



# Onshore Petroleum and Natural Gas Operations on Federal and Tribal Lands in the United States

## Executive Summary

Methane is a potent greenhouse gas, over 84 times more powerful than carbon dioxide in the first 20 years after it is emitted. Because it is the main component of natural gas, methane that is released through leaks, venting and flaring also represents a waste of a valuable energy resource. Methane escaping from the oil and gas industry is among the largest anthropogenic sources of U.S. methane emissions, but there are many highly cost-effective ways to reduce releases of fugitive and vented methane in the sector.

Environmental Defense Fund (EDF) commissioned this economic analysis of methane emission reduction opportunities from oil and natural gas operations on Federal and Tribal lands. The study examines emissions from Federal and Tribal lands, opportunities for methane mitigation and associated costs, and royalty revenue lost. It then identifies the largest emitting segments and estimates the magnitude and cost of potential reductions achievable through currently available and proven technologies.

The key conclusions of the study include:

- **Total Emissions From Federal and Tribal Lands in 2013**—Our analysis concludes that total emissions to the atmosphere from fugitive sources, vented emissions, and flares on federal lands amounted to 39.2 billion cubic feet (bcf) of methane in 2013 – equivalent to 47.5 bcf of whole natural gas. Fugitive, vented, and flared emissions on tribal lands were estimated to amount to an additional 15.6 bcf of methane, or 18.4 bcf of whole gas.
- **Flaring** — A small share of the emissions noted above represent uncombusted methane emitted by flares. We estimated that approximately 28 bcf of whole gas was sent to flares on federal lands in 2013.
- **Comparison to National Emissions.** The total emissions from federal and tribal lands represented approximately 12% of total national methane emissions from the oil and gas sector. Approximately 60% of these emissions were attributable to onshore oil and gas production and gathering and boosting facilities.

- **Federal and Tribal Land Production Coverage** – In the onshore production segment, 11% of producing gas wells and 5.4% of oil wells nationally are on Federal lands. These wells contribute 11% of natural gas and 5% of oil produced nationally. Similarly, 2.5% of producing gas wells and 1.2% of oil wells nationally are on Tribal lands. These wells contribute 3% of natural gas and 3% of oil produced nationally.
- **Cost-Effective Solutions** – On Federal lands, a 39% reduction in onshore methane emissions is projected to be achievable with existing technologies and techniques while yielding net savings of \$0.62 per thousand cubic feet (Mcf) of methane reduced, or less than 1 penny per Mcf of gas produced on federal lands, taking into account savings that accrue directly to companies implementing methane reduction measures (Figure 0-1). If the full economic value of recovered natural gas is taken into account, including savings that do not directly accrue to companies implementing methane reduction measures, the 39% reduction is valued at \$73.2 million per year. The cost for some measures and segments of the industry is more or less than the net total.
- **Abatement Costs on Tribal Lands** - On Tribal lands, a 38% reduction in onshore methane emissions is projected to be achievable with existing technologies and techniques at a net total cost of 25 cents per Mcf of methane reduced, or less than one penny per Mcf of gas produced on tribal lands, taking into account savings that accrue directly to companies implementing methane reduction measures (Figure 0-2). If the full economic value of recovered natural gas is taken into account, including savings that do not directly accrue to companies implementing methane reduction measures, the 38% reduction is valued at \$28 million per year. The cost for some measures and segments of the industry is more or less than the net total.
- **Abatement Opportunities** – By volume, the largest opportunities target leak detection and repair of fugitive emissions (“leaks”) at reciprocating compressors, gas capture of centrifugal compressors from wet seals, and replacement of high-emitting pneumatic devices.
- **Co-Benefits** – Reducing methane emissions will also reduce - at no extra cost - conventional pollutants such as Volatile Organic Compounds (VOCs) and Hazardous Air Pollutants (HAPs) that can harm public health and the environment.
- **Royalty Revenue Loss on Federal Lands** – An estimated 54 Bcf of natural gas was flared or lost from upstream oil and gas operations on federal lands, representing a potential loss of royalties to the federal government. This figure includes natural gas lost through fugitives and venting to the atmosphere (26 Bcf) and gas sent to flares (28 Bcf). At a gas price of \$4/Mcf and a royalty of 12.5% of the gas value, this results in a royalty revenue loss of \$27 million per year to the federal government.



There are several caveats to the results:

- The inventory of methane emissions from Federal and Tribal lands, which is a subset of national emissions, is based on mapping the geographic coordinates of production wells to Federal and Tribal lands as available from United States Geological Survey. However, there are leases where the BLM has the surface rights but not the mineral rights, and vice versa. The USGS only identifies surface rights, and not mineral rights. Some tests indicate that this issue is not widespread. However, the inventory has this uncertainty to the extent that BLM does not have both the surface rights and mineral rights.
- We were not able to obtain direct information on processing, transmission, storage and distribution infrastructure on federal and tribal lands, so emissions estimates for these segments are based on the proportion of oil and gas production from these lands on a state-by-state basis. This approach, though based on the best available data, carries significant uncertainty and may overstate or understate midstream and downstream emissions in certain areas.
- Emission mitigation cost and performance are highly site specific and variable. The values used here are estimated average values.
- The analysis presents a reasonable estimate of potential cost and magnitude of reductions within a range of uncertainty.