NEXT SHALE 2017

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Navigating the Future of Unconventional Resources

Reliable and Clean C&I for Remote O&G Sites

Airworks Compressors
Alphabet Energy

Agenda

1. Conventional Canadian O&G control and instrumentation (C&I)
2. Challenges with conventional C&I
3. Emissions targets in Alberta
4. Challenges with existing options for improving C&I and emissions in Alberta
5. Advantages of Airworks and Alphabet solution

Conventional C&I comprised of primarily gas pneumatics

- ~95% of well pads & batteries use pneumatics

<u>Typical pneumatic loads at well pads</u>

1. Pneumatic Pumps
2. Level controllers
3. Wellhead choke controller
4. Electro-pneumatic transducer

<u>Typical electrical loads at well pads</u>

1. SCADA
2. Telecom

A typical well emits ~299 tCO_2e/year from pneumatics

Conventional C&I is costly to both operators and environment

	Assessment	Explanation
Reliability	Low	• Prone to freeze up, results in lost production
Cost	High	• $21k/yr in fuel gas • $40k/yr in maint. & production loss
Safety	Medium	• Methane present, which lowers operator safety
Environment	Low	• 1,200 tpy $CO2_e$ emissions (4 well pad) • $81k/yr of carbon value in Alberta

Increasing pressure in Alberta to reduce methane emissions

1. The climate change impact from methane is 25x higher than CO_2[1]
2. In Alberta this results in 31.4 megatonnes of oil & gas related methane emissions (2014) [2]
3. Cutting methane emissions is the most cost effective way of reducing GHG emissions[3]
4. Alberta aims to reduce methane emissions from oil & gas by 14.13 megatonnes annually, or 45% by 2030[4]

1,2,3,4 - Alberta Govt., https://www.alberta.ca/climate-methane-emissions.aspx

Today's alternatives are not ideal replacements for gas pneumatics

	Diesel + Inst. Air	Solar PV + Inst. Air	Electrical grid + Inst. Air	Aurora + PGC
Reliability	Low	• Solar alternatives are unreliable with short days of long Canadian winters.	High	High
Cost	High	• Conversion from existing pneumatic to alternatives costly and labour intensive.	High	Lowest total cost of ownership
Emissions	Medium	Low	Low	Low
Service	High	Medium	Low	Low

Background on AIRWORKS COMPRESSORS CORP

- Edmonton based company holds several patents & patents pending
  - Established Airtek Systems Inc. in 1996 to specialize in service and sales for mobile compressed air industry
  - Airworks Compressors Corp established in 2007 to commercialize innovative "anti-idle" solution for mobile compressed; now industry leader.
  - After success in service vehicles market, Airworks developed the Aurora – the 1st off-grid, DC power rotary screw air compressor system
- Airworks is the recipient of several prestigious awards including NAIT's innovation award, Alberta Small Business of the Year, Alberta Fast Grow 50 twice and Canada Profit 500.
- Off grid instrument air units currently deployed in Wyoming at well sites on sensitive BLM lands.

<u>Customers</u>

Suncor
Syncrude
Midwest Pipelines
Ultra Petroleum
Encana
Northrup Grumann
City of Calgary
Golden Gate Bridge

Background on Alphabet

Customers and Investors

Schlumberger
BLACKBRUSH OIL & GAS, L.P.
SINOPEC
KASAB International
encana
JONAH ENERGY LLC
GM
TPG

1st company to deliver commercial, industrial-scale thermoelectric generators for waste-heat recovery

30+ patents issued, licensed, or filed

$50M Raised from investors including Schlumberger, General Motors, TPG, Ares, Claremont Creek, CalCEF, Osceola Capital Management, et.al.

Recent Awards

2018 EAGLE FORD Excellence Awards
Presented by steer

IHS ENERGY CERAWEEK
2015 Energy Innovation Pioneer

GLOBAL PETROLEUM SHOW AWARDS 2015

WORLD ECONOMIC FORUM
Technology Pioneer 2014

TechConnect
National Innovation Award

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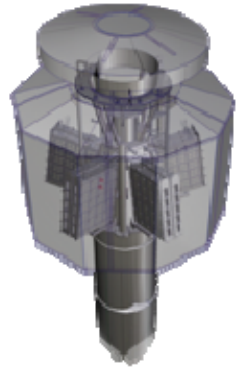
Airworks + Alphabet C&I Solution



Airworks Aurora Air Compressor (10 or 60 scfm at 100-150 psig)

The PGC™ is a turnkey package that includes:

1. **PowerModule™-based thermoelectric power generator**
2. **Low emission combustor (99.9% destruction efficiency)**
3. **Radiator**
4. **Power electronics to deliver AC power to user**
5. **Blower**
6. **Transportable skid**

Airworks + Alphabet C&I Solution

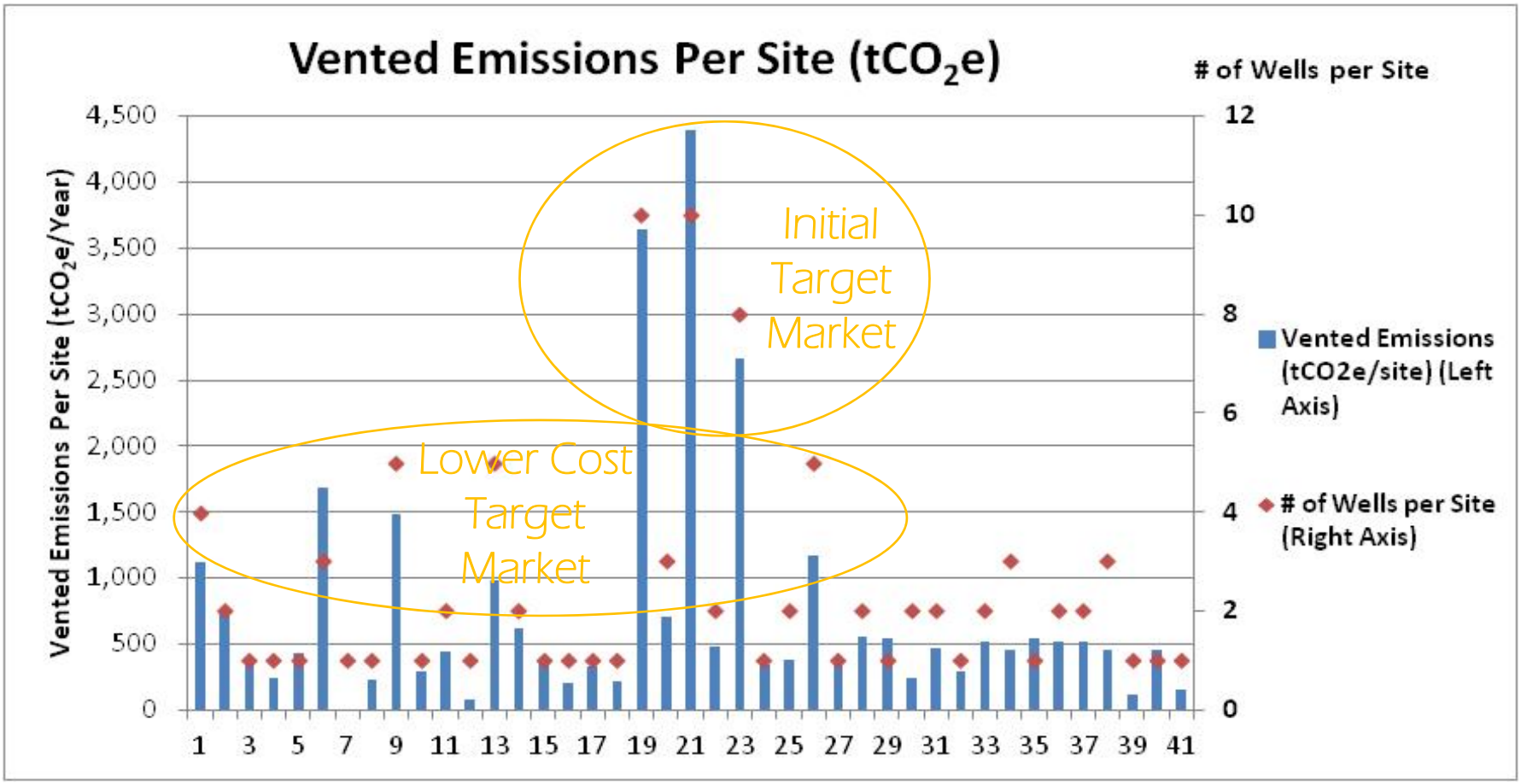
Each PGC™ will reduce GHGs by ~700 to 2,600 tCO_2e/yr

~80% reduction vs. baseline

System Size	GHG reduction per PGC™ Unit in tCO_2e/Year		% Reduction
1kW	Baseline Emissions	897	**79%**
	Project Emissions	192	
	Net GHG Reductions	**705**	
2.5kW	Baseline Emissions	3,329	**78%**
	Project Emissions	749	
	Net GHG Reductions	**2,580**	

Conservative market rollout of 800 units will achieve 4 million tCO_2e reductions

Airworks + Alphabet path to market



Sample deployments