



# U.S. Energy System

# factsheets

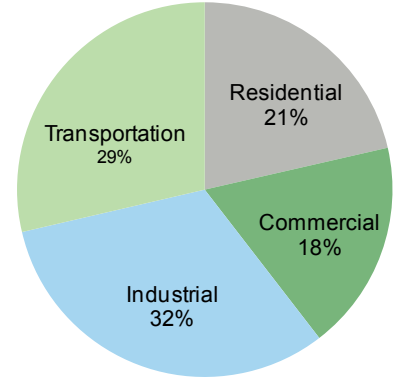
## Patterns of Use

Energy plays a vital role in modern society, enabling systems that meet human needs such as sustenance, shelter, employment, and transportation. In 2005, the U.S. spent \$1.04 trillion on energy, or 8.4% of Gross Domestic Product (GDP). When spread over the population, annual costs were \$3,525 per person.<sup>1</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 – primarily imported petroleum – poses major concerns for energy security. Gains in energy efficiency in all sectors are generally offset by dramatic increases in consumption. The unsustainable nature of the U.S. energy system is demonstrated below.

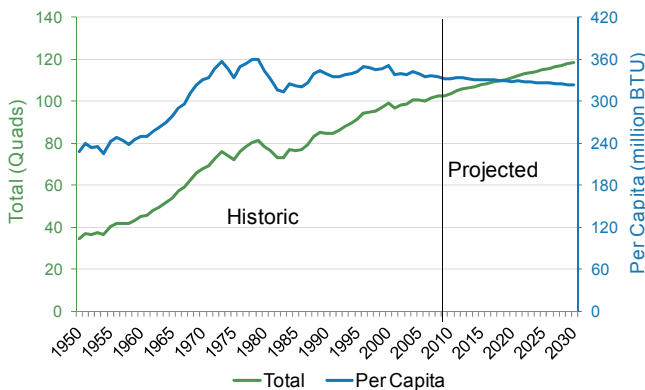
### Demand

- With less than 5% of the world's population, the U.S. consumes 22% of the world's energy and accounts for 21% of world GDP. (To compare, Europe has 7.4% of the world's population, uses 19% of its energy and accounts for 22% of its GDP, while China has 20% of the world's population, consumes 14% of its energy and accounts for 11% of its GDP.)<sup>2</sup>
- Each day, the U.S. per capita energy consumption includes nearly 3 gallons of oil, 21 pounds of coal, and 210 cubic feet of natural gas. Residential daily consumption of electricity is greater than 12 kilowatt hours (kWh) per person.<sup>1</sup>
- Over the last ten years, U.S. energy use has increased by 0.7% annually.<sup>1</sup>

U.S. Energy Consumption by Sector, 2007<sup>1</sup>



U.S. Energy Consumption: Historic and Projected Values<sup>1, 3</sup>



**kWh = kilowatt hour**  
One kWh is the amount of electricity required to light a 100 watt bulb for 10 hours.

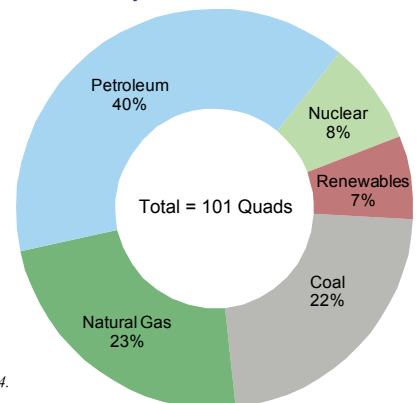
**BTU = British Thermal Unit**  
One BTU is the amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit.

**Quad = quadrillion (10<sup>15</sup>) British Thermal Units (BTU)**  
One Quad is equivalent to the annual energy consumption of ten million U.S. households

### Supply

- Almost 85% of U.S. energy is expected to come from fossil fuels through 2030.<sup>1, 3</sup>
- With an annual growth rate of 1.6% through 2030,<sup>3</sup> renewable energy growth will more than double consumption growth, increasing the portion of energy it provides from 5.7% to 7.3%.<sup>3</sup>
- The U.S. is highly dependent on foreign nations to meet its energy needs – net imports met 58% of domestic oil demand in 2007.<sup>1</sup> This figure is projected to drop to 54% in 2030.<sup>3</sup>
- The Persian Gulf region accounted for 16% of petroleum imports in 2007 and contains 57% of the world's oil reserves. A fifth of all reserves lie in Saudi Arabia alone.<sup>1, 4</sup> OPEC controlled 45% of the oil imported by the U.S. in 2007.<sup>1</sup>
- There is disagreement as to when oil production will peak: assuming reserves of 3.3 trillion barrels and a production growth rate of 2%, DOE projects oil production to peak in 2044.<sup>5</sup>

U.S. Energy Consumption by Source, 2007<sup>1</sup>



<sup>1</sup> U.S. Department of Energy, Energy Information Administration (EIA) (2008) *Annual Energy Review 2007*.

<sup>2</sup> Population figures: Central Intelligence Agency (2007) "The World Factbook – Population." Energy and GDP figures: EIA (2006) *International Energy Annual 2004*.

<sup>3</sup> EIA (2008) *Annual Energy Outlook 2008*. Historical and Projected Energy Consumption provided by EIA.

<sup>4</sup> EIA (2007) *International Energy Annual 2005*.

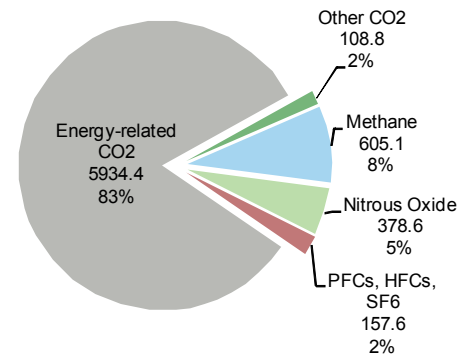
<sup>5</sup> EIA (2005) *When Will World Oil Production Peak?* <<http://www.eia.doe.gov/ncic/speeches/Caruso061305.pdf>>

## Life Cycle 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 15% from 1990 to 2006.<sup>6</sup>

Other energy sources also have environmental implications. For example, issues associated with nuclear power generation include radioactive waste and accidental leakage; large hydroelectric power plants include habitat degradation and fish kills; and wind power plants alter landscapes in ways some find unappealing and can increase bird and bat mortality.

U.S. GHG Emissions, 2006<sup>6</sup>  
(Million Metric Tons CO<sub>2</sub>-Equivalent)



## 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 factsheets on personal transportation and residential buildings list additional ways to trim energy consumption (<http://css.snre.umich.edu/facts/>)

### 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 (about 5%).<sup>7</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 & 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/>)

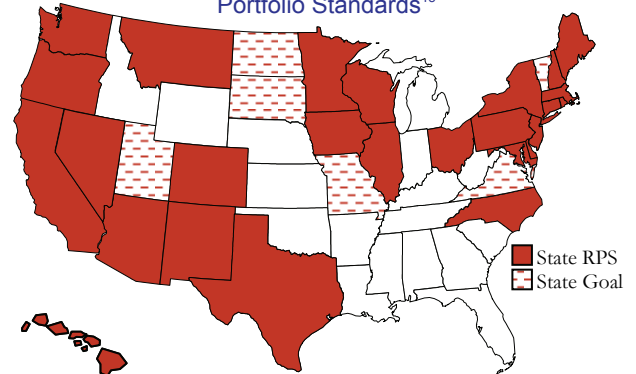
### Increase Renewables

- Areas with good wind resources have the potential to supply up to 20% of U.S. electricity consumption.<sup>8</sup>
- In 2007, U.S. wind capacity was 16.9 gigawatts<sup>9</sup> and capacity projections range from 40 to roughly 100 GW by 2030.<sup>3,10</sup>
- Solar photovoltaic modules covering 0.4% of the land in the U.S. could supply all of the nation's electricity – 1.2-6.2 acres per GWh per year.<sup>11</sup>

### Encourage Supportive Public Policy

- The U.S. produces a quarter of the world's CO<sub>2</sub> emissions and is expected to increase its CO<sub>2</sub> emissions by 15% by 2030.<sup>3</sup> It has also failed to ratify the Kyoto Protocol and continues to support voluntary actions with no guarantees for successful outcomes. 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, if it were to be opened to oil drilling, the Arctic National Wildlife Refuge (ANWR) would have a peak production of 6.2 billion gallons of gasoline per year in 2024.<sup>14</sup>
- The growth of wind and biomass has been spurred by the Federal Production Tax Credit, a 1.9-cent tax 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 July 2008, 27 states and D.C. had RPS.<sup>15</sup>
- Extended through 2010, purchasers of the first 60,000 hybrids by each manufacturer will receive a federal tax credit of up to \$3,400 depending on the vehicle's fuel economy.<sup>16</sup>

States with Renewable Energy Portfolio Standards<sup>15</sup>



<sup>6</sup> EIA (2007) *Emissions of Greenhouse Gases in the United States 2006*.

<sup>7</sup> Interlaboratory Working Group (1997) *Scenarios of U.S. Carbon Reductions: Potential Impacts of Energy-Efficient and Low-Carbon Technologies by 2010 and Beyond*.

<sup>8</sup> The White House, National Economic Council (2006) *Advanced Energy Initiative*. State of the Union.

<sup>9</sup> U.S. Department of Energy, Energy Efficiency and Renewable Energy (2007) *Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends: 2006*.

<sup>10</sup> National Renewable Energy Laboratory (NREL) (2006) *Long-Term National Impacts of State-Level Policies*. Blair, N., et al. Conference Paper NREL/CP-620-40105.

<sup>11</sup> NREL (2004) *PV FAQs*.

<sup>12</sup> Department for Environment, Food and Rural Affairs (2007) News Release: "New Bill and Strategy Lay Foundations for Tackling Climate Change."

<sup>13</sup> EIA (2002) *Analysis of Corporate Average Fuel Economy (CAFE) Standards for Light Trucks and Increased Alternative Fuel Use*.

<sup>14</sup> EIA (2004) *Analysis of Oil and Gas Production in the Arctic National Wildlife Refuge and Calculation by CSS*.

<sup>15</sup> Database of State Incentives for Renewable Energy (DSIRE) (2007) *Renewables Energy Portfolio Standards Map*.

<sup>16</sup> Internal Revenue Service (2006) *Summary of the Credit for Qualified Hybrid Vehicles*.

