



QUESTOR TECHNOLOGY INC.

Heat to Power

*Safely, Economically
and Efficiently*

Global Methane Initiative

Krakow, Poland

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Coal Methane Challenges

- Quality and composition of the methane gas
- Understanding of the quantity of gases
- Variable flow rates and composition over the life of the project
- Availability of end use options
- Economics of mitigation

Methane Sources

- CBM – Coal Bed Methane
- CMM – Coal Mine Methane
- AMM – Abandoned Mine Methane
- VAM – Ventilated Air Methane

VAM gas typically has a low methane content (< 1%)

Greenhouse Gas Emissions

- The Global Warming Potential (GWP) of methane is 21 times higher than that of CO₂ and therefore inefficient combustion increases the greenhouse gases emitted.
- For example: 19 mscf/d of waste methane gas generates the following daily CO₂ emissions :

	<u>T/d</u>	<u>T/yr</u>
■ Vented	7.6	2,775
■ 65% combustion efficiency	3.3	1,205
■ 80% combustion efficiency	2.3	840
■ 100% combustion efficiency	1.0	365

99.99% Efficient combustion converts the methane to CO₂ and H₂O

Combustion of Methane



Methane + Oxygen = heat + Carbon Dioxide + Water

99.99% efficiency requires the right mixture of fuel and air

Poor combustion results in the creation of:

- ✓ CH₄, CO, particulates
- ✓ Black carbon
- ✓ Over 250 compounds
- ✓ Volatile organic hydrocarbons or VOC's – benzene
- ✓ Sulfur compounds - H₂S, carbon disulfides, mercaptans

Negative impact on air quality, human health and climate

Flaring Concerns

- **Difficult to measure efficiency and it varies significantly**
- **Crosswinds allow gases to escape unburned**
- **Difficulty burning rich gases often producing soot deposits and black smoke (BTEX, VOC, PAH)**
- **Entrained liquid droplets decrease combustion efficiency**
- **Poor performance for low heat content gases**
- **Visible flame and poor air quality**

Efficient Combustion

Welltesting/Workover



Italy

Gas processing



Crossfield gas plant

Acid gas



Clayhurst, Alberta

Coal Mine

- Venting 5 MMscf/d of methane
- 640,000 tonnes of CO₂e eliminated yearly by incinerating at 99.99%
- Carbon credits valued at \$15/tonne of CO₂e
- Annual gross revenue = \$ 9.6 million
- Opportunity to utilize the heat

Wasted Energy 9,000 Trillion Btu/yr



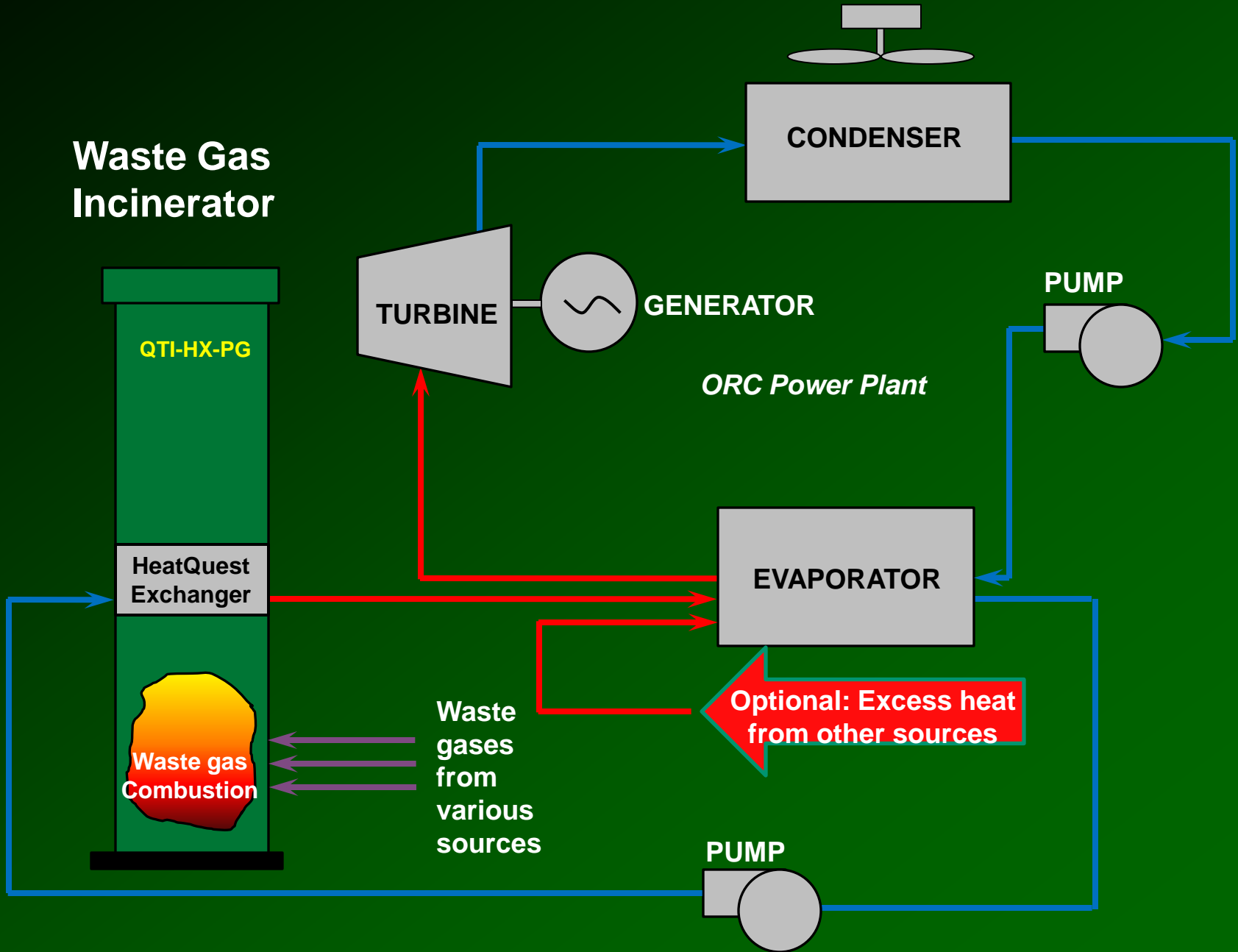
DRYING CASSAVA PASTE by a gas flare, a market woman risks her life to earn a living in Afesere, Nigeria. If a sudden flame surge doesn't harm her, airborne toxics eventually might—risks that prompted activists to demand an end to gas flaring, promised by 2008.

ED KAHN

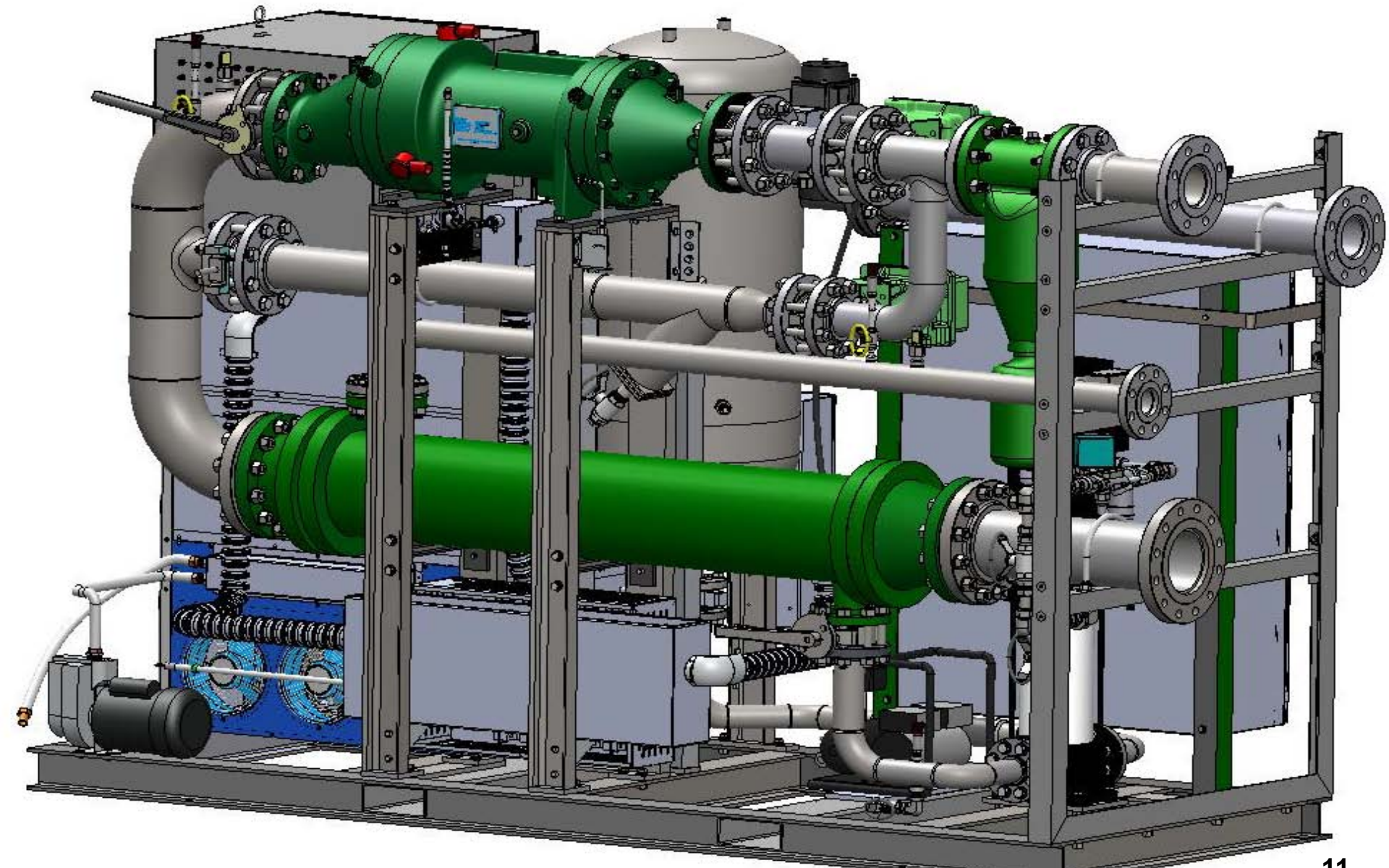
Options for the Energy

- Electricity generation
- Pipeline distribution
- On site heating
- Heating of mine ventilation air
- Town gas
- Coal drying
- Produced water vaporization

HeatQuest – Heat to Power



ORC Power Skid



Technical Advantages

- Gas does not have to be cleaned or have H₂S removed
- No moving parts - Reduced downtime and maintenance
- Easily accommodates changing flow rates and composition
- Portable skid mounted
- Economic

Portable Trailerized Units



Oil Sands

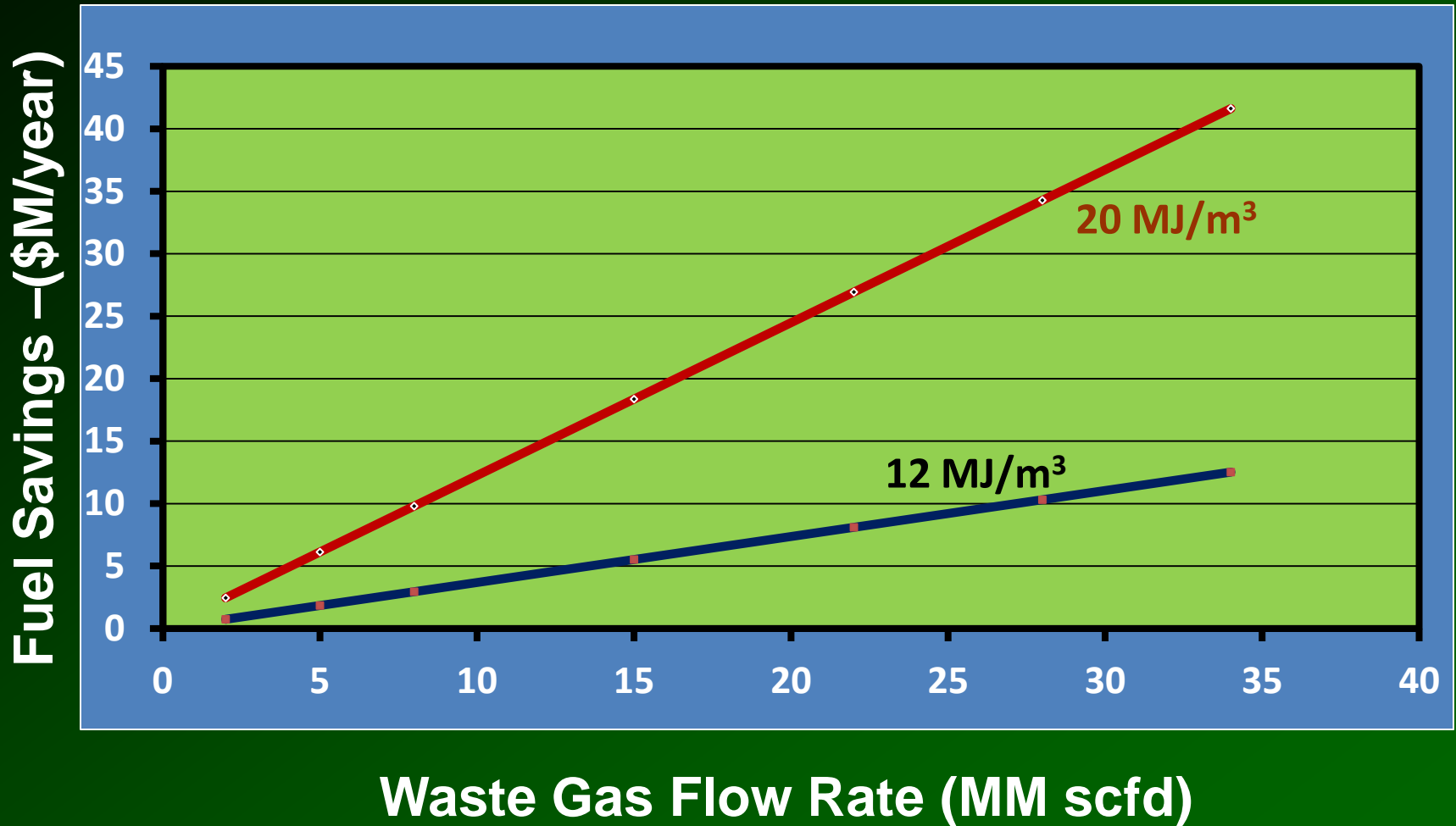
In-situ Combustion and SAGD Projects

- $<1\%$ H_2S and CH_4
- 99% CO_2 , and N_2
- Safe and efficient combustion of low heat content produced gas
- Improved air quality
- Reduce noise levels
- Significant fuel gas reduction over flaring
- Reduced CO_2 eq. emissions



**Kerrobert, Saskatchewan
Q3000 Incinerator Unit**

Annual Operating Cost Savings

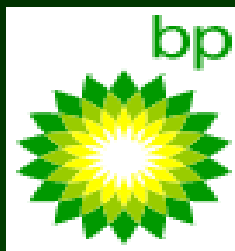


Waste gas = 4.7 MJ/m³ Fuel Gas Price \$3.86 Fuel Gas = 37 MJ/m³

Conclusions

- Improved coal mine safety and productivity
- Methane emissions reduced - air quality improved
- Replacement of Fossil fuel energy sources with green energy
- Additional revenue generated from the sale of heat, power and carbon credits
- Measurable and cost effective improvement over existing flaring and venting practices

Clients



**COST REDUCTION
FOR CLIENTS**



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