RNG WORKS

How to Engineer an RNG Project: Best Practices & Engineering Considerations for Meeting Pipeline Specifications

Aria Energy
Olsson

How to Engineer an RNG Project:

Best Practices & Engineering Considerations for Meeting Pipeline Specifications

RNG WORKS Technical Workshop & Trade Expo
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Aria Energy & Olsson Partnership

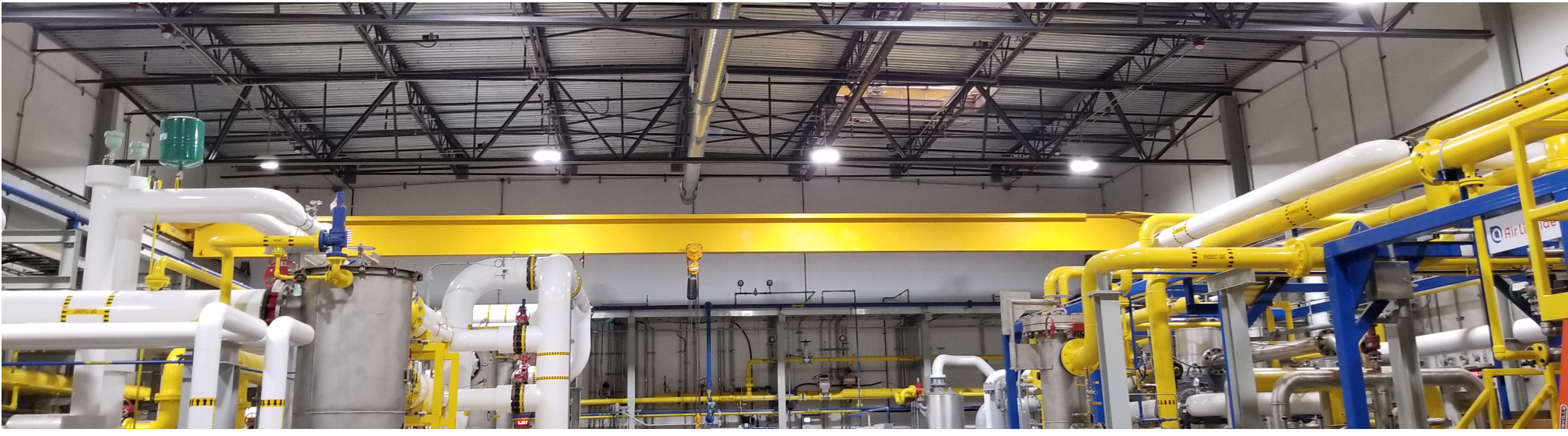
- Master Engineers for Aria Energy
- Building Information Modeling (BIM)
  - Integrated and Coordinated Design
    - Revit, AutoCAD, Solidworks, 3D Scan
- Smartsheet

Renewable Energy Market

- Olsson Services
  - Electrical Engineering
  - Mechanical Engineering (HVAC & Plumbing)
  - Process Piping Engineering
  - Power & Distribution
  - Automation & Controls
  - Civil Engineering
  - Structural Engineering
  - Environmental Planning & Permitting
  - Architecture
  - Geotechnical
  - Survey
  - Non-Destructive Testing (NDT)

Engineering Considerations

- Process Piping
  - H2S Removal Pipe Specifications
    - Highly Corrosive
    - Health Hazard
    - ASME, ASTM, AGA
- Structural
  - Coordination
    - Process Piping, Mechanical, Electrical
  - Containment



Engineering Considerations

- Mechanical (HVAC & Plumbing)
  - Ventilation Requirements
    - Range from 6 to 36 Air Changes per Hour
- Electrical
  - H2S Sensors
  - CH4 Detectors
  - Gas Analyzers
  - Area Classifications
    - Class 1, Division 2, Group D

Engineering Considerations

- Power & Distribution
  - Neutral Grounding Resistor (NGR) Requirements
- Architectural
  - Process Building H2 Occupancy, Division 2 Rating, Fully Sprinklered
  - Electrical Building F1 Occupancy, Not Sprinklered
- Geotechnical
  - Additional Borings to Accommodate Various Foundation Types
    - Mat Equipment Foundations, Shallow or Deep Building Foundations, and Drilled Pier Pipe Support Foundations
- Survey
  - Intrinsically Safe

Engineering Considerations

- Civil Engineering
  - Utility Interconnect Routing
    - Distance vs. Financially Feasible
  - Coordination
    - MEP engineers, local utility companies, authority having jurisdiction (AHJ), RNG facility ownership, and landfill ownership
  - Challenging Gradings
    - Large amount of mechanical equipment pads

Steps for Success

- Preliminary Engineering Study
  - Zoning, site development, Inlet and product Gas quality, Metering requirements, right-of-way, building permit steps, regulatory, environmental permits, construction, operating and maintenance costs.
  - Location of the interconnection is critical
- Detailed Engineering Study
  - Technology Selection, Building permit drawings, Bid and construction drawings
- Selection of Engineering Consultant
- Proactive Steps in Permit Process
- Flowmeter and Gas Analyzer/Gas Chromatograph

Technology Selection

- Several methods and technologies available to condition biogas. Technology selection can be based on many criteria:
  - Inlet LFG make up, site and operating conditions, flow capacity/plant size, contaminants, product gas specs/ Tariff, Tradeoffs in capital costs vs. operating costs

- Some Examples:
  - Pressure/Temperature swing adsorption system
  - High-selectivity membranes
  - Water scrubbing systems
  - Dry Scrubber/Solid scavenger system
  - Catalytic Oxygen removal
  - AGR Solvent systems
  - Combination of these technologies working in unification is a must to meet the stringent specifications

Challenges/Barriers

- Financial and regulatory barriers

- Critical obstacle preventing RNG adoption is the financial uncertainty of the RIN market as it is susceptible to price fluctuations.
  - Stability in RNG values would encourage investment in RNG.

- Considerable differences between the permitting processes in different parts of the Country.

- Lack of clarity and consistent regulations in RNG quality standards (clean gas quality and interconnect standards)
  - Siloxane and minimum heat standards for RNG pipeline injection are so stringent that they often become unattainable
  - Overly stringent standards effectively prohibit the injection of RNG into pipelines

- Less awareness about environmental benefits of RNG is an issue

Product Gas Specifications- Example

GENERIC PRODUCT GAS SPECIFICATIONS	
CONSTITUENTS	**RANGE**
Carbon Dioxide	Between 1% and 3%
Nitrogen	Between 2% and 4%
Oxygen	Between 0.2% and 0.5%
Total Inerts	Between 4% and 5%
Total Heating Value	Between 950 BTU/ft^3 and 1100 BTU/ft^3
Hydrogen Sulfide	Between 0.25 grains and 0.31 grains per 100 ft^3
Total Sulphur	Between 1 grain per 100 ft^3 and 20 grains per 100 ft^3
Water Vapor	Between 4 pounds per 1 million ft^3 and 7 pounds per 1 million ft^3
Temperature	Between 110° F and 120° F

Aria RNG Facility

Southeast Oklahoma City Facility

Seneca RNG Facility

Kansas City RNG Facility

Oklahoma City Relocation

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