

*Low Temperature Waste Heat to Power*



**THIS IS SMART POWER<sup>®</sup>**

# Company Overview



## Distributed Power Generation

- Waste Heat To Power
- Organic Rankine Cycle (ORC)
- 35-110 kWe

## Energy Efficiency + Cooling Offset

- Fuel Free
- Emission Free
- Base Load Power

## Targeting Low Temp Waste Heat Sources

- Stationary Engines
- Boilers / Flares
- Biomass / Process Heat / Geothermal...



Headquarters: Reno, Nevada

# Global Installations



Austria  
Canada  
Croatia\*



\* Pending  
Commissioning



Czech Republic  
France



Germany  
Hungary\*  
Italy



*Japan*

Romania  
Slovakia



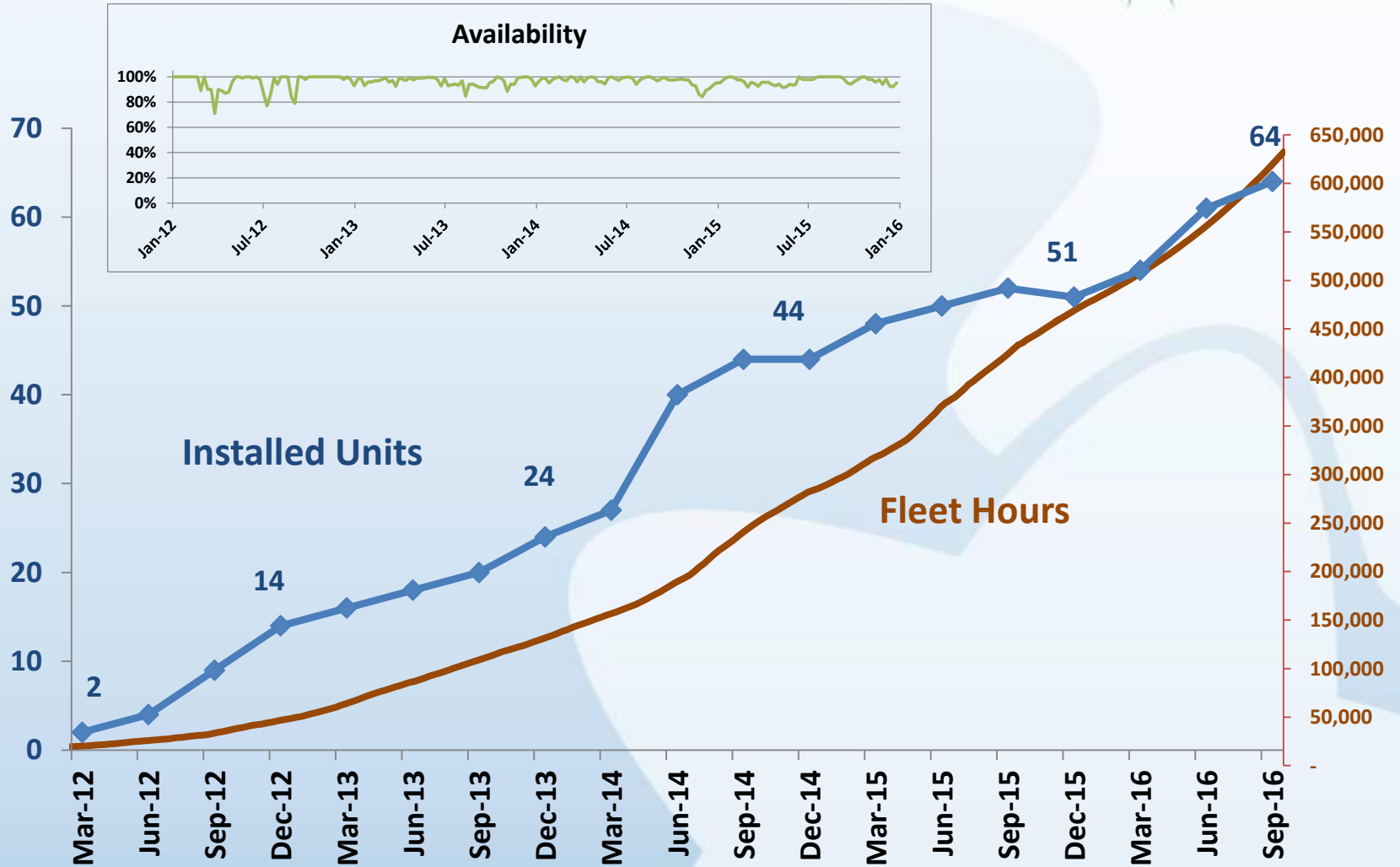
South Korea\*

*United Kingdom*

United States

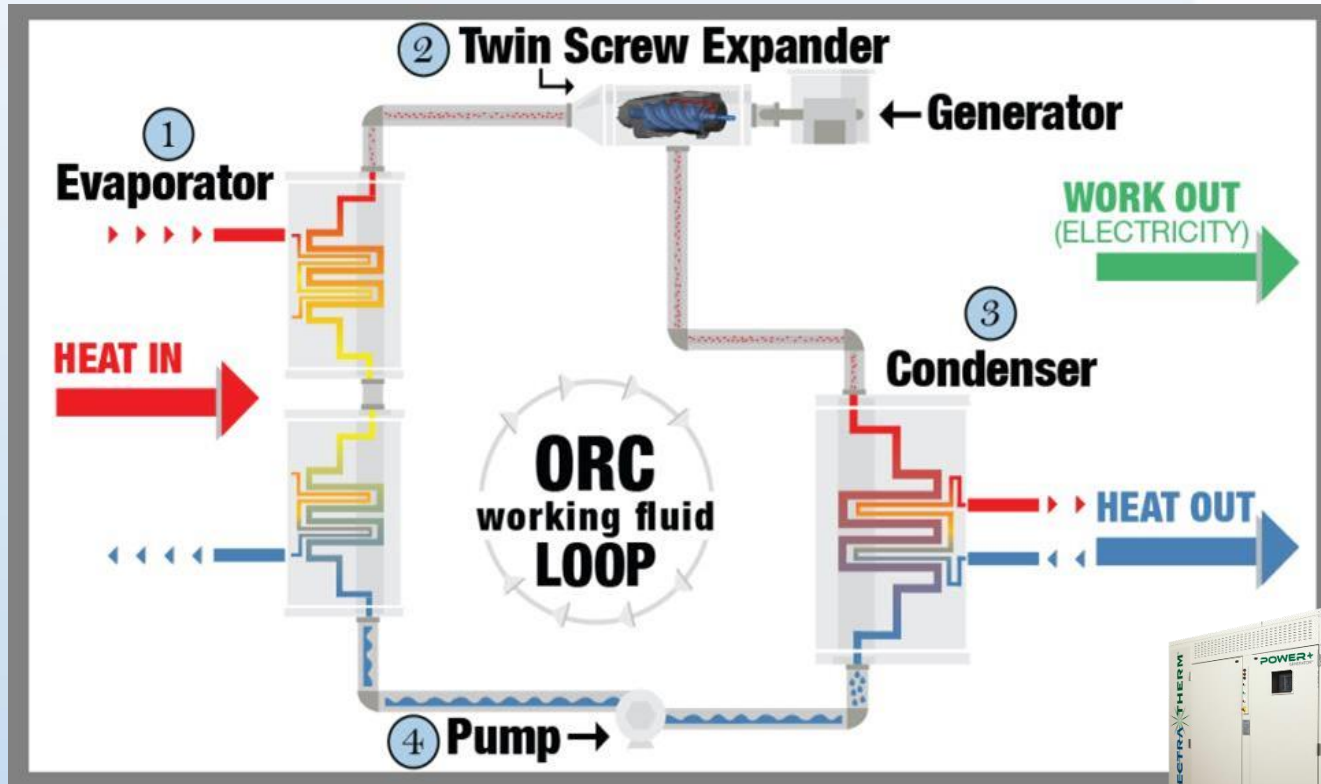


# Market Leading Installed Fleet & Hours



➤ Fleet Exceeds 60 Years Run Time ➤ Greater than 97% Up Time

# Organic Rankine Cycle = Waste Heat to Power



- *Recover heat from hot water flow to boil working fluid*
- *Use pressure of expanded working fluid to spin a drive shaft connected to a generator*

## Model

## Product

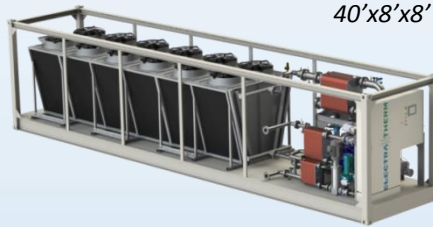
High

Power Output (kWh)

Low

**POWER+ 6500**

*Up to 110kW*



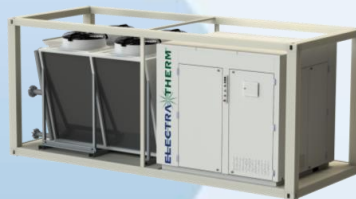
**POWER+ 4400**

*Up to 65kW*



**POWER+ 4200**

*Up to 35kW*



ElectraTherm offers 3 output levels packaged with cooling circuit or standalone



# Low maintenance

- **No oil pump, no oil changes, no gearbox**
- Off the shelf components & simple design
- 20 year design life
  - **YEAR ONE**
    - Estimated Maintenance Costs = \$650
    - Estimated Maintenance Labor = 20 hrs.
  - **YEAR TWO**
    - Estimated Maintenance Costs = \$1,100
    - Estimated Maintenance Labor = 21 hrs.
  - **YEAR THREE (22,000 hrs.)**
    - Estimated Maintenance Costs = \$16,500  
(with core exchange on P+6500)
    - Estimated Maintenance Labor = 36 hrs.

***Minimal estimated maintenance costs, approximately 1-1.5 US cent/kWh***

# Distributed Heat to Power



Prime Power Engine ✓

Biogas-AD Engine ✓

Nat Gas Compression Engine ✓

Biofuel Engine ✓

Landfill Engine ✓

CHP Engine

Waste Water Engine

- Waste heat is generated across a wide array of industrial and commercial applications

- ElectraTherm units are installed on 13 different applications and growing.

## Legend

- = Primary Market Focus
- = Reference Sites

Flare to Power Oil and Gas ✓

Flare to Power WWT ✓

Flare to Power Landfills ✓

Biomass Boilers ✓

Biomass Burners ✓

District Heat ✓

Steam Systems

Nat Gas Boilers

Process Heat ✓

Incinerators ✓

Geothermal ✓

Solar Thermal ✓

**Engines**

**Flares via Boilers**

**Biomass**

**Heating Systems**

**Process**

**Renewable**

Low Temp Waste Heat (170°F – 252°F)



# Flare to Power

*Reduce Flaring, Generate Power*



- ✓ Reduce or eliminate flare
- ✓ Much lower capital and maintenance than other power generation technologies
- ✓ Significantly reduced emissions



## Waste Water Treatment



For WWTPs under pressure to reduce flaring and lower emissions, the **POWER+** pairs with boilers and anaerobic digesters for a cost-effective solution.

## Oil & Gas Wells



In the fall of 2015, ElectraTherm demonstrated a **POWER+** paired with a boiler to reduce flaring on a **Hess** oil well in the Bakken.

# Power & Heat for Oilfield Equipment

*Beneficial use of raw or treated flare gas*



Percent Reduction in Emissions

CO ↓	89%
NO <sub>x</sub> ↓	48%
VOCs ↓	93%

## POWER+ORC vs. Flaring

### The Problem



**Input**  
Flare Gas

Reduce or eliminate flaring by utilizing raw/untreated gas

### The Solution

**POWER+**



The Power+ and Boiler is fueled by gas that would otherwise be flared

**Output**  
Power & Heat

### The Results

Reduce or Eliminate Flare and Lower Emissions

#### Generate Power

- Power for pumpjack
- Power for controls/sensors
- Power for wellhead

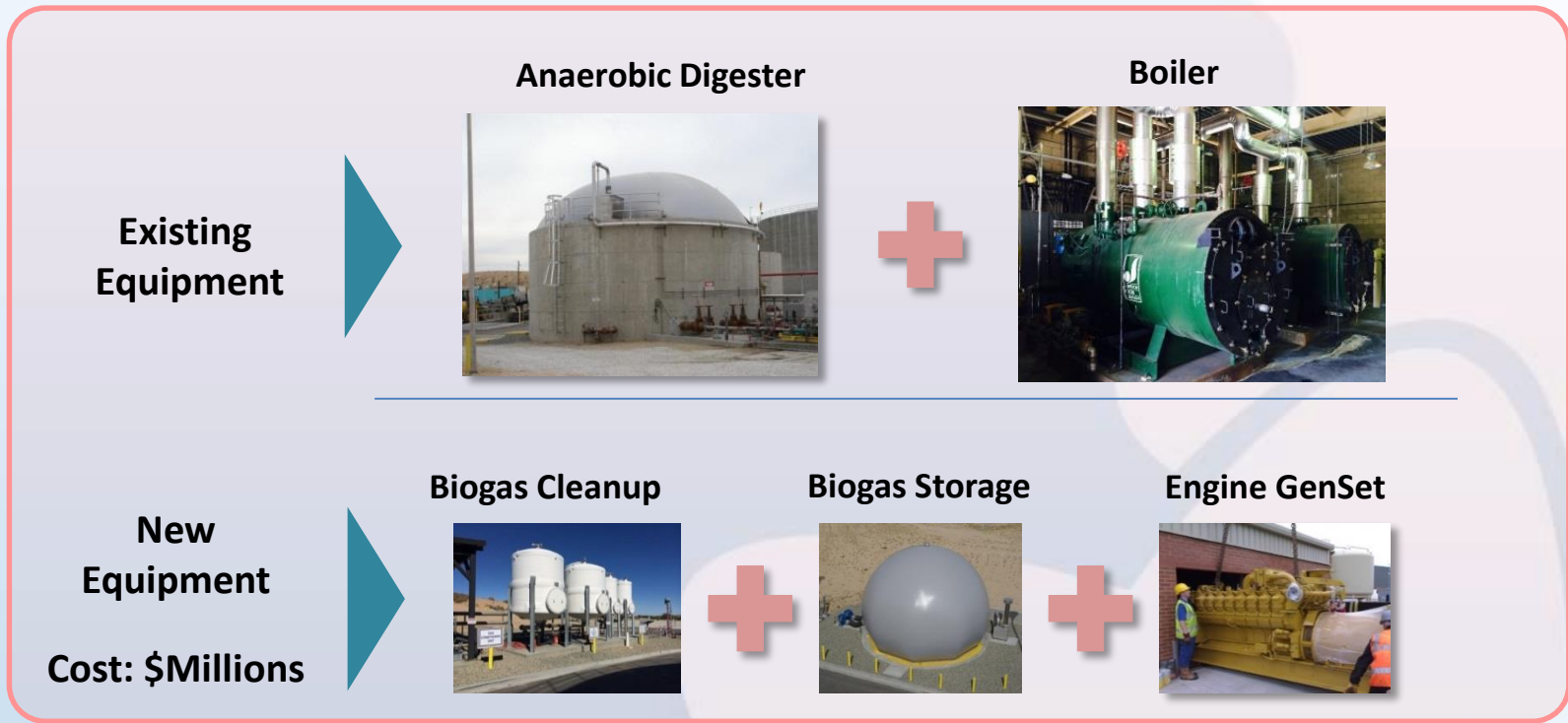
#### Generate Heat

- Heat for heater/treater
- Heat for oil flow

*ElectraTherm completed successful 2000 hour demonstration at a Hess well in the Bakken*

*Watch the video here: <https://youtu.be/4IJEZ1e-PRA>*

## Current Paradigm for Biogas-Fired Combined Heat & Power



### RESULTS: Power production and less flaring but...

- ✗ High capital cost
- ✗ Intensive annual maintenance
- ✗ Typically requires low-value utility PPA
- ✗ Flare remains
- ✗ High emissions
- ✗ Complex installation and large footprint

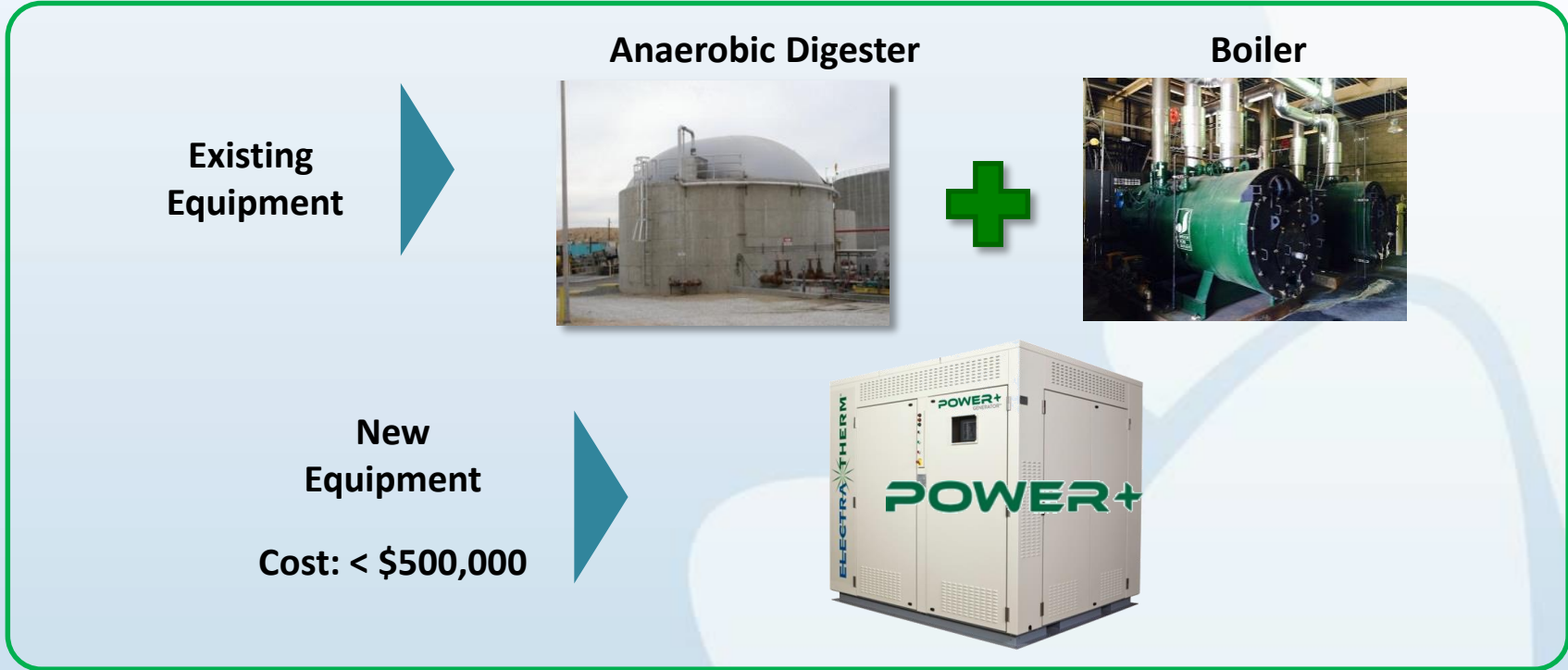
Biogas Flaring





# Waste Water Treatment

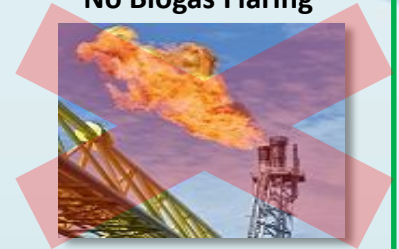
## *The New Paradigm with an ORC*



### RESULTS: Power production with...

- ✓ Much lower capital cost
- ✓ Flare greatly reduced or eliminated
- ✓ Offset onsite power use
- ✓ No gas treatment or storage
- ✓ Greatly reduced maintenance
- ✓ Reduced emissions
- ✓ Simple installation and small footprint

No Biogas Flaring

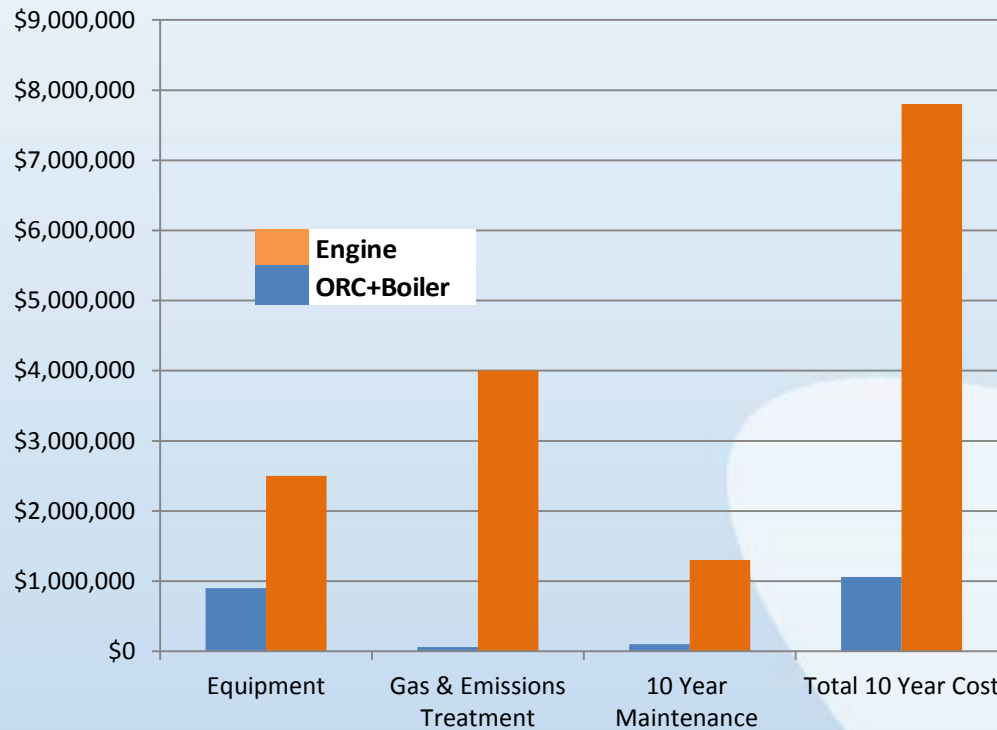


# POWER+ORC vs. Engine Economic Comparison



**80%+ lower lifecycle costs with an ORC compared to an engine**

- Unattended Operation
- Low Maintenance
- Low Emissions



**ORC vs Engine with Equivalent Gas Consumption**



# Technology Comparison

## ORCs for raw flare gas



	<b>POWER+</b> and Boiler	Engine	Micro Turbine	Fuel Cell
Lowest LCOE per kWh	✓			
Lowest O&M	✓			
No Costly Gas Conditioning	✓			
No Costly Gas Storage	✓			
Low Emissions	✓		✓	
Ease of Installation	✓			
Accepts Varying Gas Flows	✓			
Smallest Footprint	✓			
MW Output for Grid Export		✓		✓
kW Output for Local Loads	✓		✓	





***Paul Hughes,  
North American Sales  
Mobile: 559.298.5558  
ElectraTherm, Inc.  
[phughes@electratherm.com](mailto:phughes@electratherm.com)***

***[info@electratherm.com](mailto:info@electratherm.com)  
775.398.4680***