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United States: Environmental Issues

Introduction
The United States' energy abundance historically encouraged the development of a relatively fuel-intensive economy based on natural resource extraction and processing. This has changed dramatically in recent decades, however, as the U.S. economy has shifted more towards services and technology and away from traditional energy-intensive industries like raw material extraction, steel production, and others. Still, the United States remains the largest energy consumer in the world, and also the world's largest emitter of energy-related carbon dioxide. With the exception of Australia, most other industrialized countries rely much less heavily on coal, which is highly carbon intensive, to meet domestic energy needs than does the United States.

The United States, Canada and Mexico cooperate in the Commission for Environmental Cooperation (CEC), a trinational organization established under the environmental side agreement to the North American Free Trade Agreement (NAFTA). The CEC addresses environmental concerns associated with increased trade in North America. Many energy-related environmental issues, such as air pollution and "acid rain," transcend international boundaries

In June 2003, the U.S. Environmental Protection Agency (EPA) issued a draft "Report on the Environment," which outlined current U.S. environmental conditions and trends. According to the EPA, this report provided the first-ever national picture of the U.S. environment. Among the major conclusions of the report were: 1) "Over the last 30 years, total emissions of six principal air pollutants have decreased by nearly 25%, resulting in lower concentrations of these pollutants in ambient air;" 2) "One of the major components of acid rain, wet sulfate deposition, has declined. Wet sulfate deposition levels for 1999-2001 showed reductions of 20%-30% compared to levels for 1989-1991 over widespread areas in the Midwest and the eastern U.S., where acid rain has had its greatest impact; and 3) Air toxics emissions have declined, with the National Toxics Inventory estimating that nationwide air toxics emissions decreased almost 24% from baseline levels (1990-1993) to 4.7 million tons annually in 1996.

Air Pollution
Motor vehicles represent the single largest anthropogenic (man-made) source of air pollution in the United

States. In recent years, the shift away from cars towards larger vehicles, such as sports utility vehicles (SUV's), is responsible for a reversal of years in fuel efficiency improvements to the U.S. motor vehicle fleet. Fuel efficiency technology improvements generally have not been sufficient to compensate for the increasing popularity of SUV's and other relatively fuel-inefficient vehicles. These vehicles produce, on average, one-third more carbon dioxide per mile than the average passenger car.

As required by the Clean Air Act (CAA), the U.S. petroleum refining industry has responded to five major new Federal rules on motor gasoline product quality in the last 14 years or so: Phase 1 Summer Volatility (RVP) Regulation (June 1989); Phase 2 Summer Volatility Regulation (May 1992); Oxygenated Gasoline (November 1992); Reformulated Gasoline Phase 1 (December 1994); and Reformulated Gasoline Phase 2 (January 2000). Oxygenates were first required in the wintertime oxygenated gasoline program to reduce exhaust emissions of carbon monoxide (CO) in 39 areas of the country. The oxygenated gasoline program requires oxygen at a minimum level of 2.7 weight percent (equivalent to 15.0 volume percent MTBE or 7.4 volume percent fuel ethanol).

The reformulated gasoline (RFG) program requires reductions in automobile emissions of ozone-forming volatile organic compounds during the summer high-ozone season, and of toxic air pollutants and nitrogen oxides during the entire year in certain areas of the United States. RFG requires a minimum 2.1% oxygen by weight when averaging, which corresponds to approximately 11.7 volume percent MTBE or 5.8 volume percent ethanol. While the sale of Federal reformulated gasoline was mandated for only nine areas in the nation with the most severe ozone pollution, other areas are allowed to voluntarily join the Federal RFG program.

The EPA also targeted air pollution from diesel engine-powered highway vehicles such as trucks and buses. The low-sulfur diesel fuel program, which began in October 1993, reduced the allowable sulfur level in diesel fuel from 5,000 to maximum 500 parts per million (ppm). In December 2000, the EPA issued a final rulemaking that requires further reductions in the sulfur content of highway diesel fuel, which would in turn require significant investments by diesel-fuel refiners. The new rulemaking imposes a sulfur limit of 15 ppm However, pipeline owners are expected to require refiners to reduce sulfur content below 10 ppm to provide a tolerance for testing and to offset contamination from other sulfur-bearing products shipped by pipeline. The new fuel must be available at retail stations by September 1, 2006, although a phase-in option allows up to one-fifth of all diesel fuel produced to meet only the 500 ppm limit through early 2010. Because the sharply lower sulfur limit will entail new capital investment and higher operating costs for refiners, there are concerns that the transition to ultra-low-sulfur diesel (ULSD) fuel might constrain supplies of diesel fuel and raise prices.

In late 1999, the EPA released rules on new federal emission standards (“Tier 2") for passenger cars, light trucks, and larger passenger vehicles. The Tier 2 rules, which takes effect on January 1, 2004, are designed to reduce emissions most responsible for ozone and particulate matter (PM) impact from these vehicles -- nitrogen oxides (NOx) and non-methane organic gases (NMOG), consisting primarily of hydrocarbons (HC) and contributing to ambient volatile organic compounds (VOC). Tier 2 also requires a reduction in gasoline sulfur to 30 ppm by 2006. The program will, for the first time, apply the same set of federal standards to all passenger cars, light trucks, and medium-duty passenger vehicles.

The CAA was amended in 1990, addressing numerous air quality problems in the United States that were not entirely covered in earlier legislation. One of these problems is acid rain caused by sulfur dioxide (SO2) and nitrogen oxides (NOx) emissions from fossil-fueled electric power plants and, to a lesser extent, from other industrial and transportation sources. The Clean Air Act Amendments of

1990 (CAAA90) called for annual emissions of sulfur dioxide (SO2) by electricity generators to be reduced to approximately 12 million tons in 1996, 9.48 million tons between 2000 and 2009, and 8.95 million tons per year thereafter. Because companies can bank allowances for future use, however, the long-term cap of 8.95 million tons per year is not expected to be reached until after 2011. More than 95% of the SO2 produced by generators results from coal combustion and the rest from residual oil.

CAAA90 called for the reductions to occur in two phases, with larger (more than 100 megawatts) and higher emitting (more than 2.5 pounds per million Btu) plants making reductions first. In Phase 1, which began in 1995, 261 generating units at 110 plants were issued tradable emissions allowances permitting SO2 emissions to reach a fixed amount per year—generally less than the plant's historical emissions. Allowances could also be banked for use in future years. Switching to lower sulfur subbituminous coal was the option chosen by most generators, as only about 12 gigawatts of capacity had been retrofitted with scrubbers by 1995.

Nitrogen oxide (NOx) emissions from U.S. electricity generation are projected to fall as new regulations take effect. The required reductions are intended to reduce the formation of ground-level ozone, for which NOx emissions are a major precursor. Together with volatile organic compounds and hot weather, NOx emissions contribute to unhealthy air quality in many areas during the summer months. CAAA90 NOx reduction program called for reductions at electric power plants in two phases, the first in 1995 and the second in 2000. The second phase of CAAA90 resulted in NOx reductions of 0.6 million tons between 1999 and 2000.

On April 21, 2003, the Department of Justice and the EPA announced the largest CAA enforcement settlement with a power utility. Under the agreement, Dominion Virginia Power agreed to spend $1.2 billion by 2013 to eliminate 237,000 tons per year of nitrogen oxides and sulfur dioxide from eight coal-fired power plants in Virginia and West Virginia. The aim is to bring the utility into full compliance with New Source Review (NSR) requirements under the CAA. Despite the settlement, several states attorneys general, mainly in the Northeast, sued the EPA to prevent it from relaxing NSR regulations.

On the same date that the Dominion settlement was reached, a study conducted by the National Academy of Public Administration (NAPA) at the request of Congress was released. The NAPA study concluded that NSR works well in controlling air pollution from new power facilities, but not from older ones. NAPA recommended that the CAA be amended to set up a mandatory, three-tiered (cap-and-trade, cap-and-net, unit-cap), performance-based system to control emissions. In addition, the NAPA study recommended that each tier be based on performance of the cleanest technologies available.

In July 2002, President Bush submitted his initial "Clear Skies" legislation -- first announced in February 2002 -- to Congress. "Clear Skies" would create a mandatory program that aims to reduce power plant emissions of sulfur dioxide (SO2), nitrogen oxides (NOx), and mercury -- but not carbon dioxide -- by setting a national "cap and trade" system for each pollutant. Under the plan, EPA is to issue a final regulation by December 15, 2004, and require compliance by December 2007. Mercury is set to be regulated under the CAAA90, which states that "Maximum Achievable Control Technology" (MACT) must be applied, with a goal of reducing mercury emissions 69% by 2018.

According to the EPA, "Clear Skies" was proposed in response to a growing need for an emission reduction plan that will protect human health and the environment while providing regulatory certainty to the industry. The program was reintroduced in the US House of Representatives (HR

999) and the US Senate (S. 485) as the Clear Skies Act of 2003 on February 27, 2003. If it becomes law, the plan also would amend NSR regulations, which critics charge would allow for more pollution from aging, coal-fired power plants. Critics like the League of Conservation Voters (LCV), however, charged that the plan would in fact, "repeal and weaken public health protections of the current Clean Air Act, while replacing them with standards that are at best deferred and incomplete."

MTBE

The blending of methyl tertiary butyl ether (MTBE) into motor gasoline has increased dramatically since it was first produced 20 years ago. MTBE usage grew in the early 1980's in response to octane demand resulting initially from the phaseout of lead from gasoline and later from rising demand for premium gasoline. The oxygenated gasoline program stimulated an increase in MTBE production between 1990 and 1994. MTBE demand increased from 83,000 in 1990 to 161,000 barrels per day in 1994. The reformulated gasoline (RFG) program provided a further boost to oxygenate blending. The MTBE contained in motor gasoline increased to 269,000 barrels per day by 1997.

Unfortunately, because of leaking underground storage tanks or spills and because MTBE is soluble in water and does not biodegrade easily, there have been increasing detections of MTBE in ground waters and reservoirs. Because of the occurrence of MTBE in water supplies, the EPA formed the Blue Ribbon Panel On Oxygenates in Gasoline. In September 1999, the Panel issued its final report that included the following recommendations on MTBE use: 1) "Reduce the use of MTBE substantially (with some members supporting its complete phase-out), and action by Congress to clarify federal and state authority to regulate and/or eliminate the use of gasoline additives that threaten drinking water supplies;" and 2) "The current Clean Air Act requirement to require 2% oxygen, by weight, in RFG must be removed in order to provide flexibility to blend adequate fuel supplies in a cost-effective manner while quickly reducing usage of MTBE and maintaining air quality benefits."

In December 1999, the California Air Resources Board approved the California Phase 3 gasoline regulation, which prohibits the formulation of gasoline with MTBE after December 31, 2002. In March 2002, Governor Gray Davis issue and executive order calling for a one-year phaseout of MTBE, with the process to be completed by December 31, 2003. In addition to California, 16 other states (plus the city of Chicago) have enacted MTBE bans.

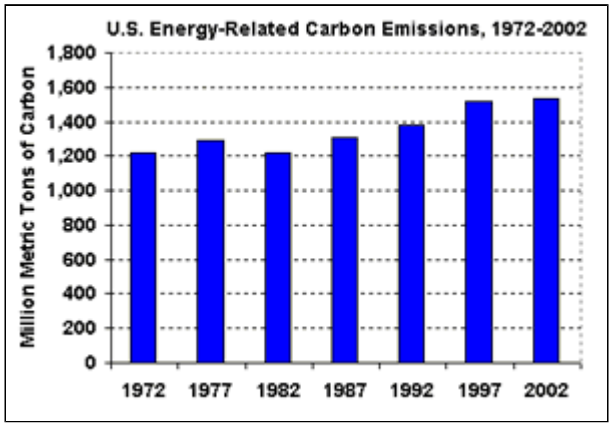
Energy Production

The United States produced around 5.7 million barrels per day (bbl/d) of crude oil in 2002, plus another 1.9 million bbl/d of natural gas liquids. In addition, the country produced a large volume of natural gas (19 trillion cubic feet - Tcf) and coal (1.1 billion short tons) in that year. U.S. crude oil production has fallen from around 9 million bbl/d in 1985, while natural gas production has risen sharply, from 16.5 Tcf in 1985 to 19 Tcf in 2002. U.S. total coal output has increased from 884 million short tons in 1985 to 1.1 billion short tons in 2002. Production and transportation of energy often has significant environmental implications.

The decline in U.S. domestic crude oil output over the past decade or so has led to calls for opening up additional areas to oil exploration and production activities. One of the most controversial of these areas is located in the Arctic National Wildlife Refuge, or ANWR. In March 2003, the National Academy of Sciences issues a report stating that oil exploration in the ANWR had definitely affected the environment in that region since oil was discovered there in 1968. In April 2003, the U.S. House of Representatives voted to include an ANWR drilling provision in comprehensive energy legislation, but the Senate energy bill passed on July 31, 2003 does not permit ANWR drilling and must be reconciled with the House bill in conference committee. The

legislation is currently being negotiated in a House-Senate Conference Committee.

Several areas off the U.S. coast are believed to contain significant oil and natural gas deposits, but have been placed off limits to development. These areas include Federal waters off the East and West coasts and in the eastern Gulf of Mexico. In December 2001, a small area south of the Florida/Alabama border was opened through a lease sale, but another area off the coast of Florida was put off limits when the Federal Government agreed to buy back leases from ChevronTexaco, ConocoPhillips, and Murphy Oil.



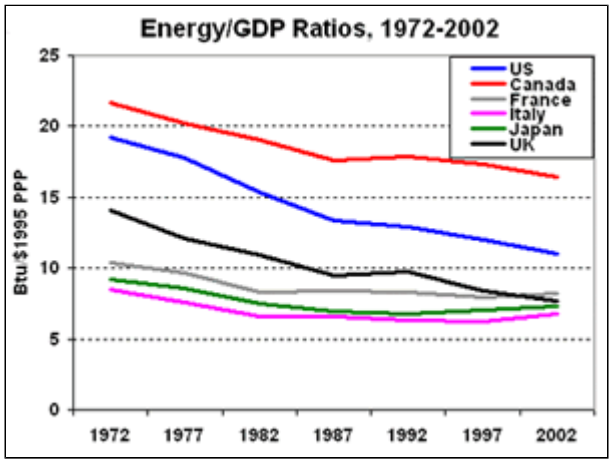
Energy Use and Carbon Emissions
In 2001, the United States consumed 97.1 quadrillion Btu (quads) of energy, representing 24% of total world primary energy consumption. The United States emitted 1,883 million metric tons of carbon in that year, accounting for around 24% of world energy-related carbon emissions. U.S. carbon emissions actually fell in 2001, by 1.2%, as economic growth and manufacturing activity slowed, and as relatively warm winter temperatures reduced heating fuel demand.

Although the Bush Administration announced in March 2001 that it would not participate in the Kyoto Protoco limiting greenhouse gas emissions, the U.S. government has introduced a series of alternative measures. In 2001, for instance, President Bush launched three initiatives: the Climate Change Research Initiative to accelerate science-based climate change policy development; the National Climate Change Technology Initiative to advance energy and sequestration technology development; and increased international cooperation to engage and support other nations on climate change research and clean technologies.

In July 2002, California became the first state in the country to regulate carbon emissions from motor vehicles. California ranks second in the country, behind Texas, in carbon emissions, with 40% coming from passenger vehicles. Under the law, the California Air Resources Board will develop carbon emissions standards for vehicles in model year 2009 and beyond. Under the CAA, California is the only state allowed to set pollution rules overriding federal law. Partly as a result, California has the strictest air quality standards in the country. Also under the CAA, any state is allowed to adopt California's emissions standards in place of weaker Federal rules, making California an important state both in its own right and also as a trendsetter for other parts of the country.

In February 2003, the U.S. Department of Energy launched President Bush's "Climate VISION" (Voluntary Innovative Sector Initiatives: Opportunities Now) plan. The program is intended to help meet the President's goal of reducing U.S. greenhouse gas intensity (the amount of carbon emitted per dollar of economic output) by 18% between 2002 and 2012. The program involves various Federal agencies working with industrial partners to reduce greenhouse gas emissions voluntarily over the next decade. In late January 2003, fourteen companies -- including Dupont, Ford, and Motorola -- established the Chicago Climate Exchange, which will allow for trading of greenhouse gas emissions credits amongst the companies. President Bush's Climate VISION program, however, will not actually reduce the absolute level of U.S. carbon emissions, only the "intensity" of emissions. EIA projects that U.S. carbon emissions will grow by 1.5% annually from 2001 to 2025.

Meanwhile, the attorneys general of seven states (Connecticut, Maine, Massachusetts, New Jersey, New York, Rhode Island, and Washington) announced in February 2003 that they would sue the Bush Administration in order to force it to take action to curtail carbon emissions from power plants. In June 2003, the suit was filed by three of those states -- Connecticut, Maine, and Massachusetts -- in Federal District Court, with the plaintiffs claiming that that the EPA has a mandatory duty to regulate carbon dioxide under the Clean Air Act.



Energy and Carbon Intensity

Historically, the United States relied heavily on energy intensive industries, but this has changed over the past several decades as the country has moved towards a more service-oriented, infomation-based economy. In 2002, U.S. energy intensity (the amount of energy consumed per dollar of GDP) was 11,047 Btu per $1995 (using purchasing power parity, or PPP, exchange rates). U.S. energy intensity is well below Canada's (16,452 Btu/$1995),. but considerably higher than other industrialized nations such as the United Kingdom (7,628 Btu/$1995), France (8,255 Btu/$1995), and Japan (7,295 Btu/$1995).

U.S. carbon intensity in 2002 was 0.17 metric tons of carbon per thousand $1995 (in PPP exchange rates), lower than Canada (0.20 metric tons/$1995) but higher than most other OECD countries. France, for instance, with its heavy reliance on nuclear power, emitted only 0.08 metric tons/$1995 in 2002, while Italy and Japan each emitted around 0.10 metric tons/$1995. The higher U.S. carbon intensity in comparison to many other OECD countries in part reflects the country's relatively high reliance on carbon-intensive coal for power generation.

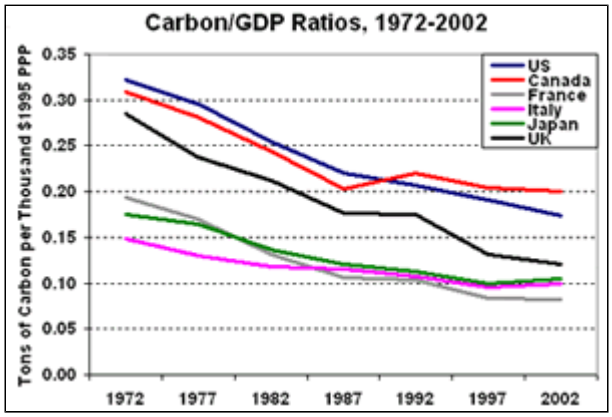
U.S. energy intensity declined at an average annual rate of 2.3% between 1970 and 1986, as oil prices spiked and the economy shifted to less energy-intensive industries and more fuel efficient vehicles. With the collapse of oil prices in late 1985/early 1986, followed by years of relative oil price stability, intensity declines moderated, averaging 1.4% per year between 1986 and 2001. Energy use per person generally declined from 1970 through the mid-1980s but began to increase as energy prices declined and stayed relative low during the late 1980s and 1990s.

One factor slowing the decline in U.S. energy intensity is the fact that newly built homes today are, on average, 18% larger than the existing housing stock, with correspondingly greater needs for heating, cooling, and lighting. Under current building codes and appliance standards, however, energy use per square foot is typically lower for new construction than for the existing stock. Further reductions in residential energy use per square foot could result from additional gains in equipment efficiency and more stringent building codes, requiring more insulation, better windows, and more efficient building designs.

Energy use for space heating, the most energy intensive end use in the residential sector, grew by 1.3% per year from 1990 to 1997. Future growth is expected to be slowed by higher equipment efficiency and tighter building codes. Building shell efficiency gains are projected to cut space heating demand by about 9% per household in 2025 relative to the demand in 1997. A variety of appliances are now subject to minimum efficiency standards, including heat pumps, air conditioners, furnaces, refrigerators, and water heaters.

Current standards for a typical residential refrigerator, which became effective in July 2001, limit electricity use to 478 kilowatthours per year. Energy use for refrigeration has declined by 1.3% per year from 1990 to 1997 and is expected to decline by about 1.4% per year through 2025, as older, less efficient refrigerators are replaced with newer models.

The “all other” category, which includes smaller appliances such as personal computers, dishwashers, clothes washers, and dryers, has grown by 2.6% per year from 1990 to 1997 and now accounts for 28% of residential primary energy use.



Per Capita Energy Consumption and Carbon Emissions

U.S. per capita energy consumption in 2002 was 338.4 million Btu per person, below the Canadian level of 410.8 million Btu per person, but higher than other OECD countries. In 2002, for instance, the United Kingdom consumed about 164 million Btu of energy per person, France around 182 million Btu per person, and Japan approximately 172 million Btu per person..

U.S. per capita carbon emissions of 5.3 metric tons in 2002 were the highest in the OECD. In comparison, Canada -- with large amounts of hydropower and nuclear, neither one of which emit carbon -- had estimated per capita carbon emissions of 5.0 metrc tons. France's per capita carbon emissions were far lower, at 1.8 metric tons, as were Italy's (2.1) and Japan's (2.5). U.S. per capita carbon emissions, while decreasing slightly from their 1977 level of 5.9 metric tons of carbon per person, have remained fairly steady over the past 20 years.

Renewable Energy

Renewable resources account for more than 90% of total U.S. energy resources. Geothermal, solar, and wind resources are particularly plentiful, raising prospects for their expanded use in the future. However, today renewable resources -- including hydropower-- account for only about 6% of the country's commercial energy consumption. Around 92% of renewable power in the United States today is biomass and hydroelectricity.

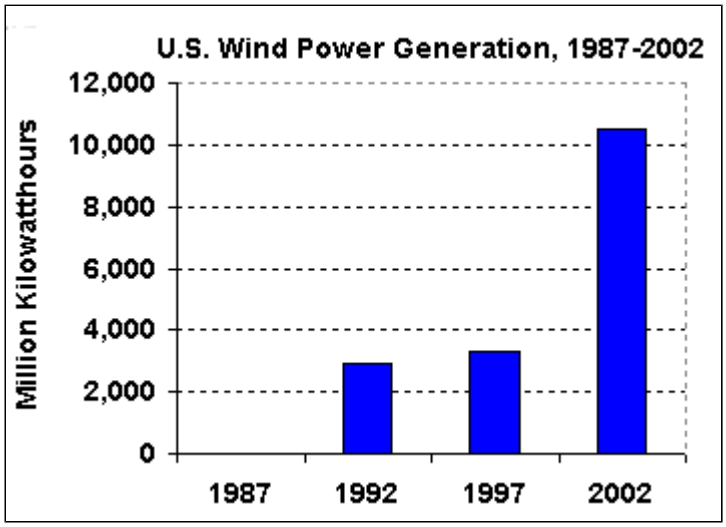
Although it currently represents just a tiny fraction of total U.S. energy consumption, wind energy use is increasing rapidly in the United States. The American Wind Energy Association (AWEA) estimates that U.S. wind power capacity will grow by 25% in 2003, from 4,700 megawatts (MW) to 6,000 MW. The AWEA also estimates that by 2020, wind power could supply at least 6% of U.S. electric power needs. One incentive that has been helping to fuel the recent growth in wind power is the Federal wind production tax credit (PTC), scheduled to expire on December 31, 2003. The AWEA has stated that the PTC is crucial to the future of wind power development in the United States. In addition to the PTC, several states, including big states like California, New York and Texas, have put in place "portfolio standards" for the use of renewable energy sources such as wind power. Congress also has been considering the possibility of setting such a standard nationwide. Even without such incentives, however, the cost of wind power production has fallen substantially in recent years, with wind turbines now larger (3.2-3.6 MW each; 262 feet tall), more efficient, and less costly to operate (an estimated 2.9-3.9 cents per kilowatthour, comparable to coal and natural gas, according to a 2001

article in *Science* magazine) than at anytime in the past. As a result, major wind farm projects are being considered for various locations, including off of Cape Cod, as well as in the Great Plains and other areas where wind and land are plentiful.

Biomass plays a relatively small role in the U.S. energy picture, with "wood, waste, and alcohol" making up about 2.8% of U.S. energy consumption in 2002. For the most part, biomass use in the United States consists of residues from pulp and paper processing being used to generate electricity and steam. Wood and agricultural residues also are used as fuels for power production and steam in the U.S. industrial sector. Also, U.S. demand for ethanol -- a renewable transportation fuel -- is now growing rapidly, in part because of the bans on MTBE.

In his January 2003 State of the Union Address, President Bush announced a $1.2 billion hydrogen fuel initiative aimed at developing technologies to produce, store, and distribute hydrogen as a fuel for power generation and transportation. Also, the Bush Administration has initiated a program called "FreedomCAR" (Cooperative Automotive Research) which aims to develop hydrogen fuel cell technology, hydrogen infrastructure, and advanced automotive technologies such as hydrogen-powered fuel cell vehicles.

In early September 2003, the United States, along with major oil producing countries attending the World Summit on Sustainable Development in Johannesburg, South Africa, rejected the adoption of firm targets or timetables for renewable power growth worldwide. The European Union had been pushing for a 15% target for renewable power by 2010.



Nuclear Waste
In 2002, over 8% of U.S. energy consumption came from nuclear power. A byproduct of nuclear power production is spent nuclear material, which is radioactive and must be stored in secure locations. In July 2002, the U.S. Senate approved (and President Bush signed) a law making Nevada's Yucca Mountain the nation's official nuclear waste storage facility, with the first shipment sof nuclear materials set to start in 2010. In January 2003, however, Nevada filed a constitutional challenge to the law, claiming that the state would bear an undue burden imposed against its will and "in derogation of the sovereignty" of the state.

Outlook
According to the United States Energy Information Agency's (EIA) "Annual Energy Outlook 2003" (AEO 2003), U.S. energy consumption is expected to increase at an average annual rate of 1.5% through 2025, to 139.1 quads. Total carbon emissions also are expected to grow at a 1.5% annual rate, reaching 2,237 million metric tons by 2025, compared to 1,559 million metric tons in 2001. Given expected U.S. economic growth of around 3.0% annually from 2001 through 2025, it is likely that carbon emissions per dollar of GDP will decline by about 30% over the period but that carbon emissions overall will keep growing. Carbon emissions per person are projected to reach 6.6 metric tons per person in 2025, up from 5.6 metric tons per person in 2001. Also according to the AEO 2003, U.S. natural gas consumption is expected to grow at an annual rate of 1.8% through 2025, nuclear energy at a rate of 0.2%, coal at 1.2%, and "renewables" (including hydropower,

wind, solar, etc.) at 2.1%.

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