Global Warming – Climate Change

- What do I need to know?
- What do I need to do?

Key Questions- ?????

- Is the earth's atmosphere warming?
- Is this warming causing climate change?
- Are humans impacting on this warming?
- If so, what can I do about it?

Is the Earth's Atmosphere Warming?

- Review global temps for last 150 years
- Variations in last 150
  - 19th century – constant; Rise in early 20th;
    Level off in mid 20th;
    Rapid rise 1990-2009 - Why?
- What causes this pattern?
  - Early – volcanoes, sun; Later – Burning fossil fuels
- Variations on global average temps
  - Land warmer than ocean; More increase towards poles
- Average temps have risen about 1.5 degrees since start of 20th century. Is this significant?

Indicators - Butterflies, Glaciers, and Hurricanes

- **Surface temps are <u>not</u> only indicators of warming**
  - Earths' inner temps; Upper levels of oceans; Lower levels of atmosphere warming - upper levels cooling
- **Earth's cryosphere (snow & ice cover) is decreasing**
  - Glaciers, Arctic ice, Ice caps, Ice sheets - Reflections
- **Weather patterns over decades show changes**
  - More extreme hot and cold; Precipitation changes, Night temps; Increase in hurricanes
- **Plants and animal species are moving**
  - NH moving northward and upward – 6 miles – 6 feet; Springtime events earlier : 2-3 days (per decade)

What Determines a Planet's Temperature?

- **Energy balance – between incoming sunlight and radiated heat loss**
- **Sun sends in ultraviolet rays; Planet sends out infrared rays – Earth balances out at zero (0) degrees**
- **Earth's atmosphere causes "greenhouse effect"**
  - Atmosphere is 80% nitrogen, 20% oxygen – transparent to sun's incoming rays and Earth's outgoing rays
  - Water vapor and CO_2 is transparent to sun's incoming ultraviolet rays BUT opaque to Earth's outgoing infrared rays – Result – increase in Earth's temp to 60 degrees

A Tale of Three Planets

- **Neighboring planets (Mars, Venus) can provide us with a "greenhouse experiment"**
- **Comparison of Temps – No Atmosphere**
  - Mars: -90 F; Earth: 0 F; Venus: 110 F
- **Comparison of Temps – With Atmosphere**
  - Mars: -120 F; Earth: 60 F; Venus: 500 F (melt lead)
- **Comparison of Atmospheres**
  - Mars: 1% (.01) of Earth's density; Cooler – reflects heat
  - Earth: 1.0 density – provides normal greenhouse effect
  - Venus: 100 times Earth's density – 96% is CO_2; All water is evaporated – powers greenhouse effect; CO_2 - permanent

The Human Factor

- **Three factors affect temps – two are natural, one is us**
- **1. Volcanoes**
  - Throws dust into air; forms clouds; decreases temps
- **2. Sun**
  - Burn rate varies; distance from Earth; tilt of Earth axis
- **3. Anthropogenic – caused by humans**
  - Burn fossil fuels – increases CO_2 in atmosphere
- **Other factors**
  - Methane (minor); Aerosals – particles in air
- **Why blame us?**
  - Strong correlation – CO_2 , higher temps; Natural causes - varying effects; Dominant correlation in recent decades has been anthropogenic

Projected Impact of Climate Change - 2100

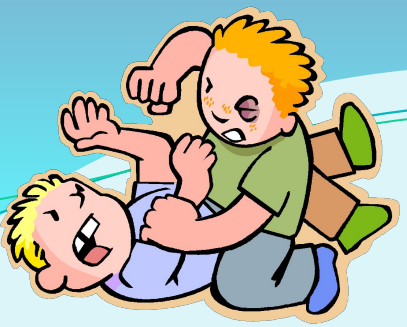
- **There will be a steady rise in global temps**
  - Most likely 3-8 degrees; Drop of 11 degrees would bring new Ice Age; Increase of 9 degrees – tropics in NH
- **Extreme weather events will increase – greater fluctuation in weather**
  - Heat waves; Intense precipitation; Droughts; Intense tropical storms

- **Sea levels will rise**
  - Average will be 6”- 18” (maybe 20); Caused by warmer water, not melting ice; Salt water will encroach on fresh
- **Polar advances of species will accelerate**

What to Do? – Replace Fossil Fuels

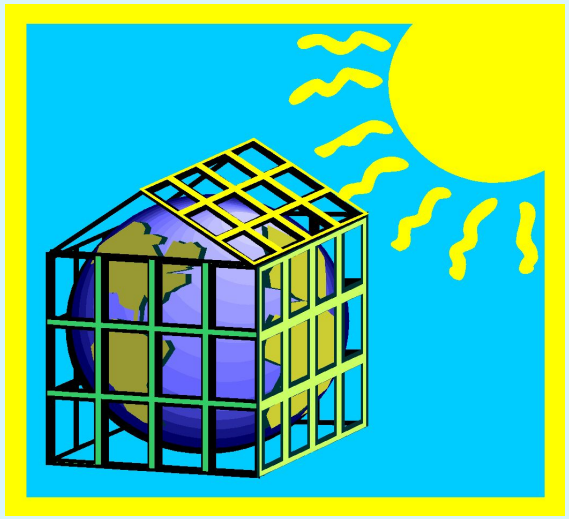
- **Two questions:** 1. Do we have it? 2. Can we get it?
- **Three main sources of energy:**
- 1. **Sun**
  - Solar, Wind – Expensive; Limited; Variable availability – cloud cover, no air moving

- 2. **Fossil Fuels**
  - Natural gas – burns cleaner; Oil – running out (decades left); Coal – dirtiest, but most abundant (300 years left); Nuclear – cleanest, but most dangerous
- 3. **Tidal waves**
  - Rivers, dams, ocean waves – limited, most being used already



Why is Global Warming So Controversial?

- Some people insist this is just an unproven theory
- Scientists have trouble communicating this to the general public
- Climate change can be confusing and upsetting to people
- Solutions will have serious economic and lifestyle impacts
- Political differences among government leaders impacts progress towards solutions



What to Teach Students?

- 1. There is a difference between weather and climate
- 2. Global warming is accelerating and is caused mainly by humans burning fossil fuels
- 3. Global warming is causing climate change and will have a significant impact on people and nature
- 4. Earth's temperatures will most likely rise 3-8 degrees by the year 2100.
- 5. Sea levels have already risen and are projected to rise much more
- 6. There is scientific consensus that global warming is causing climate change and presents us with some serious challenges

What to Teach Students? (2)

- 7. Governmental leaders from many countries are working on international agreements to deal with climate change
- 8. New technologies must be developed to stabilize and reduce greenhouse gases
- 9. Saving energy and developing alternative energy sources will help
- 10. Every individual person can take actions daily to help with this situation

What can Students and their Families Do?

1. Turn off electrical devices when not in use
2. Take shorter showers
3. Close blinds/drapes on hot, sunny days
4. Turn off lights when you leave a room
5. Switch to fluorescent light bulbs
6. Plant trees
7. Combine and reduce trips in cars
8. Recycle whenever possible
9. Purchase recycled products
10. Spread the word – encourage wise energy consumption

Global Warming Websites

- **List of Websites**
  - **www.Knowledge.Allianz.com**
  - **En.wikipedia.org/wiki/Global_warming**
  - **www.epa.gov/climatechange**
  - **www.gobalwarming.org**
  - **www.climatehotmap.org/**
  - **NationalGeographic.com**
  - **www.nwf.org/globalwarming**
  - **www.sierraclub.org**
  - **kanewd@earthlink.net (North Carolina information)**