

Natural Gas and Air Pollution

Natural gas consists primarily of methane, which makes up 70-90% of natural gas along with ethane, butane and propane.

Sources of Methane

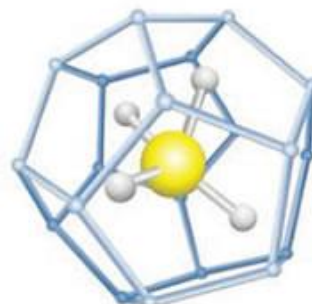
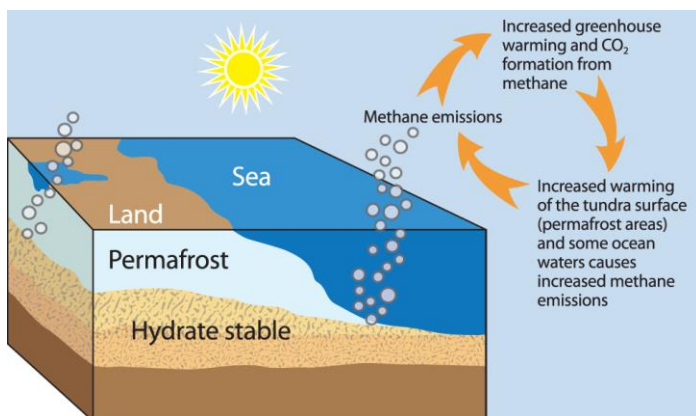
- The drilling and extraction of natural gas from wells and its transportation in pipelines results in the leakage of methane
- Enormous amounts of methane hydrate have been found beneath Arctic permafrost, beneath Antarctic ice, and in sedimentary deposits along continental margins worldwide.
- Other sources include rice paddies, cows, and bacteria in swamps and bogs

Methane Hydrates

- Methane hydrate is a central methane molecule surrounded by a "cage" of water molecules. Other hydrocarbon molecules such as pentane and ethane can occupy the central position in this structure.
- Methane hydrate is an "ice" that only occurs naturally in subsurface deposits where temperature and pressure conditions are favorable for its formation.
- In early 2012, a joint project between the United States and Japan produced a steady flow of methane by injecting carbon dioxide into the methane hydrate accumulation.
 - The carbon dioxide replaced the methane in the hydrate structure and liberated the methane to flow to the surface. This test was significant because it allowed the production of methane without the instabilities associated with a melting gas hydrate.

Natural Gas

- Natural gas emits 50 to 60 percent less CO₂ when combusted in a new, efficient natural gas power plant compared with emissions from a typical new coal plant
- Considering only tailpipe emissions, natural gas also emits 15 to 20 percent less heat-trapping gases than gasoline when burned in today's typical vehicle
- Cleaner burning than other fossil fuels, the combustion of natural gas produces negligible amounts of sulfur, mercury, and particulates.
- Burning natural gas does produce nitrogen oxides (NO_x), which are precursors to smog, but at lower levels than gasoline and diesel used for motor vehicles
- Every 10,000 U.S. homes powered with natural gas instead of coal avoids the annual emissions of 1,900 tons of NO_x, 3,900 tons of SO₂, and 5,200 tons of particulates
- $\text{CH}_4[\text{g}] + 2 \text{O}_2[\text{g}] \rightarrow \text{CO}_2[\text{g}] + 2 \text{H}_2\text{O}[\text{g}] + \text{energy}$
- CH₄ gas is 34 times stronger than CO₂ at trapping heat over a 100-year period
- Melting of sea ice causes a depletion of OH which then extends the lifetime of CH₄
- Releasing CH₄ can set a positive feedback into motion.



<https://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/environmental-impacts-of-natural-gas#.Wtf5HojwZPZ>

<http://chemistry.elmhurst.edu/vchembook/511natgascombust.html>

https://www.google.com/search?q=methane+feedback+loop&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjwk_in-NDaAhVB94MKHWbID-sQ_AUICigB&biw=689&bih=649#imgrc=vXnJdBkk6FGEeM:

<https://geology.com/articles/methane-hydrates/>

<http://naturalgassolution.org/what-is-natural-gas/>