ENCHANTED ROCK

The Power is On.

Request for Information

for

Backup Generation Solutions for

Energy Resiliency – as – a- Service

Enchanted Rock, LLC

2022

Company experience

Years providing backup generation solutions

Since 2009, Enchanted Rock (Enchanted Rock) has designed, built, and operated Dual Purpose Microgrids (DPM) that provide electrical resiliency to businesses. When backup power is not needed, the DPMs provide grid stability services, earning revenue that minimizes the cost of resiliency. This unique model has made electrical resiliency much more accessible so our customers can keep the lights on and support their communities during times of need.

Enchanted Rock is a market leader in electrical resiliency based on its proprietary DPM that provides reliable backup power with many benefits to the end customer– reliability, affordability, quiet and compact footprint, flexible design, and decreased emissions compared to alternative solutions. Our mission is "keeping businesses in business." Enchanted Rock solutions are engineered for both island mode reliability and grid-synchronous economic dispatch, the latter underwriting a substantial portion of the cost of the backup service and ensuring a fully reliable system due to its frequent grid-synchronous runs that provide constant testing and conditioning of the genset. Enchanted Rock preferred structure is a 3rd party owned and operated model that we call our Integrated Reliability On Call (iROC) agreement. This offering includes the engineering, design, procurement, construction, installation, operations, maintenance, and dispatch of the system. The customer pays a one-time upfront set up fee, that is discounted versus the cost of an upfront purchase, for the term of the service agreement.

The natural gas-powered generators act as microgrids and run synchronously either with the grid or in "island mode," when they disconnect and generate power separately from the grid at customer sites. This configuration allows Enchanted Rock to sell power back to the grid, offsetting a portion of the system's cost to the customer, while providing power for their customers even when the grid is down. Under the iROC model, Enchanted Rock NOC monitors the resiliency microgrids 24/7 and identifies and immediately addresses issues before they become problems. Enchanted Rock utilizes fully trained, full time, technicians (often ex-military with security clearances and heavy equipment training) to perform routine, scheduled and dispatch maintenance services maintaining an extremely high level of equipment availability.

With a proven track record of performance during emergency situations – including world-class performance during Winter Storm Uri, our customers know they can count on Enchanted Rock. Enchanted Rock currently manages a portfolio of 556 MW across 300 sites with another 200 MW under construction. To date, we have covered 2,741 outages totaling 10,988 hours and maintaining 99.999% combined reliability.

Total number of installed backup generators in service

Enchanted Rock currently operates and maintains 1096 natural gas backup generators and 267 diesel backup generators, for a total of 1393 generators.

Total load (kW) of installed backup generators in service

Enchanted Rock currently operates and maintains over 331,200 kW of natural gas backup generation and 167,000 kW of diesel backup generation, for a total of 498,442 kW.

O&M Model

Operations and maintenance personnel are Enchanted Rock employees. Enchanted Rock maintenance and technical service approach is based on a scalable "Hub and Spoke" model. The Hub houses our 7x24 Microgrid Network Operations Center (NOC) collecting real-time data from our fleet, providing critical feedback to our field service and sustaining engineering teams, subject matter experts, and vendor partners. This data collection and monitoring creates a technical feedback loop that ensures we continually drive improvement. The Hub coordinates with regional teams, Spokes, and provides our teams and customers with 7x24 access to technical assistance, sparing inventory planning, and warranty management. The regional teams expedite the application of the Hubs expertise. None of this would be possible without our standardized modular genset and with over 1000 units in operation, this genset is key to our Hub and Spoke model. With 5 years of operating history, Enchanted Rock has the largest technical knowledge data base on dispatchable Dual Purpose Microgrids in the business.

Our customers benefit not just from technical assistance on their assets, but also the continuous learning from the large fleet of gensets that Enchanted Rock currently operates. Enchanted Rock has developed an engineering knowledge base that drives trouble shooting and diagnostics to identify and address issues with far greater expediency than traditional OEM support, significantly reducing critical failures.

NOC ("Hub")

Enchanted Rock's NOC

Enchanted Rock NOC monitors the resiliency microgrids 24/7 and identifies and immediately addresses issues before they become problems. The NOC system runs on custom proprietary control software hosted on redundant servers at a Tier 3 Data Center and in a secure internet cloud, which allows the operators to manage all alarm notifications, security, maintenance, scheduling, and dispatch in real-time.

Enchanted Rock has a mirrored backup location at a storm-hardened Tier 3 data center that has redundant servers, redundant network connectivity, and redundant power and cooling systems for all control and monitoring hardware where the NOC can supervise the assets during storms or natural disasters. The combination of individual secure wireless control and connectivity to each genset and a separate wired connection from each genset via an independent network connection ensures that no single equipment failure will interrupt NOC operations. Importantly, all reliability operations are triggered and controlled locally, so no NOC communication is necessary.

This Network Operation Center systems were built on our founder's experience in Nuclear Navy operations and NASA systems engineering. It has taken years of development from our in-house engineers and the resulting systems have monitored and dispatched our DPMs through numerous hurricanes and major storms. In 2017, during Hurricane Harvey which hit the US Gulf Coast, Enchanted Rock DPMs successfully covered 21 individual sites for over 105 consecutive hours during the storm's destruction. In 2020, 27 locations were islanded in advance of Hurricane Hanna. 14 of these sites experience utility grid outages lasting up to 44 hours. 100% were covered with no loss of power due to Enchanted Rock systems. During Winter Storm Uri in 2021, Enchanted Rock provided backup power to 143 customer sites for a total of 4,984 hours. We provided our customers access to world-class subject matter experts at a moment's notice that could identify and address issues that emerged due to harsh winter conditions. This resulted in extremely high availability of our DPM fleet.

Field Maintenance ("Spoke")

Our scalable Hub and Spoke field services are built around the 7x24 Network Operation Center (described above) and standardized maintenance practices and procedures which result in ultra-high reliability through proactive and efficient program maintenance. This NOC hub detects anomalies in real time genset operating data and with automated analytics, triggers routine program maintenance and any required component replacement or upgrades.

Enchanted Rock utilizes fully trained, full time, technicians (often ex-military with security clearances and heavy equipment training) to perform routine, scheduled and dispatch maintenance services maintaining an extremely high level of equipment availability.

These factory-trained technicians are on call and ready to dispatch to critical alarms at a moment's notice. For a datacenter, Enchanted Rock maintenance personnel would be stationed onsite to respond immediately to resolve critical issues and perform daily site inspections. Also, Enchanted Rock creates strategic partner relationships with third party contractors that perform specialty operations such as crane services, large equipment rental, code gas fitting, and high voltage electrical maintenance.
To reduce unexpected outages during reliability operations, Enchanted Rock maintains the following preventative measures:

- Conducts routine site inspections with an itemized list of items to be checked and notated.
- Follows manufacturer's suggested maintenance schedule for all equipment.
- Performs loaded test on a minimum bi-weekly basis.
- Collects performance data from each genset on a routine basis and analyzes this data to identify and remediate potential problems before they become critical in nature.

To ensure timely repairs on malfunctioning equipment, Enchanted Rock Field Maintenance Services does the following:

- Ensures at least one maintenance technician will be on call 7x24 and will be dispatched within 2-12 hours, depending on service level.
- Ensures critical spares will be in inventory at a location within one hour of site.
- Monitors all equipment from our NOC that is staffed 7x24 so that any issues can be identified immediately.

Expertise and experience in returning power to the electrical grid

This section provides detailed description of operations and breaker sequencing of the Enchanted Rock 480V and 15-35kV distributed generation systems. There are three (3) major modes of operations: Standby, Isochronous & Grid Parallel. Please note that all Enchanted Rock sites can operate in parallel to the grid and can switch from generator to utility supply with a blinkless transfer of power.

Modes of Operation:

1. **Standby**: Generation is not operating but is energized from the utility source (load to utility)
2. **Isochronous**: Generation is running to support the customer load(s) isolated from the utility
3. **Grid Parallel**: Generation is running in parallel to the utility, any generation system excess power from load displacement is exported to the utility grid

480V Generation System

Breaker configurations: All breaker numbers called out refer to attached drawing set.

- Breaker 52M Point of Common Coupling (PCC) is the isolation breaker allowing isochronous operations separated from the utility in the event of loss of utility only. Breaker 52M will have sensing (utility-Gen Bus) for synchronization close (function 25) supervision.
- Breaker 52G is a Point of Connection (POC) for all generators at the site connected at 480V, the 52G will be tripped by the SEL 351 installed at 52M protection relay to safely isolate all Generators from the utility and Load if the voltage, frequency, or export power are outside the specifications agreed to in the interconnect agreement (ANSI functions 27, 59, 81U/O, 32, 77TT). Breaker 52G will have sensing (Y-X) for synchronization close (function 25) supervision.
- For 480V system generator bus, in the event that 52G fails to open on a trip (Breaker Fail), generators G1-to G2 Isolation Breakers GB1, GB2 will be Trip/Blocked from 52G SEL 351.
- Generators Motorized Breakers 52-Gx (52-Gx generically, where x is Gen Number) are installed on each generator and are controlled by the Generator Controller (GC on drawing) for parallel operations.

1. In Standby Mode of Operation:

Utility Breaker 52M and 52G (POC), are CLOSED. Generator internal Breakers 52-Gx (52-Gx generically, where x is Gen Number) are all OPEN isolating each of the generators from the load and the utility.

2. In Isochronous Mode of Operation:

On loss of utility voltage detected at 52M, breaker 52G (POC) will be OPENED to isolate the Generator bus, each generator will receive a start signal and all, the Generators are isolated from the utility. The utility Breaker 52M remains closed while the generators start and parallel to each other. Each generator will start independently and ramp to synchronous speed of 1800 rpm and nominal voltage of 480V. Each generators onboard Generation Controller (GC) will control each genset and ensure correct generator voltage, phase rotation and frequency and CHECK if there is voltage on the common bus.

Generators will close it's 52-Gx breaker and energize the bus. If voltage is detected on the bus, other generator's independent GC will synchronize its generator by controlling the governor and Automatic Voltage Regulator (AVR) of its generator to ensure that voltage is within +/-5VAC and synchronized within 5 degrees (ANSI function 25) prior to allowing each 52-G(X) to CLOSE.

Once a sufficient number of generators have been synchronized and CLOSED on the common bus to carry the onsite load, and nominal voltage (480V) and frequency (60Hz) have been established on the common bus, and utility voltage has not returned to nominal levels, utility Breaker 52M will be opened. Once utility Breaker 52M is verified to be OPEN, 52G (POC) will be CLOSED to connect the common bus to energize the onsite load. Each generator's GC will communicate with the other paralleled generator's GC on the site by a high-speed serial network to equally share the onsite load while controlling to nominal voltage 480V and frequency 60Hz. Utility Breaker 52-M will remain OPEN in Isochronous Mode of Operation isolating all generators and onsite load from the utility.

Closed Transition from Isochronous Mode of Operations to Standby Mode of Operations:

Utility Breaker 52M is OPEN and the Generators and Load are isolated from the utility, the generators are supporting the onsite load with 52G (POC) is CLOSED and all 52-G(X) breakers CLOSED. When the voltage and frequency conditions on the utility have returned to normal for a sufficient time (15 minutes) after an outage, the system will be commanded to return to utility with a parallel load transition at the 52M. The 52M SEL351protection relay will monitor the voltage and frequency of the utility and common bus until the synchronized generators on the common bus are controlled to a common voltage is within +/-5VAC, frequency is within +0.2/-0.1hz and synchronized within 5 degrees (ANSI function 25) prior to allowing the 52M to CLOSE in parallel with the utility while the load is being supplied by the generators, 52M Closed feedback will immediately activate the 52M SEL351 Grid Parallel Voltage , frequency or export power protections as per the specifications agreed to in the interconnect agreement (ANSI functions 27, 59, 81U/O, 32, 77TT). Each Generators GC will command the governor and AVR to ramp the power of each unit down at 2%/sec until no power is being produced by the generator and will command each of the 52-G(X) to OPEN. Each genset will cool down for 5 minutes and shutdown returning to Standby Mode of Operations.

3. Grid Paralleled Mode of Operation:

Utility Breaker 52M is CLOSED and the common bus and onsite load are connected to the utility in Standby Mode of Operations waiting for remote commands. Generator breakers (52-GX) remain OPEN until remote commands are received to start and parallel to the utility. Each generator will start independently and ramp to synchronous speed of 1800 rpm and nominal voltage of 480V. Each generator's onboard Generation Controller (GC) will control each genset and ensure correct generator voltage, phase rotation and frequency are with acceptable limits. Once nominal voltage and frequency is achieved by the individual genset, each generator's GC will synchronize its generator by controlling the governor and Automatic Voltage Regulator (AVR) of its generator to ensure that voltage is within +/-5VAC, frequency is within +0.2/-0.1hz, and synchronized within 5 degrees (ANSI function 25) prior to commanding the 52-G(X) to CLOSE in parallel with the utility. Once closed each generator's GC will control the generators governor to control power (KW) and AVR to control voltage (Var) necessary to ramp export power at 2%/sec onto the common bus with a maxim power of 400KW at 1.0 power factor. Two seconds prior to and continuously while any generator is in parallel operation with the utility, the 52M SEL351 protection relay will be in operation to ensure the voltage, frequency, and maximum export power are within the requirements of the Interconnection Agreement and in accordance with the standards established by the Texas Public Utility Commission in Substantive Rule 25.212. The utility will be monitored by the SEL protection relay to safely isolate all Generators from the utility and Load by tripping the 52G, if the voltage, frequency, or export power are outside the specifications agreed to in the interconnect agreement (ANSI functions 27, C59, 81U/O, 32, 77TT). When parallel operations are no longer required the remote command will be removed and each generator's GC will command the governor and AVR to ramp the power of each unit at 2%/sec until no power is being produced and will command each of the 52-G(X) breakers to OPEN. Each genset will cool down for 5 minutes and shutdown and return to Standby Mode of Operations.

15-35kV Generation System

Breaker configurations:

- 52M, 15-35KV 600A utility source pad mounted recloser, 52M is the isolation recloser allowing isochronous operations separated from the utility in the event of loss of utility only. Recloser 52M protection relay will have sensing (Y-X) for synchronization close (function 25), and 52M current Protections (52M Trip).

- Recloser 52M protection relay will have utility Synchronous operation protection elements supervision, as per the specifications agreed to in the interconnect agreement (ANSI functions 27, 59, 81U/O, 32, 77TT), 52M protection relay utility Synchronous Elements to trip 52G breaker.

- 52G, 15-35kV 600A Generator Bus Pad Mounted Recloser, the 52G breaker can be tripped by 52M and 52G protection relays to isolate generation system. 52G protection relay will have sensing (Y-X) for synchronization close (function 25) supervision and 52G current protections (52G Trip).

- For 15-35kV system generators, in the event of 52G fails to open on a trip (Breaker Fail), generators G-1 to G-XX individual 800A 480V breakers will be tripped open by 52G protection relay.

- Generators motorized breaker 52-Gx (52-Gx generically, where x is gen number) are installed on each generator and are controlled by the generator controller (GC) for generator synchronous and isochronous operations.

- A pad mounted 3 pole lockable switch will be available as lockable break between utility PCC and 52M breaker (normally closed).

1. Standby Mode of Operation

- Utility Breaker 52M and 52G are CLOSED.
- Isolation Breakers (GB-XX) for all generators are CLOSED.
- Generator internal Breakers 52-Gx (52-Gx generically, where x is Gen Number) are all OPEN isolating each of the generators from the load and the utility.
- Generator System is load to utility.

2. Isochronous Mode of Operation

"Break before make", open transition to Generator System on utility source loss. On loss of utility voltage 52G will be OPENED to isolate the Generator Bus from common load bus. The utility Breaker 52M remains closed while the generators are requested to start. Each generator will start independently and ramp to synchronous speed of 1800rpm and nominal voltage of 480V. Each generator's onboard Generation Controller (GC) will control each genset and ensure correct generator voltage, phase rotation and frequency and CHECK if there is voltage on the common bus. If there is no voltage on the common bus one of the GC will close it's 52-G(X) breaker and energize the bus. If voltage is detected on the bus, each generator's independent GC will synchronize its generator by controlling the governor and Automatic Voltage Regulator (AVR) of its generator to ensure that voltage is within +/-5VAC and synchronized within 5 degrees (ANSI function 25) prior to allowing each 52-G(X) to CLOSE. Once a sufficient number of generators have been synchronized and CLOSED on the common bus to carry the onsite load, and nominal voltage (15-35kV) and frequency (60Hz) have been established on the common bus, **and** utility voltage has not returned to nominal levels, utility Breaker 52M is opened. Once utility Breaker 52M is verified to be OPENED, 52G (PCC) will be CLOSED to connecting the common load to the Generator Bus to energize the onsite load. Each generator's GC will communicate with the other paralleled generator's GC on the site by a high-speed serial network to equally share the onsite load while controlling to nominal voltage 15-35kV and frequency 60Hz. Utility Breaker 52M will remain OPEN in Isochronous Mode of Operation isolating all generators and onsite load from the utility, until common Load Bus is ready to be returned to the utility Source (15-minute minimum). See Closed Transition from Isochronous Mode of Operations to Standby Mode description below. All 52M and 52G transition managed by the GMC (Generator Master Controller) and supervised by the protection relays.

Closed Transition from Isochronous Mode of Operations to Standby Mode of Operations:
Make before Break, closed transition from the generator system to the utility source. Utility breaker 52M is OPENED, the generators are supporting the onsite load through 52G breaker. When the voltage and frequency conditions on the utility have returned to normal for a sufficient time (15-minutes minimum) after an outage, the system will be commanded to return to utility with a parallel load closed transition at the 52M. The GMC will monitor the voltage and frequency of the utility and synchronize generators on the common bus to utility source, Generator Bus is controlled within +/-5VAC, frequency is within +0.2/-0.1hz and synchronized within 5 degrees (ANSI function 25) prior to allowing the 52M to CLOSE in parallel with the utility while the load is being supplied by the generators. 52M closed status will immediately activate the 52M protections per the specifications agreed to in the interconnect agreement (ANSI functions 27, 59, 81U/O, 32, 77TT). GMC will request generators to transfer load to utility source, each generator's GC will command the governor to ramp the power of each unit down at 2%/sec until no power is being produced by the generator and will command each of the 52-G(X) to OPEN. Each genset will cool down for 5 minutes and shutdown. All 52M and 52G transition managed by the GMC and supervised by the protection relays.

3. **Grid Paralleled Mode of Operation**

Utility Breakers 52M and Generation Breaker 52G (PCC) are CLOSED and the common bus and onsite load are connected to the utility in Standby Mode of Operations waiting for remote commands.
GMC initiates Grid Parallel mode, generators remote commands are received to start and parallel to the utility. Each generator will start independently and ramp to synchronous speed of 1800 rpm (60HZ) and nominal voltage of 480V. Once nominal voltage and frequency is achieved by the individual genset, each generator's GC will synchronize its generator by controlling the governor and Automatic Voltage Regulator (AVR) of its generator to ensure that voltage is within +/-5VAC, frequency is within +0.2/-0.1hz, and synchronized within 5 degrees (ANSI function 25) prior to commanding the 52-G(X) to CLOSE in parallel with the utility. Once closed, each generator's GC will control the generators governor to control power (KW) and AVR to control voltage (VAr) necessary to ramp export power at 2%/sec onto the common bus with a maximum power of 400KW at 1.0 power factor. Two seconds prior to and continuously while any generator is in parallel operation with the utility, the 52M protection relay will be in operation to ensure the

voltage, frequency, and maximum export power are within the requirements of the Interconnection Agreement and in accordance with the standards established by the Texas Public Utility Commission in Substantive Rule 25.212. The utility will be monitored by the protection relay to safely isolate all Generators from the utility and Load by tripping the 52G breaker if the voltage, frequency, or export power are outside the specifications agreed to in the interconnect agreement (ANSI functions 27, 59, 81U/O, 32, 77TT). When parallel operations are no longer required the remote command will be removed and each generator's GC will command the governor and AVR to ramp the power of each unit at 2%/sec until no power is being produced and will command each of the 52-G(X) breakers to OPEN. Each genset will cool down for 5 minutes and shutdown and return to Standby Mode of Operations.

Genset

The Enchanted Rock DPM genset is the only purpose-built natural gas backup genset in the market with load-carrying performance comparable to traditional diesel gensets. Its heritage comes from design principles found in industries such as Navy Nuclear and NASA reliability, where Enchanted Rock founders began their careers. Our exclusive focus on industrial-scale resiliency solutions has resulted in a top performing patented genset with over 1,000 production units. Unlike most equipment suppliers, our technology development reflects a productive feedback loop due to operating a standardized fleet of gensets in over 220 resiliency microgrids under rigorous conditions.

Enchanted Rock iROC offering includes the engineering, design, procurement, construction, installation, operations, maintenance, and dispatch of the system for no cost under a 15 to 20-year service agreement.

EPC Description

Enchanted Rock has completed 265 natural gas sites since 2016 using the process described below. Typical construction timelines are as follows:

- Approx. 9-12 months for LV system depending on equipment delivery timelines, size of system, and type of installation. Utility Gas and Electric Interconnection also dependent on the type of upgrade required and could adjust the timeline for commissioning.
- Approx. 14-20 months* for MV system depending on equipment delivery timelines, size of system and type of installation. Utility Gas and Electric Interconnection also dependent on the type of upgrade required and could adjust the timeline for commissioning.

*Driven by interconnection process timeline. Please note these timelines are not one size fits all and will vary depending on the project.

Enchanted Rock performs all design, engineering and procurement work in house using its own employees. Construction is run by our Executive Director of Construction and all construction activities are supervised by Enchanted Rock employees. Labor for gas plumbing, civil and electrical construction is performed by subcontractors. System commissioning is performed by in-house technicians.

Enchanted Rock construction sites have three key interfaces: customer load, metering station and the generator system. The assembly of the generator system follows the following order: site layout, civil construction, electrical construction and finally, commissioning. During site layout, Enchanted Rock EPC team uses line marking and measuring tape to layout the equipment pads, cable trays, natural gas piping and natural gas/electrical stub ups, all per the site layout drawings. Enchanted Rock then moves on to civil work. Civil work begins with site preparation and grading per the approved civil site drawings. Next, Enchanted Rock forms the equipment pads and installs natural gas piping. Electrical work begins with setting the bases and installing gas headers. Next, the construction team pulls cables through the conduit or cable trays and sets the generators on the generator bases. Enchanted Rock then terminates the generator wires and places all equipment using cranes. Once the equipment has been placed, Enchanted Rock terminates all cables in the equipment, installs bollards, fence and other final items and cleans up the project area. Finally, Enchanted Rock reviews a mechanical completion checklist. After electrical work is complete, Enchanted Rock commissioning team commissions the system per the approved site testing plan and performs final site inspection, reviewing the operations final check list to ensure all project items are either closed or added to the project punch list. After commissioning, the Enchanted Rock site is complete and Enchanted Rock Operations and Maintenance team begins monitoring the site from Enchanted Rock 24/7 NOC.

Generator manufacturer(s) / model(s) the Respondent proposes in backup generation solutions

Enchanted Rock has two independent suppliers of its patented genset. Since 2014, Power Solutions International (PSI) has been responsible for the production of the genset. In 2020, we expanded our supply chain by adding Generac as a second manufacturer, and the units are in production today. Having two completely independent manufacturers allows Enchanted to Rock to scale even greater with lower risk.

- Power Solutions International (PSI) – model number A24500.
- Generac Holdings, Inc. – model number ERT450.

The units are equivalent in physical dimensions and performance.

Scalability of the backup generation solutions offered

Enchanted Rock is designed for scalability in all areas of our business. The following capabilities enable this scalability:

1. **Diversity in supply.** Enchanted Rock mitigates supply chain risk through the use of two completely independent genset manufacturers and three switchgear suppliers. Enchanted Rock has its own production lines with both manufacturers.
2. **Modular gensets function as building blocks.** Our standardized, modular design and procedures results in a faster, more consistent, and more predictable EPC process.
3. **Existing partnerships with national contractors.** These partners are an extension of Enchanted. Rock. They have a deep understanding of how our systems operate and can scale with us to meet demand.
4. **Scalable Hub & Spoke model.** Our Houston-based NOC serves as the central “Hub” which allows O&M teams to be local and in close proximity to all installations. Standing up regional O&M teams is simplified and repeatable with this model.
5. **Standardized genset and tools results in simplified training and ease of maintenance.** Our technicians only need to be trained on one product. Maintenance and service are designed to be performed by a single technician without any specialized equipment or tools.
6. **Data collection from large genset fleet drives continual improvement.** The NOC collects and monitors data from over 700 gensets, identifying systemic issues that our sustaining engineering team can then address with solution upgrades.
7. **Spare parts distribution model.** High levels of equipment availability are maintained since each site requires the same parts. Enchanted Rock utilizes years of operational data to apply predictive analytics to build our spares inventory.

8. **24/7 access to experts.** The NOC collects real-time data from our genset fleet and provides critical feedback to our sustaining engineering team, subject matter experts, and vendor partners who in turn provide 24/7 support to our customers.
9. **Infinitely scalable NOC operations.** Our repeatable template for NOC operations enables seamless integration of new regions and new markets.

Controls for the system (local or remote or cyber protections)

The generators are equipped with a Generator Master Controller which enables sensing and control and allows the gensets to be monitored from our 24/7 NOC.

Enchanted Rock protects against cyber risk and cyber threats by adopting a defense in depth strategy, comprised of best-in-class tooling, system architecture and documented processes. All reliability operations happen based on sensing at the site and therefore do not require communication with the Network Operations Center. In addition, we have redundant dispatch systems we can use in case of a cyber security incident. The tools we use for threat monitoring and detection in our OT and IT networks include Dragos and Red Canary.

Experience with dual fuel generators for backup generation solutions

Enchanted Rock generators can be fitted to operate with dual fuel sources – Natural Gas (NG), Renewable Natural Gas (RNG) and Liquid Propane (LP). The primary fuel source is NG or RNG with LP as a backup. The LP kit would be added to each generator to convert to LP fuel. Enchanted Rock currently has two sites with this configuration. The system configuration entails continuous monitoring of the NG pressure and in the event the NG pressure falls (generally below 5 psig) while running, the system will automatically switch over to the backup LP fuel. The system is returned to NG manually after re-pressurization of the NG source is confirmed. The return to NG can also be setup with remote command after positive confirmation of NG fuel available at the required pressure.

The LP fuel system works by receiving liquid propane directly to the gens from the storage tank with no pressure or flow control required. Each generator has a built-in vaporizer to control LP fuel mixture. There is a derate associated with LP fuel system as shown below.

The power output ratings are different under each fuel type:

- NG Fuel: each gen @ 448kw (ESP)
- RNG Fuel: each gen @ 448kw (ESP)
- LP Fuel: each gen @ 315kw (ESP)

Depending upon overall size of the system there may be a need to load shed when on LP fuel. Alternatively, the system can be sized based only on the LP generator rating.

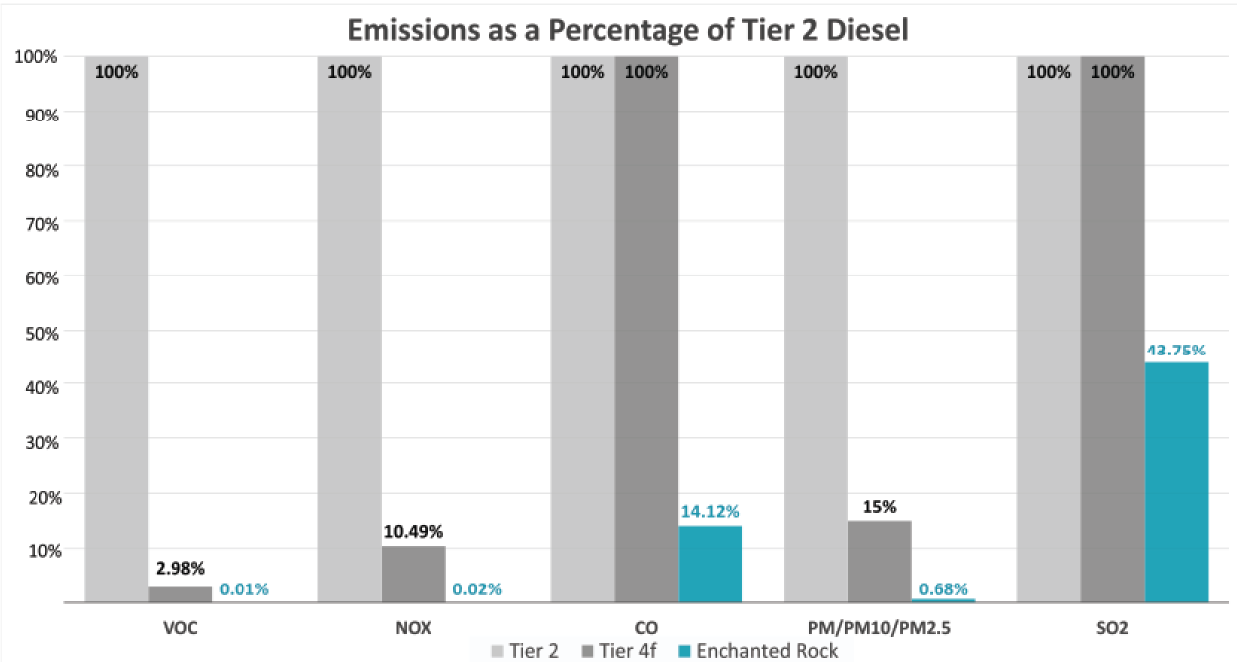
Fuel storage, polishing management or special fuel conditioning needs

Enchanted Rock natural gas microgrids do not require fuel storage or fuel maintenance. However, should Enchanted Rock require fuel storage at specific sites, a CNG/LNG/LPG solution could be provided. Enchanted Rock has experience using CNG trailers for temporary fuel supplies at customer sites, most recently during winter storm Uri.

How do natural gas compound emissions compare to diesel?

When you look at the numbers, the fact is that diesel, whether Tier 2 or the "cleaner" Tier 4, produces higher emissions than natural gas and other gas fuel alternatives.

Enchanted Rock's natural gas microgrids offer cleaner local emissions than diesel by orders of magnitude with practically no run limitations – allowing facilities to support both resiliency and sustainability strategies.



Notes:

1. *Enchanted Rock ISO 8178 D1 weighted test cycle emissions results from a single engine. Actual field test results may vary due to site conditions, installation, fuel specifications, test procedures, and engine to engine variability.*
2. *VOC emissions found to be below the minimum detection level of the equipment.*
3. *NOx and CO emissions data are near-zero hour non-deteriorated emission rates which are not guaranteed emissions for purposes of air permitting. These rates are typical for lower run hours which will increase with catalyst age.*
4. *PM emissions not expected to change with catalyst age, although differences in fuel quality could impact actual emissions.*
5. *NSPS IIII emission limit for electric generator rated greater than 560kW.*
6. *California Code of Regulations Title 17, Division 3, Chapter 1, Subchapter 8, Article 3 - Distributed Generation Certification Program*
7. *NSPS JJJJ emission limits for stationary non-emergency natural gas engine greater than 500 hp, with an efficiency of 92%*
8. *AP-42 calculation assumes engine has a heat rate of approximately 12 MMbtu/MW.*

Can natural gas backup power support onsite solar for reduced emissions?

In the right applications, onsite solar provides cost effective renewable energy for commercial and industrial buildings. Feasibility considerations include space constraints, land costs, utility tariffs, and weather-driven relationships between load and solar output. Microgrids running only on solar, or even when storage is added, are not effective in providing 100% reliability for longer term outages, but a hybrid approach is economically and technically feasible for resilience purposes. A hybrid configuration of natural gas or RNG integrated with renewables can optimize economics and reduce fuel use while providing grid support services and enabling a greener grid.

Noise control options (e.g., sound attenuating enclosure)
Each genset will be in a weatherproof enclosure with sound attenuating features tested to reduce emitted noise to below an average sound level of <68dBA measured at seven meters in all quadrants. Should ENCHANTED ROCK require further sound mitigation, Enchanted Rock has experience utilizing sound walls.

Contract structures
Enchanted Rock can offer a variety of flexible contract options, as summarized below. For the purposes of this RFI, we have provided pricing options for Options #1 (iROC) and #3 (System Sale), shown under Section 3A of this document.

1. **3rd party owned, maintained, and operated (iROC)** – Enchanted Rock preferred structure is a 3rd party owned and operated model that we call our **Integrated Reliability On Call (iROC) agreement**. Enchanted Rock iROC offering includes the engineering, design, procurement, construction, installation, operations, maintenance, and dispatch of the system. The Customer pays an upfront fee, that is discounted versus the cost of an upfront purchase and incurs an ongoing resiliency fee paid monthly. Enchanted Rock is able to structure this where ENCHANTED ROCK pays more upfront and less overtime, all upfront and nothing overtime, or anywhere in between. Enchanted Rock developed this innovative offering in 2010 and was the first to provide utility-grade backup power as a service. The customer will provide Enchanted Rock with a ground lease for the generation site for the term of the agreement. This ground lease allows Enchanted Rock to hold a separate air permit while providing backup power. The natural gas-powered generators act as microgrids and run synchronously either with the grid or in "island mode," when they disconnect and generate power separately from the grid at customer sites. This configuration allows Enchanted Rock to sell power back to the grid, offsetting a portion of the system's cost to the customer, while providing power for their customers even when the grid is down. Upon loss of grid power, the customer receives backup power within 10-30 seconds, depending on the size of the system.

2. **ENCHANTED ROCK owned, maintained, and operated** – Enchanted Rock can design and build the generation system for ENCHANTED ROCK through our standard Engineering, Procurement and Construction (EPC) agreements. ENCHANTED ROCK would own the generation systems and would be responsible for the operations and maintenance of the systems.

3. **ENCHANTED ROCK owned and 3rd party maintained and operated (System Sale)** – Enchanted Rock can design and build the generation system for ENCHANTED ROCK through our standard Engineering, Procurement and Construction (EPC) agreements. In addition, Enchanted Rock can provide a long-term Operations and Maintenance (O&M) agreement to ENCHANTED ROCK for ongoing maintenance and market management for a fee.

4. **ENCHANTED ROCK owned and maintained, and 3rd Party operated** - Enchanted Rock can design and build the generation system for ENCHANTED ROCK through our standard Engineering, Procurement and Construction (EPC) agreements. ENCHANTED ROCK would own the generation systems and would be responsible for the maintenance of the systems while Enchanted Rock can manage the market participation and dispatch the generation to earn revenues for a management fee.

Lead time (in weeks) by generator size (if there are differences

Generator lead time: Enchanted Rock currently has generator inventory to support projects as they are awarded. We cannot provide estimated lead time for the generators until we have a better understanding of when Enchanted Rock projects would be awarded and at what scale.

ATS lead time: Current lead time for a low voltage ATS is 18-24 weeks, and 25-30 weeks for a medium voltage ATS. However, the lead times could be different when these projects are awarded.

Transformer lead time: Current lead time for medium voltage transformers is 40-70 weeks from project award. However, the lead times could be different when the projects are awarded.

Shop drawings: The lead time for shop drawings will depend on the number of sites awarded, size of the systems, scope division, and the complexity of interconnection. Enchanted Rock has experience with many electric and gas utilities and understands the interconnection process and the TDSP and IFC drawing processes.

Response time and location of maintenance staff
At least one Enchanted Rock maintenance technician will be on call 7x24 and will be dispatched within 2-12 hours of being called, depending on service level. Enchanted Rock ensures critical spares will be in inventory at a location near the site.

Transfer options at end of contract terms
Enchanted Rock iROC agreement offers three options to customers upon termination.

1. The customer can elect to extend the contract for a new term length.
2. The Customer can purchase the project from Enchanted Rock at the end of, or any time, during the contract term per a pre-determined buy out schedule in the agreement.
3. At the end of the contract term, Enchanted Rock can remove the equipment from the customer site.

Fuel type, minimum fuel pressure requirements, and fuel storage costs
Enchanted Rock gensets can run on natural gas, renewable natural gas, and propane. The generators run on natural gas supply between 10-50 psi. There are no costs for fuel storage as the generators do not require fuel storage.

Patented Genset Design
With a footprint of 8.5 by 10 feet, Enchanted Rock 450kW generators allow for multiple layout configurations and improved power density.

1. Diesel like transient response
2. Modular for scalability
3. Small footprint
4. Unique airflow
5. Ultra-quiet
6. Indefinite operation
7. Island or synchronous mode

Enchanted Rock 3 generator set

Enchanted Rock 10.75 MW project at a university

Enchanted Rock microgrids have six unique features that are not typical of standard backup power systems.

1. **Reliable**: Our proven genset uses a reliable industrial grade engine that allows our microgrids to run often and run loaded, providing constant conditioning, and testing which leads to a much higher level of availability for ENCHANTED ROCK customers than traditional diesel backup.
2. **Cost-effective:** When the customer is not using the Enchanted Rock systems for backup power, Enchanted Rock will aggregate the generators and sell back to the grid to earn revenue. These frequent runs allow us to subsidize a portion or all the fixed and variable system cost for the customer.
3. **Clean:** Our microgrids use clean-burning natural gas that have emissions of less than 1% of a standard Tier 2 diesel generator and less than 4% of a standard Tier 4 generator, keeping the air cleaner for ENCHANTED ROCK customers and their families.
4. **Trouble-free:** Enchanted Rock manages the assets and is responsible physically and financially for the maintenance and operations of our resiliency microgrids, allowing ENCHANTED ROCK to focus on providing their customers with outstanding service.
5. **Quiet and compact:** With a sound level of <68 dBa at 7 meters, customers will not be bothered by noise from Enchanted Rock generators while they run to provide reliability service. Our 450kw generator footprint of 8.5 by 10 feet allows for multiple layout configurations and improved power density, saving customers valuable real estate at their site.
6. **Supports renewables:** Enchanted Rock gensets will supply the grid with a quick start generation source during normal operating conditions that supports the integration of renewable energy sources by supplying capacity to the grid when renewable power may be low.

Please see a list of Enchanted Rock major differentiators below.

Commercial

- Customer: Resiliency-as-a-service contract → 10-50% of total cost of ownership.
- Turnkey solution

Financing/Energy Markets

- Investors take the majority of the capital risk and are repaid through electricity market revenues

Maintenance Differentiators

- Standardized design
- Maintenance response time
- Predictive maintenance
- Critical spare inventory/drills
- Routine analysis of performance data

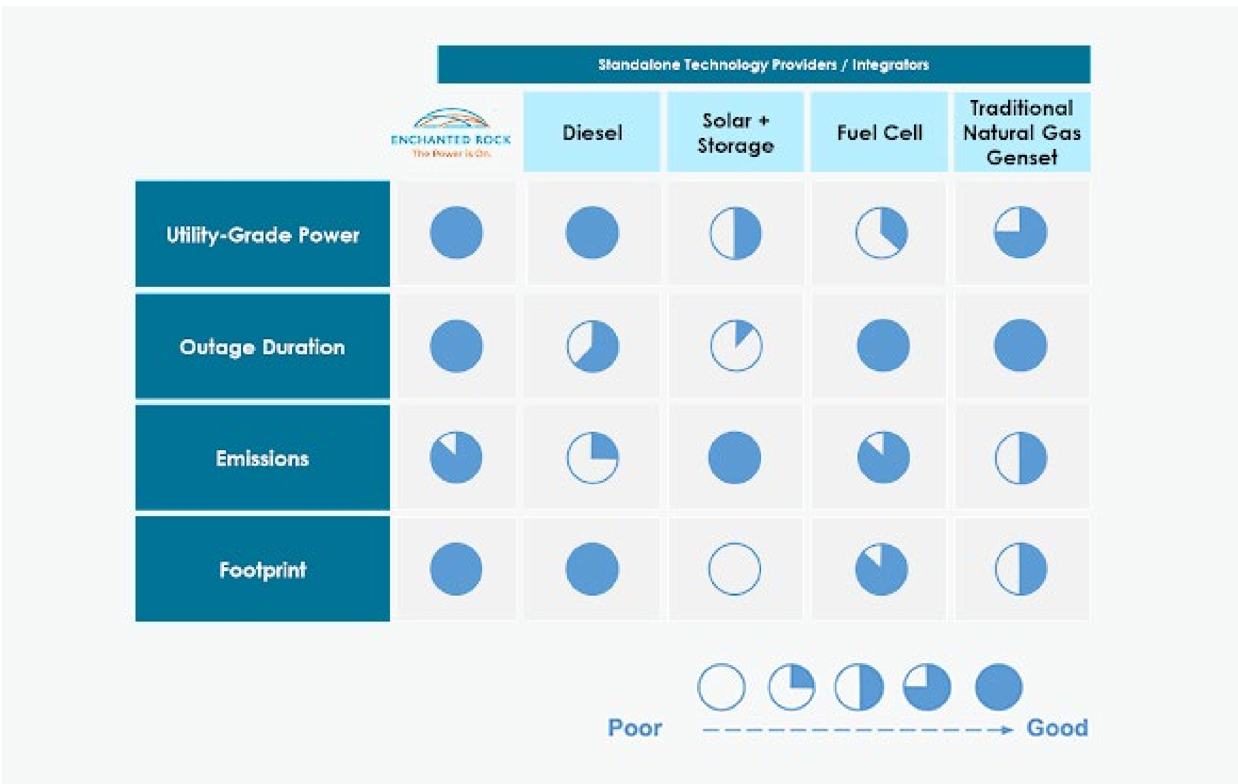
Operational Differentiators

- Run often, run loaded
- Nuc Navy/NASA concepts
- Institutional knowledge continuously supporting operations
- Standardized processes
- Tight orchestration of processes/procedures
- In-house 24/7 Microgrid Network Operations Center (MNOC)
- Secondary disaster response MNOC

- Real time analytics
- Real time operational changes per current conditions
- Operational response time
- Continuous growth and innovation
- Purchase firm no-notice gas and pay a premium price
- Less sensitive to gas pressure

Why Microgrids?

Enchanted Rock's battle-tested resiliency microgrids lead the industry in driving 99.997% power reliability, eliminating unexpected power outages, and achieving net-zero or negative carbon emissions. Our unique microgrid service offering is enabled by natural gas and RNG, making it 10x cleaner than traditional diesel.



Enchanted Rock has reinvented how organizations ensure power resiliency for their operations. Partnering with Enchanted Rock is not the same as just purchasing a backup generator and dealing with the intricacies of backup power alone. Instead, you are purchasing a fully managed service with a leader in electrical resiliency. Enchanted Rock maintains full ownership of the solution, allowing customers to focus on what they do best – their business. The combination of our clean microgrid technology, 24/7/365 support services, and flexible pricing options result in fast, simple, and worry-free protection from extended grid outages. These highly available solutions backed by skilled personnel and advanced systems result in low risk, predictable resiliency when you need it most.

MITSUBISHI ELECTRIC

Battery Energy Storage System

Cayahoga County Utility & Microgrids RFI

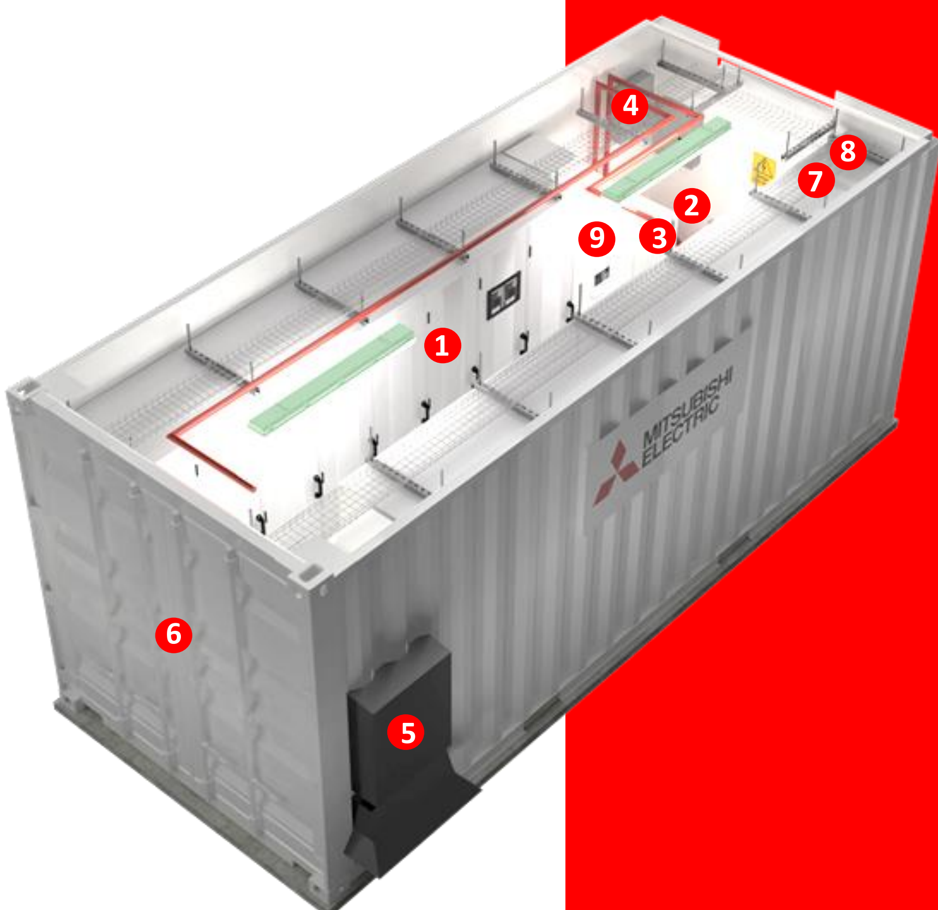
BATTERY PROJECTS AND EXPERIENCE

SECTION A

Experience Summary

MEPPI Ref:

E220XX



1. Battery Stacks
2. Fire Suppression
3. DC Collection & Protection
4. Fire Panel
5. HVAC
6. Access to Container
7. AC Distribution
8. UPS
9. HVAC Control

1.0 TURNKEY PROJECTS EXPERIENCE

Mitsubishi Electric Power Products, Inc. is the US subsidiary of Mitsubishi Electric Corporation responsible for serving the North American power systems industry with electrical and electronic products, systems and services.

Products include:

- Gas circuit breakers
- Vacuum circuit breakers
- Power transformers
- Gas insulated substations
- Power electronics
- Nuclear power plant control systems
- Uninterruptible power supplies
- Generator services

Mitsubishi Electric is a worldwide leader in the development, design and manufacture of power electronics solutions since the early 1970s. In 1979, Mitsubishi Electric developed the world's first Voltage Sourced Converter (VSC) based STATCOM system. In 1984, Mitsubishi Electric installed the world's first commercial conventional SVC using direct Light Triggered Thyristor (LTT) technology.

Today, Mitsubishi Electric provides best-in-class power electronics solutions in the form of:

- PV inverters and Power Conditioning Systems
- Battery Energy Storage Systems (BESS)
- Static VAR Compensators (SVC)
- STATCOM

BESS, SVC, STATCOM are provided as turnkey solutions with optimized equipment design, system planning, control and protection design, and project management and construction services. Mitsubishi Electric has supplied nearly 200 of these solutions throughout the world.

Our dedicated team of power system engineers has many years of experience in providing advanced technical analysis, training, and support for power system planning, operation, and equipment related issues. We provide high-quality, on-time generation and transmission system consulting in all stages of system planning.

Our experience includes:

- Nationwide utility and industrial applications
- Voltages ranging from 800kV to 120V (200+mi lines to 0.5ft cable)

- Steady-state to microsecond timeframes
- Software: PSS/E, PSLF, PSCAD, EMTP-RV, MATLAB, CDEGS, ASPEN
- Active participation in industry organizations such as IEEE, CIGRE, WECC, SPP, ERCOT

MEPPI has a staff of trained personnel who devote their full-time effort to the design and construction of substation, transmission, and electric distribution projects. We have extensive experience with managing multiple EPC project concurrently and working with local contractors to provide the necessary labor and equipment to deliver systems on schedule. Project personnel are selected based upon their experience, knowledge, and capabilities as they relate to each specific project. Personnel assigned to this project will remain with the project throughout its duration. The fundamental goal of this project team is to be an efficient, effective extension of the customer's staff, seamlessly supporting throughout the project period. MEPPI will manage a team of proven vendors and contractors to meet the turnkey equipment procurement, system design, and construction.

Control of engineering, manufacturing and construction tasks are performed in accordance with the Quality Assurance Plan and MEPPI's standard practices for engineering and manufacturing. These were developed from extensive experience in the design and construction of utility substation and generation facilities. The control system uses documented procedures and drawings to communicate expected design and performance information from one stage of the design process to subsequent stages. The system also utilizes project Procedures to control the development and handling of these documents and drawings.

Planning and control documentation for manufacturing are available during manufacturing design reviews, testing, or qualifications to the plants. Documents for specific projects are prepared and submitted for review and comments. Customer notations are then incorporated into a revised edition of the document. The revised documents will be distributed to each member of both project teams for project use. The documents will be revised and updated as required during the life of the project. MEPPI will plan the project from start to finish with the plan reviewed and revised as required throughout the Project. The project schedule will incorporate all aspects of the project including the engineering, procurement, manufacturing, delivery, construction, installation, testing and commissioning activities. The schedule will be developed and maintained utilizing a Primavera based scheduling method agreed to between MEPPI and our customer and will be updated and submitted on a bi-weekly basis, as part of the monthly progress reporting throughout the engineering and construction phases of the project to reflect any revised task start and completion dates. The schedule is a tool that the Project Manager will use to monitor and control project progress and to implement any corrective actions required to correct deviations from the plan.

2.0 BATTERY ENERGY STORAGE SYSTEM PROJECT LIST

Project #1	
Project Name	Wilson BESS
Project Description	Demand Charge Reduction
Details on your Companies role, scope of work, or scope of supply for this Energy Storage project	Supplied and warranting Batteries, Inverters, and Transformers, Engineering for Equipment including drawings and DNP to Modbus mapping, Testing & Commissioning
Project Location (City, State)	Wilson, NC
Capacity (MW)	1
Energy (MWh)	4
Interconnection Voltage	12.47kV
Project Owner	City of Wilson
Primary Use Case for the system	Demand Charge Reduction
Secondary Use Case(s)	Freq/Watt, Volt/Var
Years of Operation	5 months
Description of Warranty and Performance Guarantees	10 year warranty and energy guarantee for system

Project #2	
Project Name	Windsor BESS
Project Description	Demand Charge Reduction
Details on your Companies role, scope of work, or scope of supply for this Energy Storage project	Supplied Batteries, Inverters, and Transformers, Engineering for Equipment including drawings, Testing & Commissioning
Project Location (City, State)	Windsor, Ontario, Canada
Capacity (MW)	4
Energy (MWh)	8
Interconnection Voltage	13.8kV
Project Owner	Convergent Energy+Power
Primary Use Case for the system	Global Adjustment (Demand Charge Reduction)
Secondary Use Case(s)	None
Years of Operation	2 months
Description of Warranty and Performance Guarantees	10 year warranty and energy guarantee for system

Project #3	
Project Name	Sarnia BESS
Project Description	Demand Charge Reduction
Details on your Companies role, scope of work, or scope of supply for this Energy Storage project	Supplied Batteries, Inverters, and Transformers, Engineering for Equipment including drawings, Testing & Commissioning
Project Location (City, State)	Sarnia
Capacity (MW)	10
Energy (MWh)	20
Interconnection Voltage	27.6kV
Project Owner	Convergent Energy+Power
Primary Use Case for the system	Global Adjustment (Demand Charge Reduction)
Secondary Use Case(s)	None
Years of Operation	2 months
Description of Warranty and Performance Guarantees	10 year warranty and energy guarantee for system

Project #4	
Project Name	Kia BESS
Project Description	BESS to supply stability to off-grid generators
Details on your Companies role, scope of work, or scope of supply for this Energy Storage project	Supplied transformers, and engineering support for project. Testing & commissioning
Project Location (City, State)	Monterrey, Mexico
Capacity (MW)	12
Energy (MWh)	12
Interconnection Voltage	13.8kV
Project Owner	Pemcorps
Primary Use Case for the system	Spinning Reserve
Secondary Use Case(s)	Frequency support for microgrid
Years of Operation	11 months
Description of Warranty and Performance Guarantees	10 year warranty and energy guarantee for system

Technology	Application	Size	Location	Year Commissioned
Li-ion	Energy/Test	250kW/25kWh	Japan	2012
Li-ion	Frequency Regulation Ramping	4MW/1.6MWh	Japan	2013
Li-ion	Frequency Regulation Ramping	3.5MW/1.4MWh	Japan	2014
Li-ion & NAS	Frequency Regulation Renewable Shifting	2MW/1MWh +4.2MW/30MWh	Japan	2015
NAS	Renewable shifting	50MW/300MWh	Japan	2016
Li-ion	Frequency Regulation Ramping PV Integration	10MW/7.6MWh	Japan	2017
Li-ion	Frequency Regulation Spinning Reserve	12MW/12MWh	Mexico	2018
Li-ion	Peak Load Reduction	1MW/4MWh	United States	2019
Li-ion	Peak Load Reduction	10MW/20MWh	Canada	2019
Li-ion	Peak Load Reduction	4MW/8MWh	Canada	2019
Li-ion & Flow	Energy/Test	250kW/800kWh	United States	2019
Li-ion	Arbitrage & ERCOT RRS	40MW/40MWh	United States	2021

Since 2018, MEPPI has been installing LFP-based energy storage systems while the majority of the industry continued to use the less-safe NMC technology. By building experience with smaller projects (≤20MW) MEPPI was able to gain the understanding and expertise required to integrate LFP batteries which have characteristics unlike NMC. MEPPI then built on that experience in its 40 MW/40 MWh turnkey storage system in ERCOT which is currently being constructed and will be operational in early 2021.

The ERCOT project is more complex than what we are proposing for this project in many ways as the batteries are installed in a custom building instead of using standard container packages and the control system was required to meet demanding requirements for fast frequency response.

Most recently, MEPPI has additional energy storage projects in California, Michigan, and Virginia which have been awarded and will be underway in late 2020. Each of those projects has a planned operation date in 2021.

MITSUBISHI ELECTRIC

Battery Energy Storage System

Cayahoga County Utility & Microgrids RFI

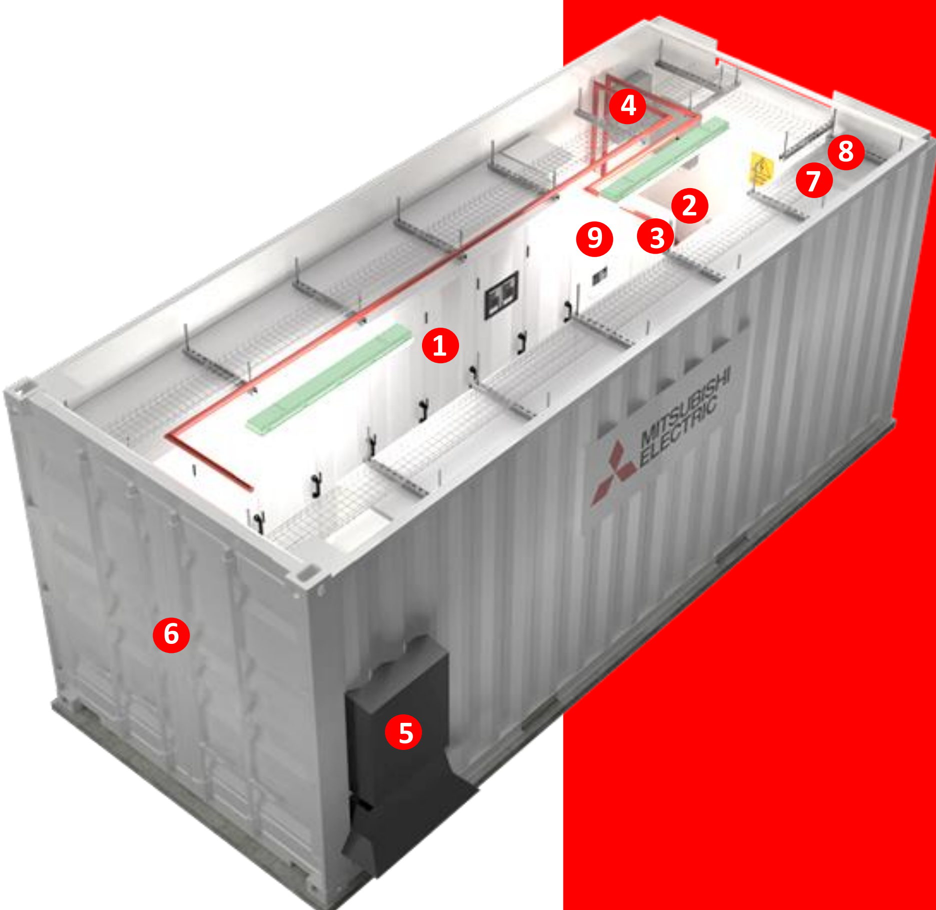
PROJECT MANAGEMENT AND KEY PERSONNEL

SECTION A

Experience Summary

MEPPI Ref: E220XX

1. Battery Stacks
2. Fire Suppression
3. DC Collection & Protection
4. Fire Panel
5. HVAC
6. Access to Container
7. AC Distribution
8. UPS
9. HVAC Control



1.0 PROJECT MANAGEMENT

In order to ensure that the Battery Energy Storage System (BESS) is delivered, installed, and commissioned on time, Mitsubishi Electric Power Products Inc. (MEPPI) will provide overall administrative oversight and control for the project during the design, procurement, fabrication, delivery, construction, installation, testing, commissioning and contract closeout phases.

Our Architectural-Engineering Company, Commonwealth Associates Inc. (CAI), will be a subcontractor to MEPPI, and will perform the substation design. Our Installation Contractor, Wasatch Electric, will conduct the civil installation works along with construction/installation activities as a subcontractor to MEPPI.

The Installation/Construction Company, Architectural-Engineering Company, and Environmental Engineering Company Project Managers will all report to the MEPPI Project Manager for overall project coordination. The Construction Companies Manager/Superintendent will report to the Project Manager and will be the primary interface with Matson Terminals for all site matters.

A chart showing the reporting relationships of the key project team members is provided in Figure 1. The duties and functions of the key project team members are described below.

1.1 MEPPI PROJECT MANAGER

The MEPPI Project Manager will be based in Warrendale, PA at MEPPI headquarters. Project Manager duties will include the following as illustrated in Figure 1:

- Contract administration including negotiations of the contract and any contract changes with the utility
- Supervision and coordination of design, procurement, fabrication, shipping, delivery, and receiving, of all material supplied by MEPPI
- Supervision and coordination of all testing and commissioning
- Regular progress reporting to the utility
- Provision of all required bonding
- Maintenance and updates of the following documents on a current basis:
    - Progress reports
    - Drawing records (in conjunction with the EPC Contractor)
    - Shop drawings
    - Specifications
    - Contract documents
    - Schedules
    - Other pertinent project related documents
- Supervision and coordination of contract closeout

1.2 MEPPI PROJECT ENGINEER

The MEPPI Project Engineer, also located at the MEPPI headquarters in Warrendale, PA, will report to the MEPPI Project Manager and carry out the technical, engineering-related duties described above (and illustrated in Figure 1). This includes but is not limited to:

- Responsible for the system integration, and technical oversight of design, fabrication, and testing, of all material supplied by MEPPI
- Development of testing and commissioning plans
- Preparing, Reviewing, and Approving the following documents:
    - Master Document Lists
    - Substation Designs & Layouts: One-Line, Plans, Elevations, Details
    - Shop drawings
    - Equipment Specifications
    - Bills of Materials

- Oversight & review all of the design and supply of all portions of the scope assigned to subcontractors

1.3 MEPPI SITE MANAGER/SITE COORDINATOR

The MEPPI Site Manger will report to the MEPPI Project Manager and will direct and coordinate all site activities for MEPPI, and equipment vendors. The MEPPI Site Manager will be located at the site full time beginning with the delivery of the BESS equipment. Prior to that, the MEPPI Site Coordinator will be located at the site to review and coordinate activities with the Construction Companies' Site Manager. Refer to Figure 1 for functional structure of the site construction and testing organization.

1.4 SVS SYSTEM STUDIES ENGINEER

The MEPPI BESS Studies Engineer will perform and coordinate the engineering studies required to the design and integration of the BESS. The BESS Studies engineer will report to the MEPPI Project Manager but will communicate directly with the Owner's systems studies personnel to facilitate the exchange of data and the review of results.

1.5 ARCHITECTURAL-ENGINEERING (AE) PROJECT MANAGER

The AE Project Manager will supervise and coordinate their team's activities related to the substation engineer such as site design, construction, installation, and testing. The Project Manager will provide input to the MEPPI Project Manager for overall project management and reporting.

2.0 KEY PERSONNEL RESUMES

MEPPI has a staff of trained personnel who devote their full-time effort to the design and construction of substation, transmission, and electric distribution projects. We have extensive experience with managing multiple EPC project concurrently and working with contractors to deliver the necessary labor and equipment to deliver systems on schedule. Project personnel are selected based upon their experience, knowledge, and capabilities as they relate to each specific project. Personnel assigned to this project will remain with the project throughout its duration. The fundamental goal of this project team is to be an efficient, effective extension of the customer's staff, seamlessly supporting throughout the project period. MEPPI will manage a team of proven vendors and contractors to meet the turnkey equipment procurement, system design, and construction.

Hezi Touaf, Senior Application/Sales Engineer

In 2012, Mr. Touaf joined Mitsubishi Electric Power Products, Inc. as a design engineer in the Rolling Start Program. As a member of the program, he worked with the MEPPI's Substation Division (FACTS and HVDC), and Power Systems Engineering Division. His experience at these divisions include: Main circuit and power electronics design, configuration and performance studies of FACTS devices (SVC and STATCOM). In addition, he has performed Electromagnetic transient analysis using PSCAD, and EMTP-RV to simulate phenomena associated with transient recovery voltages, lightning, switching surges, and insulation coordination. He also has conducted load flow and stability work using Siemens Power Technologies' PSS/E simulation software for dynamic stability, and steady state analysis. From 2013-2014, Mr. Touaf worked in Japan with MEPPI's parent company, as a project engineer on multiple FACTS project in North America and contributed to the success of five SVCs projects. From 2014-2019, Mr. Touaf worked as a systems engineer and was responsible for the technical proposal, design, analysis, installation and support of FACTS products and services. In addition, Mr. Touaf led the development of MEPPI's first Fixed Series Capacitor Control System and the first successful installation of that system. 2019 - Present, Mr. Touaf led proposals and project team in executing Battery Energy Storage projects. Mr. Touaf has worked closely with vendor's and customer's engineers to ensure customer satisfaction while ensuring safety, customer requirements and regulations which merit top priority.

Joe Chestnut PMP, Project Manager

From June 1992 to March 1994 Mr. Chestnut was employed by Amity Sales. He held the position as an Electronic Technician servicing electronic equipment in Pennsylvania, Ohio and West Virginia. From March 1994 to March 1998 Mr. Chestnut was employed by RPS (FedEx Ground). He held various positions as an Electronic Technician designing and supporting equipment required for tracking package delivery information. From March 1998 to June 2015 Mr. Chestnut was employed by CTR Systems/HUB Parking an international access control and systems integration company. He held the various positions from Technician to Manager of Operations and was responsible for all Field Service and Software Help Desk operations and also integrated three companies into one through a merger in 2014. In June 2015 Mr. Chestnut joined Mitsubishi Electric Power Products, Inc. as a Project Manager handling Power Electronics (Static Var Compensator) equipment turnkey and Gas Insulated Substation projects. Mr. Chestnut's responsibilities include managing project budget, scheduling project resources, negotiating contract terms and prices with sub-suppliers, coordinating site work, managing project safety, insurance, and warranty issues.

Justin Moon, Grid Storage Specialist

From 2015-2017, Mr. Moon joined Mitsubishi Electric Power Products as a design engineer in the Rolling Start Program. As a member of the program, he worked with the MEPPI's Power Systems Engineering Studies, Substation Division, and High Voltage Switchgear Division. His experience at these divisions include: simulation and analysis (PSES), programing for remote data collection (SSD), and mechanical testing and analysis (HVSD). From September 2016 – March 2017 he worked in Japan with MEPPI's parent company, studying battery energy storage projects completed by Mitsubishi Electric in Japan and simulation work for integrating batteries and renewable energy. 2018 - Present, Mr. Moon led the proposals for the sales team that led to four battery storage projects. Mr. Moon has also led the project team in executing these projects. Mr. Moon has worked closely with vendor's and customer's engineers to ensure project expectations have been met. Involvement in design includes battery container mechanical/electrical, DC, AC, and communications & SCADA network.

Andre Kostromsky, Project Engineer

In 2016, Mr. Kostromsky joined Mitsubishi Electric Power Products, Inc. as the Substation Department Project Engineer. His current primary responsibility is to design and engineering of the Power Electronics, Gas Insulated Substations and Battery Energy Storage Systems projects. 2014 – 2016, Mr. Kostromsky has been the lead design engineer for multiple electric utility substations and generating stations projects up to 345kV. 2012 – 2014, Mr. Kostromsky had been the lead commissioning engineer for multiple electric utility substations, generating stations and industrial projects up to 500kV.

Dianne Hetrick, Senior Project Planner\Scheduler

Dianne has been working with MEPPI for 14 years as a Senior Project Planner/Scheduler and 4 years as the Project Administration Manager while still fulfilling the role of Senior Planner/Scheduler. Dianne is responsible for the development and maintenance of all engineering and construction schedules within the Substation Division. This includes critical path analysis, expediting of engineering drawings and materials as well as resource leveling. Dianne's role is dedicated to providing a proactive approach to project planning and execution to help ensure project success.

David Giegel P.E., Quality Manager

Mr. Giegel is employed by Mitsubishi Electric Power Products, Inc. as the Substation Division Advisory Engineer. His current primary responsibility is to guide and approve the technical aspects of on-going Gas Insulated Substation (GIS) projects and hybrid Generator Main Circuit Breaker (GMCB) orders. Mr. Giegel also participates in various IEEE, IEC and CIGRE working groups. Mr. Giegel's experience includes high voltage switchgear design and development at McGraw-Edison for over four years. At Westinghouse Electric Corporation, he was a Senior Project Engineer providing engineered solutions to shipboard equipment problems for the United States Navy. Also for Westinghouse, on special assignment, he provided engineering services for the first decontamination and dismantlement of a commercial nuclear reactor. From December 1992 - January 2000, Mr. Giegel was the lead senior project engineer for all GIS projects at MEPPI. During this time he also provided support to the Gas Circuit Breaker Department as a design and customer order engineer. He was responsible for various SF_6 circuit breaker localization projects such as pressure vessels, rupture disks, gas piping and monitoring equipment. The GIS projects (many of which were turnkey) range from 115kV through 550kV in all areas of the U.S. for such customers as Southern California Edison (SCE), NStar (Boston Edison), Hawaiian Electric Company and National Grid (NEES).

Bryon E. Williams, Field Service Manager

From 1997-2001, Mr. Williams was employed by Alstom Power Inc., The Air Preheater Company as a Lead Project Engineer, dealing with the technical aspects of customer contracts. From 2001-2006, he worked as a Design Engineer for the same company at their Pittsburgh office. Mr. Williams's role was to design heat recovery equipment for petrochemical and heat recovery applications. In 2004, Mr. Williams worked as a Project Manager at US Tool & Die Inc. His responsibilities included overall project management responsibilities for a diverse set of projects relating to the nuclear industry. In January 2006, he joined Mitsubishi Electric Power Products as a Project Engineer. In May 2011, Mr. Williams was promoted to his current position. He currently manages the Field Service personnel for the Substation Division as well as site managers. This responsibility includes, Gas Insulated Substations, Static Var Compensators (SVC), and STATCOM.

Brian Link P.E., Engineering Manager

Mr. Link joined Mitsubishi Electric Power Products as a project engineer in the substation division. He was the resident engineer at 2 GIS replacement projects in Southern California learning all the details GIS field installation and designing for a complex disassembly and assembly process. Since that time Brian has continued to be instrumental in the design of some of the most complex and large GIS installations that MEPPI has undertaken. In 2007, Mr. Link assumed a supervisory engineer role, overseeing project engineering of large GIS projects and in 2009 was promoted to engineering manager.

3.0 WORK BREAKDOWN SCHEDULE (WBS)

In order to develop a specific Project Management Plan, a preliminary Work Breakdown Structure (WBS) has been developed. It subdivides the total scope of this project into its component parts, starting with the major tasks and breaking them into minor tasks. Figure 2 shows the WBS and these two levels of breakdown. It provides an overview of the program and is the framework for establishing organizational accountability for work, schedule and budget planning, and monitoring of work accomplished. Modifications to this WBS may be necessary as the result of further planning or changes in customer requirements.

Control of engineering, manufacturing and construction tasks are performed in accordance with the Quality Assurance Plan and MEPPI's standard practices for engineering and manufacturing. These were developed from extensive experience in the design and construction of utility substation and generation facilities. The control system uses documented procedures and drawings to communicate expected design and performance information from one stage of the design process to subsequent stages. The system also utilizes project Procedures to control the development and handling of these documents and drawings.

Planning and control documentation for manufacturing are available during manufacturing design reviews, testing, or qualifications to the plants. Documents for specific projects are prepared and submitted for review and comments. Customer notations are then incorporated into a revised edition of the document. The revised documents will be distributed to each member of both project teams for project use. The documents will be revised and updated as required during the life of the project. MEPPI will plan the project from start to finish with the plan reviewed and revised as required throughout the Project. The project schedule will incorporate all aspects of the project including the engineering, procurement, manufacturing, delivery, construction, installation, testing and commissioning activities. The schedule will be developed and maintained utilizing a Primavera based scheduling method agreed to between MEPPI and our customer and will be updated and submitted on a bi-weekly basis, as part of the monthly progress reporting throughout the engineering and construction phases of the project to reflect any revised task start and completion dates. The schedule is a tool that the Project Manager will use to monitor and control project progress and to implement any corrective actions required to correct deviations from the plan.

4.0 MAJOR WBS TASK DESCRIPTIONS

A preliminary set of task descriptions has been prepared for the major tasks shown on the WBS. In the early phases of the project, as the project plan is finalized, work packages to support the project will be developed in the appropriate level of detail to fully describe the work. This will ensure that those responsible for the completion of the work package understand and agree to the task requirements for cost, schedule, and performance. The following are brief descriptions for some of the major WBS task.

4.1 TASK SD – SITE DEVELOPMENT

Matson Terminals and our EPC Contractor will carry out the work for this major task. Site development covers, roughly in chronological order, the following subordinate tasks:

- Site development design - will be implemented in two phases, preliminary and final, with a design review for each phase. The final phase design review will be the first formal design review of the project.
- Site preparation - includes survey and layout of the site, rough grading, excavation for foundations, trenches, and drainage.
- Concrete placement for foundations - includes installation of the substation grounding system and trenches for cable and conduit.
- Erection of structures - includes erection of the structural steel for the outdoor bus bars and switches and support for the BESS equipment.
- Site finishing - includes completion of such items as placement of grounding material and aggregate surfaces, erection of fencing and gates, and final grading of the site.

4.2 TASK PC – PASSIVE ELECTRICAL COMPONENTS

This major task consists of the work required to specify, design, manufacture, test and deliver the passive electrical components to the project site. Lead responsibility for this task will be split between MEPPI and the AE Contractor for specific equipment as shown on the WBS. Typical milestones for each passive electrical component will be:

- Completion of design
- Completion of specification
- Order placement
- Completion of manufacture
- Completion of factory tests

- Delivery to site

4.3 TASK AC – ACTIVE ELECTRICAL COMPONENTS

This major task will entail the work necessary to specify, design, manufacture, test and deliver the active electrical components of the system to the site. MEPPI and the AE Contractor will be responsible for specific components as indicated on the WBS.

Subordinate tasks will be:

- Completion of design
- Completion of specifications
- Order placement
- Completion of manufacture
- Completion of factory tests
- Delivery to site

4.4 TASK SI – SYSTEM INTEGRATION

This major task encompasses the effort required for the overall engineering to specify and design the BESS and its components. It includes harmonic studies, analytic modeling of the BESS, seismic analyses and development of component test requirements. Spare parts are also included in this major task.

4.5 TASK IC – INSTALLATION AND COMMISSIONING

This major task consists of installation of all equipment in place at the site (inside and outside the enclosures), making all interconnections, both electrical and mechanical, checking out the entire system to verify that all parts are installed properly, and conducting tests to verify that the design and operation of the BESS meets the Owner’s requirements. It includes installation plans, test plans, obtaining customer agreement on test plans, and performing these tests to the satisfaction of the customer within the project schedule. Training is also included under this major task. Specific commissioning tests to verify proper installation, connection, calibration, and performance will also be executed. These will include:

- Mechanical tests – performed with auxiliary AC and DC systems disconnected and including meggering, continuity testing, calibration, etc.

- Electrical tests – performed with auxiliary AC and DC systems connected (but excluding high side of the transformer) and including checkout of enclosures heating, ventilation, security, lighting, station service, circuit breakers, disconnects, etc.
- Functional tests – performed to verify sequential operation of protection systems, BESS control systems, and all aspects of system performance prior to connecting the BESS to the bulk power system.
- Energizing tests – to complete final adjustments on all equipment.

Functional and energizing tests will be directed by MEPPI with support from the EPC Contractor.

4.6 TASK PM – PROGRAM MANAGEMENT

MEPPI will have overall responsibility for Program Management. The AE Contractor will also have responsibility for the following subordinate tasks for their assigned scope:

- Project management and coordination
- Construction management (AE Contractor) – includes all site activities
- QA/QC
- Documentation control

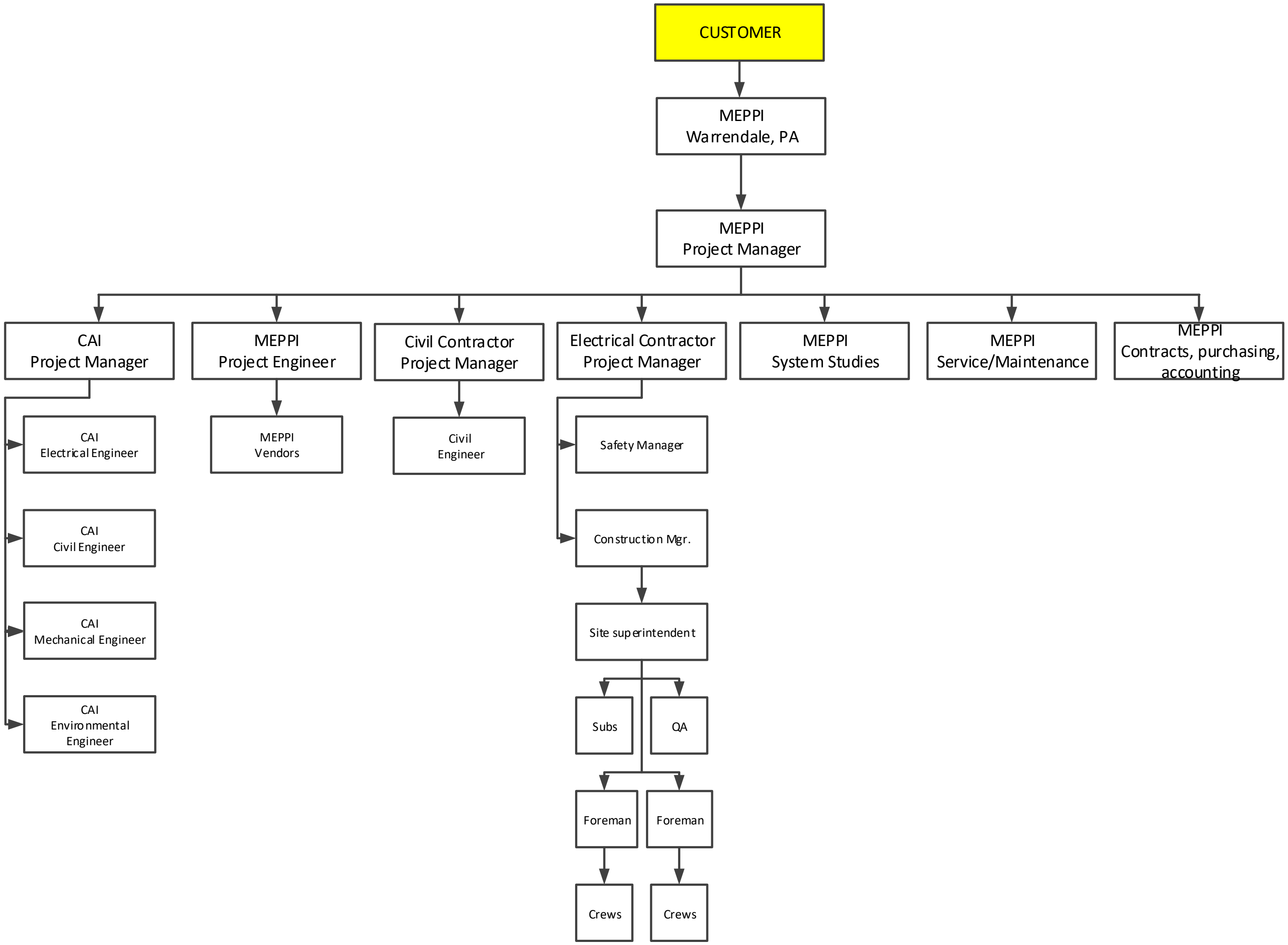
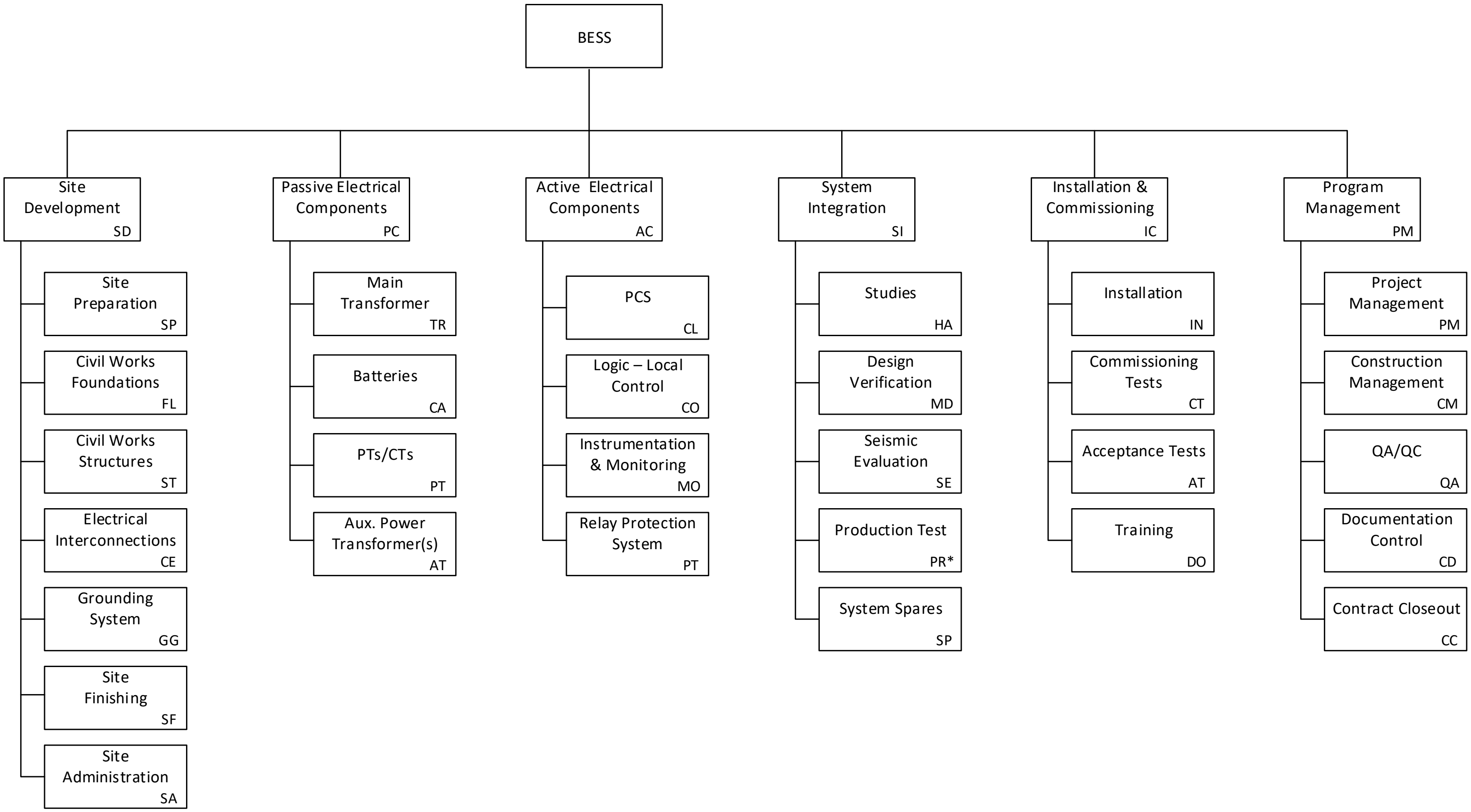


Figure 1-Project Reporting Structure



* Actual Production Test Responsibility to Individual Tasks under Tasks SD, BU, PC, & AC

Figure 2-Preliminary work breakdown schedule

MITSUBISHI ELECTRIC POWER PRODUCTS INC.

Corporate Headquarters	***Substation Division***
520 Keystone Dr.	547 Keystone Dr.
Warrendale, PA	Warrendale, PA
724-772-2555	724-772-2555

June 30, 2022

To: **Cuyahoga County Department of Sustainability**
Attention: Mr. Mike Foley
2079 East 9th Street, 8th Floor
Cleveland, OH 44115
Email: mfoley@cuyahogacounty.us

SUBJECT: Cuyahoga County Utility & Microgrids RFI - MEPPI

Mitsubishi Electric Power Products Inc. (MEPPI) thanks the County of Cuyahoga for the opportunity to respond to this important Request for Information and is pleased to offer our response. MEPPI has established a strong reputation for executing projects safely, on time, and within budget. MEPPI would be honored to have the opportunity to evaluate your project further with our engineering teams and project management experts and develop the optimal solution your team is looking for. A site visit and discussion with your team would be highly desirable to learn more about your exact requirements.

For the purposes of this RFI, MEPPI would like to be considered as an EPC. We are also considering a partnership arrangement with Enchanted Rock. Enchanted Rock offers generator sets in an Energy-as-a-Service model that may be attractive to Cuyahoga County.

We are including with this letter our responses to questions included in the Appendix of the RFI, as well as some supporting documents.

MEPPI Expertise (In-House)

- BESS (Battery Energy Storage Solution) Expertise
- BMS (Battery Management) & Inverter Mfg. & Expertise
- Microgrids Solutions and Expertise with Smarter Grid Solutions (MEPPI owned Company)
- Power Quality and Power Electronics Expertise
- Large Engineering Consulting Group (80 persons) – Expertise in Interconnection Ties/Studies
- Project Management & Service Team Expertise (ISO EPC Certifications, A-Rated)
- Mitsubishi Financial and Resource Strength
- MEPPI Flexibility to Work with Local Electrical, Construction, Engineering Companies

For more than 40 years, MEPPI has supplied large and small power solutions to utilities, power plants, industrial sites, and developers throughout North America. Because of MEPPI's success in the industry, we have localized our Power Electronics expertise within our Warrendale, Pennsylvania facility to better support our customers from early-stage system engineering to after-sales site services.

Mitsubishi Electric Power Products, Inc. (MEPPI) is pleased to provide the attached information in response to the Cuyahoga County Utility & Microgrids RFI. Renewable Energy and Smart Grid applications are becoming an increasingly larger portion of MEPPI's activity in supporting the North American electric utility market. To help in increasing MEPPI's available resources and capabilities to support these growing areas, MEPPI acquired the company Smarter Grid Solutions in 2021.

Smarter Grid Solutions Inc.

Smarter Grid Solutions (SGS), a Mitsubishi Electric company, is a software vendor of DERMS systems, head-quartered in Glasgow, UK and with an office in New York, USA. Our software platform underpins multiple products including Utility DERMS, Fleet DERMS and Microgrid DERMS to support the transition to a net zero energy system.

- Smarter Grid Solutions also provides a range of professional and managed services to support customers to deploy, integrate and manage operational systems. SGS projects are delivered through a practice structure:

- Power Systems and Consultancy: Power systems analysis, modelling of flex actions, innovation project support, control system design, data science, and optimization development;

- Integration and Delivery: System architecture, system design, DevOps, project delivery lifecycle, integration, configuration, testing and documentation;

- Project Management: Project and commercial management;

- Managed Services: 24x7x365 support desk and on call support, data analysis, system health checks, and warranty reporting.

SGS processes are managed through an ISO9001 (Quality) and ISO27001 (Security) certified Management System. SGS has 75 engineering and management professionals working from offices in Glasgow and New York. Our customers include UK Power Networks, SSE Networks, Iberdrola, Western Power Distribution, EWE Netz, Con Edison, Southern California Edison, San Diego Gas and Electric, Hydro One and Hydro Quebec.

Relevant Past Performance

Lac Megantic Microgrid Controller, Operational Date - December 2020 - The Town of Lac-Mégantic of Quebec, Canada suffered a catastrophic rail disaster in 2013 when a train full of oil derailed in downtown. Following the disaster, Lac-Mégantic formalized a vision to establish the Town as a smart city and create a "Living Lab" that would serve as a hub for technological and economic innovation. SGS was hired to deploy a state-of-the-art DERMS platform to manage, operate and optimize DER and building loads within the downtown area of Lac-Mégantic. Working in close coordination with the local utility (Hydro Quebec), the townspeople, and our development partner at CIMA+, SGS installed our microgrid DERMS manager, Strata Resilience. Strata Resilience manages a mix of three Front of the Meter (FTM) assets in parallel with six Behind the Meter (BTM) assets with a mix of solar, energy storage, and building management systems, as shown in Figure 1 below.

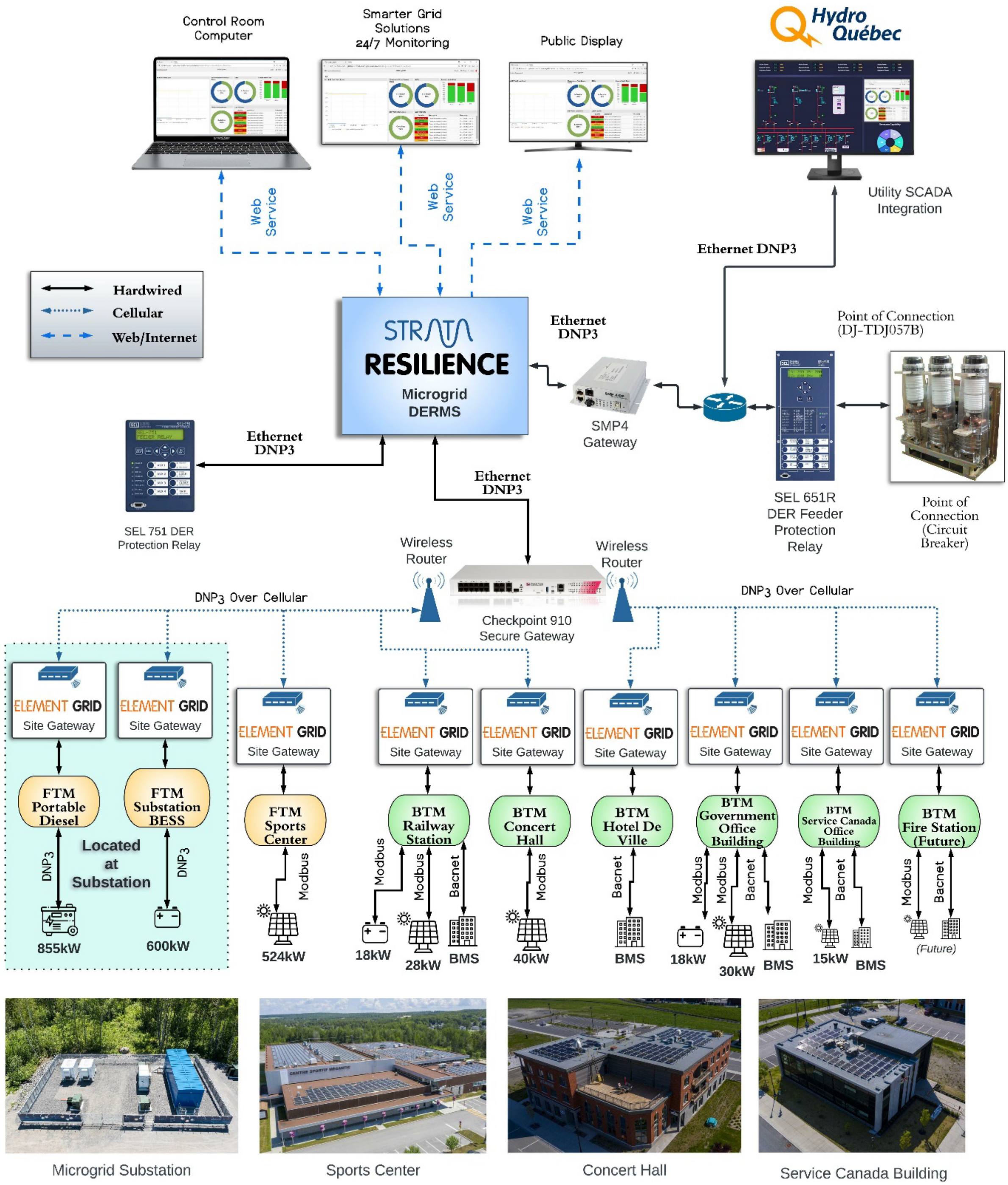


Figure 1: Lac Megantic Microgrid DERMS Architecture

Tomatek Microgrid Controller, (expected) Operational Date – Q1 2023 – The Tomatek food processing facility in Fresno, CA is a seasonal industrial facility where any interruption in energy supply during harvest season leads to substantial financial loss to the facility owner. Working with our partner, CalCom Energy, we performed a feasibility study on the existing 12kV electrical system and proposed a seamless transition microgrid solution using Strata Resilience that incorporates automated load shedding, an 8MWh energy storage system, and a 7MW solar-PV system.

Hoopa Valley Tribe Networked Microgrid, (expected) Operational Date - Q1 2023 – Following a season of heavy PSPS events for the Hoopa Valley Tribe, SGS was hired to perform a feasibility study and proposed a (5) building networked microgrid solution for the Tribe using Strata Resilience. Each building will be installed with 60kW-250kW of solar PV, 100kW - 2,000MWh ESS and diesel generators.

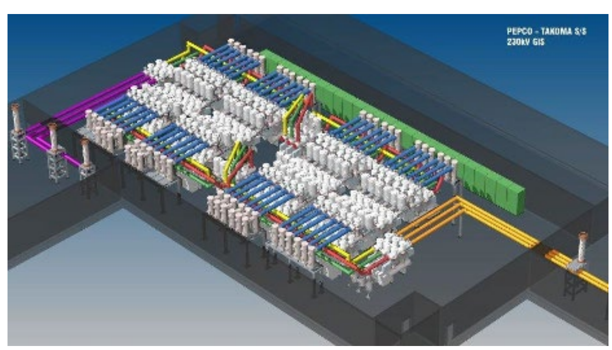
__Enchanted Rock__

ENCHANTED ROCK™

Since 2009, Enchanted Rock (Enchanted Rock) has designed, built, and operated Dual Purpose Microgrids (DPM) that provide electrical resiliency to businesses. When backup power is not needed, the DPMs provide grid stability services, earning revenue that minimizes the cost of resiliency. This unique model has made electrical resiliency much more accessible so our customers can keep the lights on and support their communities during times of need.

Enchanted Rock is a market leader in electrical resiliency based on its proprietary DPM that provides reliable backup power with many benefits to the end customer– reliability, affordability, quiet and compact footprint, flexible design, and decreased emissions compared to alternative solutions. Our mission is "keeping businesses in business." Enchanted Rock solutions are engineered for both island mode reliability and grid-synchronous economic dispatch, the latter underwriting a substantial portion of the cost of the backup service and ensuring a fully reliable system due to its frequent grid-synchronous runs that provide constant testing and conditioning of the genset. Enchanted Rock preferred structure is a 3rd party owned and operated model that we call our Integrated Reliability On Call (iROC) agreement. This offering includes the engineering, design, procurement, construction, installation, operations, maintenance, and dispatch of the system. The customer pays a one-time upfront set up fee, that is discounted versus the cost of an upfront purchase, for the term of the service agreement.

__MEPPI PSED__



MEPPI Power System Engineering Division (PSED) members have extensive experience in planning and designing microgrids for a variety of customers including commercial and industrial (C&I), utility, developer, and federal. PSED's offerings in the microgrid space include pre-feasibility study, feasibility study including microgrid distributed energy resource (DER) type selection and optimal sizing, techno-economic analysis and business case development, owner's engineering including specifications development and bid evaluation. The projects that PSED members supported in the past included demonstrating microgrid benefits for both behind-the-meter and wholesale electricity market applications; developer, C&I, federal, and utility as an end-user; and considered a variety of DERs including solar PV, wind, natural gas-powered generator, diesel generator, energy storage, dynamic rotary UPS, microturbine, and fuel cell.

A typical microgrid feasibility study performed by PSED will provide answers to the following questions:

- Do I need a microgrid? What benefits will I get?
- What generation type should I have in my microgrid?
- What are the optimal sizes for the considered distributed energy sources in my microgrid?
- What is the payback period of my microgrid? Return on Investment? Internal rate of return?
- Will my microgrid operate reliably and improve energy resiliency?
- How much electricity bill reduction will my microgrid achieve?

Typical microgrid feasibility study deliverables include:

- Microgrid preliminary designs including
    - Conceptual one-line diagrams
    - Conceptual layout diagrams
- Microgrid component costs and economic analysis
    - Costs breakdown by components and total turnkey installation cost
    - Payback calculations including return on investment, levelized cost of electricity, internal rate of return, and net present value
- Microgrid operation modes and control functionality descriptions
- Dynamic load flow, short circuit, and device evaluation studies
- Microgrid protection strategies discussion

PSED uses the following tools to optimally design a microgrid: Homer Grid, Homer Pro, DER-CAM, DER-VET, CYME, and PSCAD. Please see attached capabilities brochure named "MicrogridBrochure_3_2022.pdf".

<u>MEPPI SSD</u>

MEPPI Substation Division (SSD) has vast experience with BESS projects. Mitsubishi Electric is a worldwide leader in the development, design and manufacture of power electronics solutions since the early 1970s. In 1979, Mitsubishi Electric developed the world's first Voltage Sourced Converter (VSC) based STATCOM system. In 1984, Mitsubishi Electric installed the world's first commercial conventional SVC using direct Light Triggered Thyristor (LTT) technology. BESS, SVC, STATCOM are provided as turnkey solutions with optimized equipment design, system planning, control and protection design, and project management and construction services. Mitsubishi Electric has supplied nearly 200 of these solutions throughout the world.

Please see the attached "A-01 Experience Summary.pdf" and "A-02 Project Management and Key Personnel.pdf" for more information.

Please contact me or any member of our division with questions or comments about the responses to this RFI.

Sincerely,

Craig Swinderman
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Mitsubishi Electric Power Products, Inc.
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Questions and Answers to:

CUYAHOGA COUNTY UTILITY & MICROGRIDS
Request for Information (RFI)

Appendix

1. Vision

a. What is your vision as to how the County Utility could fit into the emerging energy ecosystem?

One path County Utility could take would be a scalable model that creates hubs or districts of highly resilient renewable energy. As these districts grow and mature, they naturally blend and interact with each other through a robust Distributed Energy Resource Management System. Pre-selected districts could serve as the base models for testing and working out a "district by district" hub and spoke integration strategy. Each district would connect and interact with one another, and all would report back to a common operating platform to allow operators the greatest possible flexibility in energy control throughout their system.

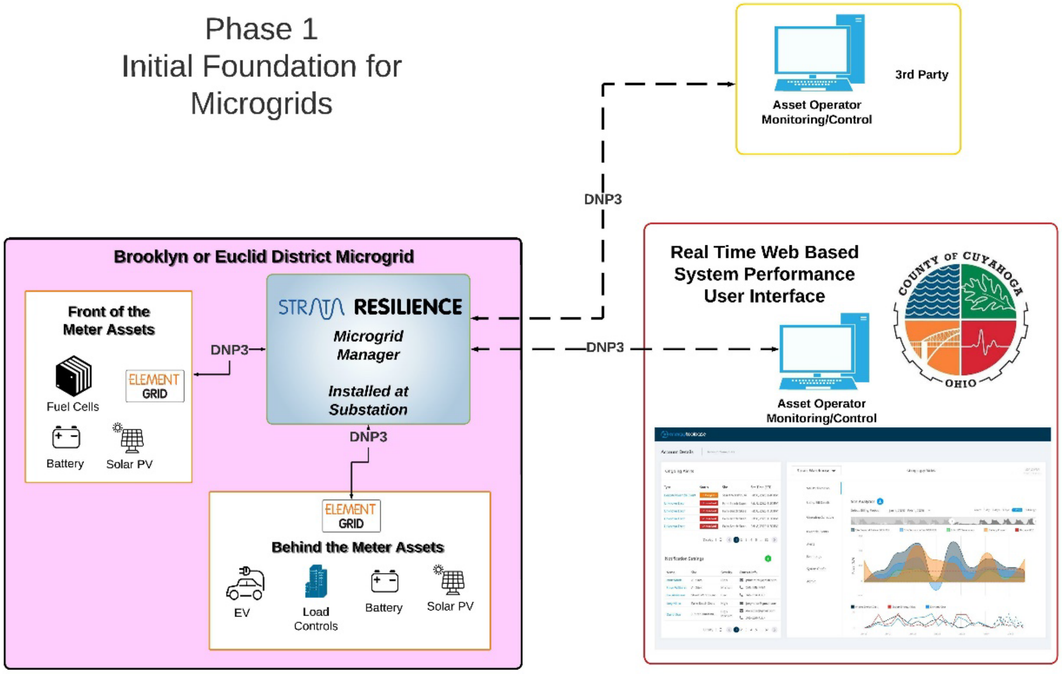
We think the framework for this program is well explained in the referenced publication "How a County Utility Can Catalyze the 21st Century Economy: Cuyahoga County's Vision to Develop Clean and Resilient Energy Districts to Attract and Retain Commercial Activity" and could be implemented in Phases.

Phase 1: Initial Foundation for Microgrids (12-18 months)

Using the districts noted in the Publication, design a system that represents a small-scale model of what the County Utility is seeking to achieve. This can begin with thorough planning and stakeholder engagement to ensure the greatest possible use of the microgrid in the given area. The main focus should be on capturing and testing the process of incorporating a district into a microgrid operating scheme.

On the technical side, use cases can be specified and then tested either in the field or beginning in a Hardware in the Loop testing environment. This will work out many bugs and bring the project forward in a gradual evolution.

Install the project in-field using an architecture similar to the following figure:



Key Components

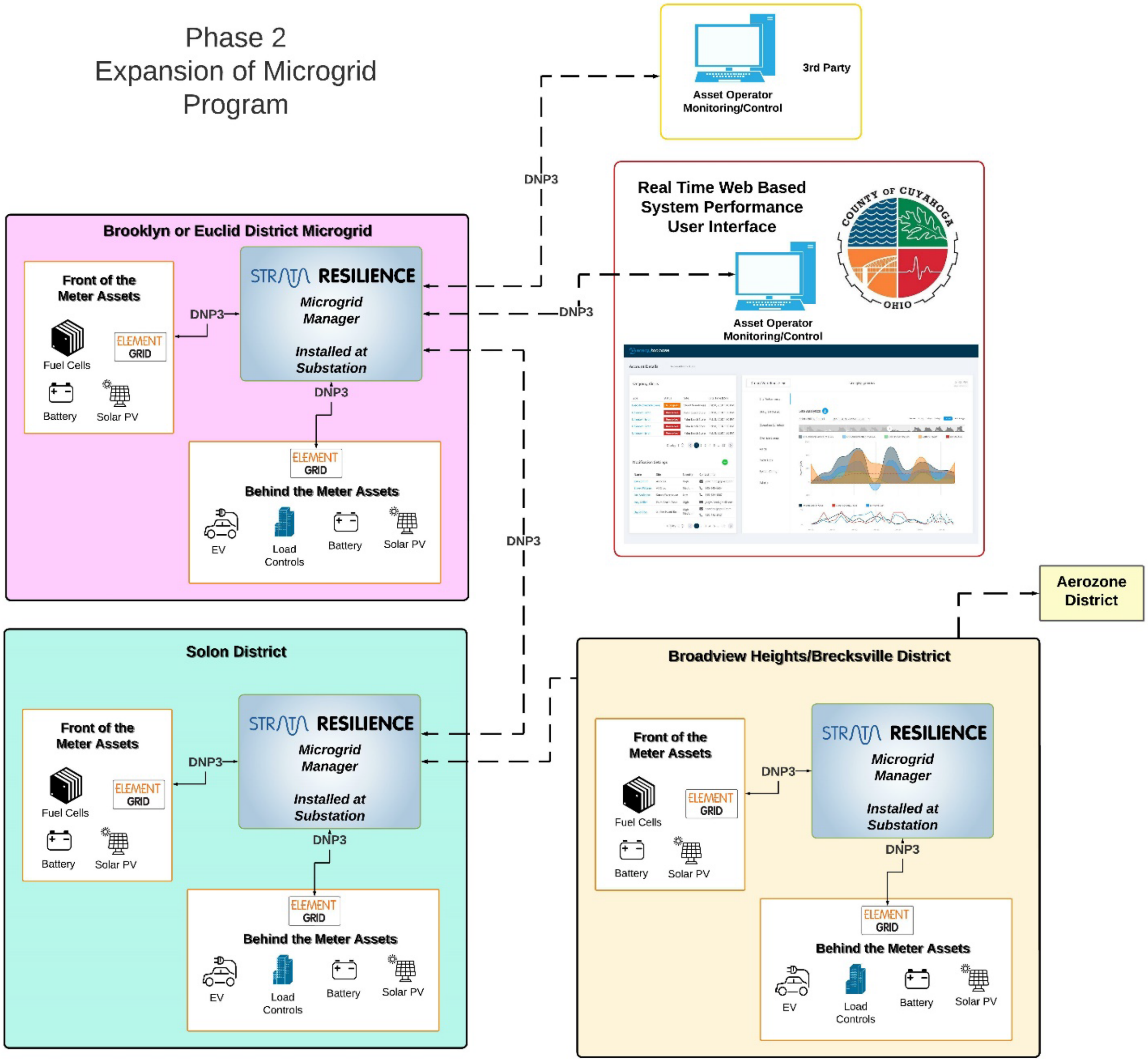
- [Strata Resilience –](#) Microgrid manager typically installed at utility substation
- [Element Grid –](#) Site controller that serves as gateway and redundancy for Strata Grid in the event of communication loss.
- [Real Time Web-Based System Performance UI –](#) This could take many shapes depending on what level of existing SCAD is available and how involved the County Utility wants to be in the day-to-day operations of the microgrids.
- [Asset Operator –](#) The 3rd party Asset Owner/Operator would have a user interface that's specific to their needs only.

At the end of Phase 1, the County Utility, in collaboration with other stakeholders or national labs, could perform a study of the project and highlight key success and areas where the team struggled. This would serve as a basis for a second phase as well as be a document that could be disseminated to other communities through the Center of Excellence.

Phase 2 (24-36 months)

Expand microgrid programs to other districts with a focus on scalability as shown in the following figure.

Phase 2
Expansion of Microgrid Program



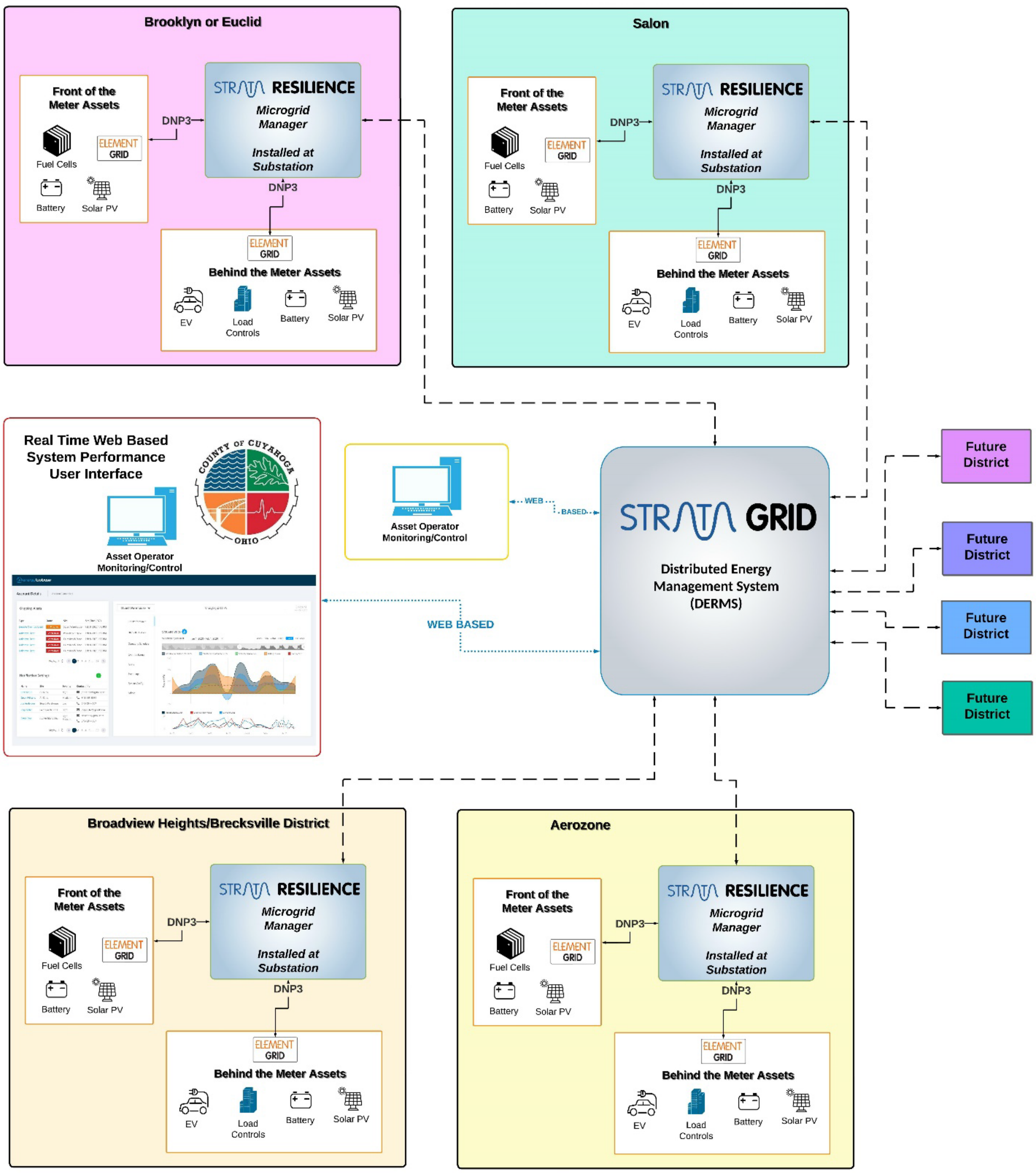
The main focus of Phase 2 is to identify efficiencies and develop the robust standards in engineering and policy required to facilitate expansion of the microgrid program throughout the County Utility service area. This would include publication of these standards as a final report and including a plan for widescale adoption of microgrids.

Electric Vehicles, (EV) could be incorporated at some small scale in either Phase 1 or 2 to test the efficacy of their inclusion into the microgrid program. This will lay the groundwork for wide scale decarbonization of transportation infrastructure to become part of the microgrid phasing plan. Given the nascent nature of hydrogen technologies, it may be better to include these in Phase 2 going forward. The program can take advantage of immediate technologies while still being capable adding new types of DER as they become commercially viable.

Phase 3 (36-48 months)

At this phase many of the technologies and standards needed for wide scale adoption have been developed and the microgrid program should be in a place for significant expansion. It could be the point where the County Utility considers purchasing a DERMS platform to enhance forecasting and optimization across all microgrids as well as incorporating new DER's and serving as the "hub" tying together all of the microgrid "spokes" as shown in the figure below.

Phase 3 of Microgrid Program



b. How might the County Utility improve services compared to traditional systems?
Incorporation of distributed renewable energy generators has been something that has overwhelmed traditional grid systems. The County Utility could create a flexible distribution system that allows for greater levels of renewable energy to be added without installing major upgrades. This is enabled through a technique called "Active Network Management" or ANM and is currently in use in the United Kingdom by UK Power Networks. We could help the County Utility understand the UK model and tailor a similar program that works best for the Cuyahoga County area.

c. How would you propose building a system in a manner that constrains costs based upon available loads, yet is flexible enough to adapt to new end users who are attracted to the system?
We believe the key is a real-time feedback loop which allows for autonomous balancing of generation and load needs. As mentioned in our response to question 1 (b) this ANM model allows for individual circuits and customers to make an informed decision about the viability of installing a renewable energy asset at any point in the grid. Based on historical data and using forecasting techniques, anticipated curtailment losses can be estimated and factored into long term pro-formas. While not necessarily replacing the wired upgrade model, it does offer the opportunity for non-wired alternative options to be baked into the day-to-day operating scheme of the County Utility.

d. How might your approach be different for new developments, such as industrial or commercial parks, versus existing customers? Would you envision merging district energy or transportation or hydrogen into the development?
The key for commercial and industrial customers is a comprehensive understanding of their specific energy need. For example, some customers are highly dependent on season energy being highly reliable, some are dependent on a traditional work day being the most vital of need, while others (like data centers) have the need for 24/7 reliability. Whatever the case may be, understanding the need and writing an adaptable service agreement ensures that the County Utility will have the greatest operating flexibility to provide comprehensive reliability throughout the grid.
Merging districts and incorporating any new renewable fuel source would absolutely be part of the model as technology continues to develop. The key is understanding how the technology incorporates into the operating scheme while managing the service agreement to all customers. If a customer decides to install hydrogen fueling stations or EV charging ports on their campus, the unique capabilities of these resources (ramp rates, fuel source priority stacking, etc.) could be added to the operating scheme to balance reliability with optimization.

e. How might you go about marketing your vision to end users?
We've heard from customers who want to invest in renewable energy but are unsure about the cost and are unclear about how they could use their generators for their own reliability needs. Others are unattracted to the daunting interconnection review timelines and unknown interconnection upgrade costs.

Using ANM allows for more options so that customers can choose the path to renewable energy that best suits their situation. This "managed interconnection" option would enable more renewable energy to be safely added to the existing infrastructure without causing undue cost to individual ratepayers. We support the managed interconnect any path with the financeable studies to forecasted curtailment (which we've found to be almost 0% in most cases) to attract private investment in renewable energy with the incentive of much shorter interconnection timelines, and far cheaper upgrade costs.

2. **Business Economic Models**
   a. How do you envision revenue flowing through the various entities?
   b. The County envisions a scenario where the developer/concessionaire is compensated through a pass-through model from power purchase agreements with individual customer/off-takers. Do you see any problems with this model or have suggestions on possible alternative compensation models?
   c. What process would you take with the County to design customer billing (i.e., tariffs) in a fair and transparent way?
   d. What types of tariffs are needed to support the County initiative?
   e. Would you be willing to provide the capital for the scope/role the County envisions?
   f. How would you ensure prices for specific projects (e.g. new distribution line or a microgrid) are competitive?
   See the included "Enchanted Rock General RFI Response" document for a general discussion of Business Economic Models.

3. **Organization Models**
   a. Would you be willing to contract directly with the County to be responsible for the full scope of this initiative?
   b. What are the tradeoffs for one firm serving all roles versus separate firms serving separate roles?
   c. How would you structure the relationship between yourself, the County, and other entities (if applicable)?
   d. What level of responsibility, if any, would you be willing to have for microgrid project identification and development, customer identification and selection, customer contract negotiations, etc.?
   e. What level of pre-design and other information or assurances would you need to respond to an RFP/Q and engage in negotiations with the County?
   We would need to see 30% design before bidding.
   f. What level of commitment would you need to have from potential County utility customers to respond to an RFP/Q and engage in negotiations with the County?

4. **Concession Agreement & Other Contracts**
   a. What contracts will need to be in place and between what entities?
   b. What critical terms and conditions need to be addressed?
   c. What term lengths would respondent be comfortable with for a distributed energy or micro grid PPA?
   d. What additional information would you need to sign a contract with the County for a scope of work?

5. **Initiative Timelines**
   a. What is a typical tum-around time for you to sign a contract for your role(s)?

b. What is a typical development time for a microgrid, from customer recruitment through operation? What are the major milestones?

c. What impact on this initiative do you foresee, if any, from the current supply chain disruptions?
The key to managing supply chain is thoughtful planning. Keeping tabs on lead times of equipment and ordering at the right time can lessen the impact of the global shortage of raw materials. Batteries are still coming in at around 18 months from time of purchase so they drive they overall project schedule.

6. **Technology**

a. What technologies should the County consider to address power issues for commercial and industrial customers? (power quality issues vs. short power outages vs. long power outages)
A Distributed Energy Resource Management System (DERMS) would afford the County much greater visibility and a wider range of tools to address all of these issues. Power quality could be addressed by a DERMS automatically sending new setpoint controls to smart inverters that produce favorable impacts on power quality at any other point throughout the system. A DERMS also allows greater flexibility to utilize any DER asset on the system to address brief outages very quickly. Finally with a long duration power outage, a DERMS could be programmed to prioritize critical loads and ensure that they are the last to lose power in a tiered load shedding scheme.

Power quality issues at commercial and industrial sites could be addressed by a power quality compensator as well. Please see included document: SA0030300001_MEPPI_VVC_Solutions_Sales_Aid_final.pdf for more information.

b. Can you provide high-level cost estimates for distribution infrastructure, distributed generation, and/or microgrid technologies across different sizes? (e.g. 14.4 kV feeder, 1 MW/1 MWh battery, 5 MW solar PV)
We typically suggest $2-3 per watt on solar installed cost. For 1 MW/ 1 MWh battery storage, we suggest $1M-1.5M installed cost. These are rough high-level estimates.

c. Are there ranges of economic feasibility that the County should be aware of when considering on-site generation, storage, etc. For example, do projects only over X MW prove to be economically feasible in your experience?
Less than size, economic feasibility really comes down to two primary factors; necessity and complexity. An argument could be made that the value of a microgrid for a hospital or 911 call center is higher than that of a retail store. It may be difficult to calculate the actual dollar value of these assets but the necessity is obvious. From a controls perspective, the County could aggregate several small assets and treat them as one bulk asset in a Virtual Power Plant arrangement so that if the customer base in that area is more focused on smaller systems, these can be integrated into the overall operating scheme without having to map each on individually.

d. How should cybersecurity of the utility, individual microgrids, customers, or other pertinent entities be ensured?
Clear contractual arrangements and data sharing agreements are vital, as are user defined roles on who can see what information at different levels of access. Selecting a control platform that allows these to be unique to the specific contract is key so that information is

e. What is your approach to managing: capacity and transmission peak load contributions? Energy market arbitrage? Frequency regulation?

Capacity and Peak Load Contributions – We utilize an Active Network Management approach in which actions are taken at predefined loading thresholds. This could take the form of removing load, dispatching energy storage, or utilizing backup generators. The appropriate blend would be determined based on the service agreement framework that exists in a specific area.

Energy Market Arbitrage – In addition to using forecasted prices and day-ahead program schedules, Active Network Management can be used to manage energy market arbitrage as well. Specific actions (charge/discharge schedules, load shedding, PV curtailment into storage, etc.) could be programed using a similar threshold approach for real time energy market participation.

7. Diversity, Equity, and Inclusion

a. How will you ensure Diverse, Equitable and Inclusive (DEI) partnership(s) throughout this Initiative?

8. Other

a. What potential risks, setbacks, or hurdles do you see for this Initiative?
Finding customers, making business case work, finding interested developers.

b. Please provide any other information that you feel would be pertinent to the County at this stage of the process.

Microgrid Consulting and Design

Helping the Electric Power Industry to Design Resilient Microgrids

Microgrids, defined as “a group of interconnected loads and distributed energy resources (DER) within a clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid”, are gaining traction all around the world to address power reliability and resiliency in the aftermath of increasing natural disasters.

Mitsubishi Electric Power Products, Inc. (MEPPI) Power Systems Engineering Division (PSED) helps customers to address critical questions for a resilient microgrid design such as what components and configurations are optimal for your specific facility, and what is the expected payback period of the proposed microgrid.

Microgrid Feasibility Studies

Our team of experienced engineers can take an initial microgrid concept and bring it to a 30% design and help develop microgrid specifications to be used for procurement.

Typical microgrid feasibility study deliverables include:

- Microgrid preliminary/30% designs
- Microgrid detailed component costs and cost-benefit analysis of various DERs and energy storage options including optimal sizing for lowest levelized cost of electricity (LCOE)
- Microgrid options and benefits resulting from the various DERs such as solar, combined heat and power (CHP), fuel cell, and existing generation
- Microgrid operation modes and control functionality descriptions

Software tools that we use for microgrid analysis include CYME, Synergi Electric, PSCAD/EMTDC, EMTP, Homer Grid, Homer Pro, System Advisory Model, DER-CAM, REopt Lite, and DER-VET.

For more information and relevant case studies visit www.meppi.com/industries/consulting

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Changes for the Better

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MITSUBISHI ELECTRIC
POWER PRODUCTS, INC.

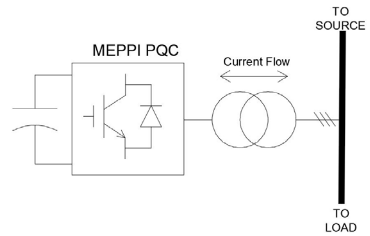
VOLT/VAR CONTROL SOLUTIONS

VVC Solutions applies a power quality compensator to monitor the grid and provide application targeted support

Mitsubishi Electric's Power Quality Compensator (PQC) is a power electronic-based Volt/Var Control product for electric distribution market customers requiring improved voltage stability and autonomous real or reactive power control. By advancing the technology beyond the traditional D-STATCOM, and thru the addition of advanced features, Mitsubishi Electric will engineer a solution to fit your grid application with a single device.

Offered as a response to distributed energy resource (DER) penetration on the distribution grid, as well as market segments not traditionally targeted by centralized transmission level solutions, Mitsubishi Electric Power Product's distribution Power Quality Compensator (PQC) is a customized solution to meet utility and industrial power quality requirements. The PQC is comprised of an compact, advanced power converter to control and regulate bi-directional power flow, and an advanced application level controller capable of interfacing with a utility's SCADA and feedback devices.

By regulating the output voltage of the Power Quality Compensator, the converter can source or absorb vars with respect to the connected power system based on the required application. Utilizing a proven power converter technology, the PQC is able to respond to rapidly changing grid conditions and offer increased dynamic reactive compensation compared to traditional solutions such as shunt



Power Quality Compensator (PQC)

- Replaces unloaded synchronous machines to control reactive power and provide virtual inertia
- Faster response time then a SVC, capacitors, reactor banks, or load tap changers
- Dynamic reactive power response with output characteristic shaping and programmable droop controls
- Standard software package and parameterized controls for applications
- Application specific mapping and sequencing
- Interfacing with existing capacitor and reactor banks for improved feeder reactive power coverage

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MEPPI VVC SOLUTIONS

reactors, capacitors, and load tap changers. Using this technology and designed with these applications in mind, the PQC is superior to other "smart" inverters that have been re-purposed as reactive devices with limited flexibility and redundancy, and also the inability to manage unbalanced loads.

Capabilities

- Volt-Var Optimization (VVO)
- Conservation Voltage Reduction (CVR)
- Current Phase Balancing
- Harmonic Mitigation
- Var Regulation
- Power Factor Correction
- Voltage Stability
- Transient Over/Under Voltage
- Frequency Regulation

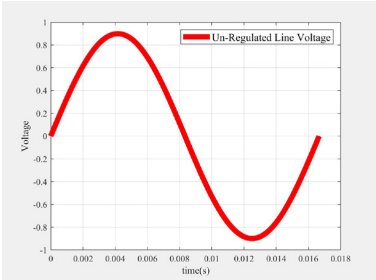
Applications

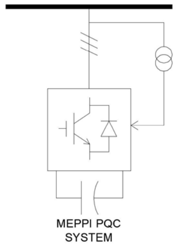
- Distributed Generation Integration
- Voltage Imbalance Situations
- IEEE 519 Compliance (Harmonics)
- Peak Demand Shaving
- Power Quality Requirements
- Asset Life Maximization
- Industrial Load Compensation
- Grid Bridging

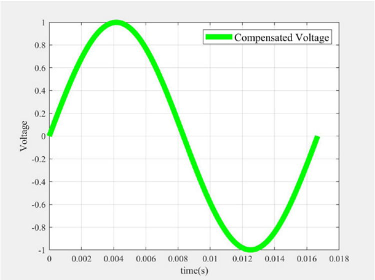
Customized solutions to the application:
By tailoring each system to solving the utility's specific needs, a VVC Solutions PQC is able to maximize the utility's investment by supplying only the features and capability required. Integrating a Power Quality Compensator with Mitsubishi Electric's internally developed software makes long term reliability and resilience part of every installation.

Example: 2-Quadrant Operations

Voltage Regulation



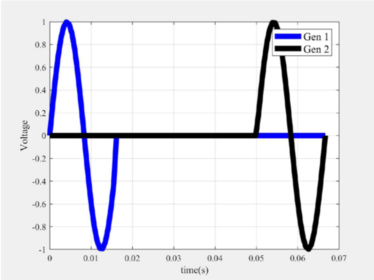


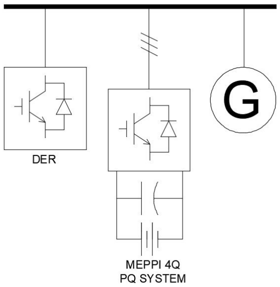


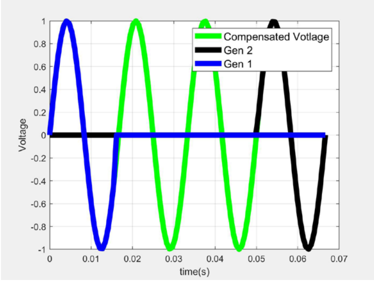
Mitigates voltage variation by VAR injection

Example: 4-Quadrant Operations

Grid Bridging







Watt injection and interim cycle replacement during generation loss

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