Jacob Mdigo, MS Systems Engineering

Current Project Overview

Energy Emissions Modeling and Data Lab (EEMDL) is a research and education initiative comprising UT Austin, Colorado State University (CSU), and the Colorado School of Mines. The initiative aims to develop tools to help resolve the challenges of emission measurement interpretation and facilitate the coming up of a measurements-informed inventory of methane emissions. Under this initiative, the Mechanistic Air Emission Simulator (MAES) from CSU will be used to model different facilities and estimate emissions. To improve MAES' ability and accuracy, a lot of data is needed from oil and gas facilities to compare what the tool is estimating to what the different facilities are reporting.

The Appalachian Methane Initiative (AMI) is collaborating with EEMDL to enhance the monitoring of methane emissions in the Appalachian basin to aid emissions reduction efforts and improve the value of natural gas produced. Aerial monitoring is used for emissions measurements from different facilities of the partnering companies every quarter of the year. To support these efforts, CSU is modeling the midstream facilities using the MAES tool to estimate their emissions. Currently, three out of the four partner companies have midstream facilities and are sharing data with us. Bridger Photonics conducts quarterly top-down methane emissions measurements for each operating partnering company.

Research Progress

From these three operating partnering companies, Bridger Photonics reports midstream measurements from 30 facilities. Midstream equipment identified includes compressors, vapor recovery units (VRU), tanks, facility piping, tanks, flares, separators, and others. We analyze the data received from Bridger Photonics for each quarter of the year and match the measurements with maintenance and compressors run-time data from operators. We look for any maintenance event that could be running during Bridger Photonics' flyover events. From Q2 and Q3, no maintenance events were found during the flyovers.

Bridger Photonics' data is post-processed for further analyses such as identifying large emitters, the number of emitting equipment per facility, total emission per facility, calculating equipment leak probability (pLeak), and generating plots to share with operators. To achieve this, we have written Python scripts to automate the process and make it suitable to handle additional data as we expect to deal with four more operators in the next year.

After simulating a facility in MAES, we can cross-reference the measurements with those from Bridger to determine if they align with our expectations. This process enables us to pinpoint

significant emitters, identify incorrect assumptions in our model, or assess uncertainties in aerial measurements. Such outcomes are only achievable through collaborative information sharing with operators.

Research Plans

1. Edit the post-processing script to be able to accommodate additional facilities from new operators in the next years.
2. Improve the model for dehydrators in MAES. Many facilities modeled are dehydrator stations and we need to be able to model these facilities correctly.
3. Utilize Pro-max to read well-head gas composition shared by operators and utilize this information to build gas composition files as input for the midstream facilities MAES models.
4. Write a paper on the comparative accuracy and efficiency of aerial measurements versus ground measurements in detecting and quantifying methane emissions from compressors' seal vents and driver exhaust emissions.

Publications

To be updated

Literature Cited

https://energy.colostate.edu/appalachian-methane-initiative-ami/
https://www.eemdl.uttexas.edu/