Reducing Carbon Emissions in Telecommunications with the Hybrid Power Shelter

Analysis of Off-grid Telecom Power Provided by a Standard Diesel Generator Compared to the HCI Energy Hybrid Power Shelter

In off-grid communications infrastructure, it is typical for a diesel generator to be leveraged as the prime power source. This report presents a comparative analysis of the annual CO_2 emissions produced by a standard diesel generator utilized for prime power versus the HCI Energy Hybrid Power Shelter™ consisting of solar panels, a wind turbine, Lithium-ion batteries, and a propane generator. The comparison showcases a substantial decrease in emissions with HCI Energy's Hybrid Power Shelter and underscores the environmental and operational benefits of integrating renewable energy sources.

Highlights

90% DECREASE
IN $C0_2$ EMISSIONS

$53,090 /YEAR
AVERAGE FUEL SAVINGS

87% REDUCTION
IN GENERATOR RUN TIME

Reduction
IN OPERATING EXPENSES

Hybrid Power Shelter System

HCI Energy Hybrid Power Shelters are equipped with Lithium-ion batteries and a propane generator*[1] with the option for integrated solar and wind. The energy from these sources is stored in the batteries which in turn power both the shelter's systems and customer equipment. If the renewables do not provide sufficient power to keep the batteries above their low state of charge (SOC) set point, the Hybrid Power Shelter system activates the integrated 25 kW propane generator. The generator runs at peak efficiency and simultaneously powers customer equipment and the shelter systems while charging the batteries until they reach a sufficient SOC**. Once the batteries reach the high SOC set point, the generator powers off. HCI Energy's system runs the generator only when renewable energy is insufficient, minimizing fuel consumption through its battery-first approach.

Background

HCI Energy deployed seven Hybrid Power Shelters in a remote location in Canada to support telecommunications connectivity for a customer. These systems supply power to network equipment, enabling a connection between the nearest uplink and the customer's location.

The data from one of these deployments was analyzed over a twelve-month period (May 2023 to April 2024) and is used for empirical comparison purposes in this report.

Methodology

DIESEL GENERATOR SELECTION

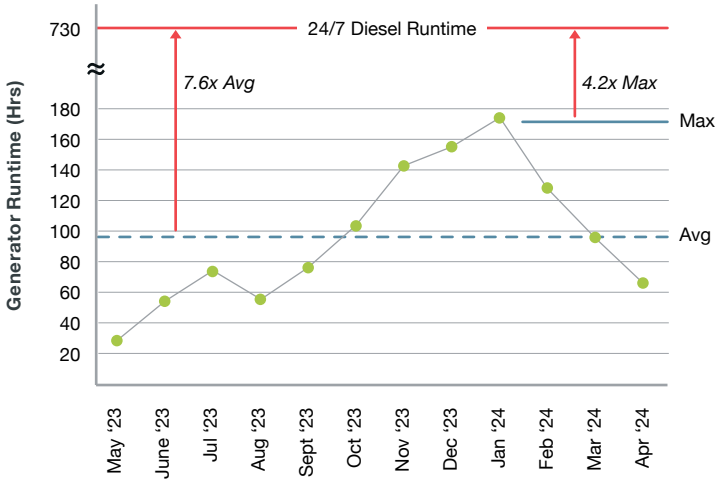
A typical 30 kW diesel generator was used for comparison because it is a common prime power source for industrial loads of this size at telecommunications sites.

ASSUMPTIONS

The emissions calculations were based on the following assumptions:

- Customer Equipment Load: 3.9 kW
- The diesel generator runs 24/7
- The diesel generator consumes 1.8 gal of fuel per hour
- The propane generator consumes 2.48 gal of fuel per hour
- Diesel generators produce 22.45 lbs of CO_2 per gallon of fuel[2]
- Propane generators produce 12.68 lbs of CO_2 per gallon of fuel[3]

COMPARATIVE GENERATOR RUNTIME



HYBRID POWER SHELTER CALCULATIONS

Using the reports generated by HCI Energy's historical data software, myHCI, the integrated propane generator as part of HCI Energy's Hybrid Power Shelter solution ran 1150 hours consuming 2852 gal of propane over the period. Calculating the emitted CO_2, the Hybrid Power Shelter's generator produced 36,163 lbs of CO_2/year.

Calculating Emissions

DIESEL GENERATOR AS PRIME POWER CALCULATIONS

Taking into account the expected fuel consumption and CO_2 generation assumptions mentioned above, the 30 kW diesel generator is expected to emit the following amounts of CO_2:

RATE OF EMISSIONS	CO_2 EMISSIONS
CO_2 /day	970 lbs
CO_2 /month	29,499 lbs
CO_2 /year	353,992 lbs

Results

COMPARATIVE EMISSIONS DATA

Our findings reveal a substantial reduction in emissions with the implementation of the Hybrid Power Shelter. Below is a detailed breakdown of the annual emissions from both systems:

ENERGY SOURCE	ANNUAL CO_2 EMISSIONS
Diesel Generator as Prime Power	353,992 lbs
HCI Energy Hybrid Power Shelter	36,163 lbs

Hybrid Power Shelter produces only 10% of the CO_2 emissions compared to the diesel generator.

ADDITIONAL BENEFITS

This report's comparison analysis is primarily focused on direct emissions considerations between HCI Energy's Hybrid Power Shelter and a typical diesel prime power installation. Several other notable indirect emissions and economic considerations exist when measuring Environmental, Social, and Governance (ESG) impact.

Reduced Maintenance and Servicing

The typical remote location of an off-grid communications facility requires access by ground and/or air utility vehicles for maintenance and service. These services have their own emissions and carbon footprint profiles. A typical diesel prime power installation, as referred to in this comparison, requires at least monthly fuel servicing and a more rigorous annual maintenance cycle than an intermittently used propane generator installation. Field records for the representative Hybrid Power Shelter site used in this comparison indicate that the propane generator only required three fuel servicing visits, decreasing indirect emissions by at least 83% per year. Additionally, a much smaller team can be used to maintain and service a constellation of Hybrid Power Shelter installations, further decreasing the overall carbon footprint due to the positive workforce impact.

Fuel and Equipment Cost Savings

A comparison of fuel costs over the analysis time frame indicates significant savings that should be noted. The wholesale diesel price average during the period was approximately USD $4.0/gal, compared with an average price of USD $3.5/gal for propane. A calculation on fuel usage from assumptions would indicate a savings of approximately USD $53,090 per year, not including any additional costs associated with delivery service or market volatility. Additionally, the propane generator in this analysis only runs at a 13% duty cycle in comparison to the diesel generator, indicating a 17.6x longer lifetime and duration between maintenance cycles.

Conclusion

This report demonstrates a significant reduction in CO_2 emissions when using the HCI Energy Hybrid Power Shelter compared to a conventional 30 kW diesel generator. The findings show that the Hybrid Power Shelter, with integrated solar panels, wind turbine, and propane generator, produces only 10% of the emissions generated by the diesel generator annually. This equates to a reduction of over 317,828 lbs. of CO_2 per year for each unit deployed.

By choosing the HCI Energy Hybrid Power Shelter, our customer supported environmental sustainability while gaining a more efficient energy solution. The reduction in emissions contributes to a smaller carbon footprint and aligns with global efforts to combat climate change. Furthermore, the use of renewable energy sources reduces dependency on fossil fuels, enhancing energy security and stability for remote operations as well as reducing fuel and maintenance costs.

For more information, please visit hcienergy.com.

* Propane generators offer cleaner emissions, fuel stability, reliable cold weather performance, lower maintenance requirements, cost-effectiveness, and versatility over diesel generators.[1]

**State of charge (SOC) is the amount of energy stored in a battery relative to its maximum capacity.

[1] https://www.hcienergy.com/blog/propane-generators-vs-diesel

[2] https://www.hunker.com/12284423/how-to-calculate-carbon-dioxide-emissions-from-a-diesel-generator

[3] https://www.eia.gov/environment/emissions/co2_vol_mass.php

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