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# U.S. Energy System

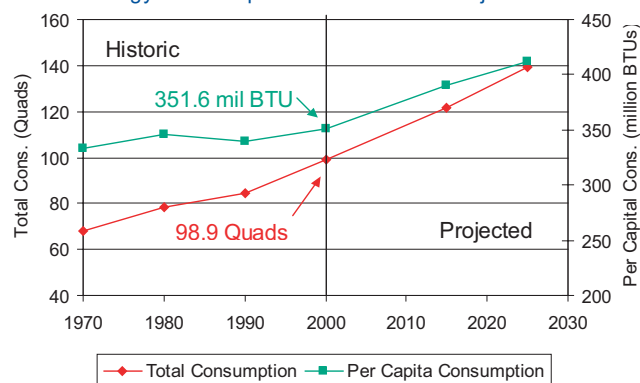
## Patterns of Use

Energy plays a vital role in modern society, enabling systems that meet human needs such as sustenance, shelter, employment and transportation. In 2000, the U.S. spent \$703 billion on energy,<sup>1</sup> or 7.2% of Gross Domestic Product (GDP).<sup>2</sup> Environmental impacts associated with the production and consumption of energy include global climate change, acid rain, hazardous air pollution, smog, radioactive waste and habitat destruction. The nation's heavy reliance on fossil fuels -- particularly imported petroleum -- poses major concerns for energy security. In general, gains in energy efficiency have been offset by dramatic increases in consumption. The unsustainable nature of the U.S. energy system is demonstrated below.

## Demand

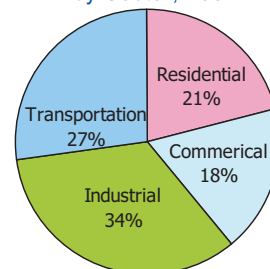
- With less than 5% of the world's population, the U.S. consumes 24% of the world's energy and accounts for 29% of world GDP. (To compare, Germany has 1.4% of the world's population, uses 3.6% of its energy and accounts for 7% of its GDP, while China has a fifth of the world's population, consumes 10% of its energy and accounts for 3.7% of its GDP).<sup>3</sup>
- Energy consumed in the Transportation sector will equal that of the Industrial sector by 2025.<sup>4</sup>
- Each day, the U.S. consumes nearly 3 gallons of oil, 20 pounds of coal and 221 cubic feet of natural gas per person. Residential daily consumption of electricity equals nearly 12 kilowatt hours (kWh) per person.<sup>1</sup>

U.S. Energy Consumption: Historic and Projected Values

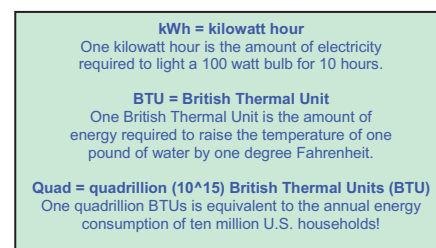


Sources: EIA, US Census

U.S. Energy Consumption by Sector, 2001



Source: AER 2002

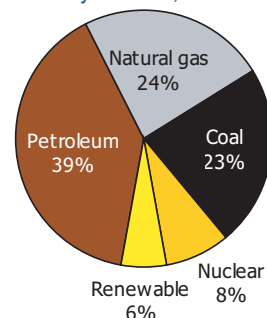


Source: EIA AER 2000, DOE-EIA-0384(2000)

## Supply

- Over 85% of U.S. energy comes from fossil fuels -- a figure which is projected to remain constant through 2025.<sup>4</sup>
- With an annual growth rate of 2.1%, renewable energy is projected to be the fastest growing source of energy from 2001 to 2025 (5.5 to 6.3% of total consumption).<sup>4</sup>
- The U.S. is highly dependent on foreign nations to meet its energy needs -- net imports met 55% of domestic oil demand in 2001. This figure is projected to reach 68% in 2025.<sup>4</sup>
- The Persian Gulf region accounts for roughly 20% of crude oil imports<sup>5</sup> and contains 65% of the world's oil reserves. A quarter of all reserves lie in Saudi Arabia alone.<sup>6</sup>
- Assuming reserves of 3 trillion barrels and a production growth rate of 2%, oil production is expected to peak in 2037.<sup>7</sup>

U.S. Energy Consumption by Source, 2001



Source: AER 2002

<sup>1</sup> U.S. Energy Information Administration (EIA), *Annual Energy Review 2002*

<sup>2</sup> U.S. Bureau of Economic Analysis, *Current-dollar and "real" GDP* (<http://www.bea.doc.gov/bea/dn/gdplev.xls>)

<sup>3</sup> Population figures: United Nations Population Division, *World Population Prospects: the 1998 Revision* (<http://www.un.org/popin/popdiv/pop1999-00.pdf>)

Energy and GDP figures: EIA, *International Energy Outlook 2003*

<sup>4</sup> EIA, *Annual Energy Outlook 2003*

<sup>5</sup> EIA, *Petroleum Supply Monthly*, August 2003

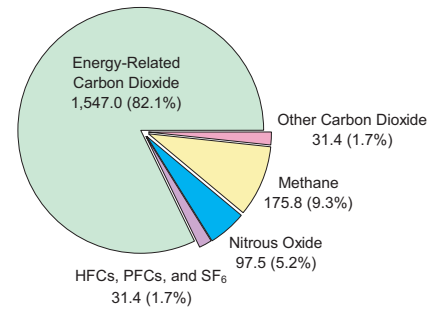
<sup>6</sup> EIA, *International Energy Annual 2001*

## Environmental Impacts

Air emissions from the combustion of fossil fuels are the primary environmental concern of the U.S. energy system. Such emissions include carbon dioxide (CO<sub>2</sub>), nitrogen oxides, sulfur dioxide, volatile organic compounds, particulate matter and mercury. The figure on the right demonstrates the considerable share of greenhouse gas (GHG) emissions due to energy consumption. U.S. GHG emissions grew 12% from 1990 to 2001,<sup>8</sup> and are expected to grow an additional 20% by 2012.<sup>4</sup>

Other energy sources also have environmental implications. For example, issues associated with nuclear power generation include radioactive waste and accidental leakage, while issues with hydroelectric power plants include habitat degradation and fish kills.

U.S. Greenhouse Gas Emissions by Gas, 2001  
(Million Metric Tons Carbon Equivalent)



Source: EIA Emissions of Greenhouse Gases in the United States 2001

## Solutions and Sustainable Alternatives

### Consume Less

- Reducing energy consumption not only brings environmental benefits, but can also result in cost savings for individuals, businesses and government agencies. Living in smaller dwellings, living closer to work and utilizing public transportation are examples of ways to reduce energy usage. The CSS fact sheets on [personal transportation](#) and [residential buildings](#) list additional ways to trim energy consumption.

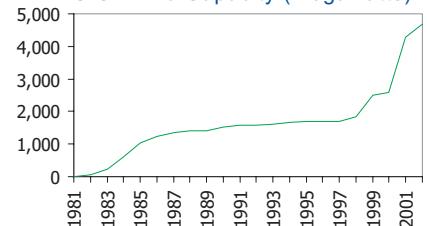
### Increase Efficiency

- A study conducted by five U.S. DOE laboratories concluded that an aggressive commitment to energy efficiency and low-carbon technologies could cost-effectively reduce U.S. carbon emissions by 390 million metric tons carbon equivalent per year.<sup>9</sup>
- Additional information on energy efficiency can be found at the following organizations:
  - General:* U.S. DOE Energy Efficiency and Renewable Energy (<http://www.eere.energy.gov/>)
  - Residential:* American Council for an Energy-Efficient Economy (<http://www.aceee.org/>)
  - Commercial:* U.S. EPA Energy Star (<http://www.energystar.gov/>)
  - Transportation:* U.S. DOE and EPA Fuel Economy Guide (<http://www.fueleconomy.gov/>)
  - Industrial:* U.S. DOE Office of Industrial Technology (<http://www.oit.doe.gov/>)

### Increase Renewables

- Wind farms on 6% of the contiguous U.S. land area could meet one and a half times the nation's current electricity needs.<sup>10</sup>
- U.S. wind capacity is projected to triple by 2025 (from 4.7 to 12 gigawatts).<sup>4</sup>
- Solar photovoltaic modules covering 0.3% of the land in the U.S. could supply all of the nation's electricity.<sup>11</sup>

U.S. Wind Capacity (Megawatts)



Source: AWEA

### Encourage Supportive Public Policy

- Although the U.S. produces a quarter of the world's CO<sub>2</sub> emissions, it has failed to ratify the Kyoto Protocol. In contrast, Britain has established a goal of reducing CO<sub>2</sub> emissions by 60% by 2050.<sup>12</sup>
- Increasing the fuel economy of light vehicles by 5% in 2005 and by 10% in 2010 would reduce annual fuel consumption by 5.5 billion gallons by 2020 at minimal cost (\$0 to \$110 per vehicle).<sup>13</sup> In contrast, opening up the Arctic National Wildlife Refuge to oil production would generate less than 300 million barrels of oil per year by 2020.<sup>14</sup>
- The growth of wind and biomass has been spurred by the Production Tax Credit, a 1.8-cent credit for every kWh sold, as well as state Renewable Energy Portfolio standards (RPS) that require a certain percentage of electricity be derived from renewable sources. As of February 2003, 11 states had RPS.<sup>15</sup>
- Buyers of hybrid electric vehicles in 2003 can receive a \$2,000 federal tax credit, an amount that will be phased to \$0 by 2007.

<sup>7</sup> EIA, *Long Term World Oil Supply*, (<http://tonto.eia.doe.gov/FTPROOT/features/longterm.pdf>)

<sup>8</sup> EIA, *Emissions of Greenhouse Gases in the United States 2001*

<sup>9</sup> Interlaboratory Working Group. 1997. *Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy-Efficient and Low-Carbon Technologies by 2010 and Beyond*. (<http://enduse.lbl.gov/Projects/5Lab.html>)

<sup>10</sup> Elliott, D.L. and Schwartz, M.N. 1993. *Wind Energy Potential in the United States* ([http://www.nrel.gov/wind/wind\\_potential.html](http://www.nrel.gov/wind/wind_potential.html))

<sup>11</sup> U.S. Department of Energy, *Photovoltaics Questions and Answers* (<http://www.nrel.gov/ncpv/pdfs/pvfacts.pdf>)

<sup>12</sup> Royal Commission on Environmental Pollution. 2000. *Energy - The Changing Climate* (<http://www.rcep.org.uk/pdf/enersumm.pdf>)

<sup>13</sup> EIA, 2002, *Analysis of Corporate Average Fuel Economy (CAFE) Standards for Light Trucks and Increased Alternative Fuel Use* ([http://www.eia.doe.gov/oiaf/servicert/cafe/pdf/sroiaf\(2002\)05.pdf](http://www.eia.doe.gov/oiaf/servicert/cafe/pdf/sroiaf(2002)05.pdf))

<sup>14</sup> EIA, 2000, *Potential Oil Production from the Coastal Plain of the Arctic National Wildlife Refuge: Updated Assessment* ([http://www.eia.doe.gov/pub/oil\\_gas/petroleum/analysis\\_publications/arctic\\_national\\_wildlife\\_refuge/html/exccsummary.html](http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/arctic_national_wildlife_refuge/html/exccsummary.html))

<sup>15</sup> AWEA, *Wind Power Outlook 2003* (<http://www.awea.org/pubs/documents/Outlook2003.pdf>)

