

Greenhouse Gases

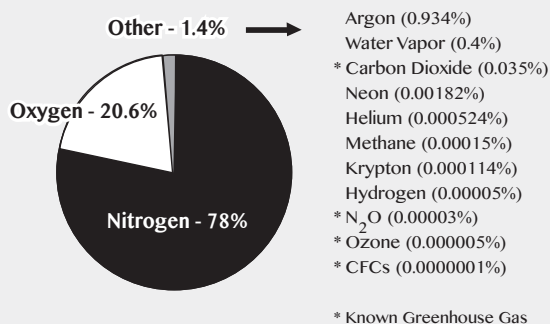
Gases that trap heat in the atmosphere are often called greenhouse gases. Some greenhouse gases such as carbon dioxide occur naturally and are emitted to the atmosphere through natural processes and human activities.

Water vapor is a greenhouse gas that has a variable composition in the atmosphere. Other greenhouse gases (e.g., fluorinated gases) are created and emitted solely through human activities. The Global Warming Potential (GWP) value is used to compare the abilities of different greenhouse gases to trap heat in the atmosphere. GWPs are based on the heat-absorbing ability of each gas relative to that of carbon dioxide (CO_2), as well as the atmospheric lifetime of the gas (the amount removed from the atmosphere over a given number of years)

The principal greenhouse gases that enter the atmosphere because of human activities are:

- **Carbon Dioxide (CO_2):** Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). Carbon dioxide is also removed from the atmosphere (or “sequestered”) when it is absorbed by plants as part of the biological carbon cycle. GWP = 1
- **Methane (CH_4):** Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills. GWP = 25
- **Nitrous Oxide (N_2O):** Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste. GWP = 298
- **Halocarbons:** Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful greenhouse gases that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting

Composition of the Earth's Atmosphere (Gases - Percent by Volume)



Source: <http://www.esrl.noaa.gov/gsd/outreach/education/climgraph/>

substances (i.e., CFCs, HCFCs, and halons). These gases are typically emitted in small quantities, but because they are potent greenhouse gases, they are sometimes referred to as High Global Warming Potential gases (“High GWP gases”). GWP = 1,430 - 22,800.

Greenhouse Gas Inventories

A greenhouse gas inventory is an accounting of the amount of greenhouse gases emitted to or removed from the atmosphere over a specific period of time (e.g., one year). A greenhouse gas inventory also provides information on the activities that cause emissions and removals, as well as background on the methods used to make the calculations. Policy makers use greenhouse gas inventories to track emission trends, develop strategies and policies and assess progress. Scientists use greenhouse gas inventories as inputs to atmospheric and economic models. Michigan (and many other states) has developed a greenhouse gas inventory.

Sources:
<http://epa.gov/climatechange/emissions/index.html> Michigan Greenhouse Gas Inventory http://www.michigan.gov/documents/deq/MI_Greenhouse_Gas_Inv_1990_2002_277467_7.pdf