

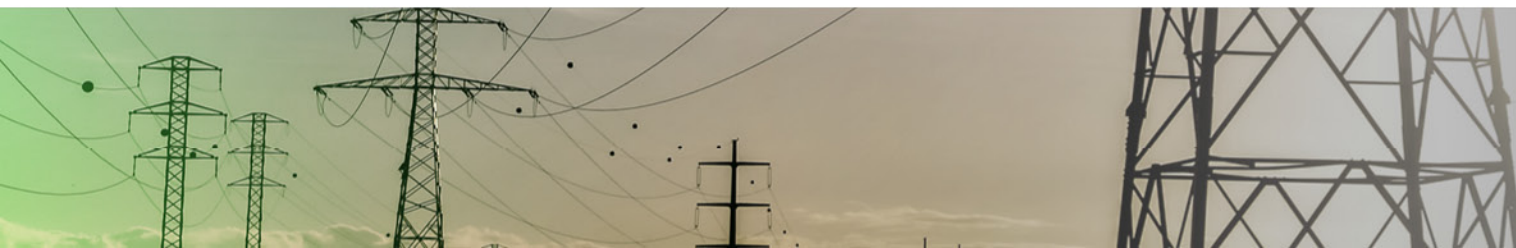


CPUC Diesel Alternatives Workshop Peterson Power Systems

August 25, 2020

Resiliency through Innovation and Diversity

- Our comments today are focused on the specific use case of islanding at a PG&E substation and providing long duration capacity (96 hrs or greater) through a hybrid microgrid system consisting of highly efficient spark ignition engines fueled by RNG with state-of-the-art emissions controls technology and energy storage. The microgrid is controlled by the CAT Microgrid Master Controller.
- This solution was bid into PG&E's DGEMS solicitation by multiple developers
- Peterson Power Systems is a leader in energy solutions providing of Distributed Energy Resources (DER) and Microgrids (ie: Lincoln High School, Portland Oregon, Taylor Farms, Gonzales, CA)
- Peterson Power Systems is advocating a diverse technology approach to address the PSPS challenges before us
- We appreciate the opportunity to participate in this discussion and contribute our perspective based on our experience addressing this very complex application that is unique at substation to substation.



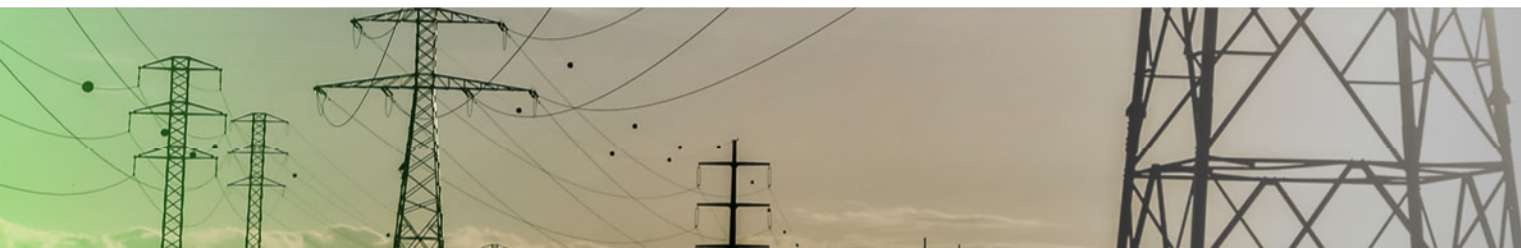
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Q1: Does your solution replace diesel generators by supplying power to all customers at a substation level?

- YES!
- PG&E's PSPS use case is very unique
- Islanding requirements cannot be satisfied solely by gaseous fuels due to technological limitations
- Mass and Inertia are important considerations
- CAT's superior efficiency is extremely important when utilizing RNG
- Peterson's Hybrid System provides immediate response and emissions free spinning reserve



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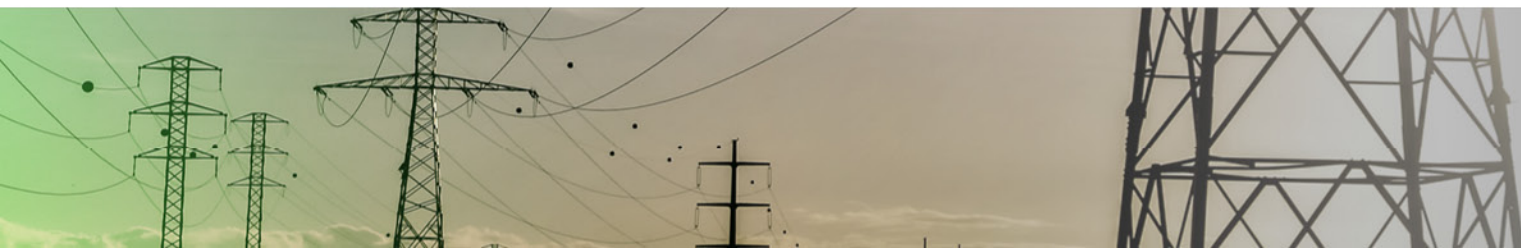
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Secondary Q1: Is it a permanent installation at a specific substation?

~~Permanent~~: Transitional

Key Issue	Specifics	Details of Peterson Solution	Peterson Cat
Timeline to Commercial Operation	Must show consideration of the timeline to operation so CPUC decisionmakers can see if feasible for 10/1/21 or longer term	Peterson has a RNG/BESS hybrid solution that can reach commercial operation by 10/1/21. This hyperscale solution was capable of meeting the DGEMS RFO schedule of 10/1/20 set forth in the DGEMS RFO.	✓
Cost	For solutions with large capital costs, must recommend how those costs be split between temporary generation and other revenue sources	Significant opportunity for RA revenues in the CAISO markets. High efficiency and unlimited starts suggests a capacity factor of greater than 20%	✓
Applicable Substations	Must show consideration for what conditions make your solution feasible and cost effective at a substation	<ul style="list-style-type: none"> - Requires low pressure RNG at substation (5-10psig) - Requires minimal real estate – high power density – 5MW per ¼ acre 	✓



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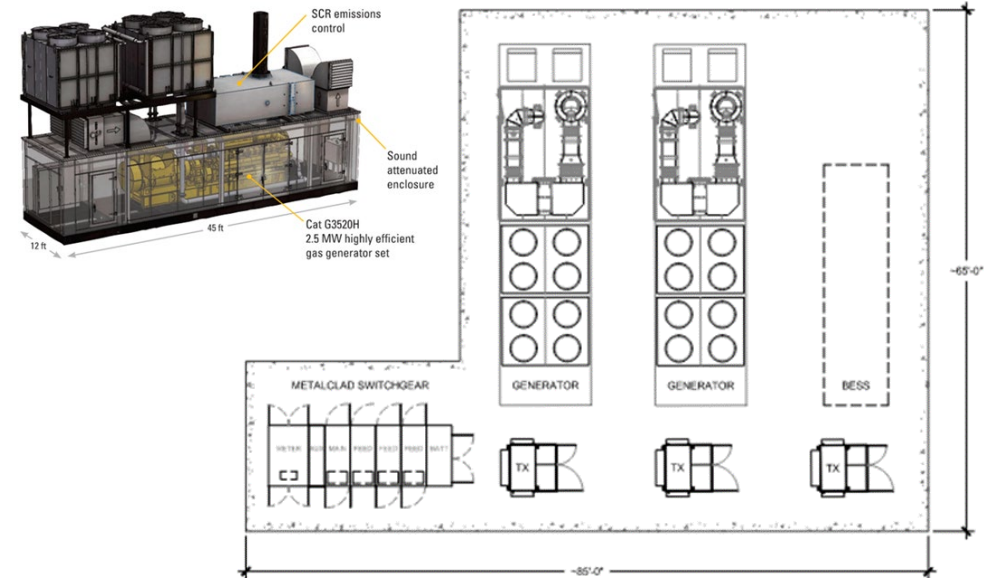
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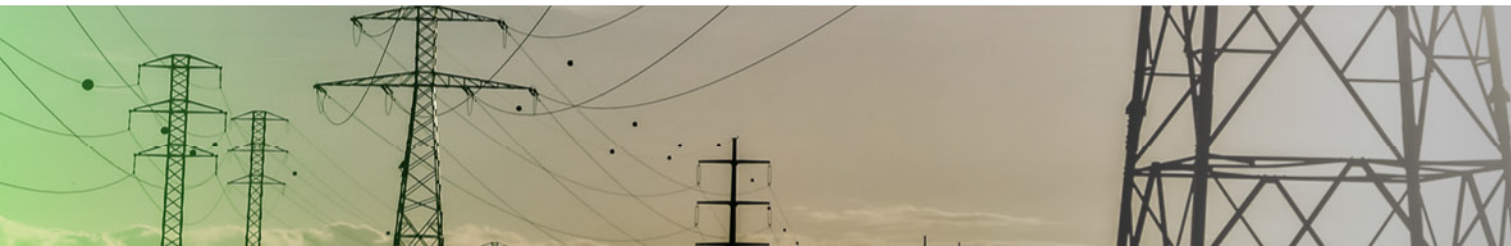
DGEMS Solution: PSPS Coverage and Cost-effective Long Duration RA

Peterson Power Systems Hybrid Microgrid Solution:

- **Quick deployment times:**
 - Pre-fabricated systems
 - Hyperscale project delivery based on data center model
 - Operates on low pressure renewable natural gas (2.5 PSIG)
- **Immediate response / highly efficient**
 - “Start time” measured in milliseconds
 - Heat rate: 9200 Btu/kwhr (HHV)
- **Can operate as an islanded grid or utility synced**
 - Back-up power capable of load following during grid interruptions
 - On demand capacity (RA) with unlimited duration



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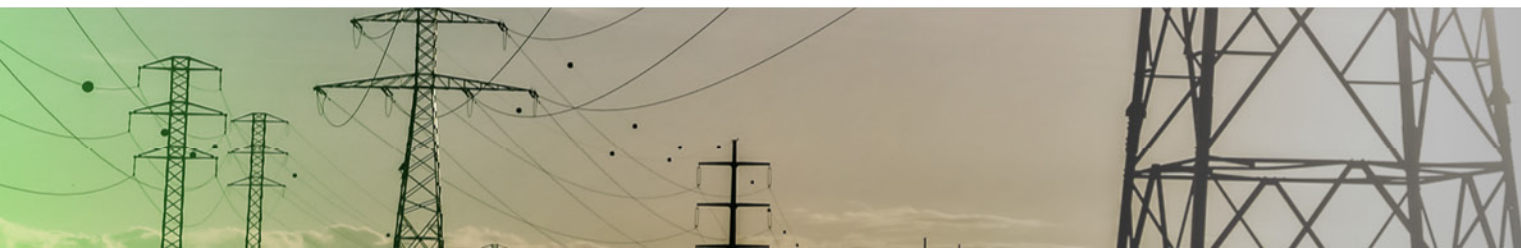
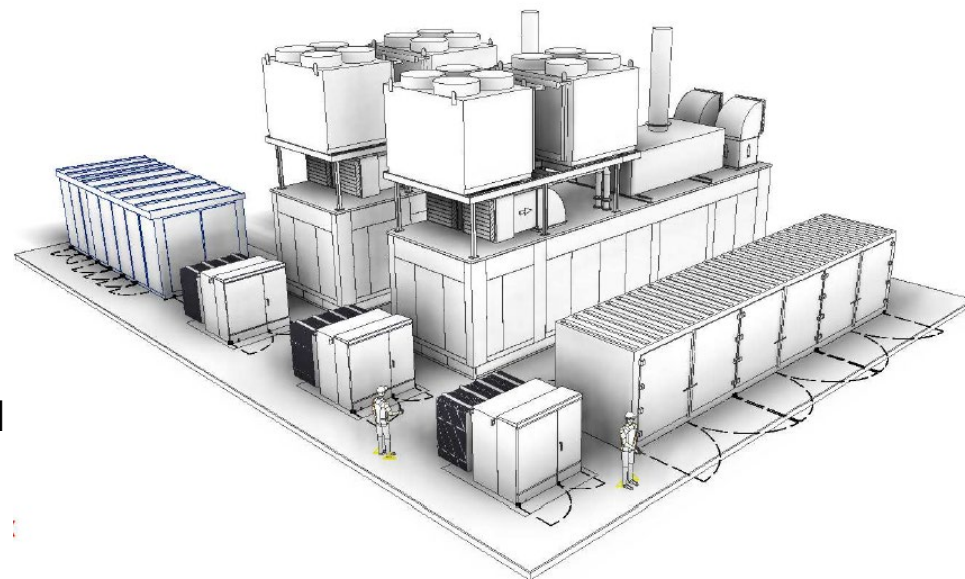


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Peterson Power Systems Hybrid Microgrid Solution:

- **Modular design - scalable to meet any load demands from 2.5MW and up**
- **Emissions free Spinning Reserve**
- **Superior Emissions when compared to Diesel #2**
 - 80% Less GHGs¹
 - 98% Less NOX¹
 - 98% Less PM10¹
- ¹When compared to Tier 2 emergency diesel generation
- **Highly efficient layout and design - Over 5MW of output per .25 acre of land**
- **No water usage**
- **Easily integrates with solar arrays and wind through CAT Microgrid Master Controller**
- **Extensive 24/7/365 service network**
- **Extended service agreements available – 10 Year @ Full Life Cycle cost**



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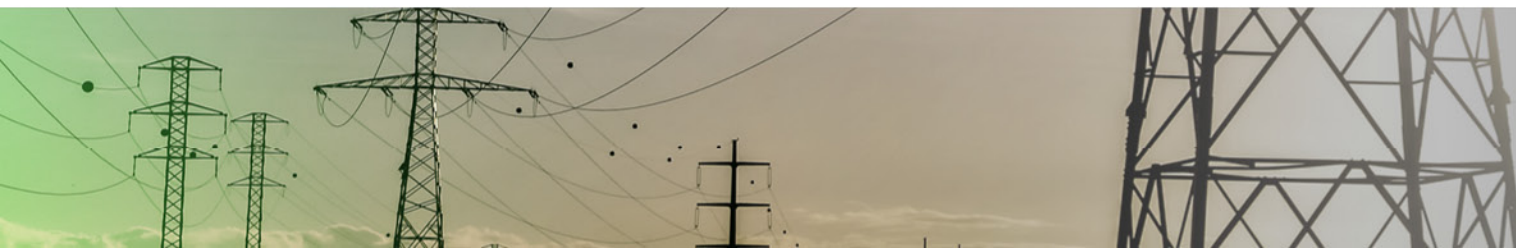
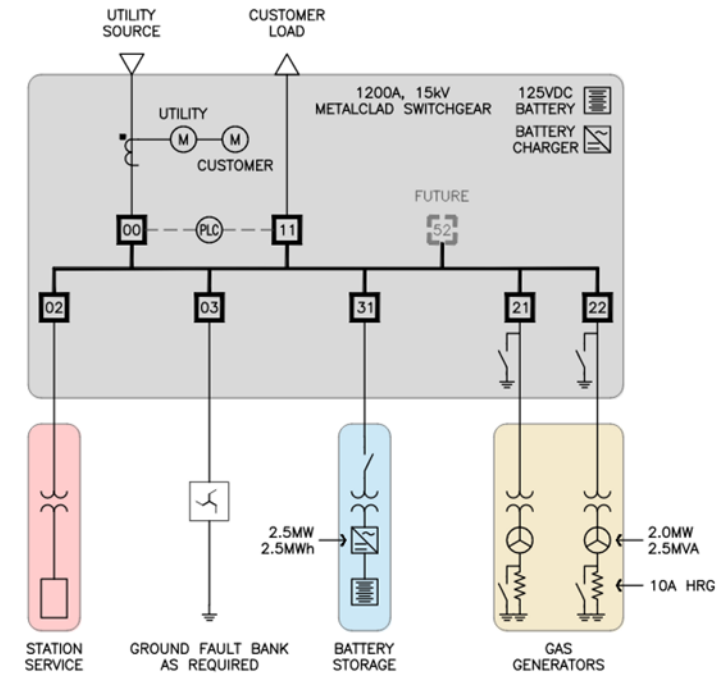


DGEMS Solution: PSPS Coverage and Cost-effective Long Duration RA

Peterson Power Systems Hybrid Microgrid Solution:

Product Components:

- **Containerized battery storage**
 - Scalable in 2.5MWH Increments
- **12kv Metal clad switchgear**
 - Built to IOU standards including CAISO meter compatibility
- **Highly efficient Caterpillar G3520H reciprocating engine**
 - BACT Emissions control rated for continuous operation
 - 2.5 MW output scalable increments
- **Caterpillar Microgrid Master Controller**
 - Can control and integrate additional renewable resources
 - Supports transition of asset over time
- **Step-up transformers**
 - 480V to 12kV



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COSTS & ECONOMICS:

- Installed costs roughly \$1500/Kw
- Difficult to compare side by side with other solutions due to 98% availability
- With a 9200 Btu/kwhr HHV heat rate, significant RA revenues are projected – dispatch modeling done during the DGEMS RFO suggested a capacity factor between 20% - 25%
 - Cat manufactures stoichiometric and lean burn engines, Peterson has selected a lean burn engine based on engine efficiency
- Considering RA dispatch and other ancillary services opportunities, the asset has a positive NPV over its assumed 10 year life
- As prime movers are transitioned out of service after 10 years, the salvage value could be up to 50% of initial equipment value considering 30yr+ design life and need for this type of asset in other markets beyond 2030

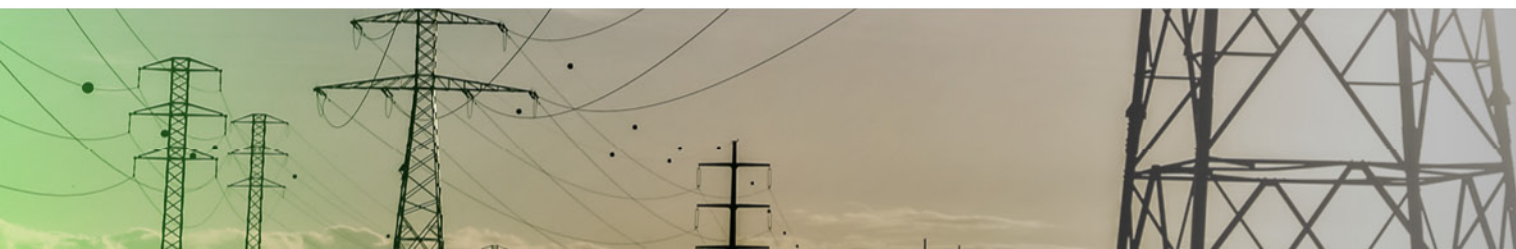


Secondary Q2: Can your solution sustain islanding for 48 and or 96 hours?

Peterson Power Solutions Hybrid Microgrid:

Substation	Substation Overview	RNG/BESS 48hrs	RNG/BESS 96hrs
Alto	31.81 MW, 400ft to gas pipeline, tight site, extensive evaluation completed as part of DGEMS RFP and bid response, Peterson has visited this site	✓	✓
Covello	2.55 MW, 28 miles to gas pipeline, adequate space, Peterson has visited this site and powered this site with portable generation on multiple occasions	✓ ¹	✓ ¹
Fort Bragg	13.75 MW, 25 miles to gas pipeline, very limited space, extensive evaluation completed as part of DGEMS RFP and bid response, Peterson has visited this site	N/A	N/A

¹ Assumes RNG storage at site is feasible and economical



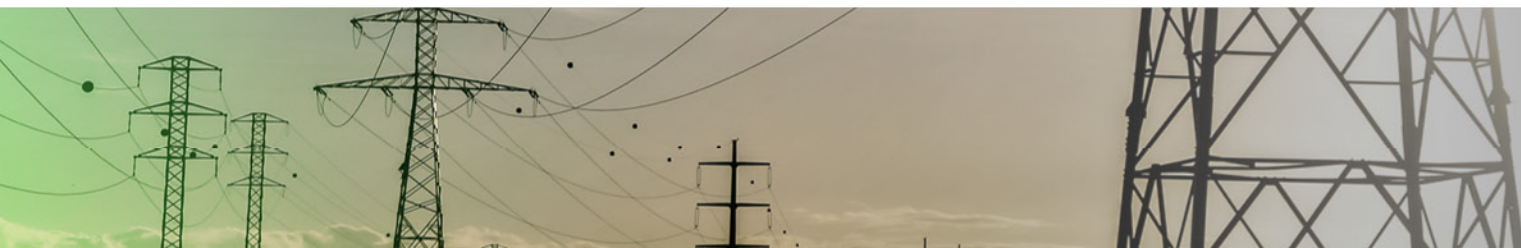
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Secondary Q3: Can your solution be ready for commercial operation by 2021?



- Yes!
- Peterson was prepared to deliver this solution in accordance with the aggressive schedule set out in the DGEMS RFO
- The microgrid system is modular and consists of proven components
- Proven equipment that is financeable
- It produces revenue due to long duration RA with an annual availability of 98%
- Hyperscale deployment can be achieved based on the application of successful data center project delivery models



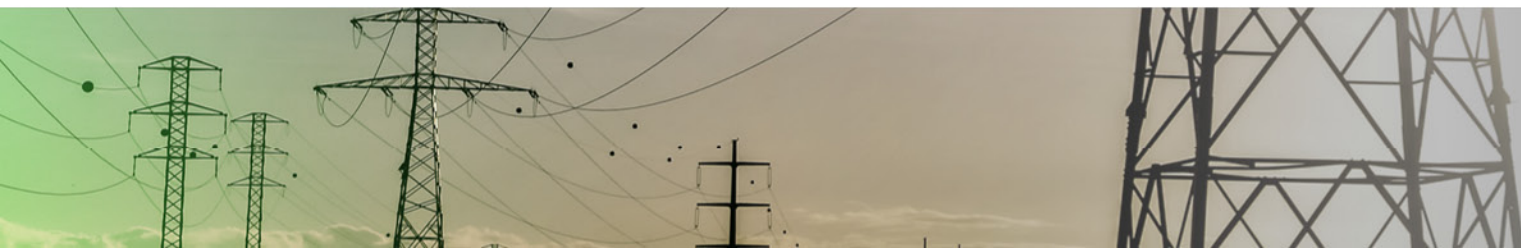
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**Secondary Q4: Given the constraints in Q3, how many MW can your solution reasonably cover in 2021? Future years?
Under what conditions can your solution be reasonably deployed?**

- **Peterson Power Systems was prepared to meet PG&E’s tight schedule for the 2019 DGEMS RFO**
 - Offered as Equipment Only and as a full EPC Turnkey (with a partner), for both utility ownership and third party PPA structures
 - Bid to PG&E in the DGEMS RFO by 6 or more parties
- **We have extensive experience in the successful completion of large volume, hyperscale projects as a result of our leadership in the data center market**
- **Caterpillar is one of the largest power generation equipment manufacturers globally, as such, Peterson has the ability to work through Caterpillar’s state-of-the-art, sustainable factory in Lafayette, Indiana to supply large amounts of equipment on very compressed schedules**



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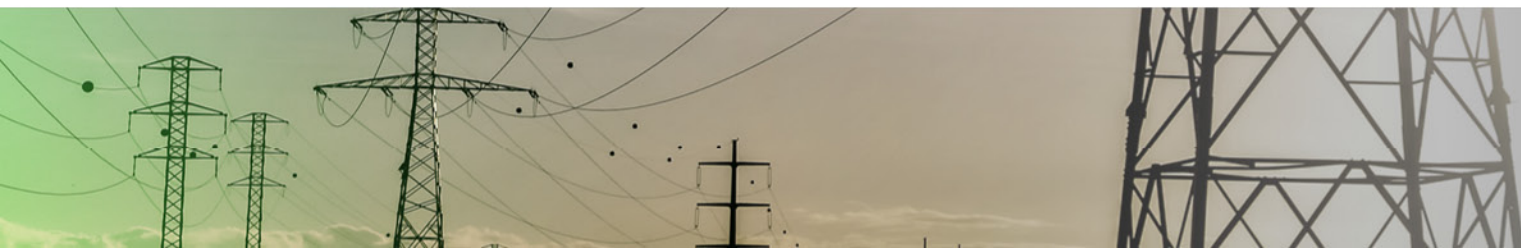
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Secondary Q4: Given the constraints in Q3, how many MW can your solution reasonably cover in 2021? Future years? Under what conditions can your solution be reasonably deployed?

Peterson Power Systems: Hybrid Microgrid (DGEMS)

- How many MW's Peterson Power's solution can reasonably cover in 2021 is a function of:
 - When an equipment order is placed
 - The number of substations made available and amount of available real estate
 - Specific interconnection limitations within substations
- Future years?
 - Virtually unlimited – this is a scalable solution that can be delivered at hyperscale
 - Dependent upon backlog
 - Numerous Load Serving Entities and Developers have expressed interest in this long duration, highly resilient, clean capacity solution
- Conditions Needed for Deployment
 - Real Estate – power density of just over 5MW per $\frac{1}{4}$ acre of land
 - Electrical interconnection
 - Low pressure fuel supply – as low as 2.5 psig



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CAT® MICROGRIDS: SOLAR & ENERGY STORAGE SYSTEMS

THANK YOU!

KEEP THE POWER ON – DEMAND CAT.

Peterson Power Systems

Powering Sustainable Progress. Everywhere. All the time.

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