

## Chapter I

### Fossil and Biomass Fuels

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This section includes emissions produced from energy-related activities. The sectors using fuel are residential, commercial, industrial, transportation and electric utility. The fuel types defined in reference sources include asphalt, aviation gasoline, distillate fuel oil, jet fuel kerosene, kerosene, liquified petroleum gas, lubricants, motor gasoline, residual fuel oil, bituminous coal, coke, natural gas and wood.

#### Overview

Energy-related activities are the most significant contributor to U.S. greenhouse gas emissions, accounting for almost 89 percent of total emissions in 1990. Emissions from fossil fuel combustion comprise the vast majority of these energy-related emissions. These emissions were produced from a variety of fossil fuel combustion activities, including heating in residential and commercial buildings, energy combustion to generate electricity, steam production for industrial processes, and gasoline consumption in automobiles and other vehicles, (U.S. EPA, 1995).

As fossil fuels burn, they emit carbon dioxide (CO<sub>2</sub>) as a result of oxidation of the carbon in the fuel. In 1990, CO<sub>2</sub> accounted for 96 percent of all greenhouse gas emissions from fossil fuel combustion. The remaining four percent can be attributed to emissions of other gases, such as carbon monoxide (CO), methane (CH<sub>4</sub>), or nonmethane volatile organic compounds (NMVOCs), which are emitted as a by-product of incomplete combustion. These gases are then oxidized to CO<sub>2</sub> within anywhere from a few days to 10 or 11 years. For purposes of this analysis, emissions of these other gases are considered to be a subset of CO<sub>2</sub> emissions. This includes all carbon emitted to the atmosphere and reported as CO<sub>2</sub> emissions, while a much smaller portion of the carbon will be reported as these other gases. This "double counting" is intentional. By reporting emissions in this fashion, state estimates of CO<sub>2</sub> will reflect total loadings of carbon. Also, since all of these gases oxidize to CO<sub>2</sub> eventually, they should be viewed as a subset of carbon emitted as CO<sub>2</sub> (U.S. EPA, 1995).

To estimate state emissions of carbon dioxide from fossil and biomass fuels, seven steps should be performed: 1) obtain the required energy data; 2) estimate total carbon content of the fuels; 3) estimate total carbon stored in the products; 4) estimate carbon potentially emitted from bunker fuel consumption; 5) estimate carbon emitted from interstate electricity consumption; 6) calculate net potential carbon emissions; 7) estimate the carbon actually oxidized from energy uses; and 8) convert net carbon emissions from energy consumption to total CO<sub>2</sub> emissions (U.S. EPA, 1995). Separate tables are presented for statewide and county-level fuel consumption. Statewide totals are given in Tables are I-1 and I-2. County-level data are given in the Appendix.

The required energy data were taken from the *State Energy Data Report 1993* of the Energy Information Administration for the years 1990 and 1993. Additional energy data were taken from

the *Utah Energy Statistical Abstract*, by the Utah Office of Energy and Resource Planning; and the *Coal Industry Annual 1993*, by the Energy Information Administration. Conversion factors and calculation procedures were taken from the *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions*, by the U.S. Environmental Protection Agency, 1995.

**Table I-1 CO<sub>2</sub> Emissions from Fossil and Biomass Fuels - 1990**

| Fuel                   | Consumption<br>MMBTU <sup>1</sup> | Carbon Content<br>Coefficient<br>lb C/MMBTU <sup>2</sup> | Total<br>Carbon<br>Tons C | Stored<br>Carbon<br>Tons C <sup>3</sup> | International<br>Bunkers<br>Tons C | Net<br>Carbon<br>Tons C | Total<br>Oxidized<br>Tons C <sup>4</sup> | CO <sub>2</sub><br>Emissions<br>Tons C |
|------------------------|-----------------------------------|--|---------------------------|---|------------------------------------|-------------------------|--|--|
| Asphalt and Road Oil   | 9,144,408                         | 45.5   | 208,035                   | 208,035                                 | -                                  | 0                       | 0  | 0                                      |
| Aviation Gasoline      | 535,088                           | 41.6   | 11,130                    | -                                       | -                                  | 11,130                  | 11,019                                   | 40,401                                 |
| Distillate Fuel Oil    | 42,749,675                        | 44.0   | 940,493                   | -                                       | -                                  | 940,493                 | 931,088                                  | 3,413,989                              |
| Jet Fuel:Kerosene      | 29,108,872                        | 43.5   | 633,118                   | -                                       | -                                  | 633,118                 | 626,787                                  | 2,298,218                              |
| Jet Fuel:Naptha        | -                                 | 43.5   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Kerosene               | 79,380                            | 43.5   | 1,727                     | -                                       | -                                  | 1,727                   | 1,709                                    | 6,267                                  |
| LPG                    | 4,303,803                         | 37.8   | 81,342                    | 65,074                                  | -                                  | 16,268                  | 16,106                                   | 59,054                                 |
| Lubricants             | 1,855,890                         | 44.6   | 41,386                    | 20,693                                  | -                                  | 20,693                  | 20,486                                   | 75,116                                 |
| Misc. Petroleum Prod.  | -                                 | 44.7   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Motor Gasoline         | 87,341,631                        | 42.8   | 1,869,111                 | -                                       | -                                  | 1,869,111               | 1,850,420                                | 6,784,873                              |
| Naptha<104 deg F       | -                                 | 40.0   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Naptha>104 def F       | -                                 | 44.0   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Pentane Plus           | -                                 | 40.2   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Petroleum Coke         | -                                 | 61.4   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Residual Fuel Oil      | 2,338,764                         | 47.4   | 55,429                    | 55,429                                  | -                                  | 0                       | 0  | 0                                      |
| Still Gas              | -                                 | 38.6   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Waxes                  | -                                 | 43.7   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Anthracite Coal        | -                                 | 62.1   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Bituminous Coal        | 375,956,930                       | 56.0   | 10,526,794                | -                                       | -                                  | 10,526,794              | 10,421,526                               | 38,212,262                             |
| Sub Bituminous Coal    | -                                 | 57.9   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Lignite Coal           | -                                 | 58.7   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Coke                   | -                                 | -  | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Natural Gas            | 119,480,000                       | 31.9   | 1,905,706                 | -                                       | -                                  | 1,905,706               | 1,896,177                                | 6,952,651                              |
| Wood (5)               | 9,000,000                         | 0.5  | 2,138                     | -                                       | -                                  | 2,138                   | 1,924                                    | 7,054                                  |
| Ethanol                | -                                 | 41.8   | -                         | -                                       | -                                  | -                       | -  | -                                      |
| Other                  | 17,586,300                        | 44.6   | 392,174                   | -                                       | -                                  | 392,174                 | 390,214                                  | 1,430,783                              |
| <b>Total-Statewide</b> | <b>699,480,741</b>                | <b>-</b>   | <b>16,668,582</b>         | <b>-</b>                                | <b>-</b>                           | <b>16,319,352</b>       | <b>16,167,455</b>                        | <b>59,280,669</b>                      |

Data Source:

1. *Utah Energy Statistical Abstract*, 1995.
2. Energy Information Administration, *State Energy Data Report 1993*, pp 293-298.
3. U.S. Environmental Protection Agency, Policy Planning and Evaluation, *State Workbook: Methodologies for Estimating Greenhouse Gas Emissions*.
4. *Ibid*, p 1-12.
5. *Ibid*, p 1-13.
6. Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, p 61, 1995.

Note: C=Carbon