



# Heartland Water Technology

A proven solution  
for beneficial use  
of flare gas for  
evaporation

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CEO

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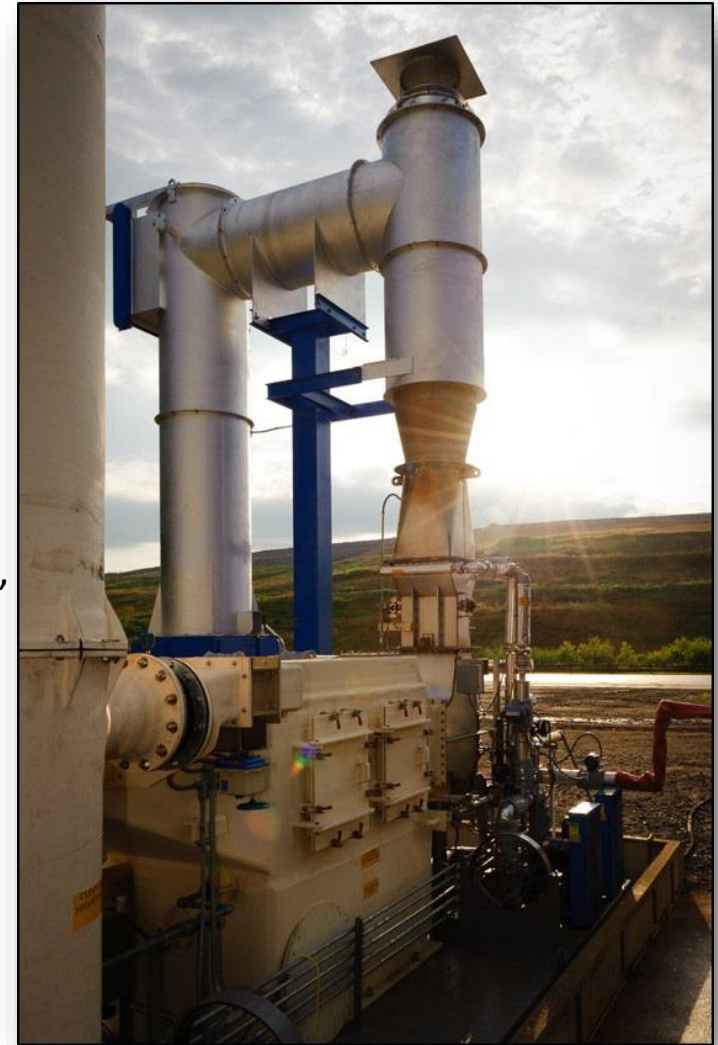
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HEARTLAND  
WATER TECHNOLOGY

# Key Takeaways

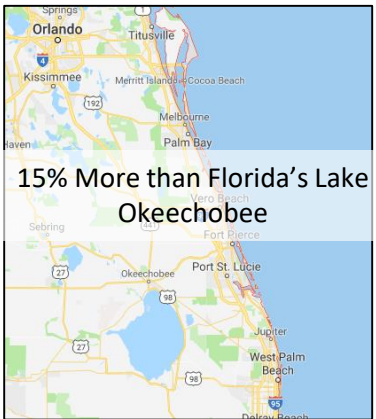
## Heartland's LM-HT Concentrator:

1. A proven solution for treating produced water and frack water to zero liquid discharge with starting solids concentrations up to 300,000 mg/l
2. A proven solution for using flare gas or engine/turbine exhaust as thermal energy for evaporation
3. Has materials of construction that can stand up to the harsh, corrosive nature of produced water brine
4. A proven ability to easily recover water vapor for reuse
5. A rugged, simple, easily re-deployable solution

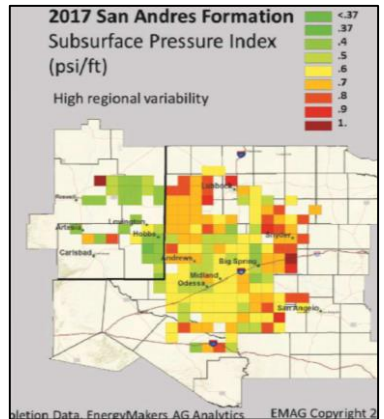


# Produced Water and Flare Gas

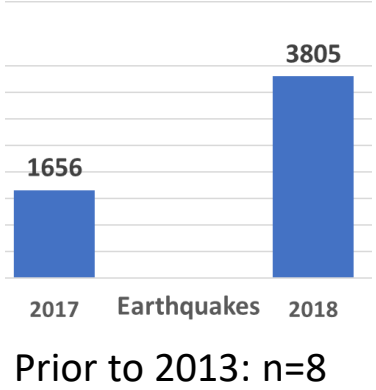
**30B bbl of Excess Produced Water in the Next Decade**



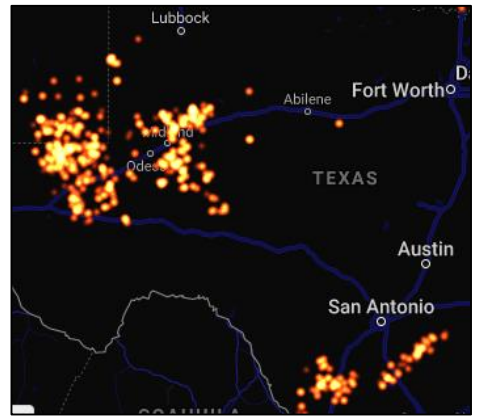
**Disposal Well Pressures are Rising and can not Support this Volume**



**Water Disposal Causing an Increase in Seismic Activity**



**104B mcf Flared in 2018, enough to Evaporate 600,000 bbl/day<sup>2</sup>**



**Water is Not Longer “Just a Cost” to be Managed**

# A Work Horse: Heartland's LM-HT<sup>®</sup> Concentrator<sup>™</sup>

LM-HT: Low Momentum – High Turbulence



- ① Heat Source
- ② Evaporation Zone
- ③ Feed and Recirculation
- ④ Droplet Separator
- ⑤ Sump
- ⑥ Exhaust

<b>Sizes</b>	300 to 4000 bbl/day
<b>Delivery</b>	6-9 months; modular and re-deployable
<b>Flex-Heat</b>	Flare, CoVAP, Hybrid
<b>Lifespan</b>	20+ yrs

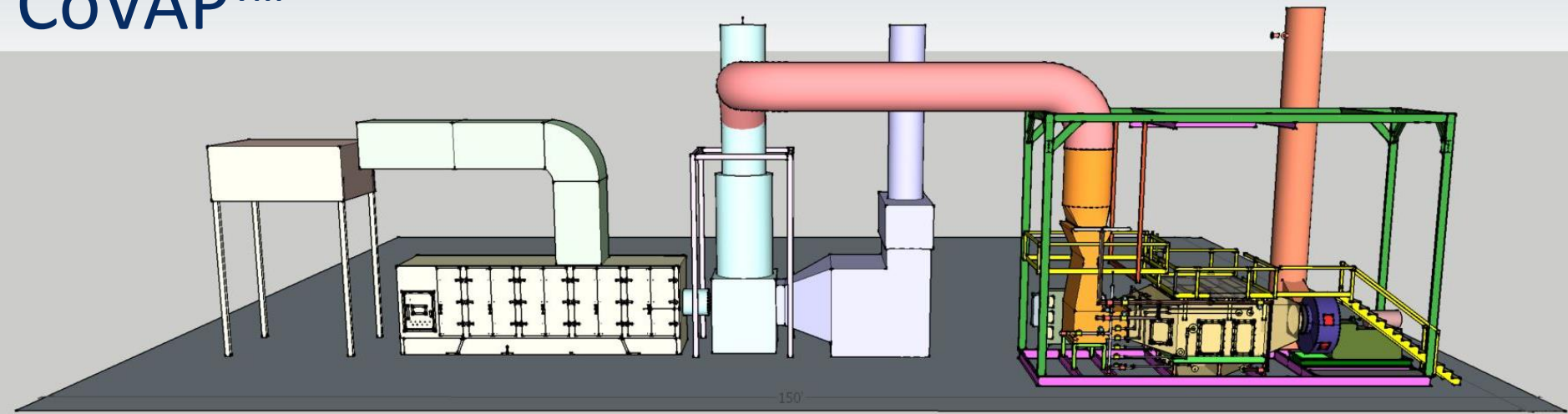


Feed

Brine Concentration

Zero Liquid Discharge





## Cogeneration for Industrial Wastewater Evaporation (CoVAP™)

### A New Category of Cogeneration Application

- Traditional
1. Additional Power Generations
  2. Industrial Steam
  3. Hot Water
  4. Refrigeration

and now...

New

### 5. CoVAP

### Benefits of CoVAP™:

1. Distributed, reliable renewable power
2. Energy efficient use of waste heat
3. Reliable and cost-effective wastewater treatment
4. Easy and reliable integration
5. Simple to retrofit into simple cycle
6. Rapid deployment



## Flare Configuration

Proven solution for using waste gases for thermal energy for evaporation, such as O&G Flare Gas, Biogas, Flue Gas



## Cogeneration (CoVAP) Configuration

Using the exhaust from turbines for the thermal energy for evaporation



# Proven Solution for Frack Water

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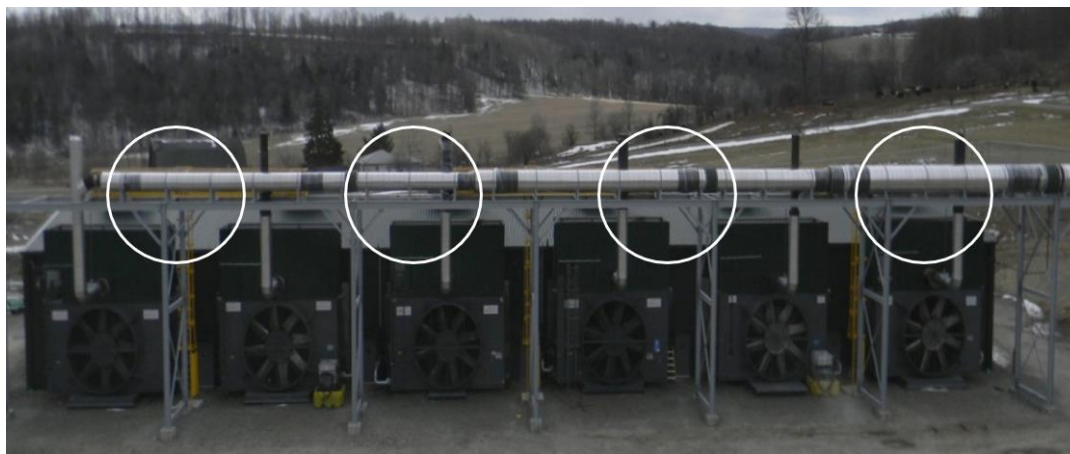
# CoVAP for Produced Water

US Produced Water Using Compressor Station Waste Heat

Waste Heat from Compressor Engines



Waste Heat Collected into a Common Header



ID Fan Draws Heat into the Heartland Concentrator



Water Collected and Re-used with Simple Condensing




Salts Solidified and Stabilized for Disposal



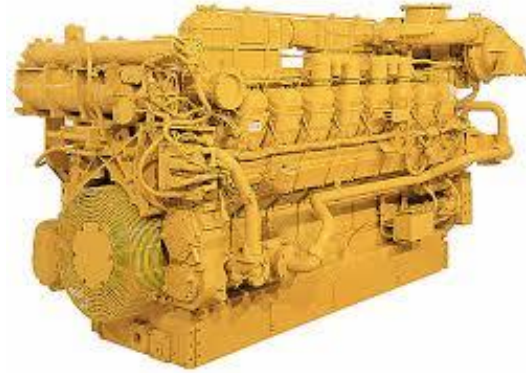


# Ability to 'Dial-in' Residual Concentration

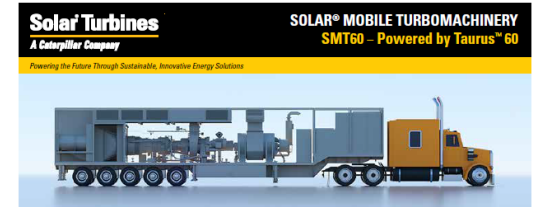
TS (mg/L)	14,000	385,000	471,000	565,000	1,030,000
TDS (mg/L)	14,000	291,000	383,000	460,000	~475,000
TSS (mg/L)	~0	84,000	88,000	105,000	~555,000
Specific Gravity	1.0	1.21	1.26	1.36	1.67
Chlorides	4,000	125,000	165,000	192,000	~200,000
pH	5-6	4-5	2-3	3-4	~3
					



**Solar Turbines**  
A Caterpillar Company



**CATERPILLAR**



**SMT60 - POWERED BY TAURUS 60**

The SMT60 is the answer for short-term generating capacity which is both economical and environmentally friendly. The SMT60 is designed for projects where fast setup and reliable operation are critical. This solution is based on the 7700 hp (5.7 MWe) Taurus 60 gas turbine generator set – a proven industry standard.

**COMPLETE SYSTEMS**

- Complete Mobile Power Plant
- Wide Fuel Composition Flexibility
- Low Emissions SoloNOx™ Fuel System
- Low Profile Design to Minimize Installed Height

**STANDARD FEATURES**

- Low Noise Level
- CSA/NEC Capable (If Required)
- 13.8KV (60 Hz) Generator (50 Hz Can Be Accommodated Upon Request)
- Highway Transportable
- Compact Footprint to Minimize Space
- Auto Leveling
- Quick Set Up, Park, Plug & Play

**OPERATIONAL FEATURES**

- Single Trailer Design
- Complete Electrical Equipment Compartment (EEC) with HVAC
- Utility Grade Switchgear and Protective Relay Module
- Low Voltage Motor Control Center (MCC) for Power Plant
- Low Voltage Step-Down Transformer for SMT60 Auxiliary Loads
- Turbine and Switchgear Battery and Charger
- Neutral Grounding Resistor (NGR)
- Dual Fuel Capability (Natural Gas, CNG, LNG or No. 2 Diesel)
- Range of Control System Options for Remote Operation
- KVAR Control for Excellent Reactive Power Control Capability
- Lockable Low Speed Coupling, Minimizing Alignments
- No Concrete Foundation Required
- Easy to Permit

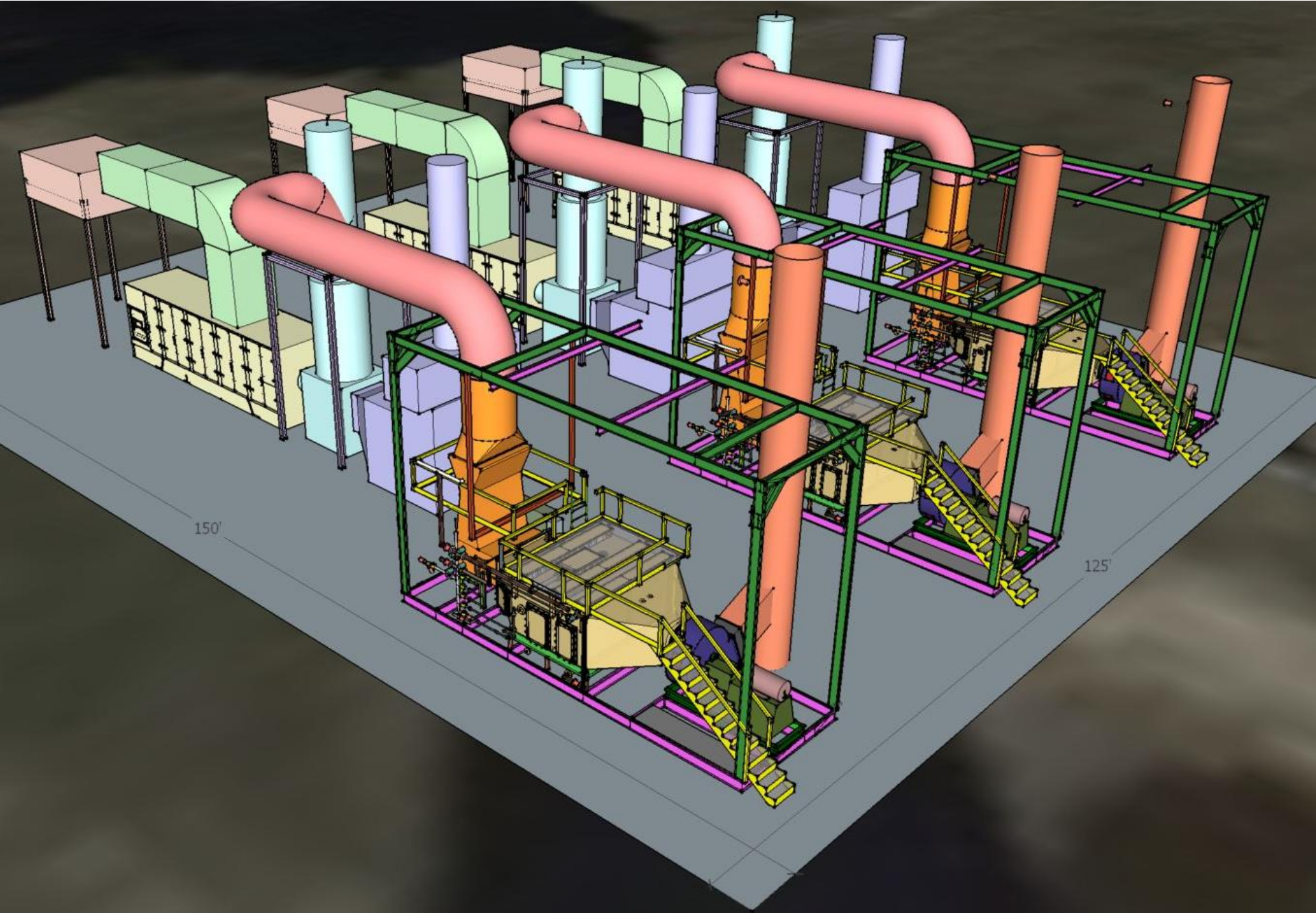
# Proven Integrations

# Solar Turbines

A Caterpillar Company







150'

125'









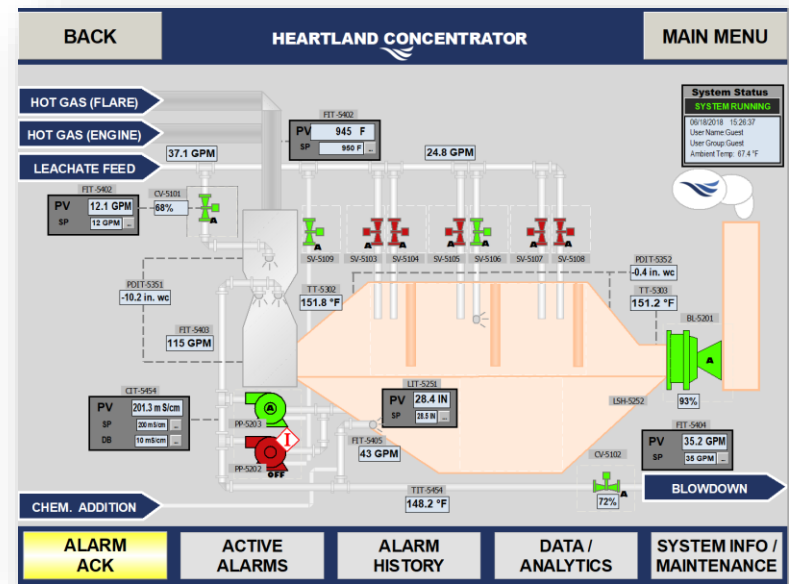
## All Heartland Concentrators are full Skidded and Ready for Rapid Deployment

1. Minimize field installation complexity – often in remote areas
2. Factory-tested to ensure seamless start-up and commissioning
3. Lower total cost-of-delivery

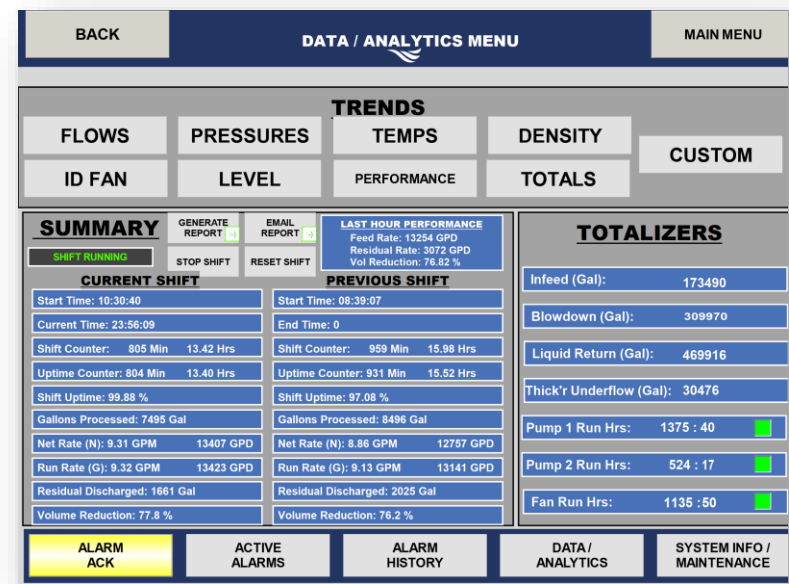


# Remote Operation & Unattended Campaigns

- Heartland has extensive experience in the O&G industry, and understands the need for reliable and rugged operation with a minimal and rotating staff.
- Heartland has included the following features geared toward serviceability and maximizing remote and unattended operation potential:
  - An automated CIP sequence system that periodically flushes the Concentrator system with water and/or a cleaning agent to reduce frequencies of required servicing and cleaning
  - Remote control and operation via an integrated 4G LTE data package coupled with VPN service, that can be securely accessed remotely via laptops, Android devices, or iOS devices
  - Data logging and trending of key process parameters with automatically generated and emailed daily reports
  - Operator user access and security levels, including logging of critical process changes by location, personnel, and time
  - Remote alarm call-out and/or email notification for system warnings, notifications, and alarmed shutdowns.



Heartland's HMI, driven by an Allen Bradley Compact Logix PLC, offers an intuitive graphics-based process flow and operator interaction.



Heartland's robust data and analytics package trends all critical process parameters, tracks processing throughputs and system performance to help operators ensure optimal performance and alert them to any potential forthcoming issues.

# Heartland's 25 BPD Pilot Unit



# 300 BPD Demonstration Unit

- Capacity: 300 BPD
- Heat Source: NG / Propane Burner
- Electrical / Burner Approved for use Canada (CSA Group, Enefen)
- 2-3 day set-up time
- Remote monitoring





# Heartland Concentrator™

## Zero Liquid Discharge

- Single unit operation
- Future proof (POTW, Regulations)

## Flex-Heat Solution

- Enable/Leverage LFG-to-Energy
- Access CHP Incentives
- Hybrid Configuration maximizes electricity sales; gas utilization

## LM-HT® Process

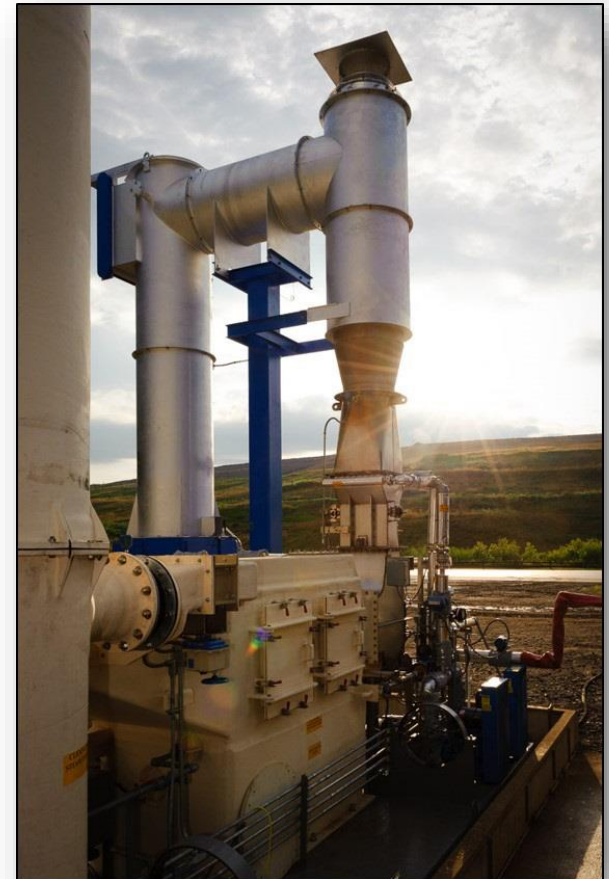
- No Heat Exchangers or Membrane
- Low risk of corrosion or fouling
- Ability to handle widest range of waste streams, including chlorides, suspended solids

## Highly reliable

- Only two moving parts
- No water chemistry experience req'd

## Low Cost Materials of Construction

- Low cost
- Highly corrosion resistant
- Long-lived (20+ years)

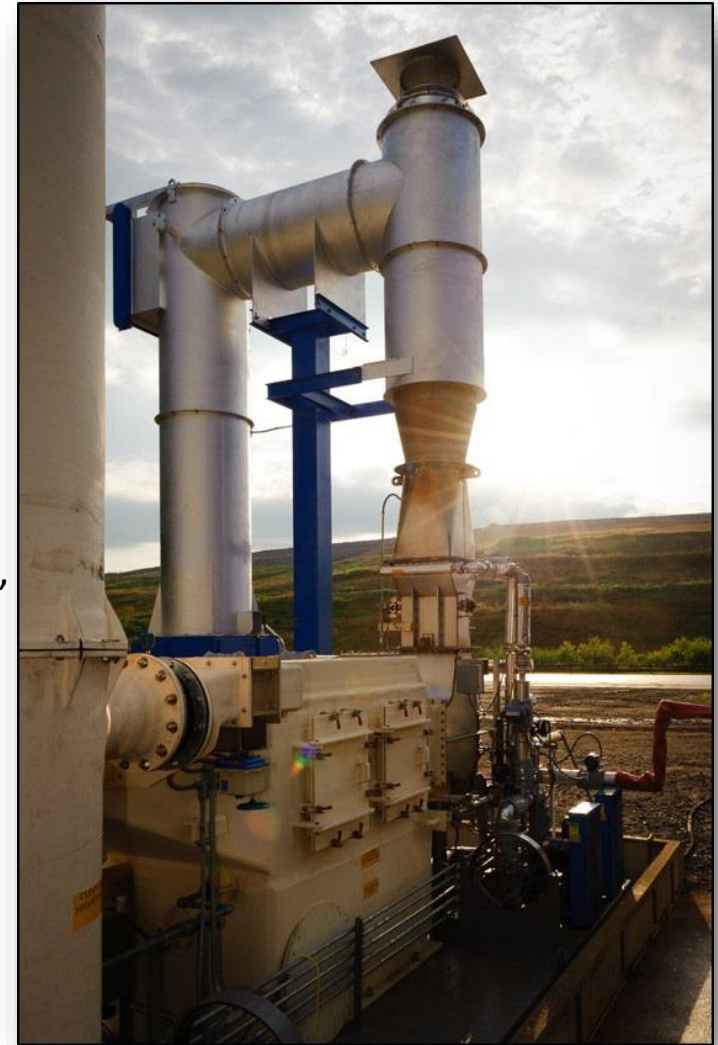


**Safe, Simple, Rugged, Reliable and Cost Effective  
Built by Operators for Operators**

# Key Takeaways

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