

# Reducing Air Quality Impacts of Backup Generation and Peaking Plants

November 2023





# The Energy Transition Will Falter Without A Stable and Resilient Grid

Drivers of evolving grid needs:

- Legacy generation retirements
- Increasing penetration of intermittent resources
- Acceleration of electrification
- Expanding set of critical facilities relying on electricity

Key to the transition is **dispatchable generation** providing:

- ✓ Clean megawatts
- ✓ Local resilience
- ✓ Affordability
- ✓ Commercial availability

The Enchanted Rock solution meets these criteria and is **not constrained** by:

- Run time, min or max
- Weather
- Start/stops
- Natural gas pressure
- Location
- Emissions
- Charge cycle




# Introduction to Enchanted Rock

Enchanted Rock’s solution to the grid challenge is a clean dispatchable **microgrid** that sets the bar for price and performance associated with contingent energy supply while also meeting local resiliency needs.


### Features


 Flexible


 Ultra-clean local and GHG emissions

 Affordable


### Use Cases


 Balancing renewable generation


 Protect against extreme weather

 Resilient against grid emergencies and outages

## Enchanted Rock by the Numbers

 Operational Microgrid Sites **294**

 Unit Run Hours **1,032,949**

 Operational MWs **592**

 Microgrid Continuous Availability **98%**



## Microgrids as a “Good Neighbor”



1. Land use advantages over solar & storage
2. Minimal visual impact
3. Low noise pollution
4. No water usage

## Health & Environmental Impacts



1. Protect EJ communities against diesel emissions
2. Support air quality attainment status
3. Net zero GHG emissions
  - Hydrogen-ready
  - (Future) Advanced nuclear-ready to meet local baseload power needs

## Promotes Safety & Resiliency



1. Critical infrastructure protection
2. Reduce CO poisoning and fire risk from residential backup generators
3. Alleviates burden on emergency personnel during major outage events and disasters

## Supports Economic Development



1. Avoid grid constraints, supply chain slowdowns, and interconnection delays to meet rapid economic and electric demand growth
2. Cleaner, more reliable and more affordable power attracts plant investment and associated new jobs and tax base





# Case Studies



# Grid-Scale Microgrids



California Dept. of Water Resources

**Contract Executed:** November 2022

**Project Size:** 148 MW

**Project Location:** California

**Commercial Operation Date:** Staggered in Q3 2023

## Problem

California's electric grid has increasingly experienced energy capacity shortfalls. The CA legislature tasked the California Department of Water Resources (CDWR) with procuring emergency generation capacity that will be available quickly and for the next 5-7 years until additional long-term capacity is added.

## Solution

As a turnkey provider of grid-facing microgrids, Enchanted Rock with its dual-purpose microgrids, has contracted to build and operate three projects through the Strategic Reliability Reserve program. DWR is partnering with Enchanted Rock to deliver three commissioned 48 MW plants of fast response, dispatchable dual-purpose microgrids by September of 2023.

## Enchanted Rock Solution Benefits



**Ultra-Clean** – Reduces permitting timeline and enables unrestricted operations in California market, optionality for RNG and H2 blending



**Fast start** – Full load in <60 seconds, modular configurations to fit available space



**Speed to Market** – Standardized equipment and process enables quick and safe delivery



**High Availability** – No single shaft risk or planned outage, unconstrained by start/stops, gas pressure, weather

# Community Microgrid



Bronzeville Community Microgrid, Chicago

**Contract Executed:** Fall 2020

**Project Size:** 5.8 MW ESP

**Project Location:** Chicago, IL

**Commercial Operation Date:** Fall 2023

## Problem

ComEd wanted to use a microgrid to increase reliability while ensuring local resiliency in small sections of the grid. Chicago's Bronzeville neighborhood has historically experienced reliability issues, making it an ideal testing ground for the world's first "clustered microgrid".

## Solution

ComEd partnered with Enchanted Rock to execute a phased, DOE-funded microgrid project to provide reliability to this disadvantaged neighborhood.

- **Phase 1** - Integrated IIT's CHP plant with ComEd's 750kw rooftop solar and 1,000kwh BESS system. System was successfully testing in 2021.
- **Phase 2** - Enchanted Rock added 5.8 MW of clean, dispatchable natural gas assets to reform the grid during widespread electrical outages to enable rooftop solar to continue providing power.

## Enchanted Rock Solution Benefits



**Environmentally Friendly** - Lowest available emissions profile, least visually intrusive design



**Flexible** – Modular configuration allowed for optimal use of available substation space



**Affordable** – Enchanted Rock's total project cost for clean generation was the most competitive



**Reliable** – High availability with N+1 design

# Critical Facility Microgrid



Houston Northeast Water Purification Plant

**Contract Executed:** Summer 2020

**Project Size:** 32.9 MW ESP

**Project Location:** Houston, TX

**Commercial Operation Date:** Spring 2023

## Problem

To meet the growing needs of Harris and Fort Bend counties in TX, the City of Houston added 320,000,000 GPD of additional water purification capacity. To comply with regulatory requirements for resiliency set forth by the Texas Commission on Environmental Quality, a highly reliable backup generation system was needed.

## Solution

Through a competitive bid process, Enchanted Rock was selected to provide full facility back up power. The City evaluated several companies and selected Enchanted Rock for this project based on technical requirements, performance of past projects, and competitive pricing. This solution is the largest water pumping plant microgrid in the country.

## Enchanted Rock Solution Benefits



**Compliant** – Enables NEWPP to meet regulatory requirements specified by the Texas Commission on Environmental Quality



**Worry free** – Fully turnkey solution from system design through ongoing operations



**Affordable** – Cost of system offset by market revenues; lowest cost solution to NEWPP



**Reliable** – High availability system with 99.9995% combined reliability



# Data Center Microgrid



Microsoft San Jose Data Center

**Contract Executed:** May 2022

**Project Size:** Phase 1 60 MW

**Project Location:** San Jose, California

**Commercial Operation Date:** 2024

## Problem

Microsoft's proposed 96MW San Jose, CA data center faced external pressure for cleaner back up power solutions and their internal commitments for elimination of diesel generation led to evaluation of alternatives that could fit with their electrical design and space constraints yet deliver the same performance as diesel back-up.

## Solution

Enchanted Rock's modular natural gas genset was selected due to its performance (start time, transient response) and flexible configuration that did not require a change to the standard 3MW power block. Served by nearby redundant gas pipelines, and using renewable natural gas (RNG) offsets allows for market participation in PG&E's BIP electrical emergency programs to avoid rolling blackouts across CA, which generates a revenue stream resulting in a more cost-effective resiliency service compared to Tier 4 total cost of ownership

## Enchanted Rock Solution Benefits



**Ultra-Clean** – met stringent BAAQMD permitting requirements with CARB DG emissions. RNG offsets provide zero CO2 equivalent emissions



**Performance** – comparable to diesel (ISO 8528 G3), Microsoft cyber standard compliant



**Speed to Market** – Standardized equipment and field assembly process meets Microsoft buildout timeline



**High Availability** – modular design provides for even greater redundancy than 4:3 design



# Distributed Microgrids (VPP)



## National Super Retailer

**Pilot Launch:** September 2019

**Portfolio Size :** 183 MW to date

**Project Locations:** TX, LA, VA, PA, NJ, IL

## Problem

As the number and frequency of weather events increased and electric pricing became more volatile, Walmart was seeking a partner to provide clean, reliable backup power that also allowed them to hedge the energy market.

## Solution

In 2020, Walmart successfully completed a five-location pilot to prove the benefits of Enchanted Rock dual purpose microgrids. The program was expanded to 30 additional stores (36MW) in 2021 and added another 123 stores (145 MW) and a 9 MW distribution center in 2022.

Over the past three years, Walmart has avoided 1,909 hours of outage time across the portfolio.

## Enchanted Rock Solution Benefits



**Ultra-Clean/Quiet** – allows Walmart to deploy backup generation in residential areas where most stores are located



**Flexibility** – standardized approach allows for ease of installation across portfolio as well as future proofing for additional technologies ie: BESS & EV



**Speed to Market** – Standardized equipment and field assembly process meets Walmart buildout timeline



**High Availability** – modular design provides for even greater redundancy traditional diesel





# Technology Advantages



# Dispatchable Capacity Technology Comparison

Technology Attributes	Combustion Turbine @ Transmission Voltage	Med Speed Reciprocating Engine @ Transmission Voltage	Utility Scale BESS @ Transmission or Distribution Voltage	Enchanted Rock Microgrids @ Distribution Voltage
<b>Primary, Secondary Use Cases</b>	Dispatchable Capacity Grid Synchronous, No Black Start	Dispatchable Capacity Grid Synchronous, No Black Start	Dispatchable Capacity + Frequency response	<b>Dispatchable Capacity + Local Resiliency + Black Start</b>
<b>Local Emissions</b>	Moderate w/ SCR	Moderate w/ SCR	Zero	<b>Ultra-low, can be permitted in all CA air districts</b>
<b>Carbon Neutral Options</b>	RNG, H2 blending	RNG, H2 blending	Depends on marginal energy source when charging	<b>RNG, H2 blending</b>
<b>Cold Start time</b>	< 10 minutes	< 5 minutes	<1 second	<b>&lt;10 seconds</b>
<b>Operating Duration</b>	Indefinite	Indefinite	Dispatch constrained by SOC at event start, typically 2–4 hours	<b>Indefinite</b>
<b>Siting</b>	Concerns about noise, visual impact	Concerns about noise, visual impact	Possible fire code limitations	<b>Quiet operation, low profile</b>
<b>Gas Pressure Required</b>	> 300 psig	> 70 psig	n/a	5-125 psig

*Note: Distributed energy technologies such as fuel cells, lean burn gas engines, and linear generators are more costly, need more space, and designed for baseload or must run grid synchronous operations only*



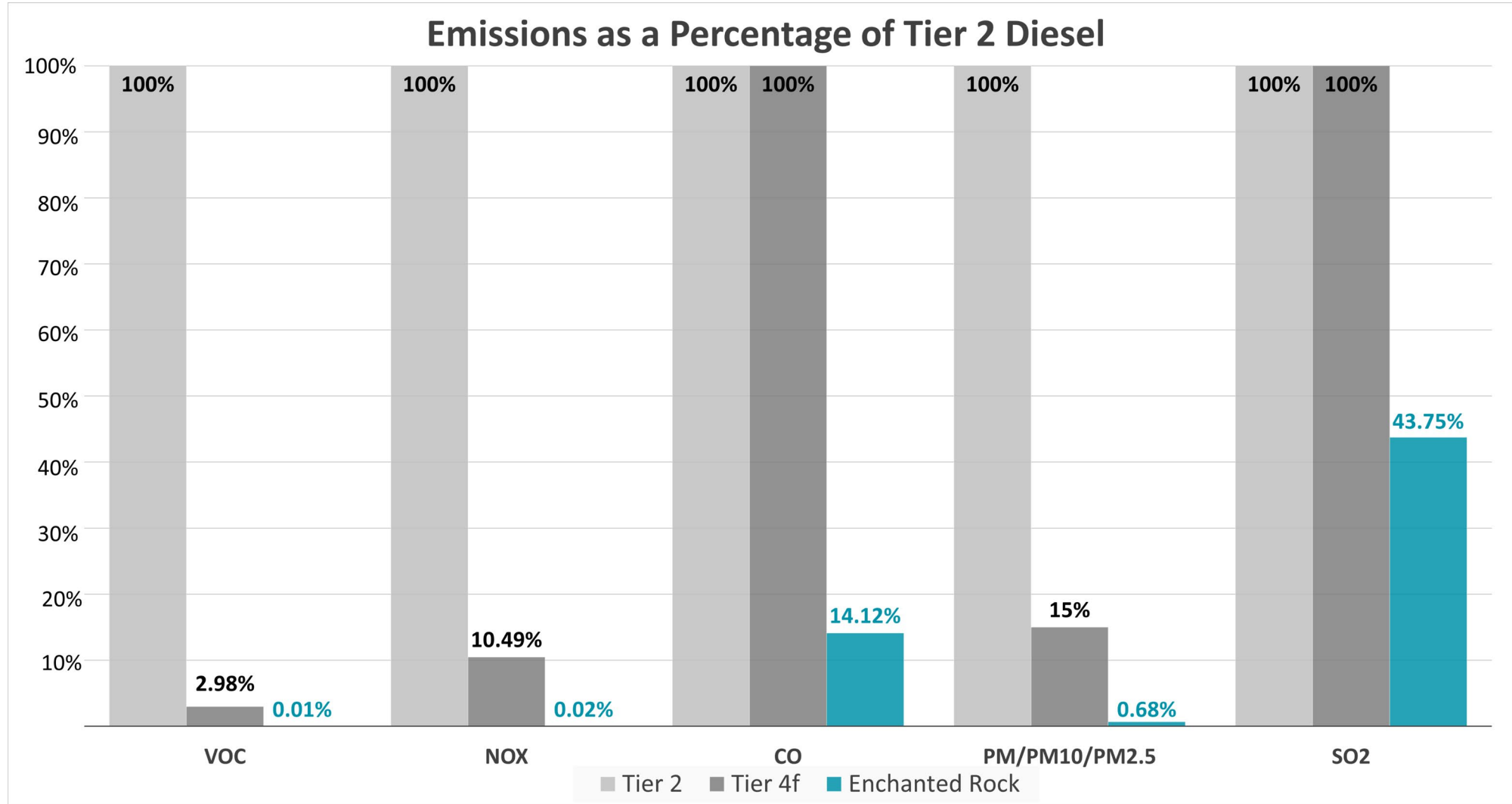
# Solving the Need for Bridge Power

# Emergency Backup Technology Comparison

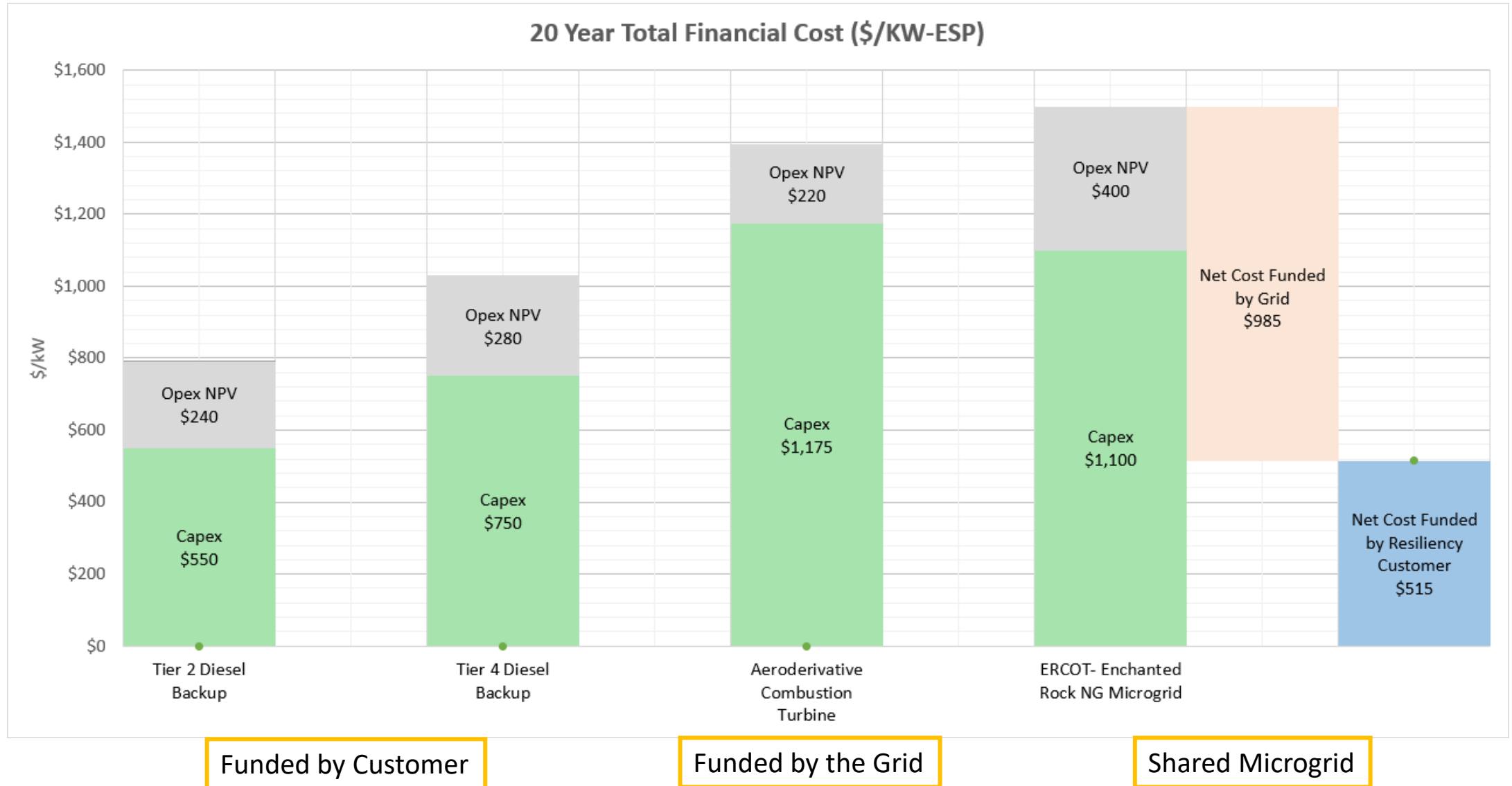
Back Up Genset Requirements	Diesel	Enchanted Rock - Natural Gas
<b>Technical Performance</b> Black Start, Transient Response, Ramp Time	Meets requirements	Meets requirements
<b>Local Emissions</b>	Higher emissions; Tier 4 requires SCR	10-100x lower than Diesel; No SCR emissions control system required
<b>GHG Emissions</b>	Reduction with HVO diesel blends	Negative GHG possible with renewable natural gas
<b>Power Density</b>	Meets requirements	Meets requirements
<b>Fuel Security</b>	Limited fuel on-site, subject to delivery interruptions in emergencies	Continuous supply from underground pipeline; On-site storage possible



# Local Emissions 10-100x Cleaner than Diesel



# Economics Comparison





# Policies should encourage the use of microgrids

- Provide expedited permitting and siting for cleaner options to meet demand growth in a timely fashion
- Tighten air quality regulations to update BACT for the cleanest, commercially viable technology
- Create monetization opportunities for grid services provided by microgrids to reduce the need for large peaking plants
- Promote firm gas supply service to microgrids for resilience



**ENCHANTED ROCK**  
The Power is On.

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Reducing Air Quality Impacts of Backup  
Generation and Peaking Plants



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# Appendix: Estimated Criteria Pollutant Emissions for Life-time Emergency MWh

Pollutant	Metric Tons of VOC	Metric Tons of CO	Metric Tons of NOx	Metric Tons of PM	Metric Tons of SO2
<b>Tier 2 Diesel</b>	21.0	35.67	44.21	2.03	.07
<b>Enchanted Rock</b>	.12	5.04	.02	.01	.03
<b>Total Saved</b>	20.88	30.63	43.19	2.02	.04

# Appendix: NOx Emission Rate Comparison

Pollutant	lb/MWh NOx
Texas Peaker Plants	1.32
Enchanted Rock	.004