WESTGEN TECHNOLOGIES

Shell Canada EPOD

Case Study 2020

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1600, 205 5th Ave SW
Calgary, AB, T2P, 2V7
info@westgentech.com

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EXECUTIVE SUMMARY

In April 2020, Shell trialed a 20kW EPOD remote power generation module which powers an instrument air compressor with a generator/battery/solar panel system. The EPOD deployment on the Shell site resulted in greenhouse gas reductions through reduced power demand (elimination of oversize generator + load bank), elimination of venting from pneumatics, and minimizing construction scope.

Coupled with Shell's zero venting wellpad design, switching to EPOD resulted in >35% overall reduction in greenhouse emissions from previous gas pneumatic designs. In addition to improved environmental performance, Shell also realized capital and operating cost savings.

The success of this trial has resulted in the adoption of the EPOD in all future wellpads in Shell's Alberta Shales operations.

> **"The EPOD fills a void that existed in the power generation market for remote locations. The EPOD trial unit operated consistently and demonstrated a significant reduction of fuel gas consumption, GHG emissions and maintenance costs."**
>
> David Hatch, Shell Facilities Engineer

BACKGROUND

In 2017, Shell collaborated with industry, international institutions, non-governmental organizations and academics to develop a set of Methane Guiding Principles, and in 2020, Shell announced an ambition to become a net-zero emissions energy business by 2050.

In line with these goals, Shell Canada updated the wellpad design in their Alberta Shales business in 2019 to eliminate methane emissions from pneumatic devices using instrument air. At the time, Shell used surplus generators with a load bank in order to supply the power required to run an air compressor on their sites.

In late 2019, the EPOD solution was presented to Shell who decided to move forward with a trial. A 20 kW EPOD was installed and started up on April 15, 2020 at one of their Alberta Shales multiwell pad sites. The EPOD was installed along side the existing traditional generator and air compressor design to do a side-by-side comparison of the technology. The results of this trial are presented in this case study.

Located in the McKinley / Tony Creek field, near Fox Creek Alberta, the Shell trial wellpad has 6 wells producing from the liquid rich Duvernay shale and uses gas lift for artificial lift.

DESIGN

EPODs are available in 6, 20, and 30 kW sizes, depending on the air compressor size and additional site power requirements for electric heaters, heat trace, client panels, electric pumps, and other loads.

With Shell's provision of a typical wellhead and test separator piping and instrumentation drawing (P&ID), Westgen completed an estimate of the instrument air consumption from each device. For all sites it is important that equipment be accurately captured, including any pneumatic injection pumps.

A 20 kW EPOD unit with duplex 5 HP reciprocating air compressors was quoted based on an estimated maximum air consumption of 8.2 scfm for site equipment and based on Shell's requirement of site power for measurement, controls and automation, and inexpensive electric heat trace. Instrument air packages require some air for blowdown and for regeneration of the dryer. Westgen's package uses approximately 15% of the design air flow rate to regenerate its electric air dryer. These considerations brought the total sizing air flow rate to 10.4 scfm. With a rated output of roughly 19 scfm per compressor at 125 psig air pressure, the package exceeded site air requirements and was estimated to operate with 27% run time per air compressor.

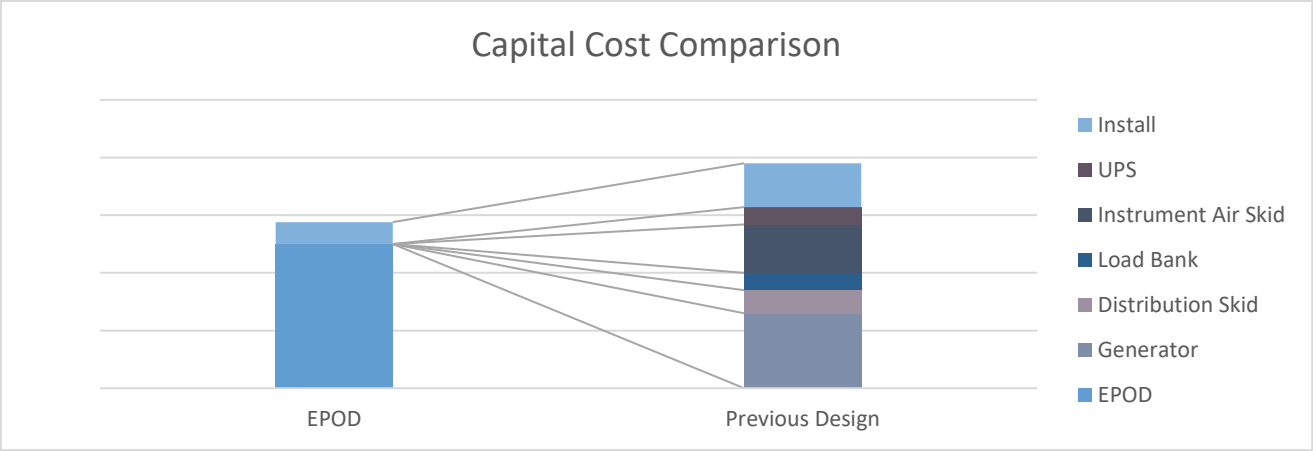
ESTIMATING INSTRUMENT AIR

Instrument air flow rates are difficult to reliably calculate. For this trial, Westgen had estimated a long-term air usage of 4.48 scfm. A comparison of the actual air consumption at site against three instrument air consumption estimate methods is summarized below.

	Air Consumption (scfm)	Estimate as % of Actual
Actual Air Consumption:	**6.08**	**-**
Westgen Estimated Maximum:	**8.21**	**135%**
Estimate from Shell DBM:	**5.42**	**89%**
Estimate from AER Manual 15:	**4.48**	**74%**

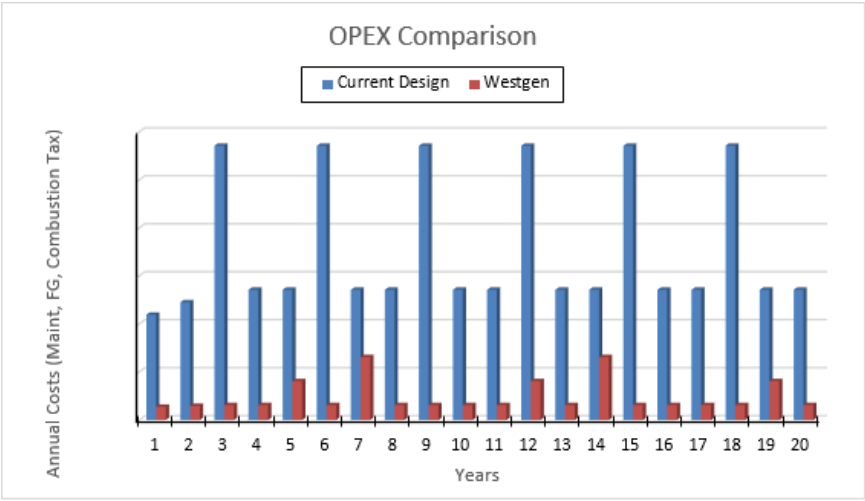
CAPITAL COST REDUCTION

By integrating components such as generator, distribution skid, uninterruptible power supply, and instrument air skid from their previous design into one modular shop-fabricated solution, Shell realized 26% capital cost savings. Shell further reduced capital cost by incorporating their wellpad control panel (RTU) into the EPOD's general area classification enclosure (rather than requiring a separate enclosure). In addition, Shell reduced field labour due to the turn-key nature of the EPOD which resulted in one day of time savings in the facilities construction schedule and a 50% reduction in installation costs.



OPERATING COST REDUCTION

Shell's EPOD was installed alongside a 41 kW (turned down from 75 kW) Cummins generator setup. This type of generator needs to run continuously and typically has a lifespan of only 20,000 hours, needing to be replaced approximately every three years at a significant cost. Given an estimated power consumption of 36,500 kWh, the previous design represented an average power cost of less than $1.5 per kWh while changing to the EPOD will reduce that cost by close to 80%.



Eliminating the need for a load bank, coupled with the EPOD's partial duty cycle design and solar power input resulted in reduced fuel gas consumption by $9,000 per year. The overall reduction in maintenance, fuel gas, and carbon tax resulted in more than 85% savings in operating expenses compared to the previous design.

DEPLOYMENT AND COMMISSIONING

The EPOD can be lifted with a crane or winched onto a trailer. Two full size EPODs can be shipped on a single tractor trailer with no additional shipping considerations.

For Shell's site, installation included a rig mat foundation for the EPOD and the extension of fuel gas and instrument air to the EPOD package using half inch flexible tubing mounted on pipe stands. Shell had an existing air compressor at site driven by a Cummins natural gas engine, so a new instrument air header did not need to be installed at site prior to the EPOD installation.

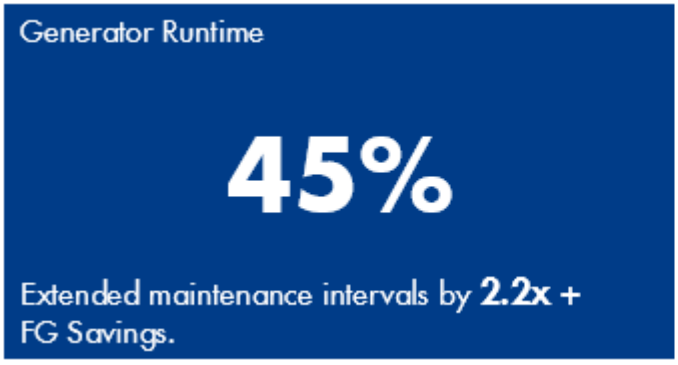
Installed - Front

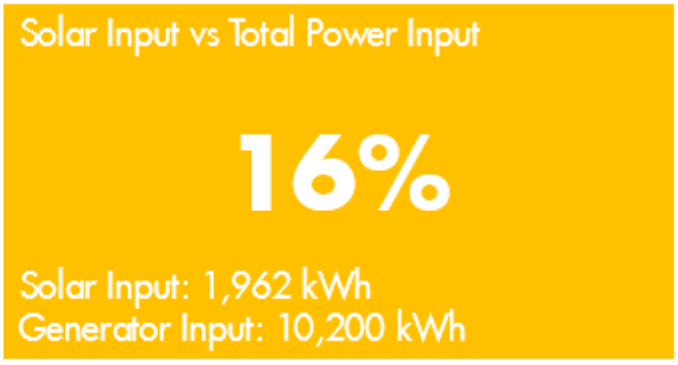
Installed - Rear

Loading

OPERATING PERFORMANCE IMPROVEMENT

Where Shell has previously performed maintenance on their onsite generator every three months, the EPOD generator has a maintenance cycle of eight months in this application. The 45% runtime is high compared to most applications due to a heat trace load. It is common for the EPOD maintenance period to be only once per year.





The Shell unit is equipped with remote monitoring and key operating parameters are sent to a server in five-minute intervals. This allows any issues with the unit to be identified and addressed in real-time. For example, the unit shut down on June 15th, 2020 due to over-current on the solar charger. Westgen responded within one day to have the breaker replaced and increased the wire gauge as a solution. This change has been incorporated into all EPODs produced moving forward.

EMISSIONS REDUCTION

By choosing instrument air instead of instrument gas to actuate pneumatics on this site, Shell is eliminating methane venting. The 6.05 scfm average rate of air supplied to the site equates to more than 1,400 tCO2e/yr of emissions reduction. The EPOD in this application is receiving 16% of power input from solar and the balance from the EPOD generator. The partial duty cycle EPOD generator is emitting an estimated 17 tCO2e/yr which represents a 93% reduction compared to emissions from the base design with Cummins generator. The EPOD, coupled with Shell's zero venting wellpad design, resulted in >35% overall reduction in greenhouse emissions compared to previous gas pneumatic designs.

The EPOD has an integrated high accuracy meter which measures the volume of air being supplied to site to quantify vented gas emissions reduced. For sites in Alberta like this one, this data is used to generate carbon credits under the pneumatics quantification protocol. Carbon price in Alberta is $30 per tonne CO2 equivalent in 2019 and increases to $40 and then $50 per tonne in 2021 and 2022 respectively. Based on measured air rates, the Shell EPOD will generate hundreds of thousands of dollars of carbon credit revenue over the next eight years of crediting.

In December 2020, the Shell team responsible for delivering the EPOD trial were recognized internally with a Shell Low Carbon Ambition award.

RESULTS AND SHELL FEEDBACK

After months of operation, Westgen has received valuable feedback from Shell's operations team.

"The EPOD is a great solution that offers several benefits that are very well aligned with Shell's ambitions," says David Hatch, Shell Facilities Engineer. "When designing the zero venting wellpad catalogue, one of the main issues we encountered was finding an appropriately sized and reliable power generation system. The use of over-sized inventory generators in our existing design required us to waste energy using load banks."

The EPOD ran well with little to no operator intervention required. Shell's maintenance team benefitted from the degree of data collection integrated in the unit. The only issue encountered during the trial was due an overcurrent of the solar charger. This component was upsized, and the design improvement has been made on all future EPODs. The success of this trial has resulted in the adoption of the EPOD in all future wellpads in Shell's Alberta Shales asset.

On the success of the trial, David concludes, "The EPOD was installed safely and seamlessly, it operated consistently and demonstrated reduced maintenance costs. It also significantly reduced our fuel gas consumption further reducing the wellpad design GHG emissions. The compact and modular design of the utility system will allow us to reduce our construction schedule providing direct improvements to HSSE and construction cost."

For more information, please contact info@westgentech.com.