PLS 209 – Environmental Politics
Mark T. Imperial

Topic: Global Warming

Greenhouse Effect

- When visible light is scattered and absorbed at the earth's surface it changes into heat, part of which is trapped in the lower atmosphere by carbon dioxide gas and water vapor, and is then re-radiated back to the earth's surface
  - The carbon dioxide and water vapor (among other gases) perform like the glass in a greenhouse trapping in the heat
  - This natural process helps explain why the earth is warm
  - However, the build-up of greenhouse gases is hypothesized to increase this natural phenomenon – a process known as the *greenhouse effect or global warming*
  - See the issue memo and chapter for evidence of warming and increased concentrations of carbon dioxide at the Mauna Loa Observatory and various estimates of warming (between 1.5 degrees and 8.1 degrees Celsius
- *Carbon dioxide* is the major concern because it is the most prevalent greenhouse gas. Thus, most studies of global warming examine the sources and sinks for carbon dioxide
  - It is not an EPA criteria air pollutant and it is about .036% of the atmosphere
  - While it is a small part of our atmosphere, the levels have increased by about 30% since the start of the industrial revolution
  - Fossil fuels account for over 70% of anthropogenic carbon dioxide emissions
  - It does not adversely affect human health
  - *Naturally* it comes from volcanic emissions, weathering of carbonate rocks, natural forest fires, plant and animal respiration, decomposition of organic matter, release from sea water
  - *Anthropogenic sources* include power plants and industrial processes fueled by fossil fuels, cars, land conversion/slash and burn agriculture, and homes heated by wood, oil, or natural gas
  - Natural processes known as *sinks* remove gases from the atmosphere. Two important carbon sinks include:
    - Photosynthesis whereby vegetation, trees, lichens, and algae consume carbon dioxide
    - Uptake by ocean waters whereby it is used to form carbonates and bicarbonates
  - Unfortunately, it is being added to the atmosphere faster than natural sinks can remove it
- *Methane* is formed when organic matter decomposes in wet, oxygen deprived environments such as swamps, bogs, wetlands, and rice paddies. Methanogenic bacteria facilitate this process. It is also released in the gastrointestinal systems of cattle
  - About .0002% of the atmosphere and is also a natural component
  - Methane levels are rising and it is a more potent greenhouse gas than carbon dioxide (about 20 times more potent)
  - Main sources of this increase are wetland areas (rice agriculture) and cattle ranching
  - Methane levels have more than doubled since preindustrial times
- *Nitrous oxide* is formed through bacterial decomposition of manure and fertilizer, decay of plant and animal matter, and forest fires

  - Levels have risen only slightly but the gases are a concern because they are 200 times more potent than carbon dioxide
- *Chloroflourocarbons (CFCs)* are used as refrigerants in air conditioners, food coolers, and freezers. Unavoidably, CFCs find their way into the stratosphere that depletes ozone levels
  - As greenhouse gases, CFCs are about 10,000 times more potent per molecule than carbon dioxide
  - 1987 Montreal Protocol and subsequent agreements have banned the production of CFCs in industrial countries starting in 1996 and worldwide production should cease in 2002
- *Ozone* is also a greenhouse gas. In the stratosphere, it shields life from harmful UV radiation and plays no role in global warming. In the lower atmosphere (troposphere), ozone in the form of photochemical smog traps IR and behaves as a greenhouse gas
  - Ozone levels in the lower atmosphere are too low to affect global warming

Other Natural Processes Influencing Global Temperatures and Weather

- *Urban heat island effect* is when temperatures in urban areas tend to overestimate true air temperatures because urban structures absorb and re-radiate heat. Many climate observations are made in urban areas that have grown over time, thus magnifying the actual temperature change due to global warming.
- Sulfate aerosols, very small solid particulate matter, reflect a small fraction of incoming energy back into space causing global cooling
  - One of the major sources is volcanic eruptions.
  - In 1991, Mount Pinatubo in the Philippines and Mount Hudson in Chile ejected about 60 million tons of sulfur dioxide into the atmosphere. This resulted in a cooling of about .3 degrees Celsius or about 38% of the previous 118 years of warming
  - They also come from combustion of fossil fuels containing sulfur (coal), coal boilers, and coal smelting of ores
- El Nino/La Nina
  - It is a major shift in pacific ocean temperatures that leads to changes in weather patterns
  - El Nino occurs every 2 to 10 years and is represented by the warm waters from the central Pacific flowing eastward as the westward flowing tradewinds are interrupted. This change in wind patterns and ocean temperatures influences rainfall patterns and fisheries
  - La Nina refers to unusually cold ocean temperatures in the central and eastern Pacific. It occurs when eastward blowing tradewinds intensify the upwelling of deep, cold waters off Peru and Ecuador

Converting Science into Policy

- Legitimate differences and uncertainty is amplified because many of the greenhouse skeptics repeatedly advised policymakers to defer action
  - They argued that even if the risks turned out to be serious, the penalty for another decade of inaction would be small
  - Almost from the beginning of international negotiations divisions between the U.S. and its traditional allies over the interpretations of greenhouse science threatened to scuttle plans for a treaty with binding commitments
  - U.S. negotiators argued that there was too much uncertainty to justify abatement measures that would inhibit economic growth

  - The fact that a majority of scientists believed in global warming was not sufficient in and of itself to reject the arguments of the skeptics because the "tyranny of the majority" can be just as damaging to good science (remember, scientists were once nearly unanimous that the earth was flat)
  - Debate has been fueled by the lack of agreement between models and disagreement over model design and the accuracy of the data used in the models
  - Debate has also been fueled by legitimate gaps in scientific understanding about such things as the role of the oceans, inconsistencies in temperature measurement, the role of clouds and other positive and negative feedback loops, the role of carbon sinks, variations in solar output, the effects of volcanic eruptions, shifts in ocean currents (e.g., el nino), slight changes in the earth's orbit and rotation, etc.
  - There is agreement that carbon dioxide is rising, temperature appears to be rising (albeit slower than most models predict), that world carbon dioxide and other greenhouse gas emissions will continue to rise if no action is taken, that resulting warming will be greater at higher latitudes than at the equator
- Public in the U.S. is generally more concerned about other environmental issues even though global warming gets a lot of press and there have been record heat waves
  - It is an example where science pushed an issue onto the policy agenda without any catastrophic event (e.g., Three mile island, Love Canal)
- Many policy questions confound the greenhouse debate
  - Is the threat real? What counts as proof? Who is an expert?
  - What is the net present value of an avoided climatic catastrophe? Is it possible there is actually a net benefit?
  - What is the opportunity cost of trying to stabilize greenhouse gas emissions at 7% below 1990 levels f future population growth and increased emissions from developing countries swamp the gains
  - What are the costs of acting now versus waiting to act in the future? Perhaps future technologies will offer a more cost effective solution?
  - What are the political costs of acting now? If the greenhouse effect does result in dire consequences, the politicians in office now will no longer be in office when the impacts are observed. Conversely, acting now may result in great political cost with no visible benefits.
  - Is prevention better (i.e., cheaper) than adapting to future climate changes?
  - Is the threat cumulative? Are there threshold effects? Are there irreversible outcomes?
- Basic policy options (see Hemple 1996, 110 – 111)
  - *Inaction*: wait for the results of future studies
    - Current U.S. position on Kyoto Protocol
    - While it could turn out to be the most expensive option, it is possible that acting hastily could prove costly or cause money to be spent on ineffective policy remedies
  - *Adaptation* to future climate changes (e.g., sea walls to hold back the seas)
  - *Sequestration* (absorption) of greenhouse gases through forestation and other geoengineering and biochemical scrubbing processes
  - *Prevention and reduction* of greenhouse gas emissions (e.g., switching to carbon free fuels)

- Kyoto Protocol
  - Origins are the 1992 Conference on Environment and Development ("Earth Summit")
    - President George Bush and the official U.S. delegation were widely criticized for their reluctance to take a leadership position and their objections to different agreements being negotiated
  - In 1992, President Clinton agreed to stabilize greenhouse gas emissions at 1990 levels by the year 2000, thereby reversing the Bush administration's policies
    - However, no action was taken to achieve this promise during Clinton's eight years in office
  - Kyoto Conference in late 1997
    - NGOs played an important role, pressuring many of the countries in attendance
    - In the U.S., Car manufacturers, utility companies, and petroleum producers were joined by unions in opposing cutbacks of fossil fuel emissions.
    - Projected economic costs were quite high at the time and have since increased further.
    - Republican Congress did not support the agreement
    - Poor and developing countries objected to being required to have emission reductions arguing that they didn't have the money and that it was unfair since they should have the opportunity to develop their own economies
    - For some time it was unclear whether the U.S. would agree to tough greenhouse gas emissions. Then, Vice President Al Gore gave an important speech committing the U.S. to greenhouse gas reductions and agreeing to negotiate a binding agreement
    - By agreeing to the draft treaty, the U.S. pledged to
      - A set of binding emission targets for the 6 greenhouse gases which for the U.S. amounted to a 7% reduction in 1990 levels
      - Achieve emission targets over a set of five-year budget periods
      - Join other countries in accepting an emission trading regime
      - Permit joint implementation such that one country could get credit through emission reductions in other countries
      - Encourage developing nations to join voluntarily
    - Treaty would enter into force when 55 countries accounting for at least 55% of the total 1990 carbon dioxide emissions of developed countries ratified the agreement
    - Developing countries including China and India are not subject to binding reductions
    - Many climate modelers see only marginal changes in predicted temperatures even if agreement was fully implemented
    - In 1998, the U.S. Senate voted 95 – 0 that they had no plans to support the treaty in its current form
    - The U.S. has withdrawn its support of the Kyoto Protocol under President Bush although other nations have decided to continue forward after the latest round of negotiations in July 2001.
    - It is unclear if Japan will ratify the agreement. If they don't, then the treaty is unlikely to enter into force