# Natural Gas and GHGs

ConocoPhillips

2018

Greenhouse gases (GHGs) act as a blanket within the atmosphere to capture and radiate heat from the sun that would otherwise be reflected into space. GHGs, which are primarily water vapor, carbon dioxide, methane and ozone, constantly flow into and out of the atmosphere and are the result of either natural sources or human activity.

They are also needed for plant photosynthesis and respiration. Natural sources of GHGs include plant and animal decay, wetlands, wildfires and volcanic eruptions, whereas man-made sources include power generation, agricultural and industrial activities, transportation, deforestation, and home heating and cooking. The largest global anthropogenic methane emissions sources include agricultural activities, power production, landfills, wastewater treatment and biomass burning. Oil and natural gas (comprised mainly of methane) exploration, production, processing and pipeline transport activities account for less than 10 percent of global GHG emissions.

## U.S Regulations

Because of its potency as a GHG, a number of voluntary and regulatory initiatives have focused on reducing methane emissions. Oil and natural gas operators comply with emission regulations set by the U.S. Environmental Protection Agency (EPA) under the authority of the Clean Air Act. State and local governments may enact additional regulations.

We report GHG emissions from operated assets to the EPA and describe how we manage GHG emissions in our annual Sustainability Report.

## Reduced Emission Completions, Flaring and Venting

In the well completions process, gas and liquids flow back to the surface after hydraulic fracturing (also known as fracking) treatments and bring with them a portion of the injected fluids. Most wells are now completed using a process call green completions. In a green completion, operators bring temporary processing equipment to the well site to separate gas and liquid hydrocarbons from the flowback fluids. The gas is then captured to be flared or sent to pipelines for eventual delivery to consumers. Producers are working with service providers to design and manufacture green completion equipment and with pipeline companies to secure necessary permits, conduct required environmental impact assessments and construct pipelines. Both will help reduce flaring and venting over the long-term.

In some cases, green completions are not feasible due to a variety of reasons, including insufficient availability of gas pipeline infrastructure or when the gas is not suitable for recovery. Gases that cannot be captured and sold are either flared or vented if safety, environmental, or other conditions prevent flaring. Flaring is a controlled burning process that safely eliminates VOC and methane emissions, converting these to carbon dioxide and water vapor. ConocoPhillips avoids flaring and venting when possible.

## GHG Life Cycle Analysis

Life cycle analysis is a methodology that quantifies GHG emissions from the well through the entire value chain and can be used to compare the GHG emissions intensity of different fuels and technologies. For natural gas, this includes emissions from drilling, well completion, production, transportation, distribution and combustion. For coal, this

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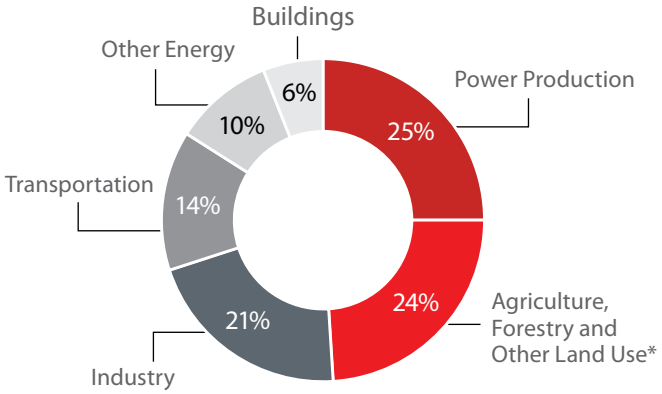
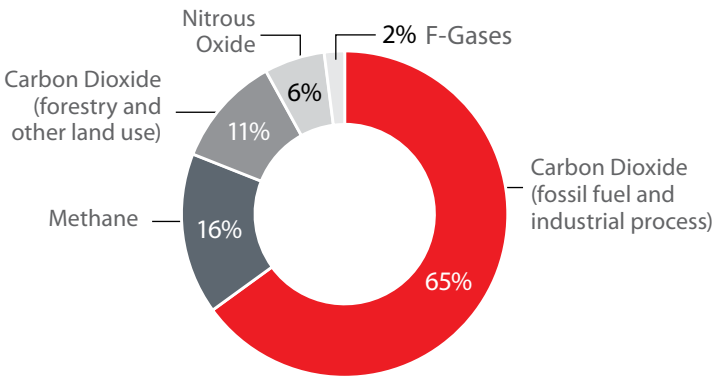
### Global Greenhouse Gas Emissions by Economic Sector




*Other Energy refers to all emissions from the energy sector not directly associated with electricity or heat production, such as fuel production, refining, processing and transportation.

### Global Greenhouse Gas Emissions by Gas




Greenhouse Gas data source: *https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data*

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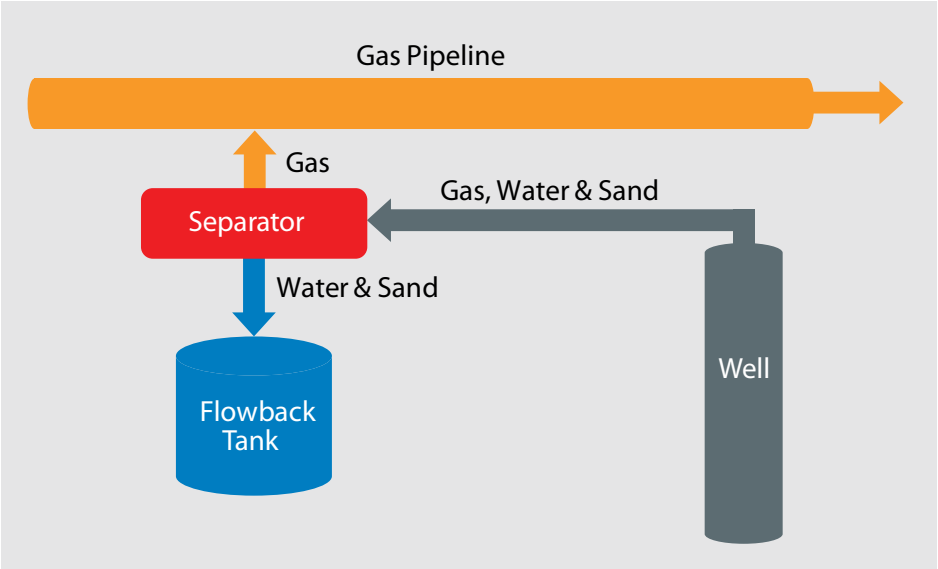
## Green Completion




**Typical steps of a green completion in a gas well:**

- Gas, water and sand flow from the wellbore to separation equipment.
- Water and sand are separated from the gas and sent by pipe to a flowback tank for disposal.
- The separated gas is routed to gas pipelines for eventual delivery to consumers.

includes emissions from mining, cleaning/washing, transportation and combustion. Life cycle analysis offers additional insight for policy makers because it recognizes the differences in fuel production, delivery and conversion processes. The 2017 World Energy Outlook report by the International Energy Agency (IEA) looked at GHG emission intensity and calculated the average global emission rate of methane in power at 1.7 percent. At an emission rate of 1.7 percent, the GHG emission intensity of power production for the full life cycle of natural gas is favorable in both the Intergovernmental Panel on Climate Change's 100-year global warming potential value and the shorter, 20-year outlook.

**50%**

**LOWER**

Lifecycle emissions of natural gas-fired plants compared to coal-fired power plants

Use of natural gas has surpassed coal in generating electricity. This increased use of natural gas has resulted in 20-year lows for carbon dioxide ($CO_2$) emissions from the power sector. Increased use of natural gas has also led to reduced emissions of criteria pollutants such as sulphur dioxide ($SO_2$), nitrogen dioxide ($NO_2$), and fine particulate matter (PM).

To add clarity to the ongoing debate regarding emissions associated with shale gas production, the American Petroleum Institute and America's Natural Gas Alliance recently released a study that examined 91,000 wells, 10 times the number that the EPA considered in its estimates that serve as the foundation for most life cycle analysis. The API study found actual natural gas production emissions to be 50 percent lower than the EPA's estimates, due to the industry's widespread use of green completions and the EPA's faulty estimates of volumes returned, durations, and frequency of refracturing. This is further proof of the advantage of natural gas over coal.

**For more information: www.powerincooperation.com**