KATHAIROS

WHITEPAPER

Using Nitrogen to Power Liquid Separators During Flowback Operations:

1 tank, 22 days, 102,000 scf methane (55 MT CO2e) emissions avoided

PENNENERGY RESOURCES

"We were able to utilize one of Kathairos' largest nitrogen tanks to power all of our liquid separators throughout the entire duration of the flowback operation, which completely eliminated methane emissions from those sources."
- Domenic Tedesco, Director - Air Quality & Sustainability, PennEnergy Resources

KATHAIROS PENNENERGY RESOURCES

TITLE

Using Nitrogen to Power Liquid Separators During Flowback Operations: 1 tank, 22 days, 102,000 scf methane (55 MT CO2e) emissions avoided

CUSTOMER

PennEnergy Resources, Pittsburgh, PA

SITE TYPE

New multi-well pad, Marcellus Basin

APPLICATION

Replacing methane-powered dump valve separators with nitrogen during flowback

Challenge

PennEnergy has been working with Kathairos to utilize nitrogen systems on their well pads to run their pneumatic devices and eliminate all vented methane emissions. After experiencing the simplicity and reliability of the liquid nitrogen solution, the forward-thinking operator approached Kathairos to discuss a further emissions elimination opportunity during flowback operations.

The company performs several flowback operations each year and regularly hires a third-party company to perform the service. Historically, the dump valves on the three large separators utilized during the flowback operations are run through well head gas. However, due to significant amounts of liquids flowing back during the three to six-week operation, the amount of methane emitted is significant and something that PennEnergy began deploying solutions toward.

The third-party provider shifted to the use of instrument air compressors to run the pneumatic valves, but due to the large demand and heavy workload of the compressor, they experienced regular failures of these packages, with costs passed on to PennEnergy.

“We’ve been attacking the emissions from permanent tanks and pneumatics for years now,” said Domenic Tedesco, Director - Air Quality & Sustainability, PennEnergy Resources. “From there we shifted our focus to D&C operations.”

Project

Brilliantly, PennEnergy approached Kathairos to inquire about the use of a single large nitrogen tank to power the process instead.

Kathairos and PennEnergy worked together to estimate the potential daily nitrogen consumption, and determined that a 5500L liquid nitrogen system would handle the demand on a three to four-week refill cycle. Kathairos' 5500L tank is equipped with an external vaporizer which would easily provide the nitrogen gas at the pressure and flow rate required for the high-demand operation.

It was agreed to pilot the system on PennEnergy's first flowback project of 2023. The tank was delivered to the site and easily connected to the three pneumatic-driven dump valve separators. The tank was commissioned and turned on, and seamlessly supplied dry, inert nitrogen gas for the entire flow back operation which lasted nearly six weeks. The tank was refilled only one time during the project, minimizing any additional equipment on site. It performed exactly as anticipated and provided 100% reliability from start to finish.

Results and Next Steps

This is the first known operation of using a liquid nitrogen system during a flowback operation. It was an idea that was innovatively conceived by PennEnergy Resources and immediately and collaboratively brought to life with Kathairos.

In 22 days of operating the 5,500L liquid nitrogen tank to actuate the liquid separators, approximately 80,000scf of nitrogen was used. Thanks to the gas equivalence ratio of nitrogen to methane, this equates to approximately 102,000 scf methane (CH_4) or 55 MT CO_2e emissions avoided. A remarkable achievement with zero waste produced.

Following the flowback project, the liquid nitrogen tank was decommissioned and moved to the next well pad for the next flowback operation. It was utilized a total of three times in 2023 and was considered a great success. PennEnergy has since contracted this tank for all their 2024 flowback operations.

Project Specifics

- Kathairos nitrogen system size: 5500L with external vaporizer
- Application: Operating third-party liquid separator dump valves during flowback operations
- Operation duration: Flowback operation lasted 22 days
- Nitrogen consumption: System required only one refill during the operation
- Operational reliability: Provided 100% reliability with no downtime
- Number of flowback operations in 2023: Used in 3 separate operations
- Emissions impact: Significant reduction in methane and CO_2e emissions (exact figures to be determined based on nitrogen consumption analysis)
- Go-forward commitment: PennEnergy contracted the 5500L Nitrogen tank for all 2024 flowback operations