PLS 209 – Environmental Politics
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Topic: Energy Policy

Definitions and Terms

- Energy policy is environmental policy
  - Most forms of energy production on which the U.S. depends create significant, and often adverse environmental impacts. Any change in the amount, variety, or duration of U.S. energy production of consumption therefore has some impact on the environment
  - Link between energy and the environment is so strong that the nation's environmental agenda for the next decade will be inherently linked to energy policy
  - Energy conservation ranks in priority only behind global warming and ozone destruction
- *Primary energy sources* include coal, petroleum, natural gas, wood, and nuclear fuels as well as geothermal, hydroelectric, solar, and wind power.
- *Secondary energy* is electricity generated using primary energy sources
- *BTU* is the amount of energy needed to raise the temperature of 1 pound of water by 1 degree Fahrenheit
- One *watt* is the rate at which energy is produced or consumed. 1 watt = 1 joule/second
  - One *kilowatt* (kW) is 1,000 watts
  - One *megawatt* (MW) is 1,000,000 watts.
  - A small hydroelectric dam might produce 1,000 kW (1 MW) – enough to power about 330 typical American homes.
  - A large coal-fired power plant or nuclear reactor may generate 1,000 MW (1 *gigawatt*). This is enough for about 330,000 homes
- *Base loads* are minimum power levels needed day and night to meet normal electricity requirements
- *Peak loads* are additional loads placed on the power grid due to such things as summer air conditioning, heating, cooking during the dinner hour, etc.
- *Nonrenewable resources* refer to the fact that there are limited quantities of fossil fuel, especially oil and natural gas (there is quite a bit of coal), which causes concern about when they will run out.
- *Renewable sources* of energy are not depleted when they are used
  - This does not necessarily imply that they have no adverse impacts. There can still be significant environmental externalities associated with renewable resources
  - In terms of energy, sustainable means tapping renewable sources of power in ways that create few environmental externalities

Energy Use

- American Petroleum Institute data suggest that 76.5 million barrels of oil are consumed worldwide daily
- There is a 95% probability that global oil supplies will last until 2056
- In 2000
  - 86% of the worlds energy depends on fossil fuels
  - 12% is hydroelectric and nuclear
  - Alternative sources such as solar, wind, geothermal, and biofuels is about 2%

  - See Figure 9.11 for projected U.S. and World energy demand
- About 86% of all energy consumed in the U.S. comes from petroleum, natural gas, and goal and this has big ecological consequences
  - Transportation and fossil fuel combustion annually produce 34% of the volatile organic compounds, 78% of the carbon monoxide, and 85% of the sulfur dioxides, and 95% of the nitrogen oxides
  - Coal is responsible for about 50% of electricity generation. The land area disturbed by coal mining in the U.S. had reached more than 5.7 million acres, roughly the size of New Hampshire
  - During the 1990s there were more than 9,000 large spills of hazardous substances, most of which was petroleum
- Other than a brief period emphasizing conservation in the late 1970s, our energy policy (or lack thereof) has generally focused on production
  - Despite federal programs pushing energy efficiency, our economy has achieved great strides in terms of energy efficiency
  - Since 1973, the U.S. economy has grown 5 times faster than energy use

Oil and Natural Gas

- *Petroleum* is a thick, dark oil composed of organic chemicals, most of which are made up solely of hydrogen and carbons, hence they are commonly referred to as hydrocarbons
  - It is formed slowly through geologic eras spanning 60 to 600 million years.
    - Organic matter accumulates in sediments and the build up of successive layers of sedimentation exerts increasing pressure and temperature.
    - A series of biological, chemical, and physical reactions take place
    - Petroleum and natural gas then collect in porous sandstone and limestone formations in the earth's crust.
  - The terms oil, crude oil, and petroleum generally mean the same thing while fossil fuels refers to coal, natural gas, and petroleum.
- Petroleum occurs as solids, liquids, or gasses depending on the number of carbon atoms.
  - One to three carbon atoms (methane, ethane, and propane) is natural gas, which is free of sulfur impurities and burns cleaner than coal or petroleum
  - Five to about 38 carbon atoms are liquids such as octane, a common component of gasoline
  - Compounds greater than 40 carbon atoms are solids such as the chemicals found in paraffin
- Discovered in 1859 in Titusville, PA
  - Originally became important because one of its components, kerosene, could be burned in street lamps and lanterns instead of whale oil
  - Soon discovered that oil burned cleaner and was easier to transport than coal
  - Invention of the automobile soon spurred demand for gasoline
- Unclear how long reserves will last but we are heavily dependent on foreign sources
  - Some suggest that the reserves will last until around 2050. Others suggest that production will start declining and become more expensive in 2010. It is possible that world consumption is or will soon outpace world production as a result of declining U.S. and Russian production and increased consumption in Eastern Europe and Southeast Asia

  - U.S. dependence on foreign oil declined sharply in the years following the second oil shock in 1978 but then gradually started to increase
  - U.S. oil production is dwindling and in 1997 was at its lowest level since 1954
  - Oil production in Alaska is now at about half the peak rate of the 1980s. Proposals to open up ANWR, in part, are tied to a desire to increase production in Alaska.
- Oil refining
  - As crude oil is heated in a *fractioning tower*, various oil fractions are distilled (boiled off) and collected at different elevations in the tower. Small molecules near the top with relatively low boiling temperatures (gasoline), higher boiling at the middle (kerosene), with higher still near the bottom (gas oil).
  - *Catalytic cracking* allowed hydrocarbons in the gas-oil fraction to be split (cracked) into smaller molecules. The small molecules can then be reformed to make aviation fuel or gasoline. It also allows other materials such as synthetic rubber, plastics, etc.
- Natural Gas
  - Natural gas is expected to constitute about 90% of the projected increase in electricity generation between 1999 and 2020
  - About 85% of natural gas is produced domestically with almost all of the rest coming from Canada
  - With natural gas price increases, it may soon become cost effective to import natural gas from abroad but it is expensive and more risky since it must be liquefied and transported by sea
  - Natural gas prices are set regionally rather than on a world market since it is shipped primarily by pipelines and trucks.
  - Increased prices in the U.S. are occurring as a result of increased demand.
    - Demand comes from new power plant construction – clean air requirements encourage cleaner burning natural gas and plants can be constructed quickly.
    - Increased use for heating homes as well as additional homes and uses
    - Clean air act regulations are beginning to require use of low sulfur coals, which is causing some power plants to switch to cleaner burning natural gas

Coal

- Coal continues to be the most abundant fossil fuel
  - U.S. is the Saudi Arabia of coal
  - Its use is likely to dominate energy production in some countries such as China and the US where many Midwestern power plants burn coal
  - Widely used because it is cheap. Older plants in the Midwest often produce electricity for $.02 per kWh or less
  - Coal peaked at 62% of the world's energy in 1910 and is now at 23% in dropping even though the price of coal is dropping
  - More than 200 billion tons of coal, perhaps a fourth of the nation's reserves, lie below western lands under the jurisdiction of the DOI
- Lots of health problems with coal.
  - Miners get "black lung" from coal dust. Explosions, falls, and other accidents make coal mining one of the most dangerous occupations

  - Particulates from combustion lodge deep in the long and cause a range of respiratory and heart problems
  - Coal smoke contains carcinogens
- Many major environmental problems such as acid rain, climate warming, and smog are caused by coal
  - 9 of the 10 most air-polluted cities in the world burn coal
  - Burning coal releases nitrous oxide that reacts with sunlight to cause ground-level ozone
  - Sulfur content leads to acid rain
  - Efforts to reduce air pollution often involved building taller smoke stacks which spread the problem over a larger area
  - It is the most carbon rich fossil fuel making it bad for global warming
  - Many developing countries like China are repeating the same mistakes that developed countries made with respect to their heavy reliance on coal. Today, many cities in China experience the same air quality problems the U.S. experienced decades ago
- After the oil shocks of the 1970s, Reagan pushed for expanding coal mining on western public lands
  - Accelerated coal combustion could reduce our reliance on oil and bring tens of thousands of jobs to poor areas of Appalachia and the west
  - Proposals caused a backlash by environmentalists
- Not all coal is created or mined the same way
  - Virtually all of the coal mined west of the Mississippi and half of that produced in Appalachia is surface mining
  - Surface mining is preferred by the coal industry because it is cheaper, more efficient, more profitable, and less labor intensive
  - 1.5 million acres of land has been disturbed by surface mining despoiling natural landscapes and habitat
  - Coal in Appalachia and much of the mid-west has a higher sulfur content than western coal or Indonesian coal. As the 1990 CAA amendments have phased in, it is causing some of the higher sulfur coal mines to go out of business. The power play between high and low sulfur coal states was one of the important dynamics in the debate over the 1990 CAA.

Nuclear Power

- Concerns over global warming and the "greenhouse effect" have sparked new interest in nuclear power
  - It is a carbon free energy source. Eight ponds of enriched uranium can produce the energy equivalent of 6,000 tons of oil or 8,000 tons of coal and a large reactor can generate enough electricity to power 1.5 million homes
  - Public opinion is still against but not nearly as much as it used to be
  - There is a new generation of smaller, safer reactors. New designs have additional safety systems and are standardized in order to reduce operation and training costs
  - Environmentalists still object to the ecological risks and technological difficulties including the lack of a safe permanent disposal facility

- *Isotopes* are atoms that are different forms of the same critical element and therefore have different physical properties
  - Hydrogen has regular hydrogen (1 proton in its nucleus), deuterium (1 proton and 1 neutron in its nucleus), and tritium (1 proton and 2 neutrons)
  - Uranium. Natural uranium contains 99.28% uranium-238 and .72% uranium 235.
  - *Nuclear fuels* are enriched to about 3% uranium-235 while nuclear bombs are enriched to about 90% or more. *Isotropic enrichment* (gaseous diffusion) can be carried out to any desired level
- Atomic fission revealed that splitting atoms of uranium released large quantities of energy
  - $E = mc^2$
  - Einstein's equation provides a way to calculate how much energy is created
  - If 5 grams of matter were converted into an equivalent amount of energy it would power New York City for over a year
  - Nuclear reactors are based on creating a self-sustaining chain reaction
- First nuclear reactor was created by Enrico Fermi in 1942 under the grandstands of the University of Chicago football stadium and was important to the Manhattan project
- In 1953, President Eisenhower gave his atoms for peace speech and sparked a new industry
  - Even though there was no energy shortage, he urged their construction believing that it would bring cheap energy.
  - Government subsidized initial research and development and assumed the costs of mining and refining nuclear fuels and shared patents
  - Industry prospered in the early to mid 1970s as a result of benevolent regulation and government subsidies
  - All of this changed by the late 1970s. The Three Mile Island accident in 1978 combined with the release of the film China Syndrome 12 days earlier demonstrated the dangers as well as solidified opposition to nuclear plant construction in the US by environmental groups and other activists.
  - Chernobyl's core meltdown in 1986 gave further fuel to the anti-nuclear movement.
  - Both examples illustrate that safety systems can and do fail and human error is often at the heart of these accidents.
- Types of nuclear reactors
  - See advantages and disadvantages of coal and nuclear plants listed in *Table 10.1*
  - In U.S. nuclear reactors, the fuel is configured as small pellets of uranium dioxide. *Pellets* are stacked in *rods* about 15 ft long. As many as 250 fuel assemblies made up of 50,000 rods are loaded into a reactor core. They are immersed in ordinary water that serves as a neutron moderator and reactor coolant
  - *Pressurized water reactors (PWRs)* heat water under high pressures, which prevents the water from boiling. A heat exchanger transfers heat to a secondary loop outside the reactor core
  - In a *boiling water reactor (BWR)* the water surrounding the fuel boils producing steam. Spent steam is condensed using cooling water or a cooling tower and is recycled
  - Several new types of reactors have been proposed such as the pebble-bed reactor. The new generation of reactors is safer, smaller, and will be of a standardized construction to reduce training costs and improve operational efficiency. (See handouts)

- Reactor Construction
  - Have both primary and secondary containment structures
  - *Control rods* positioned above or below the reactor core create nuclear fission. They are made of materials that trap neutrons. When they are inserted, they slow down or stop nuclear fission
- Problems with Nuclear Power
  - Both short and long-term waste disposal problems as a result of nuclear power, military weapons programs, hospitals, research facilities, educational institutions, and uranium mining.
  - *High level radioactive wastes* are materials that release significant quantities of potentially damaging radiation – spent fuel rods from nuclear power reactors are an example
    - More than 100 million gallons of high-level waste is stored in temporary containment facilities in ID, NY, SC, and WA
  - *Transuranic wastes*: Radioactive by-products of reactor fuel and military waste processing remain dangerously radioactive for long periods of time. Plutonium-239 has a half life of 24,000 years while others can exceed 200,000 years
  - *Spent nuclear fuel*: Spent fuel rods are now stored "temporarily" on site in steel-lined concrete pools filled with water that serve as cooling ponds.
    - Existing and planned facilities were only designed to store about 3 year's worth of spent fuel since it was assumed that the fuel would be reprocessed or moved to a permanent storage facility and nuclear plants are reaching their onsite storage capacity.
    - 15 million fuel rods are now stockpiled in this manner and most facilities are at their capacity and space and time are running out even with the construction of additional cooling ponds.
    - By 2000, it is estimated that there will be more than 42,000 metric tons of spent fuel
  - *Low-level radioactive wastes* are materials contaminated with small quantities of radioactive residues – tools or clothing from nuclear facilities, medical waste
    - Each state is responsible for finding a site for its low-level waste. Regional compacts are being used to create regional disposal sites
    - Low-level wastes are stored at repositories in NV, NY, and SC
  - In the early years of nuclear power it was assumed that spent fuel would be reprocessed and no one expected the resulting volume of waste or the vast quantity of military waste that would need to be stored
  - Future storage site appears to be Yucca Mountain
    - *Yucca mountain* is currently being evaluated as the main site for long-term disposal – maybe open by 2010
    - 1982 Congress passed the Nuclear Waste Policy Act that was designed to create a process for designating the first permanent repository for nuclear waste
    - Originally, the process was supposed to result in a few sites from which the President would pick one east and west of the Mississippi. To demonstrate confidence in the process the DOE agreed to begin accepting high-level commercial wastes in 1998
    - In 1985, the DOW nominated three sites: Texas (Deaf Smith County), WA (Hanford Nuclear Military reservation), and Yucca Mountain NV

  - In 1987, Congress renounced its procedures and simply designated Yucca Mountain
  - Since this designation, NV has continued to resist the development and opening of Yucca Mountain
  - Fate of Yucca Mountain remains unclear as research continues and construction is now under way
- Big problem on the horizon is plant decommissioning
  - Plants have a fixed lifetime and the NRC and DOE require the owners to "decommission" their plant by removing from the site all radioactive materials including, land, groundwater, buildings, equipment, etc. in order to make the site safe for another use
  - No utility has yet to decommission a plant so one can only guess at the costs which could range from tens of millions to maybe $3 billion or more

- Future of nuclear power
  - 435 nuclear reactors in 32 countries.
  - In 1997, there were 110 operating reactors in the U.S.
    - These reactors generate about 20% of the peak summer loads
    - Many reactors are now producing electricity at rates competitive with other forms of generating capacity with the exception of coal
    - Many utilities have a virtually uninterrupted record of safe operations and management but there have been some notable problems
    - Between 2005 and 2015 half the current reactors will end their legal operating lives under current schedules. The remainder will shut down before 2075
    - No new nuclear reactors on the horizon in the U.S. because among other things NRC regulations make construction expensive
    - The industry was plagued by a history of significant cost over runs and higher than expected operating costs as a result of government regulation and the lack of a standardized reactor design
    - Lack of a permanent disposal site remains another significant barrier to expanded reliance on nuclear power
  - France is one of the few Western European countries to have built reactors following Chernobyl
  - Japan and the U.S. are investigating the possibility of *nuclear fusion* reactors in which light elements such as hydrogen are joined to form helium, similar to the process in stars.

Alternative/Renewable Energy Sources

- Solar
  - It is the holy grail of alternative energy sources because it is clean and generates no greenhouse gases or air pollutants
  - Each year, the earth receives 15,000 times more energy from the sun than the world uses – 100 times more energy than all of the proven reserves of coal, oil, and natural gas could generate
  - It is widely distributes which means it is available to developing nations as well as the industrialized world
  - *Passive solar heating* involves taking advantage of concepts such as double-pane windows, southern exposures, and other architectural features and building materials

  - *Active solar heating* involves using pumps and fans to transport heat or cooling to various interior areas
- Wind
  - Windmills were first used 15 centuries ago in Persia to pump groundwater and irrigate farmland
  - One of the most competitive (in terms of cost) forms of alternative energy. Can no generate at under .05/kWh
  - California has one of the largest concentrations of wind turbines. At Altamount Pass there are 5,041 wind turbines generating 544MW of power. Almost 14,000 generating close to 1,680 MW of power in CA in 1997 – 1.5 percent of the state's total electricity cost
  - Impacts are large land areas, bird kills, some noise. Currently redesigning towers and using slower blades to avoid bird kills.
  - Lots of potential because relatively cheap and quick to build and there are many areas that receive strong sustained winds year round
- Hydroelectric
  - Water is stored be hind a dam and slowly released to turn turbines that generate power.
  - Largest power source of the renewables
  - Many large hydroelectric plants were built during the 30s and 40s as part of the public works programs initiated to lift America out of the depression
  - Biggest problems are that power generation can be limited during drought periods. They also obstruct anadramous fish runs. Even with fish ladders, the smolts can be destroyed during their downriver migration
  - *Three Gorges Dam* in China will be the world's largest hydroelectric facility when completed generating over 18.2 gigawatts of power, the equivalent of 23 large coal fired or nuclear power plants. See video for description and impacts
- Parabolic-collector solar electric
  - Series of 100 meter long, silvered-glass, computer controlled parabolic mirrors that focus light on heat-collecting steal pipes running the length of each collector
  - 9 power plants called Solar Electric Generating Systems (SEGS) were build in CA that generated 354 MW, about 80% of the world's solar-generated electricity
  - It is used mostly to meet peaking demands in the afternoon
  - Utilize natural gas turbines that serve as back up power on cloudy days but overall production from the natural gas generators is *limited to 25%* of annual power production in order to qualify for tax credits
  - Various government incentives and tax credits were used to stimulate its construction during the energy crisis of the 1970s but operating company had to file for bankruptcy in 1991 and are now operated by three other companies
  - Costs between $.25 and $.08 per kWh
- Central-receiver solar-electric
  - 1,818 sunlight tracking mirrors or *heliostats* are used to reflect sunlight onto a receiver atop a tower 260-ft above the ground. There water is converted into steam
  - In the winter about 10 MW of power is produced 4 hours a day and 8 hours a day in the summer
  - Still in the demonstration phase and operating costs are unknown

- Photovoltaic solar-electric
  - *Photovoltaic (PV) cells* are semiconductors that convert light directly into electricity.
  - They are commonly made of silicon and are often used to power calculators, watches, buoys, call boxes, remote signaling devices, irrigation pumps, spacecraft, etc.
  - In 1954, scientists at Bell labs produced the first solar cell. However, PV manufacturers are just starting to make money and some now predict it eventually could be big business
  - Practical applications continue to increase as more efficient and cheaper cells are developed
  - A 50 MW plant will be constructed by Amoco/Enron Solar on the Greek Island of Crete and it will be the largest in the world when completed. Costs are expected to be near $.08 per kWh
  - In 1997, the U.S. initiated its million solar roofs program with plans to place solar panels on 1 million public and private buildings. A program this large might help reduce costs of building panels further. Program was still in the development stage when the election was held.
  - General problem with solar is that today's batteries are too expensive and inefficient to store energy. This limits production.
  - There is still a long way to go before PV can compete with the coast of coal, oil, or even nuclear power generation
- Wind-turbine electric
  - Minnesota's legislature mandated that one of the states power companies build a wind power plant in 1994 in exchange for permission to store nuclear wastes in its service region
  - Minnesota's plan is to produce 425 MW of power by 2002. It is delivering electricity at about $.05 per kWh. Development of larger and more efficient wind turbines may further reduce these costs
  - About 9,600 MW of utility-scale wind turbine facilities were operating worldwide in 1999 – less than 1% of the world's needs today
  - The US has about 2,100 MW of commercial wind power
  - Germany, Spain, and Denmark are moving towards in a big way
  - Global wind generating capacity in 1999 was near 9,600 MW, a 26% increase from a year earlier
  - New generators have variable pitch blades as long as 40 meters and can spin in winds as little as 15 km/hr. They also have variable speed drives to improve their efficiency. Little downtime and maintenance
  - Lot of opportunity in farmland, ranching, and other rural areas because they have a small footprint that allows traditional uses of the lands below the wind-turbines.
  - Denmark and the Netherlands plan large offshore wind farms in the North Sea
- "Green" marketing of power
  - Deregulation will eventually allow consumers to choose who they buy power from. Many may choose to buy from "green" companies even if it is more expensive.

- Hydrogen fuel
  - *Electrolysis* is a simple process in which electric current is used to "split" water into its basic chemical elements: hydrogen and oxygen
  - Hydrogen gas could be stored to where it could be used in combustion processes or be oxidized in fuel cells. The benefits are reducing air pollution, curtailing acid rain, and reduced emission of greenhouse gases
  - Problem is hydrogen gas is explosive
  - *Fuel cells* offer great promise and are used by NASA
  - In a *fuel cell*, hydrogen and oxygen react electrochemically at ordinary temperatures to generate electricity
  - This could lead to a zero emission vehicle. While hydrogen fuel may cost more, there are reason to believe that its operating costs may be similar
  - Still in the relatively early stages of technological development

Energy Development on Public Lands

- Controversies surrounding energy development expanded during the 1980s as a result of a series of proposals by President Reagan and his controversial Secretary of the Interior James Watt
  - Proposed leasing exploration rights to 11 billion tons of coal on public rangeland, timberland, and wilderness areas in NM, UT, MT, and ND
  - Proposed opening about 1 billion acres of the OCS (virtually all offshore areas) to oil and gas exploration
  - DOI proposed to sell to state and private bidders 35 million acres of public land
  - Proposed permitting the USFS to open up wilderness areas within national forests to mineral and energy exploration before they were placed off limits in 1984
- Frustrated with Reagan's policies, environmentalists turned to Congress
  - Environmentalists were effective in convincing Senate and House committees that the DOI, with the approval of the White House, was abusing its delegated authority and subverting congressional intent with their energy proposals
  - Democrats on house oversight committees sought opportunities to challenge and embarrass the White House
- White House policies also cause some state and regional opposition
  - Many states wanted both resource development and environmental protection and did not view it as an either or proposition
  - Many coastal states voiced strong opposition to OCS development
- While many of the conflicts subsided, the growing energy crisis and Bush proposals for expanded exploration may rekindle old flames
  - Unfortunately, many of the remaining oil and gas reserves are located offshore or in Alaska, low-sulfur coal deposits remain on federal lands and national monuments, and natural gas is also located on many public lands

Arctic National Wildlife Refuge (ANWR)

- 1960 – Large, pristine region was set aside as the Arctic Wildlife Range through the National Wildlife Refuge system (about 8.9 million acres).
- The main reasons for establishing the Arctic Wildlife Range were:
  - Preserve a large self-sustaining arctic ecosystem
  - Protect natural breeding and feeding grounds
  - Shelter wildlife, especially the caribou herds, for posterity
- 1980 – Size was more than doubled with the creation of the Arctic National Wildlife Refuge (ANWR) (about 19.5 million acres)
  - Region larger than New Hampshire, Vermont, and Massachusetts
  - Contains an 8 million acre wilderness area within the ANWR
  - Wilderness area is off limits to roads, building, pipelines, vehicles, timber harvesting, oil or mineral exploration and development, etc.
  - Activities mostly limited to hiking, camping, sport fishing, and similar recreational pursuits. Aircraft are allowed to fly into the wilderness areas
- 1984 – Canada established the Northern Yukon Park
- Major objectives in creating the ANWR
  - To conserve the region's fish and wildlife, maintain its diversity, and protect its natural habitats
  - To enable native people to continue their subsistence way of life
  - To safeguard the region's environmental resources, including its air and water quality
  - To comply with the Canada-U.S. Porcupine Herd Treaty in which the countries pledged to protect this caribou herd
- Establishing the ANWR was based on a compromise
  - A portion of the ANWR, Section 1002, was set aside with the understanding that oil and gas developments might be allowed there in the future

Section 1002

- It is both a magnificent and distinctive environment as well as a potentially rich source of petroleum
- Only Congress has the authority to decide whether oil and gas development will be allowed in this section or whether it will become part of the protected wilderness
- Conservationists believe serious environmental problems will result if oil and gas development is allowed
- Others see little ecological danger and believe that the energy resources should be developed

Potential Environmental Problems with Developing Section 1002

- Porcupine caribou calve in Section 1002 and the Coastal plain tundra is only about 30 miles wide
- Caribou seek relief from summer mosquitoes by wading into the Beaufort sea and this could be cut off
- The coastal plain is a significant polar bear denning habitat
- Oil and gas developments on the Kenai National Moose Range have had impacts and similar impacts might occur in Section 1002
- An oil spill in Section 1002 could impact the Beaufort Sea Aquatic habitat where cold weather diminishes the rate of oil evaporation and increases environmental damage

Potential Energy Benefits

- 19% probability of finding 3 billion barrel deposit and a 5% probability of finding a 9 billion barrel deposit under Section 1002.
  - 12 billion in proven reserves were show to have existed initially at Prudhoe Bay.
  - Prudhoe Bay's proven reserves are declining and are projected to run out by 2020
  - If the 3 billion barrel estimate is correct and it was pumped through the Trans Alaska Pipeline System (TAPS) at 1.7 million per day it would fill 10% of the nations needs for less than five years
- 1986 Study by the Department of the Interior recommended opening up Section 1002
  - President's Reagan (1987) and Bush (1990) asked congress to open Section 1002.
  - 1995 – Alaska Federation of Natives Board voted 19 to 9 in favor of opening Section 1002 (many native groups have benefited from leasing and tax revenues)

Reasons Oil Industry Does Not Believe Oil and Gas Development in Section 1002 Will Not Harm the Environment

- Arctic petroleum operations, especially transporting drilling rigs and personnel, can be shifted to the winter seasons when the tundra soils are frozen
  - Equipment and personnel can be transported on ice roads and drilling can be carried out on ice pads.
- Constructing ice roads and ice-based drilling rigs instead of gravel roads and pads is much less harmful and minimizes the requirements for gravel
- Drilling rigs can use directional-drilling technology resulting in a smaller environmental footprint
- Today's drilling pad is smaller (82% less area) and spent muds can be injected in wells drilled thousands of feet below the tundra.

Estimated Infrastructure Needs

- Major pipeline 100 miles long connecting into TAPS
- 120 miles of main roads and 160 miles of spur roads
- 2 large permanent airfields, 2 smaller airfields
- 50 to 60 drilling pads (about 8 acres each)
- 10 to 15 gravel-mining sites