explore that myth later. Before AI and advancements in grid technologies, microgrids struggled to respond dynamically to peak demand and grid fluctuations, reinforcing doubts about their scaling potential.

New Technology Makes Microgrids a Viable Option for Capacity Support

Advancements in technology, microgrid controls, and energy management systems have transformed microgrids into essential components of the broader energy ecosystem.

Microgrids have become well-suited to support utilities' capacity needs. Modern microgrids can now integrate easily with centralized grids, deliver reliable power during peak periods, and support renewable energy adoption. Their scalability, cost-returns, and ability to enhance resilience make microgrids a vital tool for utilities seeking to modernize infrastructure and meet growing capacity needs. As companies continue to embrace these innovations, microgrids are proving to be transformative in building a more sustainable and decentralized energy future.

How Microgrids Enhance Capacity

Generation and battery storage systems can be placed at substations or near commercial and industrial loads to reduce system loading during capacity shortfalls. Distributed energy resources (DERs) can be in front of the meter as a supply-side resource or behind-the-meter on the customer side. These resources can offload demand from the grid during emergencies or grid constraints, making a resiliency solution even more beneficial.

Modern microgrids, particularly advanced or hybrid systems, integrate multiple DERs such as solar panels, Tier 4 Final diesel or EPA-certified natural gas generators, and energy storage solutions like batteries. When effectively integrated with the utility grid, these microgrids can:

- **Support Peak Demand Reduction:** By supplying additional power during high demand, microgrids alleviate stress on the central grid and reduce the need for utilities to activate expensive peaking plants.
- **Facilitate Load Balancing:** Microgrids can manage energy flows intelligently, ensuring that demand and supply remain balanced even during fluctuating conditions.

- **Contribute to Capacity Relief:** During grid constraints, microgrids can operate as virtual power plants, providing capacity support without requiring new infrastructure.

The Role of Technology in Grid Integration

Advanced control systems and real-time monitoring capabilities enable microgrids to adapt to grid needs dynamically. Innovative grid technologies, such as advanced sensors, real-time monitoring systems, and automated controls, allow microgrids to communicate with the main grid and dynamically manage energy flow. Improved energy storage solutions enable microgrids to provide stable, high-quality power, even during fluctuations in generation or consumption. These innovations have transformed microgrids into reliable capacity resources, helping utilities modernize infrastructure and meet evolving energy demands. For example:

- **Demand Response Participation:** Modern microgrids can participate in utility demand response programs, reducing consumption during peak periods or feeding excess power back to the grid.
- **Renewable Energy Integration:** By pairing renewable resources with energy storage, microgrids help smooth the intermittency of solar and wind power, enhancing their reliability and contribution to grid stability.
- **Economic Optimization:** Microgrids with sophisticated energy management systems enable customers to avoid peak pricing by strategically drawing from stored energy or on-site generation.

By reducing dependence on expensive peak power purchases, minimizing service interruptions, and enabling participation in demand response programs, microgrids create opportunities for cost recovery and profitability. These financial advantages make microgrids an attractive investment for utilities and organizations looking to build sustainable and efficient energy systems.

As capacity continues to be an issue, adopting microgrids will be a key strategy for maintaining reliability and efficiency while supporting long-term growth.

Redefining Microgrid Perception

The stereotype that microgrids are synonymous with basic backup generators does a disservice to their transformative potential. Modern microgrids go beyond resilience—they are integral to load management, cost optimization, and the transition to a cleaner, more flexible energy future.

As the energy landscape evolves, microgrids' ability to act as capacity resources will continue to grow, benefiting utilities, customers, and the environment alike.



Myth 2: Microgrids Are Complex to Implement and Difficult to Operate and Maintain

To many, microgrids represent an intricate system requiring significant expertise to implement and maintain. This misconception deters organizations from exploring their potential. Let's explore the myth of microgrid complexity and shed light on how these systems are, in fact, manageable and effective solutions for modern energy needs.

This misconception arises from the idea that integrating distributed energy sources is an insurmountable challenge. In reality, think of it less like a chaotic orchestra and more like a well-designed puzzle.

Each microgrid is made up of a singular or multiple DERs. These DERs work with supporting components to run independently or parallel to the primary electrical grid depending on the needs of the facility.

Policy changes, innovative technology, and a growing variety of fuel sources ensure that microgrids can be more accessible, cost-effective, and efficient than ever before.

Demystifying the Implementation Process

Implementing a microgrid doesn't have to be overwhelming. Turnkey microgrid solutions and modular components allow faster and more streamlined implementation, even in challenging environments. Expert microgrid providers simplify the process into clear stages, ensuring organizations receive tailored solutions that meet their unique needs.

1

Feasibility Studies: This initial stage involves understanding a business's unique energy needs and operational goals. Providers should consider site conditions, load requirements, and financial factors by examining existing energy usage patterns and future demands.

2

Design & Customization: Once feasibility is established, the design process begins. Microgrid providers should work closely with organizations to develop systems tailored to meet all requirements and overcome environmental challenges. Depending on the project, your microgrid provider may work directly with any Architectural, Engineering, or Construction (AEC) firms or the general contractor chosen to ensure a successful design. The design process should also account for scalability, ensuring the system can adapt to future expansions.

3

Installation: Microgrid installation involves careful coordination to minimize disruptions to operations and any existing infrastructure. Suppliers should be able to handle construction, integration, and testing, ensuring all components work seamlessly together. By employing standardized procedures and leveraging experience, installation can be completed efficiently and on time.

4

Ongoing Support: Post-installation, microgrids require consistent monitoring and maintenance to ensure optimal performance. Leading providers offer real-time support, predictive maintenance, and system updates. These services are crucial for addressing issues proactively, reducing downtime, and extending the system's lifespan.

Additionally, experienced microgrid providers often help organizations navigate complex regulatory landscapes and identify cost-saving opportunities, such as government incentives, organized market programs or utility programs. This comprehensive approach simplifies what might initially seem daunting, enabling organizations to focus on reaping the benefits of their microgrid investment.



CASE STUDY Quakertown Community Microgrid

The Borough of Quakertown, Pennsylvania, hosted AMP's behind-the-meter R.I.C.E Peaking Project, integrating PowerSecure systems to reduce energy costs and provide backup power. This project supported 132 municipal members and aimed to lower system peaks and transmission costs. Quakertown benefited from enhanced energy resilience and environmental standards with low-emission Tier 4 PowerBlocks, which were monitored and maintained 24/7.

Operational Simplicity Through Technological Advancements

The operation of microgrids has been revolutionized by technological advancements, making them more efficient, reliable, and user-friendly.

- **AI and Machine Learning:** Modern microgrid systems can utilize AI-driven algorithms that analyze energy usage patterns, predict demand fluctuations, and optimize resource allocation in real-time. Machine learning enables these systems to adapt to changing conditions, improving efficiency and reducing operational oversight.

- **Advanced Control Systems:** The integration of sophisticated control platforms has transformed microgrid management. These platforms offer real-time visibility into energy flows, system performance, and financial metrics. These systems simplify tasks like load balancing and fault detection.
- **Fuel Diversity:** Microgrids can be powered by a variety of fuel sources, allowing organizations to choose the DERs that best align with their energy goals. Common sources include:
 - **Renewable Energy:** Solar panels and wind turbines provide clean, sustainable power.
 - **Energy Storage:** Battery systems store excess energy for use during peak demand or outages.
 - **Generators:** Fuels like natural gas, HVO or traditional diesel can offer reliable backup power independent of outside forces.

DER diversity enhances microgrid resilience and ensures energy availability under various conditions. For example, an industrial facility might pair battery energy storage with Tier 4 Final generators to achieve sustainability and reliability.

These advancements debunk the myth of operational complexity, proving that microgrids are accessible even for organizations without extensive energy expertise.

Simplifying Microgrid Maintenance & 24/7 Support

Innovative providers, like PowerSecure, ensure operational efficiency through real-time monitoring and control. Tools such as the PowerControl® Network Operations Center reduce operational burdens and ensure peak performance.

Myth 3: Microgrids Can Only Address Localized Resiliency Needs

Aren't microgrids local energy systems? How can microgrids go beyond localized resiliency? This myth stems from misconceptions around the different definitions of localized. Today's microgrids are far more than backup power sources for a single building. In fact, microgrids have evolved from small-scale emergency generators to scalable energy solutions that can support communities, industrial and commercial businesses, college campuses and even military bases for extended periods.

So, how can a microgrid scale beyond localized needs? Let's break down the components of a microgrid, explore its scalability, and see just how expansive these systems can truly be.

What Makes Up a Microgrid?

Today's microgrid consists of several key components that work together to provide reliable and resilient energy to a grouping of connected loads:

- **Energy Generation:** DERs such as solar panels or natural gas, HVO or diesel generators that generate energy.
- **Energy Storage:** Battery storage systems that store excess energy for later use, ensuring grid stability.
- **Control System:** A smart management system that optimizes energy distribution and efficiency.

The scalability of a microgrid depends on these resources. A robust combination of generation sources and storage solutions allows the system to expand as energy demands grow.

How Large Can a Microgrid Get?

As we discussed in Myth 1, microgrids can go much further than ever before. Modern custom microgrid solutions can scale to support larger loads. This flexibility means microgrids are increasing resilience across wider areas while decreasing spatial needs.

This ability to expand is not limited to physical size. The energy output of a microgrid is determined by its design and resource capacity. Microgrids can generate between 75 kilowatts to several megawatts, providing islanded power for a few hours to extended periods of time.



Microgrids for Remote Facilities

Providing demand restoration services quickly to rural areas can be challenging, so these communities rely on microgrids to ensure essential energy supply. While for remote locations without any access to the macro grid, microgrids can serve as the only option for reliable energy.

Mobile microgrids offer even greater flexibility. Whether it is for temporary power during building projects, disaster relief or special events, these transportable systems are enabling energy independence at new distances.

While space and capacity requirements may still be factors in a microgrid design, they are no longer as limiting as they once were. Energy density advancements have significantly reduced the constraints of space and capacity, allowing microgrids to be tailored to a wide range of applications and enhancing their ability to provide resilient and reliable power solutions. This newfound flexibility is especially for mission-critical services which are essential to society.

Real-World Examples of Large-Scale Microgrid Solutions

To showcase the scalability of microgrids, consider these case studies:

- **City of Bennettville:** A microgrid providing power resiliency for an entire community.
- **Alabama Smart Neighborhood:** A smart neighborhood utilizing demand response software.
- **Ocracoke Island:** An independent microgrid ensuring power security for an isolated island.

These examples illustrate how microgrids can be adaptable energy solutions that meet a wide range of needs.

Microgrids: A Scalable Solution for the Future

Modern microgrids have outgrown the misconception that they only serve localized energy needs. They are scalable, adaptable, and capable of supporting entire communities. Whether expanding an existing microgrid or designing a large-scale energy system, microgrids play a key role in building resilient and reliable energy strategies.



NATURAL GAS GENERATOR

Back-up generation source to ensure reliability of the microgrid. Uses natural gas to create electricity.

LOAD BANK

Enables testing of the generation assets to ensure the system is working correctly before connection to customers.

BATTERY

Stores energy generated for when it is needed. The equivalent to over 200,000 alkaline batteries.

POWER EQUIPMENT CENTER

Acts as the control center of the microgrid contains batteries, system controller, communications server, and switchgear.

SOLAR ARRAY

Converts light from the sun into energy that can be used to power the neighborhood and existing electric grid, or stored in the batteries. Eleven rows of solar panels with more than 1,200 modules.

THE SOUTHEAST'S FIRST COMMUNITY-SCALE MICROGRID

The Smart Neighborhood microgrid sits on five acres in suburban Birmingham, Alabama. It has the capacity to generate more than 600,000 kilowatts annually, which enough to power the 62-home subdivision of Reynolds Landing at Ross Bridge. The neighborhood is powered by the microgrid and the existing electric grid.

Myth 4: Any Type of Distributed Energy Resource (DER) Can Be Used to Power a Microgrid Efficiently

Different Benefits for Different Companies in Different Places

Microgrids are known for their flexibility and resilience, but that doesn't mean that any DER can be used to power a microgrid effectively. While microgrids can integrate various DERs, not all of them offer the same level of performance, reliability, and cost-effectiveness.

The Misconceptions Behind Choosing A DER

Some people assume that just because a microgrid can incorporate a certain Distributed Energy Resource (DER), it should. However, many microgrid customers are not optimizing their energy mix, which leads to unnecessary costs or inefficiencies. While microgrids are highly customizable, not all configurations are equally reliable or cost-effective.

The reality is that different DERs vary in factors like energy output, storage capabilities, cost, and sustainability. Choosing the wrong combination can lead to higher operational expenses, lower system efficiency, missed emission reporting goals or reduced resilience during outages.

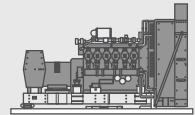


A Review of Distributed Energy Resources

Before diving into how to choose the right DERs, let's explore some of the most common options and their roles in microgrids.

Reciprocating Engines (Diesel & Natural Gas Generators)

- Generates energy from a fuel source such as diesel, natural gas or hydrogenated vegetable oil (HVO).
- Varying levels of emissions reporting depending on types of generator or fuel source.



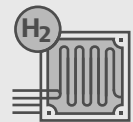
Energy Storage Systems (Batteries)

- Stores excess energy generated.
- Ensures a steady power supply, especially during peak demand, grid outages, or when renewable options are not feasible.



Fuel Cells

- Generates energy using hydrogen or natural gas fuel sources.
- A low emissions option that is highly efficient while also lowering noise contamination.



Combined Heat and Power (CHP) Units

- Simultaneously produces electricity and usable heat, increasing overall efficiency.
- Ideal for facilities with high heating or cooling demands, such as hospitals and industrial sites.



Solar Photovoltaic (PV) Systems

- Generates power from the sunlight.
- Best suited for locations with ample sunlight and space for panel installation.



Wind Turbines

- Generates energy from wind energy.
- Effective in high-wind areas, but intermittent and typically require backup storage or supplemental energy sources.



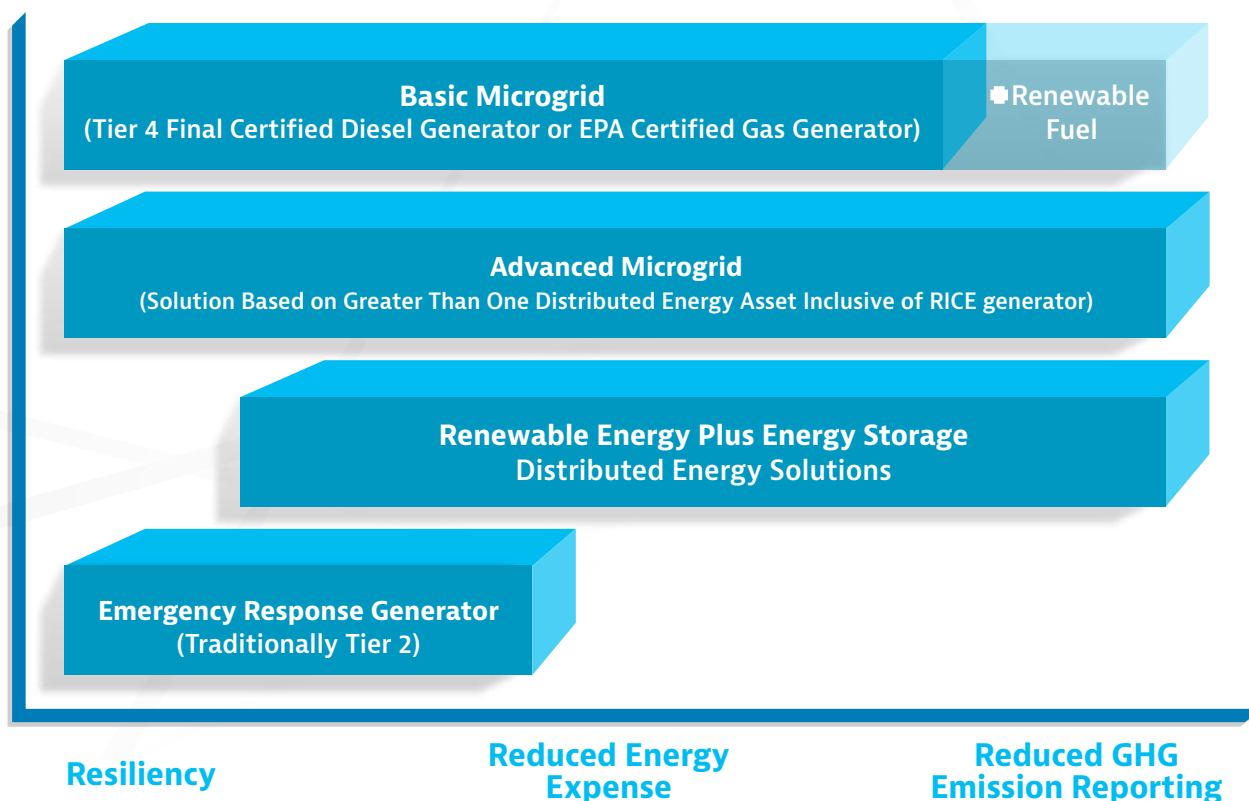
What to Consider When Choosing Distributed Energy Resources for a Microgrid

While microgrids can integrate multiple DERs, choosing the right mix depends on geography, load demand, cost constraints, and resilience requirements.

Choosing the right DERs requires careful evaluation of your specific energy needs. Here are some key factors to consider:



BENEFIT RATIO

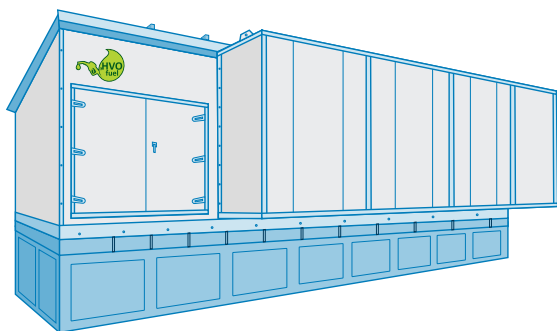


CUSTOMER ENERGY OBJECTIVES

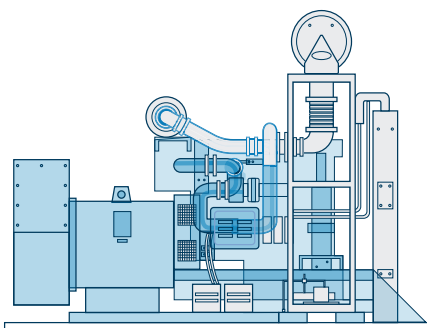
The best solution is the one that meets your needs and maximizes efficiency. Hybrid solutions or a single generator with renewable fuels can offer a better benefit to resilience ratio, but it is important to work with a microgrid provider that can design a microgrid tailored to your needs.

While microgrids offer remarkable flexibility and resilience, it's essential to choose the right mix of Distributed Energy Resources (DERs) to optimize performance, economic benefit potential, reliability, emissions reporting, and cost-effectiveness. Understanding each DER's unique benefits and limitations and considering factors like energy demand, location, and regulatory requirements can ensure your microgrid is tailored to your specific needs. By making informed choices, you can maximize efficiency and long-term savings, turning the myth of "any DER will do" into a well-strategized reality of the "right DERs for you."

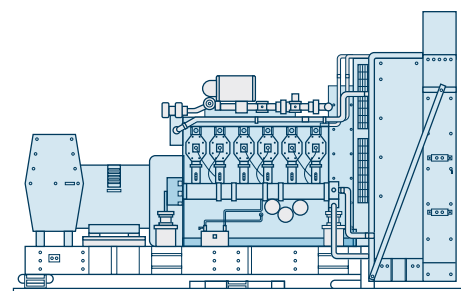
PowerBlock® Generation System



Tier 4 Final Diesel Engine



Natural Gas Engine



Myth 5: Microgrids Cannot Be a Low Carbon Solution

Businesses increasingly recognize microgrids as a key solution for energy resilience and sustainability. However, a persistent misconception suggests that microgrids cannot be a low carbon solution. This blog, the last of our five-part Distributed Energy Resources (DER) series, highlights how microgrids can play a crucial role in achieving decarbonization goals.

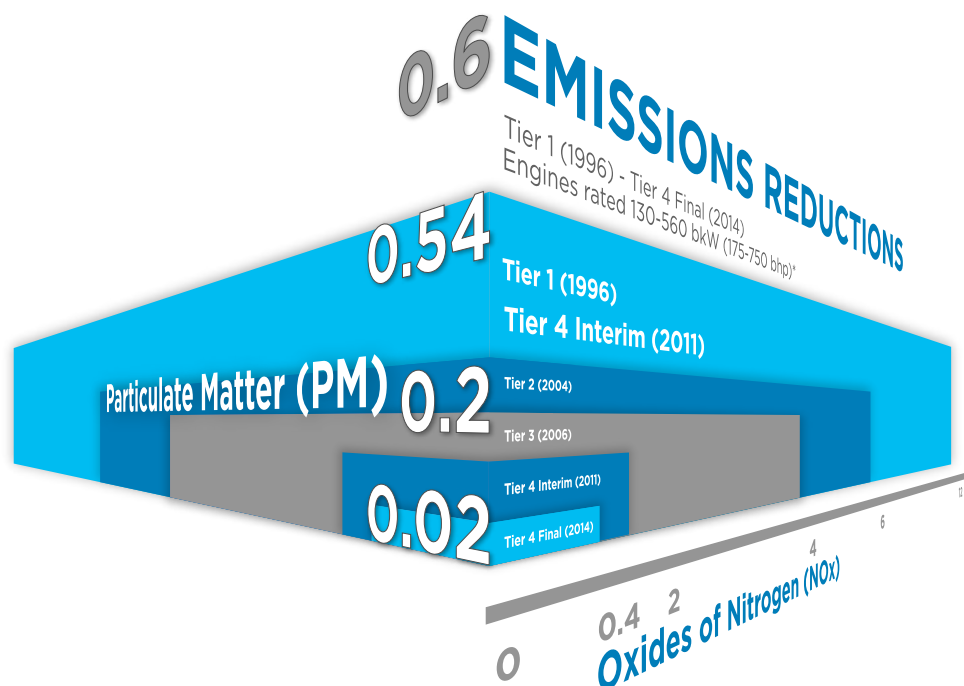
Like many of our other myths, this one is based on historical precedent. Early microgrids primarily used diesel and natural gas, reinforcing the belief that they contributed significantly to emissions. The rapid evolution of the type and technology of DERs and microgrids has outpaced public perception. Early scalability concerns led some to doubt whether microgrids could provide sufficient clean power for large-scale applications. However, recent innovations have turned this once-unattainable vision into reality.

Today's advanced microgrids can incorporate renewable energy sources, energy storage systems, and alternative fuels, enabling them to operate sustainably while ensuring grid stability and resilience. This shift demonstrates that microgrids can indeed support the transition to a net-zero carbon future.

How Microgrids Can Be Low Carbon

Microgrids optimize energy use, minimize waste, and maximize efficiency—leading to significant carbon reductions. Here's how:

- **Hybrid Microgrids:** Also known as Advanced Microgrids, these systems can incorporate solar, renewable fuels and battery storage to minimize reliance on fossil fuels while maintaining resiliency.
- **Adoption of HVO:** Hydrotreated Vegetable Oil (HVO) can replace diesel in generators, eliminating reportable fossil-based carbon emissions when 100% HVO burned.
- **Renewable Natural Gas:** Natural gas generators can also be used to reduce dependence on fossil fuels through use of renewable natural gas.
- **Technology Innovations:** AI-driven energy management emissions in a hybrid microgrid.



What Is HVO and How Could It Support Low Carbon Microgrids?

Hydrotreated Vegetable Oil (HVO) offers an alternative to both fossil diesel and biodiesel. Unlike biodiesel, which requires blending and has different chemical properties, HVO is chemically identical to fossil diesel, making it a true drop-in replacement that requires no modifications to existing engines. Produced from renewable and sustainable raw materials, one of its most significant advantages is its environmental impact— reportable Scope 1 fossil-based greenhouse gas (GHG) Emissions are zero. Whether used at 100% purity or blended, HVO provides a practical and immediate solution for businesses and industries looking to decarbonize their operations without sacrificing performance.



100% Renewable Fuel Microgrid

The Durham Campus Microgrid Initiative serves as a leading example of a low carbon microgrid. This advanced microgrid features solar energy, battery energy storage, fuel cells and generators operating on HVO. This microgrid provides a real-world demonstration of how advanced microgrid solutions can decarbonize reliable power.

Understanding Scope 1, 2, and 3 Emissions in Microgrid Sustainability

To evaluate a microgrid's carbon neutrality, it's essential to understand the three scopes of greenhouse gas (GHG) reporting:

- **Scope 1 (Direct Emissions):** Emissions from sources owned or controlled by an organization, such as on-site generators.
- **Scope 2 (Indirect Emissions from Purchased Energy):** Emissions from electricity purchased and used by an organization. A microgrid that relies on on-site renewable energy eliminates Scope 2 emissions.
- **Scope 3 (Indirect Emissions from Supply Chain and Operations):** Emissions from upstream and downstream activities, such as fuel transportation. Microgrids powered by local renewable energy sources, such as HVO, can reduce Scope 3 emissions.

By utilizing renewable fuels like HVO and renewable DERs, microgrids help businesses and communities meet aggressive decarbonization targets across reporting scopes.

Preparing For an Evolving Energy World

As energy demands evolve and the need for resilient solutions grows, microgrids are emerging as a critical component of the future energy landscape. By integrating distributed energy resources, microgrids offer improved reliability, efficiency, and energy independence, making them a viable solution for various applications, from municipalities and campuses to military installations and industrial facilities.

Despite misconceptions surrounding their complexity and scalability, microgrids are proving to be an adaptable and forward-thinking approach to energy management. Advances in technology, regulatory support, and innovative financial models are making microgrids more accessible and cost-effective than ever before.

Organizations looking to invest in microgrids must consider key factors such as system design, financing strategies, and long-term sustainability. By leveraging the right expertise and resources, stakeholders can maximize the benefits of microgrid deployment, ensuring a cleaner, more resilient energy future.

As the energy sector shifts, microgrids will be essential in shaping a more flexible and secure power infrastructure. The time to explore and invest in microgrid solutions is now.

For more information or to discuss how microgrids can benefit your organization, contact PowerSecure today.

HEADQUARTERS

4068 Stirrup Creek Drive
Durham, NC 27703
919-556-3056
info@powersecure.com



PowerSecure

