



**PIONEER**  
ENERGY

***Turning Flares into Resources***

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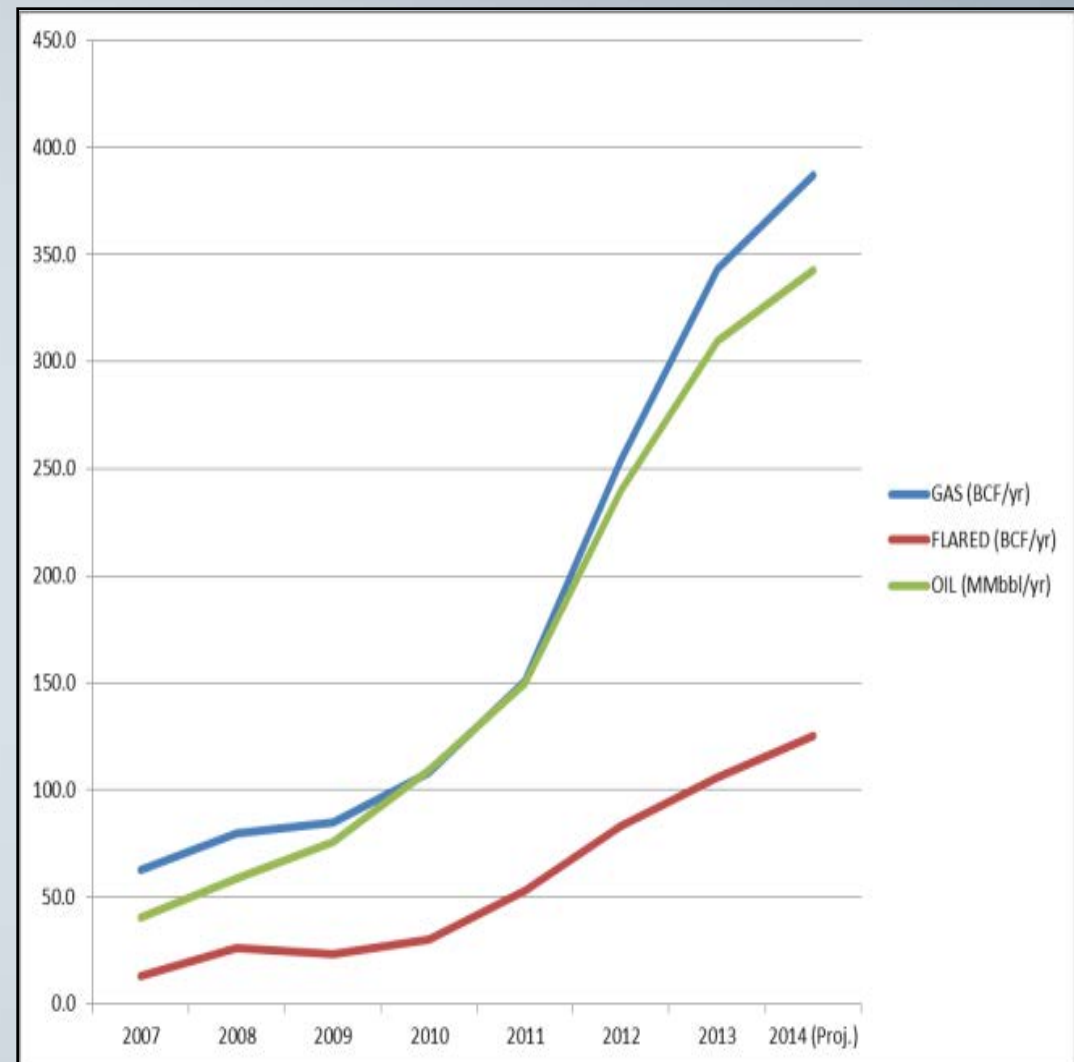
# Problem

- Oil wells produce associated gas, a mixture of methane and natural gas liquids (NGLs). Mixed together, they are unusable.
- Pipelines can transport this gas to large processing facilities where it can be separated. However, many wells are not connected to pipelines. Terrain and right of way issues may leave wells stranded, or exploration may simply outpace pipeline build out.
- Flaring produces pollution and wastes valuable resources.



# Flaring in the US

- 125 BCF / year of associated gas is flared in North Dakota alone.
- Flaring has doubled since 2012
- Over 7,000 wells flare some amount of gas
- Over 500 wells flare over 200,000 CF / day



# Flaring in the US: Heightened Focus

- Flaring is under scrutiny resulting in tightened regulations
  - North Dakota passed legislation July 2014 reducing allowable flaring.
  - Greater oversight is being imposed in CO, TX, and WY.
  - EPA could be much more severe.
- Royalties and taxes are expected on produced hydrocarbons
  - Flared gas is a resource that could generate income and taxes.
  - Lawsuits are outstanding by mineral rights owners to collect lost income.
- Public outcry is increasing over flaring – threatening to shut wells down.





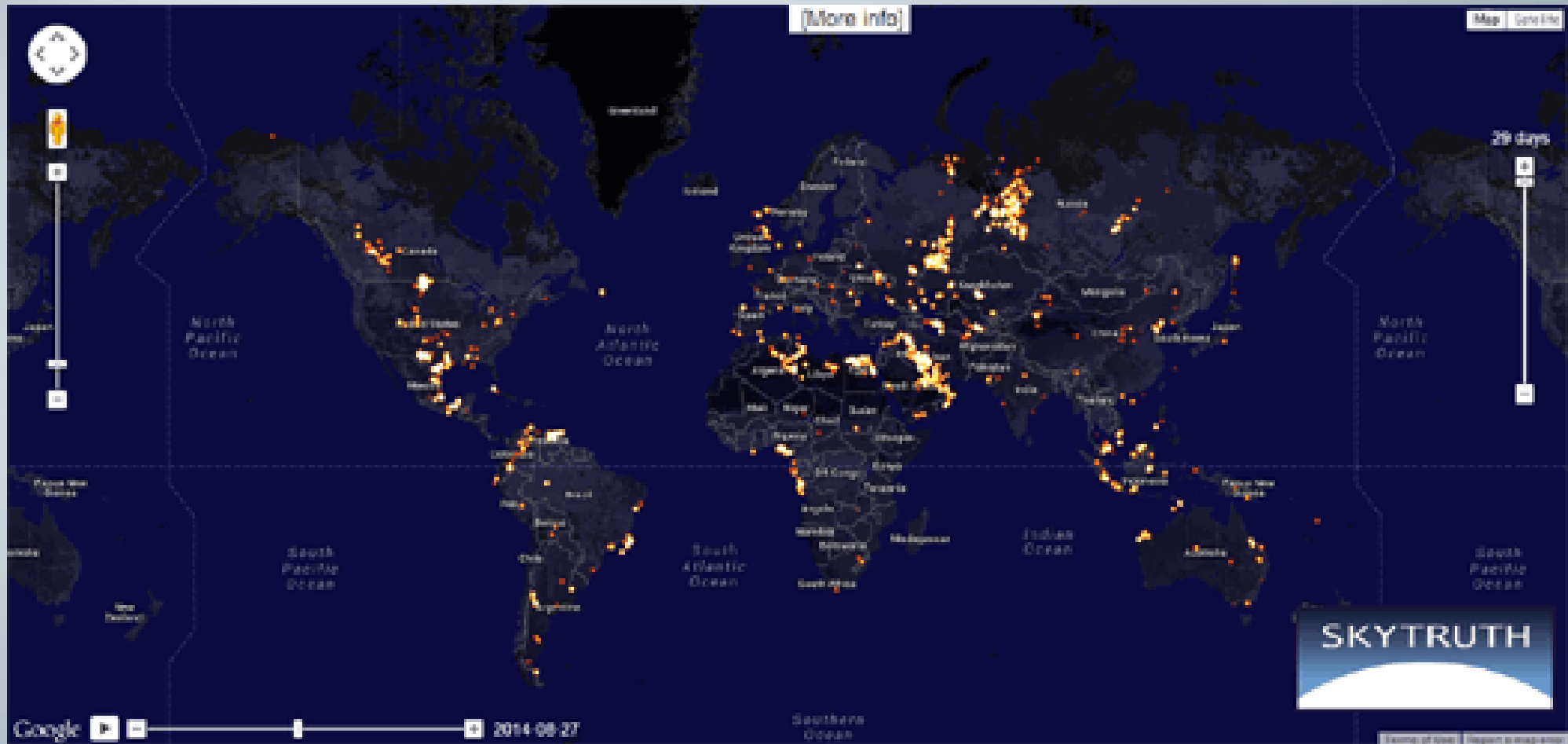
**Bakken  
Oil Fields**

**Minneapolis**

**Chicago**

# World-Wide Flaring

- 5,400 billion cubic feet of associated gas is flared worldwide per year.



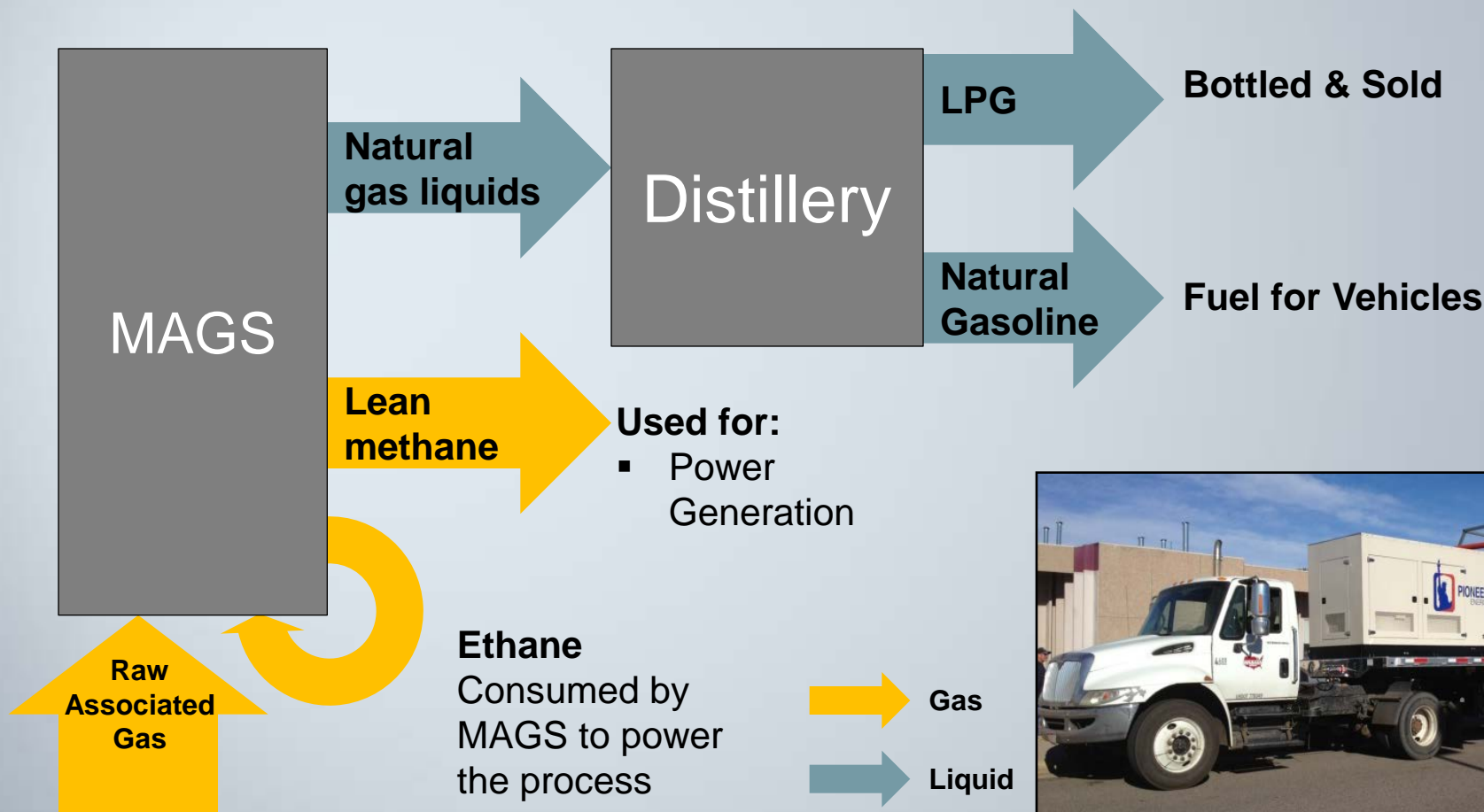


# Solution

- Pioneer Energy's MAGS system – a field mobile gas processing plant. Each MAGS can process up to 350 MCF/day of raw associated gas.
- MAGS separates gas into 3 streams:
  - Methane (dry natural gas): Very high quality output. Perfect for power generation.
  - Ethane: This is a low value component, so MAGS consumes it in order to run the process, leaving the other outputs higher value.
  - NGLs (Natural Gas Liquids): Can be trucked to market directly, or can be further processed by Pioneer Energy's Distillery to produce:
    - LPG: A high value mixture of propane and butane tailored to meet requirements for sale to Indonesia's market.
    - Natural Gasoline: Heavier hydrocarbons (C<sub>5</sub>+) that can be used as fuel for vehicles.

# Mobile Alkane Gas Separator (MAGS)

- Compression, Dehydration, Refrigeration, Separation.
- Cold (-80 °C) process results in extremely high liquids capture efficiency.
- Lean methane is very high quality. Perfect for generators, CNG or LNG.
- Ethane rejected and used to power the process.

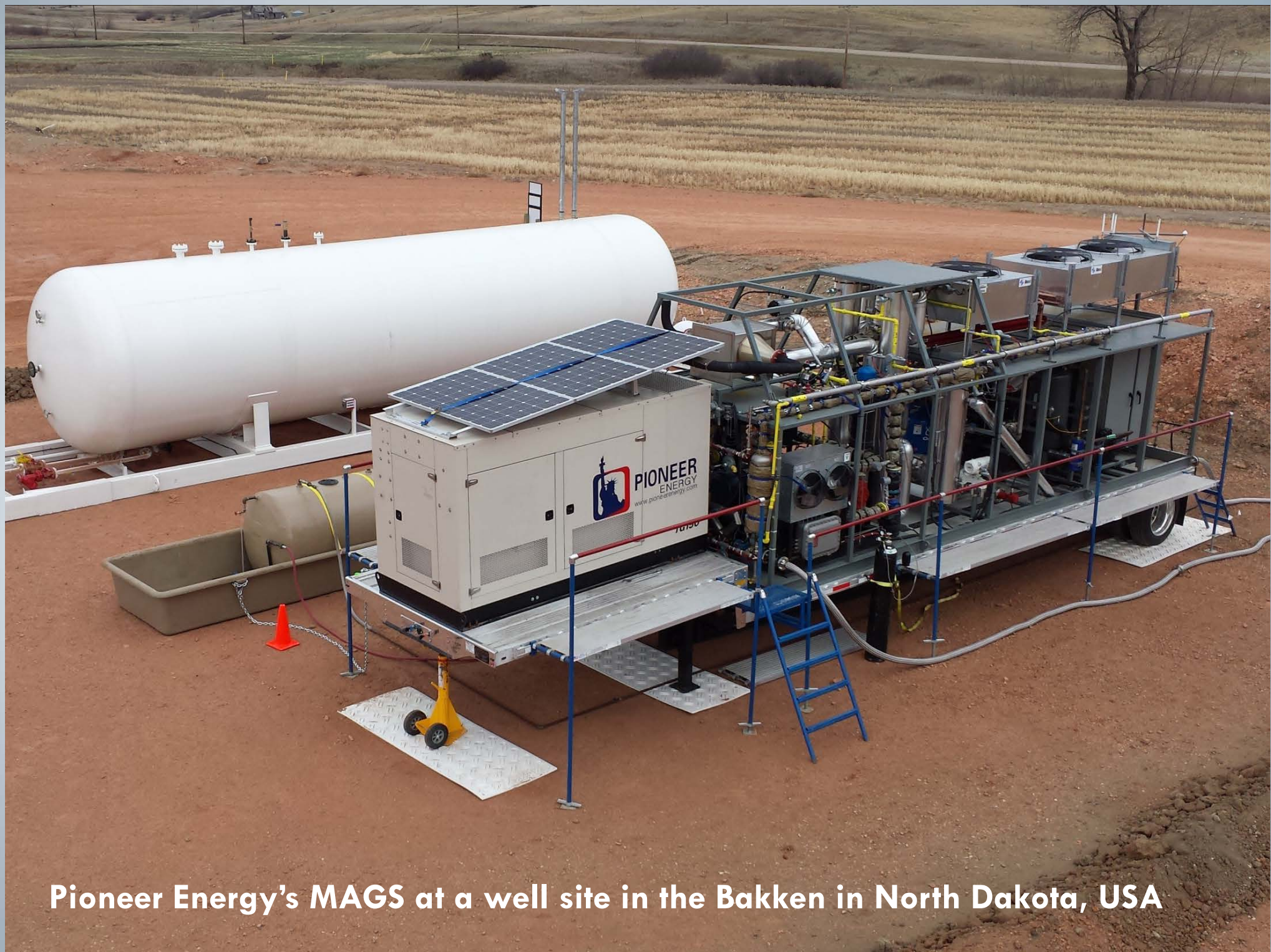




# MAGS Performance

Raw Gas Input	1700	1600	1500	1400	1300	Btu/ft3
Flow Rate	1000	1000	1000	1000	1000	Mcf/day
Cummins fuel quality MN	45	47	49	53	58	
Methane	51%	58%	65%	72%	79%	vol%
Ethane	25%	22%	18%	14%	11%	
Propane	13%	11%	8.9%	7.1%	5.3%	
Butanes+	11%	9.7%	8.0%	6.4%	4.8%	
Lean Methane Output	1130	1117	1105	1090	1075	Btu/ft3
Diesel fuel replacement	4913	5370	5800	6100	6400	gal/day
Cummins fuel quality MN	70	73	76	81	86	
Shaft power est.	2783	3037	3267	3433	3600	hp
Electrical power est.	1983	2164	2328	2446	2565	kW
Y-grade NGL Output (0% methane, ethane rejected to 10% by volume)						
Daily capture rate	7087	6000	4933	3900	2867	gal/day
Composition						
Methane	0%	0%	0%	0%	0%	
Ethane	10%	10%	10%	10%	10%	
Propane	43%	42%	42%	42%	42%	
Butanes+	47%	48%	48%	48%	48%	
Vapor Pressure at 100 °F (37.8°C): 154 psia (all cases)						





**Pioneer Energy's MAGS at a well site in the Bakken in North Dakota, USA**

# Conclusion

- The recent revolution in oil drilling & fracking has unleashed a massive boom, and with it, a huge increase in the amount of liquids-rich associated gas related and flared world-wide.
- These circumstances have created an enormous and immediate need for a field-deployable technology that can capture this flare gas and turn it from an environmental catastrophe into a vast resource.
- Pioneer Energy has that technology, and is actively deploying it.
- Let's turn our flares into resources!