

Enhance Operational Readiness with Electrical Resiliency-as-a-Service



TABLE OF CONTENTS

The Emerging Resiliency Challenge2

An Alternative Approach to Resiliency — Dual Purpose Microgrids3

Pricing and Contracting Options4

Relevant Project Examples5

The Benefits of an Enchanted Rock Microgrid6

What Differentiates Enchanted Rock7

Summary8

About Enchanted Rock8



Microgrids provide industrial-scale, long-duration power resiliency for fixed military installations

Executive Summary

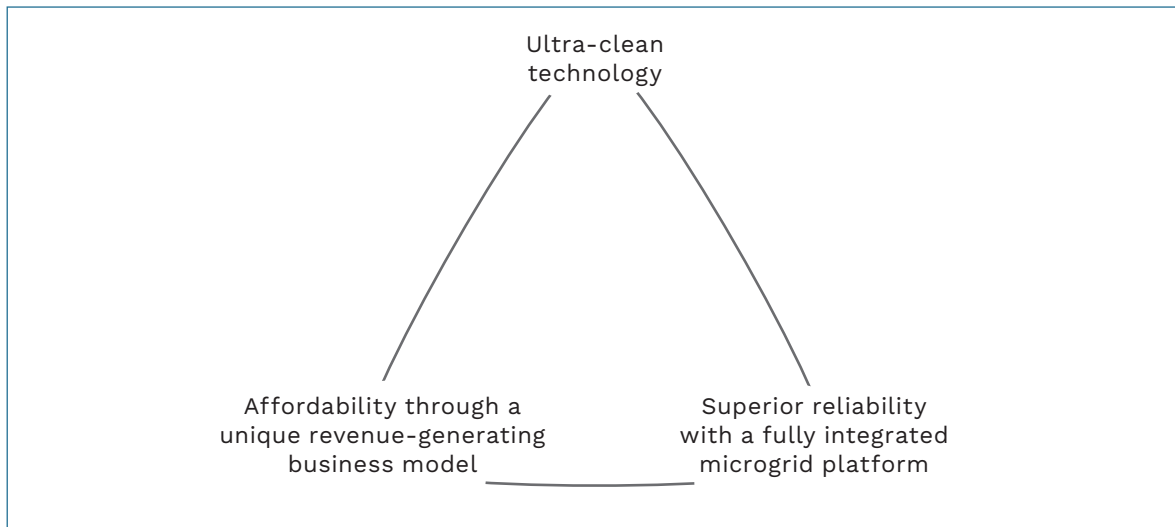
Fixed military installations demand the continuous availability of energy to maintain mission readiness, yet they rely on an aging, vulnerable utility grid. Enchanted Rock’s electrical resiliency-as-a-service provides industrial-scale, long-duration power resiliency.

This white paper describes our microgrids’ performance at Marine Corps Base Quantico, U.S. Army Engineer Research and Development Center in Vicksburg, MS, and City of Houston’s Northeast Water Purification Plant, demonstrating proven technology and the value of an integrated microgrid platform. Other customers include 20% of the Fortune 10.

Our patented natural gas generator unit is modular at 450 KW, which enables a high degree of standardization, regardless of the load requirement. We offer the cleanest backup power application available at scale, with quiet operation, ultra-low local emissions, and benign visual impact making for rapid permitting and deployment.

Our solutions are proven with over 330 microgrid installations exceeding 1,000 MW in operation or construction, and with 1,300-plus individual generating units monitored and managed from our secure Network Operations Center. Enchanted Rock also leads in innovation and decarbonization, offering renewable natural gas and hydrogen blends for net-zero carbon resiliency.

Enchanted Rock excels by achieving three key objectives:



The Emerging Resiliency Challenge

Fixed military installations need continuous energy to operate, and they significantly rely on electricity to support critical missions and support functions. But these installations are reliant on an aging utility grid that is vulnerable to disruption due to severe weather, physical and cyberattacks, and equipment failure.

Relying on a vulnerable electric grid exposes the Department of Defense (DoD) to the risk of power outages caused by a range of mechanical, operational, environmental, and human-related hazards. Protection against these risks requires a well-maintained, local generating source that starts quickly to provide utility-grade power for base operations for the duration of the outage, whether it's for a few minutes, several days, or weeks. Additionally, power outages can affect local communities that house and provide critical services to base personnel, and backup power for these communities is inconsistent or non-existent.

The default solution for backup energy at military installations relies on emergency diesel generators for selected buildings and loads but rarely covers most base operations, much less the surrounding communities. Additionally, diesel generators are vulnerable to fuel supply chain disruptions during an extended outage. A 2020 NREL study showed diesel generators “can fail more often than recognized and their reliability must be considered when evaluating energy backup system architectures.” The study also found “poorly maintained emergency diesel generators are unlikely to run more than a few days, and even well-maintained emergency diesel generators have only an 80% likelihood of being operational at the end of a two-week outage.”



Failure of a backup power supply during a long-duration outage can risk mission readiness across several strategic focus areas such as:

- Implementing predictive maintenance and supply
- Assuring cybersecurity
- Increasing autonomy and mobility of DoD systems
- Discovering blue sky/other technology applications

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An Alternative Approach to Resiliency: Dual Purpose Microgrids

Enchanted Rock's electrical resiliency-as-a-service provides industrial-scale, long-duration power resiliency. Our unique solution is anchored on patented natural gas reciprocating engines that are in commercial operation in seven states with over 1 million unit run hours. The distributed generator unit is modular at 450 KW, which enables a high degree of standardization, regardless of the load requirement. We offer the cleanest backup power application available at scale, with quiet operation, ultra-low local emissions, and benign visual impact making for rapid permitting and deployment. In our as-a-service model, Enchanted Rock designs, finances, constructs, operates and maintains the resiliency microgrid. The microgrid responds autonomously to grid power disturbances and can be designed to cover full base operations and also export surplus energy to support the surrounding community in conjunction with the local electrical utility.

In addition, the microgrid is periodically dispatched to support the grid and surrounding communities during grid stress, preventing blackouts and earning revenue to offset system cost as well as keeping the asset primed for use when a power outage occurs. This feature results in the lowest cost of resiliency with the highest state of operational readiness at all times, and these principles of "run often and run loaded" are borrowed from our team's experience in the Navy Nuclear program.



Microgrid Network Operations Center in Houston, TX

Enchanted Rock's technology is field proven at Technology Readiness Level 9. Enchanted Rock currently protects private industry, critical infrastructure, and government facilities across more than 330 operational microgrid sites, totaling over 1,000 MW — all managed by our 24/7 microgrid Network Operations Center and microgrid operating platform.

Pricing and Contracting Options

All solutions are turnkey, covering engineering, installation, maintenance, and 24/7 monitoring. Microgrids provide both resilience and market based grid services. We offer four pricing models:

- 1. Utility Partner Model:** Utility owns and operates the asset, assuming performance and market risks. Customers pay a monthly resiliency fee. Used by U.S. Army Engineer Research and Development Center.
- 2. Integrated Resiliency on Call (iROC):** Enchanted Rock owns and operates the microgrid, assuming performance and market revenue risk. Customers pay an upfront resiliency fee and ongoing monthly fees for operations and maintenance.
- 3. Energy Savings Performance Contract (ESPC) Indefinite Delivery/Indefinite Quantity:** A flexible model combining resiliency with energy efficiency. The ESCO owns and operates the assets, receiving payments based on savings. Used by Marine Corps Base Quantico.
- 4. System Sale:** Customer owns the assets, makes a higher investment, and bears market risk while Enchanted Rock manages market services for a small fee.

Relevant Project Examples



Marine Corps Base Quantico, VA

- Enchanted Rock partnered with the privatized utility operator and the DoD to provide long-duration electrical resiliency to protect their Quantico, VA installation from power outages.
- Installed over 3 MW of ultra-reliable natural gas generation in 2022 protecting the Marine Corps base from grid interruptions. Future propane backup is an option.



U.S. Army Engineer Research and Development Center

- Enchanted Rock Partnered with U.S. Army Corps of Engineers and their electric utility, Entergy Mississippi, to provide the Engineer Research and Development Center in Vicksburg, MS a 3.2 MW resiliency microgrid to protect against outages.
- Resiliency fees are collected by Entergy through monthly on-bill charges.
- Protected against five outages over a cumulative 15.4 hours, with an average duration of 3.1 hours and no impact to the facility since implementation.



City of Houston's Northeast Water Purification Plant

- Pumping over 320 million gallons per day, this important source of drinking water needed a low-emissions resiliency solution to meet projected water demands.
- Enchanted Rock provides 32 MW of backup power at the Northeast Water Purification Plant, the largest water infrastructure microgrid in the US.
- Enchanted Rock's unique model resulted in cost savings of over \$20 million for the city.

In our extensive operational history, Enchanted Rock has consistently demonstrated excellence and a proven track record. Our portfolio boasts remarkable achievements, including safeguarding customers from over 5,700 outages, totaling 12,000 outage hours. With a presence at 330 microgrid sites, we have commissioned or are in the process of constructing 1,000 MW across various sites, ranging from 1 MW to 60 MW. Our units have run for a cumulative total of 1,313,723 hours, reflecting the robust reliability of our systems at an impressive 99.999%.

Notably, during Winter Storm Uri, we successfully maintained the protection of 143 sites for up to 60 hours while the broader Texas grid faced challenges.

Our coverage during Winter Storm Uri spanned 5,000 outage hours, and our fleet remained unaffected by gas pressure issues impacting bulk power system generators.

Safeguarded customers from*:

5,700
OUTAGES

24,818
HOURS OF OUTAGES

329
MICROGRID SITES

1 GW COMMISSIONED
OR
UNDER CONSTRUCTION

1,424,491
RUN HOURS

*Stats as of Aug 2024



While our technology is proven, we also continue to innovate to future-proof and decarbonize.

- Our renewable natural gas option, which can provide net-zero carbon electrical resiliency, is available now.
- Hydrogen blends up to 25% have been tested with no performance degradation.
- Longer term repowering leveraging about 80% of initial installation, for a low-cost solution once hydrogen can be cost effectively delivered and stored onsite.

The Benefits of an Enchanted Rock Microgrid

Enchanted Rock currently ensures electrical resiliency for the U.S. Army’s Engineer Research and Development Center, achieving a notable 100% protection from all outages since installation. Our client portfolio includes respected entities such as Walmart, Microsoft, AbbVie, the City of Houston, Praxair, and Texas A&M University. Additionally, we maintain strategic relationships with leading utilities and independent system operators like California ISO, ERCOT, Entergy, Exelon, CPS Energy, and the Tennessee Valley Authority, which also enable us to deliver specialized grid support services.



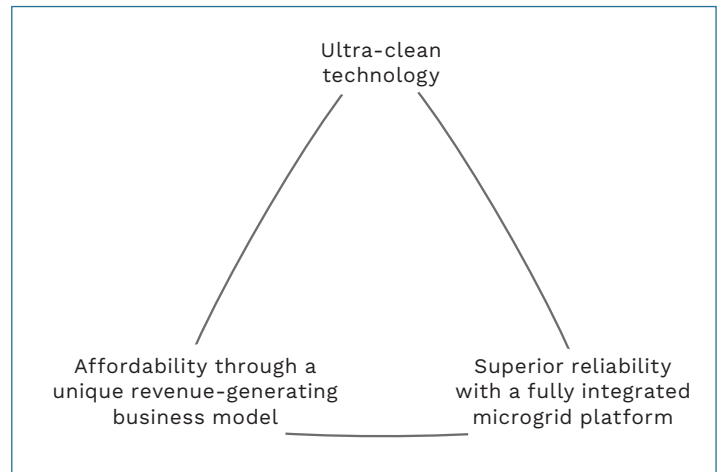
Customer benefits of the Enchanted Rock microgrid solution:

- Protects against long-duration outages and disturbances. This maintains operational continuity and worker productivity, reduces equipment damage and outage recovery costs, and enhances safety.
- Reduces upfront costs thanks to participation in energy markets.
- Reduces operational risk with 24/7 monitoring, sustaining engineering, preventive and predictive maintenance, regular testing, and onsite technician visits.
- Saves money and time because resiliency-as-a-service is a full turnkey solution, which doesn't require onsite personnel to support the solution.

What Differentiates Enchanted Rock

Enchanted Rock is set apart by achieving 3 simultaneous objectives: proven technology that is the cleanest backup power available commercially, affordability through a unique business model that generates revenues from the microgrid installation, and last but not least, superior reliability for long-duration island operation, supported by a fully integrated end-to-end microgrid operating platform. Our offering includes:

- Patented generation technology, using rich-burn natural gas reciprocating engines that match the form factor of diesel, but with 10-100 times cleaner local emissions and quiet, low-impact operation.
- Microgrid operating platform that standardizes equipment for scale economies, provides monitoring and analytics of real-time operational data, includes preventive and pre-emptive maintenance based on system condition, and utilizes feedback loops for continuous improvement.
- Integration with other onsite generation technologies, energy storage, and building controls, and our microgrids do not negatively impact solar generation during blue sky operations. During power outages, the Enchanted Rock microgrid's controls direct all other energy assets on site to maintain utility-grade voltage and frequency until grid service is restored.
- Asset management. When backup power is not needed, the microgrid provides grid stability services back to the grid and local community during periods when grid operators need capacity to prevent blackouts. These grid stability services earn a return, which reduces the net cost to the customer and strengthens the grid. In most cases, this results in the same or lower costs for comparable diesel backup solutions.



Enchanted Rock has extensive experience and proven, documented performance from 15 years of microgrid services covering: design, build, operate and maintain.

An NREL study found grid-connected natural gas generators like those used in our microgrids “create positive economic value and have significantly lower failure rates than backup-only generators.”

Enchanted Rock provides turnkey resiliency solutions using a standard approach to engineering, maintenance, and operation. In all pricing options, Enchanted Rock's scope covers:

- Engineering and design
- Generator and electrical equipment procurement and project management
- Equipment installation, and site construction
- System commissioning
- Permitting
- Gas/electric interconnection (as applicable)
- Preventative and corrective maintenance
- 24/7 Network Operations Center monitoring and support
- Remote dispatch and market deployment
- Availability guarantees
- 15-20 year warranty
- System reporting

Summary

Enchanted Rock, assessed as "Awardable" by the Department of Defense (DoD) Chief Digital and Artificial Intelligence Office's (CDAO) Tradewinds Solutions Marketplace, offers a unique electrical resiliency-as-a-service solution to the challenges faced by fixed military installations and critical infrastructure. Our microgrids, powered by patented natural gas generator units, provide industrial-scale, long-duration power resiliency. These microgrids have been successfully deployed at Marine Corps Base Quantico, U.S. Army Engineer Research and Development Center, and the City of Houston's Northeast Water Purification Plant, among others, showcasing their proven technology and integrated platform.

Enchanted Rock's modular generator units enable high standardization and clean backup power, with quiet operation, ultra-low emissions, and rapid permitting. With over 330 microgrid installations exceeding 1,000 MW in operation or construction, Enchanted Rock leads in innovation, offering renewable natural gas and hydrogen blends for net-zero carbon resiliency. Their solutions focus on achieving ultra-clean technology, affordability through a revenue-generating model, and superior reliability, making them a top choice for critical infrastructure resilience.

[VIEW ENCHANTED ROCK'S AWARDABLE SOLUTION](#)

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About Enchanted Rock

Founded in 2006, Enchanted Rock is a leader in electrical resiliency-as-a-service, powering companies, critical infrastructure, and communities to ensure operational continuity during unexpected power outages from extreme weather, infrastructure failures, cyberattacks and other grid disruptions. Enchanted Rock's dual-purpose microgrids use natural gas and renewable natural gas (RNG) offsets to produce significantly lower carbon emissions and air pollutants than diesel generators, capable of achieving resiliency with net-zero emissions. Additionally, the company's end-to-end microgrid software platform, GraniteEcosystem™, provides real-time 24/7/365 system monitoring and optimization, including forecasting of electricity market conditions to ensure worry-free reliable power to customers.

For more information, please visit www.enchantedrock.com or visit [Twitter](#) or [LinkedIn](#).