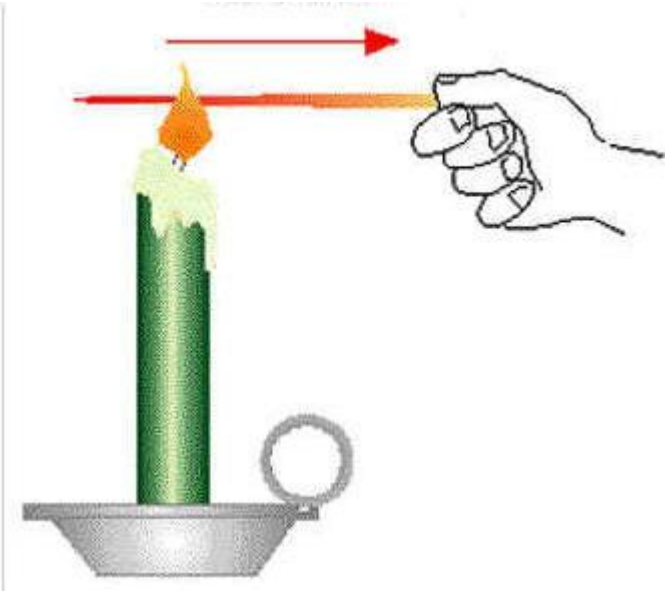
Heating the Atmosphere

Heat

- **When air transfers heat energy to a cooler object, the air temperature decreases**
- What are some ways that you can heat up an object?

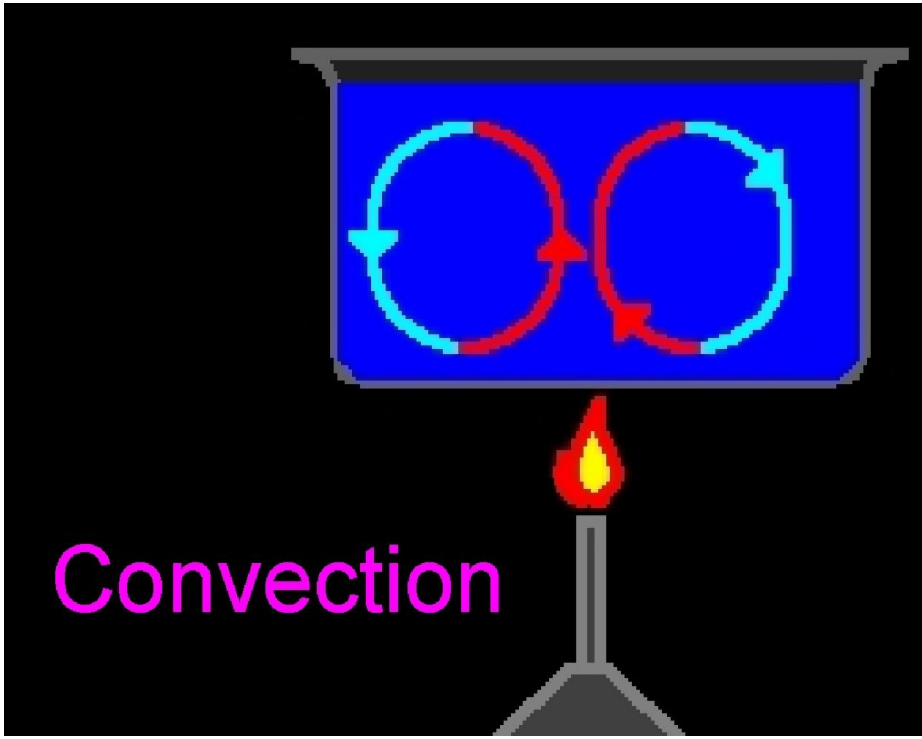
Conduction

- The transfer of heat through matter by direct contact.
- Heat flows from the warm object to the colder one
- Conductors vs. Non-conductors:
  - Some materials are very good at transferring heat, like metals (conductors), while others are not, like air (non-conductor)



Convection

- The transfer of heat by the circulation of currents within a substance.
- **When you boil a pot of water the warm water at the bottom of the pot expands and rises.**
  - This is called a convection current.



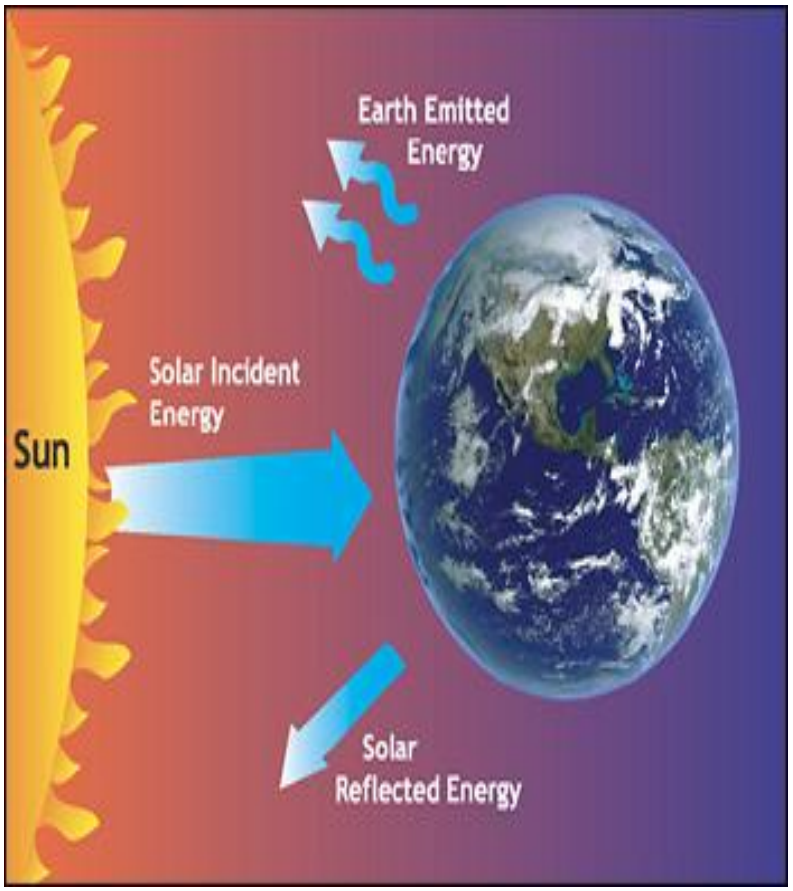
Radiation

- The transfer of heat through space by electromagnetic waves
- Most heating of the atmosphere comes from radiation

Solar Radiation

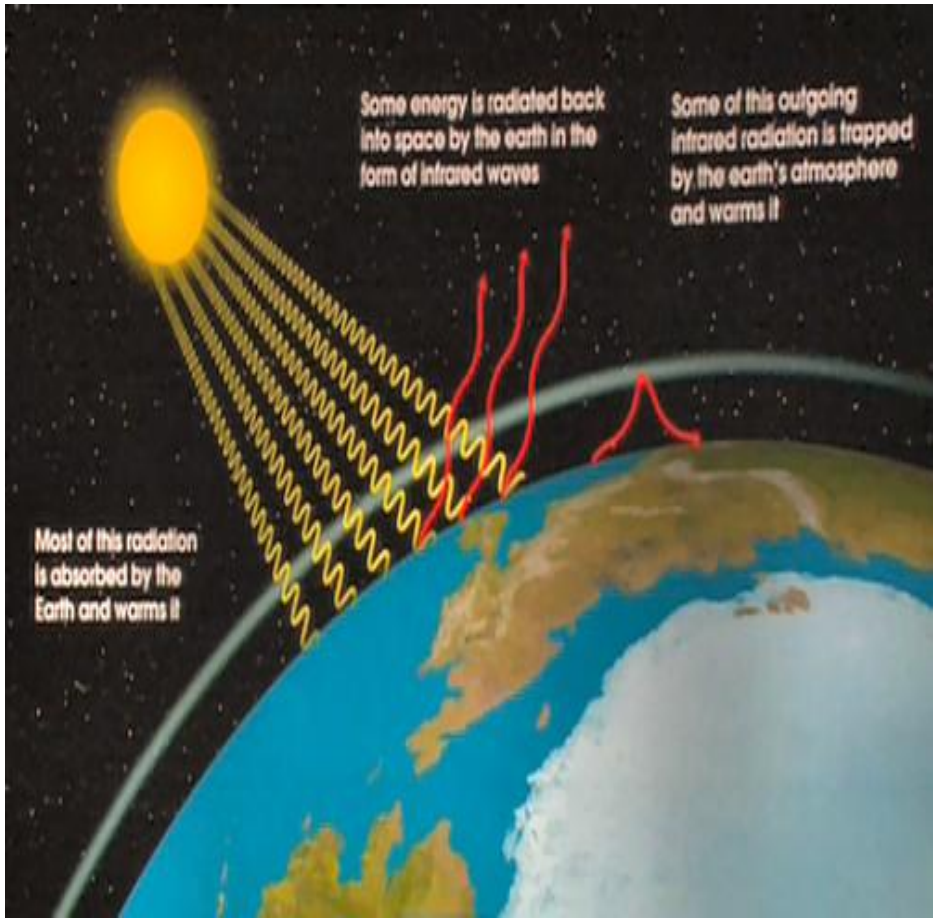
- When radiation strikes an object 3 results

1. Some energy is absorbed by the object
2. Substances such as water/air are transparent to radiation and transmit it (energy passes through it)
3. Some radiation may bounce off the object without being absorbed or transmitted.



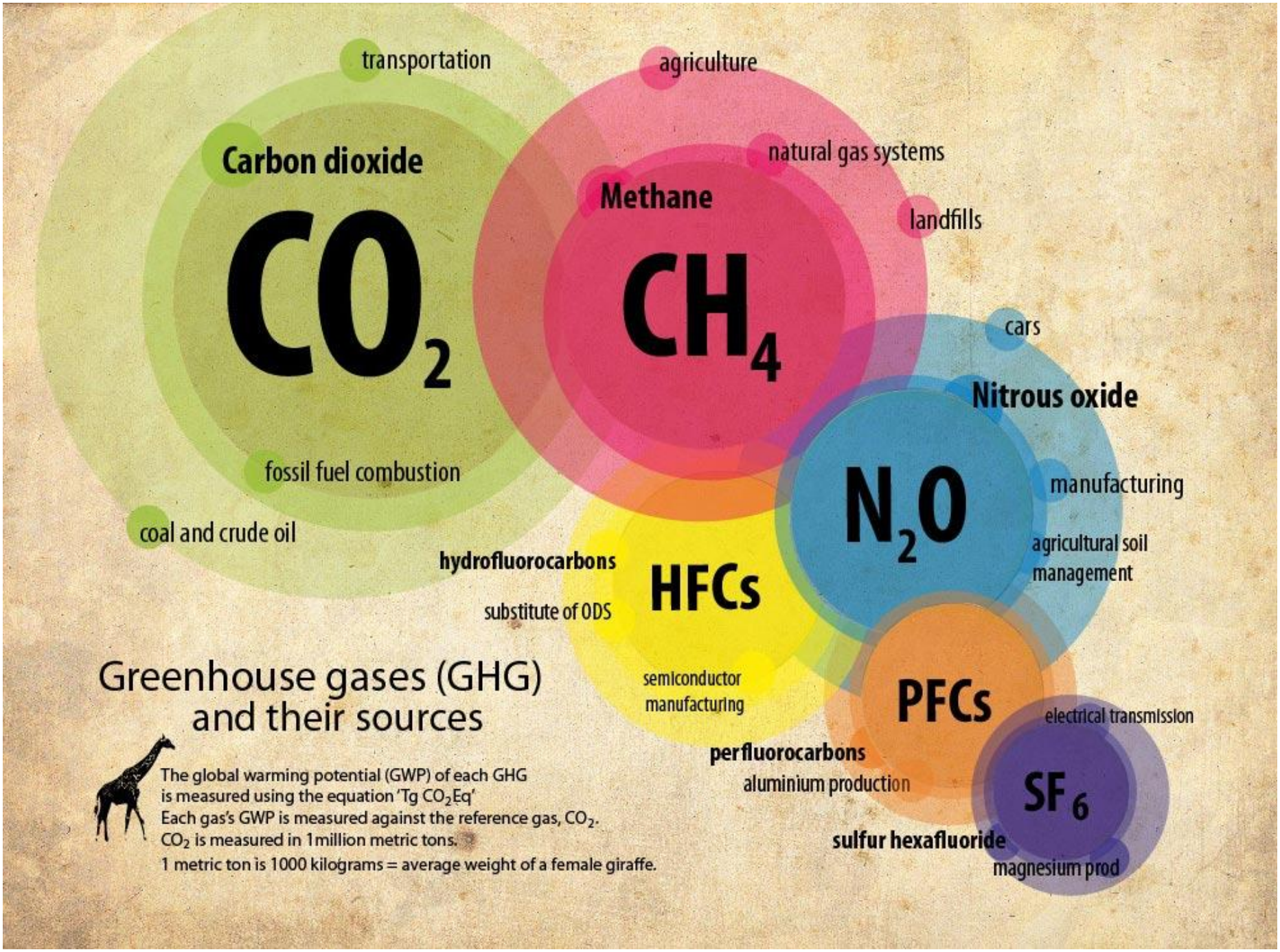
Greenhouse Effect

- **The Sun radiates energy to the Earth and naturally warms the lower atmosphere and surface**
  - Some heat re-radiates and escapes into space.
  - Some heat gets trapped by the atmosphere and warms the air.
- **Greenhouse gases in the atmosphere absorb some of the Earth's re-radiated heat, but are transparent to incoming solar radiation**



Greenhouse Gases

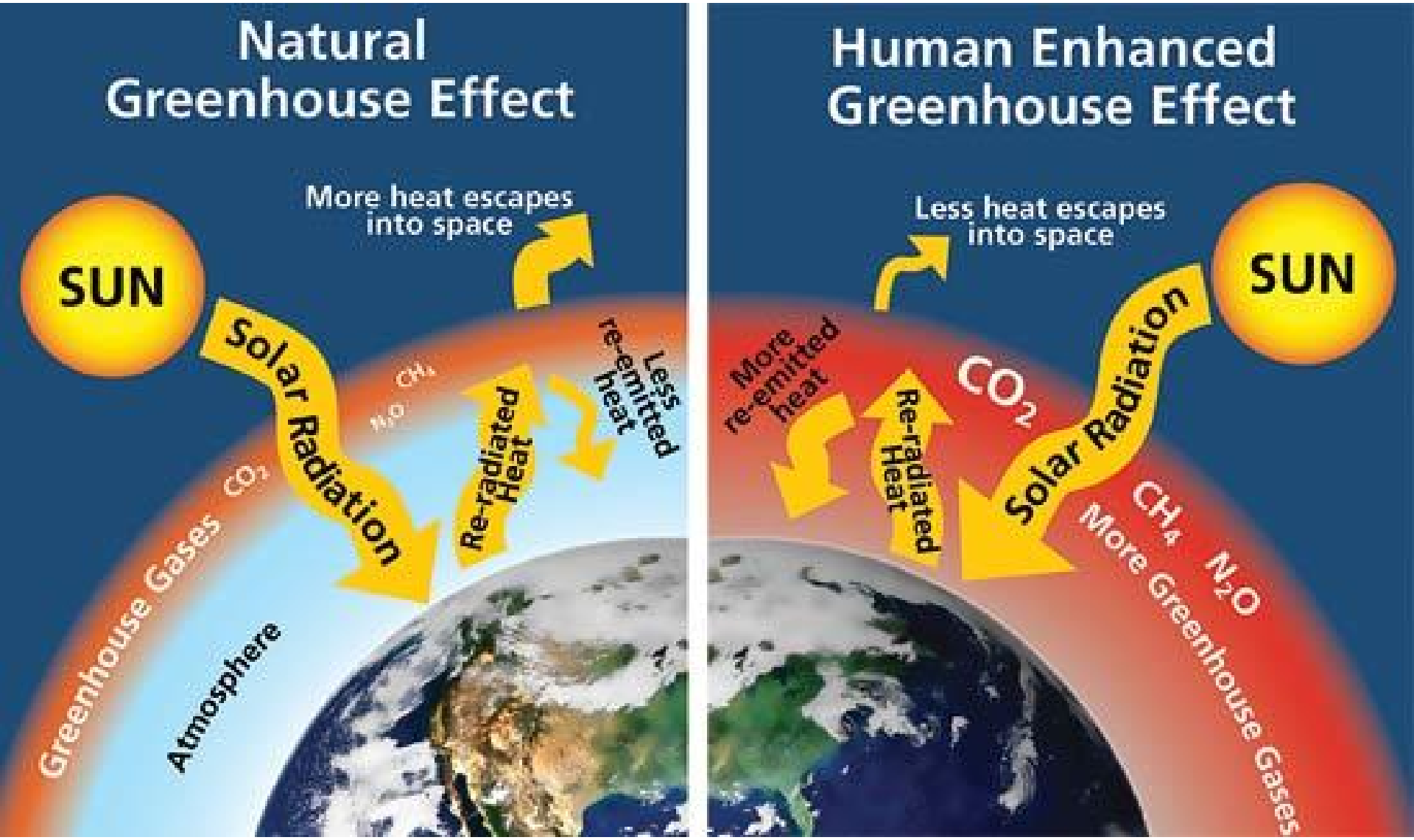
- Water Vapor (H_2O), Carbon Dioxide (CO_2), and Methane (CH_4)
- Carbon dioxide is most often the focus of public discussion
  - **Humans burning fossil fuels releases carbon dioxide into the atmosphere increasing the greenhouse effect leading to global warming.**
  - **Industrial factories could decrease the carbon dioxide levels in the atmosphere by transitioning from burning fossil fuels to using alternative energies**



Greenhouse gases (GHG) and their sources

The global warming potential (GWP) of each GHG is measured using the equation 'Tg CO_2Eq'
Each gas's GWP is measured against the reference gas, CO_2.
CO_2 is measured in 1million metric tons.
1 metric ton is 1000 kilograms = average weight of a female giraffe.

A human enhanced greenhouse effect leads to global warming



Why do some places heat differently?

- Global temperatures vary due to several things

Land vs. Water

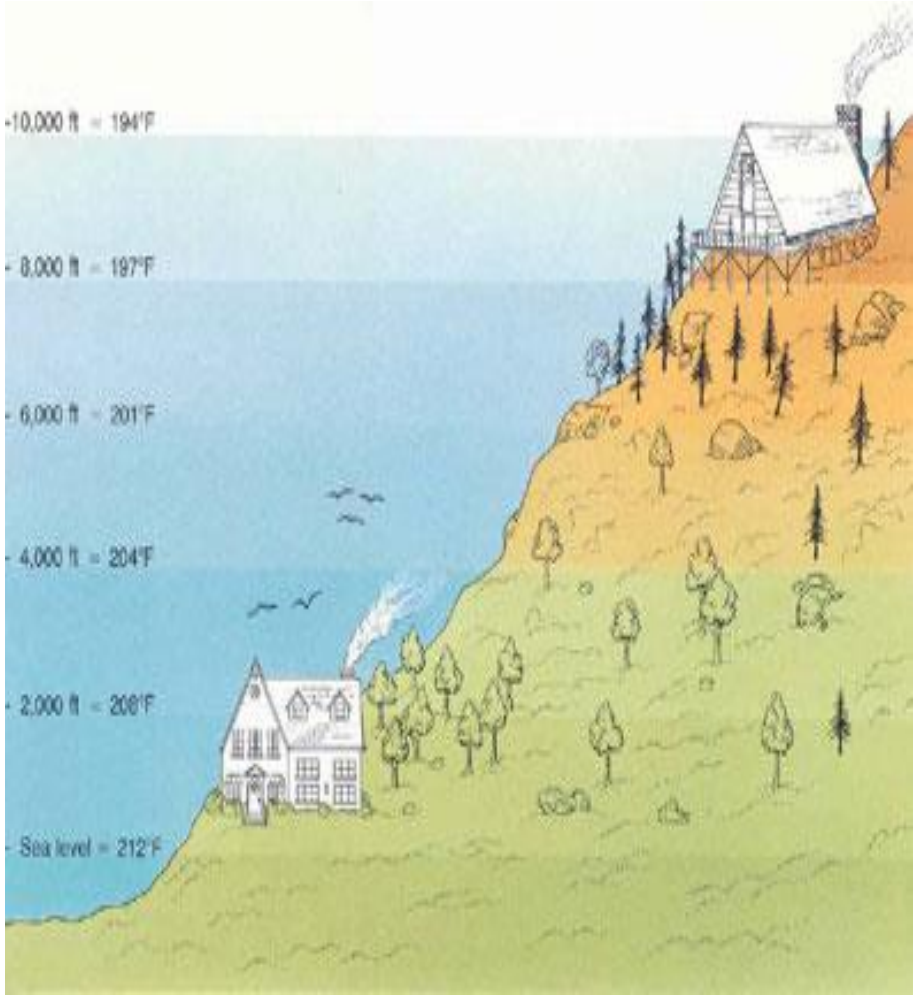
- **Land heats more rapidly than water**
- **Land reaches higher temperatures than water**

- How might this affect a coastal city vs. a land locked city?
  - **Temperatures of a body of water influence the temperatures of the air above it**

Altitude

- **Places at higher altitudes have cooler temperatures than places at lower altitudes**

- Ex. Boone vs. Wilmington



World Temperature

- **Isotherms- lines that connect points of equal temperature**
- By studying isotherm maps you can detect patterns and see the effects of phenomena.