Re-imagining Flares

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Introduction/Background

Personal Background

I have worked in energy for over 38 years first with Gulf Canada Resources Ltd. and now with Questor Technology Inc. I have a Bachelor's degree in Chemical Engineering from the University of Toronto and a Master's Degree in Petroleum Engineering from the University of Calgary. I spent the first 18 years of my career in oil and gas. In the last 20 years at Questor, pursued a passion to improve how we deal with waste gases. I served as a distinguished lecturer for SPE in 2010/2011. I am a fellow of the Canadian Academy of Engineers. A member of the Schulich Industry Engineering Advisory Council and recently chaired the Canadian Federal Government clean technology economic strategy table. I am currently an advisor on the Canadian Council of Academics circular economy expert panel.

Organization's background and area of expertise

Questor founded in 1994, is a leading global provider of safe, reliable, 99.99% efficient waste gas clean combustion systems that eliminate the emission of harmful pollutants into the atmosphere.

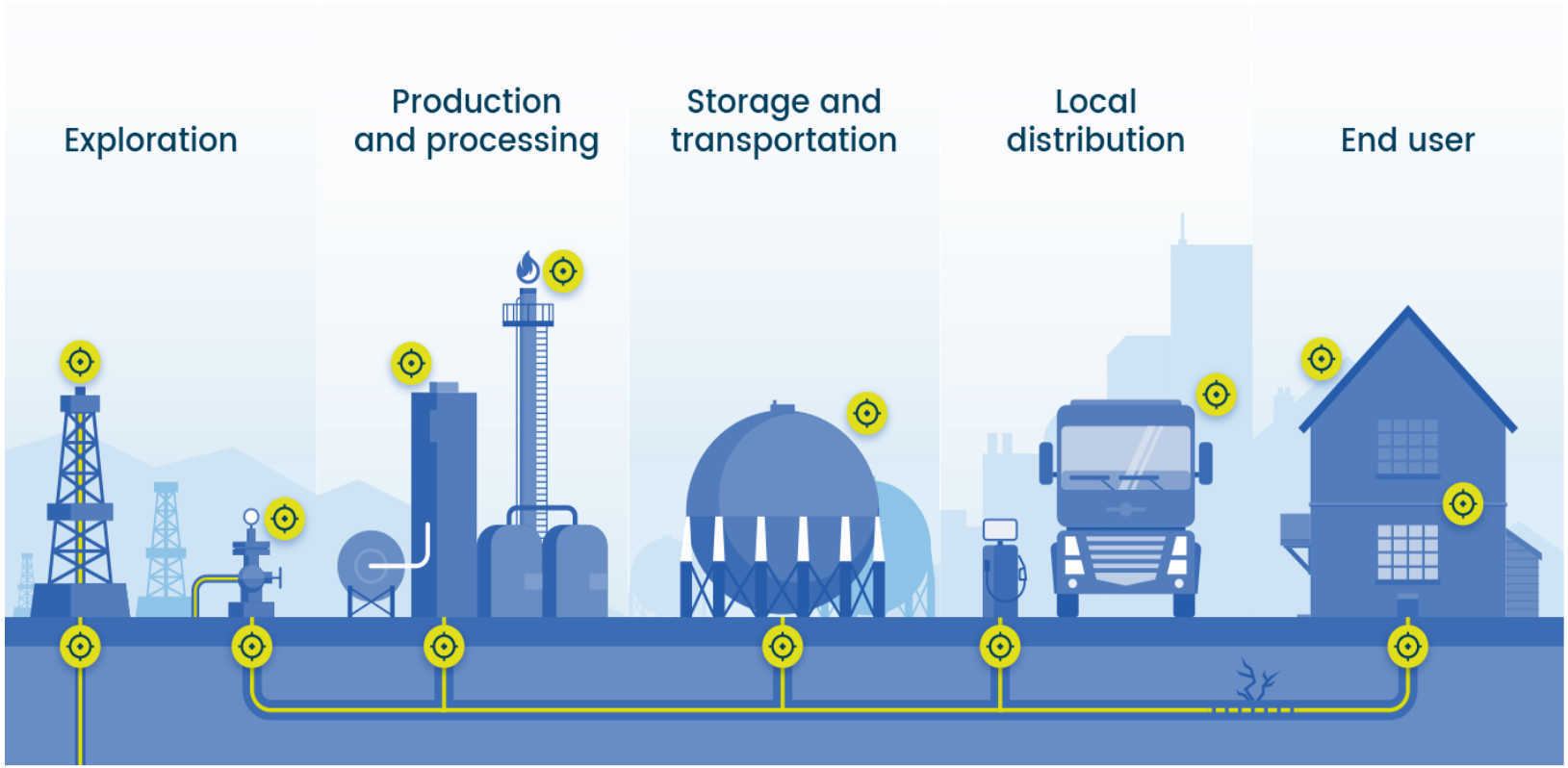
Specializing in unique cost-cutting clean combustion solutions for many industries including the upstream, midstream, downstream and distribution sectors in oil and gas.

Questor is able to generate power from the heat and is developing waste water treatment utilizing this heat to reduce costs associated with transport and disposal of produced water.

Questor's energy efficiency reduces costs, achieves compliance, reduces GHG emissions while obtaining public support.

First company globally to receive ISO 14034 certification for 99.99% combustion efficiency performance.

Methane emission reduction opportunities



Accountability and Public Trust – transition to a low carbon economy

Recent Technology Advances

- Portable units – Non routine flaring

- Solutions at well pad sites – drilling, completions, production

- Process solutions at Midstream facilities – dehydrators, amine, zero methane emission sites

What is needed for adoption

- Better measurement and assessment of the significant non-routine flaring and venting volumes. Poor understanding of total methane emissions at site. API factors/guidelines significantly underestimating emissions.
  - Pipeline maintenance
  - Engines/Turbine soft starts
  - Well unloading, workovers
  - Tank vapours
  - Flares
  - Engine compressor maintenance
  - ESD's, PSV's
  - Plant and facility turnarounds
  - Truck, Rail cars, Ship loading and unloading
  - Process units – dehy, amine, etc
- Regulation that focuses on performance over the entire site vs snap shots
  - Site methane targets vs. pneumatics, compressor seals, LDAR
- Acceptance that a flare is not 98% efficient.
  - It cannot be if it is black and smoky. Research shows efficiency ranges from 20-85% . Influenced by wind, composition, size of entrained droplets, tip velocity,
- Great reliable enclosed clean combustion equipment solutions - BACT

Technology Gaps

Equipment

- Improve performance and air intake on units handling low pressure volumes from tanks, casing, landfills, etc. Majority of enclosed combustion units are not reliable, smoky and are leaking methane. Look at opportunities to improve reliability and reduce costs.
- Current Questor unit works well when one there is always a high pressure stream that brings in air and the other low pressure streams. Need additional R&D to improve design when there is no high pressure gas. Also need to design a the burner system to meet the new NOx regulations.
- Increase throughput by 30% on a 5MMscf/d unit to bring down costs and improve efficiency and handle multiple streams that fluctuate considerably.
- Expand Joint Research Project with Stanford utilizing a new catalyst to create a portable unit – Utilities, Landfills, RNG sites, Engine methane slip – low methane out of flammability limits, NOx regulation
- High cost and complexity with current thermal oxidizers and regenerative oxidizers. Opportunities to improve operation, lower cost and guarantee 99.99% in the applications of low methane content gas from mining and landfills.

Technology Gaps

Measurement and understanding of emission sources

- **Improve understanding of site emissions - Routine and Non-routine.** To date focus has been on less than 5% of the site methane emission sources. i.e. pneumatics and compressor seals. LDAR – 2-4 times a year. 90% of the actual emissions ignored. Need the development of a credible digital data system to keep track and develop an understanding on the emissions real time.
- Development of a digital twin of all the equipment on site to predict emissions from all the equipment on site including expected flowrates and maintenance schedules.
- Initial field methane detection on airplane flyovers are indicating significant volumes of methane leaking from flares and enclosed combustors. Conduct integrated study to quantify how large the problem is.
- **API emission factors are incorrect** – significantly underestimate emissions but accepted as standard practice. Use field data to improve.

Taking a System approach

- Build credible digital data driven system that can measure and credibly quantify the emissions before and after. Demonstrate all equipment on sites is operating at optimal. Ultimately, prove its a zero emission site 24/7 365 days a year
- Gather all the different sources of methane emission data and analyse it to create a meaningful understanding of the sites entire emissions. Digital twin of the site for predictive emissions monitoring (PEM)
- Demonstration sites
- Continue with catalyst technology development with Stanford to reduce NOx and handle low methane concentrations
- Create value from the waste gases – heat to power, water vaporization, process heat

Thank you

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