Estimated State-Level Energy Flows in 2008

United States

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Abstract

An energy flow chart “atlas” of the U.S. states has been constructed from publicly available data and estimates of energy use patterns. Approximately 100 quadrillion BTU of primary energy are used in the U.S. each year, however, energy use is distributed unevenly across from state to state. Energy can be visualized as it flows from resources (Coal, Oil, Natural Gas, etc.), through transformations (electricity generation) to end uses (Residential, Commercial, Industrial, Transportation). While the basic structure of the energy system is consistent from state to state, the patterns of resource consumption and energy use vary considerably. These flow patterns are visualized in this “atlas” of 51 state-level energy flow charts (all 50 states plus the District of Columbia are represented).

Introduction

Lawrence Livermore National Lab (LLNL) has published flow charts (also referred to as “Sankey Diagrams”) of important national commodities since the early 1970s. The most widely recognized of these charts is the U.S. energy flow chart (http://flowchars.llnl.gov), however, Livermore has also published charts depicting carbon (or carbon dioxide potential) flow and water flow at the national level as well as energy, carbon and water flows at the international, state, municipal and organizational (eg. Air Force) level. Flow charts are valuable as single-page references that contain quantitative data about resource, commodity and byproduct flows in a graphical form that also conveys structural information about the system that manages those flows.

LLNL has depicted energy use in its home state of California for the various years including the mid-1970s through the mid 1990s and the year 2000. Despite occasional interest from various state agencies, a comprehensive package of state-level energy flowcharts has not been assembled until now.

Recent advances in the automation of Sankey Diagram generation have made it possible to produce a consistent set of state-level energy flowcharts. A computer program reads SEDS data, performs a set of calculations and re-sizes and re-labels the flows in the figure. Human interaction is required only to reconcile instances where graphical elements overlap.

Energy use at the state level is compiled by the Department of Energy’s Energy Information Administration (EIA) in the State Energy Data System (SEDS). SEDS is updated annually and generally reports data for the time period two years prior to its year of update (ie. the 2010 update records energy use in 2008). SEDS contains data on primary resource consumption, electricity generation, and energy consumption within each of the economic sectors.
Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527.
Estimated Arizona Energy Use In 2008
~1846.4 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Arkansas Energy Use In 2008
~1160.3 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated California Energy Use In 2008
~7708.6 Trillion BTU

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Estimated Colorado Energy Use In 2008
~1479.0 Trillion BTU

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Estimated Delaware Energy Use In 2008
~258.9 Trillion BTU

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Estimated District of Columbia Energy Use In 2008
~94.0 Trillion BTU

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Estimated Florida Energy Use In 2008
~4152.7 Trillion BTU

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Estimated Georgia Energy Use In 2008
~2910.2 Trillion BTU

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Estimated Hawaii Energy Use In 2008
~286.5 Trillion BTU

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Estimated Illinois Energy Use In 2008
~4554.0 Trillion BTU

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Estimated Indiana Energy Use In 2008
~2998.6 Trillion BTU

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Estimated Iowa Energy Use In 2008
~1365.2 Trillion BTU

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### Estimated Kansas Energy Use In 2008

\~1188.1 Trillion BTU

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Estimated Kentucky Energy Use In 2008
~2005.8 Trillion BTU

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Estimated Louisiana Energy Use In 2008
~3387.7 Trillion BTU

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Estimated Maine Energy Use In 2008
~462.8 Trillion BTU

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Estimated Maryland Energy Use In 2008
~1313.5 Trillion BTU

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Estimated Massachusetts Energy Use In 2008
~1324.9 Trillion BTU

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Estimated Minnesota Energy Use In 2008
≈1816.5 Trillion BTU

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Estimated Mississippi Energy Use In 2008
~1138.3 Trillion BTU

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Estimated Missouri Energy Use In 2008
~1947.4 Trillion BTU

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Estimated Montana Energy Use In 2008
~585.4 Trillion BTU

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Estimated Nebraska Energy Use In 2008
~743.8 Trillion BTU

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Estimated Nevada Energy Use In 2008
~710.3 Trillion BTU

- Solar 3.0
- Nuclear 0.0
- Hydro 17.3
- Wind 0.0
- Geothermal 30.4
- Natural Gas 274.9
- Coal 88.6
- Biomass 13.5
- Petroleum 264.1
- Electricity Generation 320.4
- Net Electricity Imports 18.5
- Residential 91.4
- Commercial 66.1
- Industrial 97.0
- Transportation 237.0
- Rejected Energy 467.8
- Energy Services 242.5

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
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Estimated New Mexico Energy Use In 2008
~828.0 Trillion BTU

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Estimated New York Energy Use In 2008
~3878.8 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

~3878.8 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated North Carolina Energy Use In 2008
~2602.2 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated North Dakota Energy Use In 2008
~664.4 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 80% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Ohio Energy Use In 2008
~3856.6 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Oklahoma Energy Use In 2008
~1728.2 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

Lawrence Livermore National Laboratory
Estimated Oregon Energy Use In 2008
~1095.0 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Pennsylvania Energy Use In 2008
~4508.9 Trillion BTU

Source: LLNL. 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527

[Diagram showing energy sources and their contributions to electricity generation and end uses.]

[Legend for energy sources: Solar, Nuclear, Hydro, Wind, Geothermal, Natural Gas, Coal, Biomass, Petroleum.]

[Data values for energy sources and end uses.]
Estimated Rhode Island Energy Use In 2008 ~201.1 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated South Carolina Energy Use In 2008
~1815.5 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated South Dakota Energy Use In 2008
~273.8 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
### Estimated Tennessee Energy Use in 2008

**~2112.8 Trillion BTU**

**Source:** LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Texas Energy Use In 2008
~11485.4 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Utah Energy Use In 2008
~943.8 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Vermont Energy Use In 2008
~164.1 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527.
Estimated Virginia Energy Use In 2008
~2211.2 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant “heat rate.” The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Energy Services 731.5

Petroleum 786.0

Biomass 97.8

Coal 94.6

Natural Gas 307.2

Geothermal 0.8

Wind 36.0

Hydro 765.0

Nuclear 96.9

Solar 0.2

Electricity Generation 1073.9

Net Electricity Exports

Energy Services 731.5

Rejected Energy 1410.4

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated West Virginia Energy Use In 2008
~1369.8 Trillion BTU

Source: LLNL. 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Wisconsin Energy Use In 2008
~1760.8 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Estimated Wyoming Energy Use In 2008
~845.8 Trillion BTU

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports flows for non-thermal resources (i.e., hydro, wind and solar) in BTU-equivalent values by assuming a typical fossil fuel plant "heat rate." The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. Interstate and international electricity trade are lumped into net imports or exports and are calculated using a system-wide generation efficiency. End use efficiency is estimated as 65% for the residential, 70% for the commercial, 80% for the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LLNL-MI-410527
Analysis

SEDS reports many of the flows depicted on the state-level charts directly.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLACB</td>
<td>Coal consumed by the transportation sector.</td>
</tr>
<tr>
<td>CLCCB</td>
<td>Coal consumed by the commercial sector.</td>
</tr>
<tr>
<td>CLEIB</td>
<td>Coal consumed by the electric power sector.</td>
</tr>
<tr>
<td>CLICB</td>
<td>Coal consumed by the industrial sector.</td>
</tr>
<tr>
<td>CLRCB</td>
<td>Coal consumed by the residential sector.</td>
</tr>
<tr>
<td>ENACB</td>
<td>Ethanol (biomass) consumed by the transportation sector.</td>
</tr>
<tr>
<td>ESACB</td>
<td>Electricity consumed by the transportation sector.</td>
</tr>
<tr>
<td>ESCCB</td>
<td>Electricity consumed by the commercial sector.</td>
</tr>
<tr>
<td>ESICB</td>
<td>Electricity consumed by the industrial sector.</td>
</tr>
<tr>
<td>ESRCB</td>
<td>Electricity consumed by the residential sector.</td>
</tr>
<tr>
<td>GECCB</td>
<td>Direct use of geothermal energy and heat pumps in the commercial sector.</td>
</tr>
<tr>
<td>GEEGB</td>
<td>Thermal input to electricity produced from geothermal energy by the electric power sector.</td>
</tr>
<tr>
<td>GEICB</td>
<td>Direct use of geothermal energy and heat pumps in the industrial sector.</td>
</tr>
<tr>
<td>GERCB</td>
<td>Direct use of geothermal energy and heat pumps in the residential sector.</td>
</tr>
<tr>
<td>HYCCB</td>
<td>Thermal equivalent of hydroelectricity produced in the commercial sector.</td>
</tr>
<tr>
<td>HYEGB</td>
<td>Thermal equivalent of hydroelectricity produced by the electric power sector.</td>
</tr>
<tr>
<td>HYICB</td>
<td>Thermal equivalent of hydroelectricity produced in the industrial sector.</td>
</tr>
<tr>
<td>NGACB</td>
<td>Natural gas consumed by the transportation sector.</td>
</tr>
<tr>
<td>NGCCB</td>
<td>Natural gas consumed by the commercial sector.</td>
</tr>
<tr>
<td>NGEIB</td>
<td>Natural gas consumed by the electric power sector.</td>
</tr>
<tr>
<td>NGICB</td>
<td>Natural gas consumed by the industrial sector.</td>
</tr>
<tr>
<td>NGRCB</td>
<td>Natural gas consumed by the residential sector.</td>
</tr>
<tr>
<td>NUEGB</td>
<td>Thermal input to electricity produced from nuclear power by the electric power sector.</td>
</tr>
<tr>
<td>PAEIB</td>
<td>All petroleum products consumed by the electric power sector.</td>
</tr>
<tr>
<td>PARCB</td>
<td>All petroleum products consumed by the residential sector.</td>
</tr>
<tr>
<td>SOEGB</td>
<td>Thermal equivalent of electricity produced from photovoltaic and solar thermal energy by the electric power sector.</td>
</tr>
<tr>
<td>SOHCB</td>
<td>Thermal equivalent of photovoltaic and solar thermal energy consumed by the residential and commercial sectors.</td>
</tr>
<tr>
<td>WDRCB</td>
<td>Wood (biomass) consumed by the residential sector.</td>
</tr>
<tr>
<td>WWEIB</td>
<td>Wood and waste (biomass) consumed by the electric power sector.</td>
</tr>
<tr>
<td>WYEGB</td>
<td>Thermal equivalent of electricity produced from wind energy by the electric power sector.</td>
</tr>
</tbody>
</table>
Those that are not reported directly are calculated from the following data:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELISB</td>
<td>Net interstate sales of electricity and associated losses.</td>
</tr>
<tr>
<td>ELNIB</td>
<td>Net imports of electricity into the United States.</td>
</tr>
<tr>
<td>ENCCB</td>
<td>Fuel ethanol consumed by the commercial sector.</td>
</tr>
<tr>
<td>ENICB</td>
<td>Fuel ethanol consumed by the industrial sector.</td>
</tr>
<tr>
<td>ESTCB</td>
<td>Electricity total consumption.</td>
</tr>
<tr>
<td>LOTCB</td>
<td>Total electrical system energy losses.</td>
</tr>
<tr>
<td>PAACB</td>
<td>All petroleum products consumed by the transportation sector.</td>
</tr>
<tr>
<td>PACCB</td>
<td>All petroleum products consumed by the commercial sector.</td>
</tr>
<tr>
<td>PAICB</td>
<td>All petroleum products consumed by the industrial sector.</td>
</tr>
<tr>
<td>TEACB</td>
<td>Total energy consumed by the transportation sector including electrical system losses.</td>
</tr>
<tr>
<td>TECCB</td>
<td>Total energy consumed by the commercial sector including electrical system losses.</td>
</tr>
<tr>
<td>TEICB</td>
<td>Total energy consumed by the industrial sector including electrical system losses.</td>
</tr>
<tr>
<td>TERCB</td>
<td>Total energy consumed by the residential sector including electrical system losses.</td>
</tr>
<tr>
<td>WWCCB</td>
<td>Wood and waste consumed by the commercial sector.</td>
</tr>
<tr>
<td>WWICB</td>
<td>Wood and waste consumed by the industrial sector.</td>
</tr>
</tbody>
</table>

Certain other flows are computed as functions of directly reported energy use in SEDS:

SEDS reports petroleum consumption in certain sectors as the total of consumption petroleum products including blended ethanol. Therefore, petroleum consumption is computed for the following sectors as:

PACCB – ENCCB (Commercial)
PAICB – ENICB (Industrial)
PAACB – ENACB (Transportation)

Biomass consumption is computed for the following sectors as:

WWCCB + ENCCB (Commercial)
WWICB + ENICB (Industrial)

SEDS separates interstate and international imports/exports of electricity. Furthermore, those statistics are reported as the thermal equivalent required to generate the imported/exported electricity. In order to represent the total net import/export of electrical energy, electric imports/exports are computed as:

\[(\text{ELISB} + \text{ELNIB}) / (1+\text{LOTCB}/\text{ESTCB})\]
Total state energy use is calculated as:

\[ \text{CLACB} + \text{PAACB} + \text{NGACB} + \]
\[ \text{CLCCB} + \text{PACCB} + \text{GECCB} + \text{HYCCB} + \text{NGCCB} + \text{WWCCB} + \]
\[ \text{CLICB} + \text{PAICB} + \text{GEICB} + \text{HYICB} + \text{NGICB} + \text{WWICB} + \]
\[ \text{CLRCB} + \text{PARCB} + \text{GERCB} + \text{NGRCB} + \text{WRCB} + \text{SOHCB} + \]
\[ \text{CLEIB} + \text{GEEGB} + \text{HYEGB} + \text{NGEIB} + \text{UEGB} + \text{PAEIB} + \text{SOEGB} + \text{WWEIB} + \text{WYEBG} + \]
\[ \frac{(\text{ELISB} + \text{ELNIB})}{(1 + \text{LOTCB} / \text{ESTCB})} \]

The end use service sectors are assumed to have the following efficiencies:

- 65% Residential
- 70% Commercial
- 80% Industrial
- 25% Transportation

**Conclusion**

The flow charts described in this report are compact depictions of the energy use at the state level in 2008. These diagrams will be made available at:

http://flowcharts.llnl.gov

**References**

EIA’s State Energy Data System available at: [http://www.eia.doe.gov/states/_seds.html](http://www.eia.doe.gov/states/_seds.html)

(Livermore, 2009)