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.

Estimated Alabama Energy Use In 2008
~2503.7 Trillion BTU

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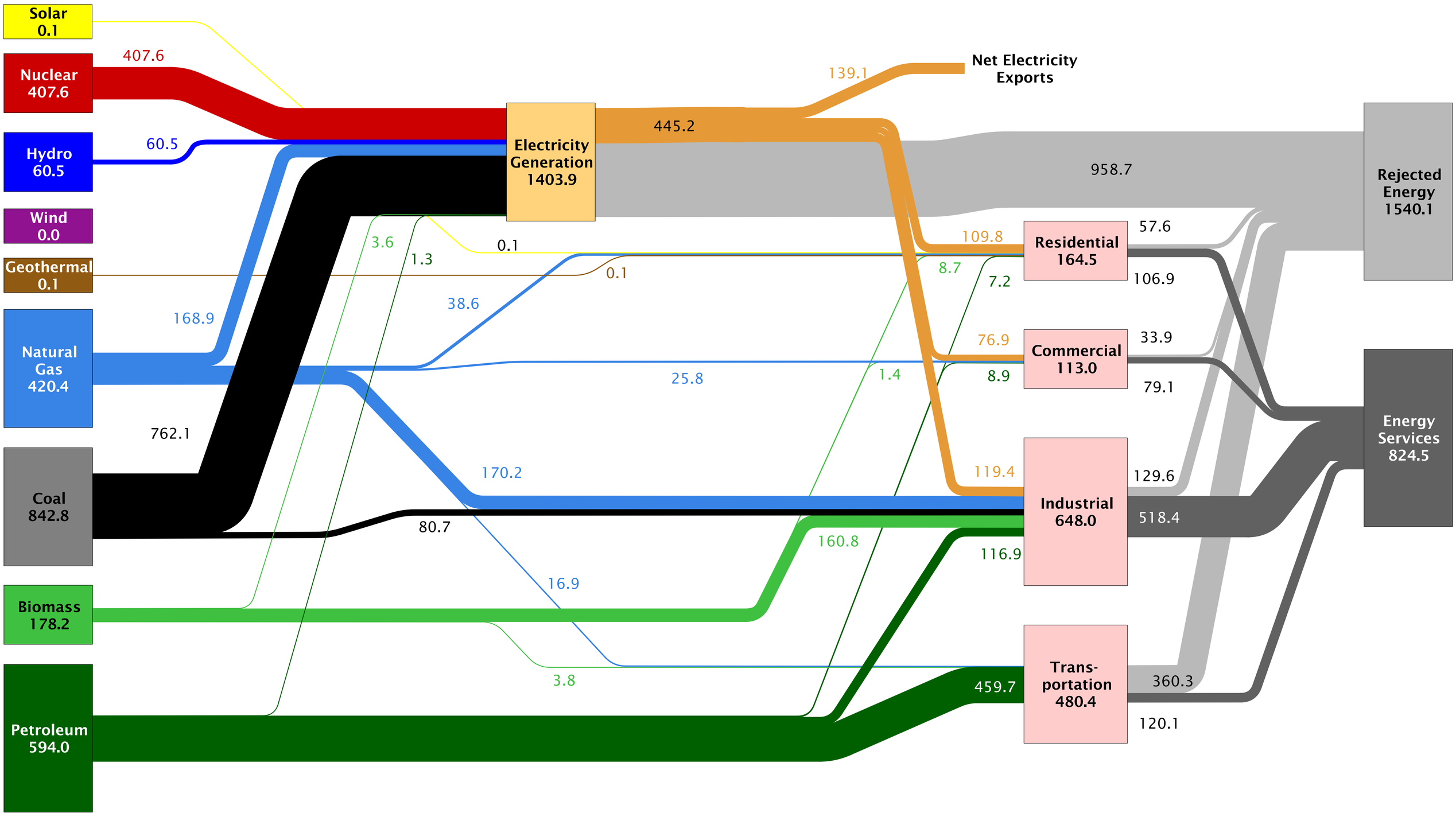

Source: LLNL 2010. Data is based on DOE/EIA-0214(2008), June 2010. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only 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 Alaska Energy Use In 2008
~650.8 Trillion BTU

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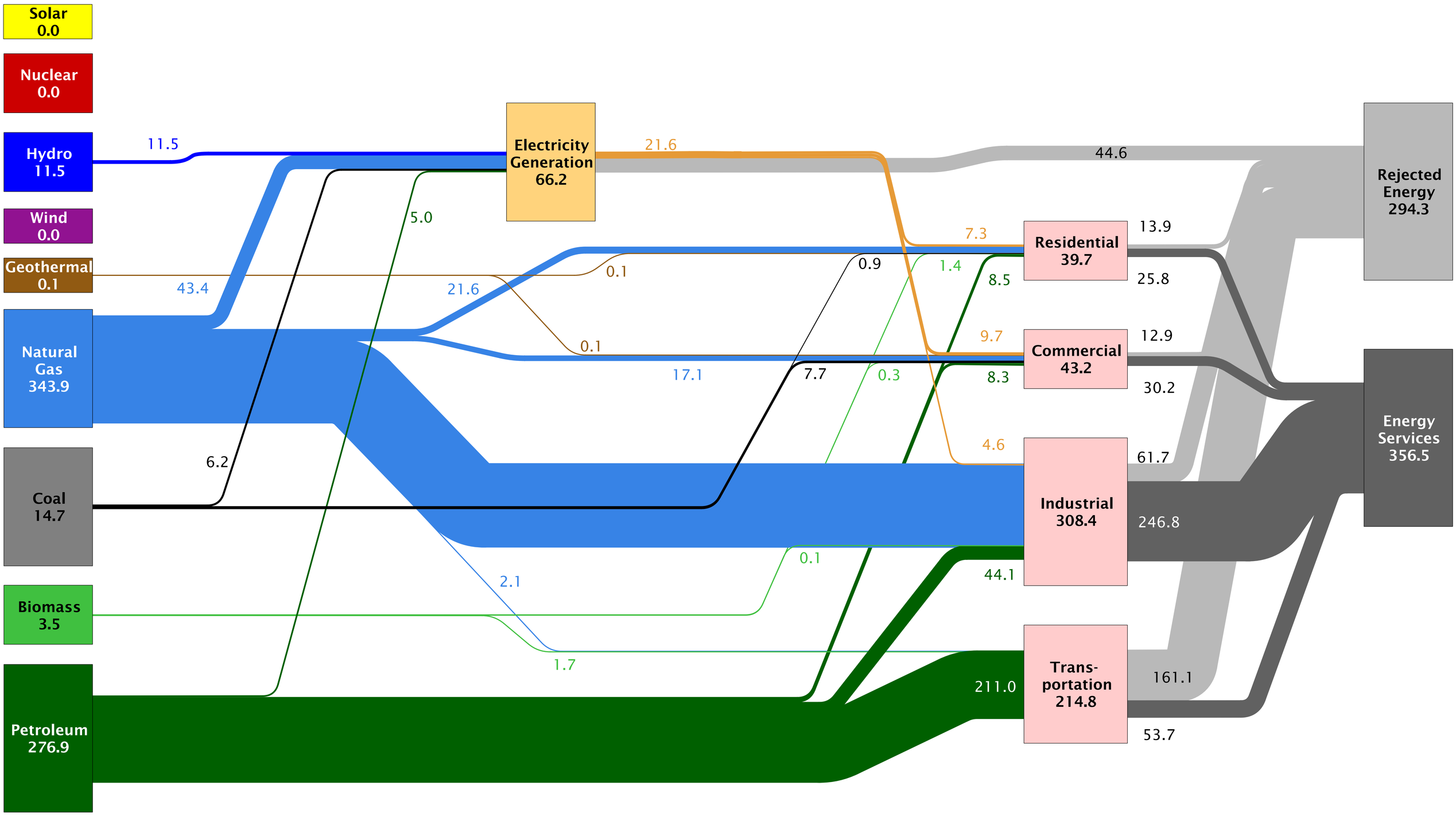

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Estimated Arizona Energy Use In 2008
~1846.4 Trillion BTU

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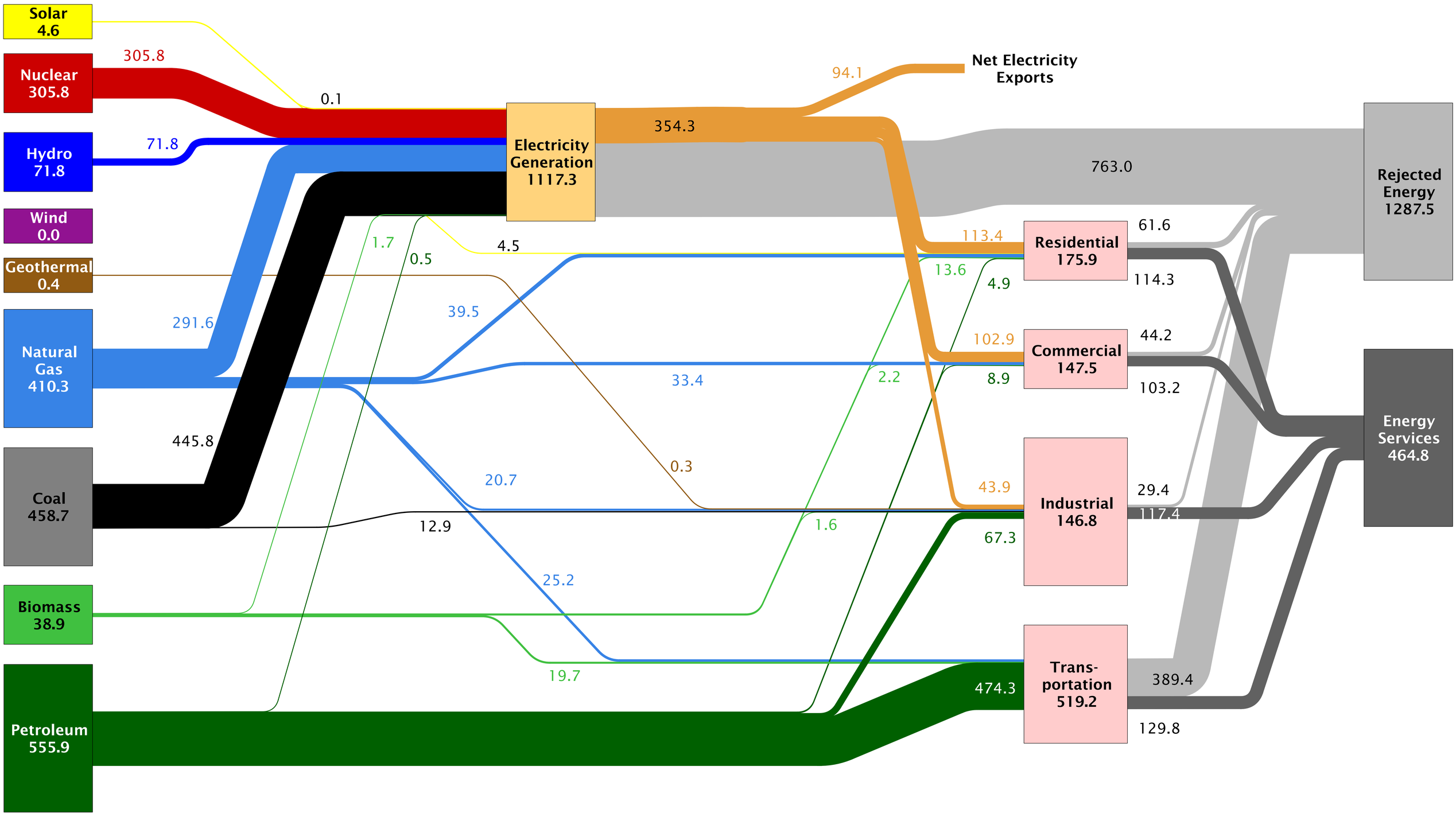

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Estimated Arkansas Energy Use In 2008
~1160.3 Trillion BTU

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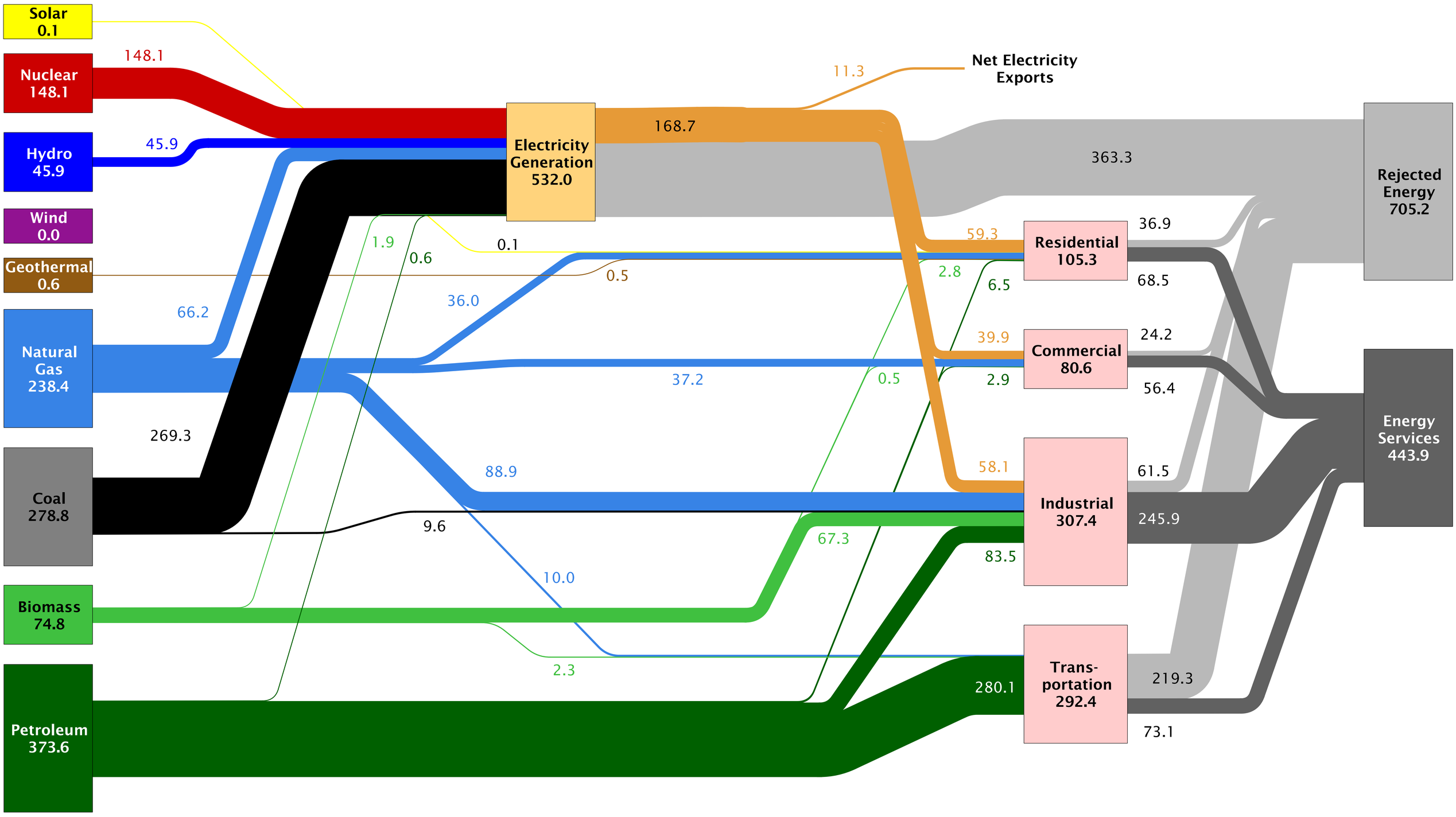

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Estimated California Energy Use In 2008
~7708.6 Trillion BTU

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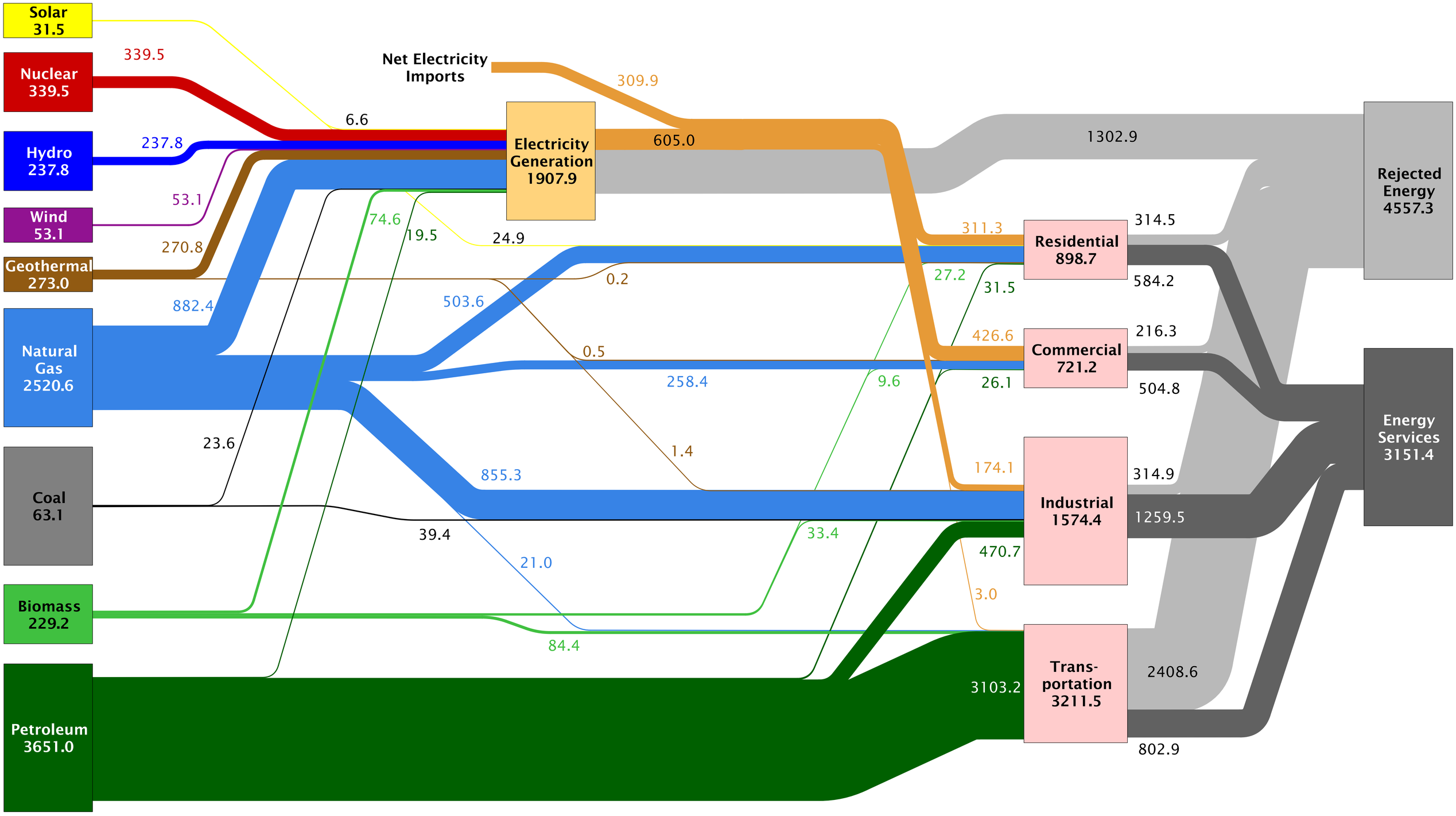

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Estimated Colorado Energy Use In 2008
~1479.0 Trillion BTU

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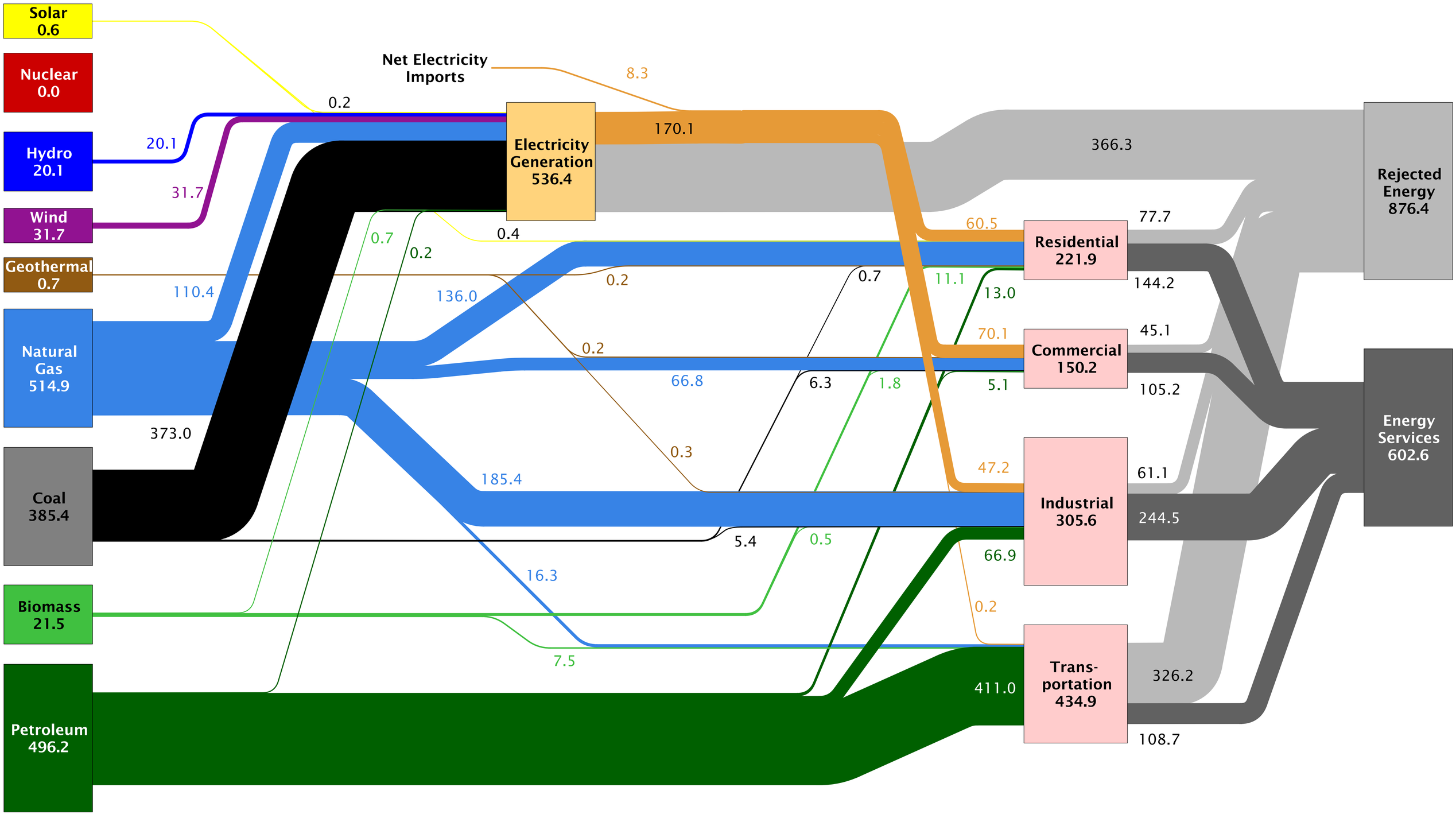

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Estimated Connecticut Energy Use In 2008
~781.4 Trillion BTU

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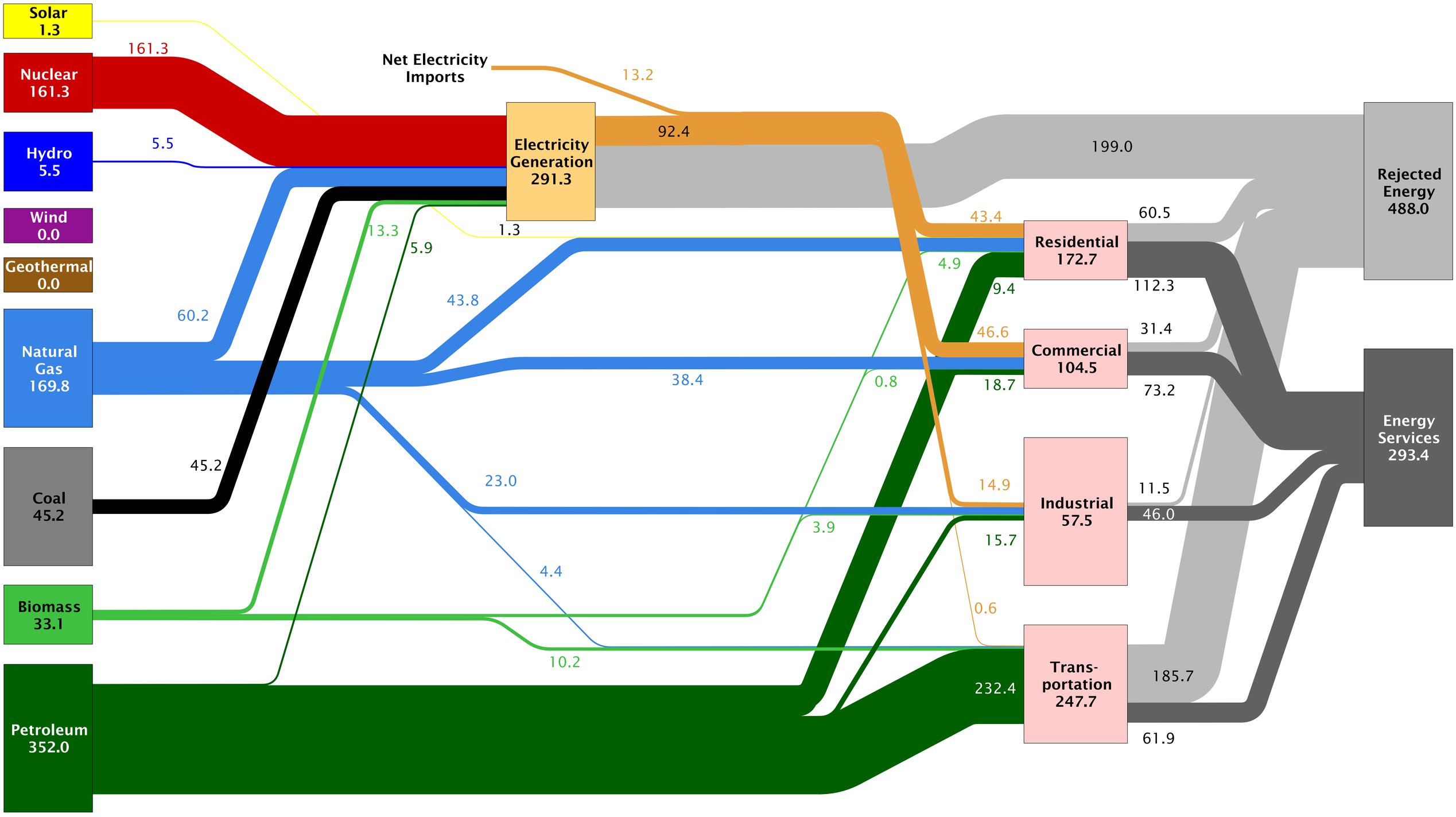

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Estimated Delaware Energy Use In 2008
~258.9 Trillion BTU

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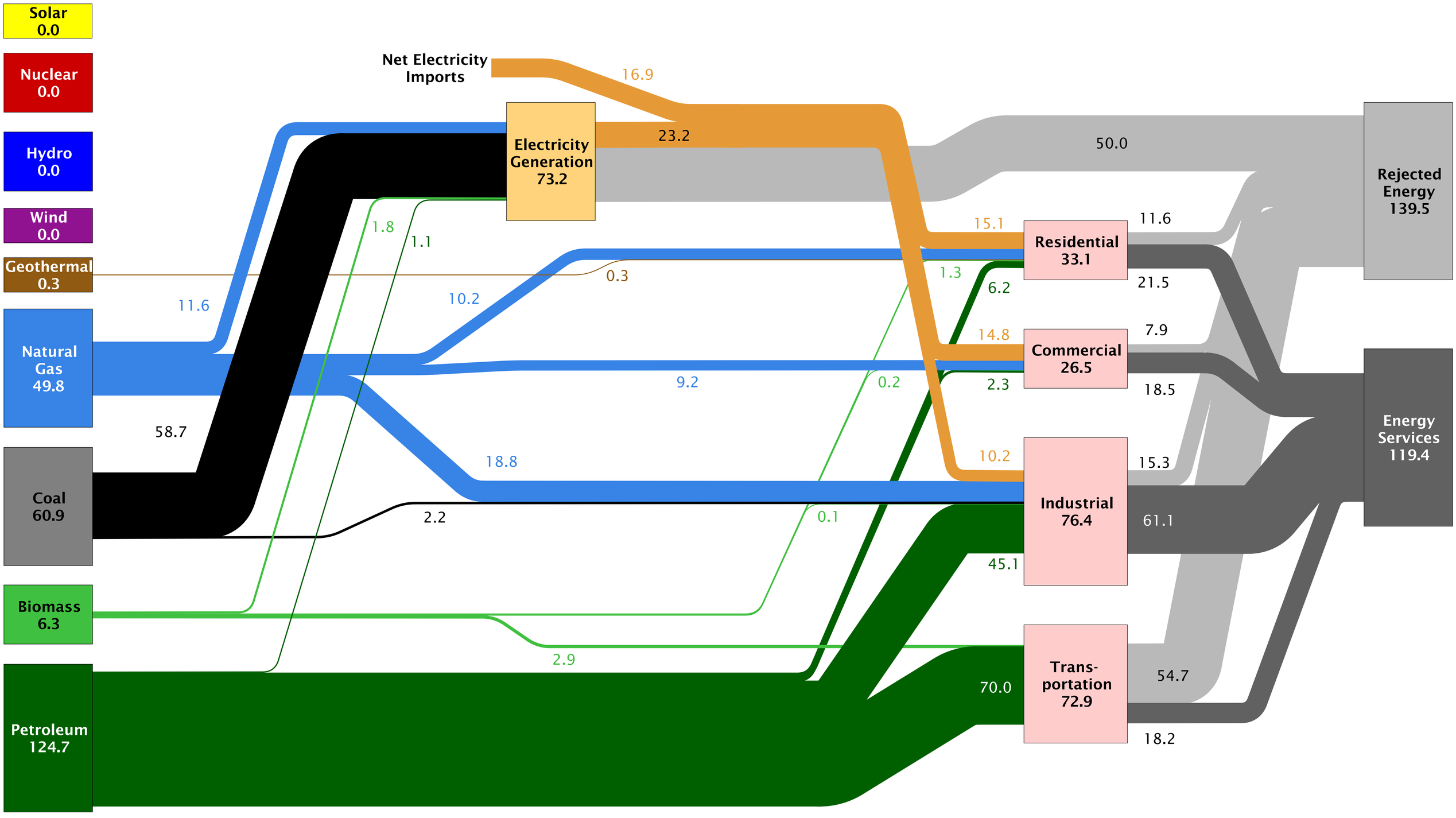

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Estimated District of Columbia Energy Use In 2008
~94.0 Trillion BTU

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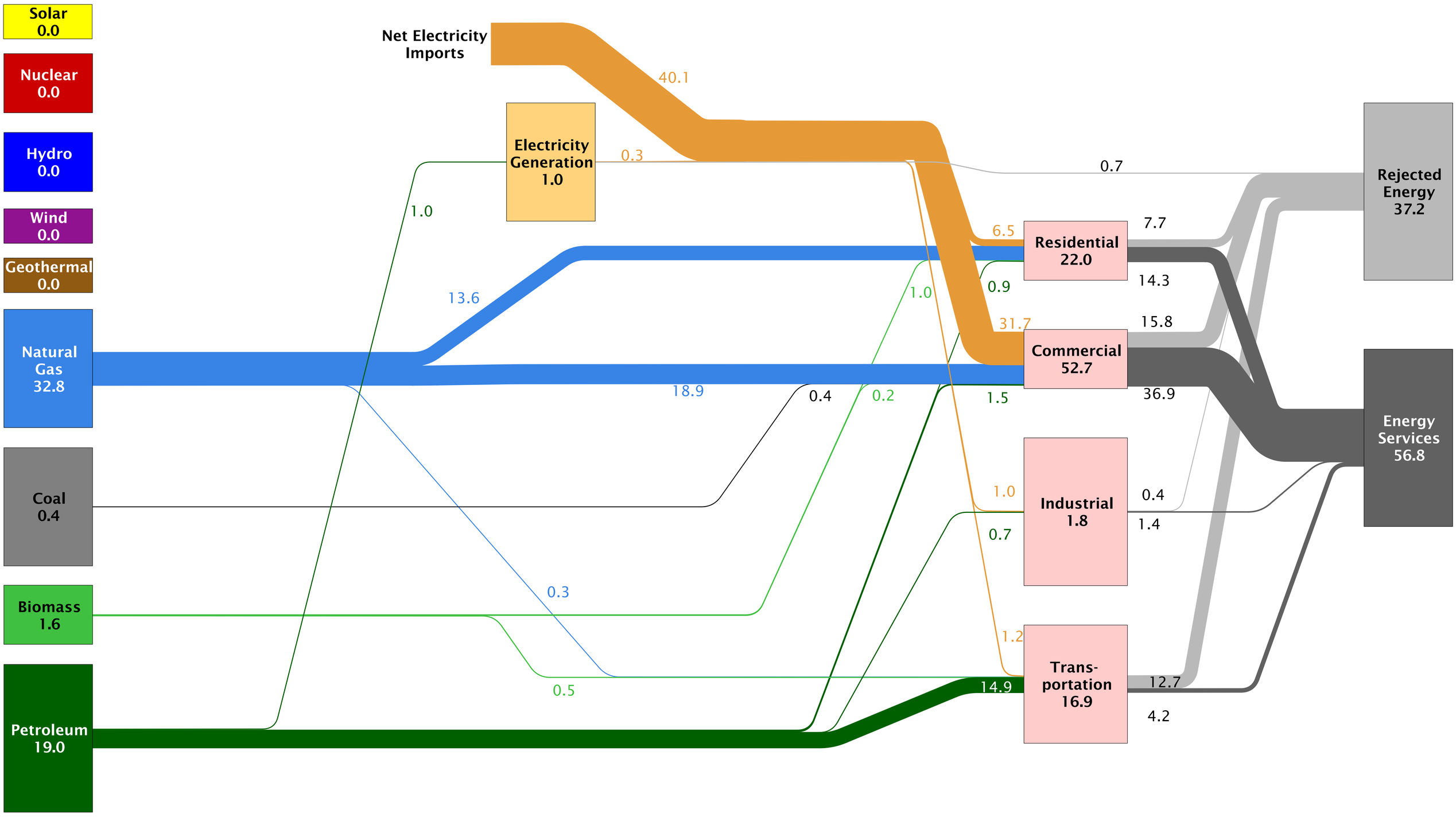

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Estimated Florida Energy Use In 2008
~4152.7 Trillion BTU

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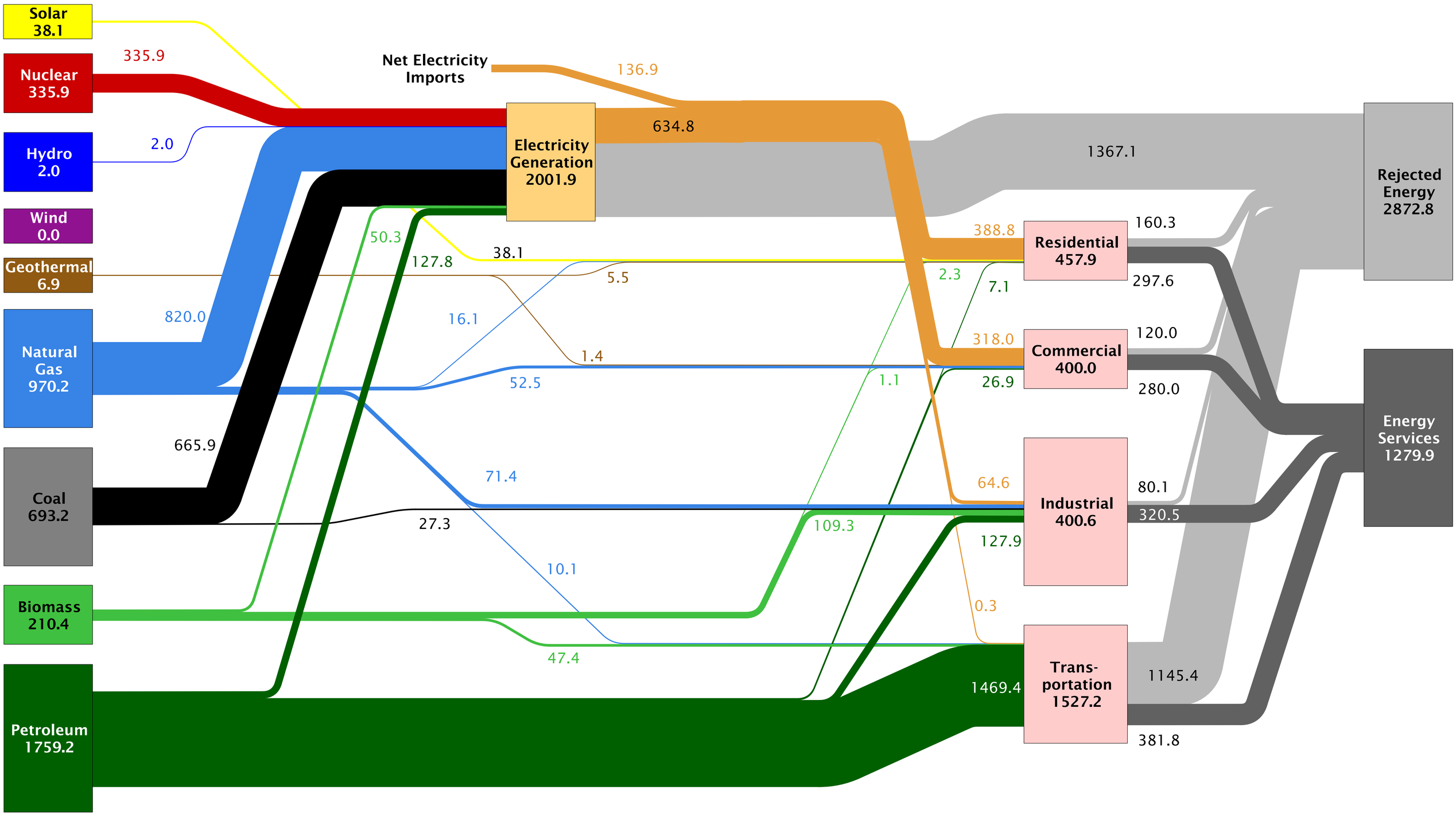

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Estimated Georgia Energy Use In 2008
~2910.2 Trillion BTU

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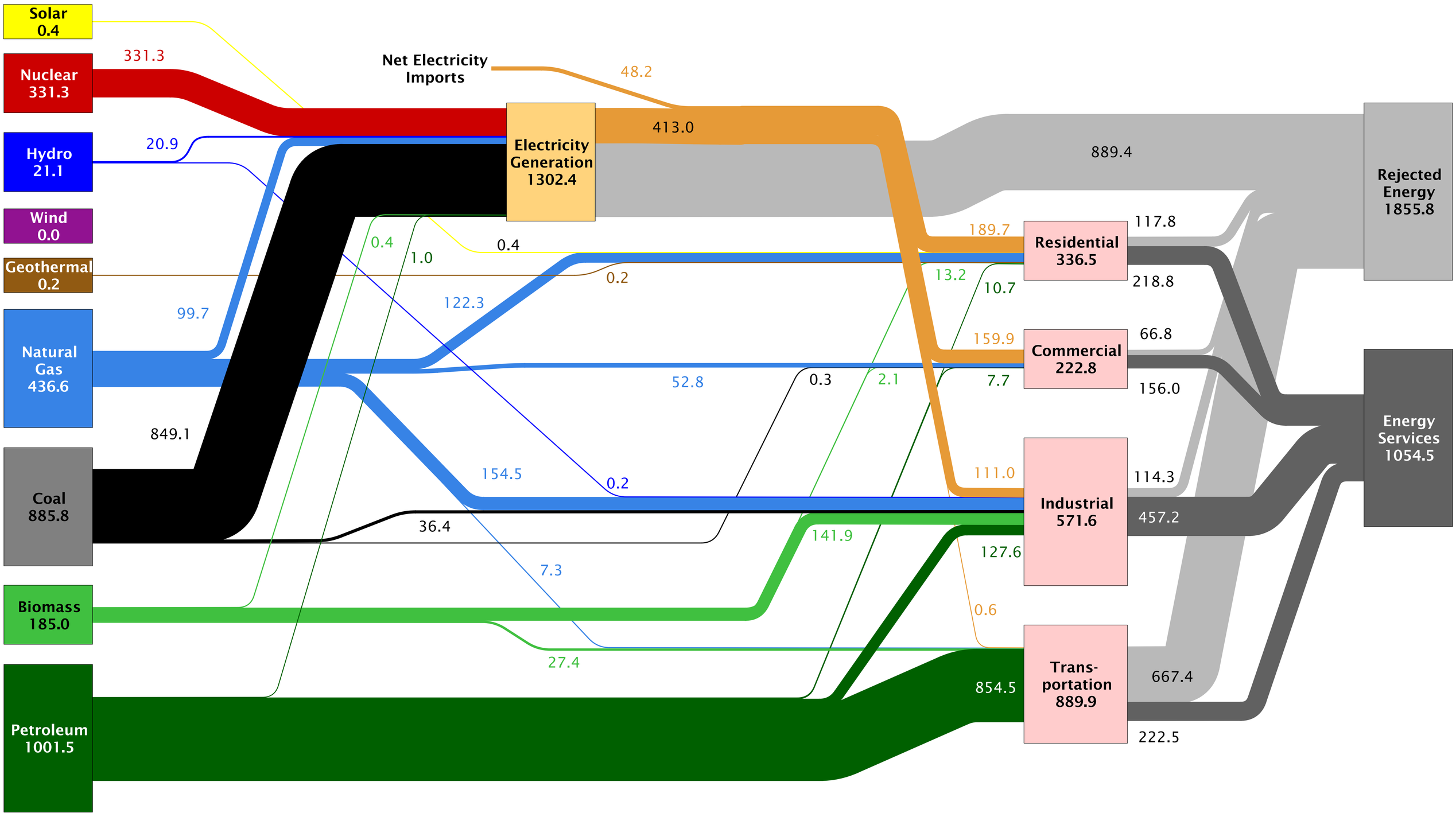

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Estimated Hawaii Energy Use In 2008
~286.5 Trillion BTU

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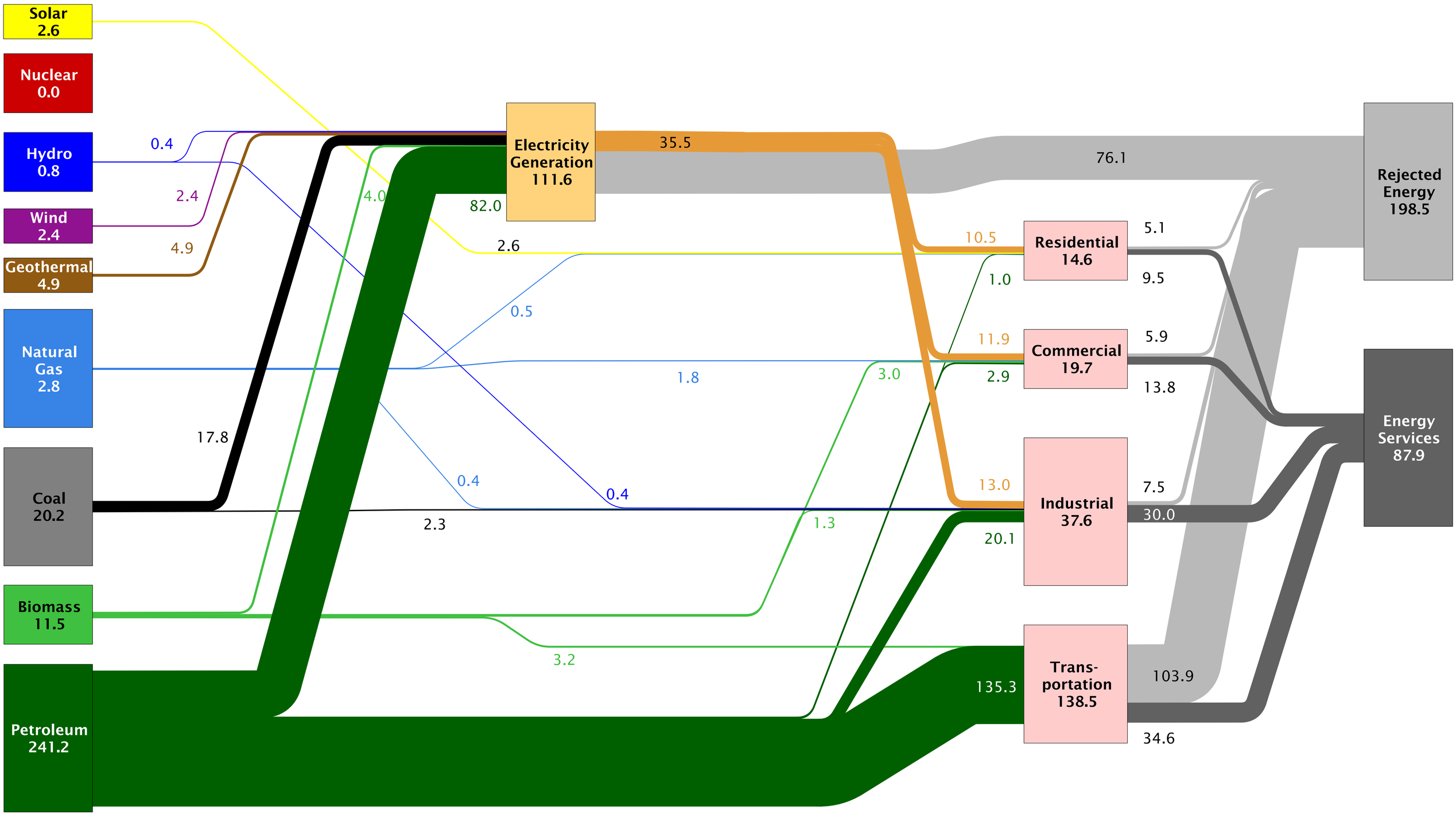

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Estimated Idaho Energy Use In 2008
~426.7 Trillion BTU

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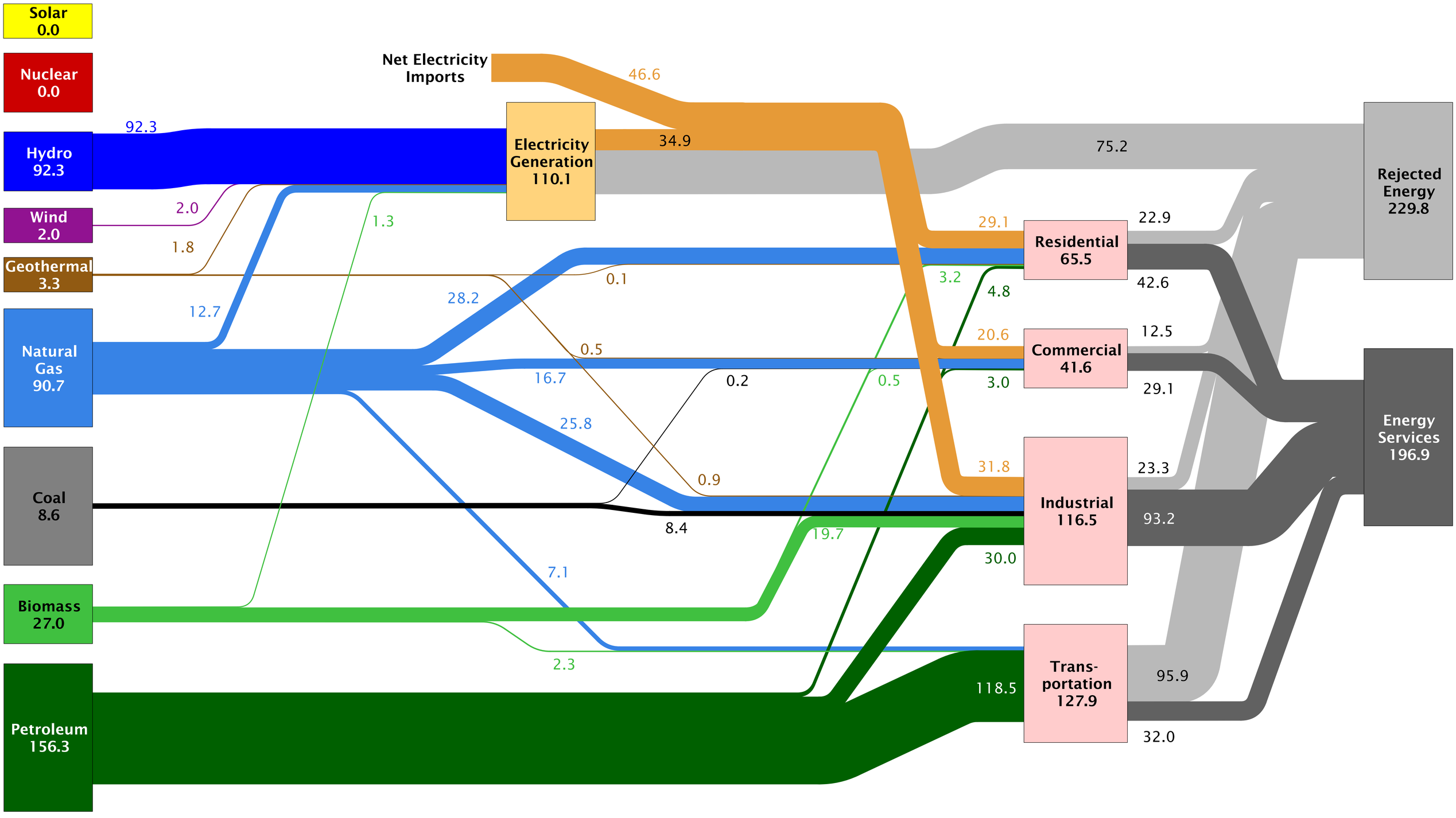

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Estimated Illinois Energy Use In 2008
~4554.0 Trillion BTU

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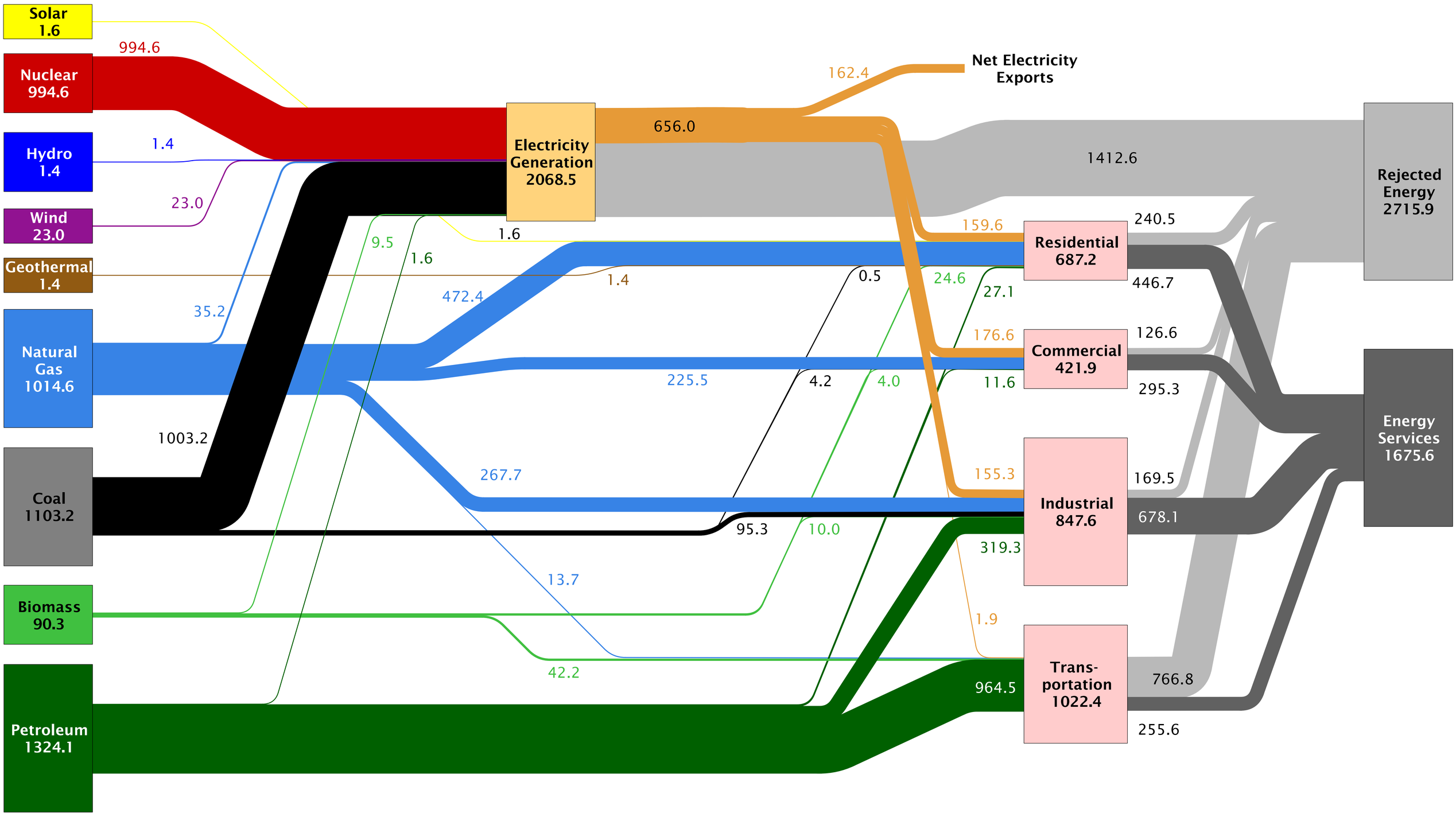

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Estimated Indiana Energy Use In 2008
~2998.6 Trillion BTU

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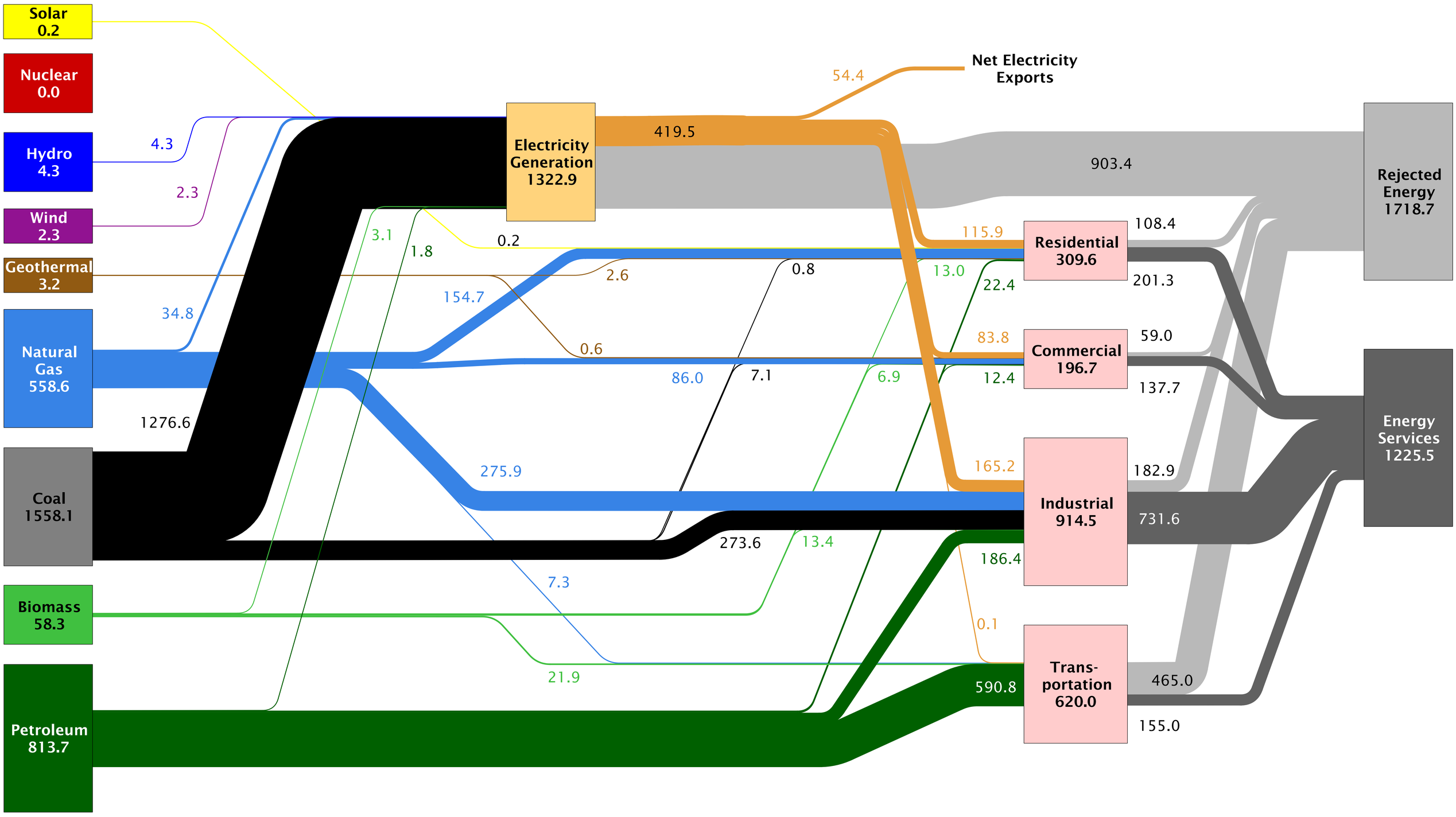

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Estimated Iowa Energy Use In 2008
~1365.2 Trillion BTU

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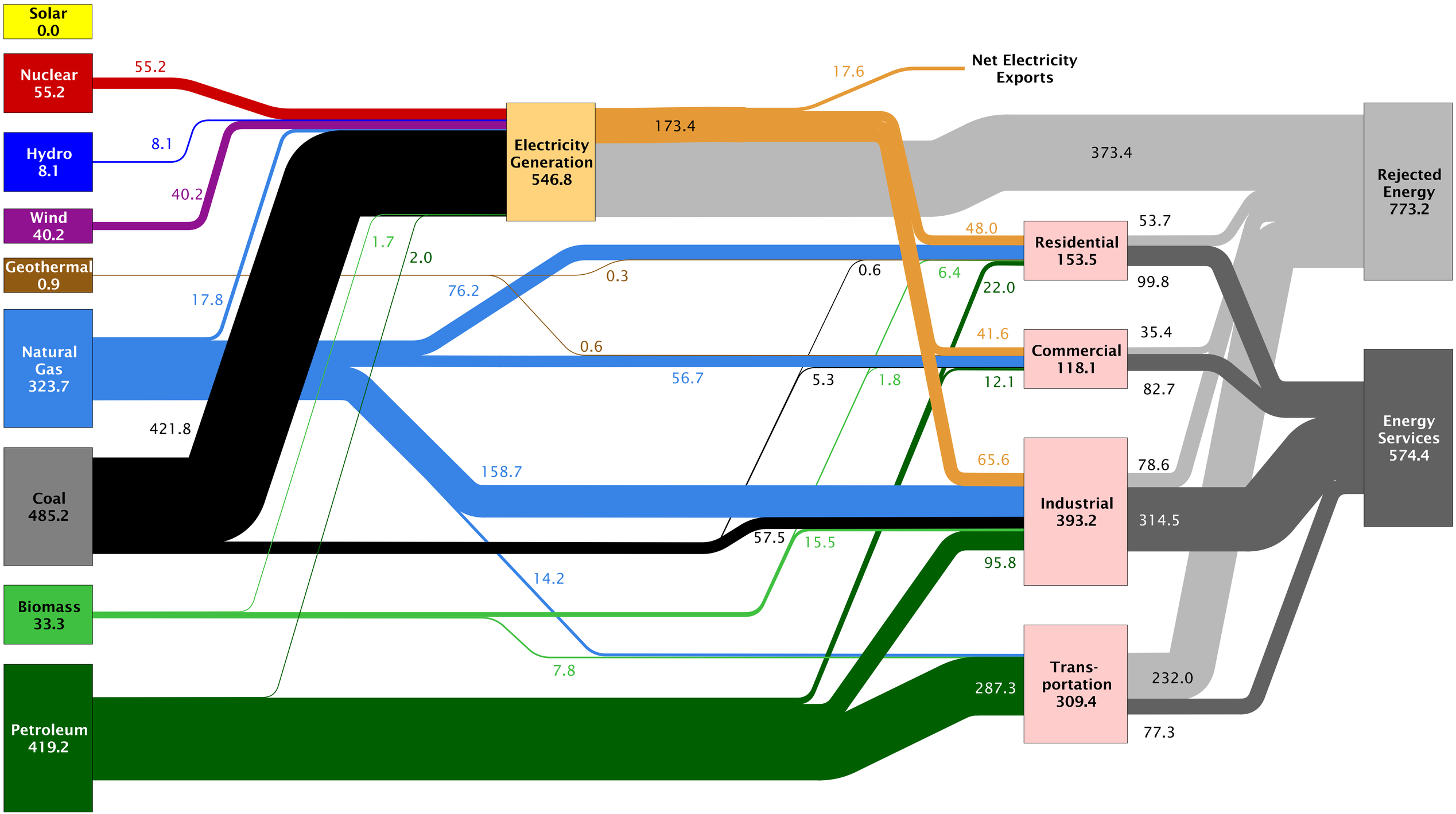

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Estimated Kansas Energy Use In 2008
~1188.1 Trillion BTU

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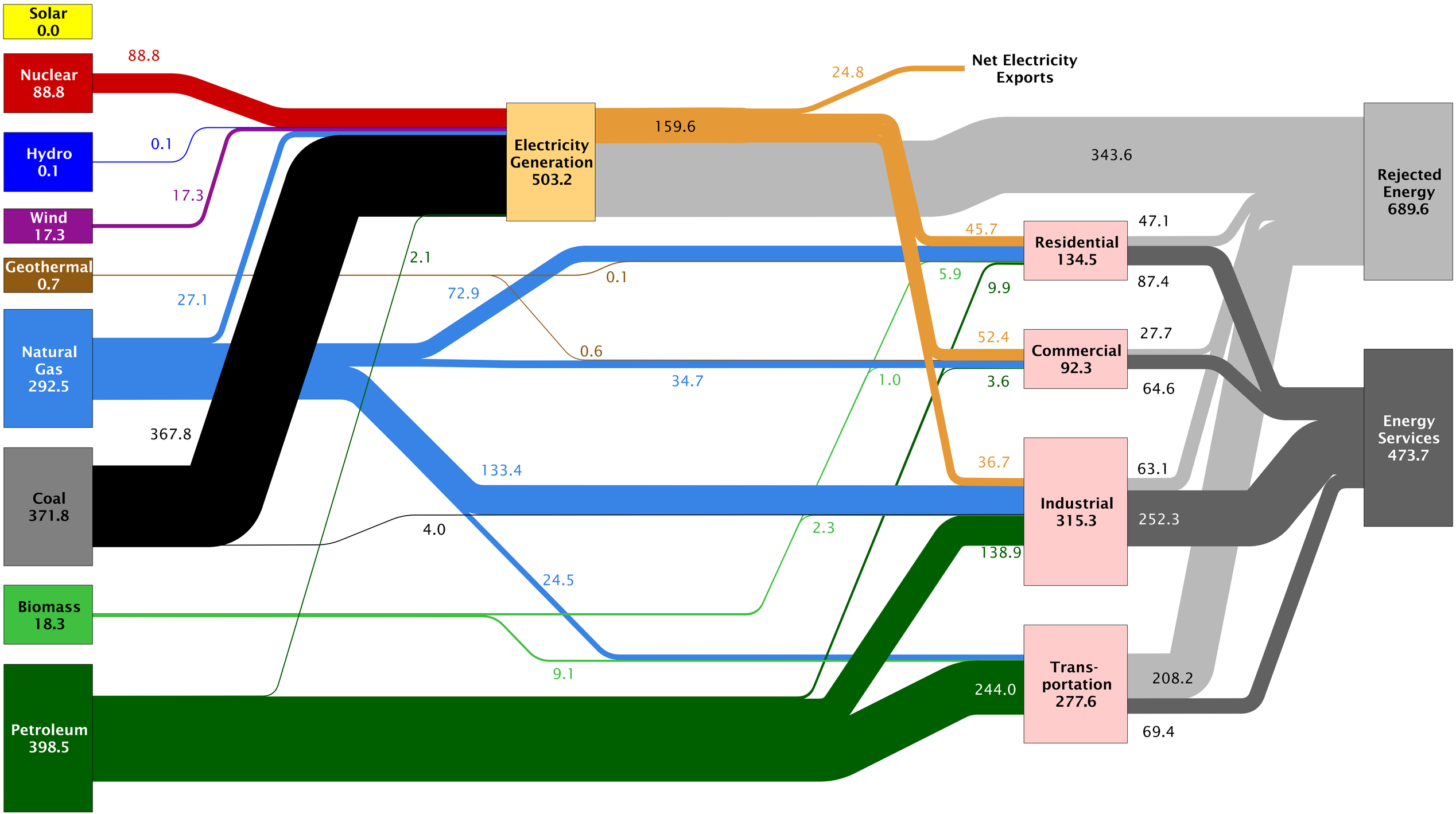

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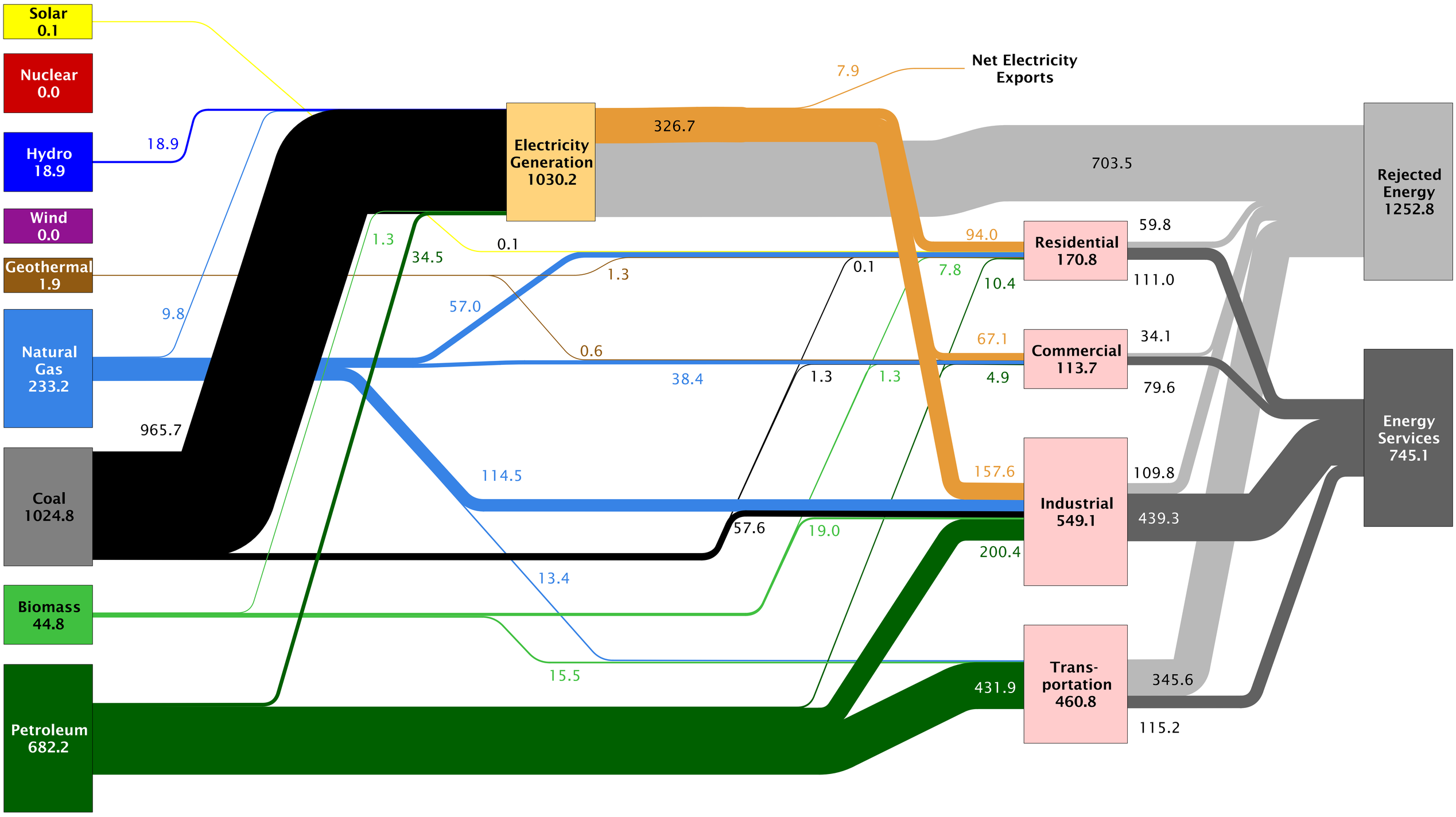
Estimated Kentucky Energy Use In 2008
~2005.8 Trillion BTU

Lawrence Livermore National Laboratory



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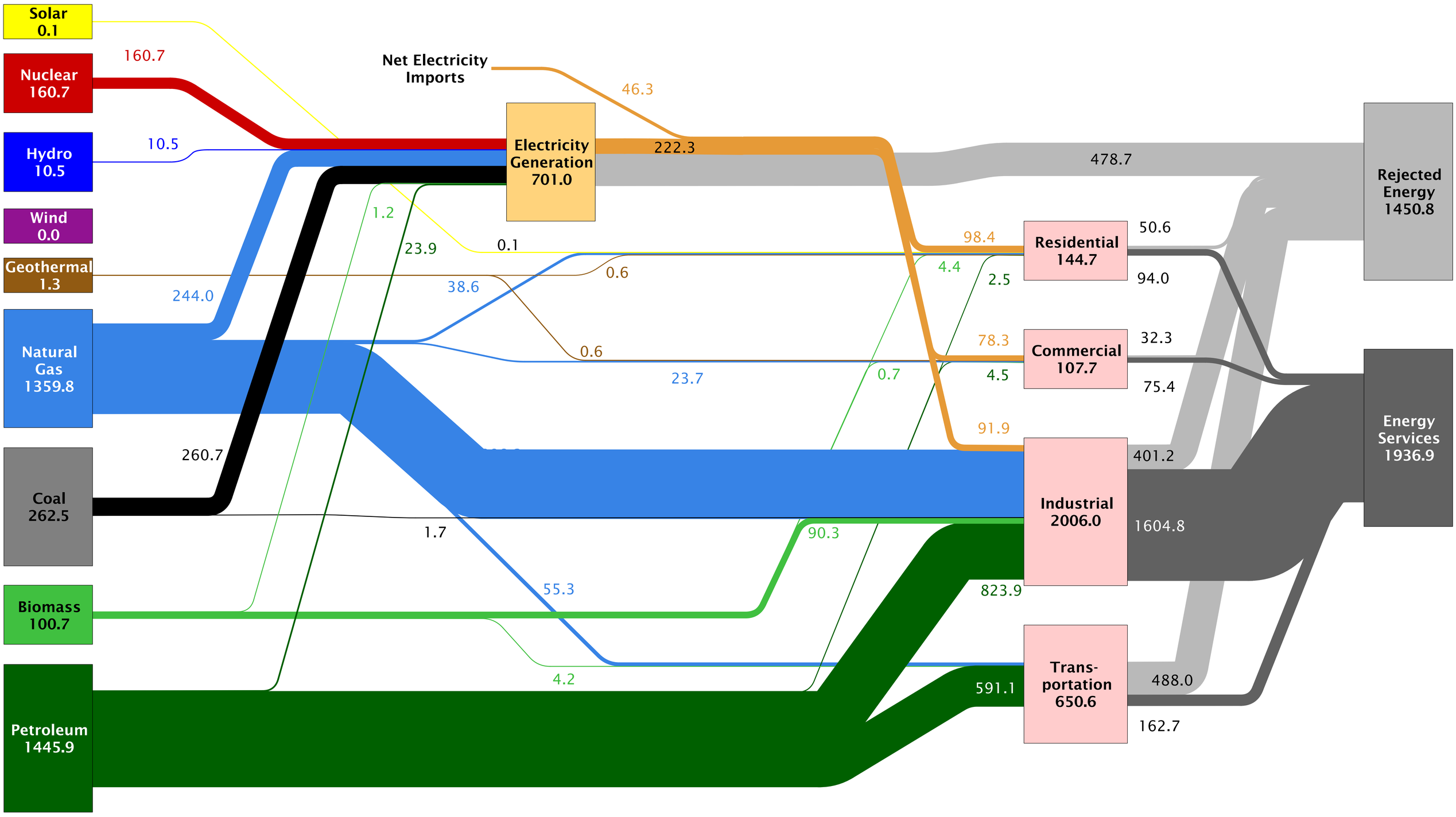
Estimated Louisiana Energy Use In 2008
~3387.7 Trillion BTU

Lawrence Livermore National Laboratory



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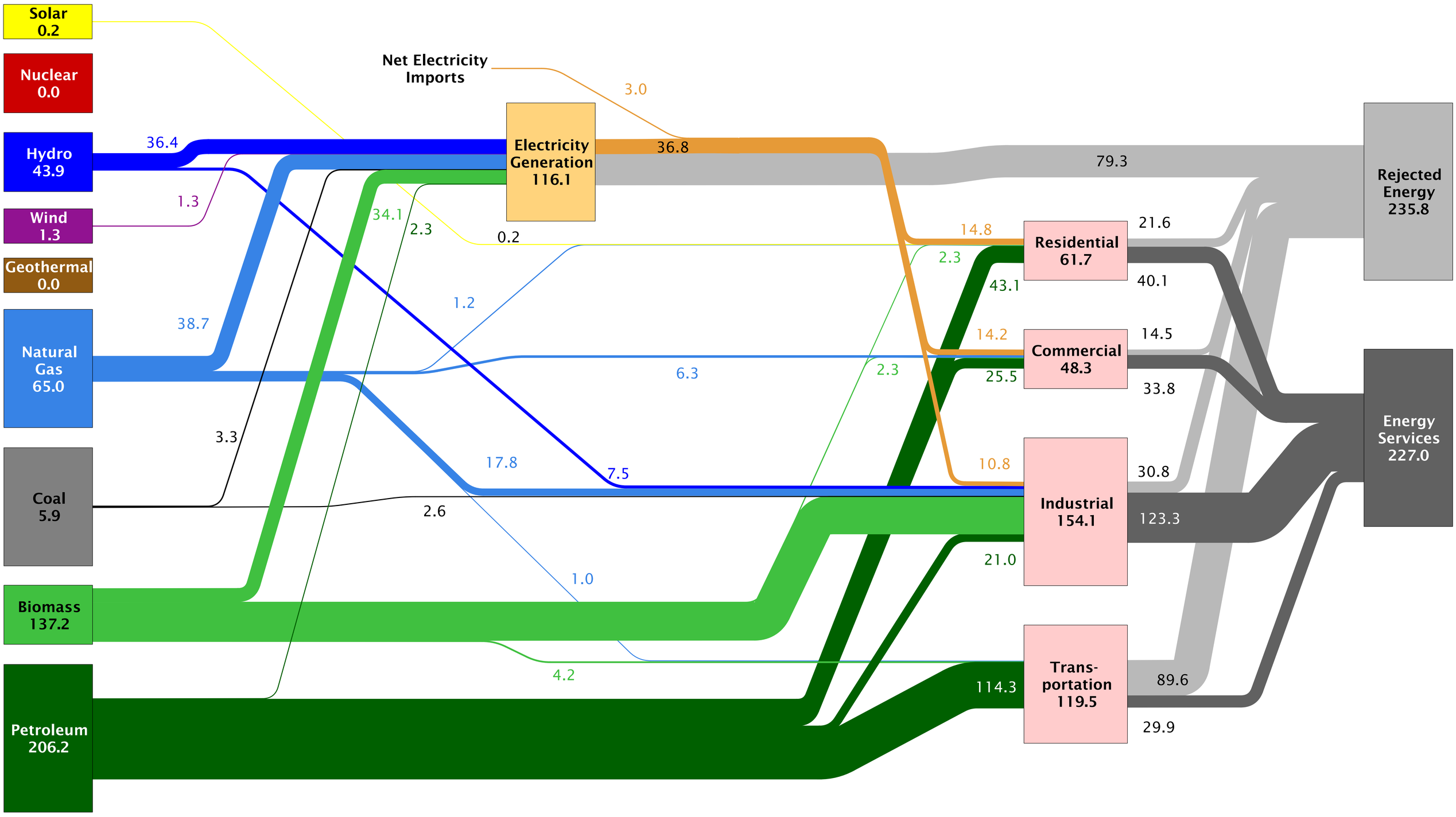
Estimated Maine Energy Use In 2008
~462.8 Trillion BTU

Lawrence Livermore National Laboratory



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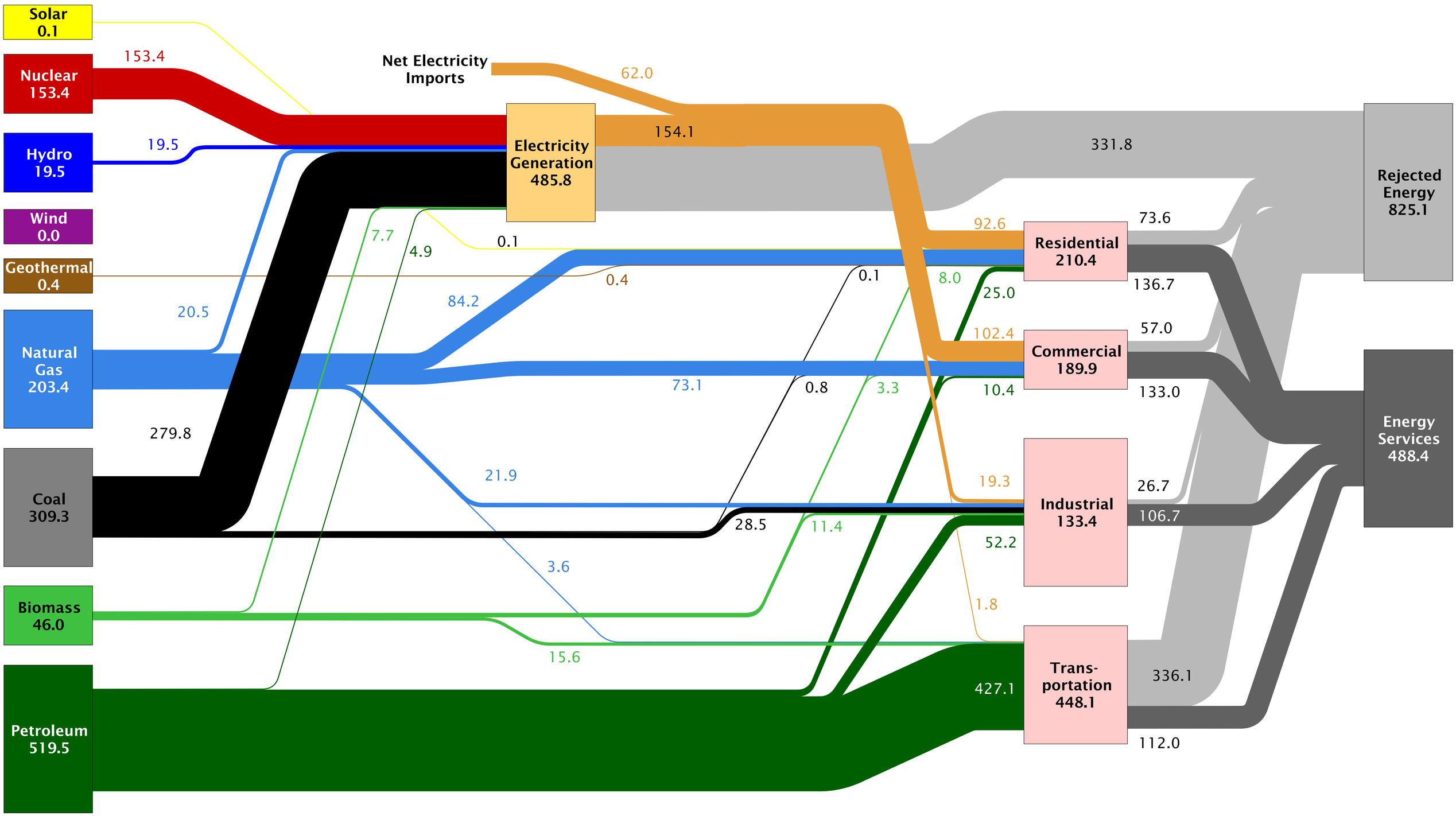
Estimated Maryland Energy Use In 2008
~1313.5 Trillion BTU

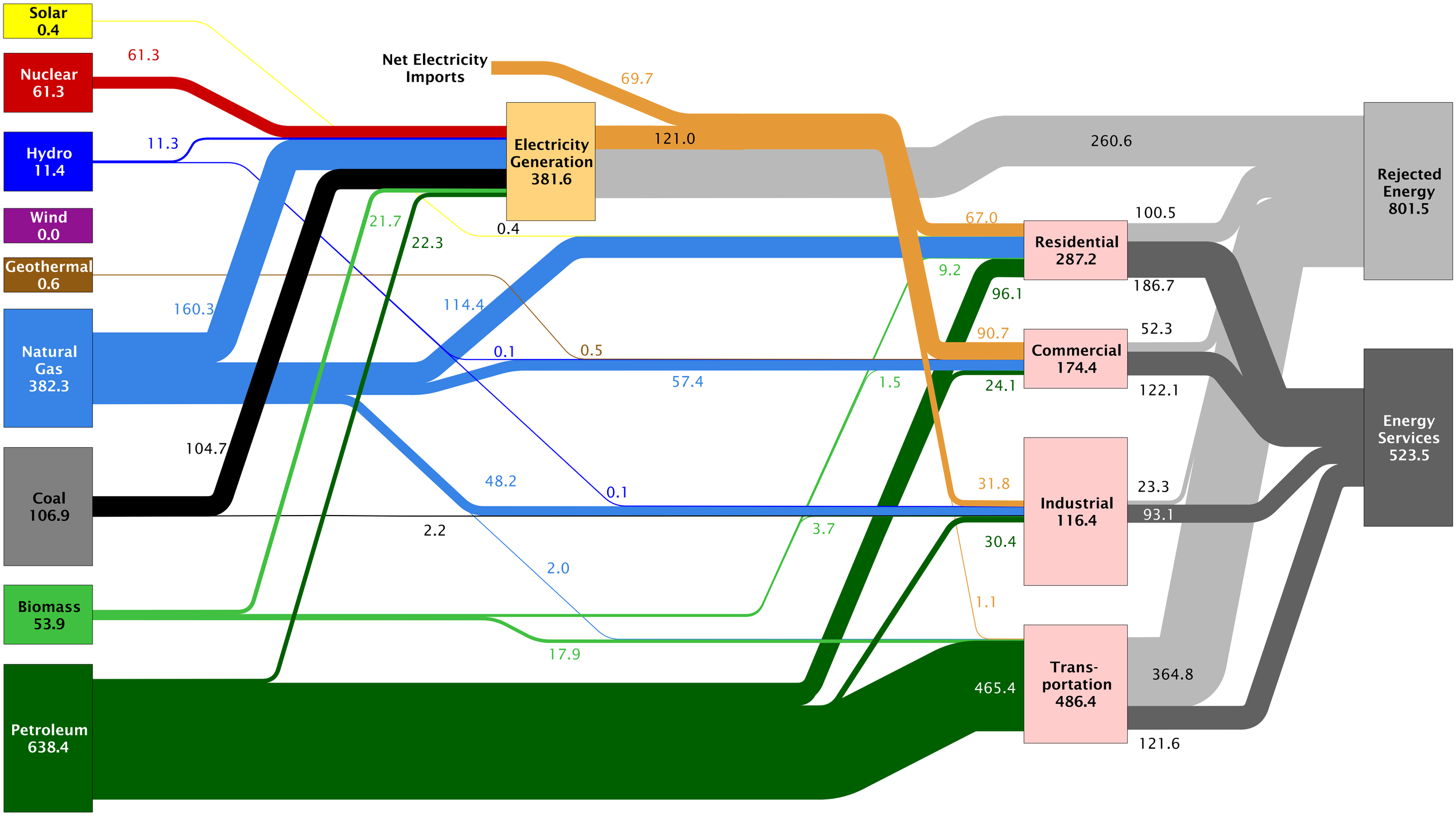
Lawrence Livermore National Laboratory



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 Massachusetts Energy Use In 2008
~1324.9 Trillion BTU

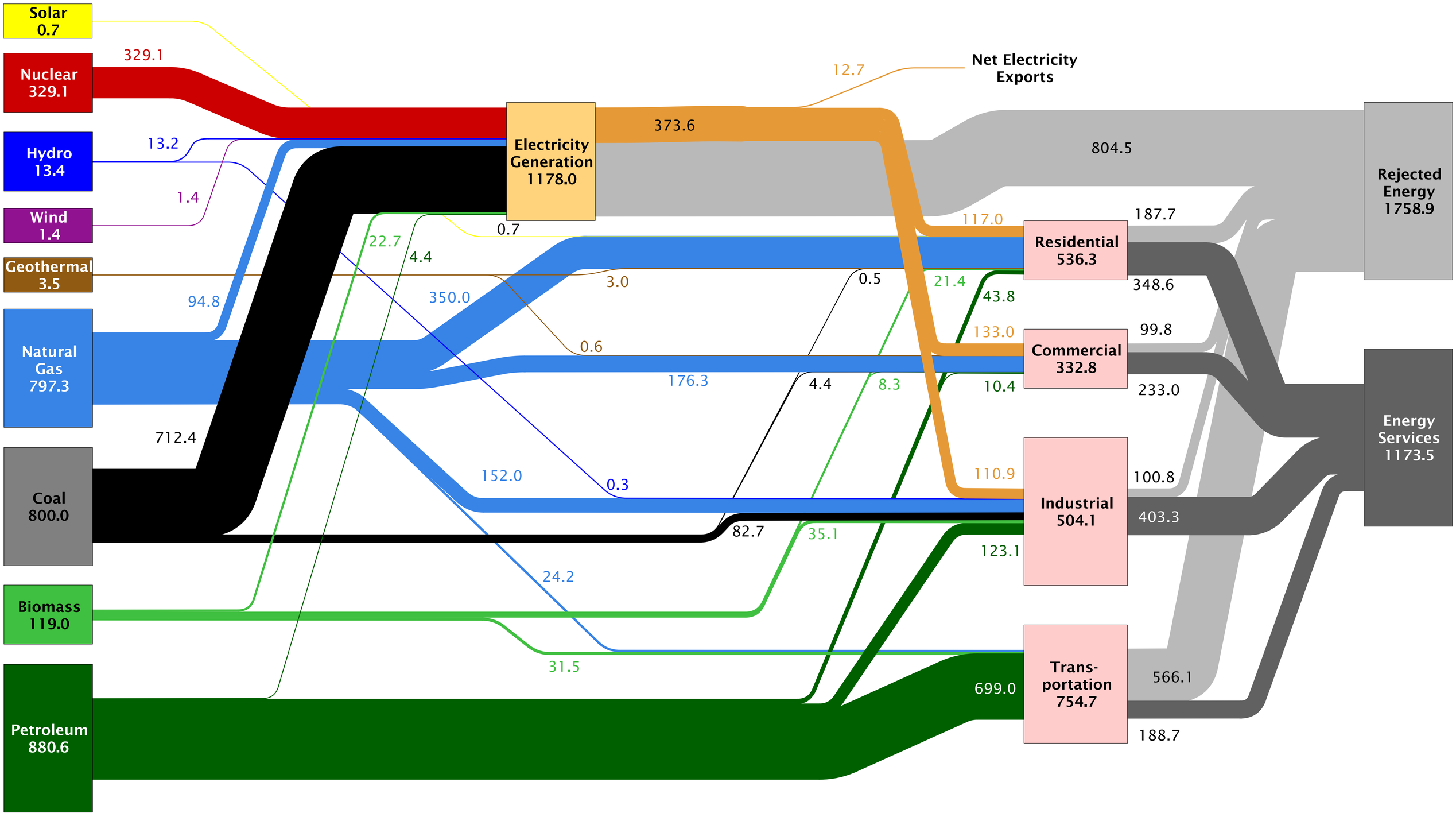
Lawrence Livermore National Laboratory



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 Michigan Energy Use In 2008
~2945.1 Trillion BTU

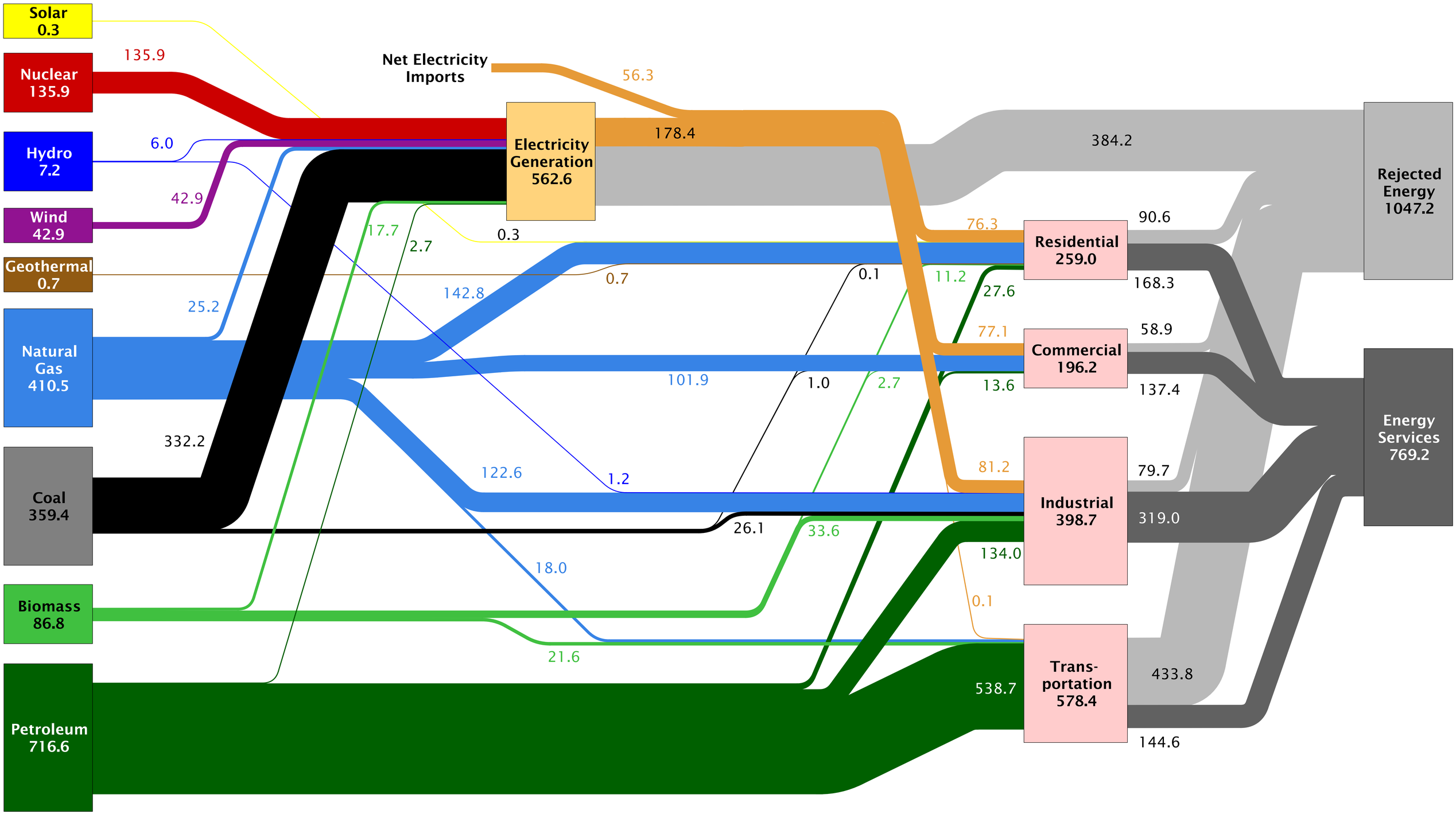
Lawrence Livermore National Laboratory



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 Minnesota Energy Use In 2008
~1816.5 Trillion BTU

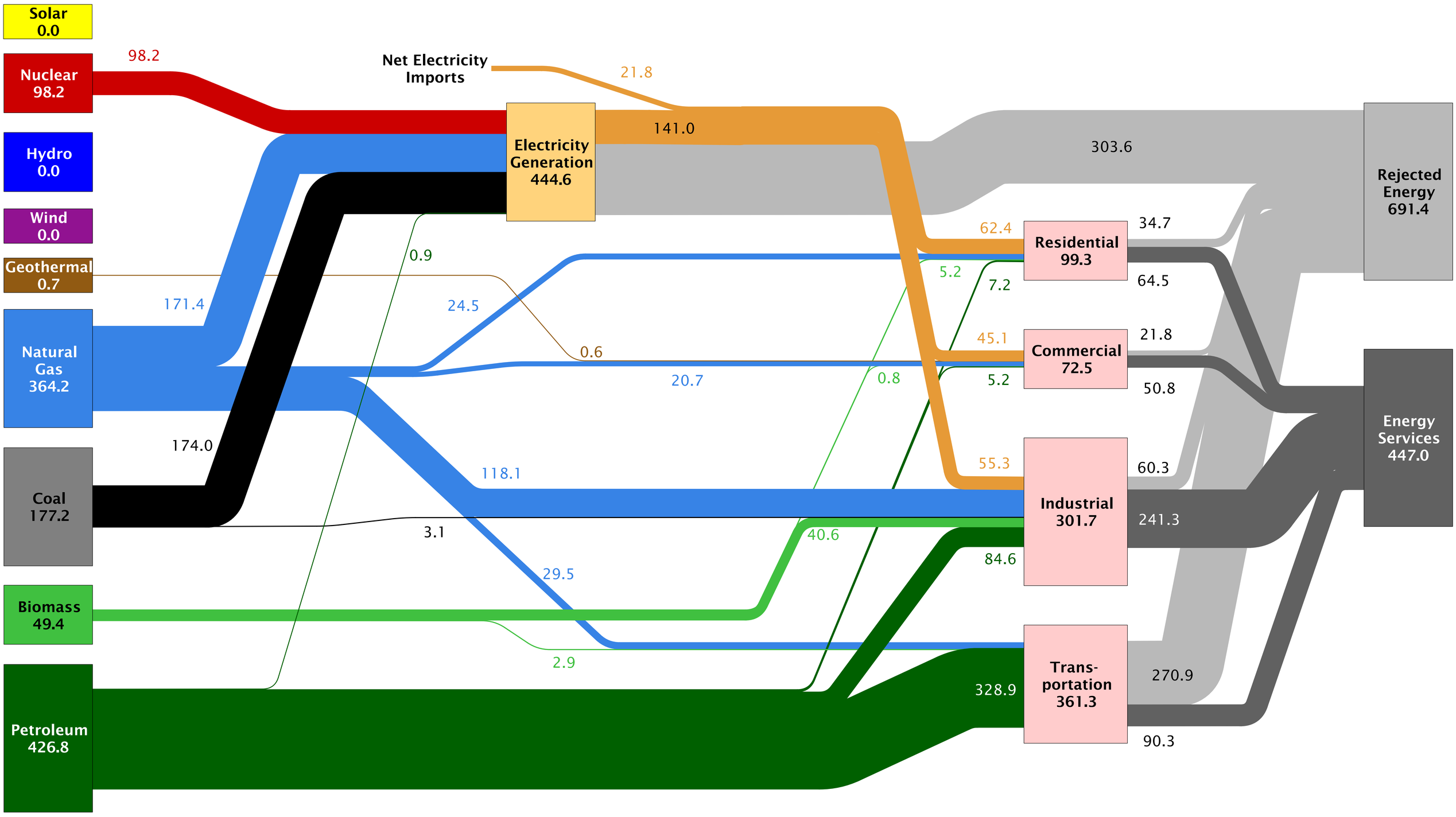
Lawrence Livermore National Laboratory



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 Mississippi Energy Use In 2008
~1138.3 Trillion BTU

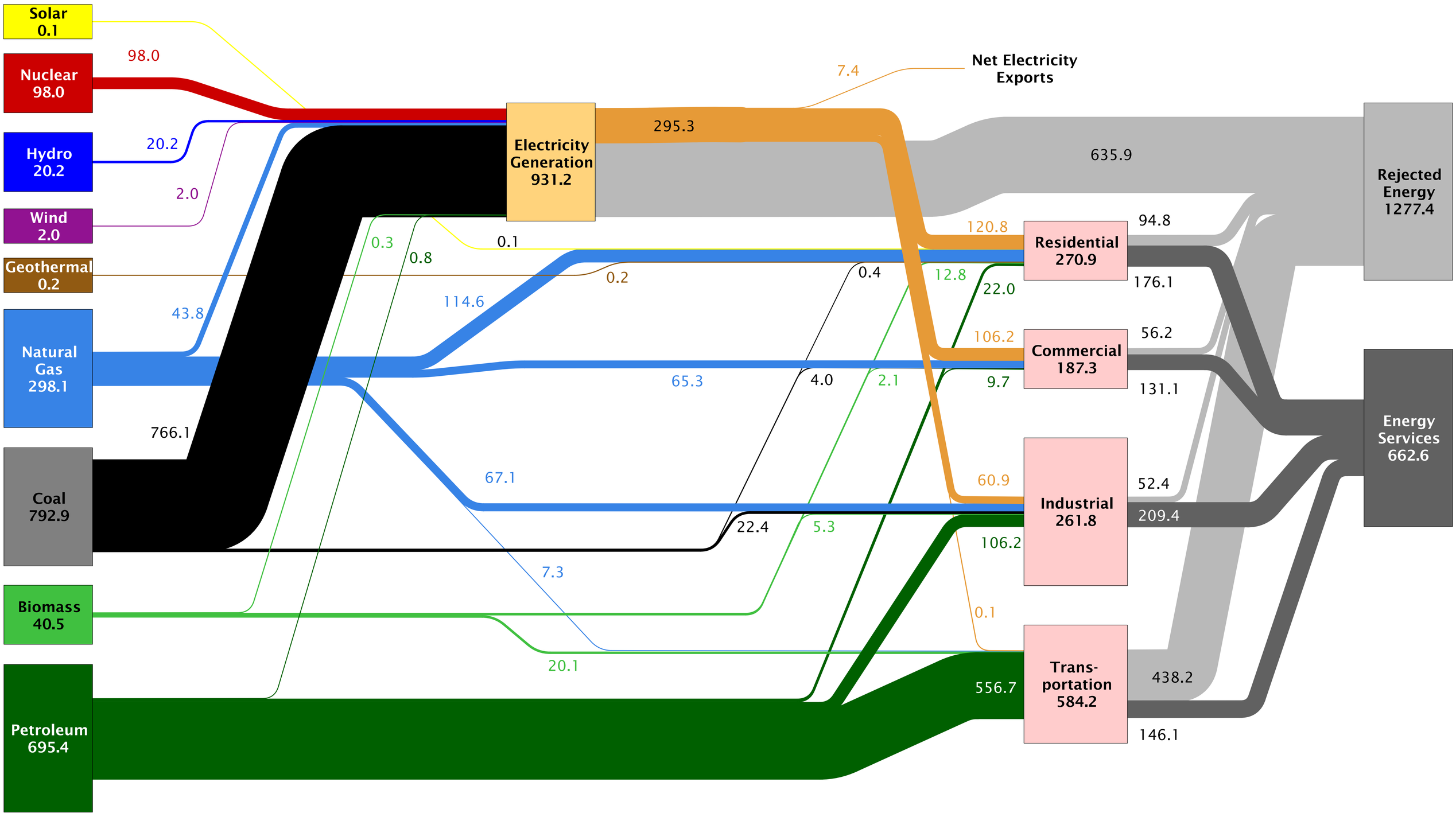
Lawrence Livermore National Laboratory



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 Missouri Energy Use In 2008
~1947.4 Trillion BTU

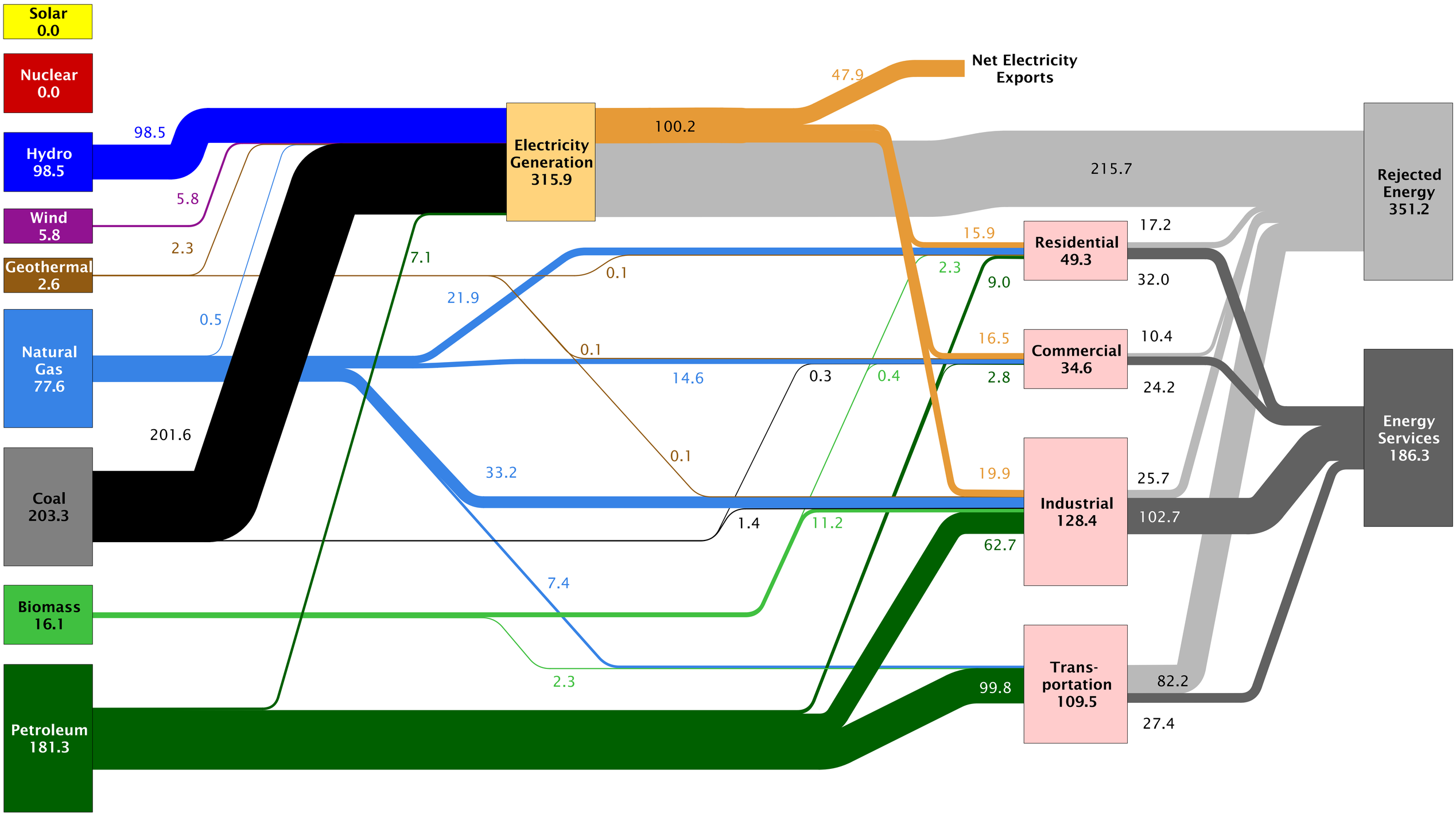
Lawrence Livermore National Laboratory



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 Montana Energy Use In 2008
~585.4 Trillion BTU

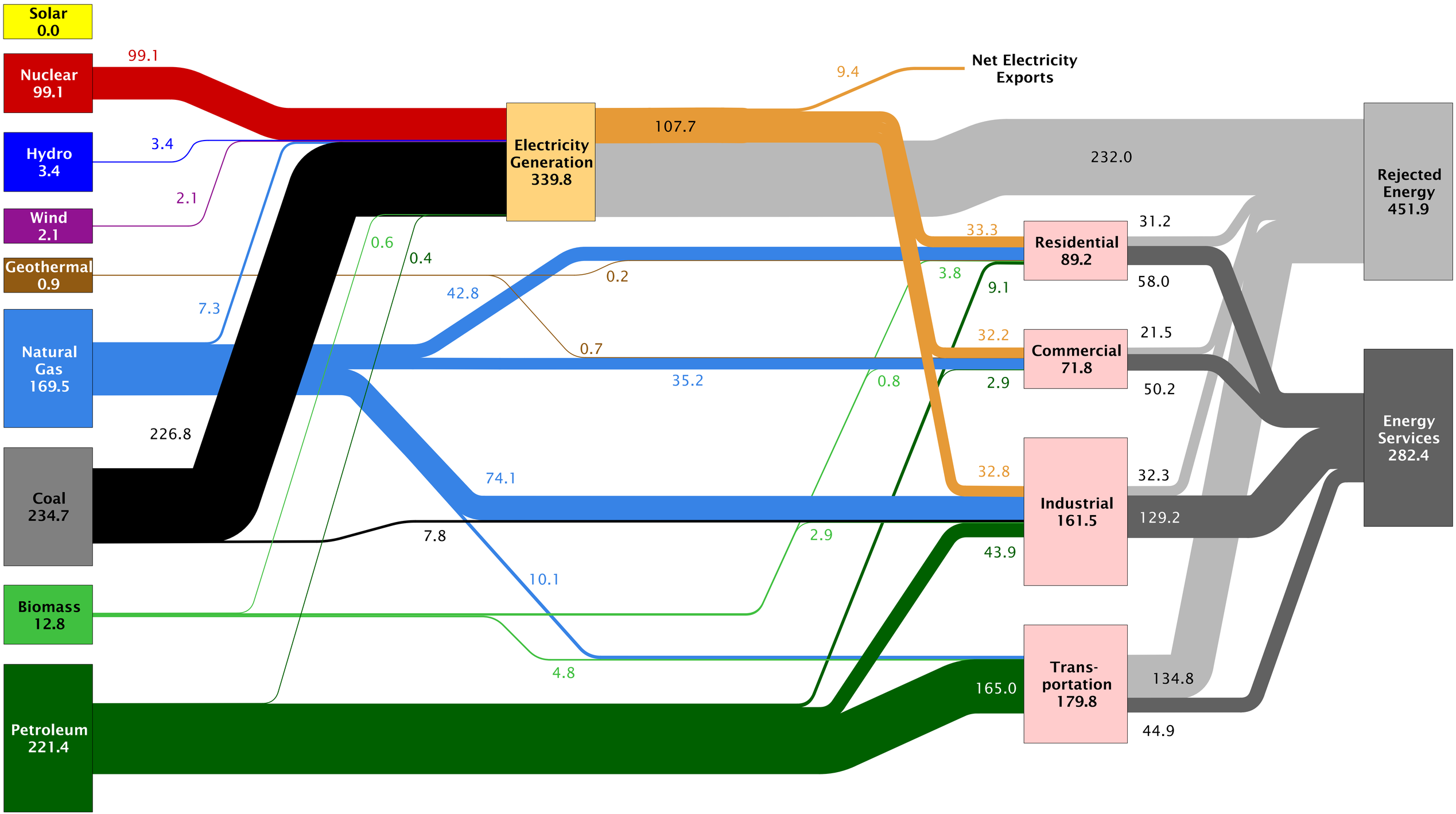
Lawrence Livermore National Laboratory



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 Nebraska Energy Use In 2008
~743.8 Trillion BTU

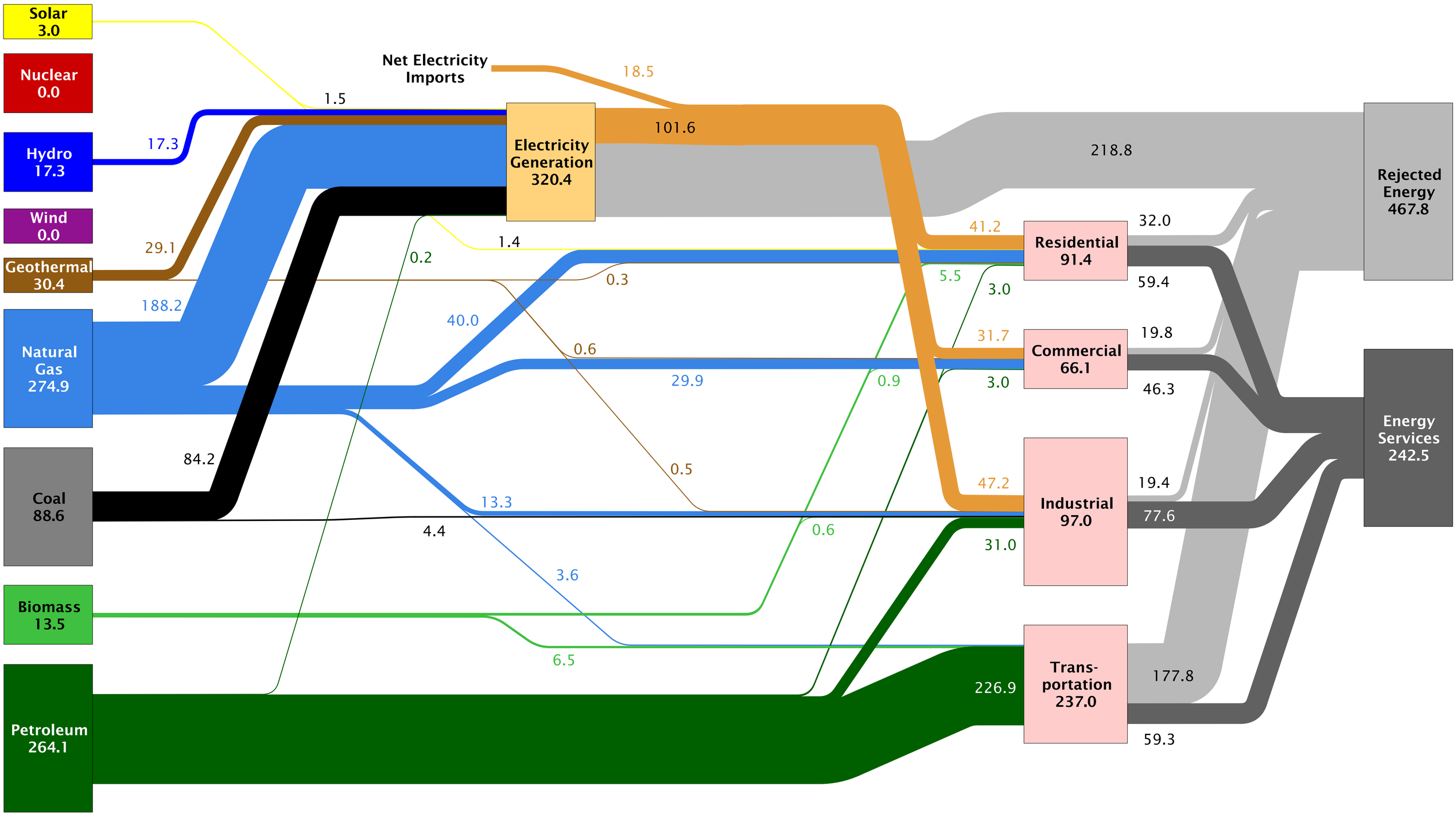
Lawrence Livermore National Laboratory



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 Nevada Energy Use In 2008
~710.3 Trillion BTU

Lawrence Livermore National Laboratory



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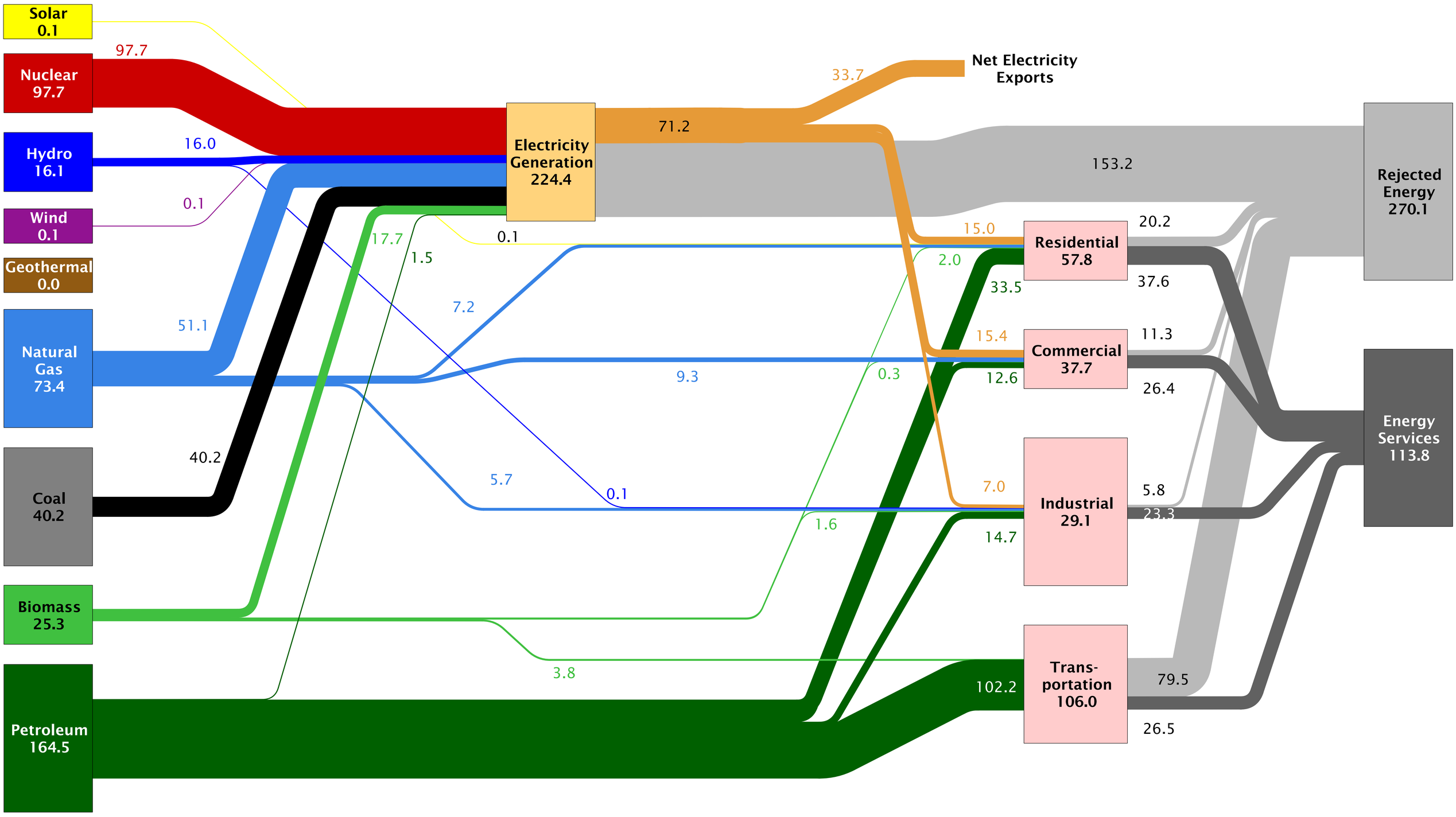
Estimated New Hampshire Energy Use In 2008
~417.5 Trillion BTU

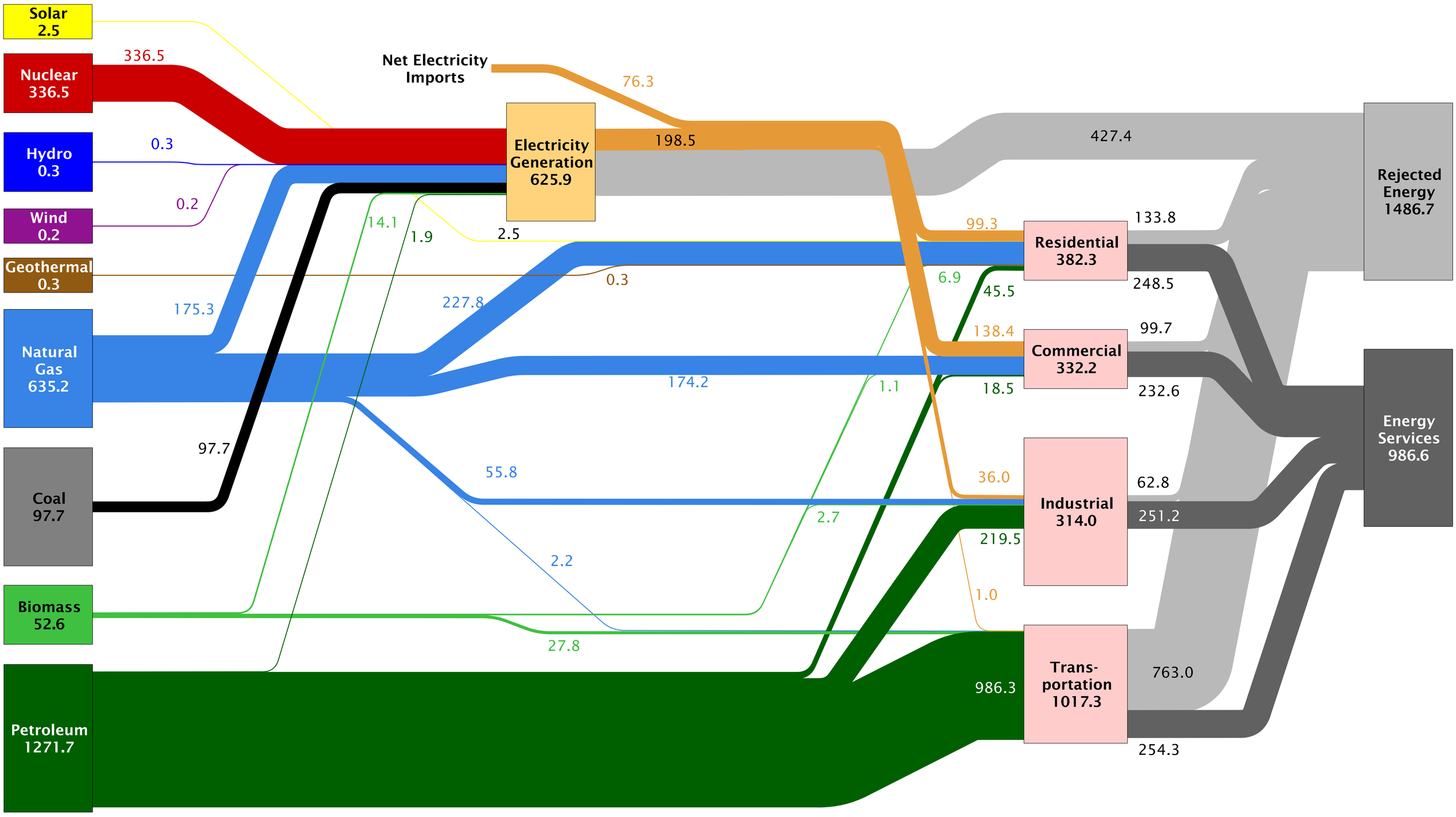
Lawrence Livermore National Laboratory



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 New Jersey Energy Use In 2008
~2473.3 Trillion BTU

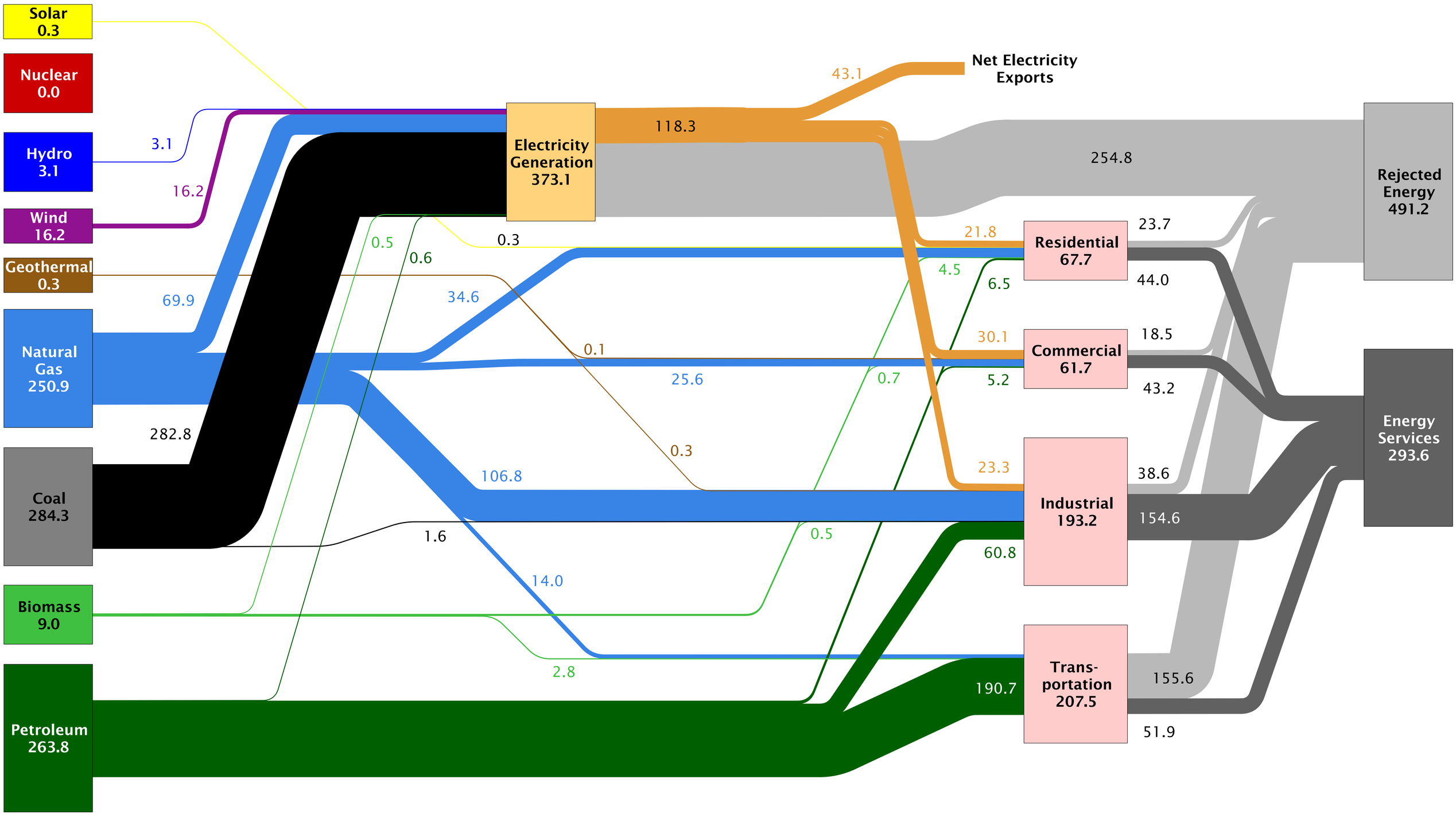
Lawrence Livermore National Laboratory



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 New Mexico Energy Use In 2008
~828.0 Trillion BTU

Lawrence Livermore National Laboratory



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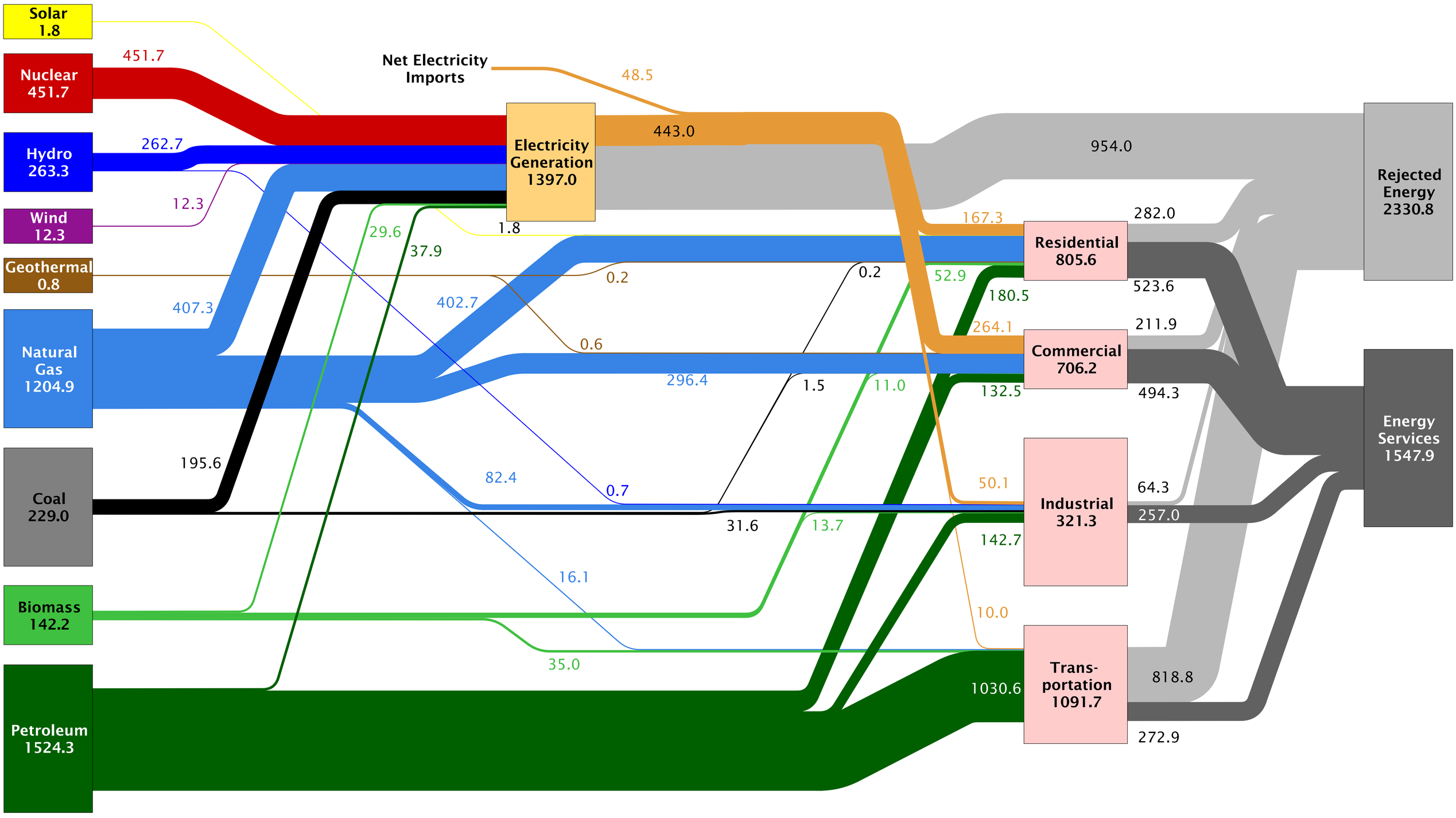
Estimated New York Energy Use In 2008
~3878.8 Trillion BTU

Lawrence Livermore National Laboratory



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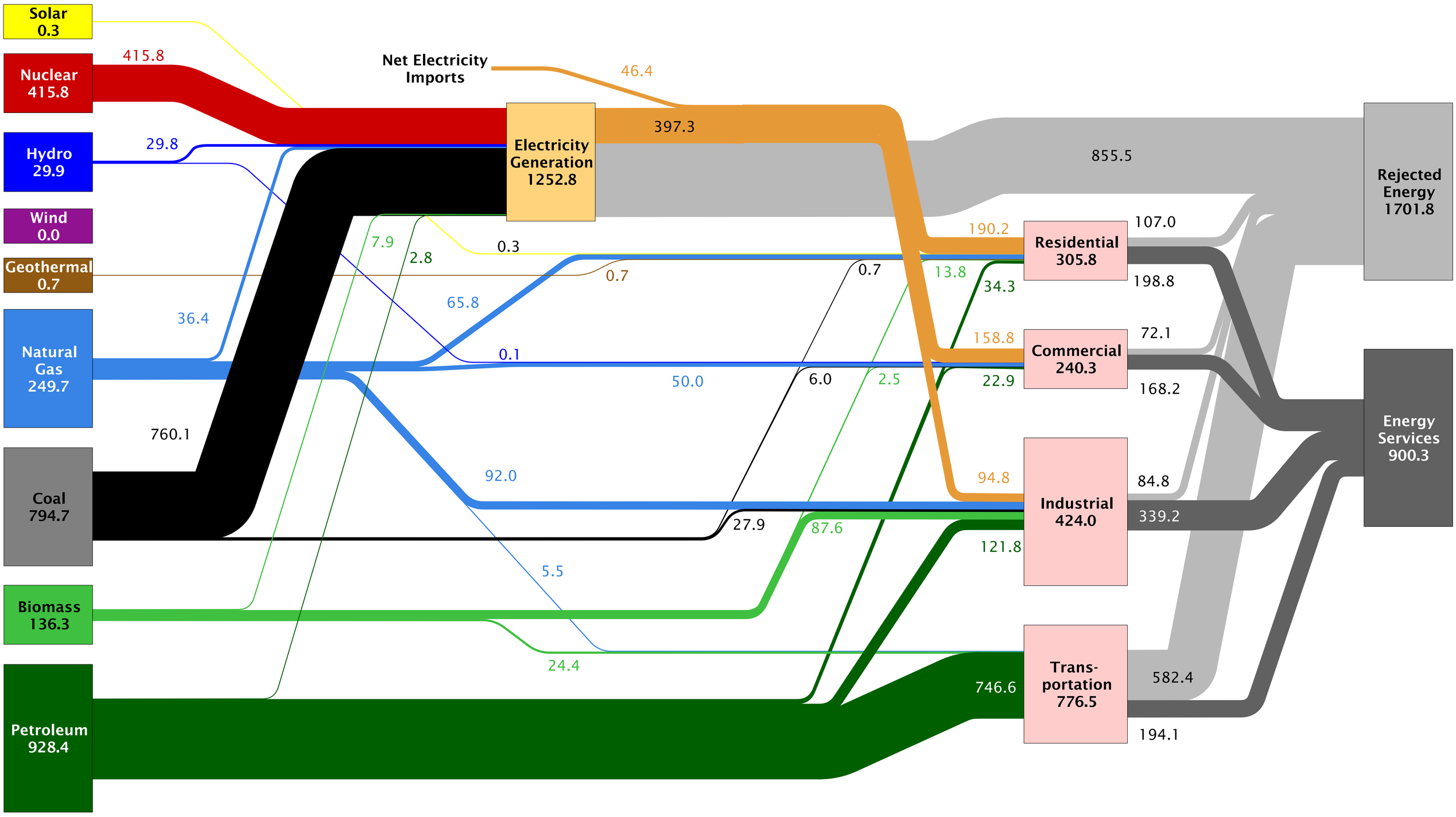
Estimated North Carolina Energy Use In 2008
~2602.2 Trillion BTU

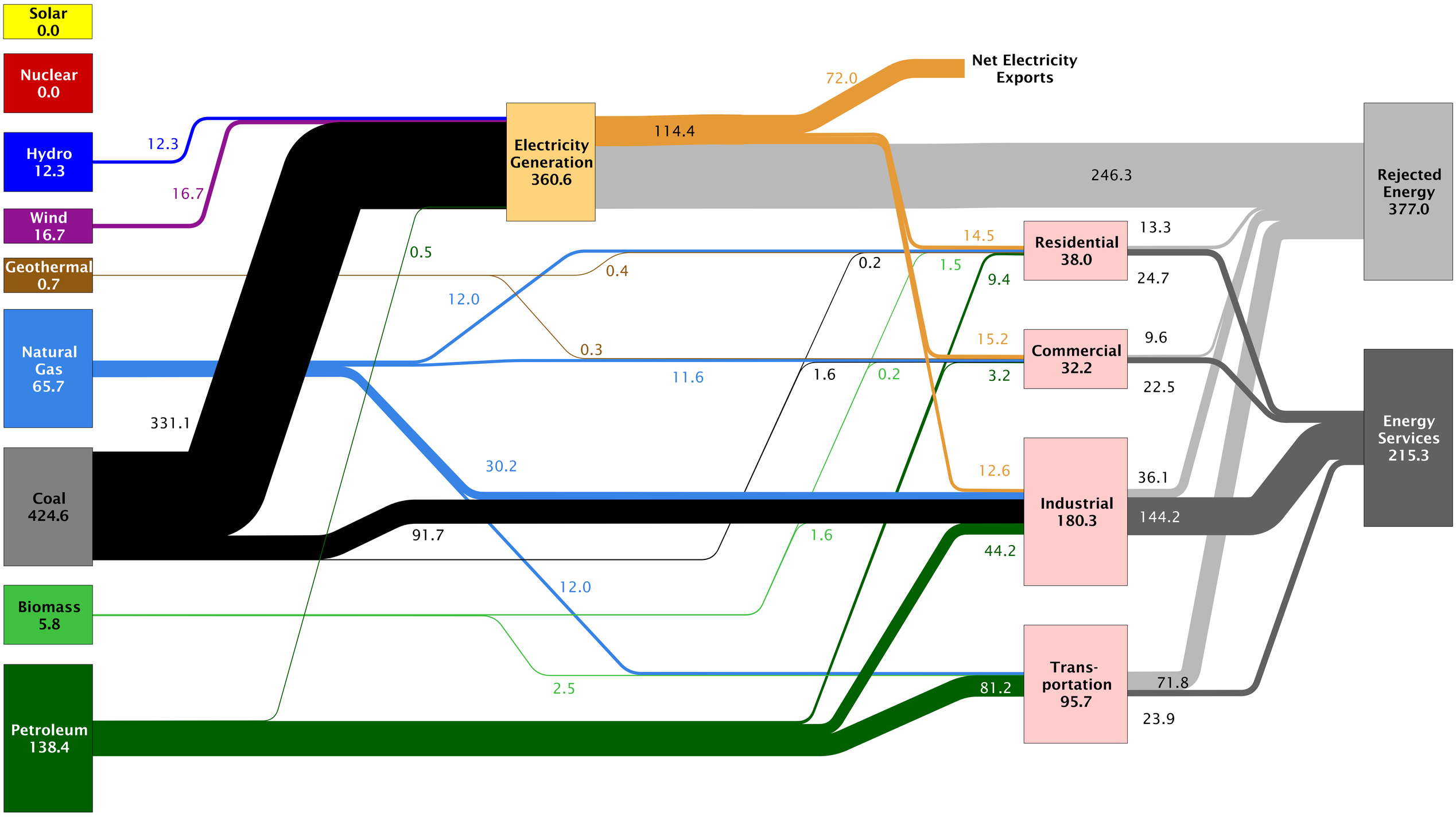
Lawrence Livermore National Laboratory



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

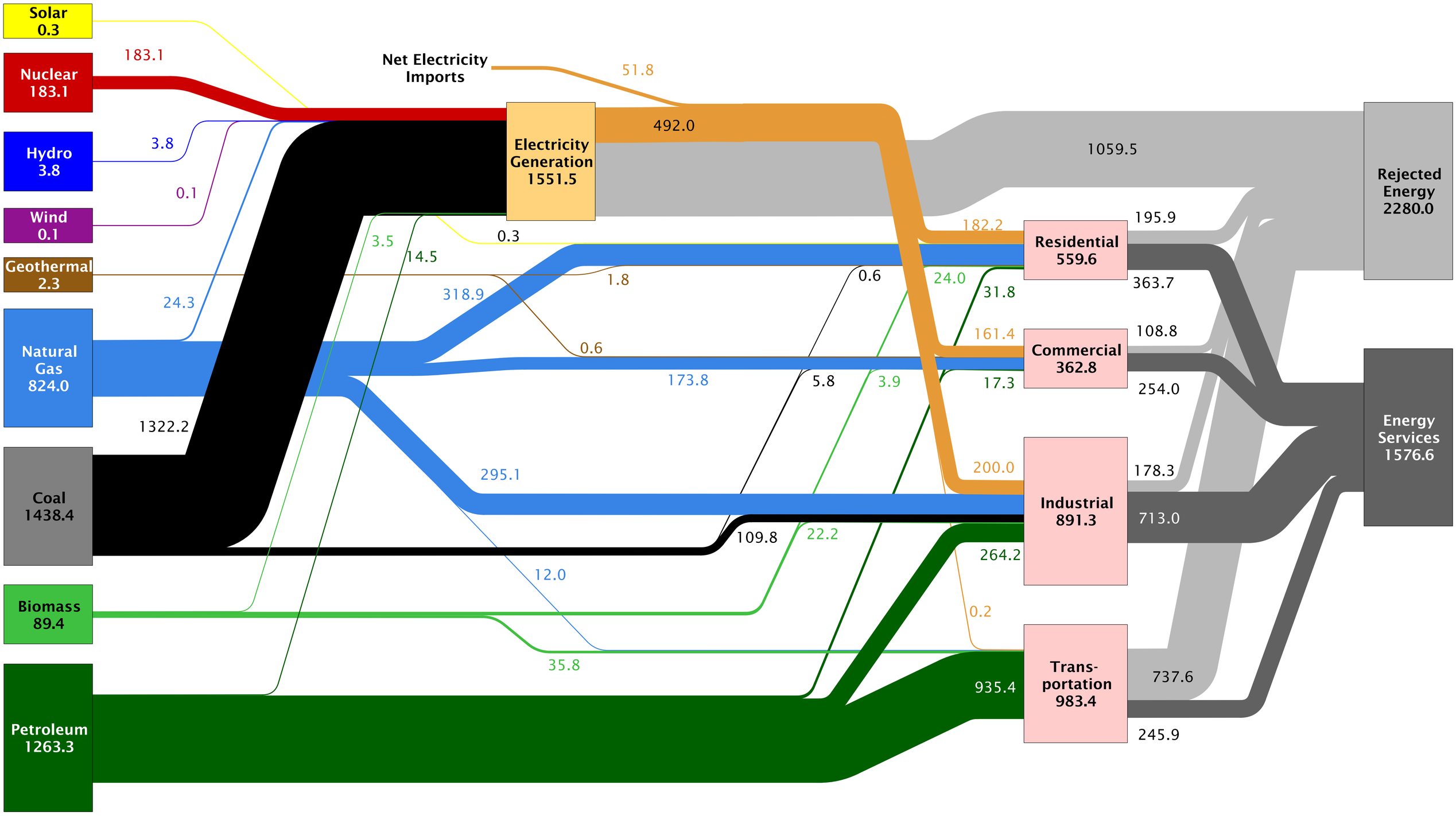
Lawrence Livermore National Laboratory



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 Ohio Energy Use In 2008
~3856.6 Trillion BTU

Lawrence Livermore National Laboratory



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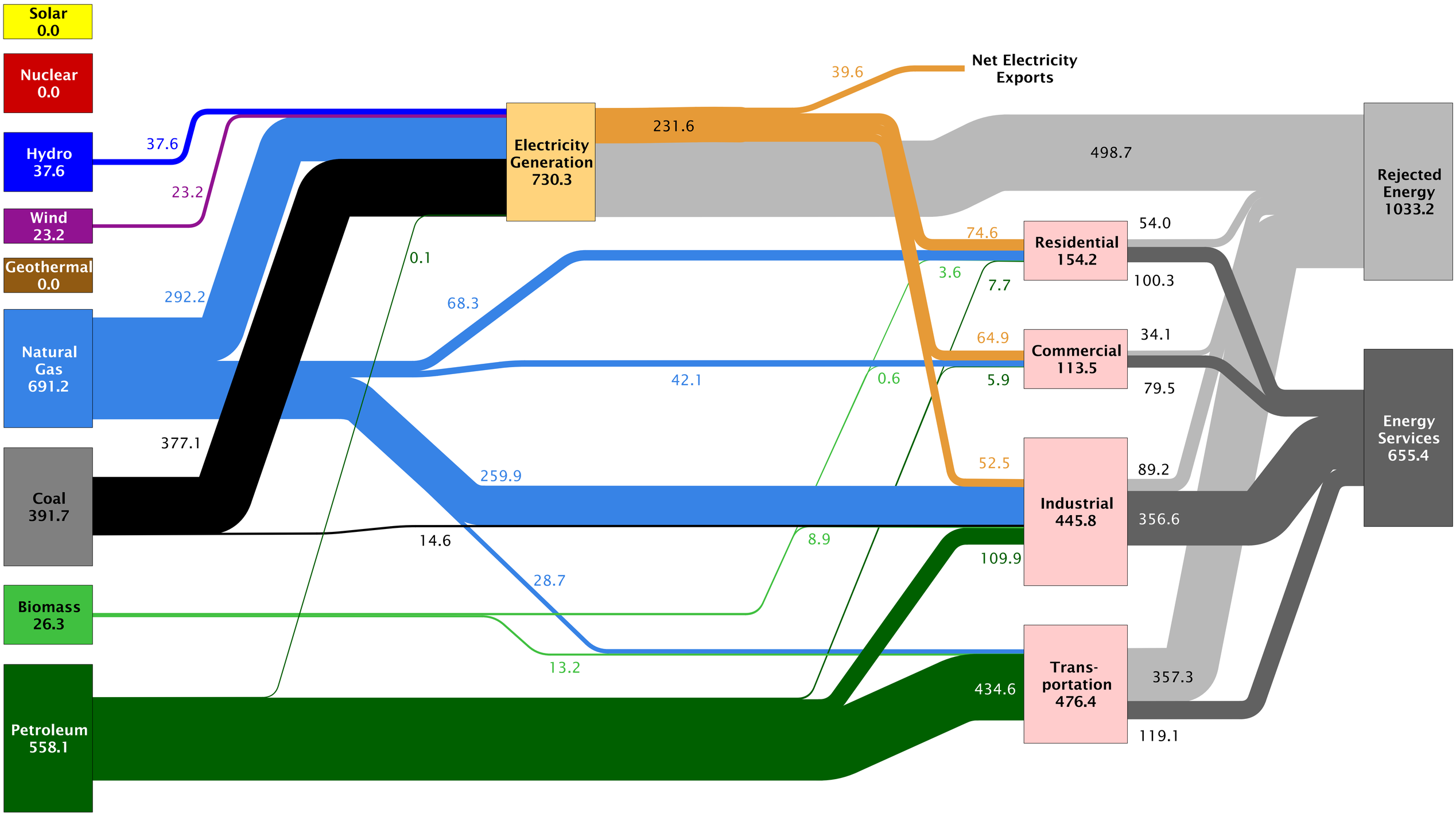
Estimated Oklahoma Energy Use In 2008
~1728.2 Trillion BTU

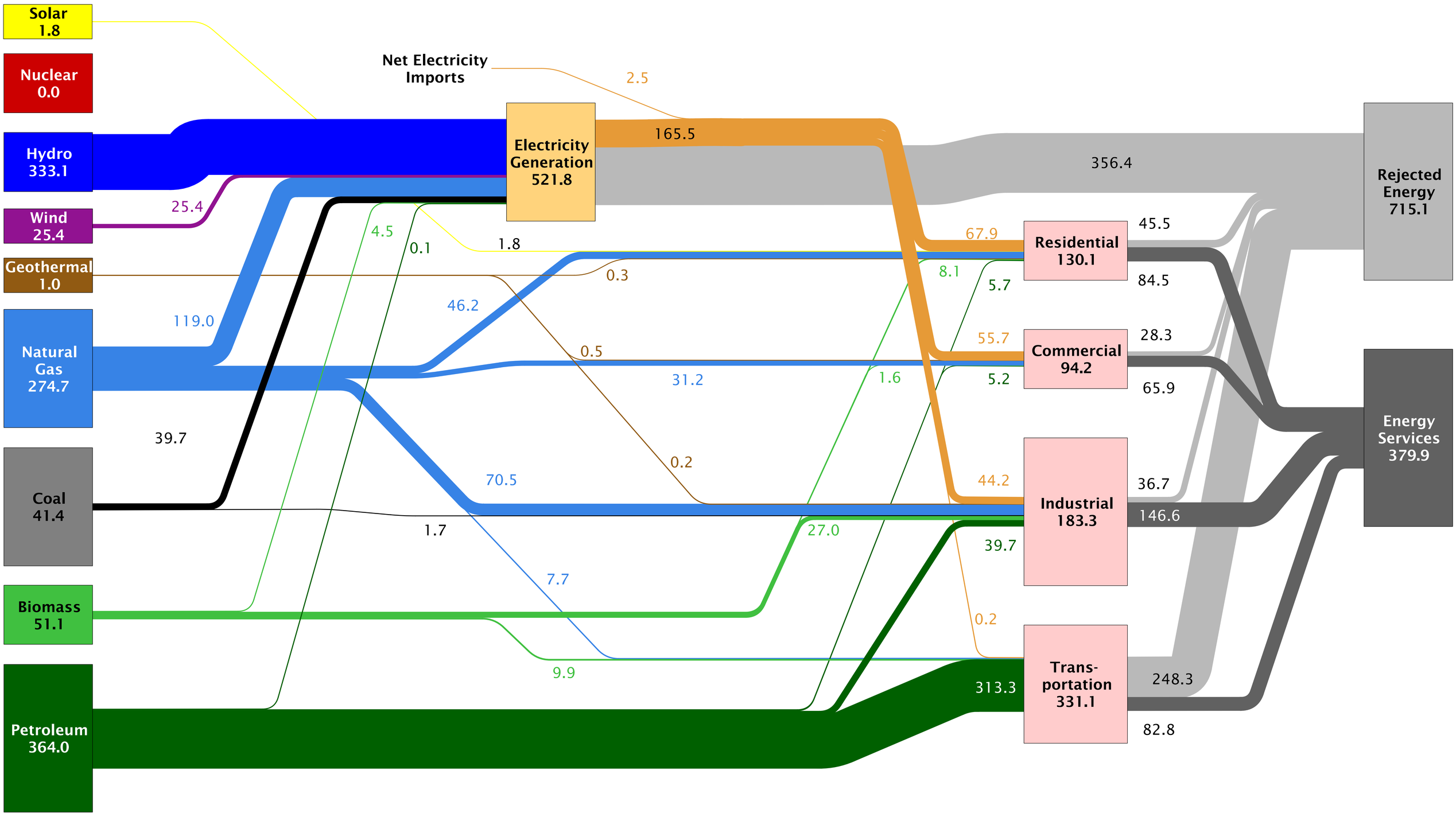
Lawrence Livermore National Laboratory



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 Oregon Energy Use In 2008
~1095.0 Trillion BTU

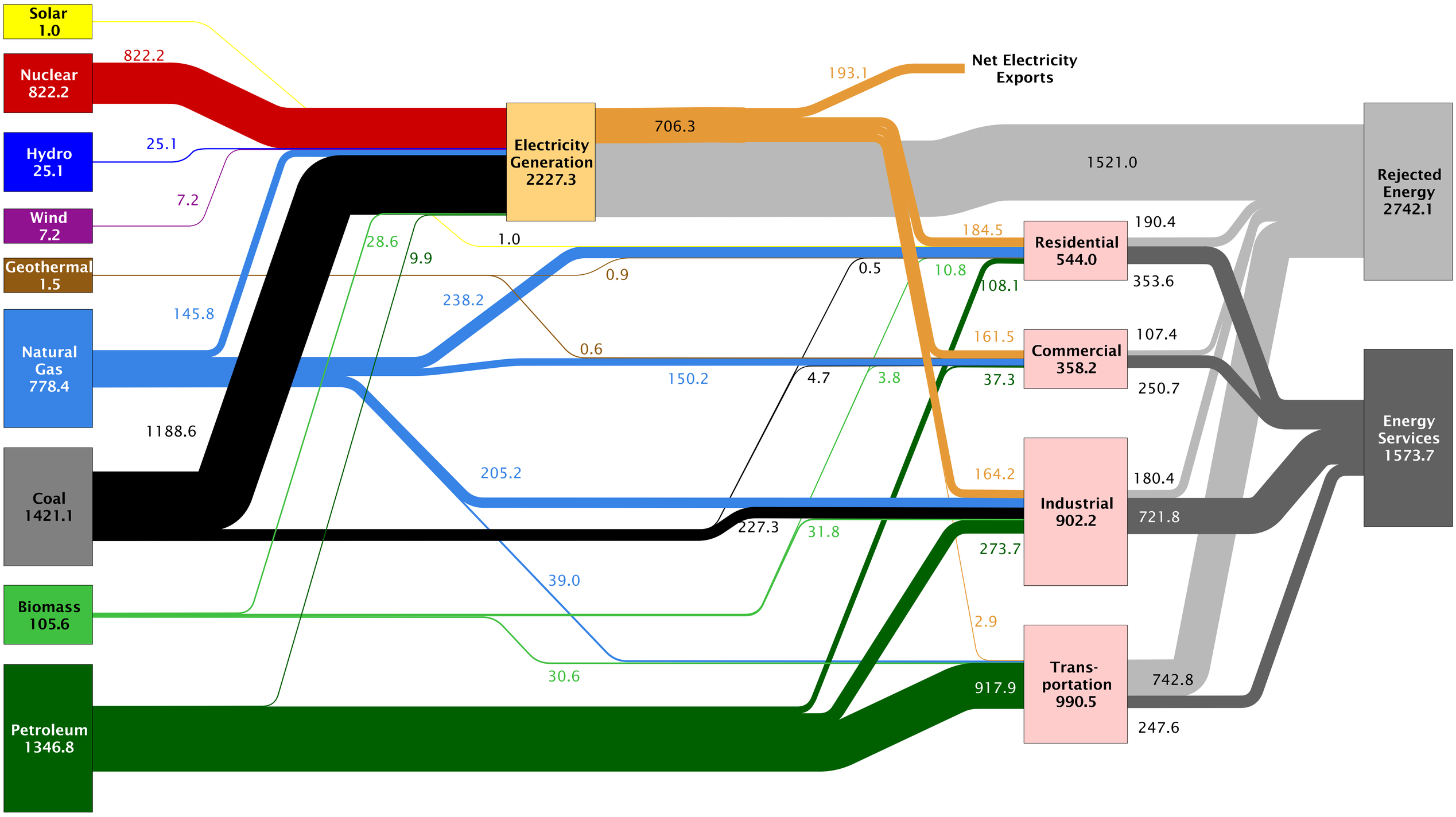
Lawrence Livermore National Laboratory



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

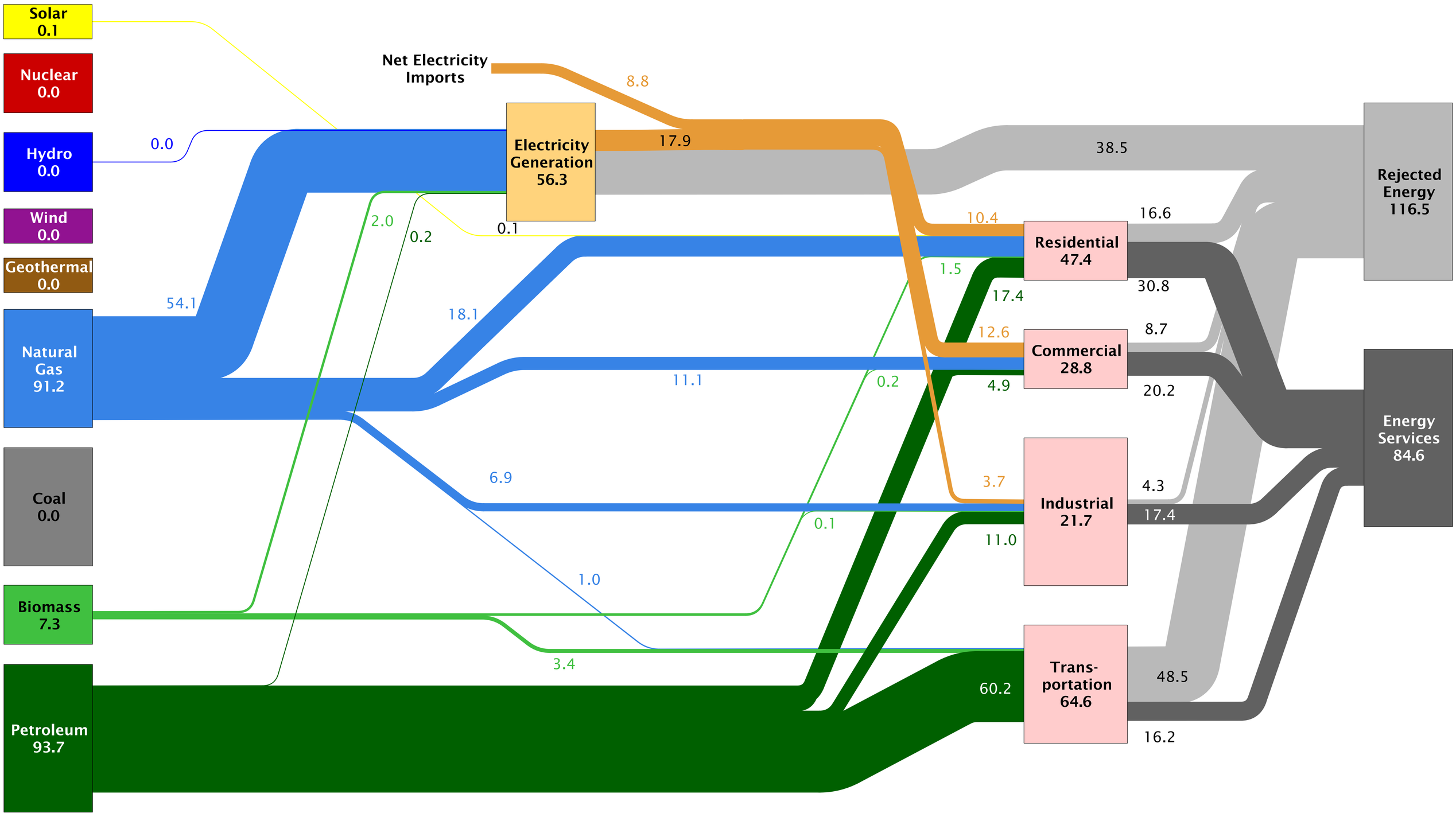
Lawrence Livermore National Laboratory



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 Rhode Island Energy Use In 2008
~201.1 Trillion BTU

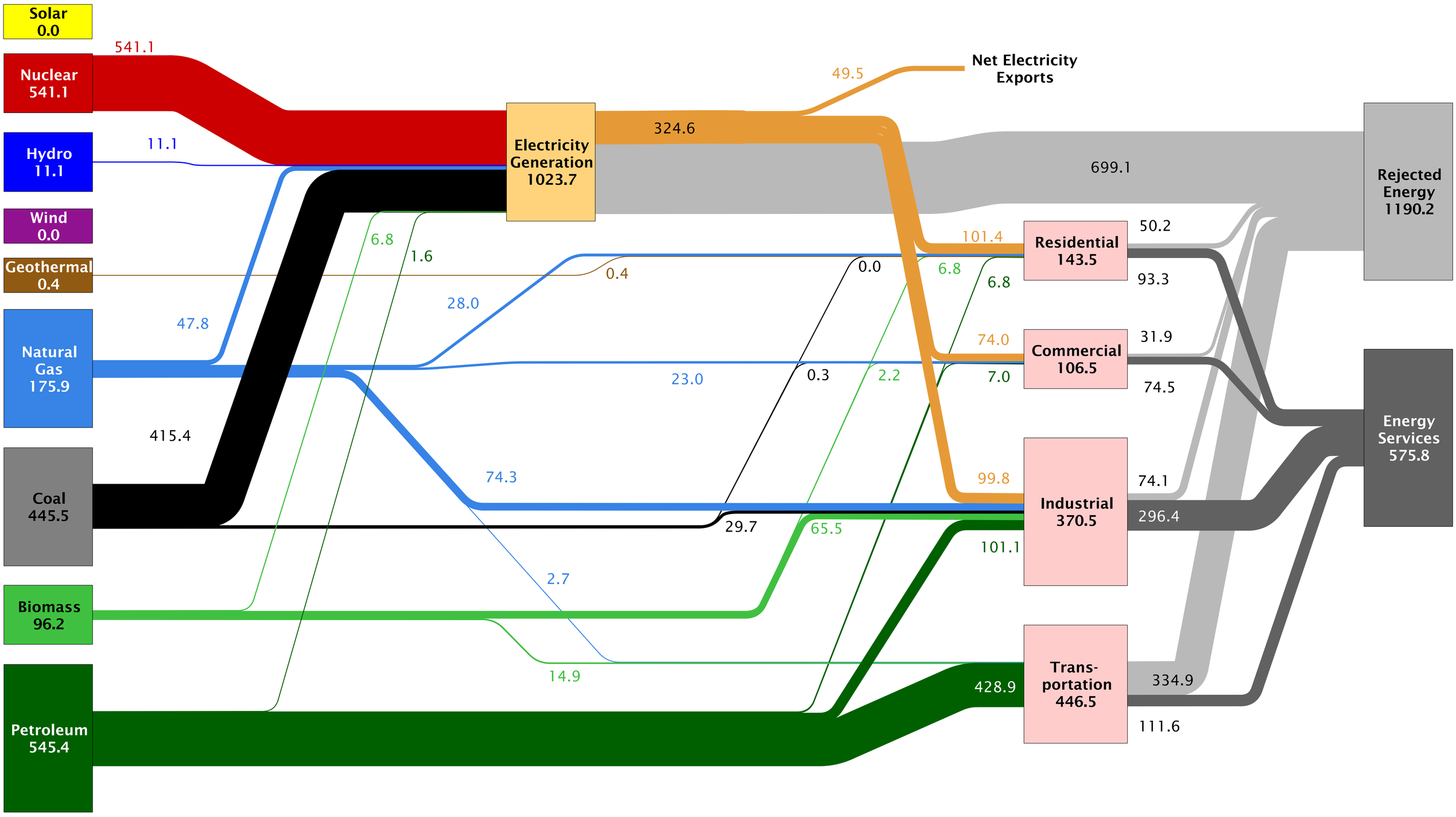
Lawrence Livermore National Laboratory



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

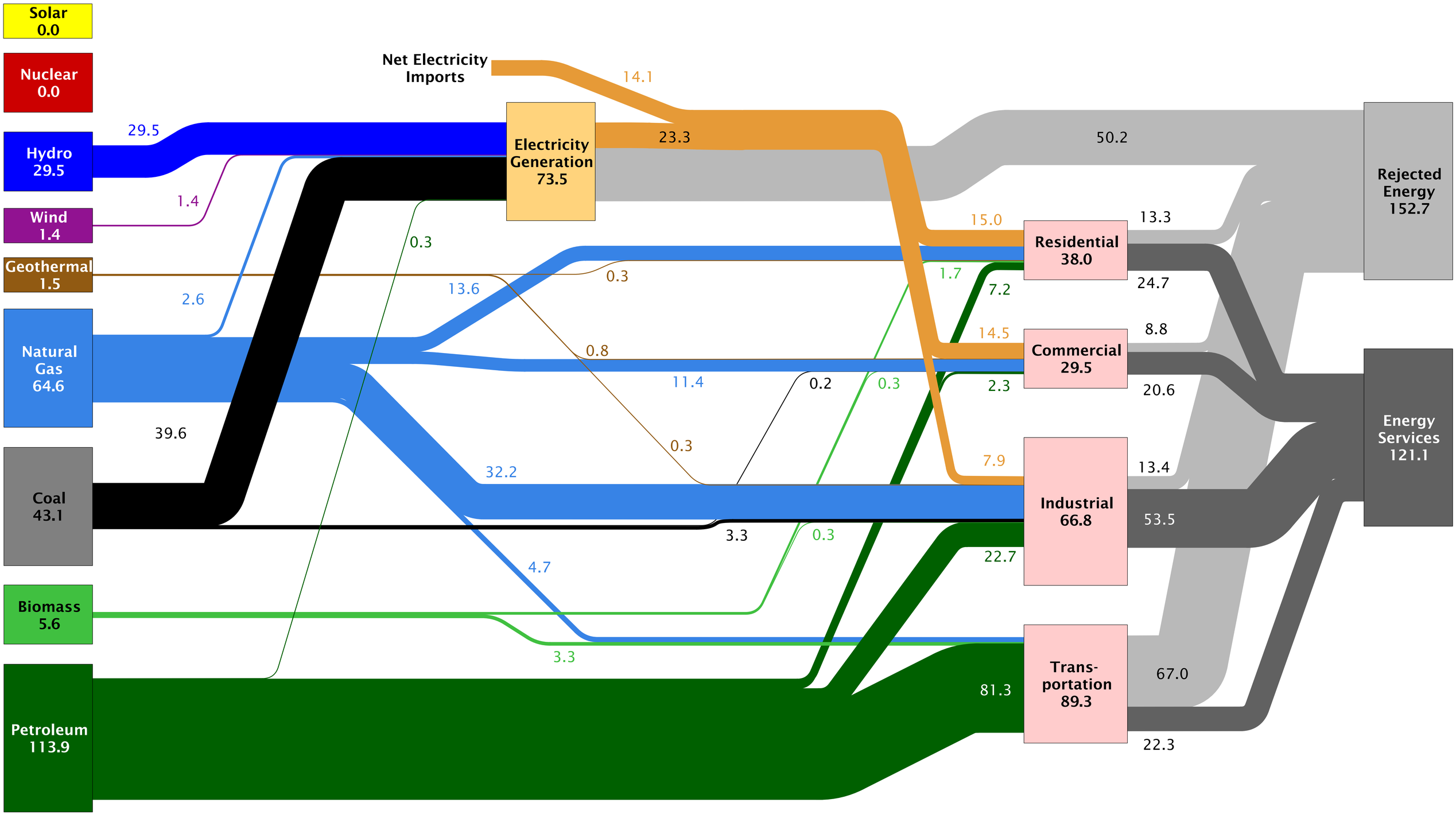
Lawrence Livermore National Laboratory



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

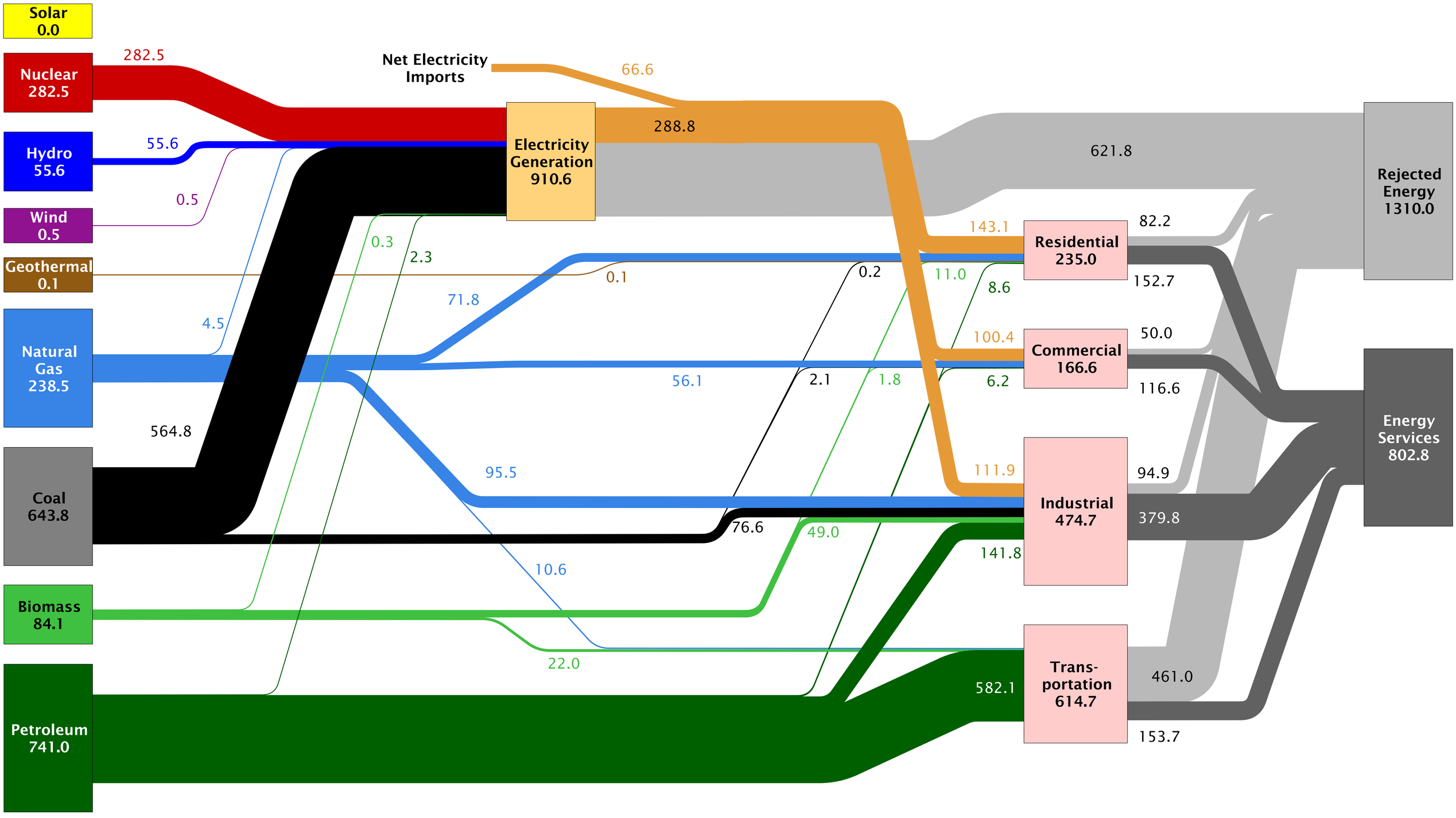
Lawrence Livermore National Laboratory



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

Lawrence Livermore National Laboratory



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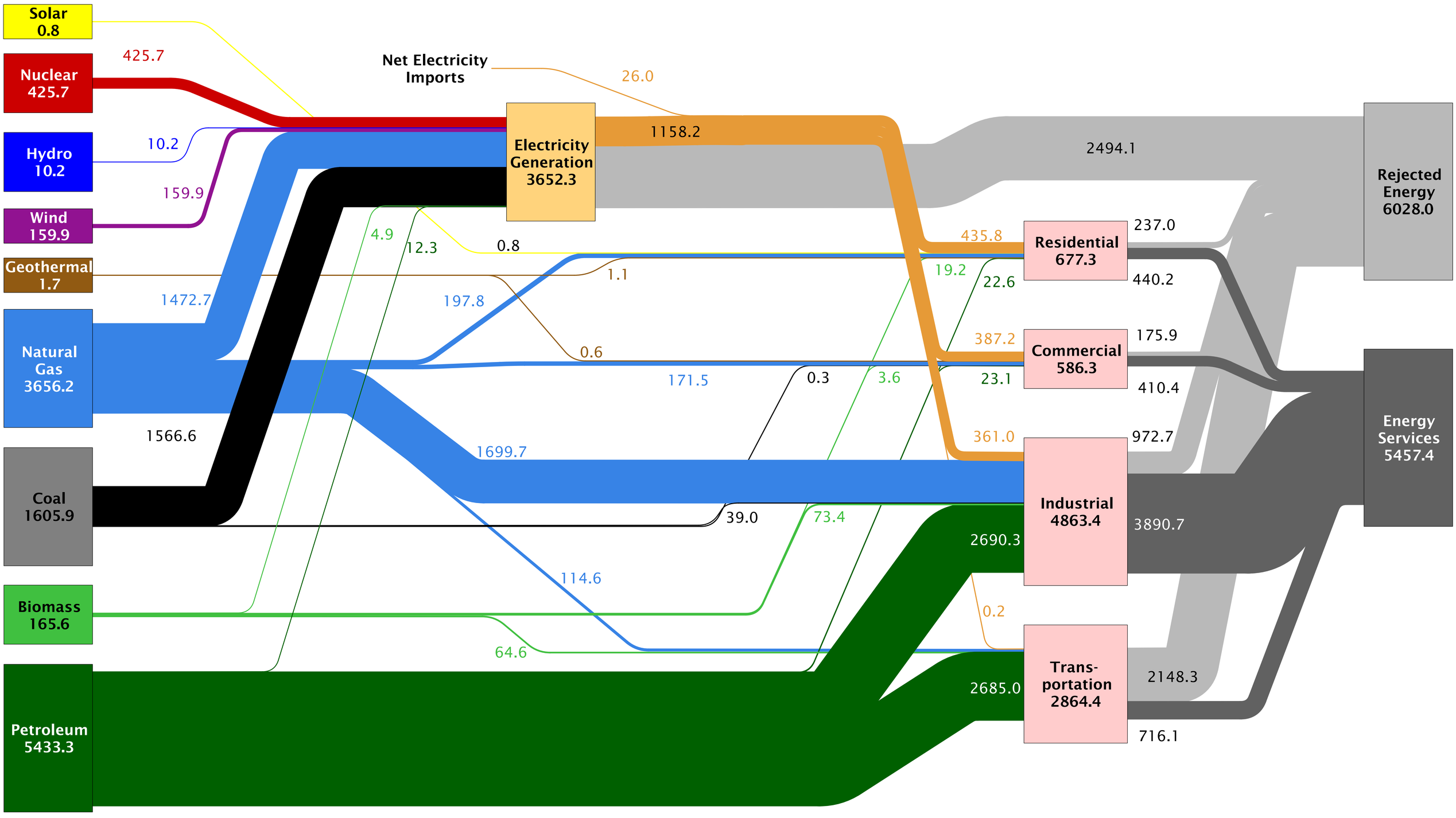
Estimated Texas Energy Use In 2008
~11485.4 Trillion BTU

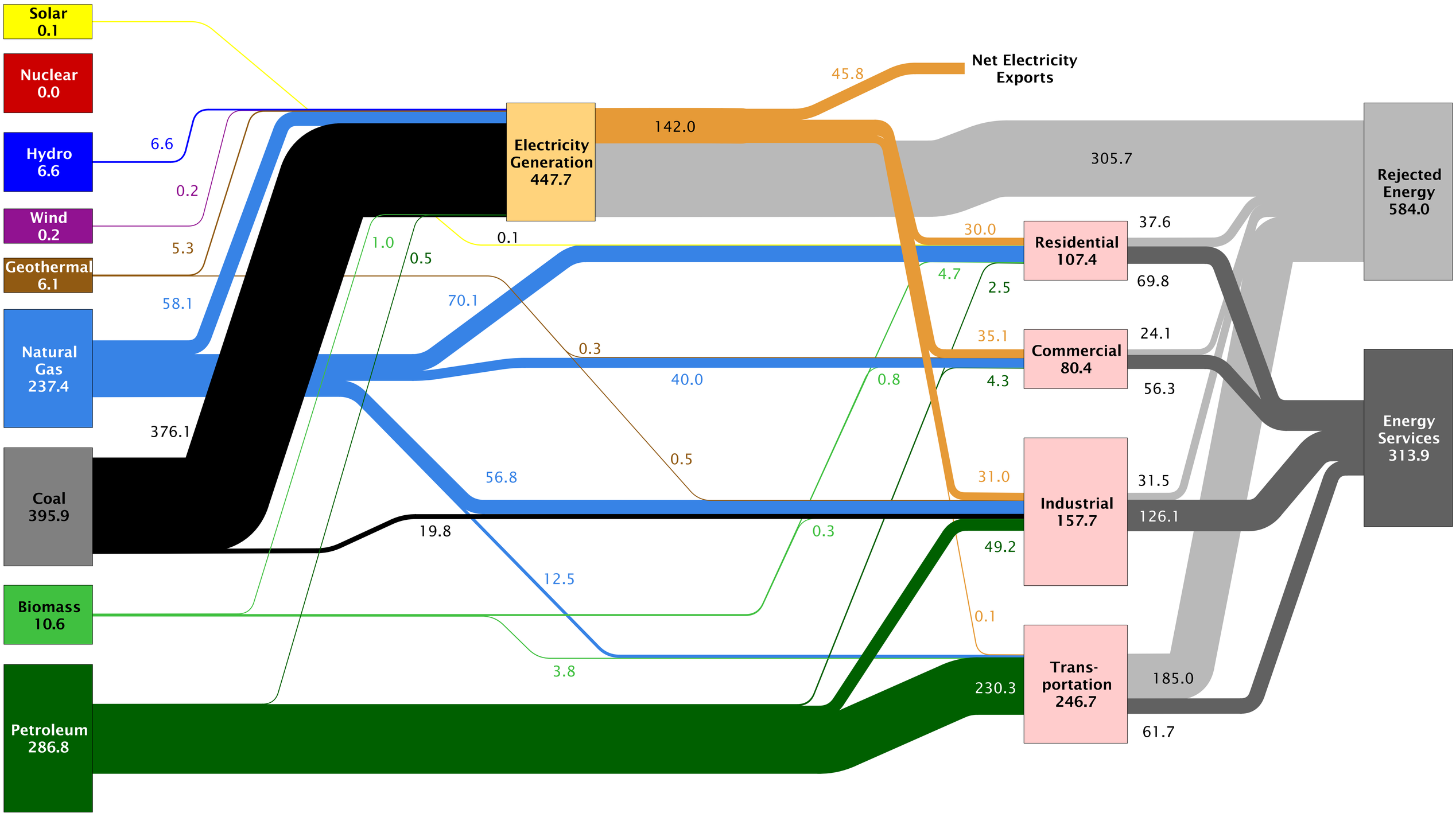
Lawrence Livermore National Laboratory



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

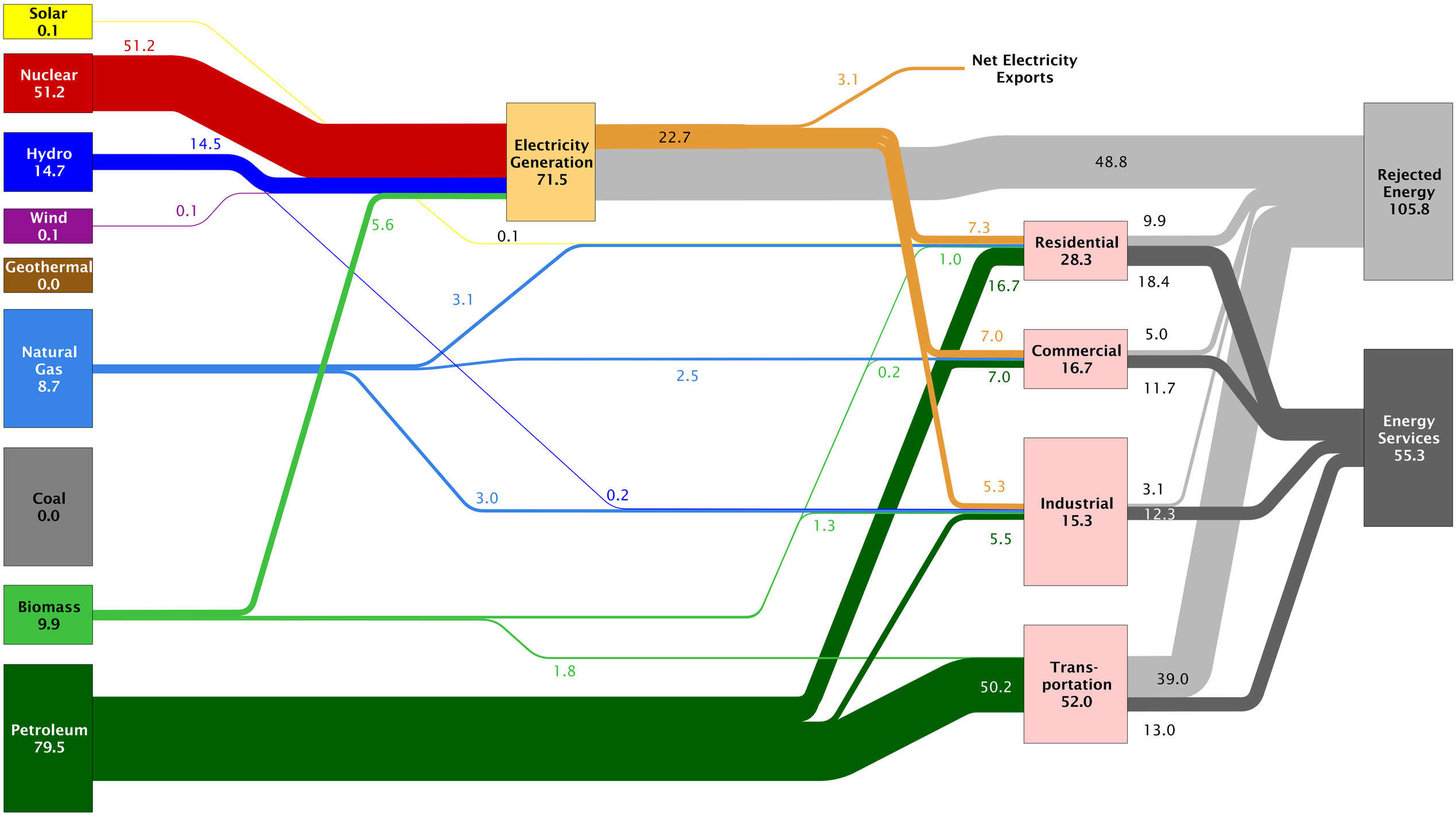
Lawrence Livermore National Laboratory



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

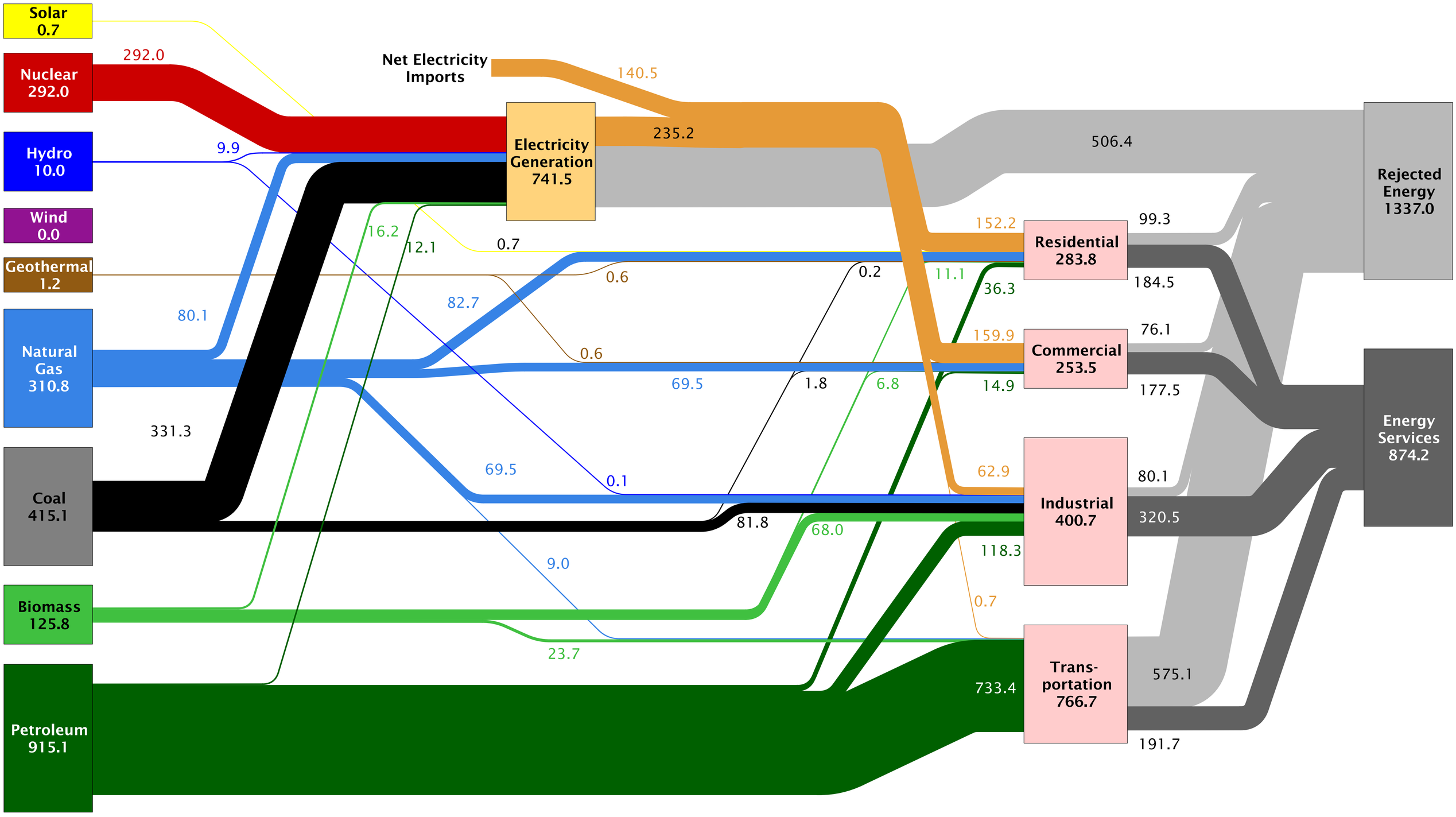
Lawrence Livermore National Laboratory



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

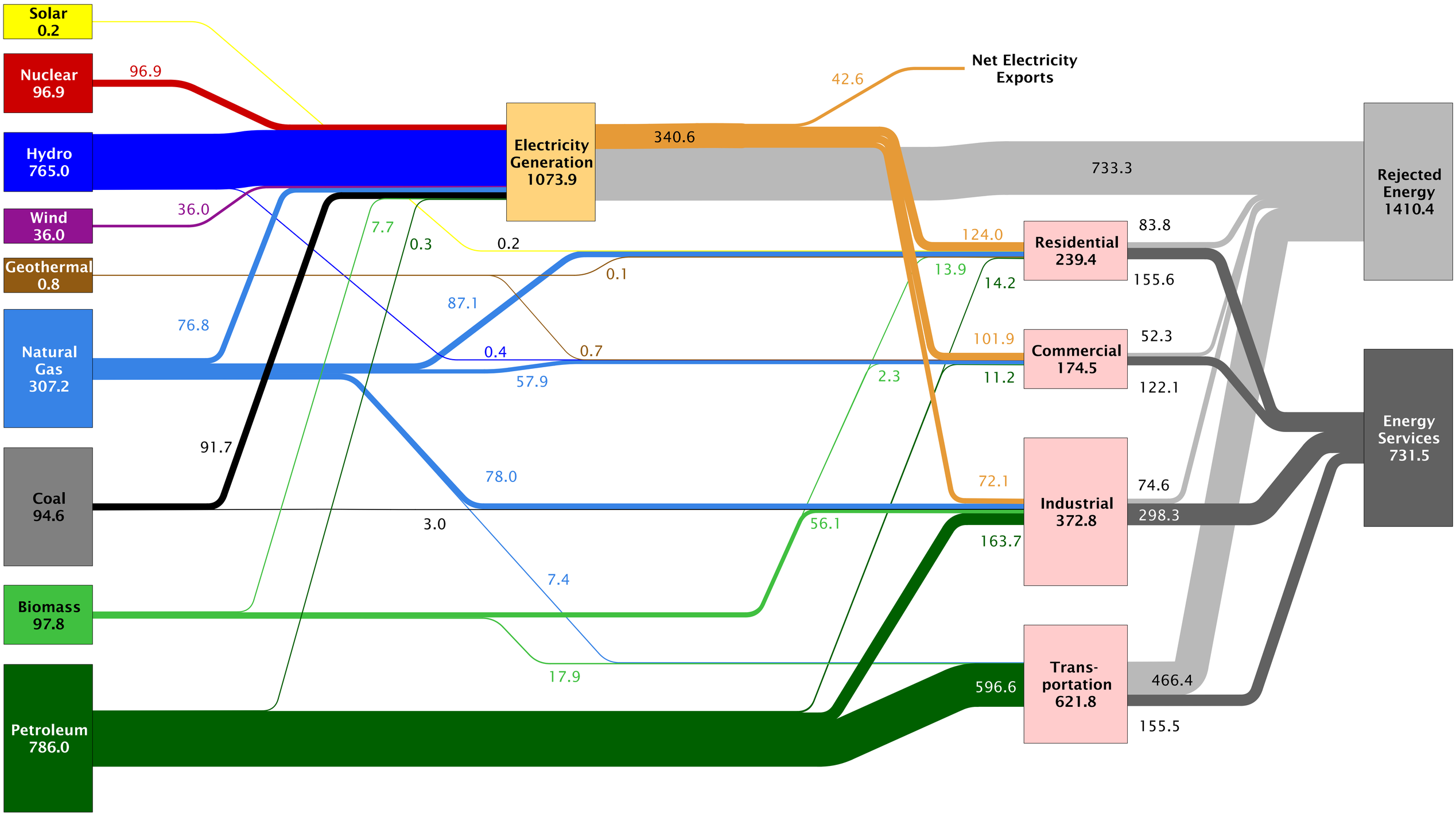
Lawrence Livermore National Laboratory



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 Washington Energy Use In 2008
~2184.4 Trillion BTU

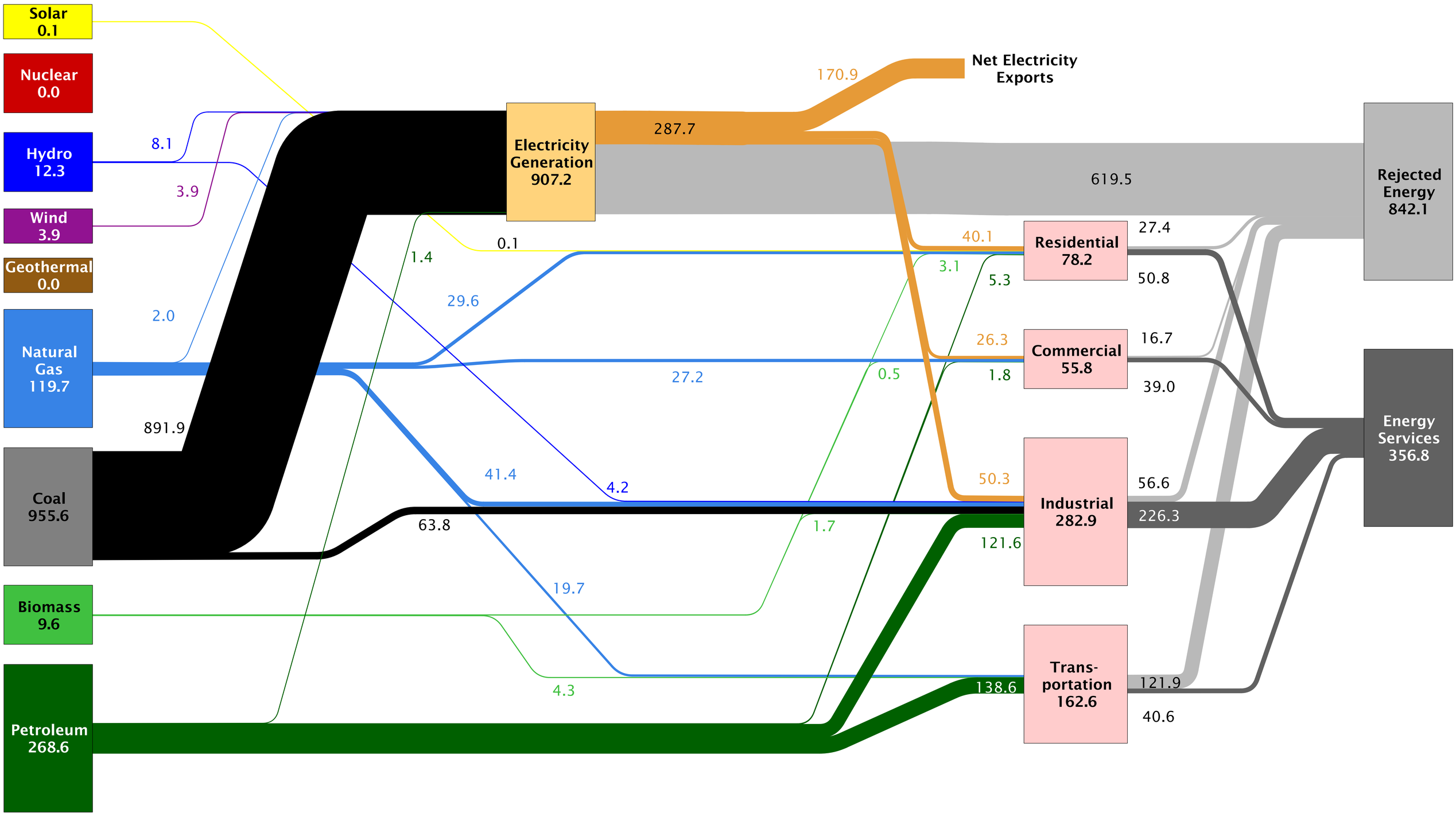
Lawrence Livermore National Laboratory



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

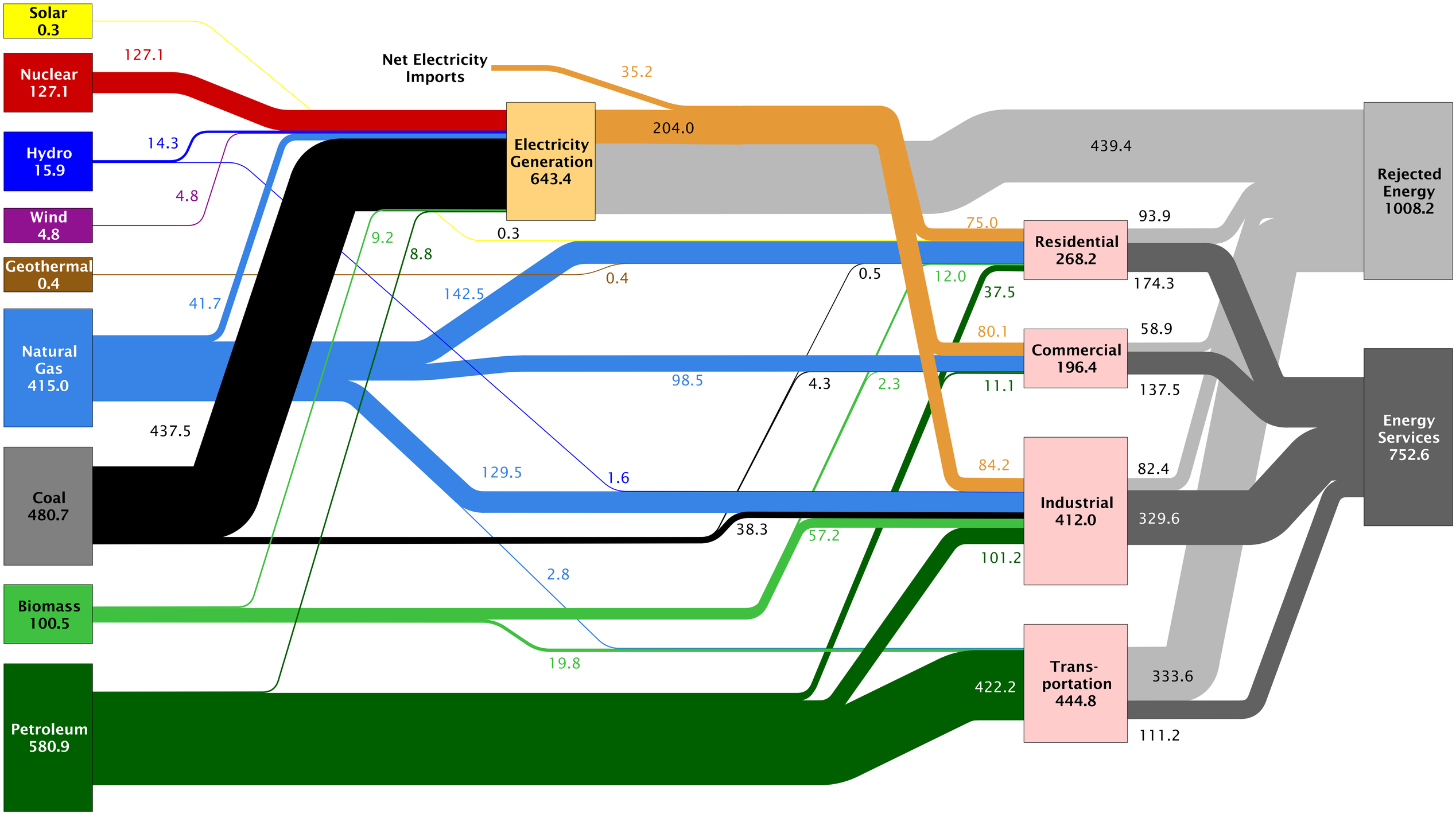
Lawrence Livermore National Laboratory



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

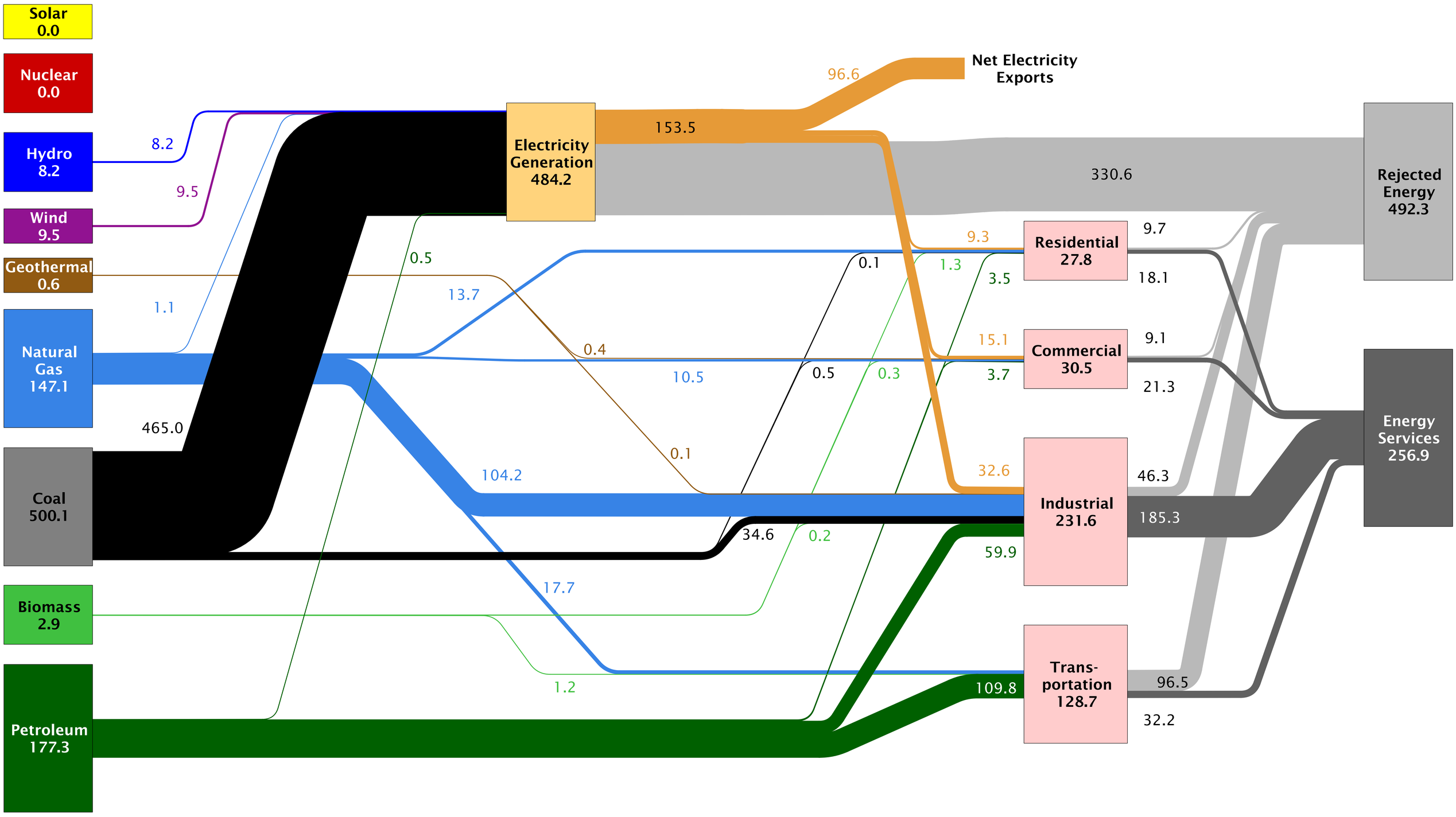
Lawrence Livermore National Laboratory



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

Lawrence Livermore National Laboratory



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.

CLACB	Coal consumed by the transportation sector.
CLCCB	Coal consumed by the commercial sector.
CLEIB	Coal consumed by the electric power sector.
CLICB	Coal consumed by the industrial sector.
CLRCB	Coal consumed by the residential sector.
ENACB	Ethanol (biomass) consumed by the transportation sector.
ESACB	Electricity consumed by the transportation sector.
ESCCB	Electricity consumed by the commercial sector.
ESICB	Electricity consumed by the industrial sector.
ESRCB	Electricity consumed by the residential sector.
GECCB	Direct use of geothermal energy and heat pumps in the commercial sector.
GEEGB	Thermal input to electricity produced from geothermal energy by the electric power sector.
GEICB	Direct use of geothermal energy and heat pumps in the industrial sector.
GERCB	Direct use of geothermal energy and heat pumps in the residential sector.
HYCCB	Thermal equivalent of hydroelectricity produced in the commercial sector.
HYEGB	Thermal equivalent of hydroelectricity produced by the electric power sector.
HYICB	Thermal equivalent of hydroelectricity produced in the industrial sector.
NGACB	Natural gas consumed by the transportation sector.
NGCCB	Natural gas consumed by the commercial sector.
NGEIB	Natural gas consumed by the electric power sector.
NGICB	Natural gas consumed by the industrial sector.
NGRCB	Natural gas consumed by the residential sector.
NUEGB	Thermal input to electricity produced from nuclear power by the electric power sector.
PAEIB	All petroleum products consumed by the electric power sector.
PARCB	All petroleum products consumed by the residential sector.
SOEGB	Thermal equivalent of electricity produced from photovoltaic and solar thermal energy by the electric power sector.
SOHCB	Thermal equivalent of photovoltaic and solar thermal energy consumed by the residential and commercial sectors.
WDRCB	Wood (biomass) consumed by the residential sector.
WWEIB	Wood and waste (biomass) consumed by the electric power sector.
WYEGB	Thermal equivalent of electricity produced from wind energy by the electric power sector.

Those that are not reported directly are calculated from the following data:

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

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:

```
(ELISB + ELNIB)/ (1+LOTCB/ESTCB)
```

Total state energy use is calculated as:

```
CLACB + PAACB + NGACB +
CLCCB + PACCB + GECCB + HYCCB + NGCCB + WWCCB +
CLICB + PAICB + GEICB + HYICB + NGICB + WWICB +
CLRCB + PARCB + GERCB + NGRCB + WDRCB + SOHCB +
CLEIB + GEEGB + HYEGB + NGEIB + NUEGB + PAEIB + SOEGB + WWEIB + WYEGB +
(ELISB + ELNIB)/ (1+LOTCB/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

Lawrence Livermore National Lab, 2009, Energy Flow Chart. Available at : http://flowcharts.llnl.gov (Livermore, 2009)