



Flaring in the Bakken

Oil drilling in the Bakken shale formation of North Dakota has often resulted in associated natural gas being flared. In 2014, roughly a third of all natural gas produced in North Dakota was wasted through flaring. State Officials recently passed regulations that require well operators to find viable alternatives to flaring or will risk mandatory production cutbacks.

EFD Program Field Trial

Through RPSEA (Research Partnership to Secure Energy for America) funding, the Environmentally Friendly Drilling team, partnering with Hess, ElectroTherm, and Gulf Coast Green Energy demonstrated a cost effective solution to produce electricity out of flare gas. This field trial of the Power+ Generator/Boiler System was piloted at a producing well site in North Dakota.

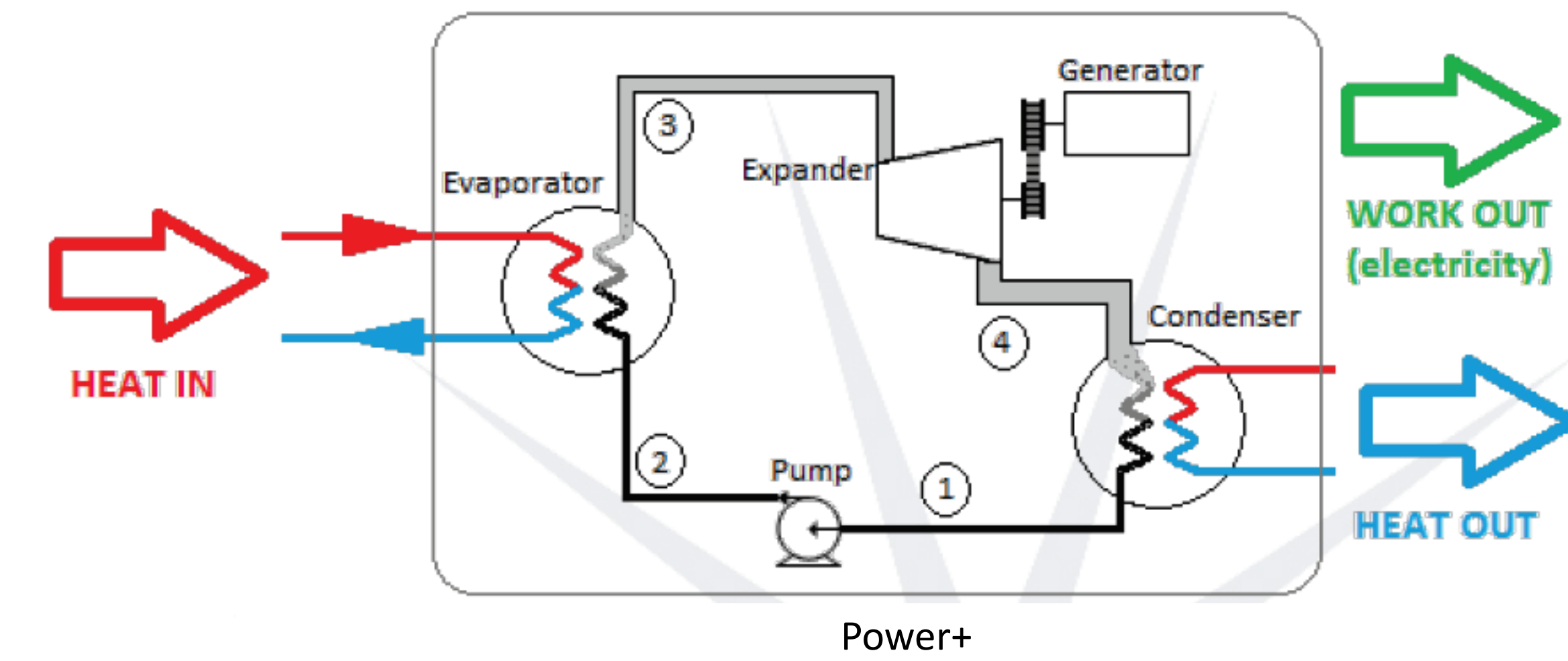
The Environmentally Friendly Drilling Program had 4 main goals for this field trial.

- Demonstrate the ability of the equipment to produce electricity from the flare gas.
- Demonstrate that electricity production does not interfere with well operation.
- Determine environmental impacts of flare gas reduction.
- Reduce Operating Costs

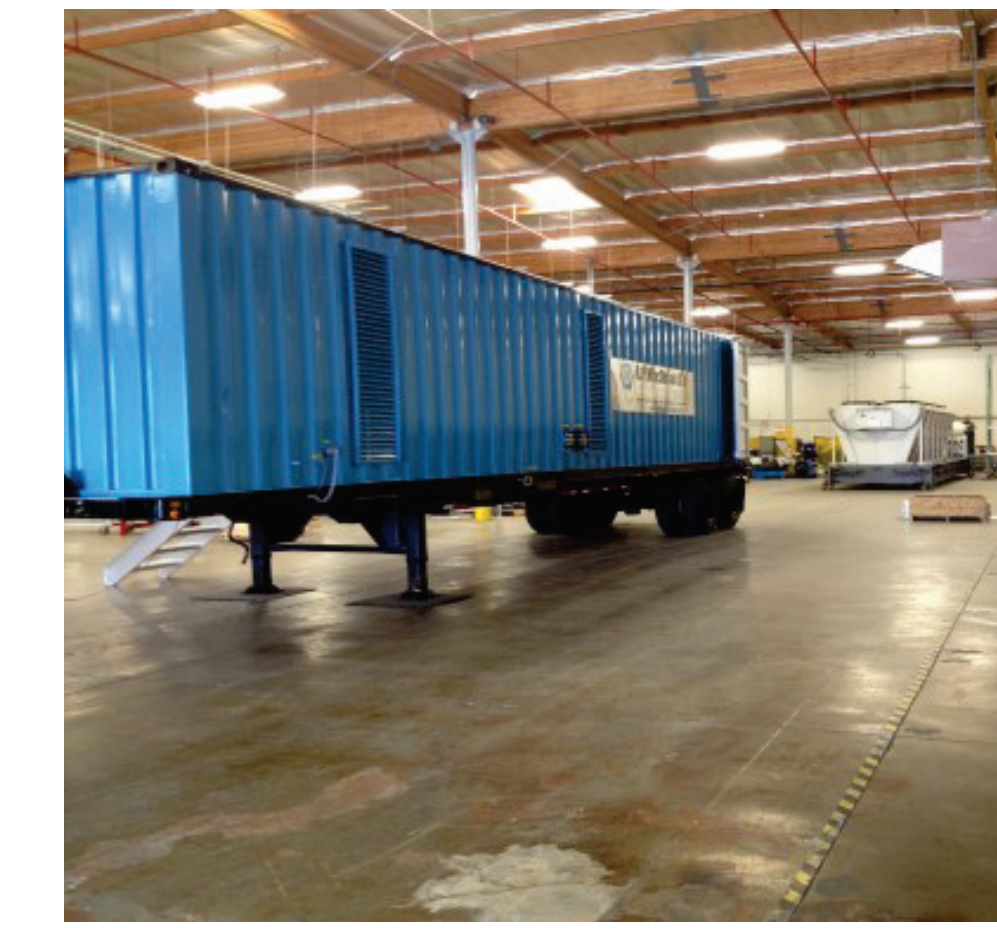


Power+ Generator System

The Power+ Technology utilizes an Organic Rankine Cycle (ORC) System to produce electricity from waste heat. The ORC is a thermodynamic cycle that makes use of an organic fluid to convert low-temperature heat into mechanical work. That work can be converted into electricity. An ORC thermodynamic process transfers the heat using an organic working fluid with a boiling point below that of water.



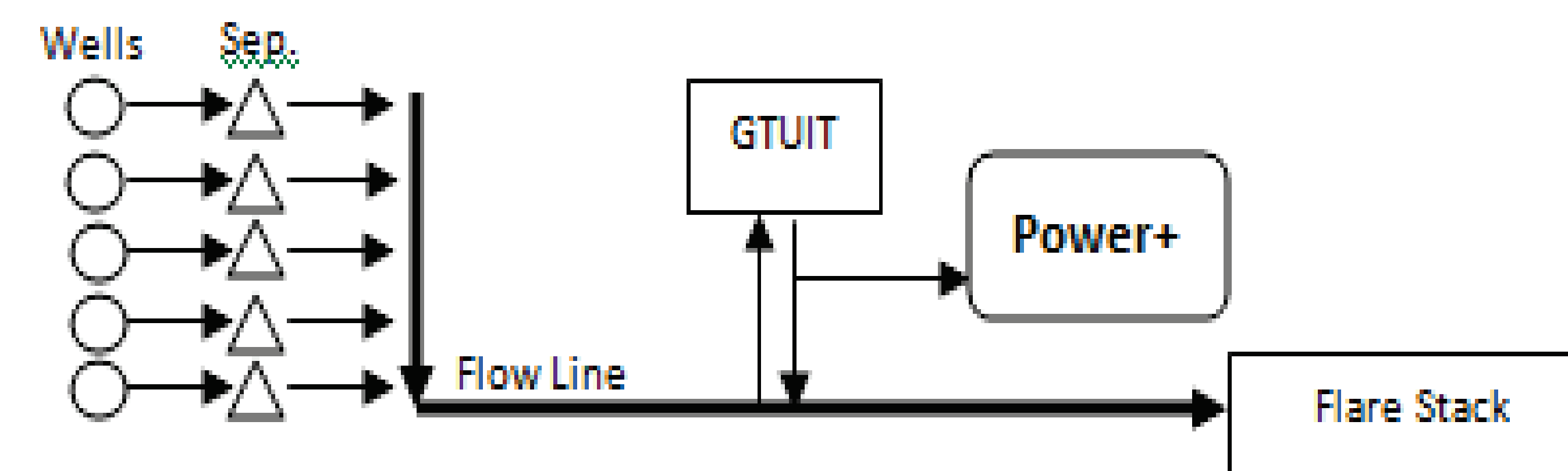
A Power+ 4400 Model and a low NOx hot water boiler were used in this field trial. The flared gas is burnt inside the hot water boiler. The hot water then enters a heat exchanger that excites the working fluid of the Power+ generator, which in turn drives a twin screw expander to create electricity. The expander creates a low pressure working fluid that is condensed to a liquid and pumped into an evaporator to start the cycle again. A water condenser loop carries heat away and air cools it in a radiator.



Trial Set Up

There are 5 free flowing oil and gas wells at the selected site. The liquids are loaded onto tanker trucks after being processed by heater treaters. The wet gas after processing is pushed out to the flare.

GTUIT, a mobile gas treatment company has equipment onsite to treat the produced gas being sent to the flare stack. Their equipment is designed to extract NGLs from the produced gas. The dry gas that comes out of this process is then pushed back to the flare stack. The Power+ System is utilizing this dry gas stream to burn in the boiler. This dry gas stream represents only a small percentage of the total volume sent to the flare stack.



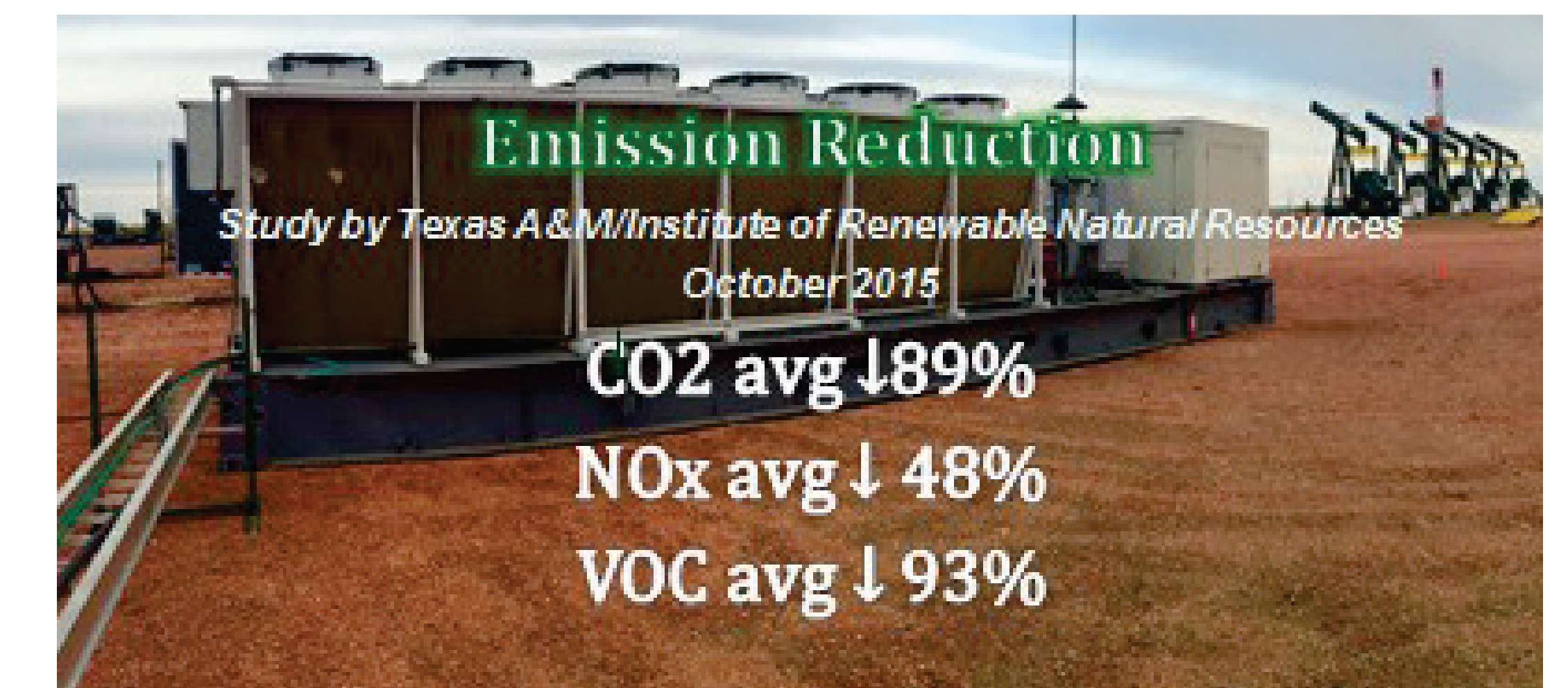
Emissions Study

The Texas A&M Institute of Renewable Natural Resources performed an emissions research study during the field trial. This study compared the emissions from the Power+ Generator with emissions from the open flare. Nox, VOC and CO were the contaminants of concern for the study.

The data collection process consisted of taking readings of raw gas and fuel gas from each of the five heater treaters units (total flare gas available) off the data acquisition system display and readings from the gas meter installed on the Power+ boiler.



The analysis of the data collected from this study concluded that 1.57% of the total produced gas was being sent to the boiler. A reduction of nearly 90% in CO, 52% in NOx, and 93% in VOCs was observed.



Results

The 93 day Field Trial successfully demonstrated the ability to produce onsite power from wasted flare gas using the Power+ System. The field trial resulted in the following

- Over 1,900 hours of runtime (87% up time)
- Cumulative production of 103,486 kWh
- Average Gross kWe of 53.4
- Emissions study showed that the Power+ System would meet the goals of the US EPA and North Dakota Department of Health – Air Quality by reducing emissions.

