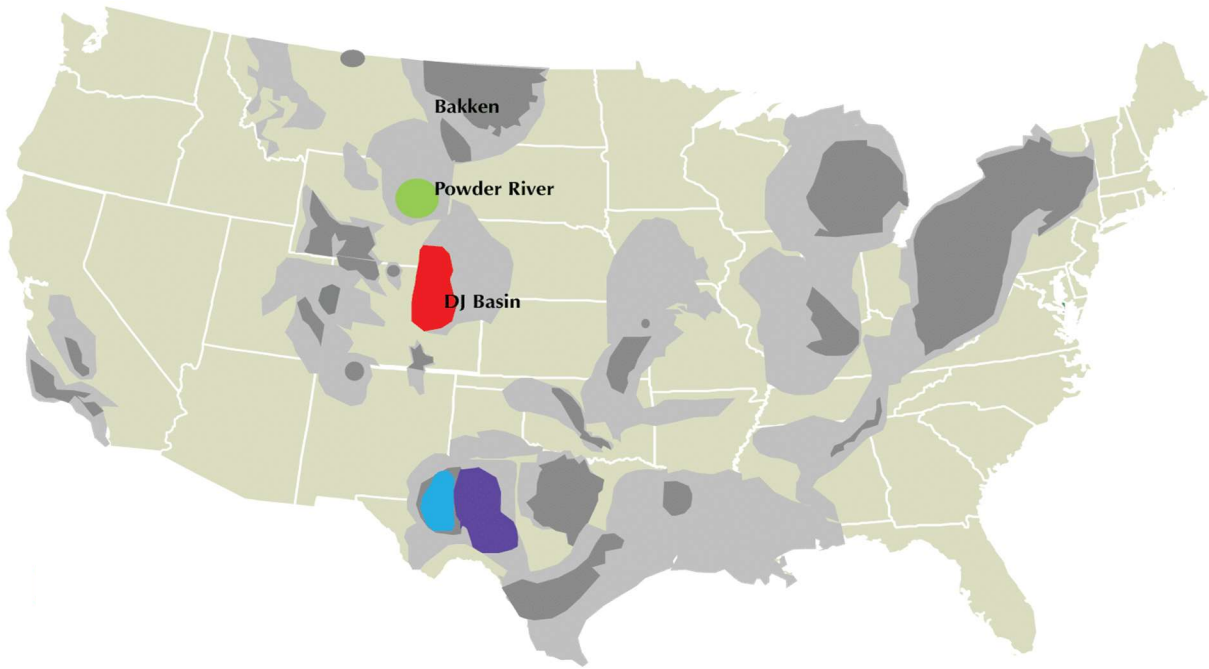


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*Figure 1: Map of the U.S. The Red shedded area represents the Denver-Julesburg Basin in Colorado.*

**Current Project Overview**

Given the low or nonexistent ethane ( $C_2H_6$ ) signature in biogenic emissions, top-down studies of methane ( $CH_4$ ) emissions use wellhead gas composition to determine the associated ethane-to-methane ( $C_2/C_1$ ) average ratio, which is then often used to differentiate oil and gas from biogenic sources. However, this ratio may vary within and across different basins, emitting sources, and facility configurations. This study investigates stack test data from Fourier Transform Infrared Spectroscopy (FTIR) analysis of the exhaust gas for four-stroke rich-burn engines and four-stroke lean burn engines. Fuel gas is fed into natural gas-fired engines for compression purposes, and stack tests determine the amount of specific pollutants in the exhaust gas. Our analysis shows that engines preferentially combust heavier hydrocarbons over methane, evidenced by consistently higher destruction efficiency for ethane than methane across all engine types. Additionally, recent design modifications in O&G production sites revealed a reduction in  $CH_4$  emissions and a more pronounced decrease in ethane emissions. In the Denver-Julesburg basin in Colorado, natural gas production increased by 73.9% from 2015 to 2021. Despite these increases, the companion paper

by Daley et al. (2025) reveals that top-down methane and ethane emissions from oil and natural gas (O&G) facilities decreased by 24.4% and 63.6%, respectively. The present analysis provides an explanation and reveals a shift in emissions from the production sector to the midstream sector.

### **Research Progress**

This work is currently undergoing internal review.

### **Publications**

Significant reductions in ethane emissions in the Denver-Julesburg basin from 2015 to 2021 from oil and natural gas operations. 2025 (**in view**).

### **Literature Cited**

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