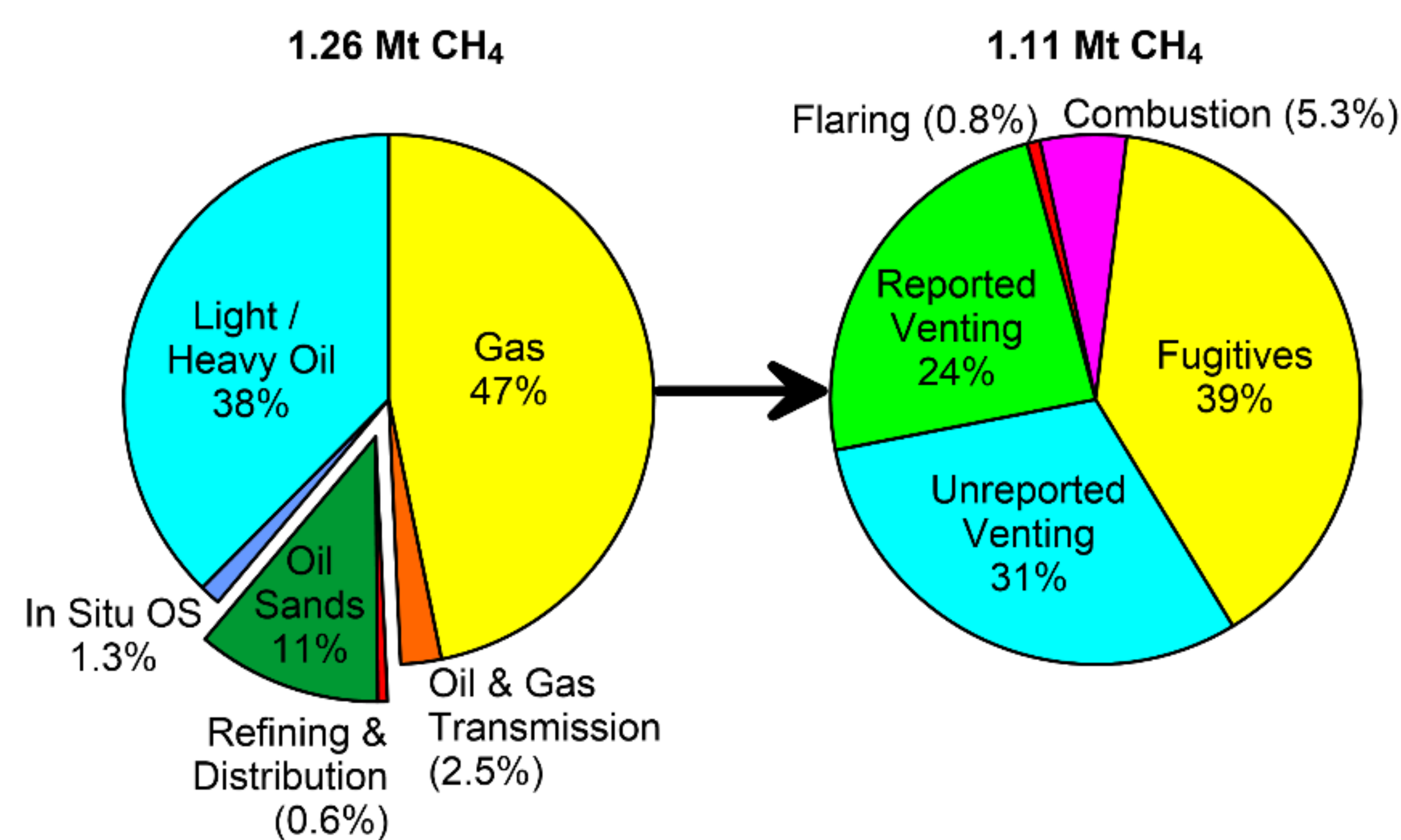


2014 ECCC Methane Inventory Data for Alberta

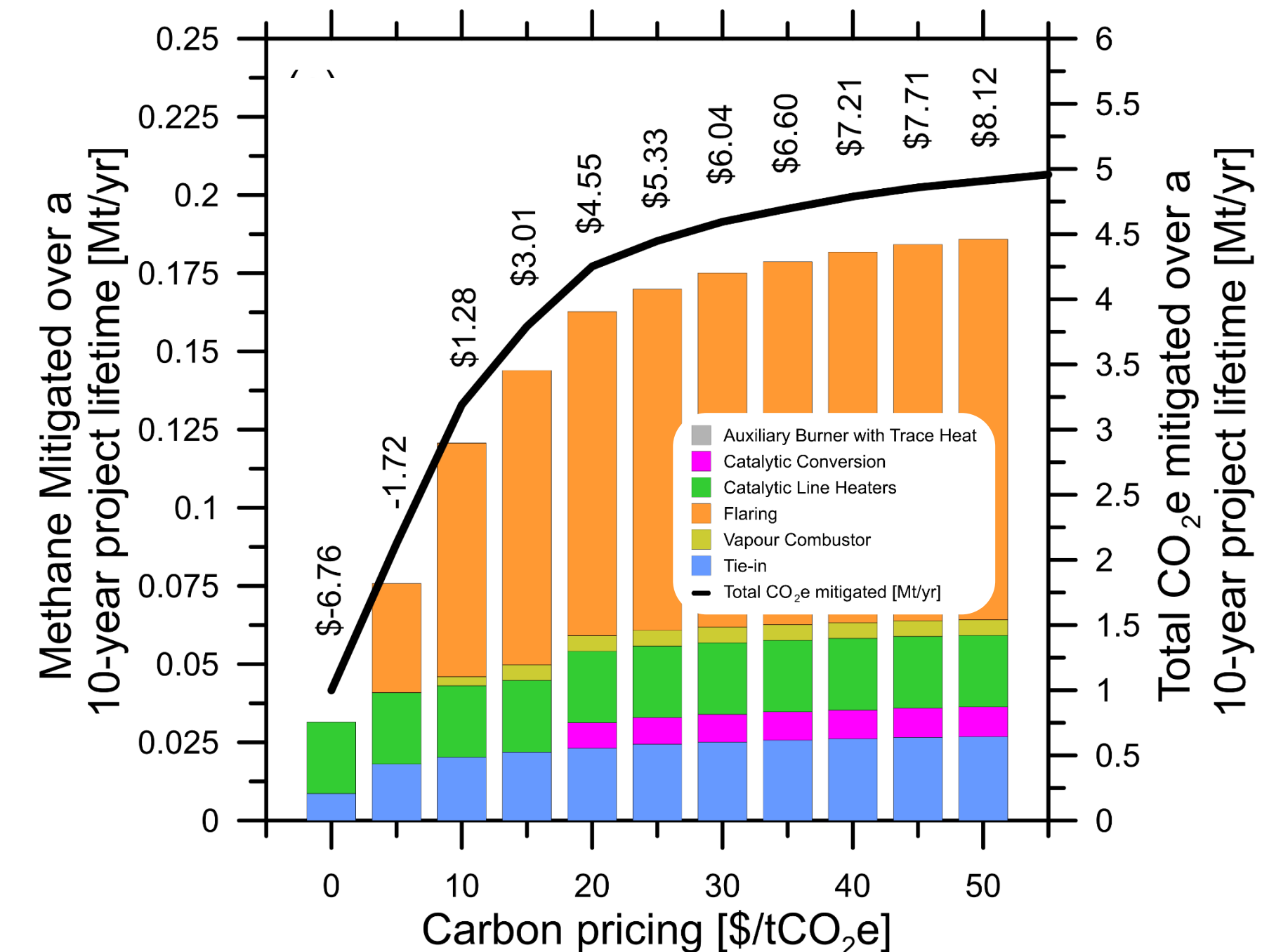


Techno-Economic Objectives

For flaring and venting oil sites assess:

- I. Feasibility of a 45% reduction in reported methane emissions
 - Site by site NPV over a range of technologies and carbon pricing
- II. Impact of implementing methane reduction technologies on provincial flaring
- III. Sensitivity to inventory estimates

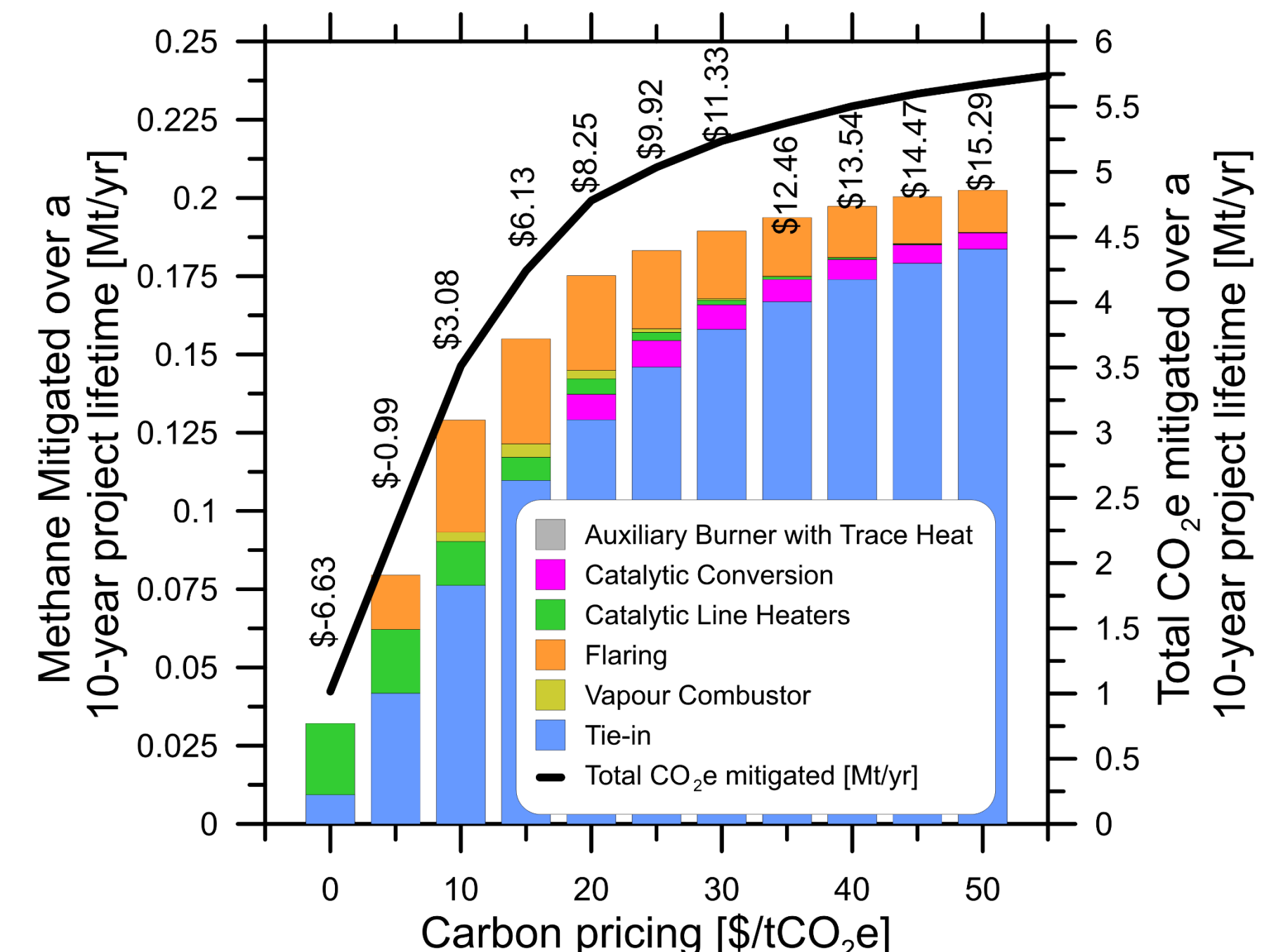
Methane Mitigation Potential



Mitigation potential least costly to industry

For an imposed carbon price of \$30/tCO₂e

- 78% CH₄ reduction, at an avg. cost of ~\$6/tCO₂e
- 63% of CH₄ flared or incinerated
- 374 million m³/y flared/incinerated after mitigation

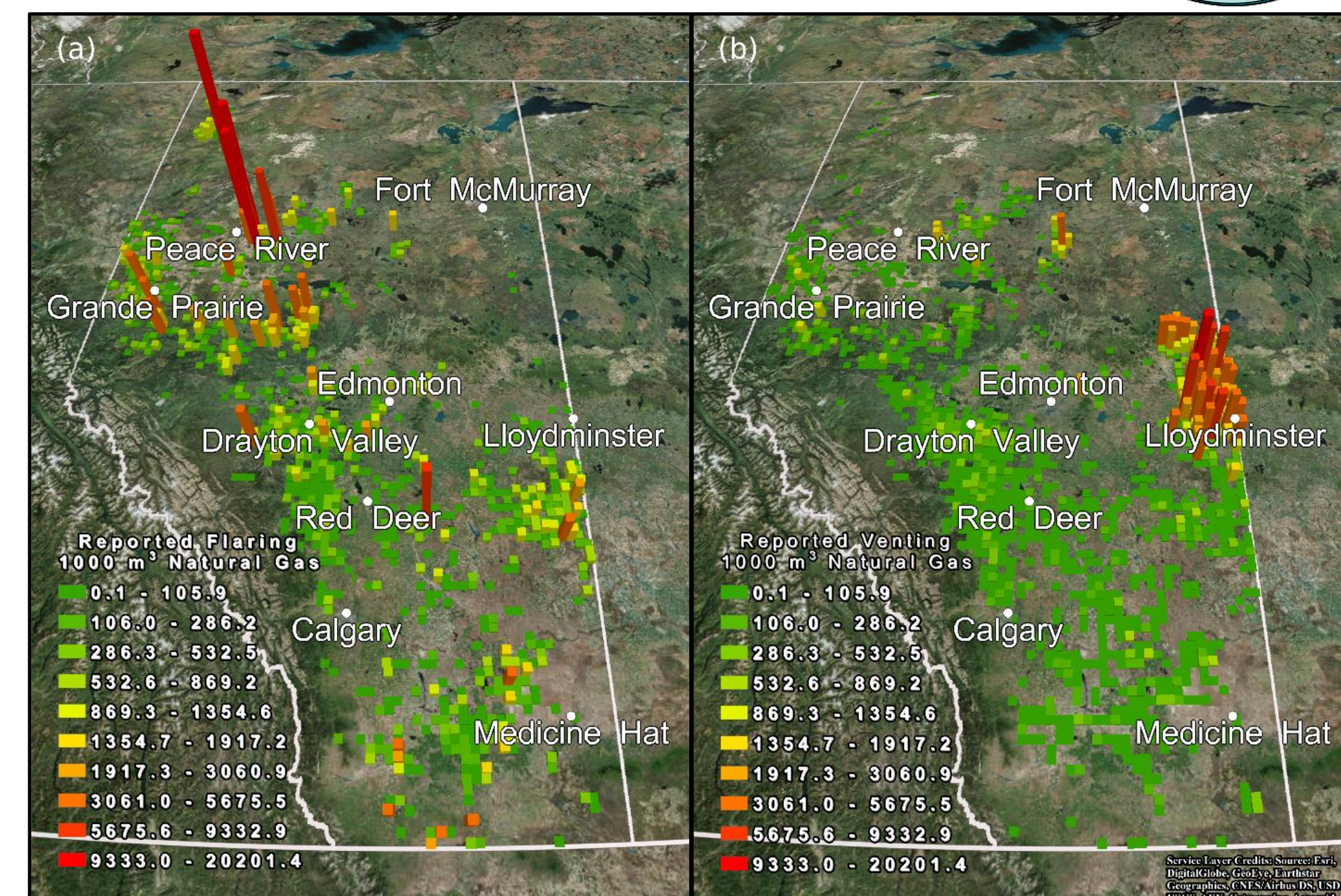
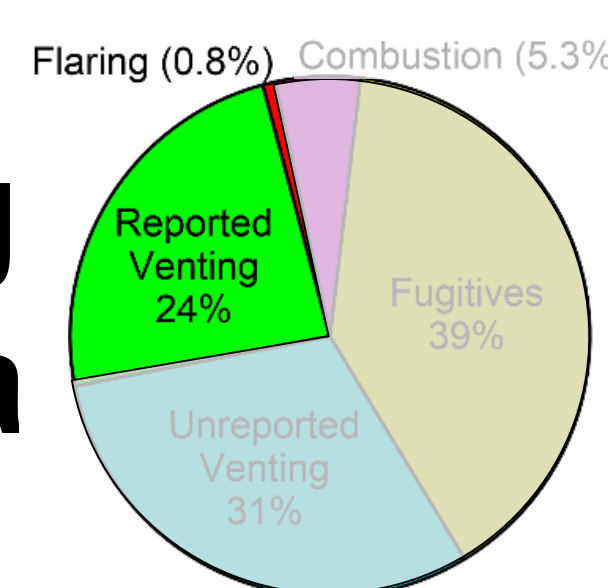


Mitigation potential with a tie-in clause

For an imposed carbon price of \$30/tCO₂e

- 84% CH₄ reduction, at an avg. cost of ~\$11/tCO₂e
- 10% of CH₄ flared or incinerated
- 186 million m³/y flared/incinerated after mitigation

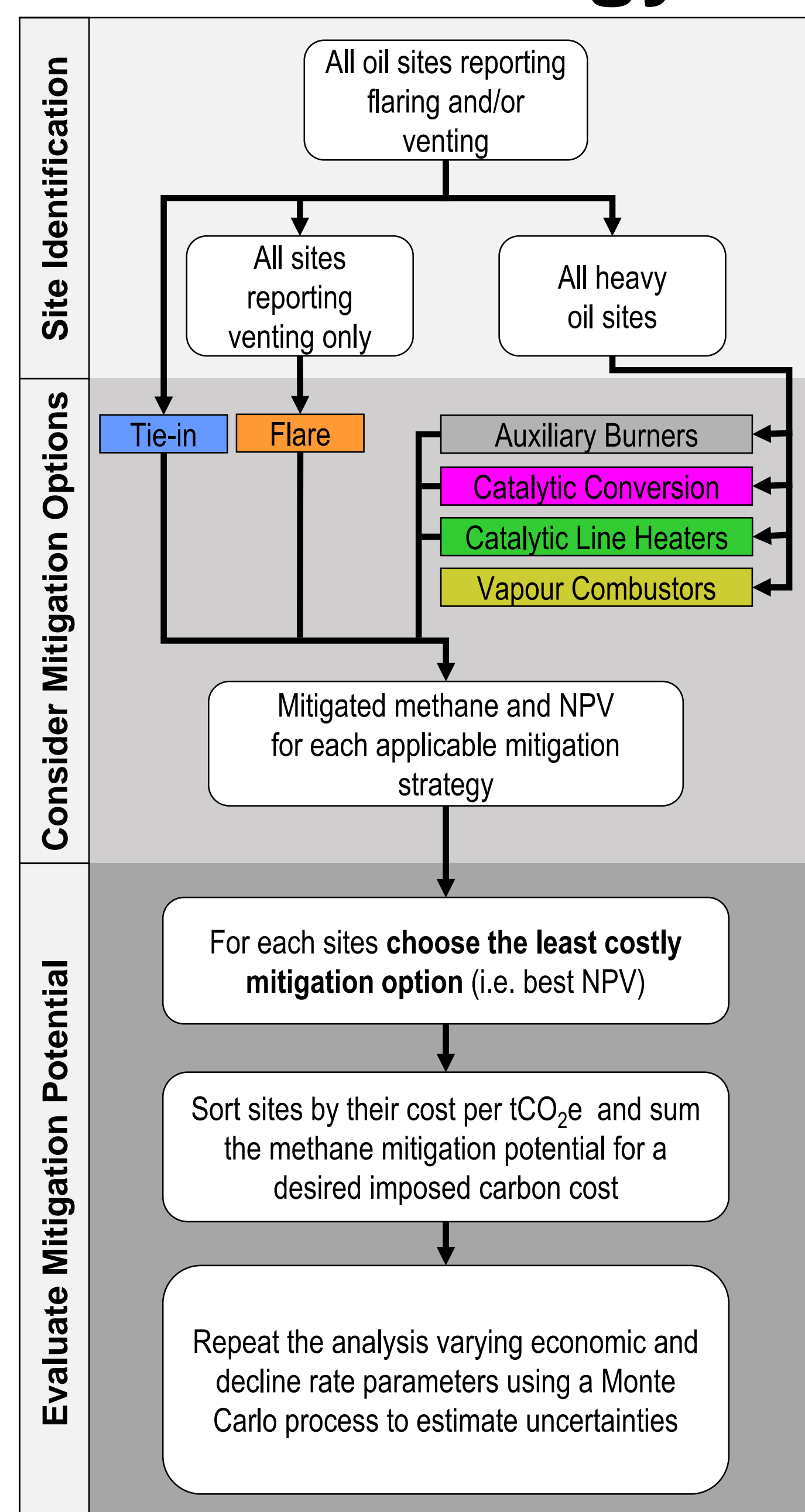
2015 Reported Flaring and Venting in Alberta



Distribution of reported whole gas (a) flaring and (b) venting volumes in Alberta in 2015.

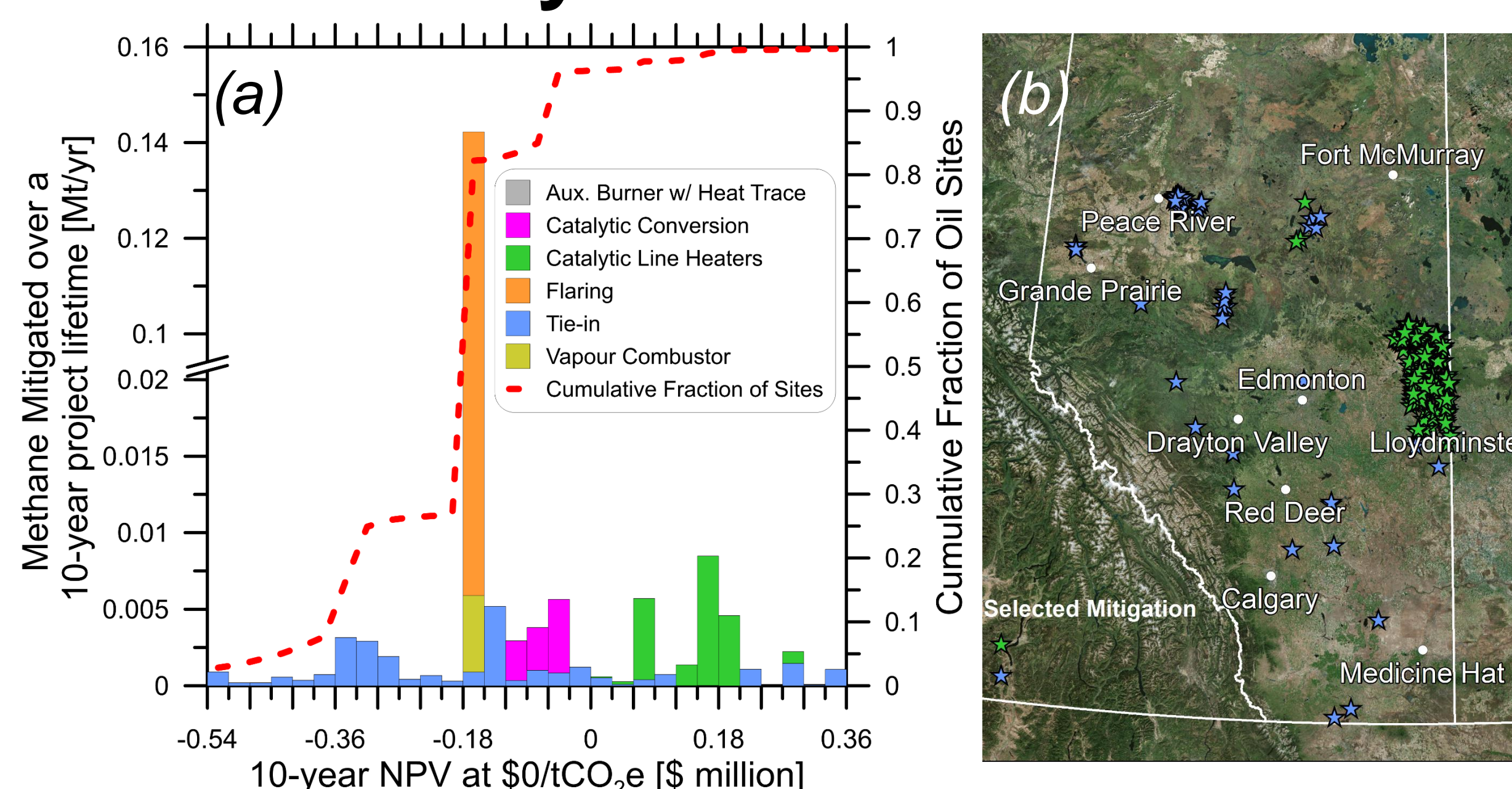
- ~27,000 Oil and Gas Facilities (Batteries, Gas Gathering Systems, Gas Plants etc.)
- Reported flaring and venting = 254 ktCH₄
- 90% of reported CH₄ from conventional oil
- 66% of reported CH₄ from venting located in the "Lloydminster region"
 - Dominated by cold heavy oil production

Methodology



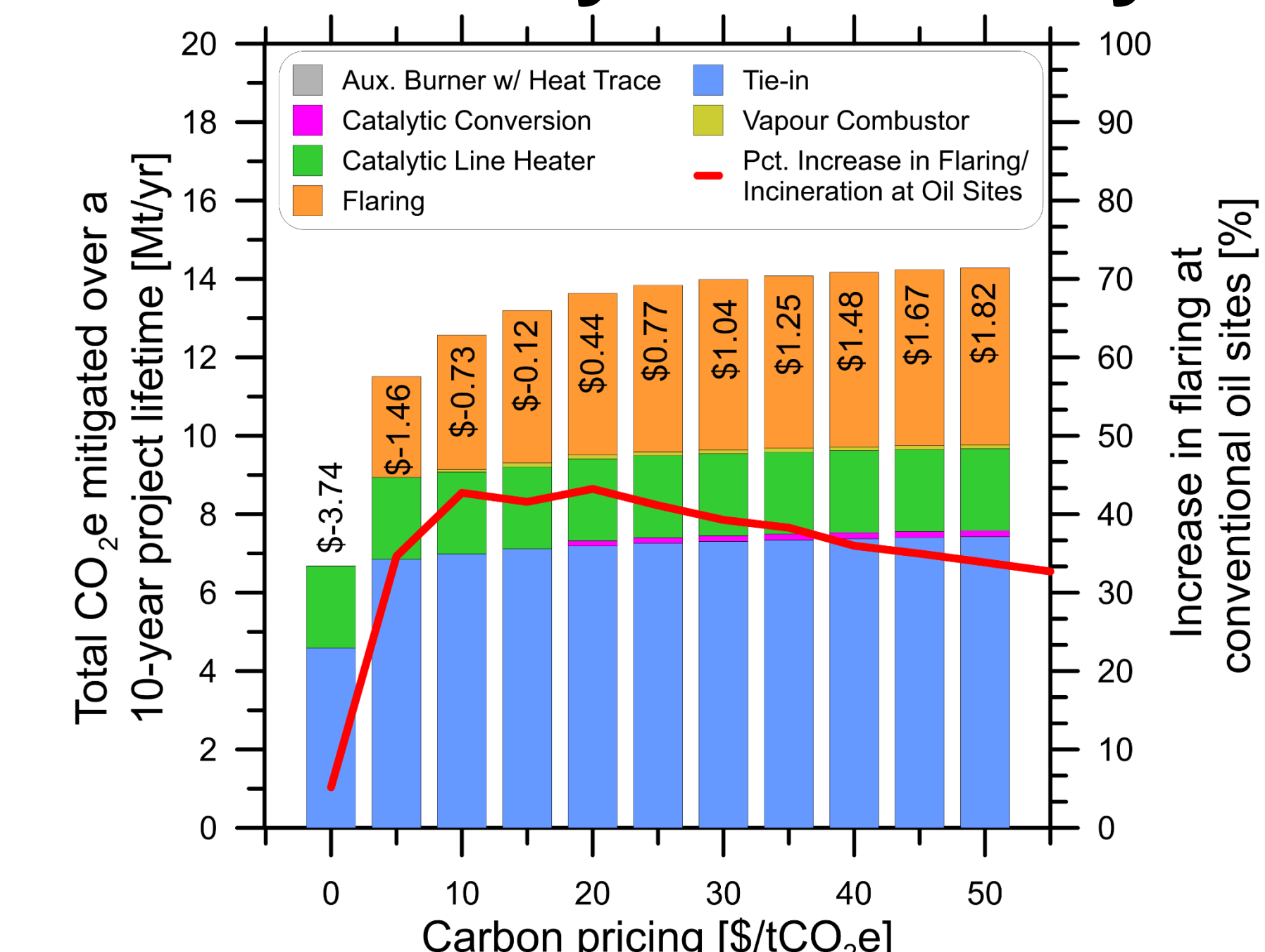
Site-by-site evaluation of methane mitigation potential from reported venting and flaring

Site-by-Site Economics



Under current economic conditions (a) Economics at all oil sites (b) Location of economic oil sites

Inventory Sensitivity



- Heavy oil venting increased by ~5x to match recent airborne measurements
- Mitigation potential ~3x greater at \$30/tCO₂e
- Potential significant impact on provincial flaring