



# U.S. Energy System

# factsheets

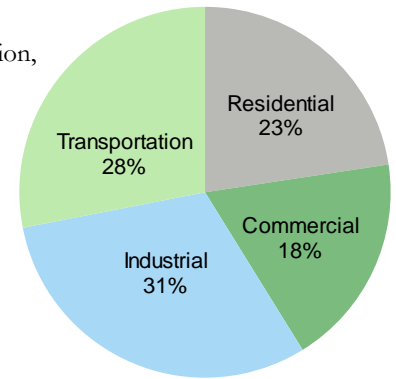
## Patterns of Use

Energy plays a vital role in modern society, enabling systems that meet human needs such as sustenance, shelter, employment, and transportation. In 2009, the U.S. spent \$1.06 trillion on energy, or 7.5% of Gross Domestic Product (GDP). When spread over the population, annual costs were \$3,461 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 increases in consumption. The unsustainable nature of the U.S. energy system is demonstrated below.

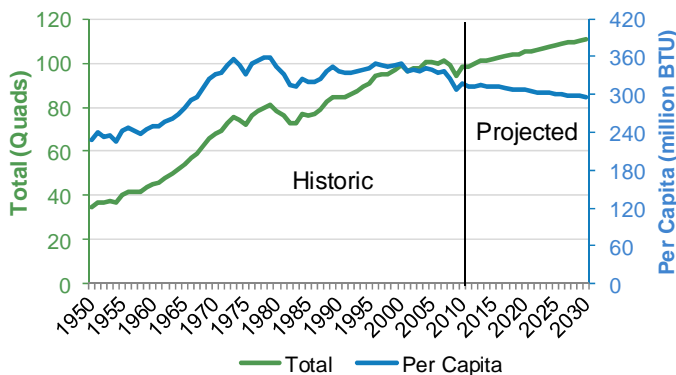
### Demand

- With less than 5% of the world's population, the U.S. consumes 20% of the world's energy and accounts for 20% of world GDP. (To compare, Europe has 7% of the world's population, uses 17% of its energy and accounts for 21% of its GDP, while China has 19% of the world's population, consumes 17% of its energy and accounts for 12.5% of its GDP.)<sup>1,2,3</sup>
- Each day, the U.S. per capita energy consumption includes nearly 3 gallons of oil, 19 pounds of coal, and 214 cubic feet of natural gas. Residential daily consumption of electricity is nearly 13 kilowatt-hours (kWh) per person.<sup>1</sup>
- Over the last twenty years, on average, U.S. energy use increased 0.7% annually.<sup>1</sup>

U.S. Energy Consumption by Sector, 2010<sup>1</sup>



U.S. Energy Consumption: Historic and Projected Values<sup>1,4</sup>



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

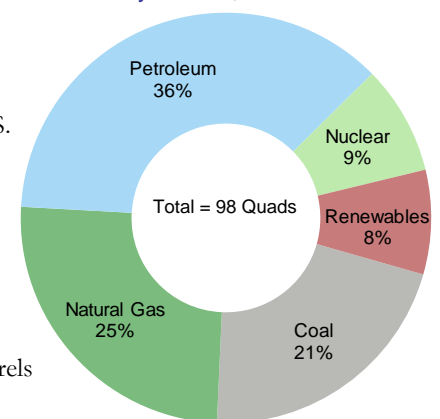
**BTU = British Thermal Unit**  
One BTU is the amount of energy required to raise the temperature of one pound of water by one degree Fahrenheit.

**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

- By current estimates, over 80% of U.S. energy will come from fossil fuels in 2035.<sup>4</sup>
- Renewable energy consumption is projected to increase annually at a rate of 1.7%, on average, between 2009 and 2035 (compared to 0.7% growth in total energy). Biofuels and E85 are projected to grow fastest. However, at these rates renewables would only provide 7.92% of U.S. energy consumption in 2035 (compared to about 7% currently, see Figure on right).<sup>4</sup>
- The U.S. is highly dependent on foreign nations to meet its energy needs – net imports met 52% of domestic oil demand in 2009. This figure is projected to drop to 41% in 2035. Canada and Mexico are the two largest foreign suppliers of U.S. oil.<sup>1,4</sup>
- The Persian Gulf region accounted for 14.5% of petroleum imports in 2010, and contains 55% of the world's oil reserves. A fifth of all reserves lie in Saudi Arabia alone.<sup>1,3</sup> OPEC controlled 42% of the oil imported by the U.S. in 2010.<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, 2010<sup>1</sup>



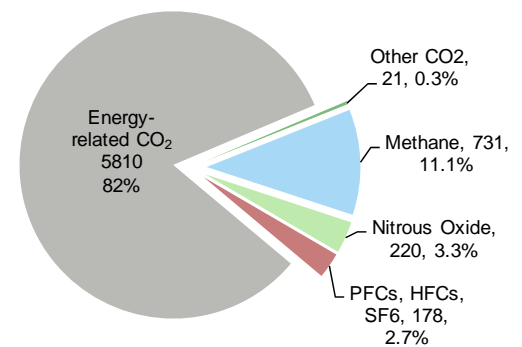
<sup>1</sup> U.S. DOE, Energy Information Administration (EIA) (2011) *Annual Energy Review 2010*.  
<sup>2</sup> CIA (2009) *The World Factbook* <<https://www.cia.gov/library/publications/the-world-factbook/>>  
<sup>3</sup> EIA (2011) International Energy Statistics  
<sup>4</sup> EIA (2011) *Annual Energy Outlook 2011*  
<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 7% from 1990 to 2009.<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, 2009<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/publications/factsheets>).

### 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>8</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 Industrial Technologies Program (<http://www1.eere.energy.gov/industry/>)

### Increase Renewables

- U.S. installed wind capacity grew 15% in 2010, to 40 GW.<sup>10</sup> If 300 GW of wind capacity was installed by 2030, an amount determined feasible by one U.S. DOE study, wind could satisfy 20% of projected electricity demand.<sup>11</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>12</sup>

### Encourage Supportive Public Policy

- The U.S. currently produces a quarter of the world's CO<sub>2</sub> emissions, which are expected to increase by 12% between 2009 and 2030.<sup>4</sup> The Clean Energy and Security Act, passed in the House in June 2009, would require emissions reductions of 3% below 2005 levels in 2012, 20% below 2005 levels in 2020, 42% below 2005 levels in 2030, and 83% below 2005 levels in 2050. In comparison, Britain has established a goal of reducing CO<sub>2</sub> emissions 80% below their 1990 level by 2050.<sup>13</sup> The U.S. has yet to ratify the Kyoto Protocol.<sup>14</sup>
- Recently passed legislation mandating an increase in the fuel economy of new cars and trucks could reduce U.S. petroleum use by 25 billion gallons by 2030.<sup>15</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>16</sup> In contrast, if it were to be opened to oil drilling, the Arctic National Wildlife Refuge (ANWR) would have a peak production of 284.7 million barrels of oil per year in 2027.<sup>17</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. Thirty states and the District of Columbia have renewable portfolio standards and five states have goals in place.<sup>18</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>19</sup> Additionally, there is \$2,000-\$7,500 tax credit available for plug-in hybrid electric vehicles purchased after January 1, 2009.<sup>20</sup>

States with Renewable Energy Portfolio Standards<sup>9</sup>



<sup>6</sup> U.S. Environmental Protection Agency (2011) *Inventory of US Greenhouse Gas Emissions and Sinks, 1990-2009*.

<sup>7</sup> EIA (2007) *Emissions of Greenhouse Gases in the United States*.

<sup>8</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>9</sup> Interstate Renewable Energy Council (2009) "Renewable Portfolio Standards." North Carolina State University.

<sup>10</sup> American Wind Energy Association (2011) *US Wind Industry Year-End 2010 Market Report*

<sup>11</sup> U.S. DOE Energy Efficiency and Renewable Energy. "20% Wind Energy by 2030" July 2008.

<sup>12</sup> National Renewable Energy Laboratory (2004) *PV FAQs*.

<sup>13</sup> Department for Environment Food and Rural Affairs (2009) *Climate Change Act 2008*. Office of Public Sector Information.

<sup>14</sup> U.S. House of Representatives Committee on Energy and Commerce (2009) *American Clean Energy and Security Act 2009 Draft*.

<sup>15</sup> DOE, EERE, and EPA (2009) *Fuel Economy, Reduce Oil Dependence Costs*. [fueleconomy.gov](http://fueleconomy.gov).

<sup>16</sup> EIA (2002) *Analysis of Corporate Average Fuel Economy (CAFE) Standards for Light Trucks and Increased Alternative Fuel Use*.

<sup>17</sup> EIA (2008) *Analysis of Crude Oil Production in the Arctic National Wildlife Refuge*. SR/OIAF/2008-03.

<sup>18</sup> U.S. EPA (2009) "Land Methane Outreach Program: State Renewable Portfolio Standards." <http://www.epa.gov/lmop/publications-tools/funding-guide/renewable.html>

<sup>19</sup> Internal Revenue Service (IRS) et al. (2010) "New Energy Tax Credits for Hybrids" [Fueleconomy.gov](http://www.fueleconomy.gov/feg/tax_hybrid.shtml). [http://www.fueleconomy.gov/feg/tax\\_hybrid.shtml](http://www.fueleconomy.gov/feg/tax_hybrid.shtml).

<sup>20</sup> U.S. Energy Star (2009) *Federal Tax Credits for Consumer Energy Efficiency*.

