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LLNL-TR-473098

# 2007 Estimated International Energy Flows

C. A. Smith, R. D. Belles, A. J. Simon

March 11, 2011

## Disclaimer



This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

# Estimated International Energy Flows

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Clara Smith, Rich Belles and A.J. Simon
Lawrence Livermore National Laboratory

**Abstract**

An energy flow chart or "atlas" for 136 countries has been constructed from data maintained by the International Energy Agency (IEA) and estimates of energy use patterns for the year 2007. Approximately 490 exajoules (460 quadrillion BTU) of primary energy are used in aggregate by these countries each year. While the basic structure of the energy system is consistent from country to country, patterns of resource use and consumption vary. Energy can be visualized as it flows from resources (i.e. coal, petroleum, natural gas) through transformations such as electricity generation to end uses (i.e. residential, commercial, industrial, transportation). These flow patterns are visualized in this atlas of 136 country-level energy flow charts.

## Introduction

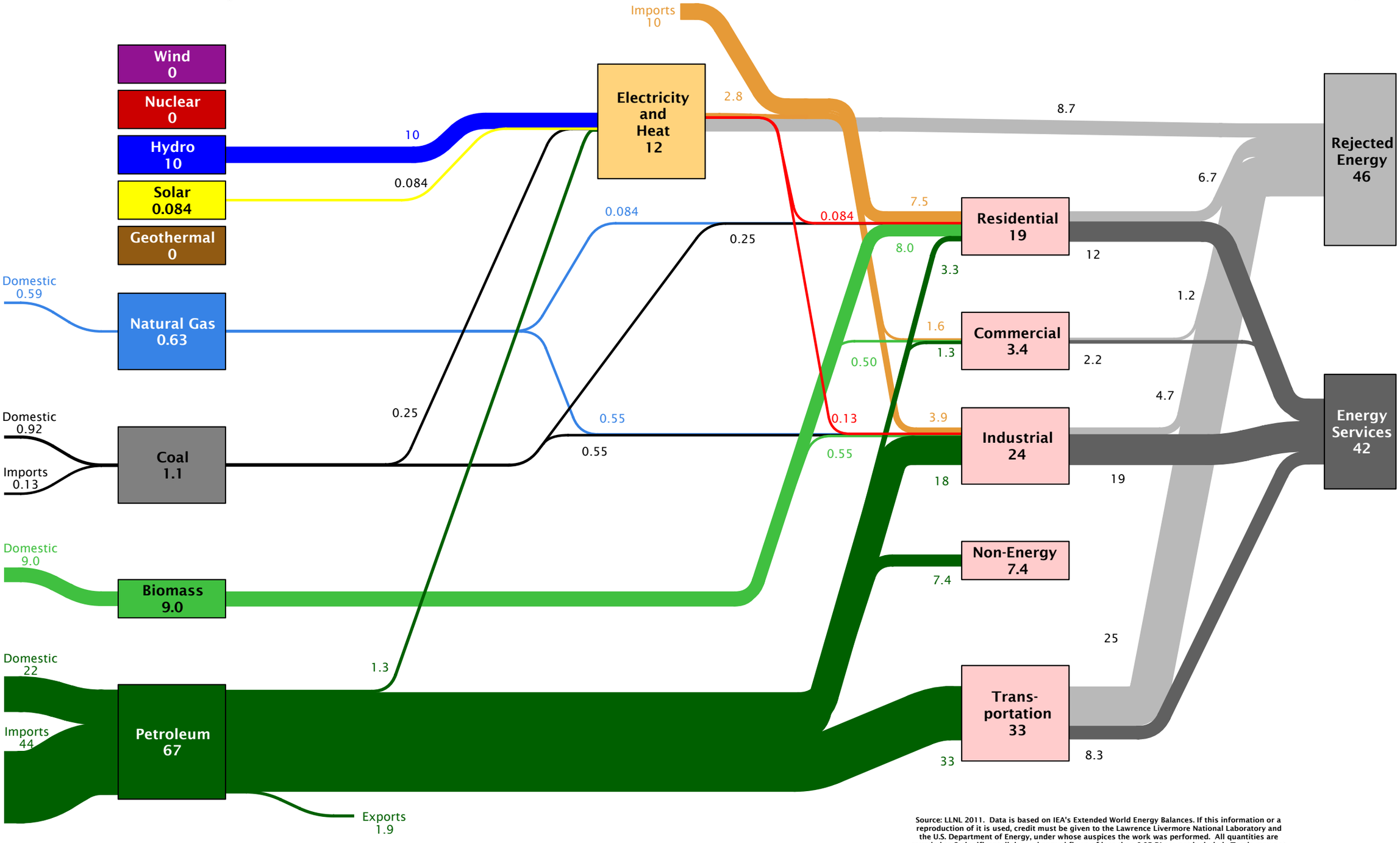
Lawrence Livermore National Lab (LLNL) has published flow charts (also referred to as "Sankey Diagrams") of important national commodities since the early 1970s. The most widely recognized of these charts is the U.S. energy flow chart (http://flowcharts.llnl.gov). LLNL has also published charts depicting 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 (i.e. United States 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.

This is the first comprehensive package of worldwide country-level energy flowcharts that has been produced.

Energy use data is compiled by the IEA in the publications: Energy Balances of Non-OECD Countries and Energy Balances of OECD Countries. These publications are updated annually and generally report data for the time period two years prior to its year of update (ie. the 2009 update records energy use in 2007). IEA data contains information on primary resource consumption, electricity generation, and energy consumption within each of the economic sectors.

# Albania Energy Flow in 2007: ~96 PJ

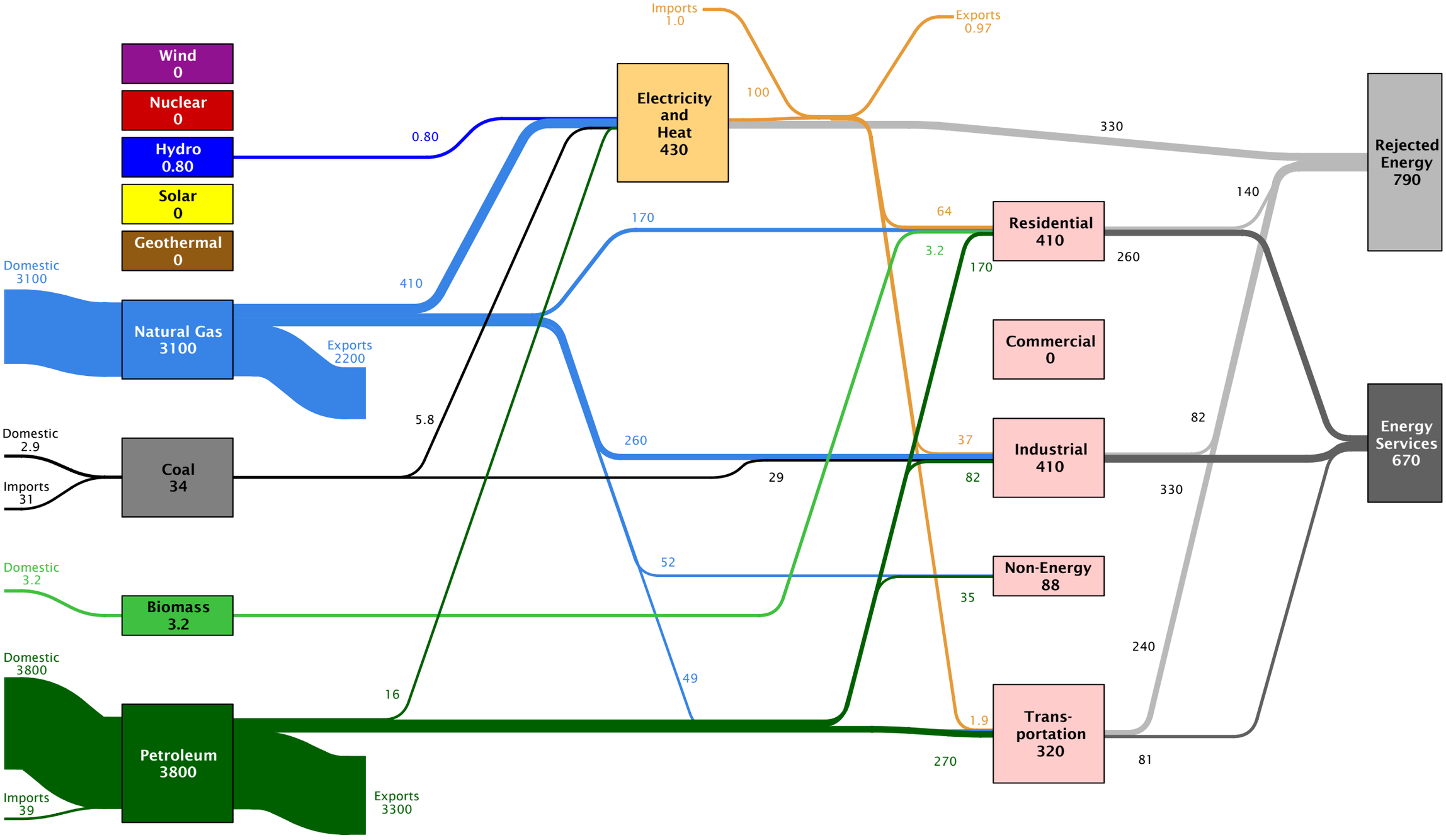
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Algeria Energy Flow in 2007: ~1600 PJ

Lawrence Livermore National Laboratory

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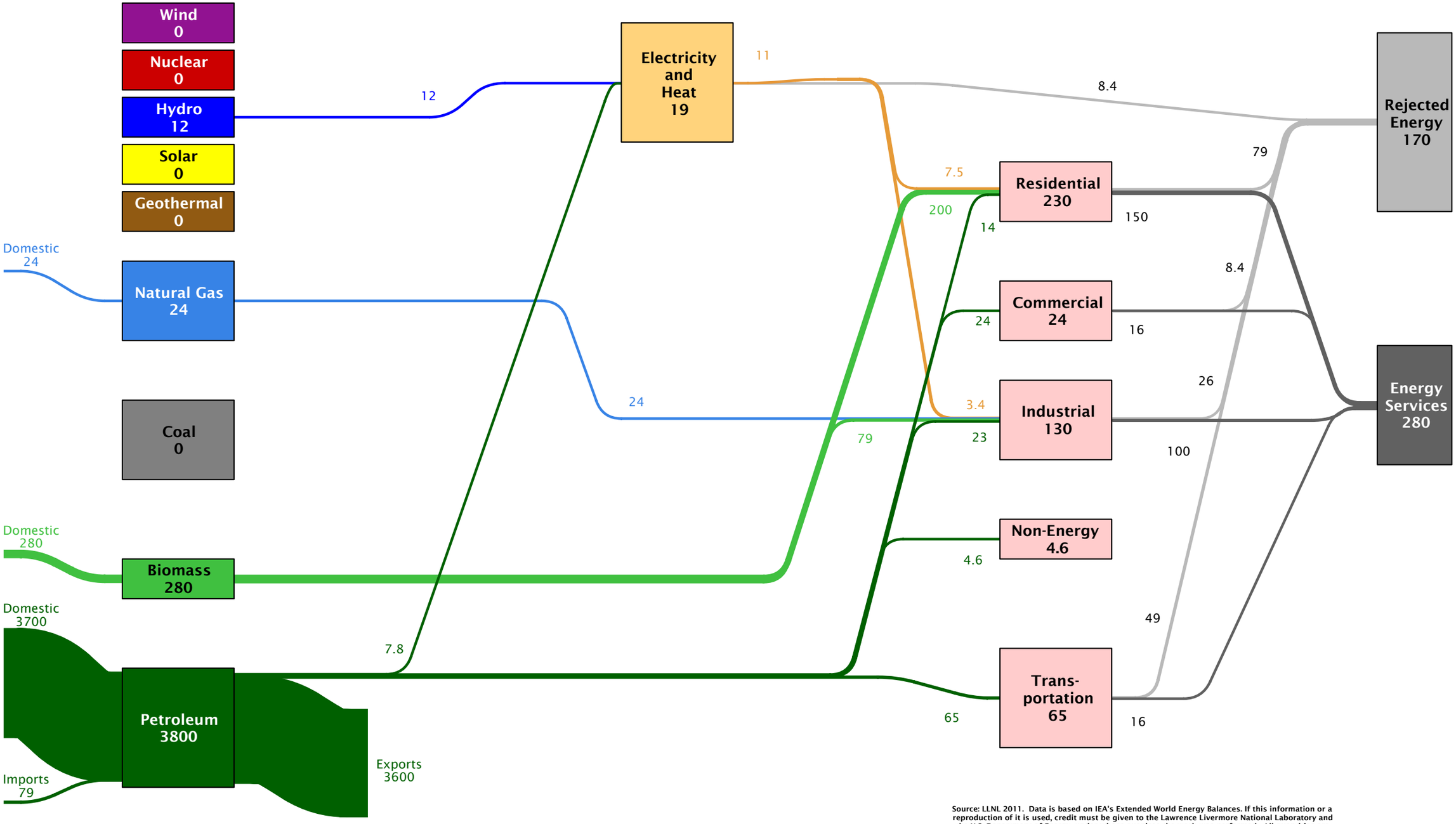
# Angola Energy Flow in 2007: ~460 PJ

Lawrence Livermore National Laboratory

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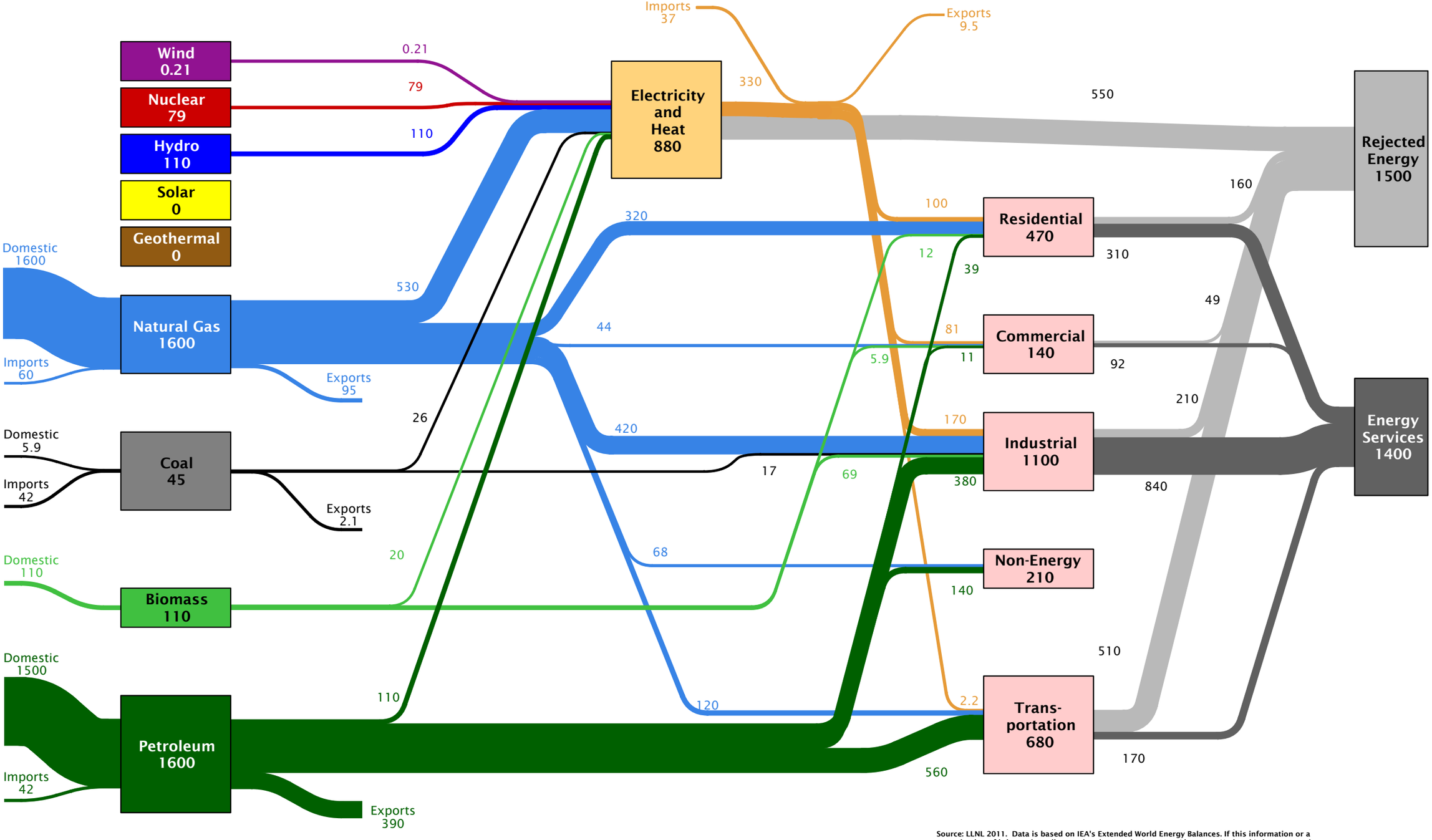
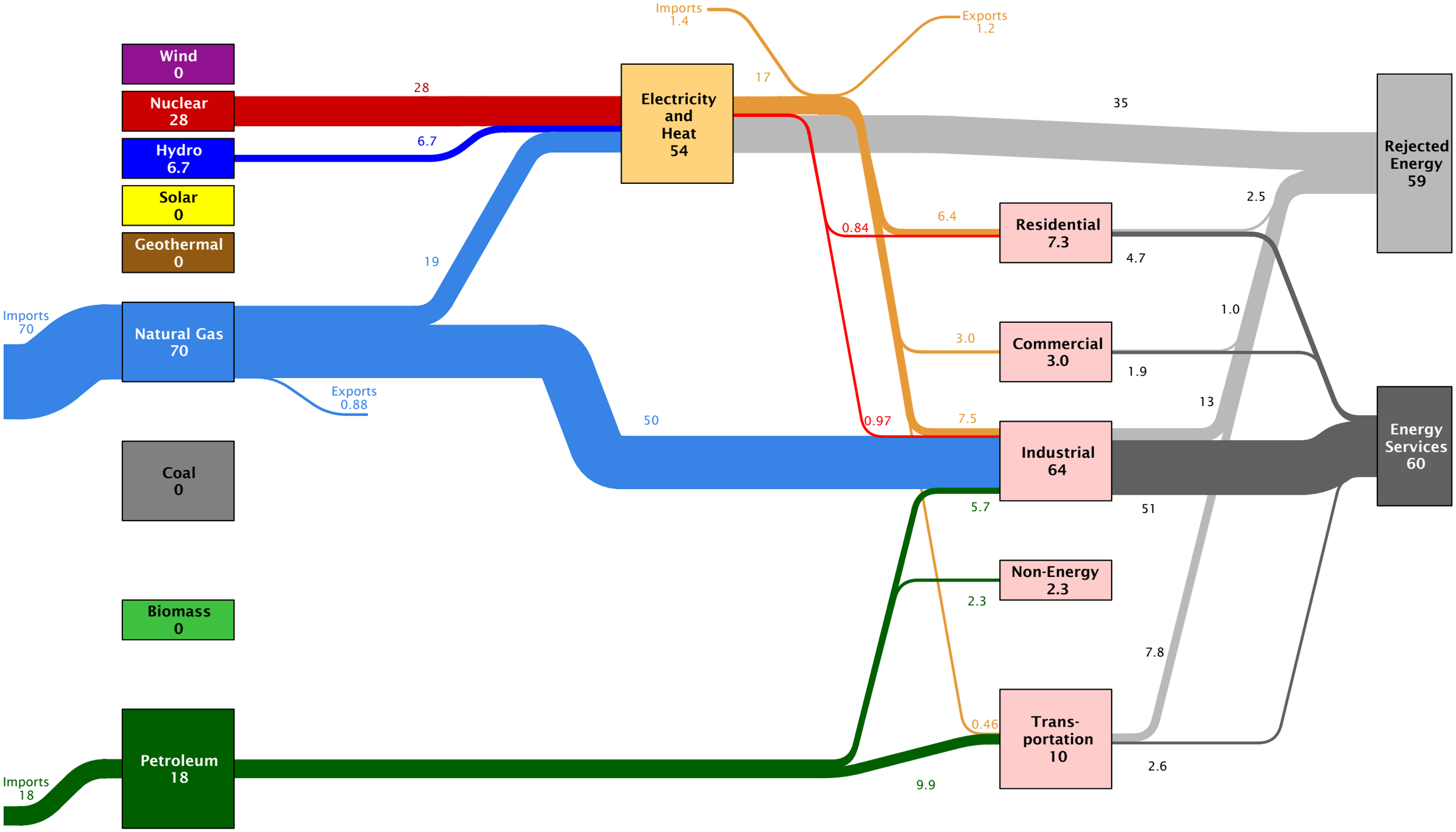
# Argentina Energy Flow in 2007: ~3100 PJ

Lawrence Livermore National Laboratory



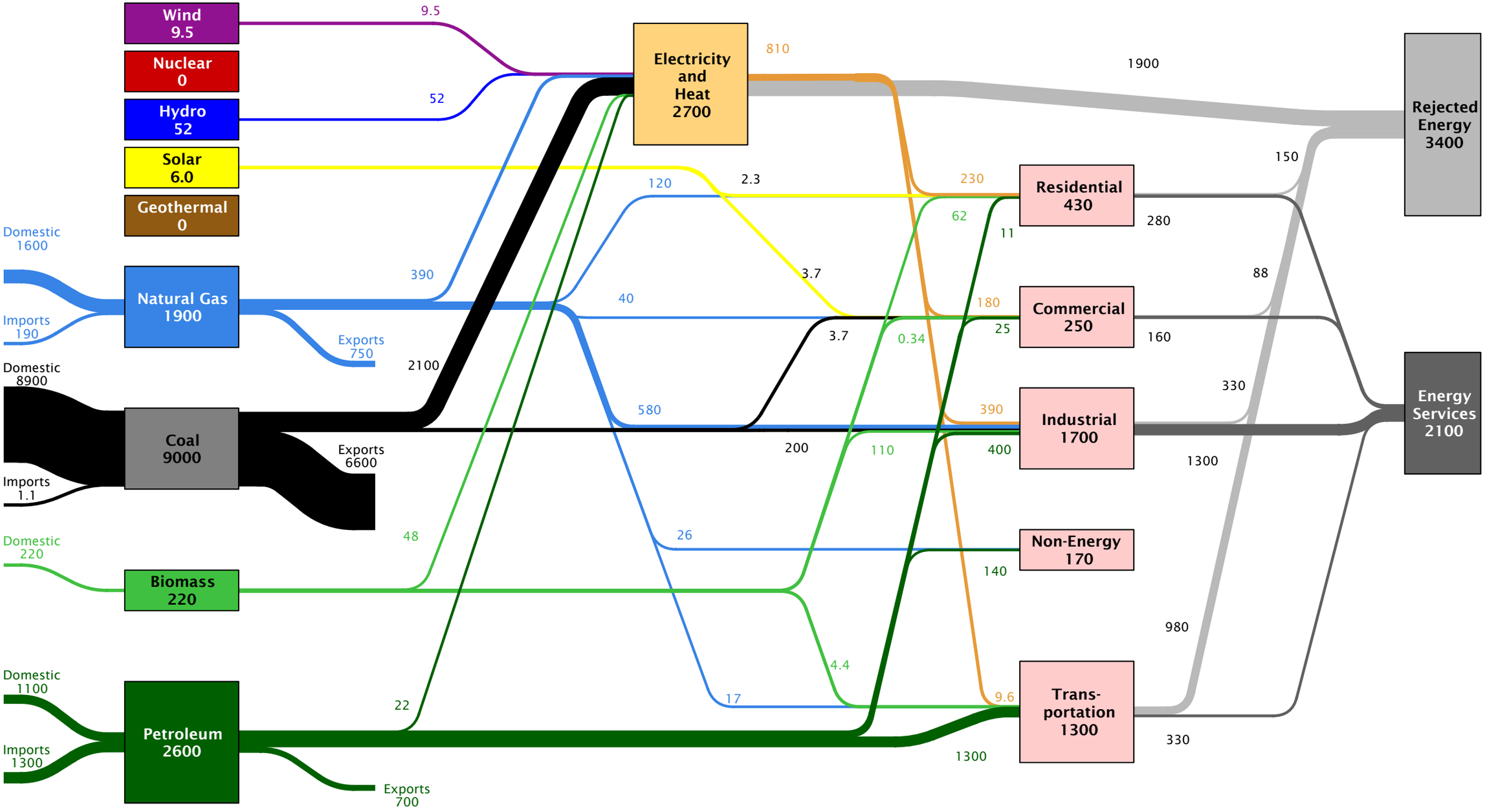
# Armenia Energy Flow in 2007: ~120 PJ

Lawrence Livermore National Laboratory



# Australia Energy Flow in 2007: ~5700 PJ

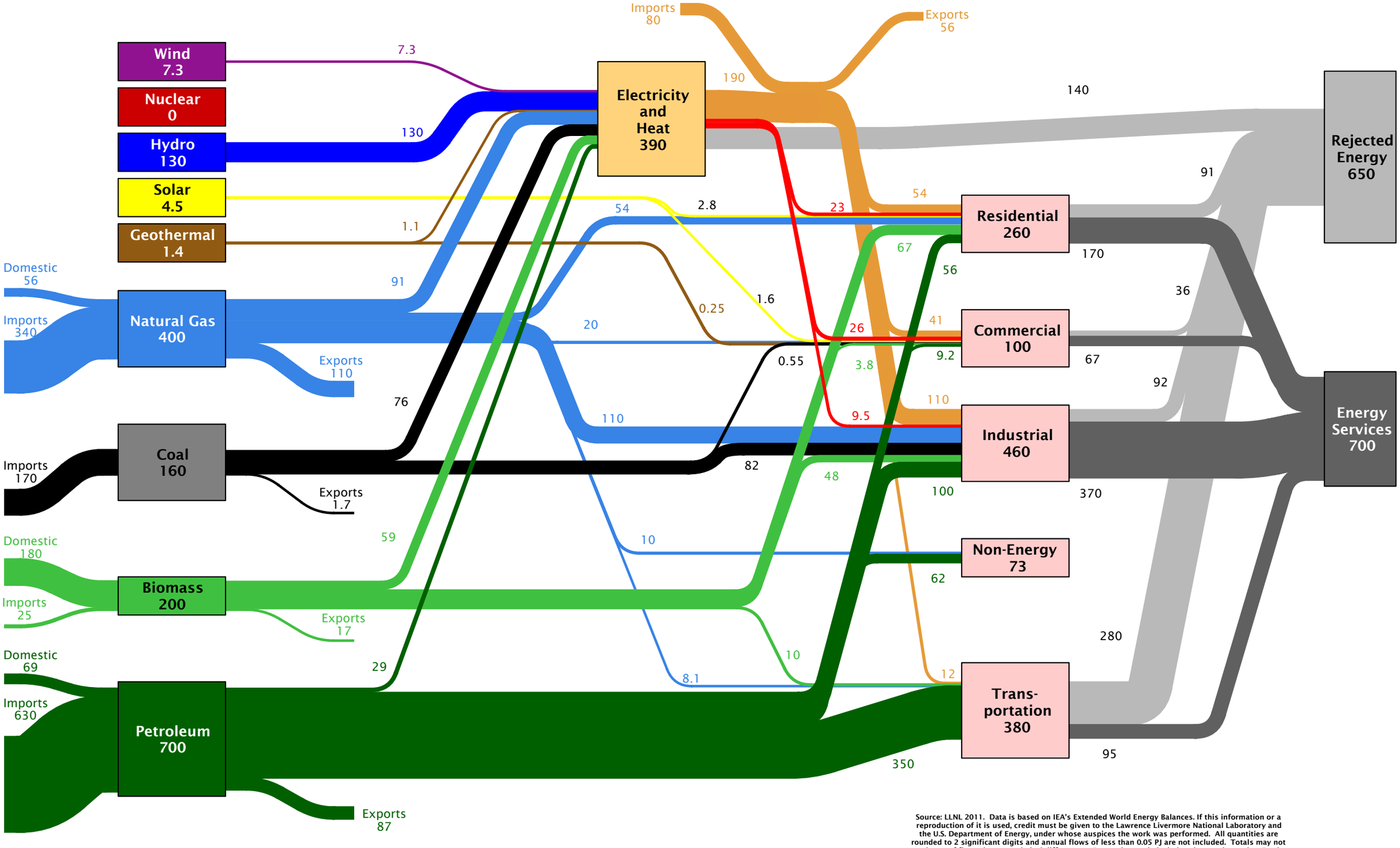
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

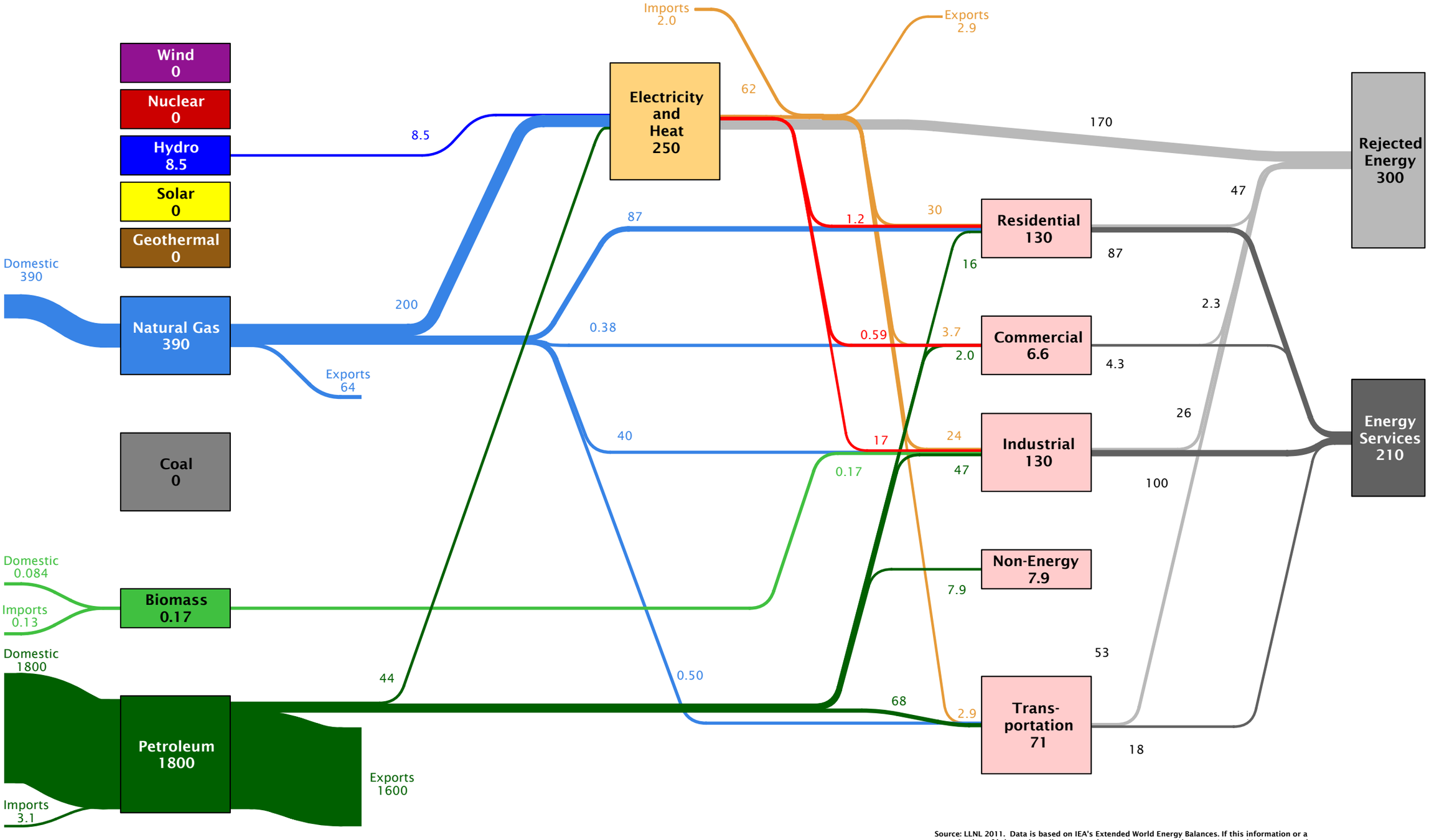
# Austria Energy Flow in 2007: ~1400 PJ

Lawrence Livermore National Laboratory



# Azerbaijan Energy Flow in 2007: ~520 PJ

Lawrence Livermore National Laboratory

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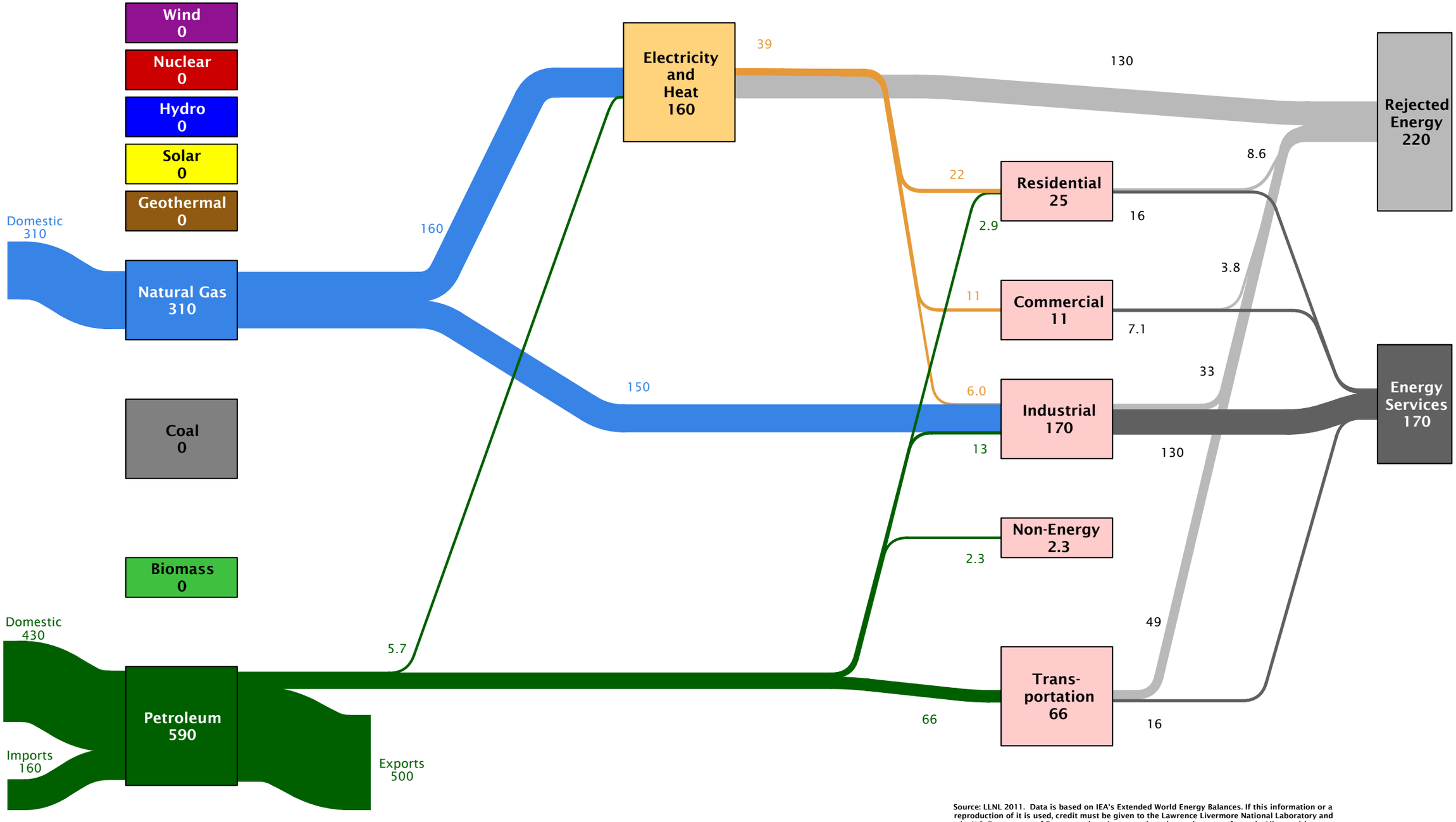
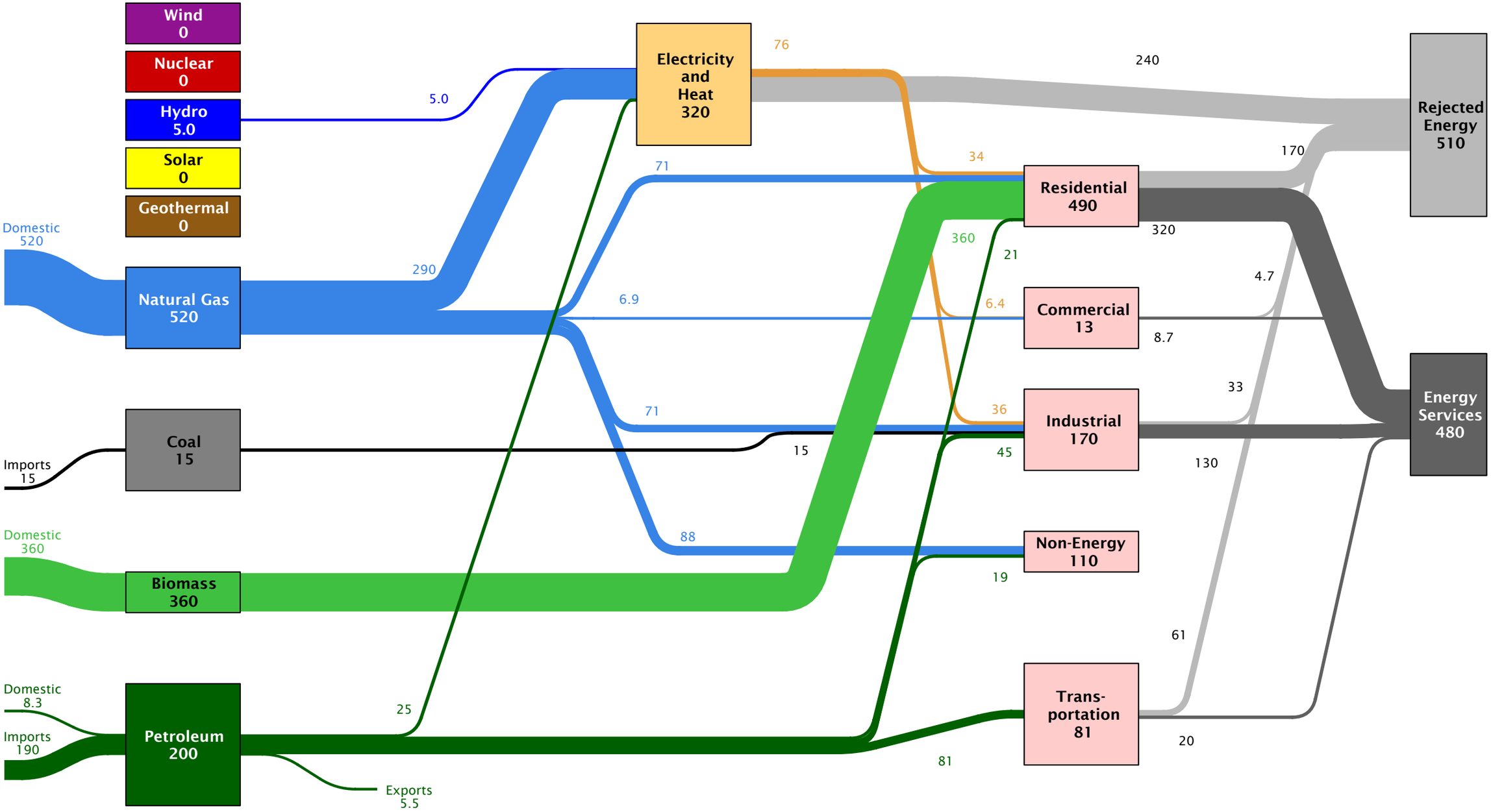
# Bahrain Energy Flow in 2007: ~400 PJ

Lawrence Livermore National Laboratory



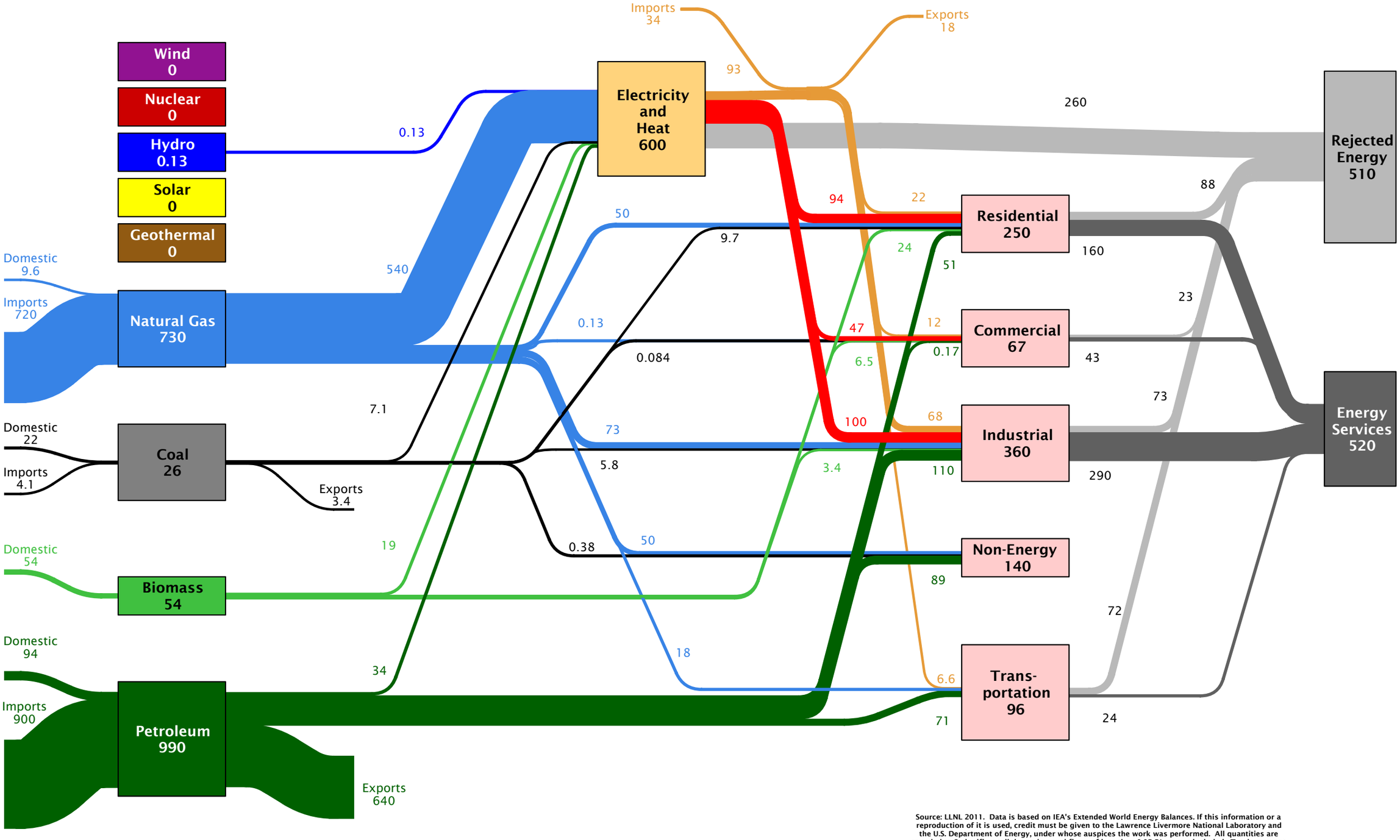
# Bangladesh Energy Flow in 2007: ~1100 PJ

Lawrence Livermore National Laboratory



# Belarus Energy Flow in 2007: ~1200 PJ

Lawrence Livermore National Laboratory

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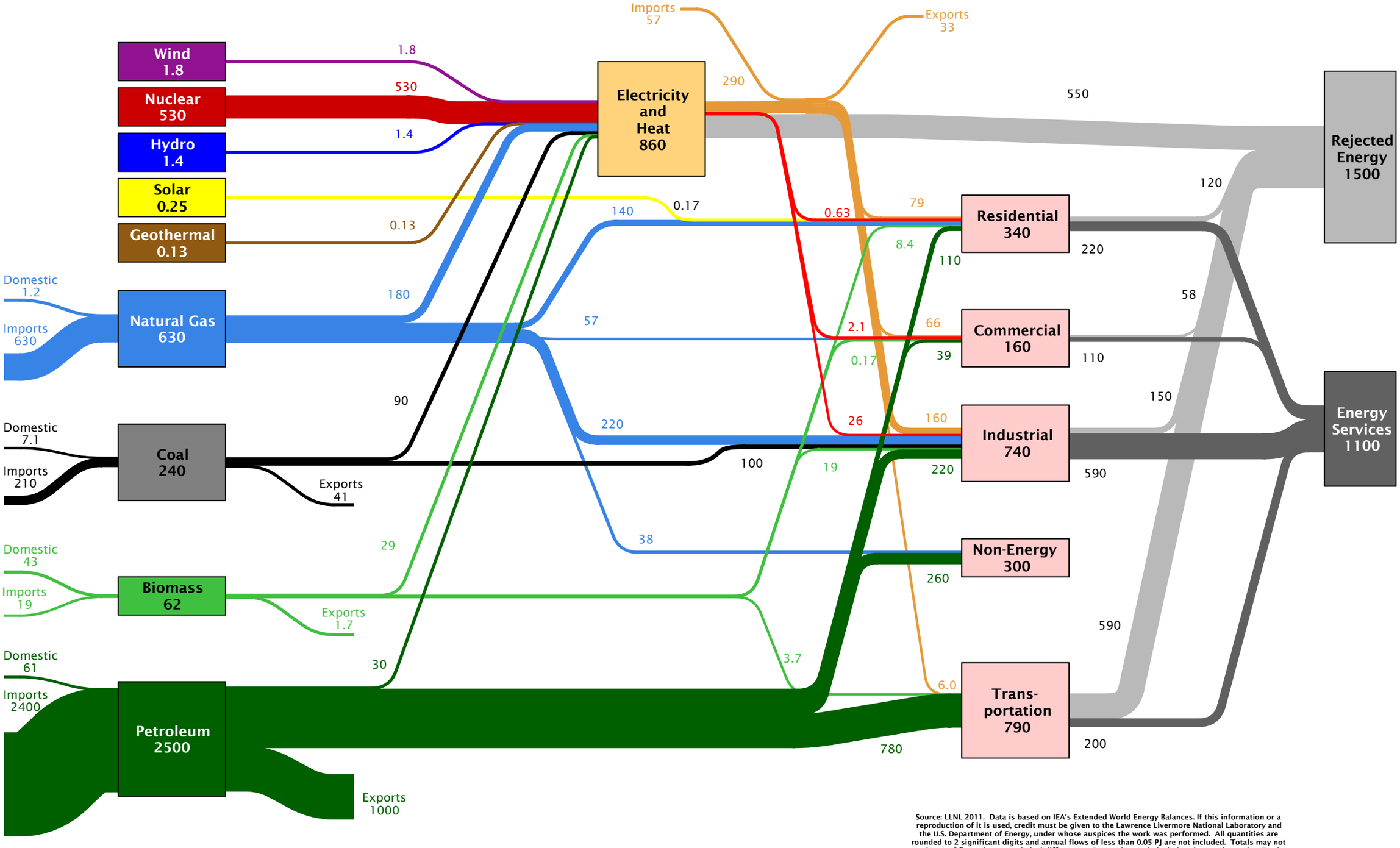
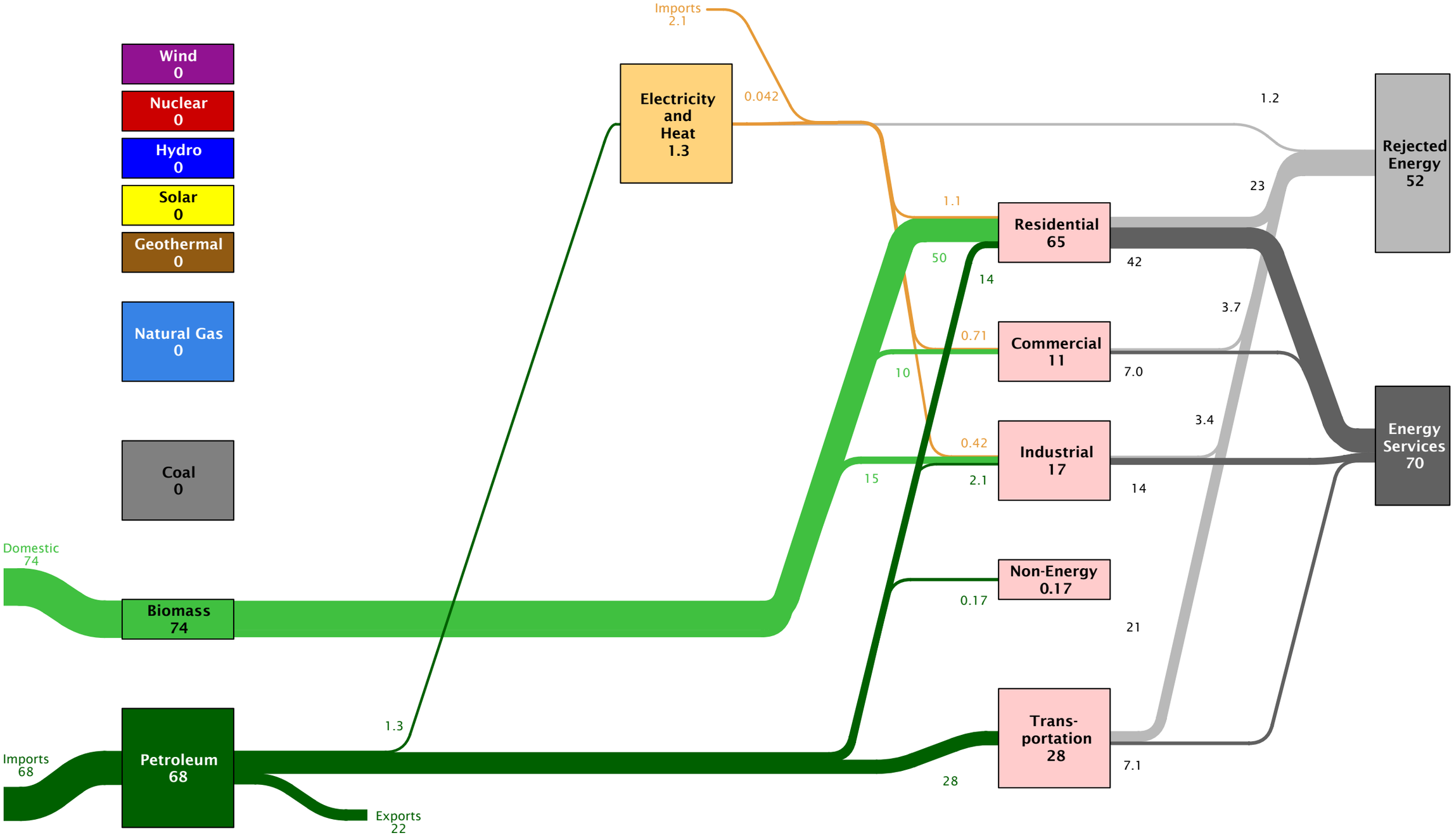
# Belgium Energy Flow in 2007: ~2900 PJ

Lawrence Livermore National Laboratory



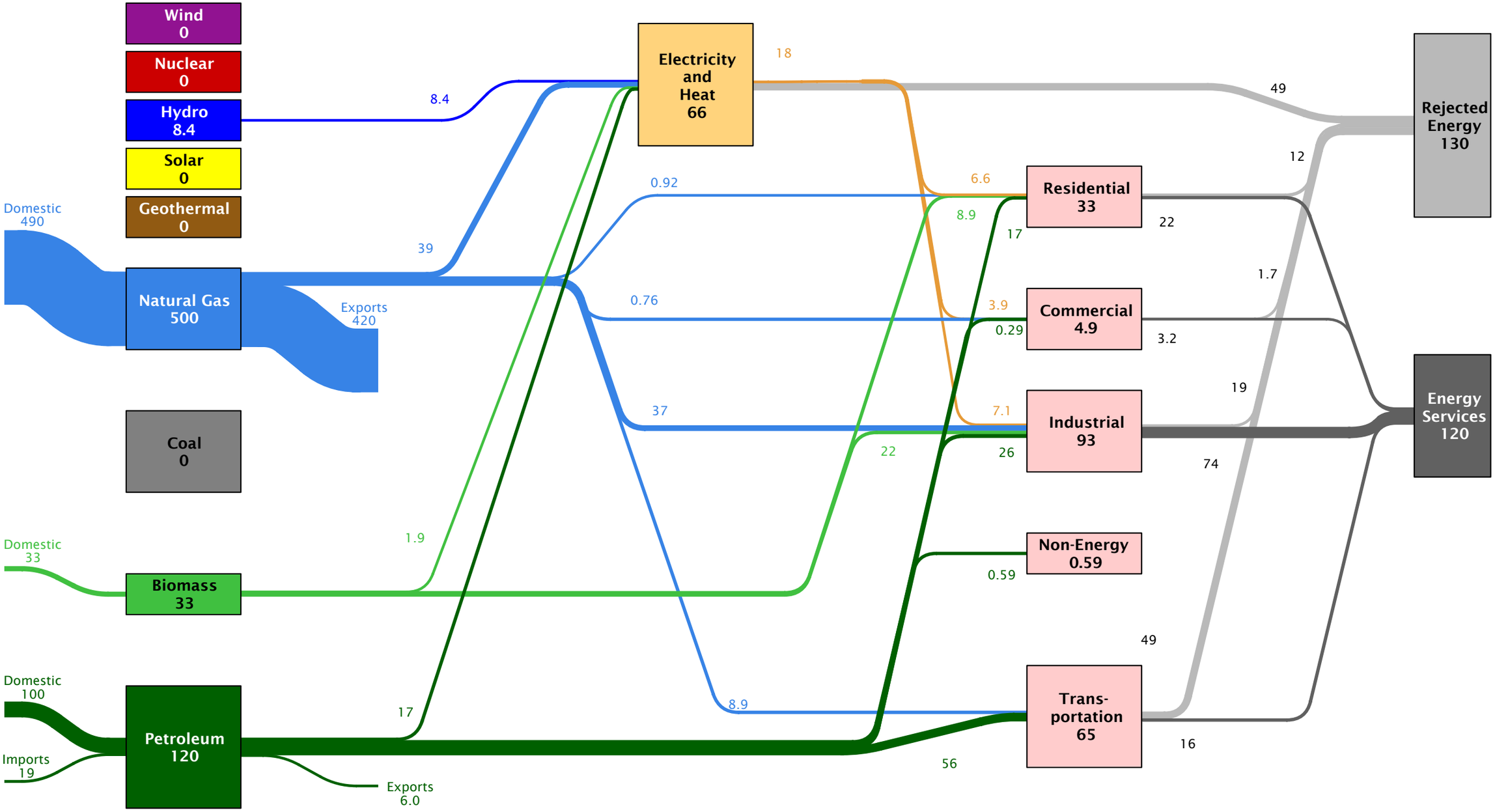
# Benin Energy Flow in 2007: ~120 PJ

Lawrence Livermore National Laboratory



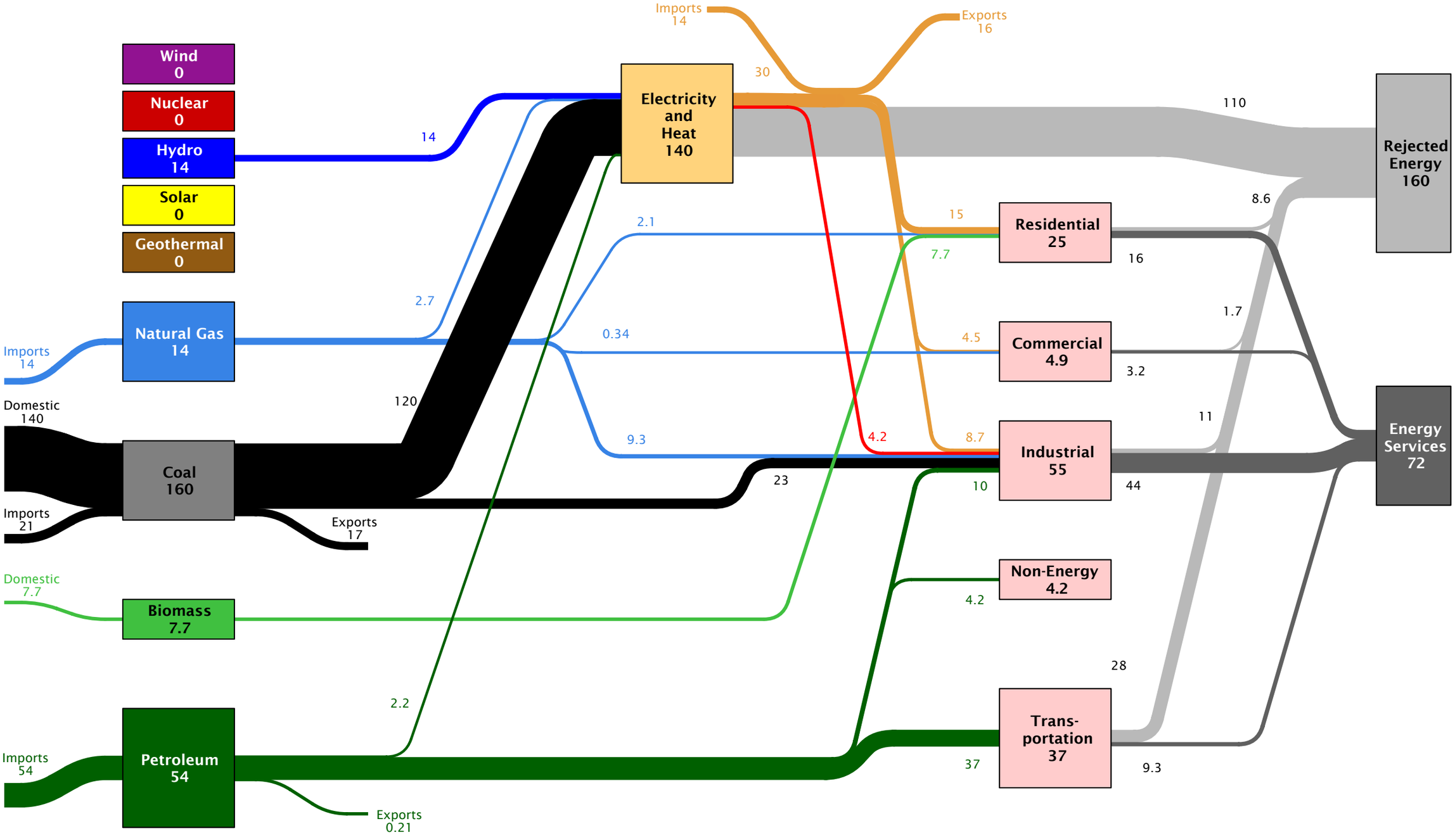
# Bolivia Energy Flow in 2007: ~250 PJ

Lawrence Livermore National Laboratory



# Bosnia and Herzegovina Energy Flow in 2007: ~240 PJ

Lawrence Livermore National Laboratory

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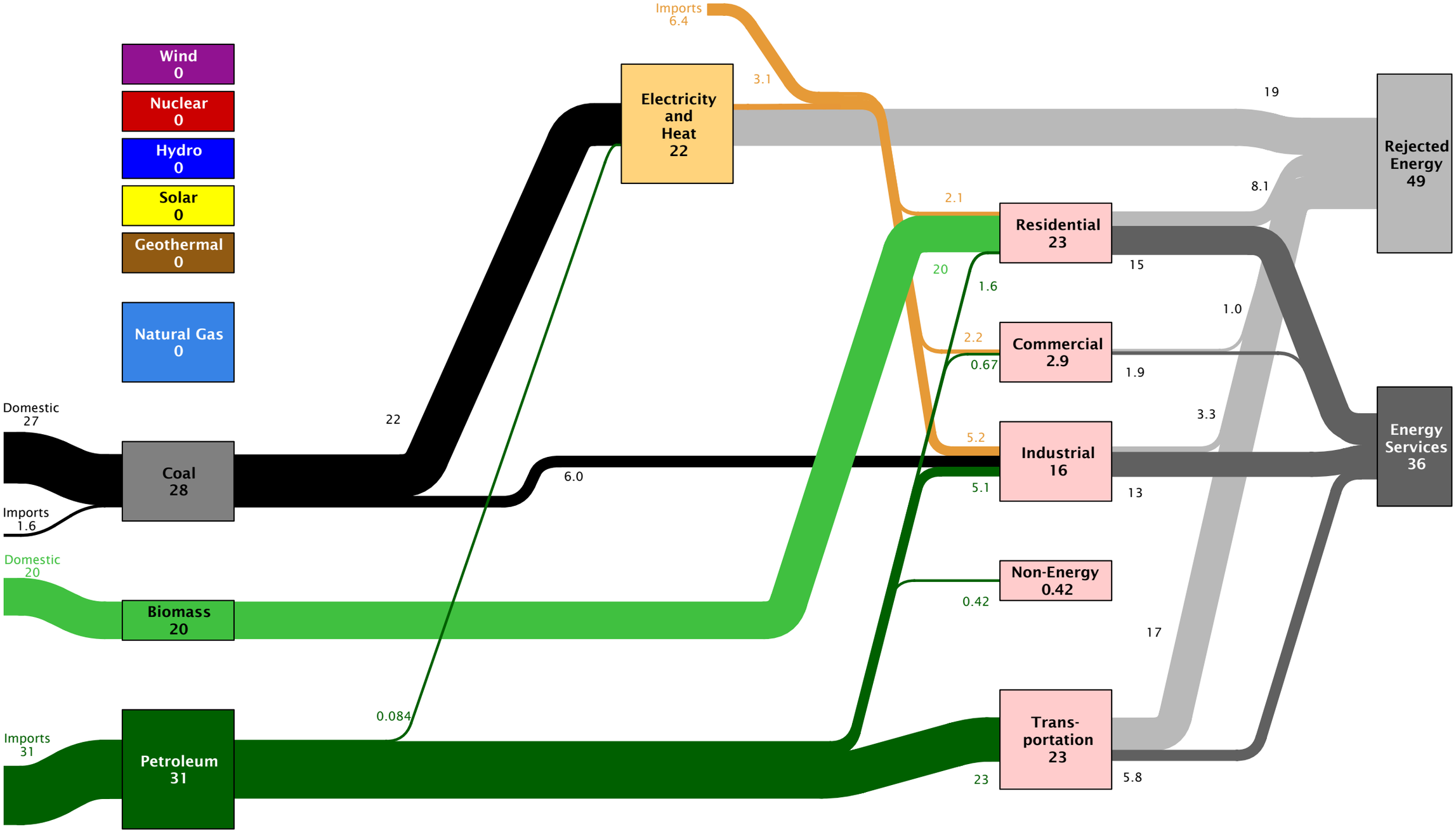
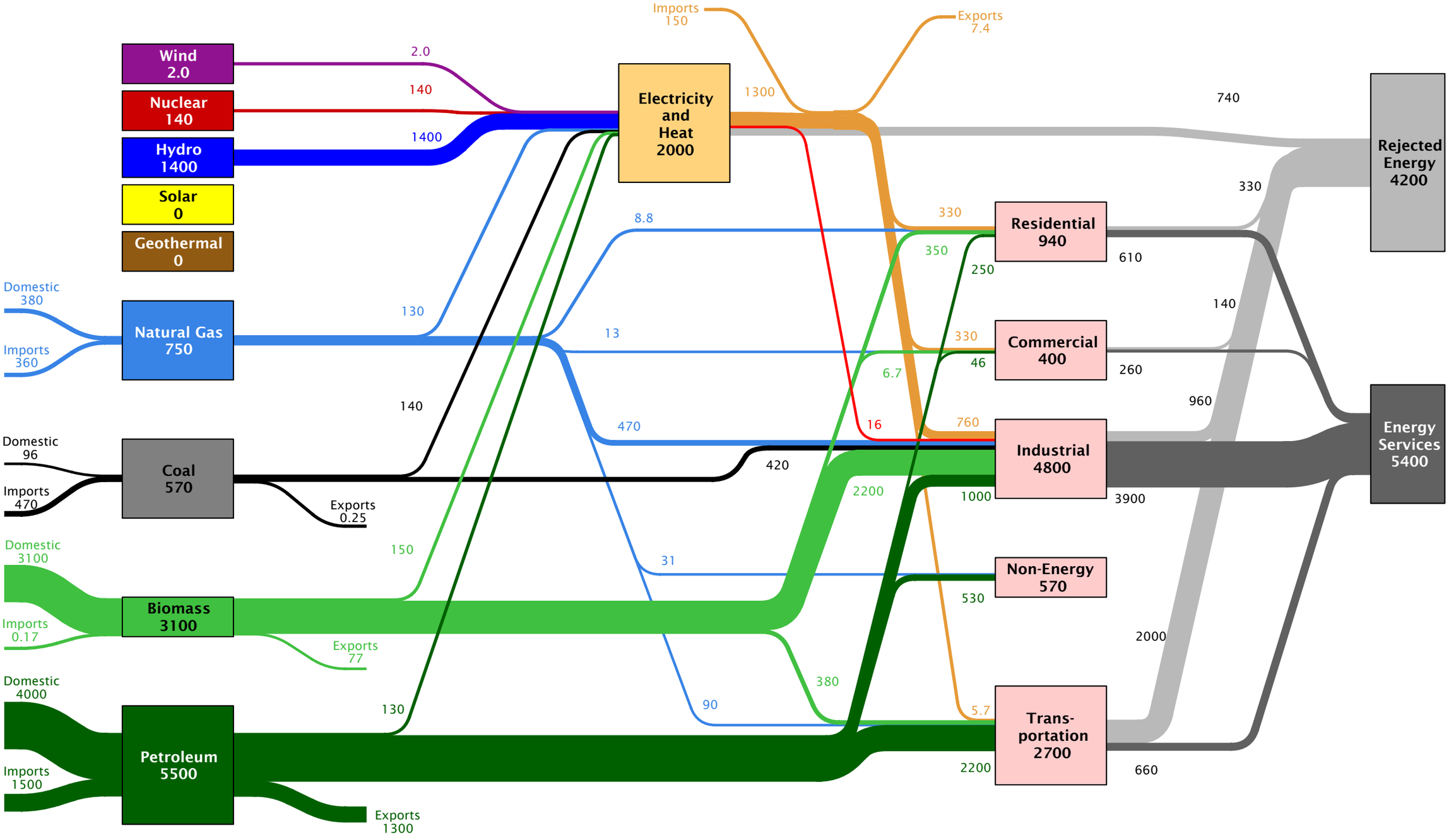
# Botswana Energy Flow in 2007: ~85 PJ

Lawrence Livermore National Laboratory



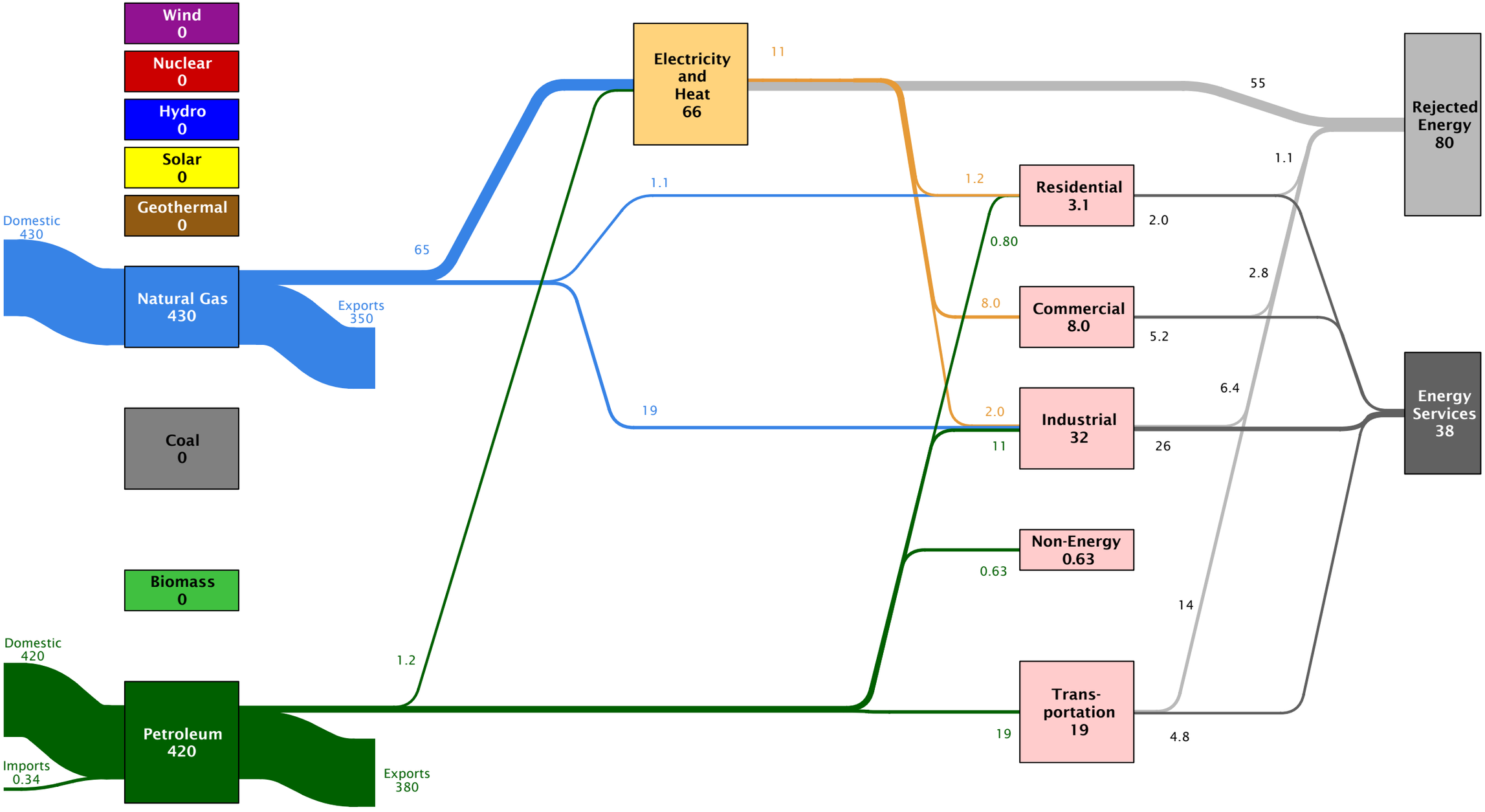
# Brazil Energy Flow in 2007: ~10000 PJ

Lawrence Livermore National Laboratory



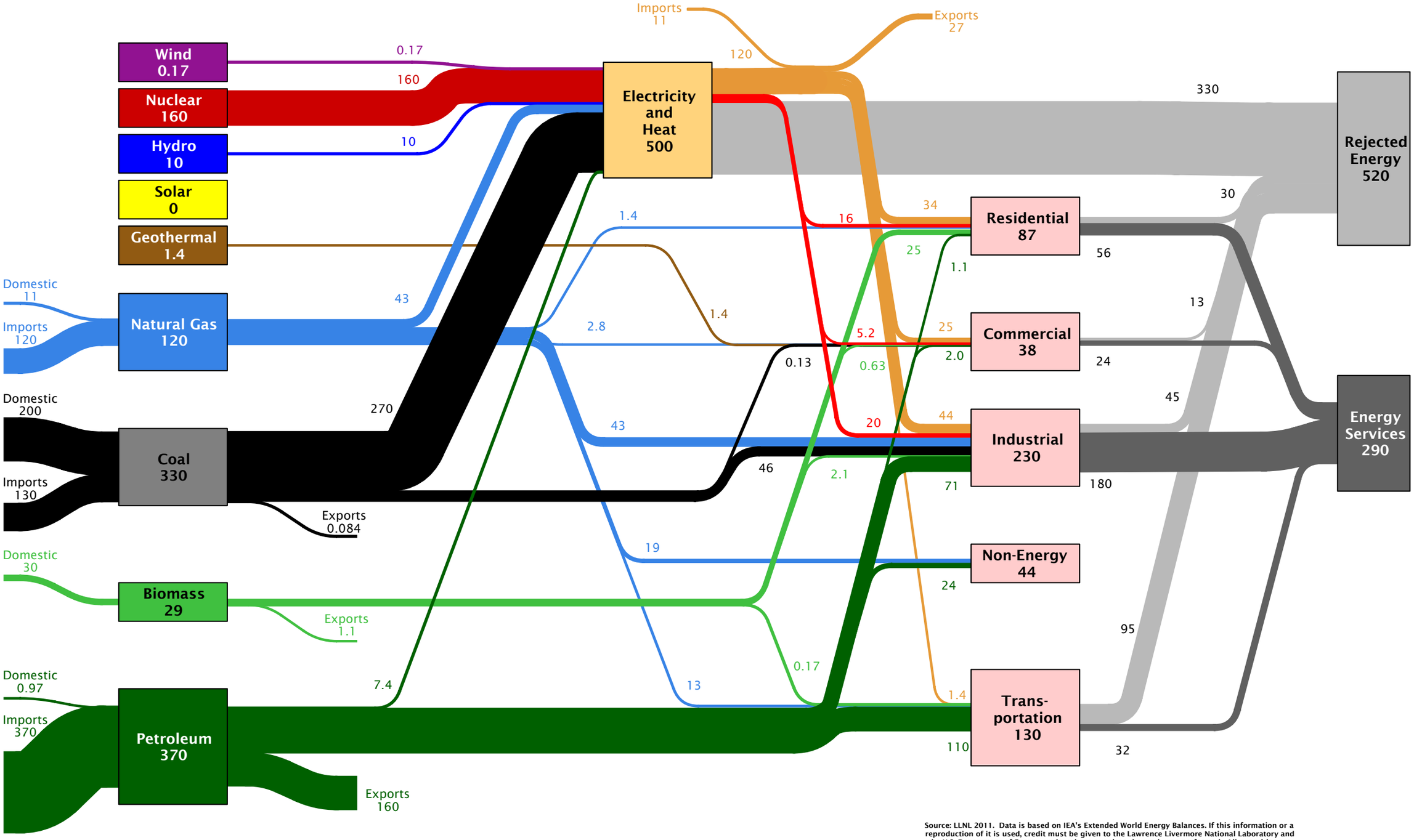
# Brunei Darussalam Energy Flow in 2007: ~120 PJ

Lawrence Livermore National Laboratory



# Bulgaria Energy Flow in 2007: ~860 PJ

Lawrence Livermore National Laboratory

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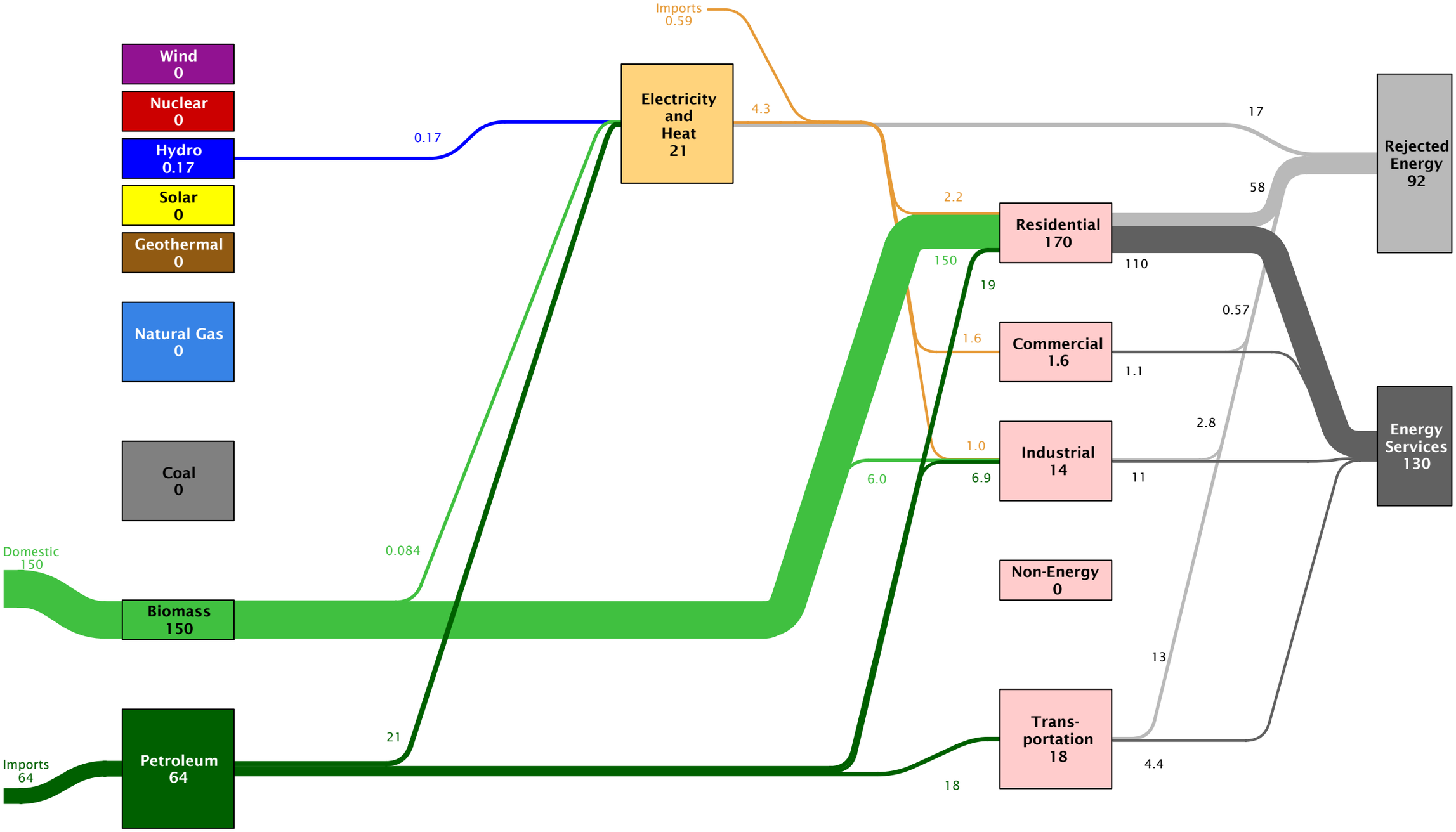
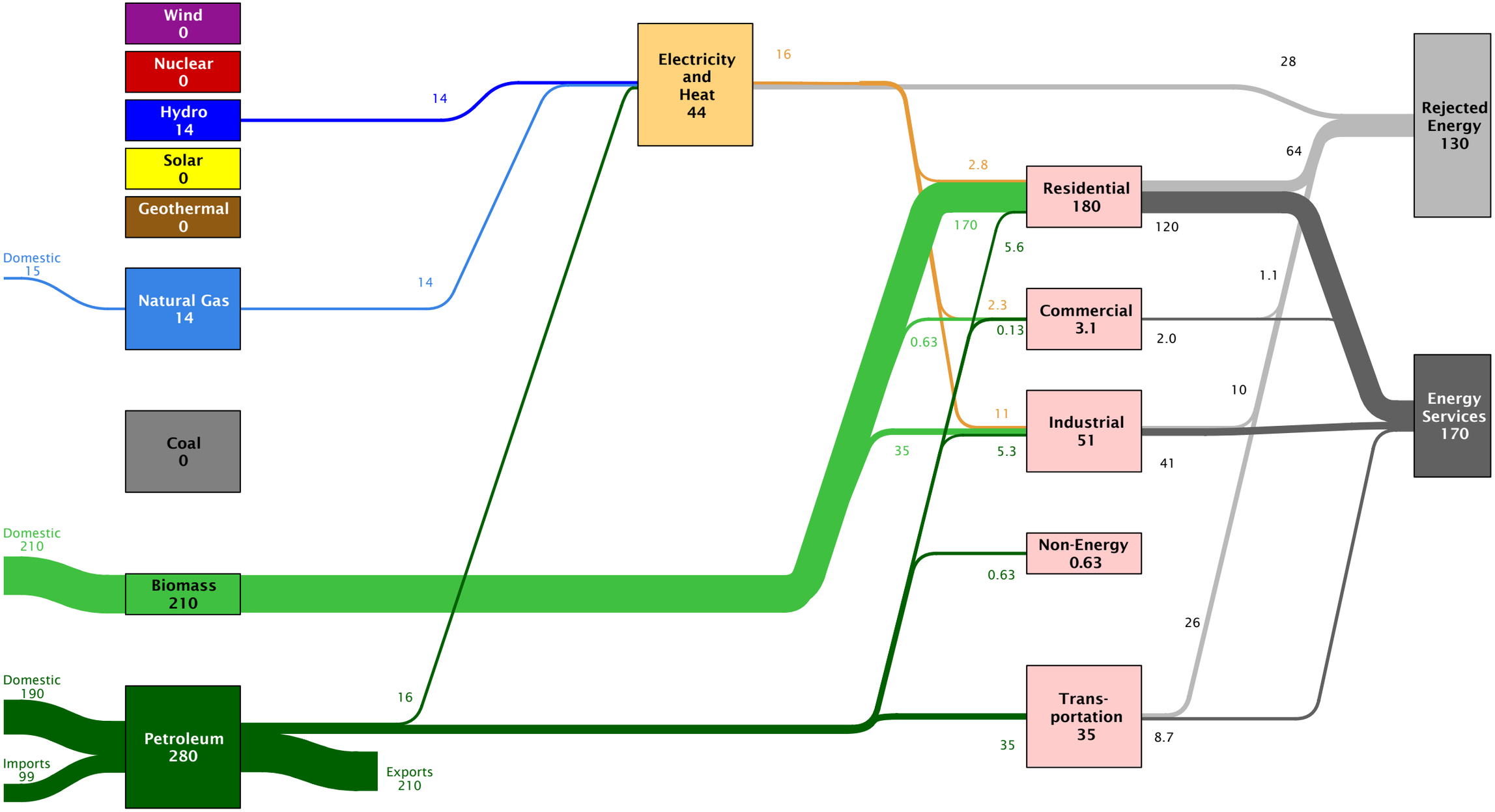
# Cambodia Energy Flow in 2007: ~220 PJ

Lawrence Livermore National Laboratory



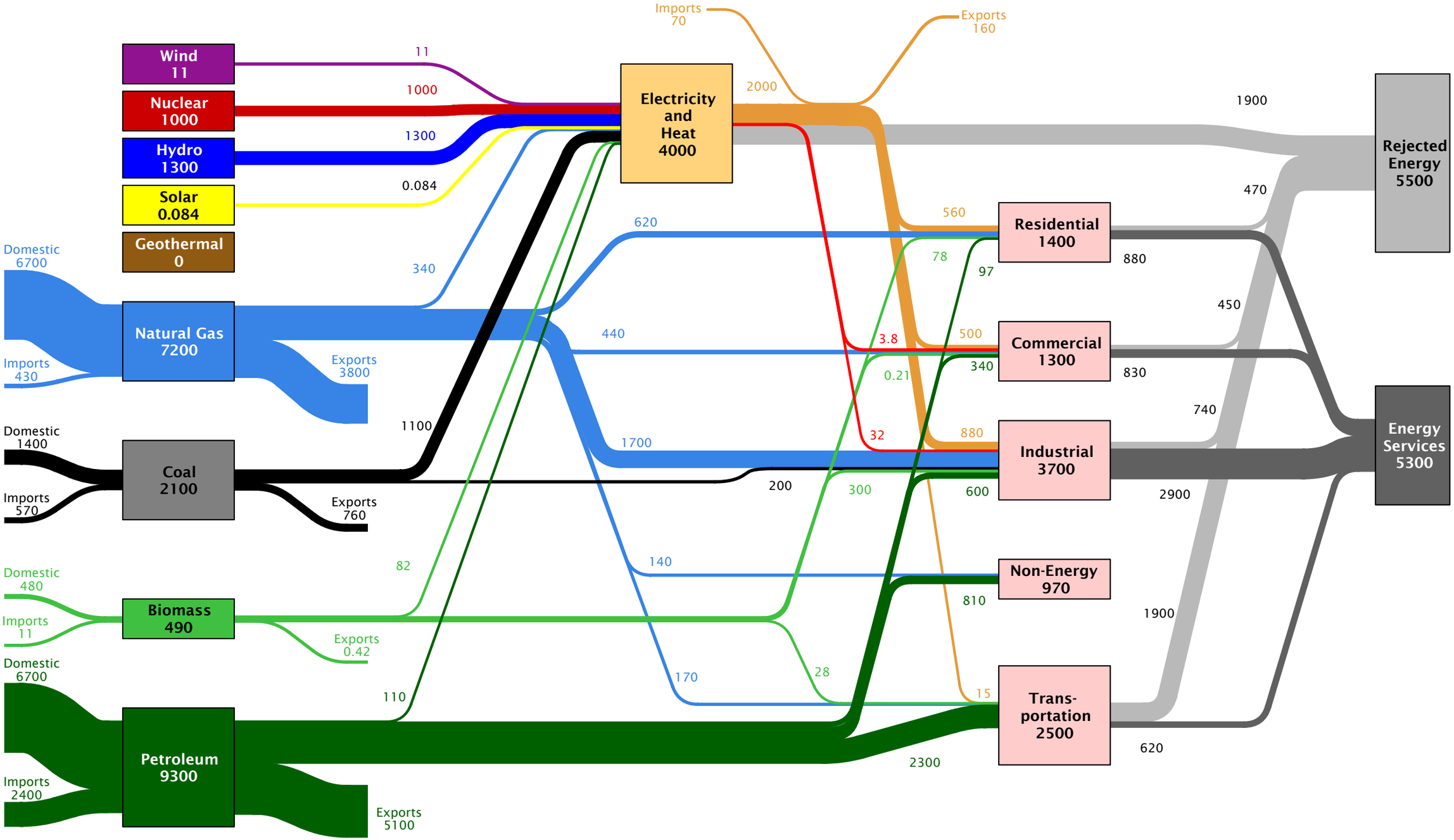
# Cameroon Energy Flow in 2007: ~300 PJ

Lawrence Livermore National Laboratory



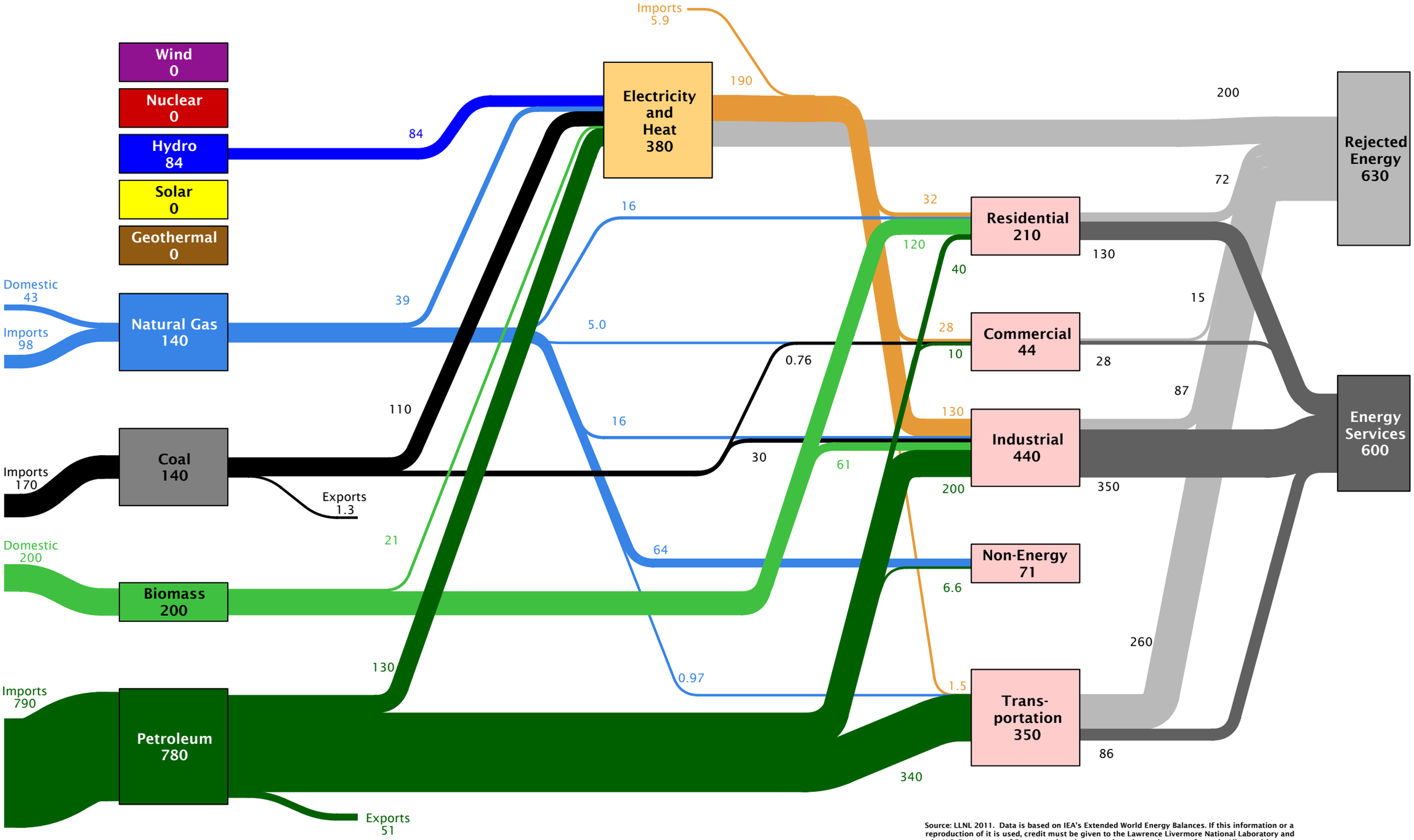
# Canada Energy Flow in 2007: ~12000 PJ

Lawrence Livermore National Laboratory



# Chile Energy Flow in 2007: ~1300 PJ

Lawrence Livermore National Laboratory

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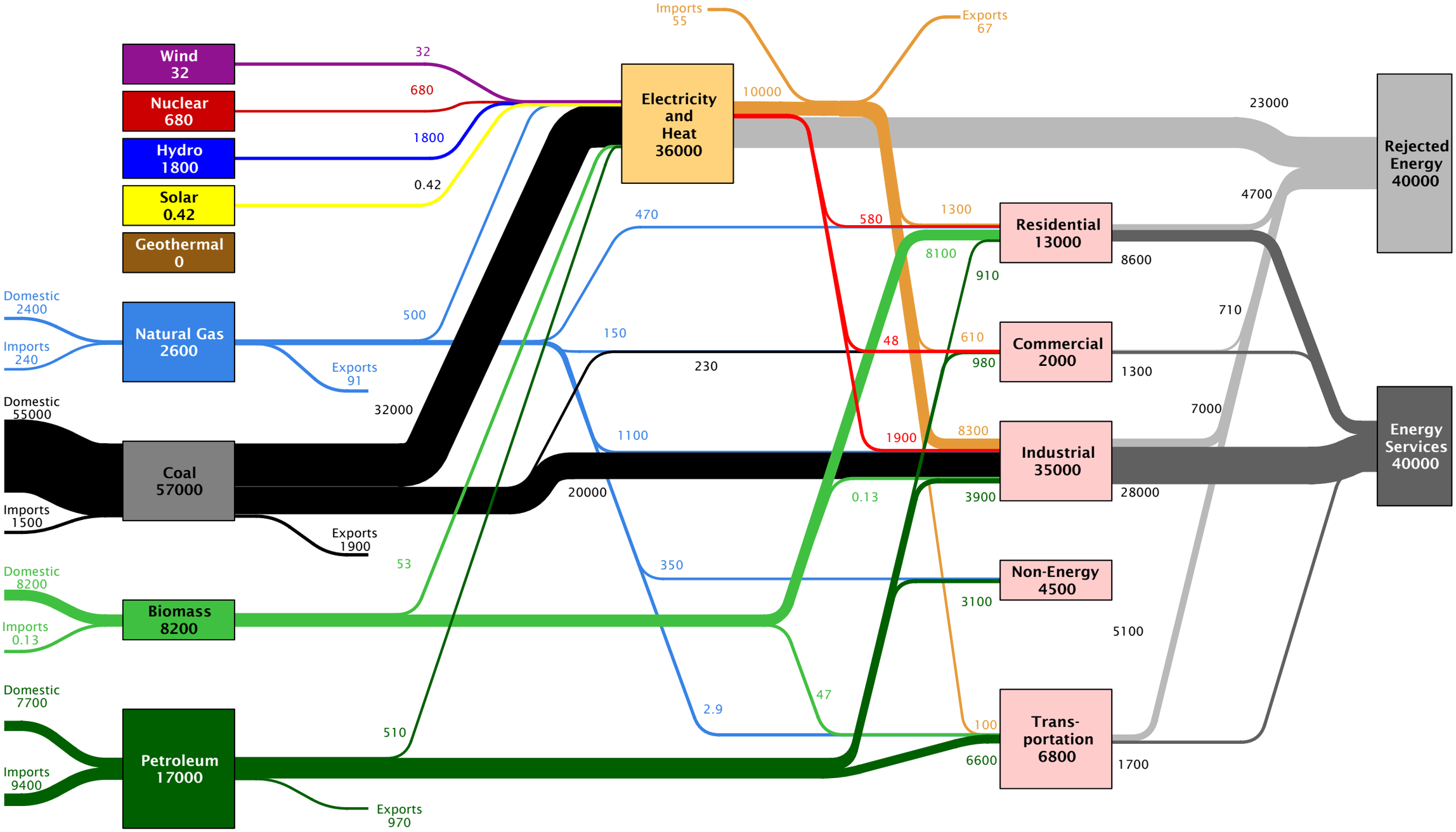
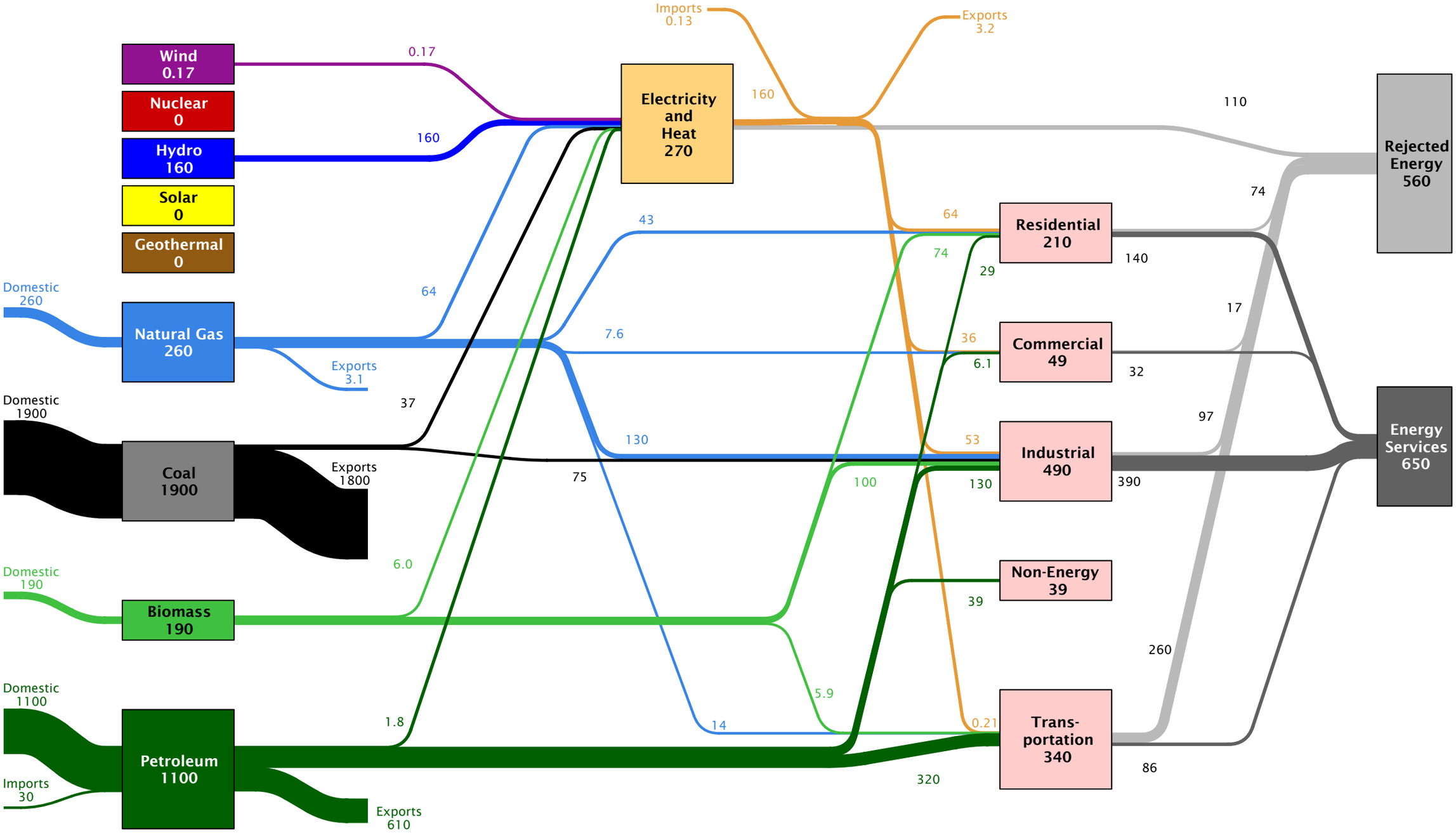
# China Energy Flow in 2007: ~85000 PJ

Lawrence Livermore National Laboratory



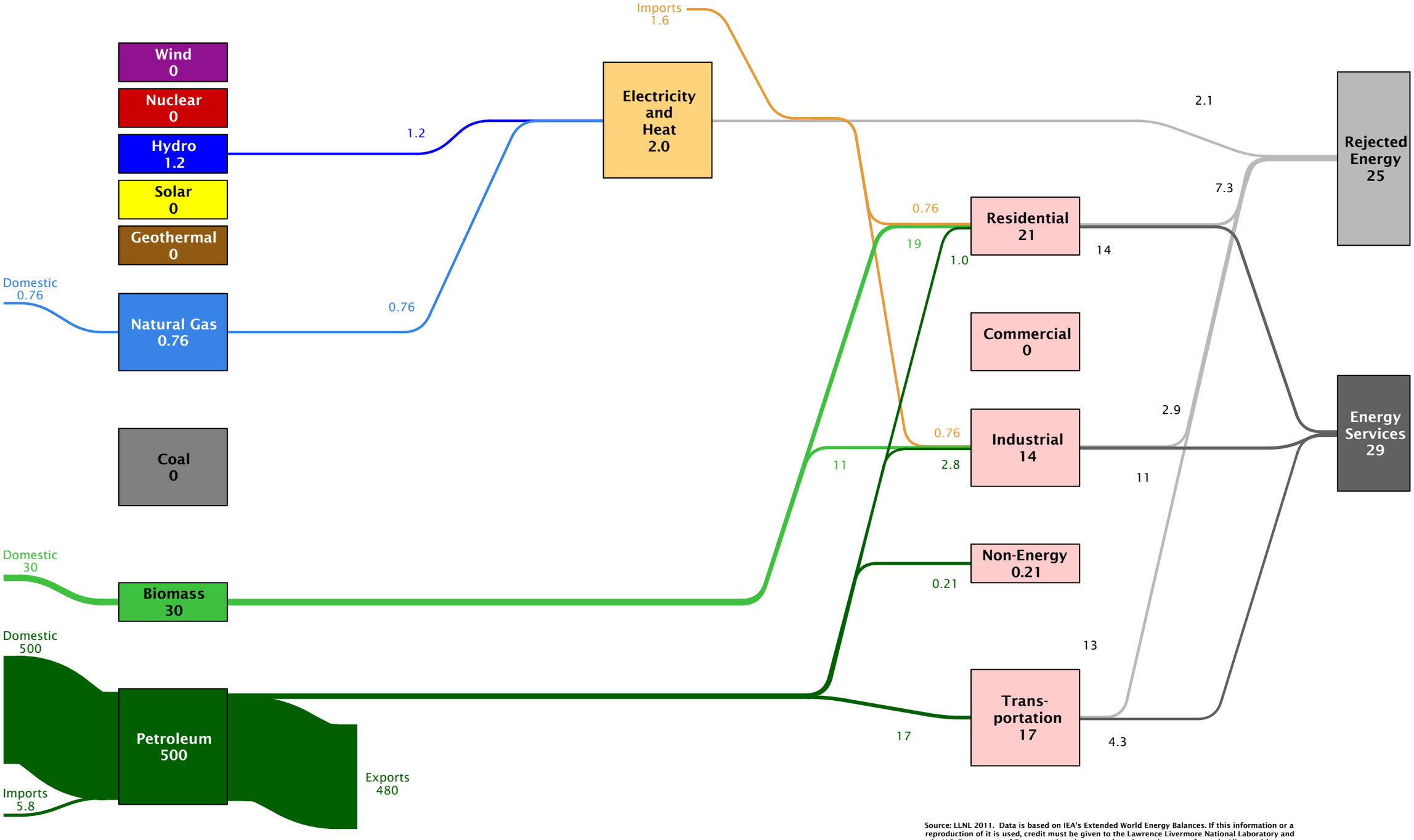
# Colombia Energy Flow in 2007: ~1200 PJ

Lawrence Livermore National Laboratory



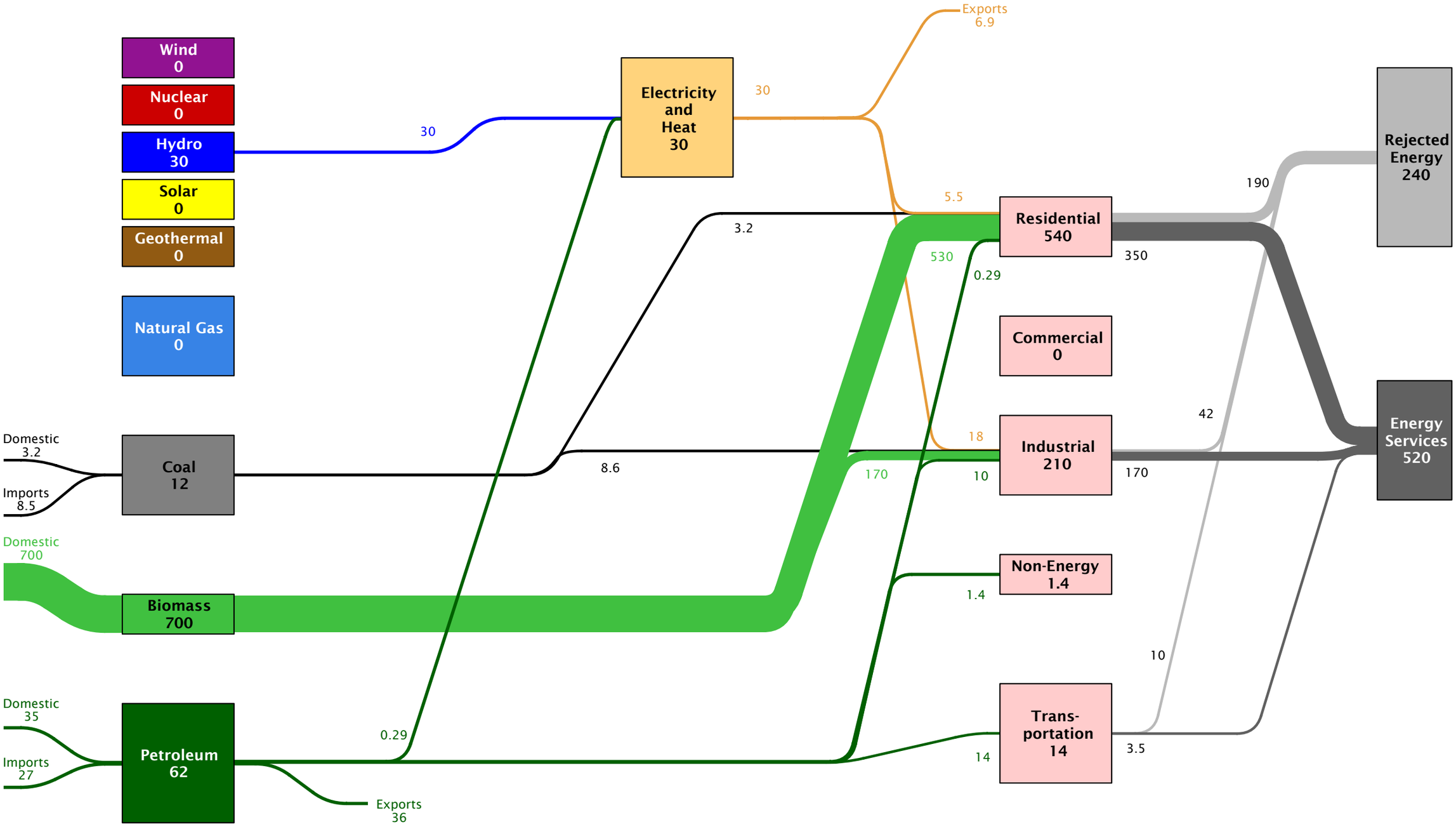
# Congo Energy Flow in 2007: ~54 PJ

Lawrence Livermore National Laboratory



# Democratic Republic of the Congo
# Energy Flow in 2007: ~770 PJ

Lawrence Livermore National Laboratory

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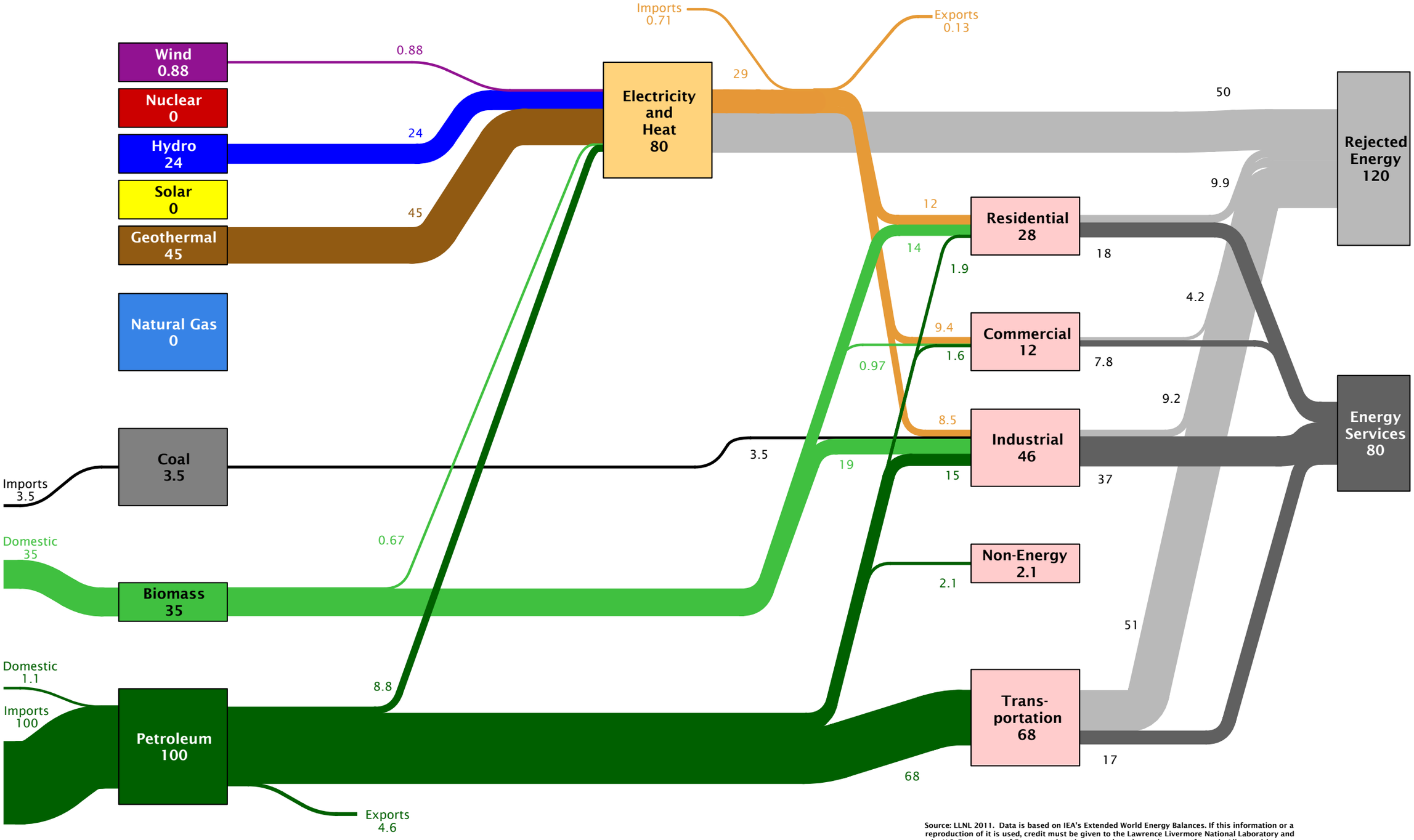
# Costa Rica Energy Flow in 2007: ~210 PJ

Lawrence Livermore National Laboratory

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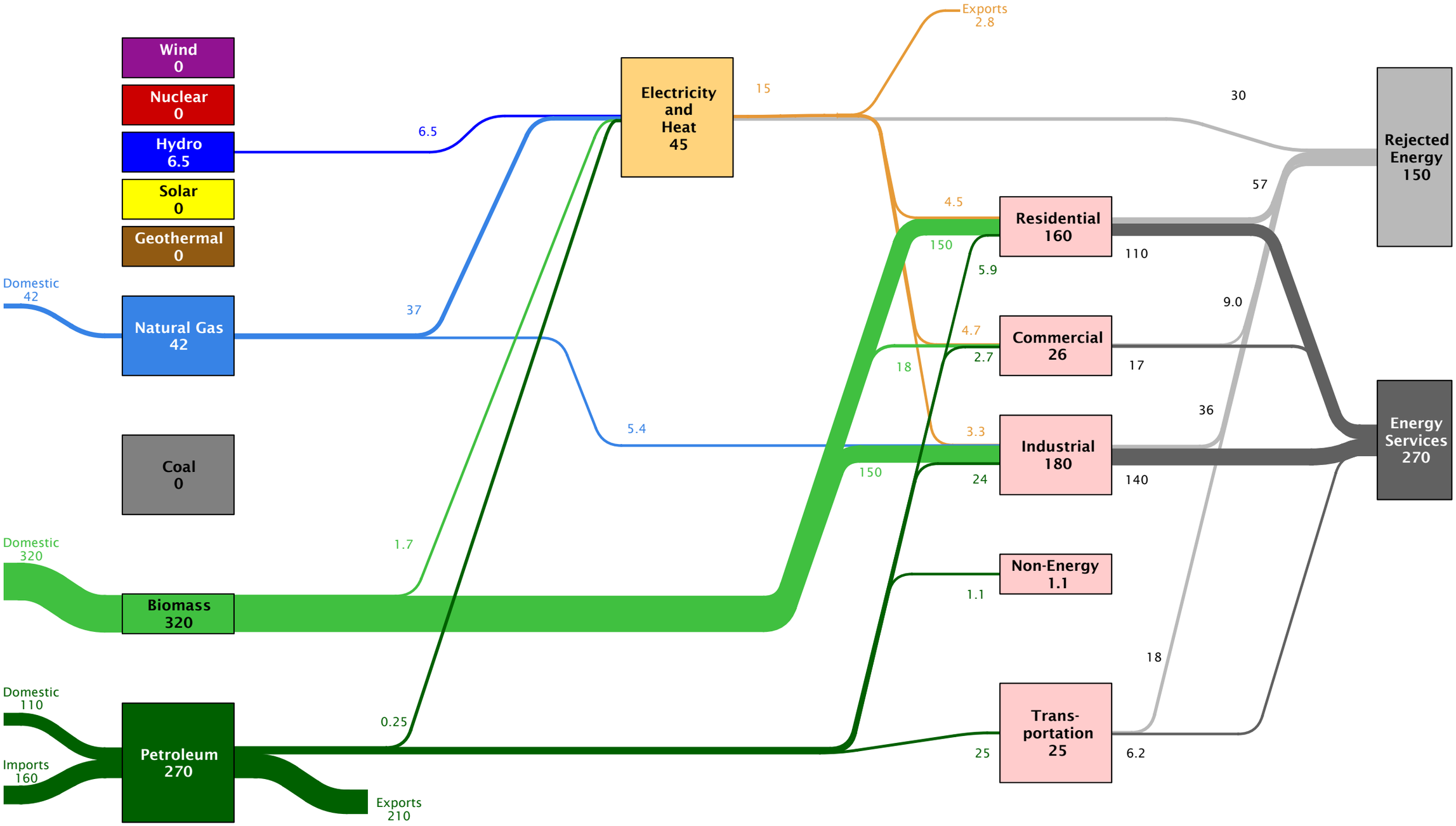
# Cote d'Ivoire Energy Flow in 2007: ~420 PJ

Lawrence Livermore National Laboratory

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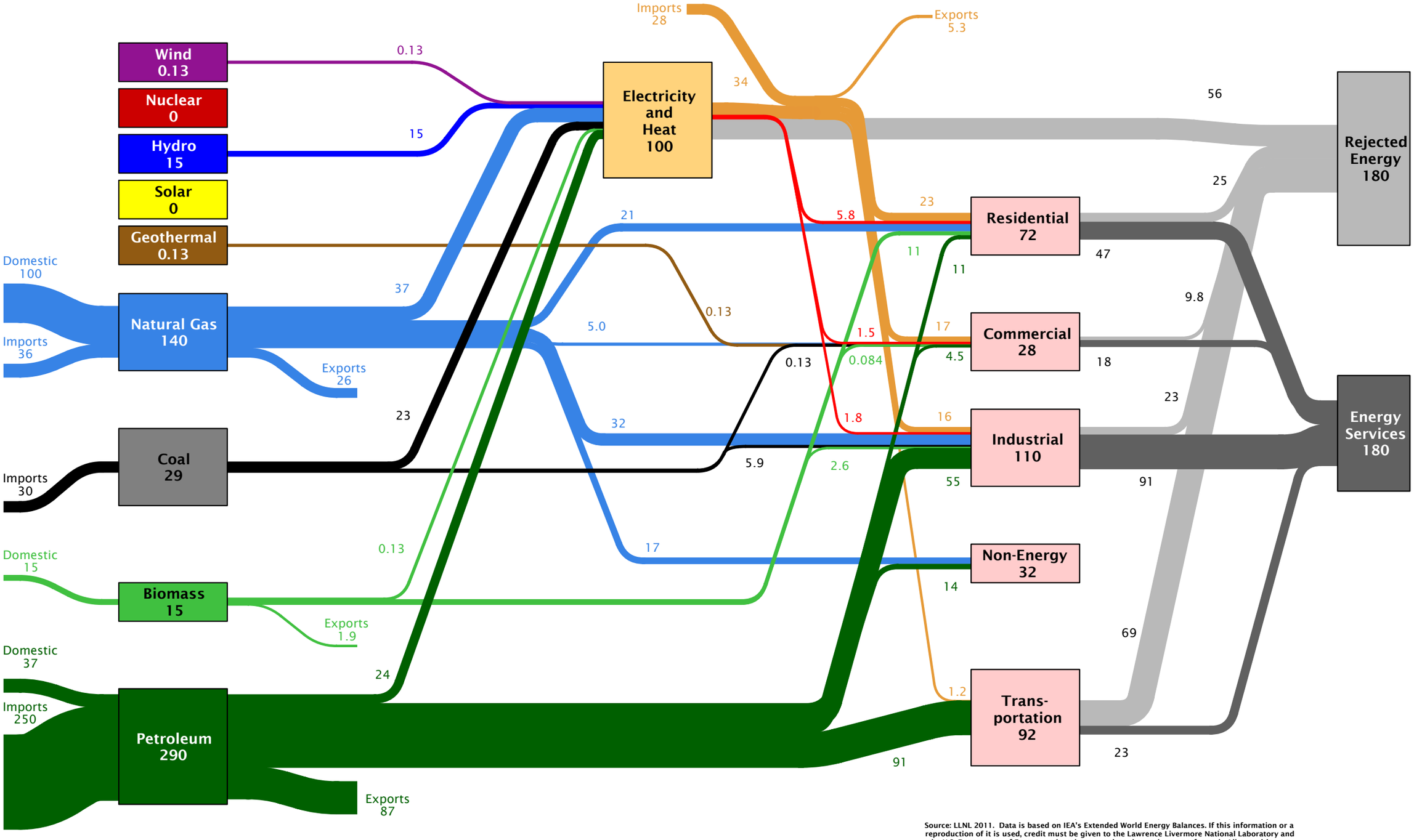
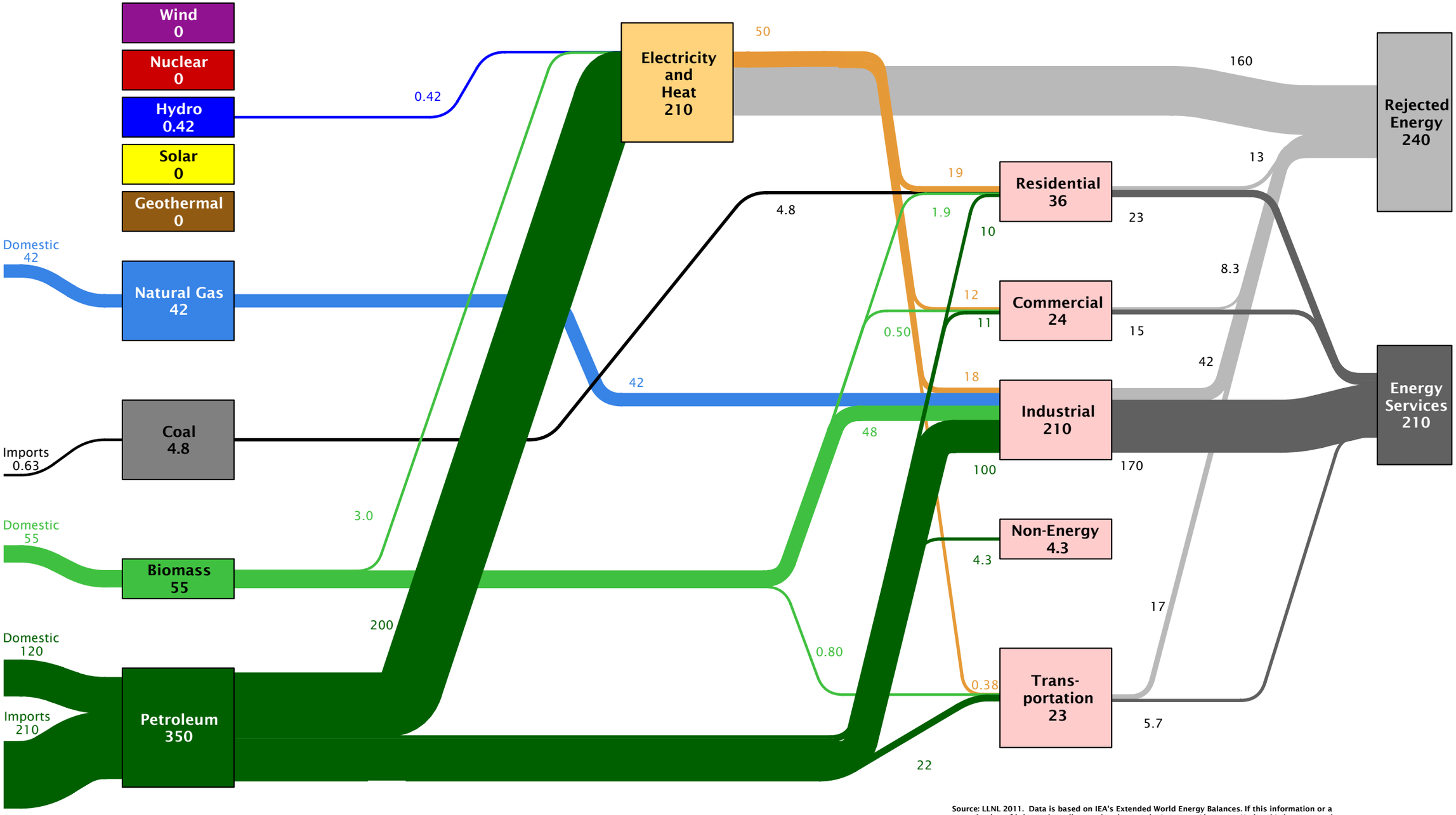
# Croatia Energy Flow in 2007: ~390 PJ

Lawrence Livermore National Laboratory



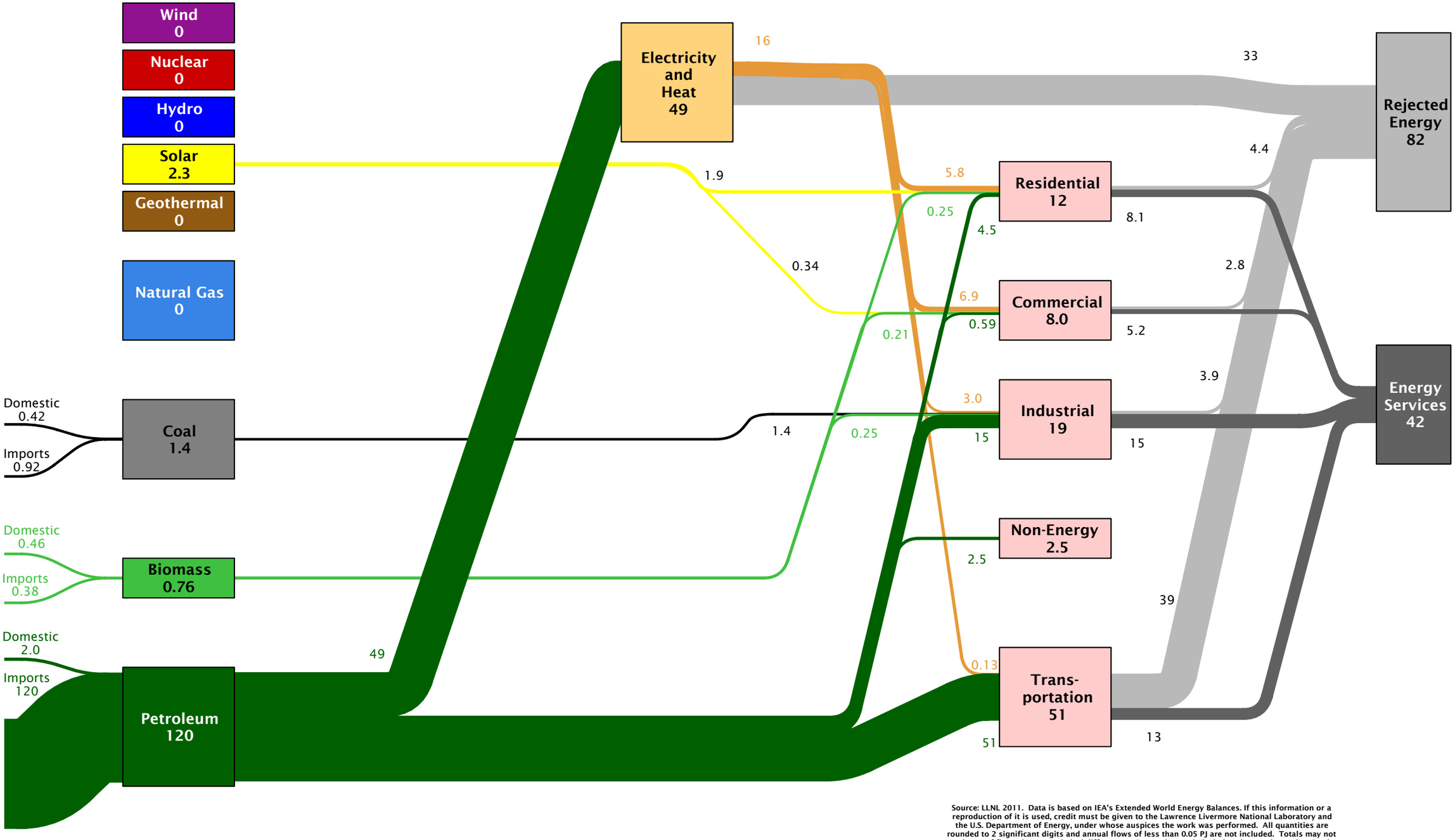
# Cuba Energy Flow in 2007: ~450 PJ

Lawrence Livermore National Laboratory



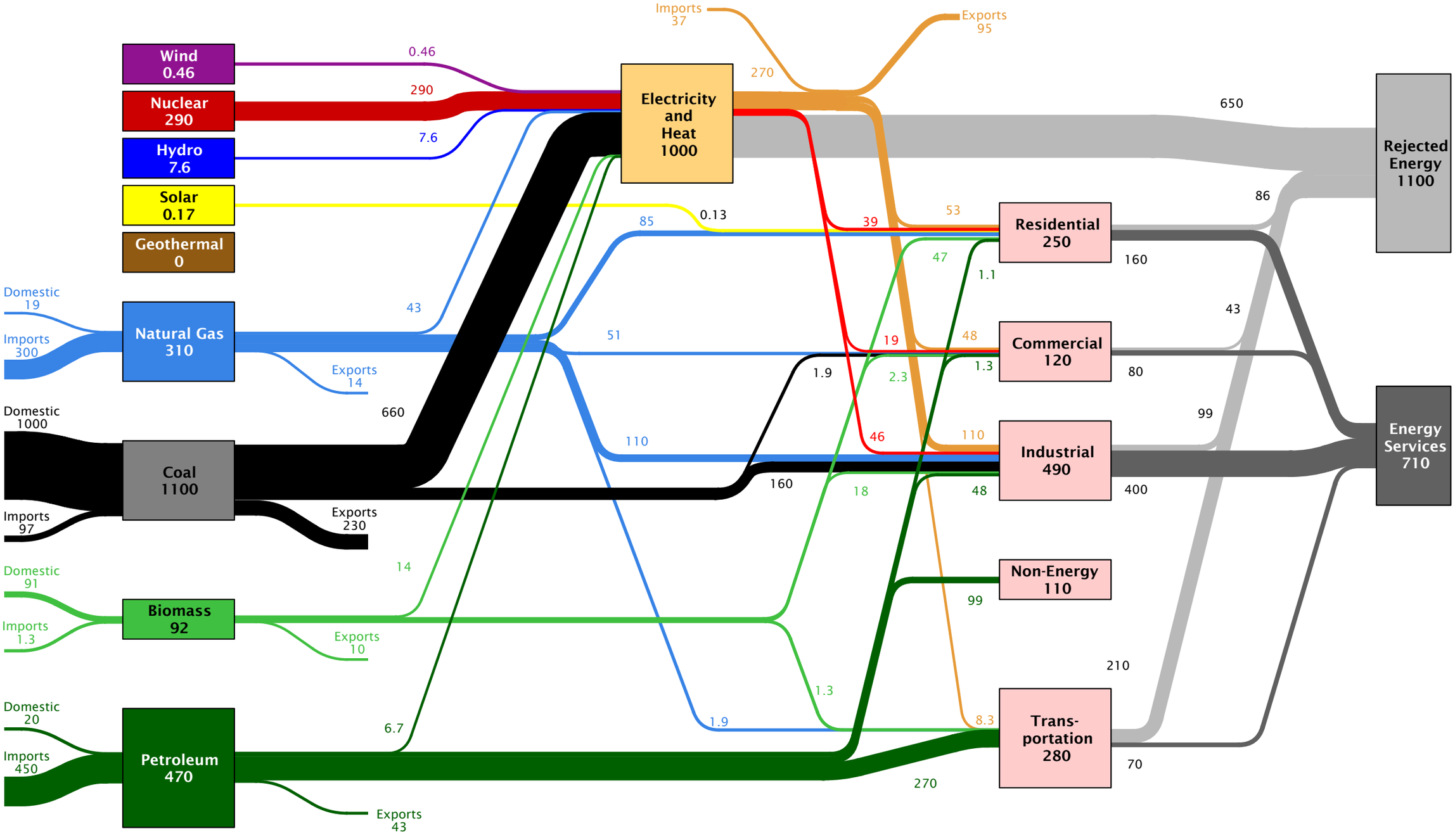
# Cyprus Energy Flow in 2007: ~130 PJ

Lawrence Livermore National Laboratory



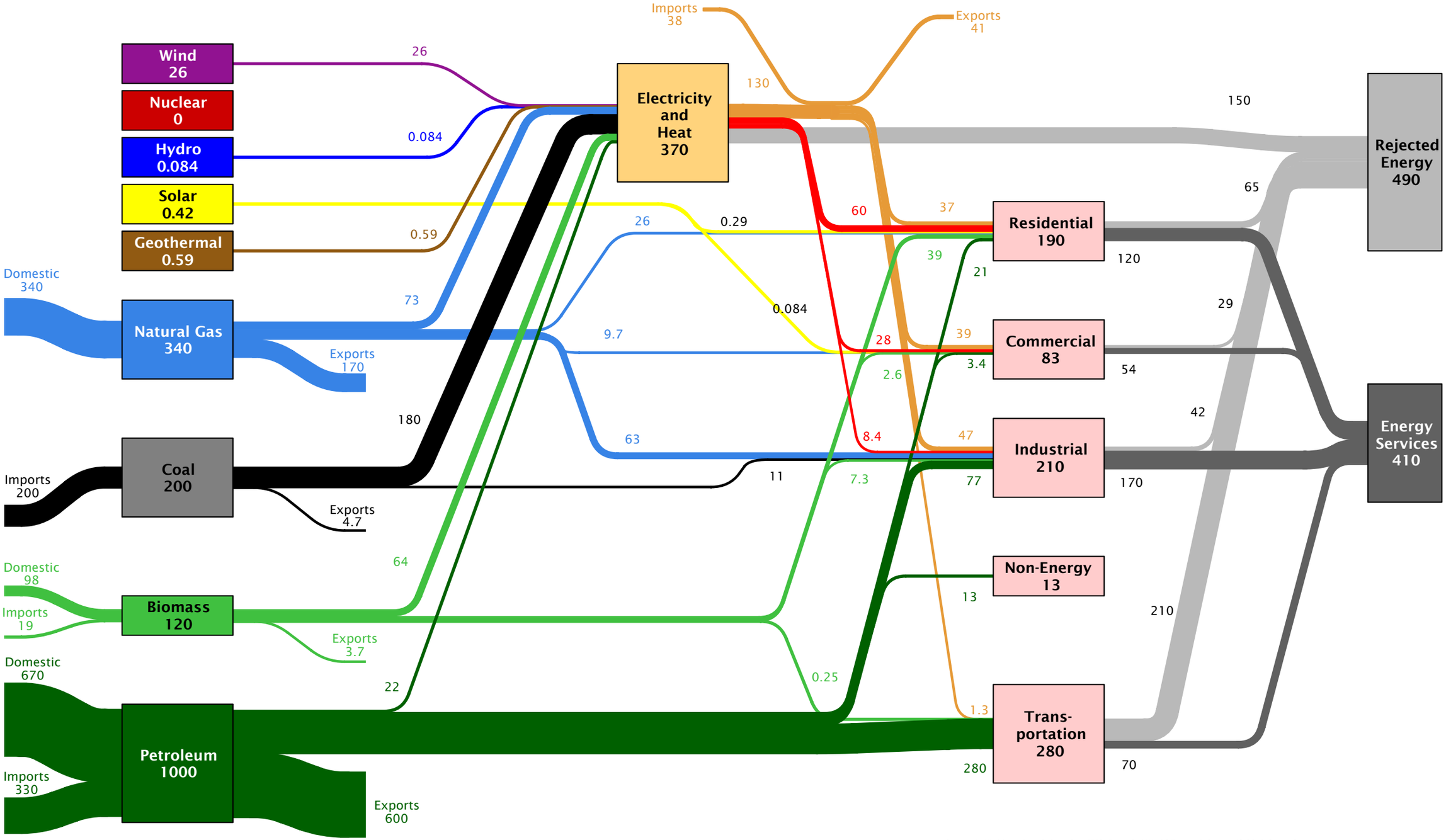
# Czech Republic Energy Flow in 2007: ~1900 PJ

Lawrence Livermore National Laboratory



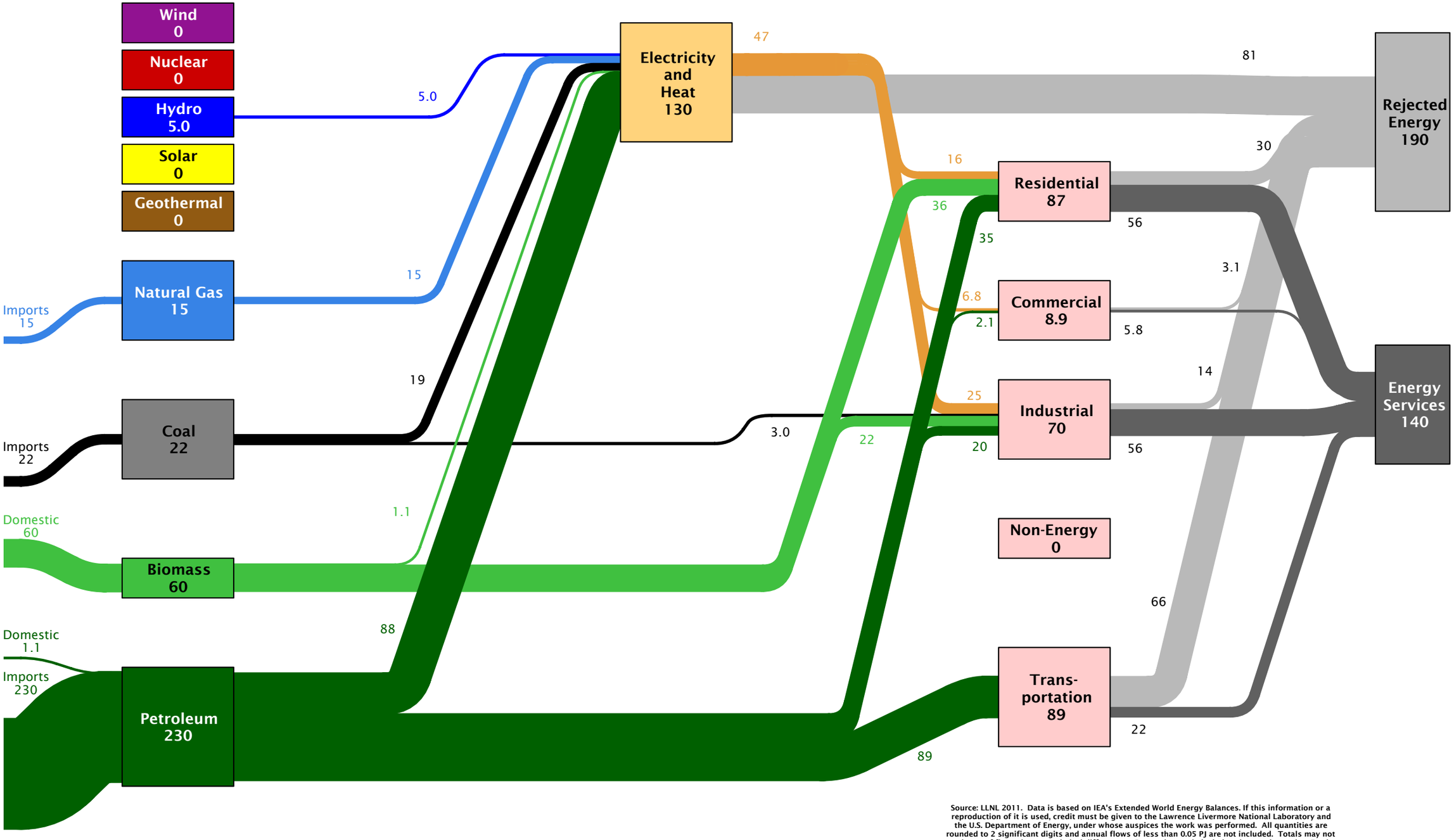
# Denmark Energy Flow in 2007: ~920 PJ

Lawrence Livermore National Laboratory



# Dominican Republic Energy Flow in 2007: ~330 PJ

Lawrence Livermore National Laboratory

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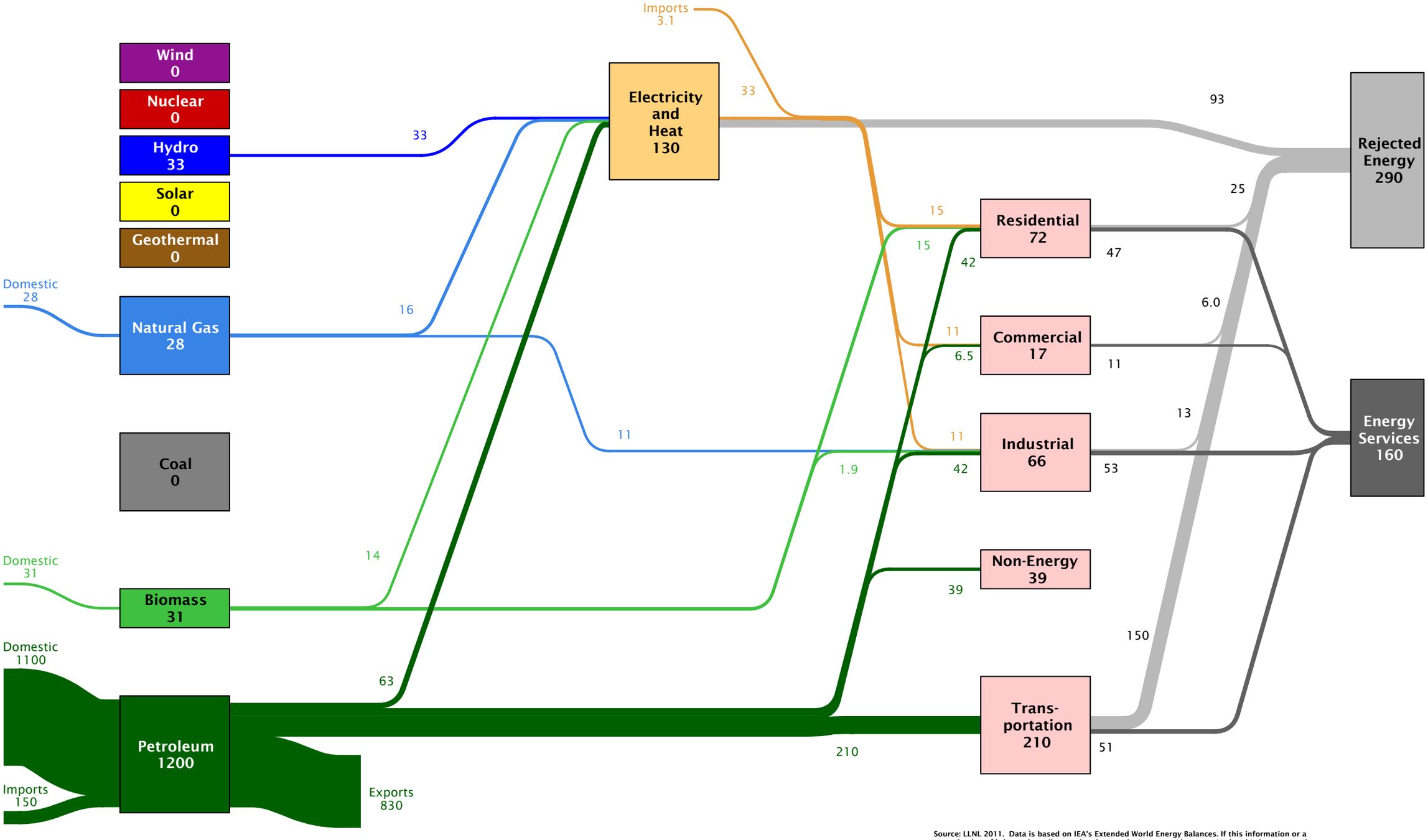
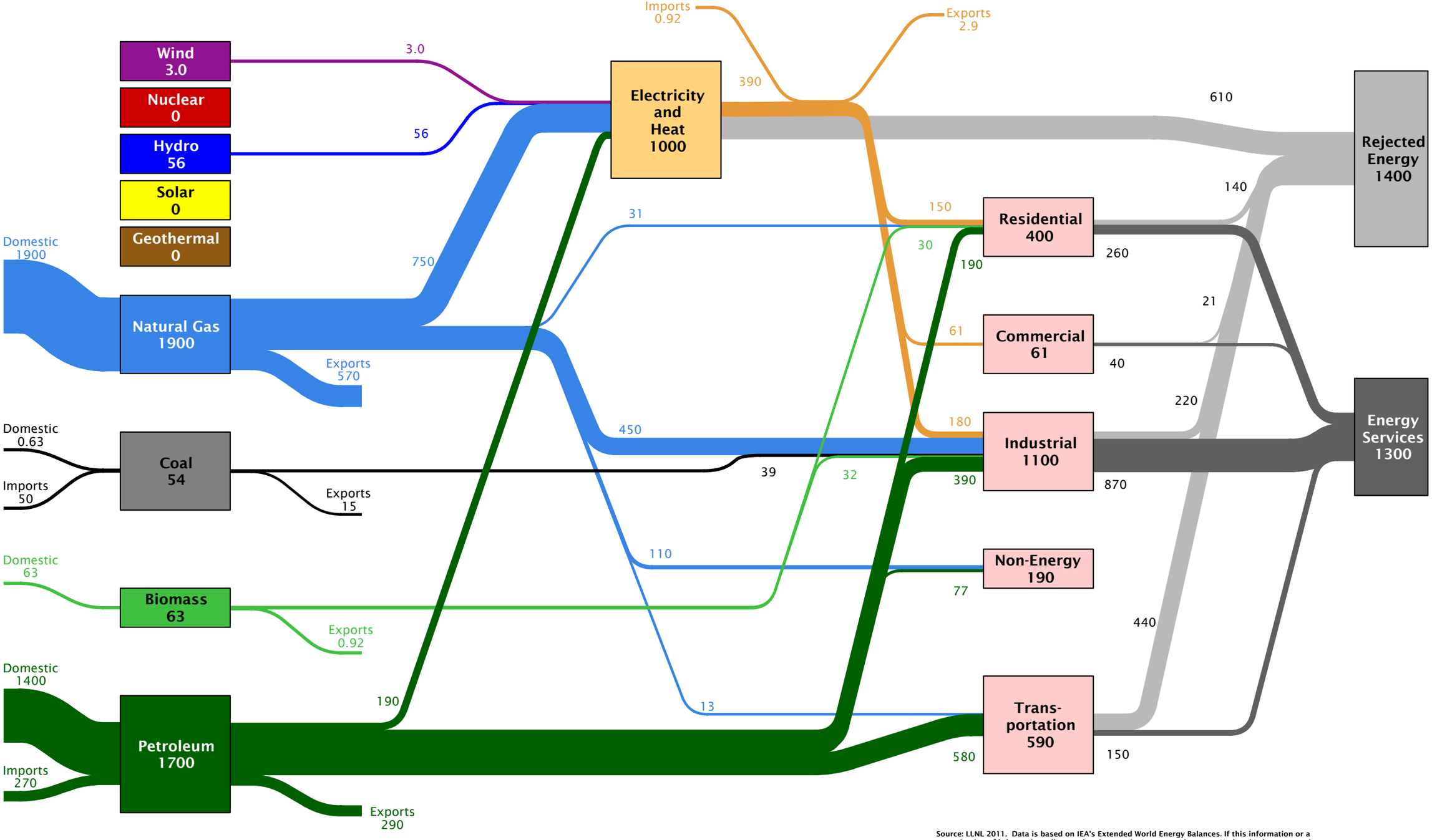
# Ecuador Energy Flow in 2007: ~490 PJ

Lawrence Livermore National Laboratory



# Egypt Energy Flow in 2007: ~2900 PJ

Lawrence Livermore National Laboratory

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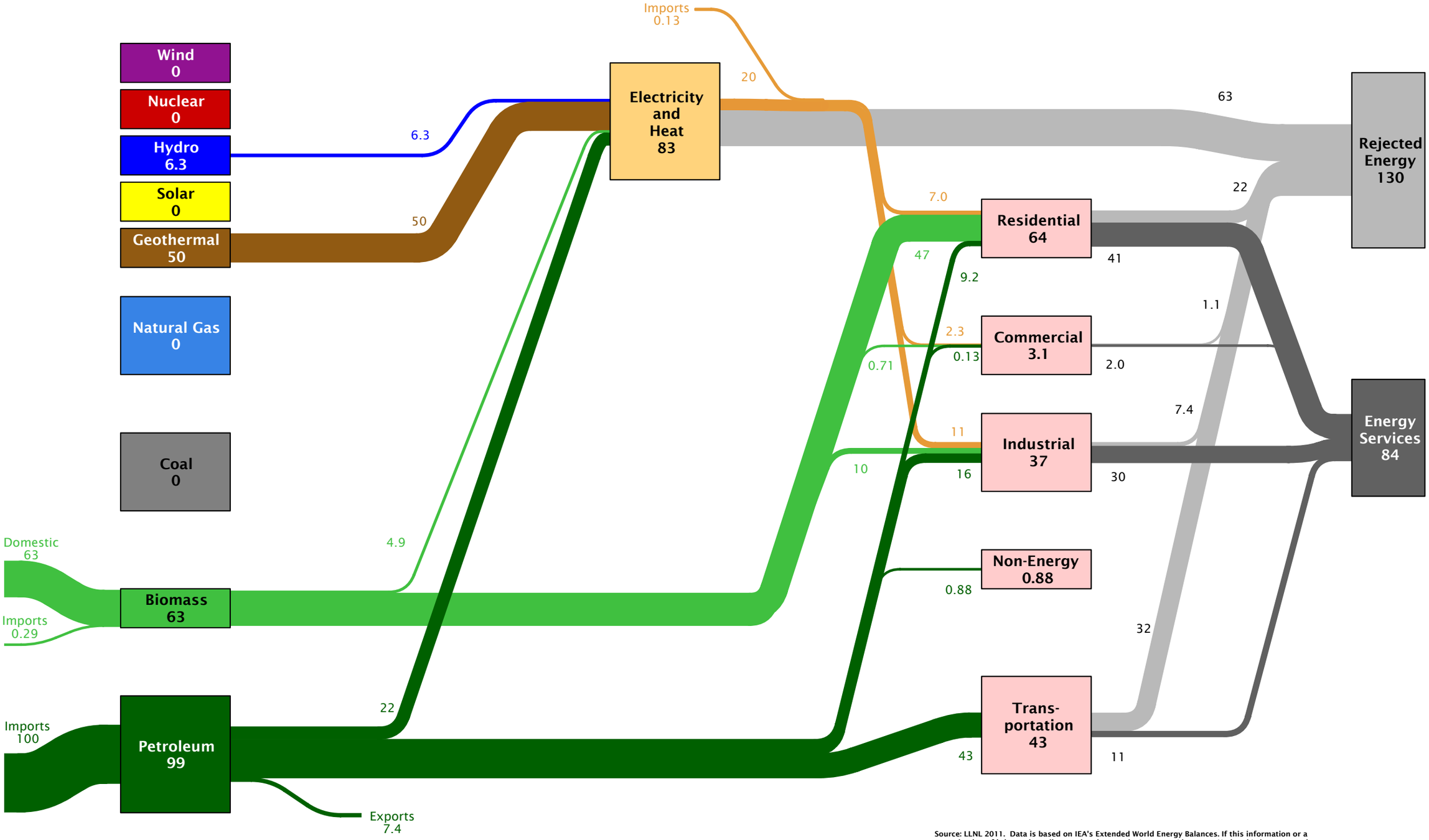
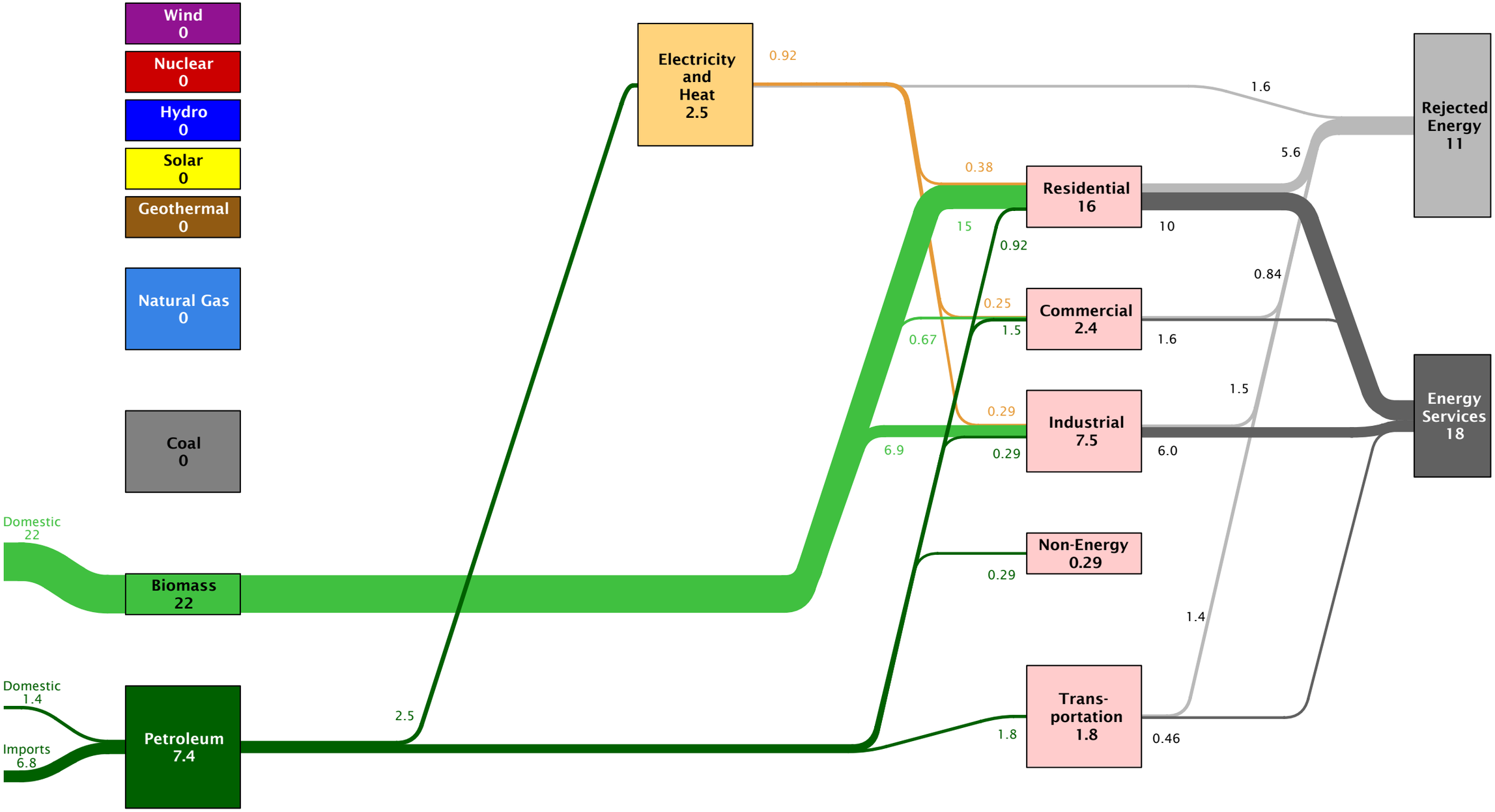
# El Salvador Energy Flow in 2007: ~210 PJ

Lawrence Livermore National Laboratory



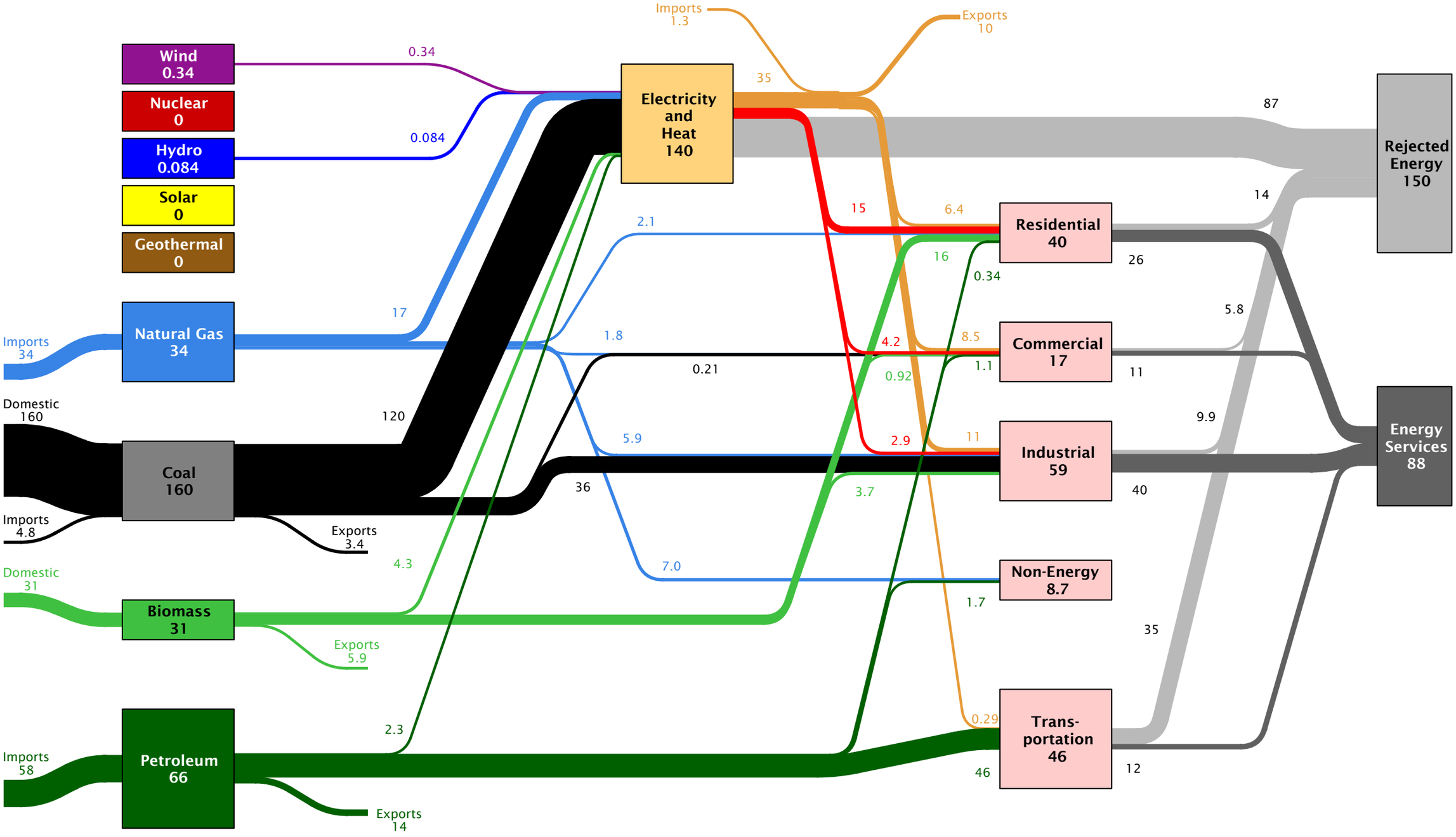
# Eritrea Energy Flow in 2007: ~30 PJ

Lawrence Livermore National Laboratory



# Estonia Energy Flow in 2007: ~250 PJ

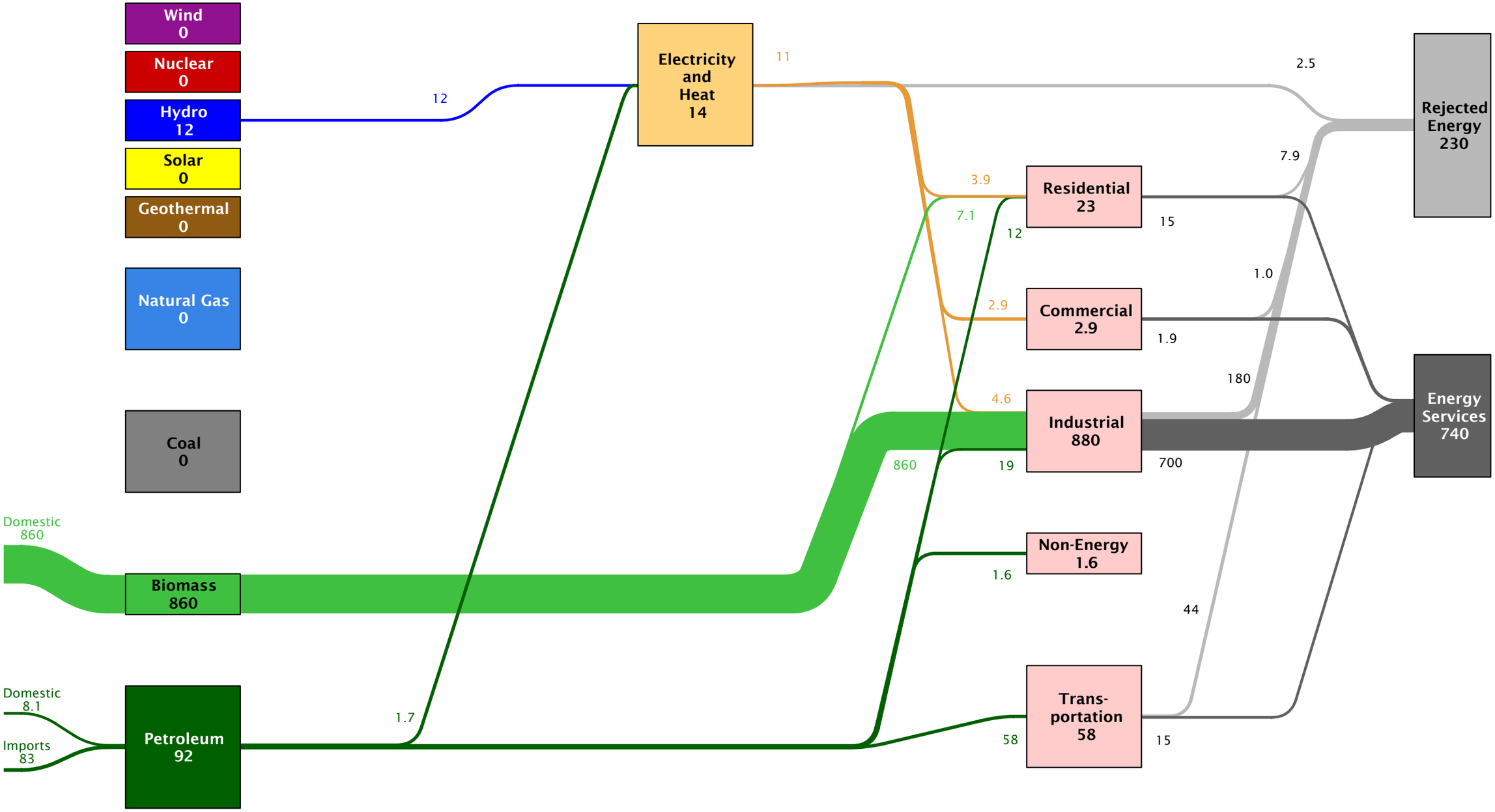
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Ethiopia Energy Flow in 2007: ~970 PJ

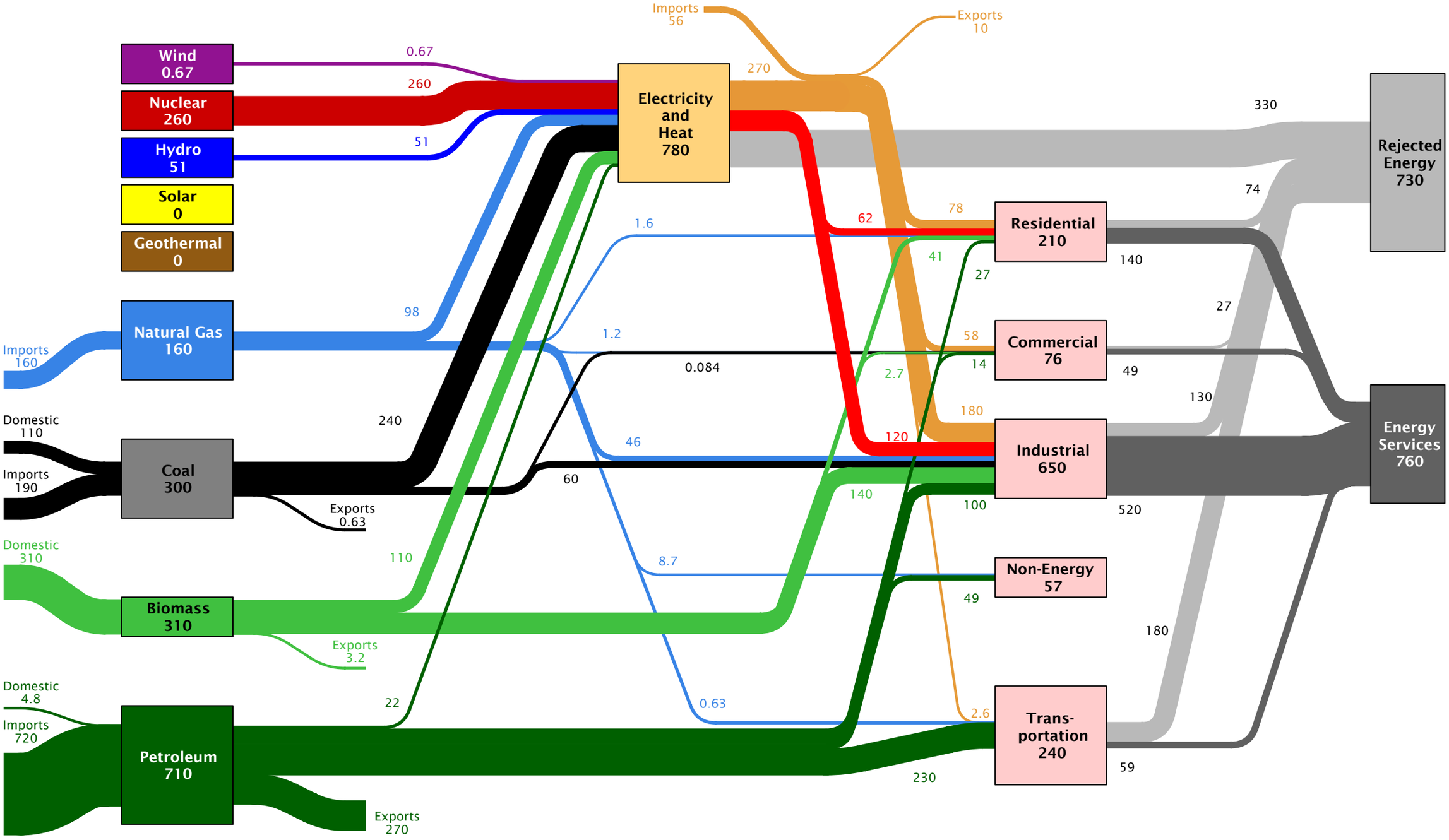
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

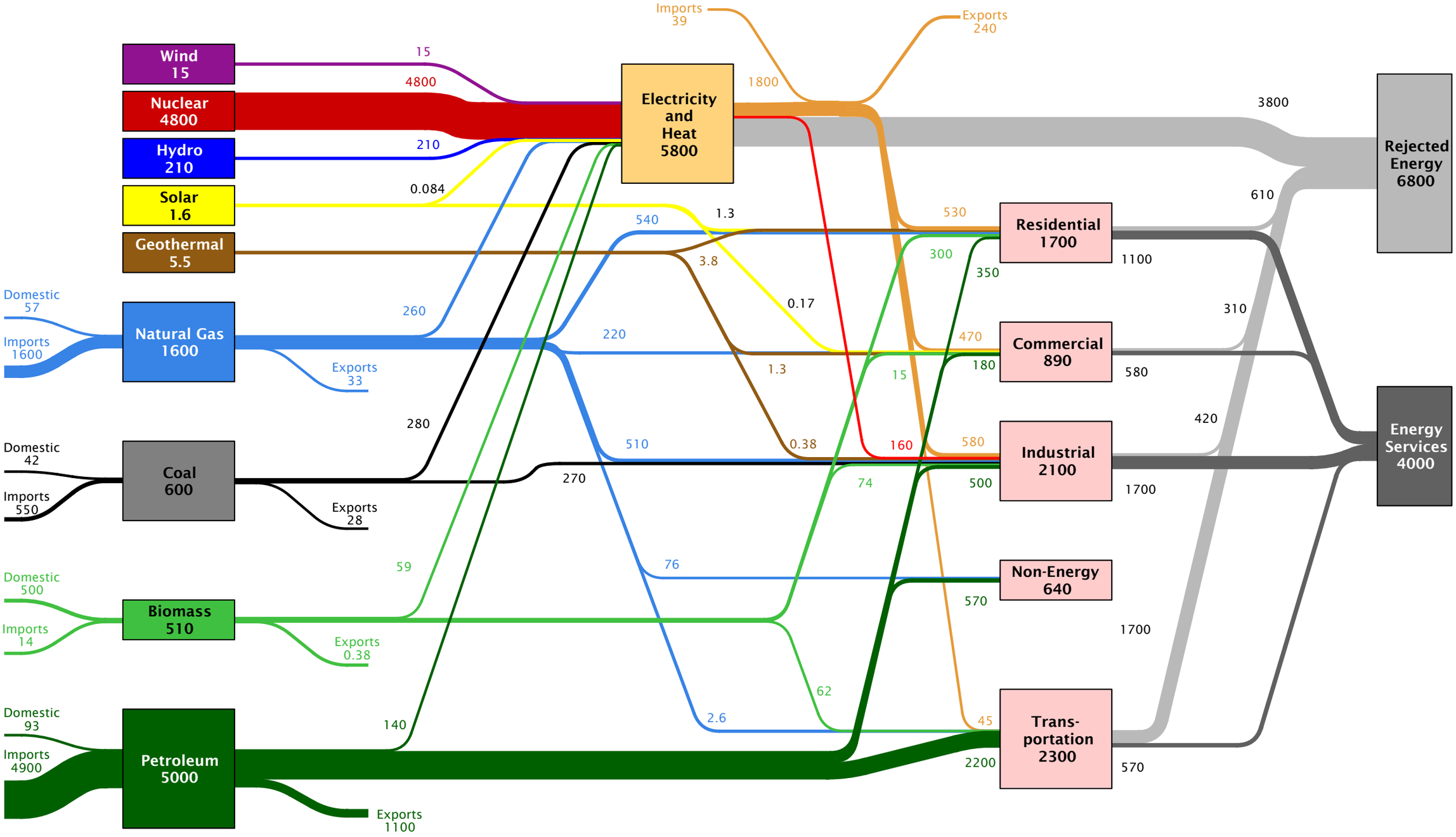
# Finland Energy Flow in 2007: ~1600 PJ

Lawrence Livermore National Laboratory



# France Energy Flow in 2007: ~11000 PJ

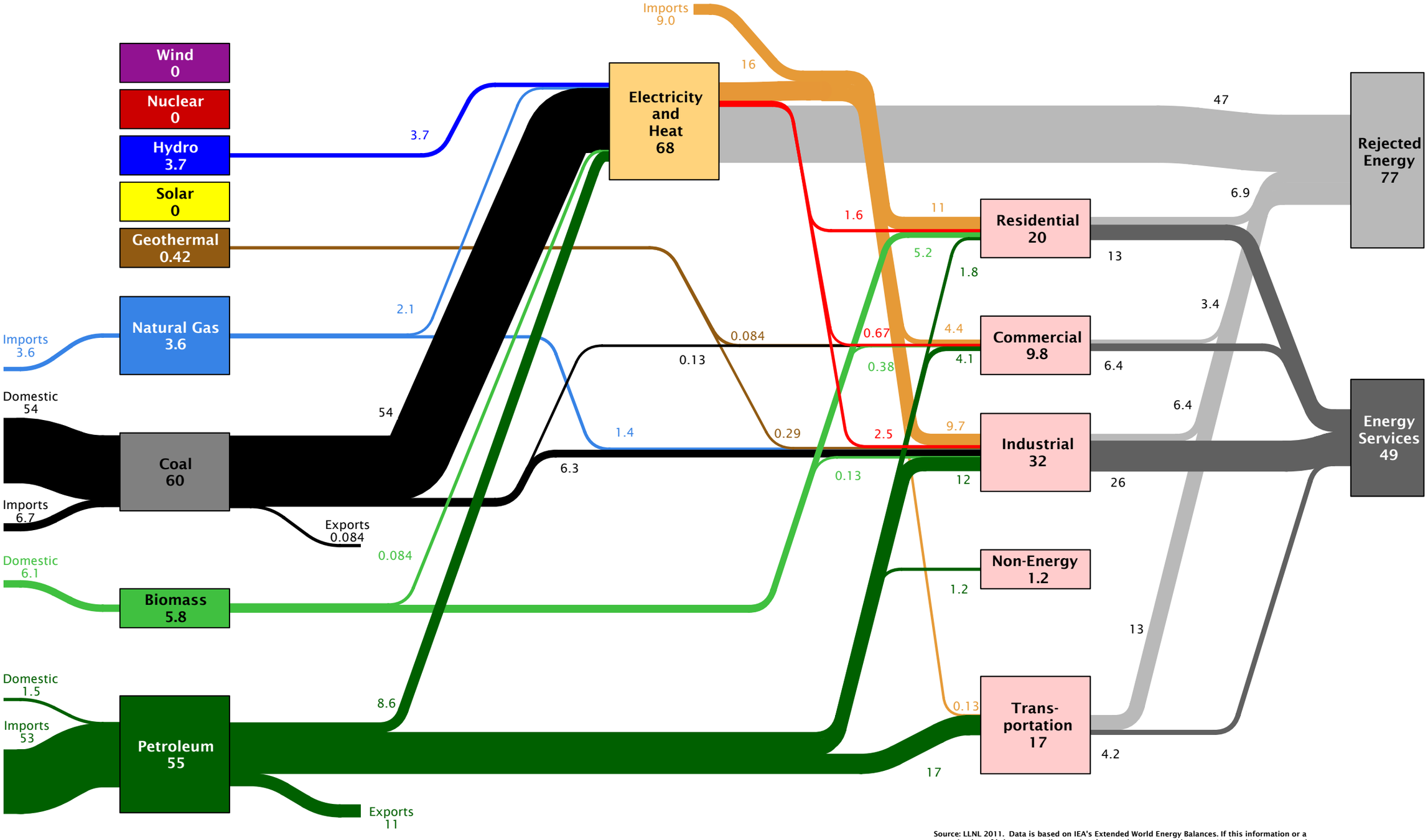
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

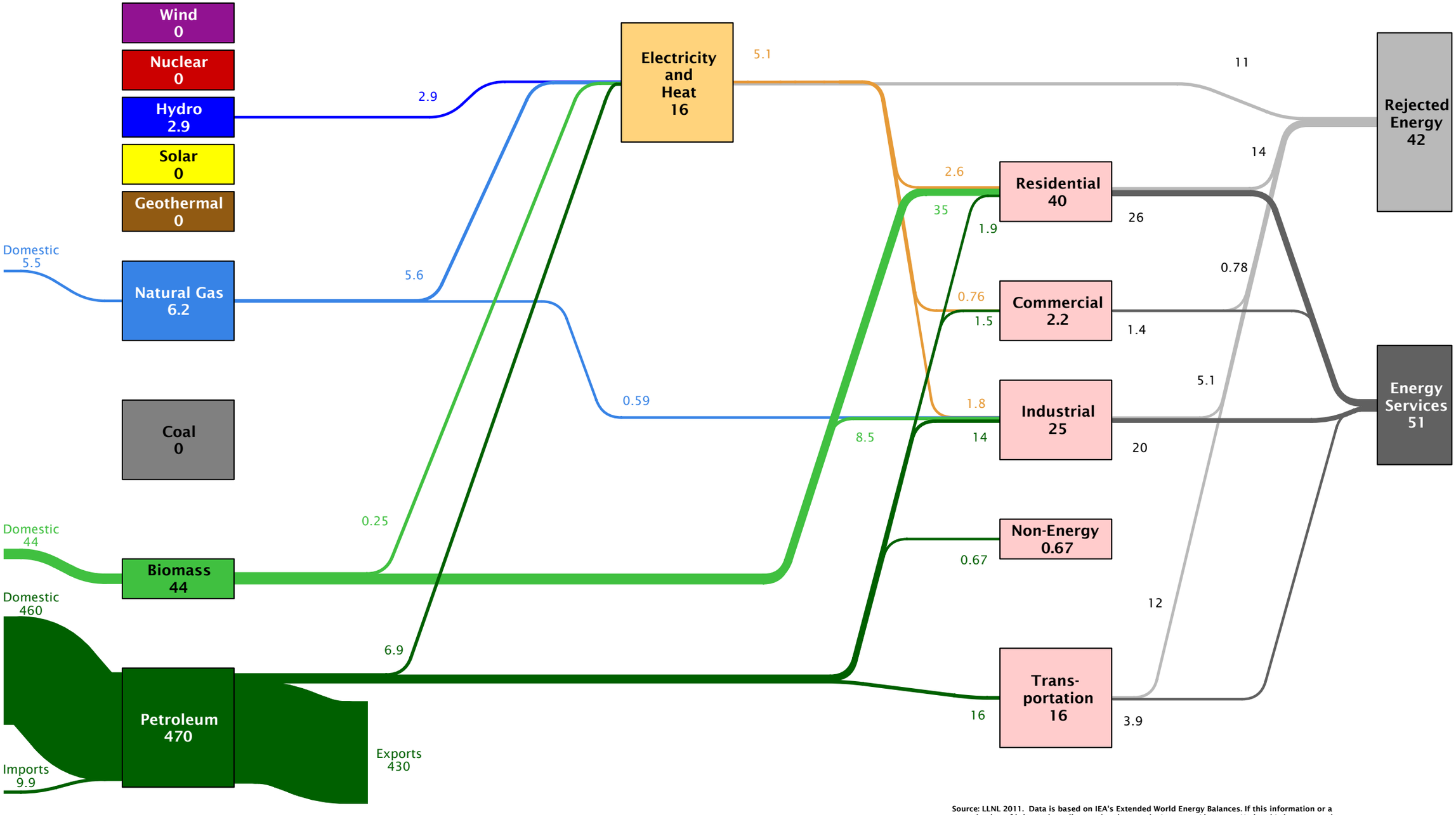
# former Yugoslav Republic of Macedonia
# Energy Flow in 2007: ~130 PJ

Lawrence Livermore National Laboratory



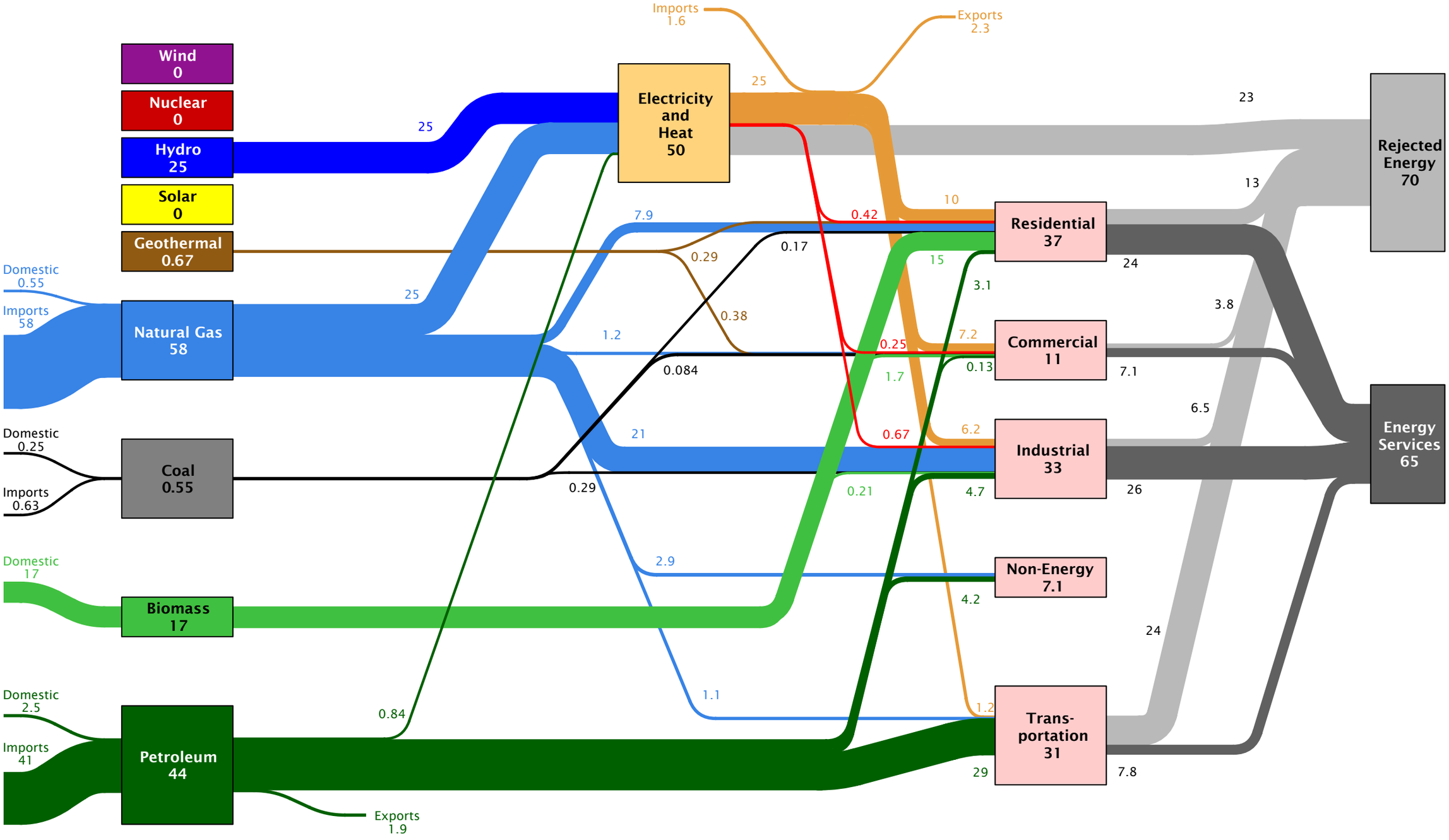
# Gabon Energy Flow in 2007: ~94 PJ

Lawrence Livermore National Laboratory



# Georgia Energy Flow in 2007: ~140 PJ

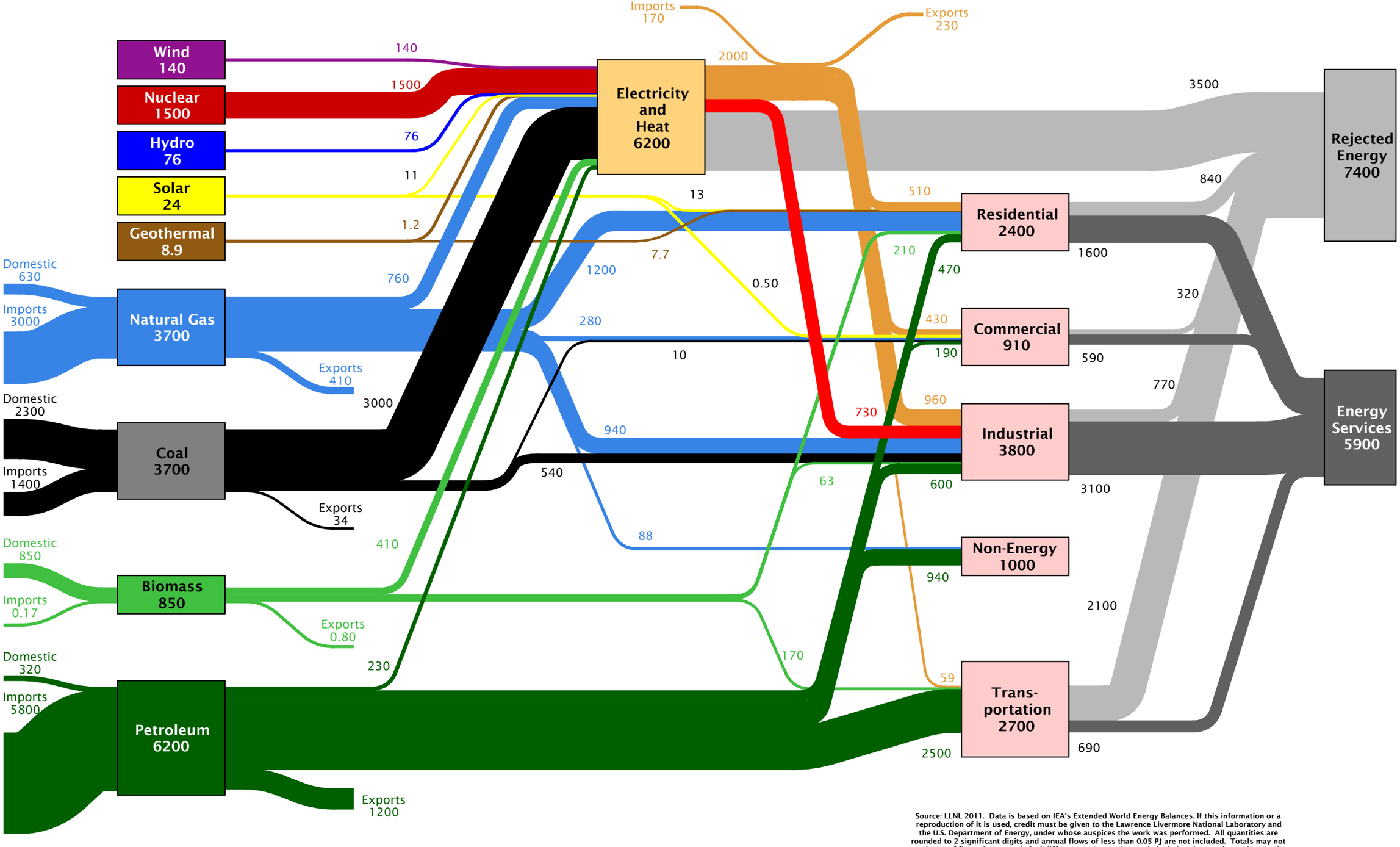
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Germany Energy Flow in 2007: ~14000 PJ

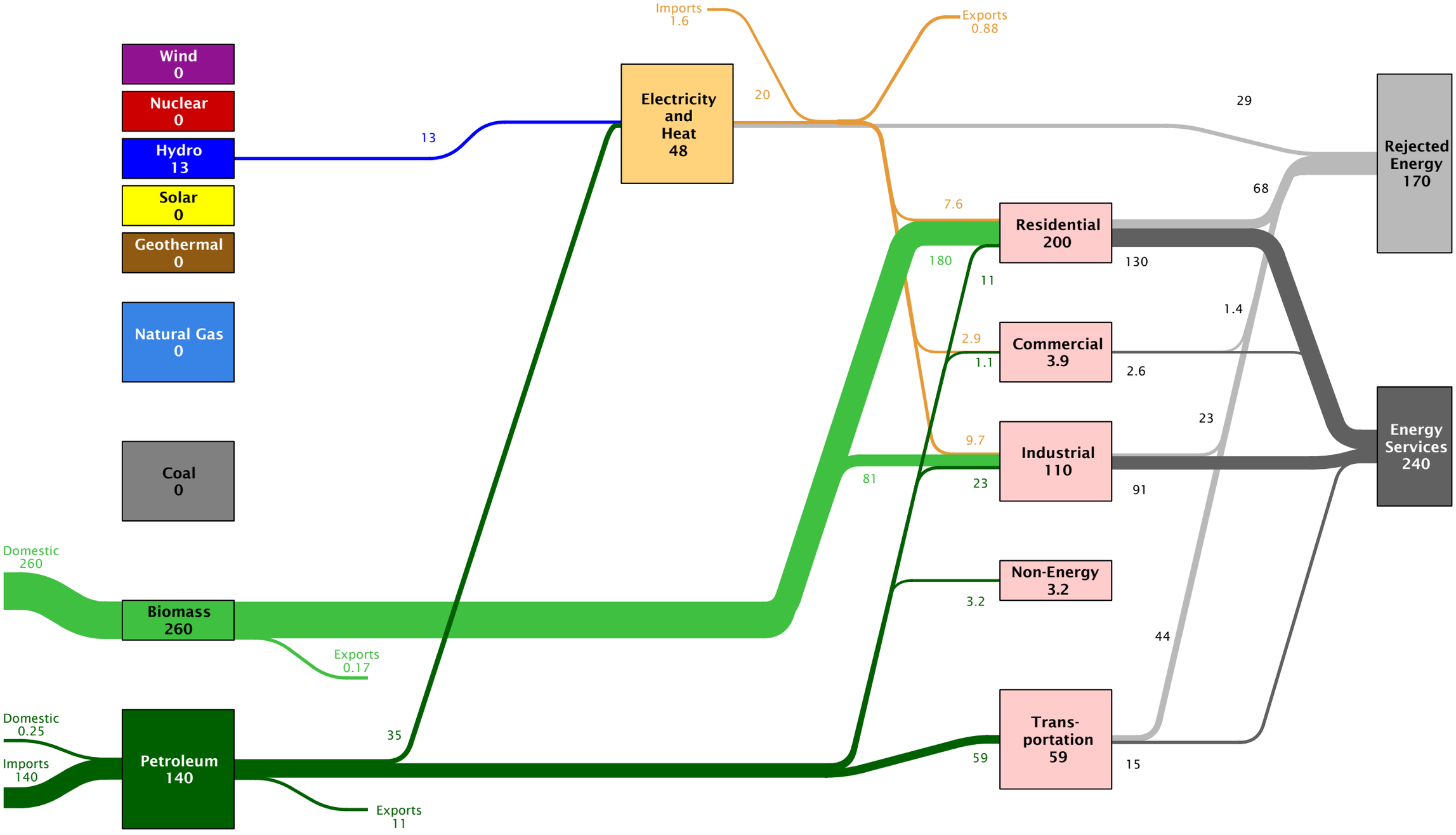
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Ghana Energy Flow in 2007: ~400 PJ

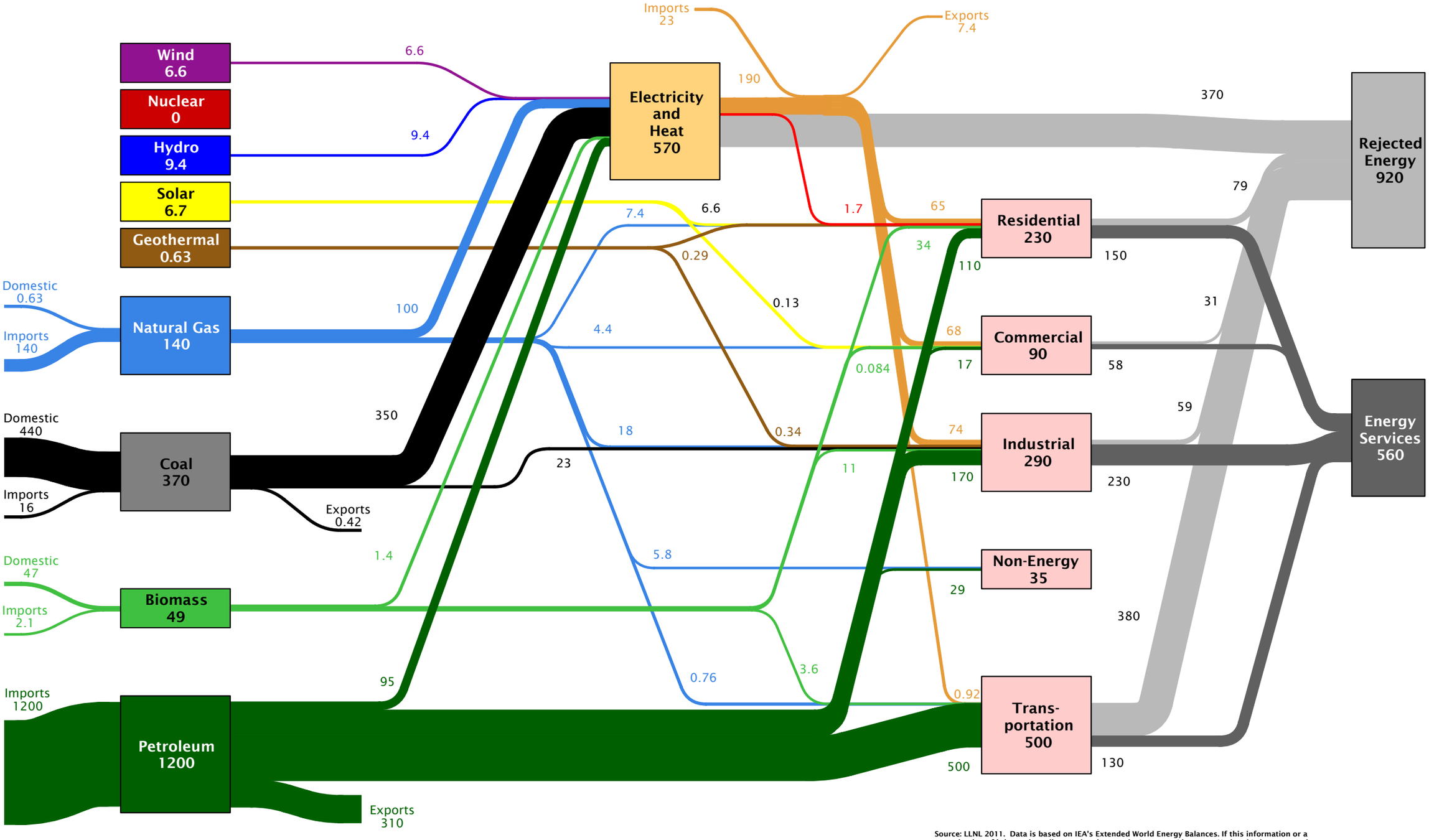
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Greece Energy Flow in 2007: ~1500 PJ

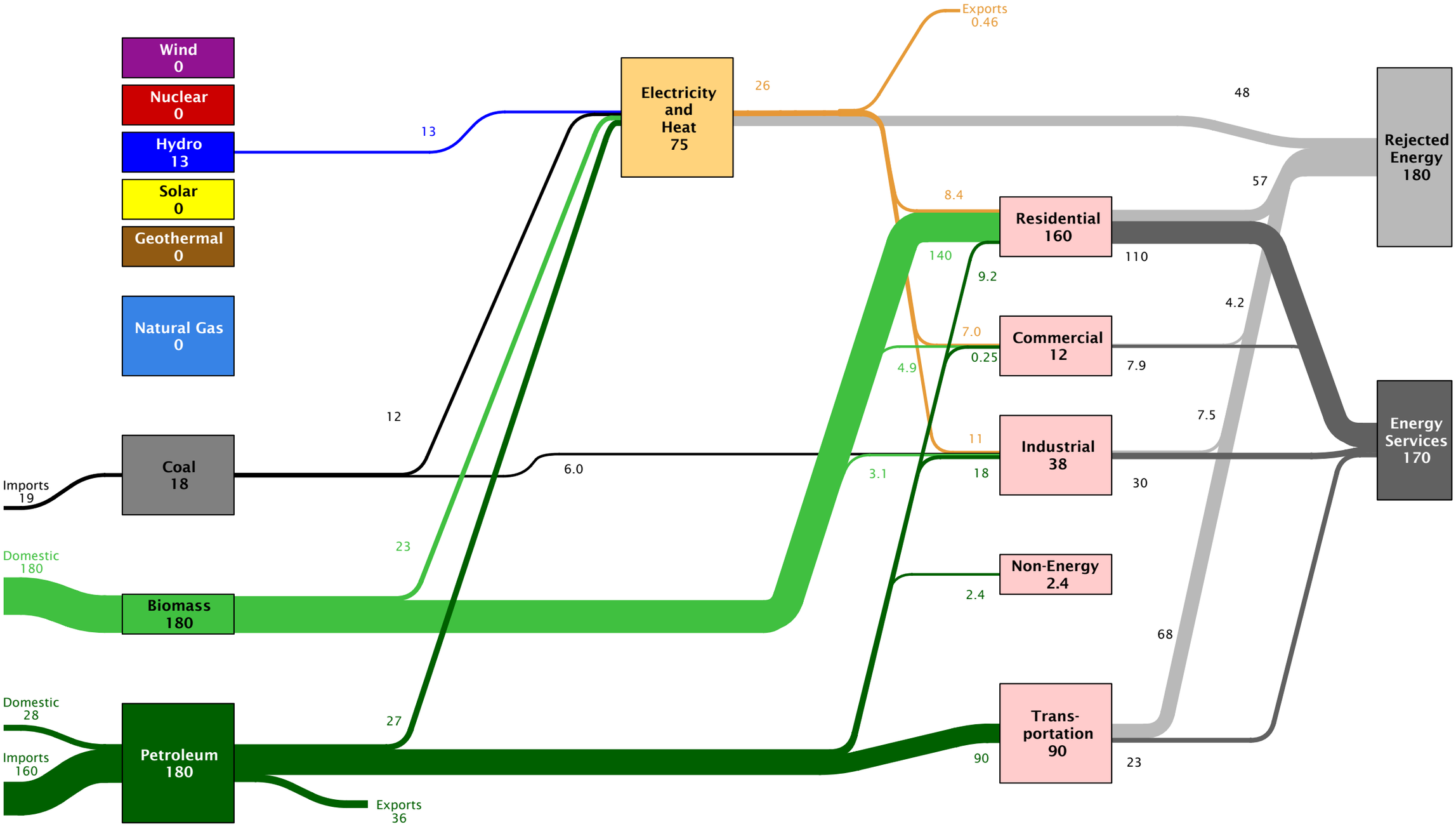
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

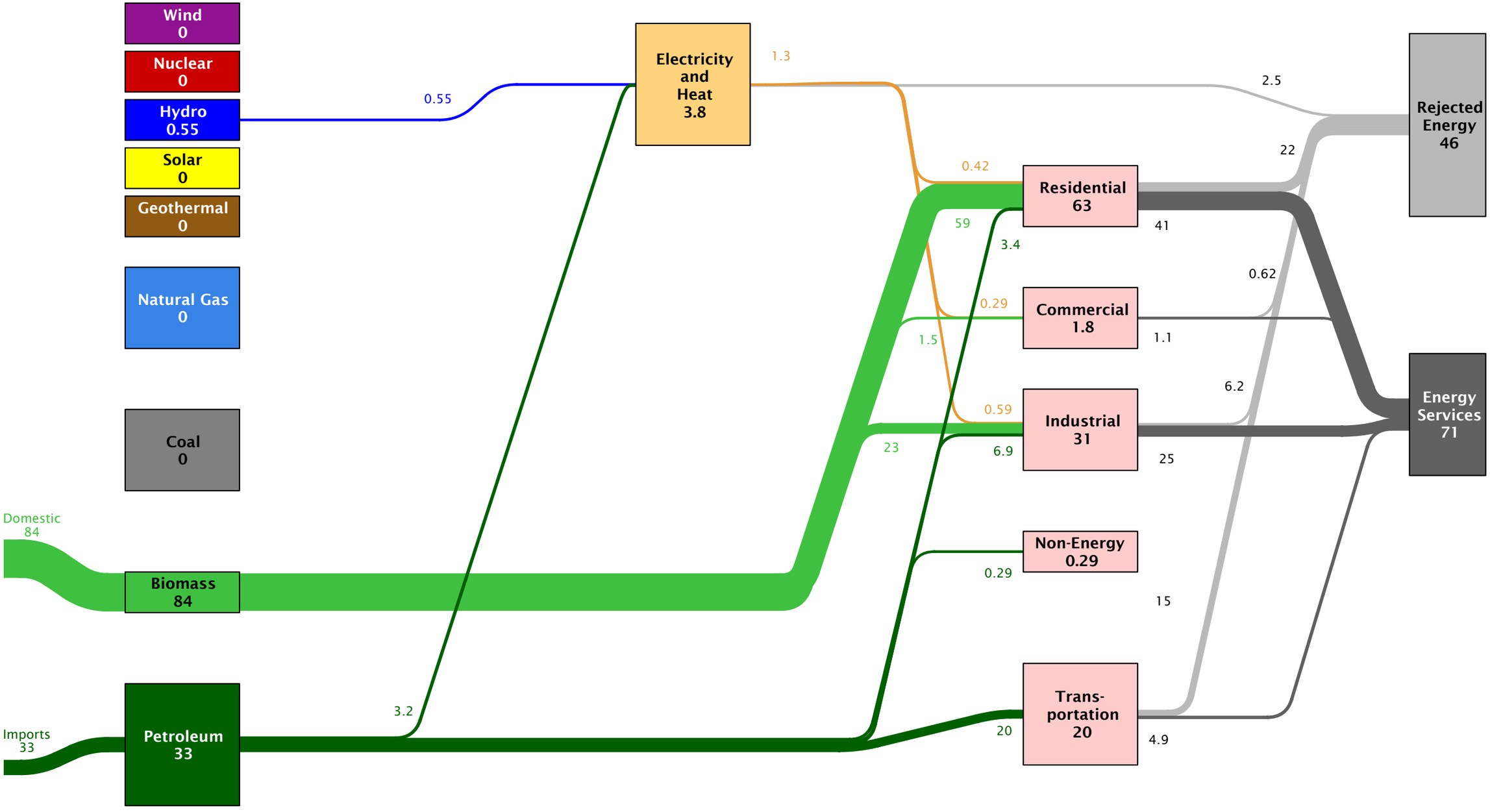
# Guatemala Energy Flow in 2007: ~350 PJ

Lawrence Livermore National Laboratory



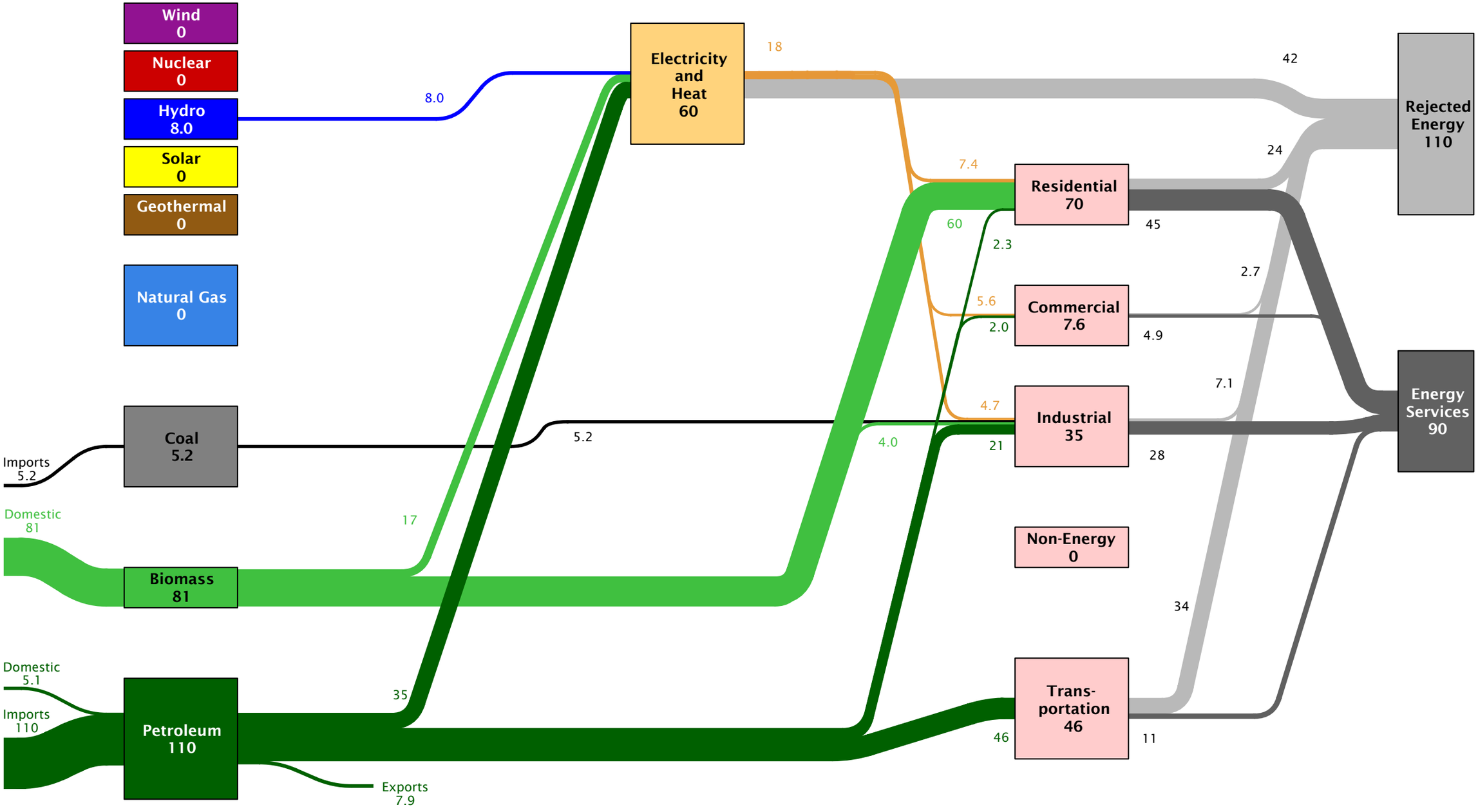
# Haiti Energy Flow in 2007: ~120 PJ

Lawrence Livermore National Laboratory



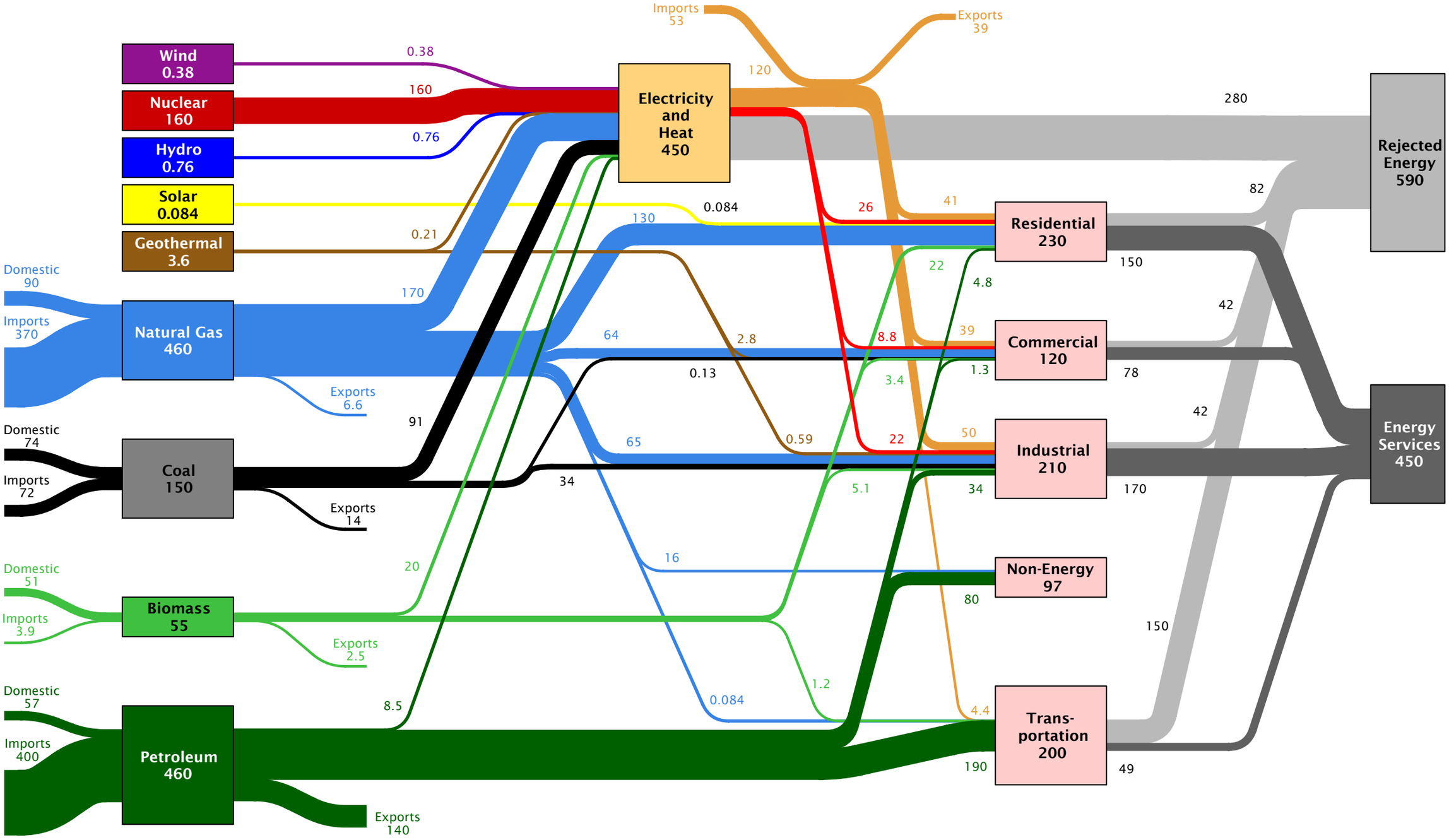
# Honduras Energy Flow in 2007: ~200 PJ

Lawrence Livermore National Laboratory



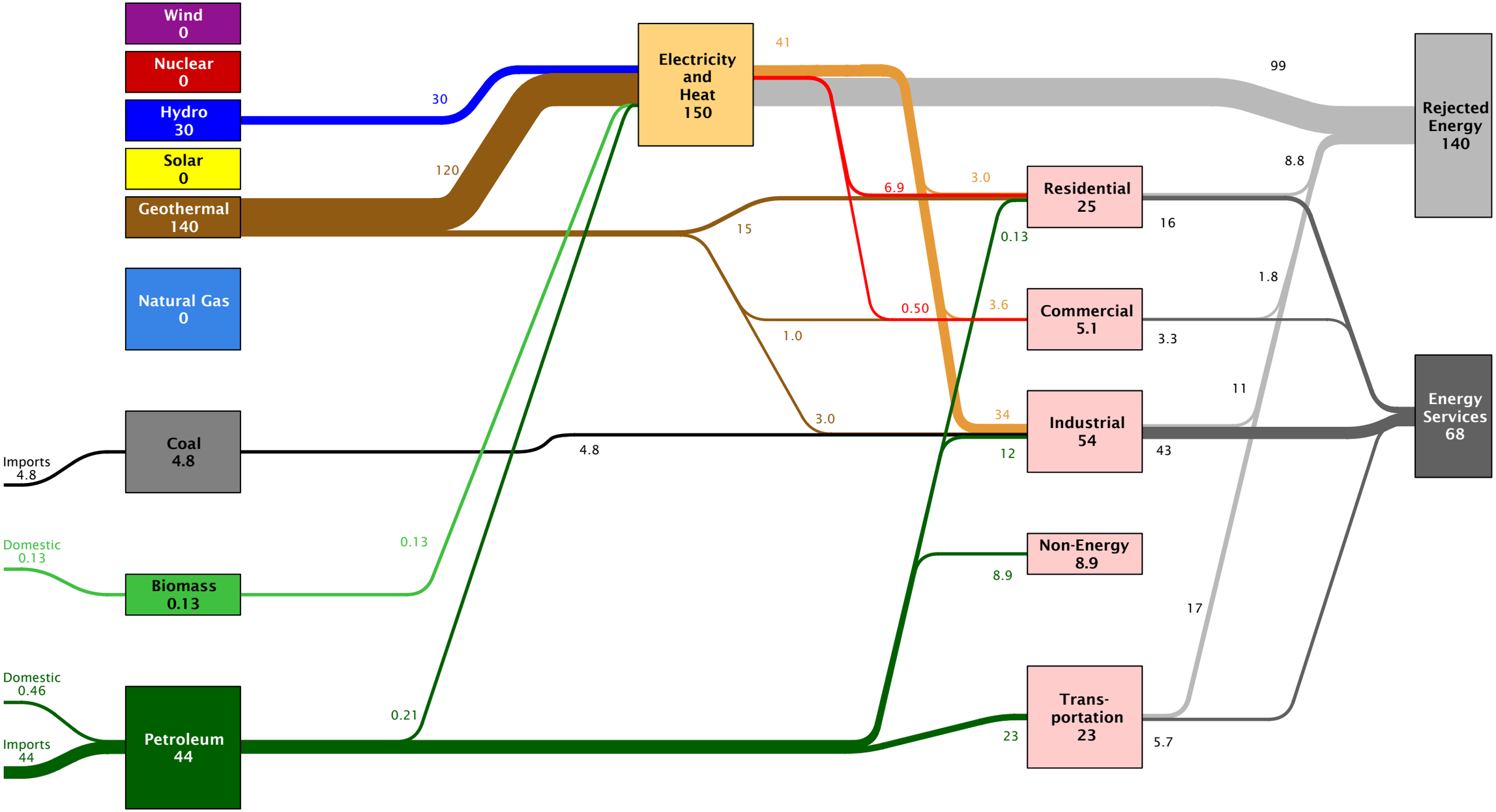
# Hungary Energy Flow in 2007: ~1100 PJ

Lawrence Livermore National Laboratory



# Iceland Energy Flow in 2007: ~220 PJ

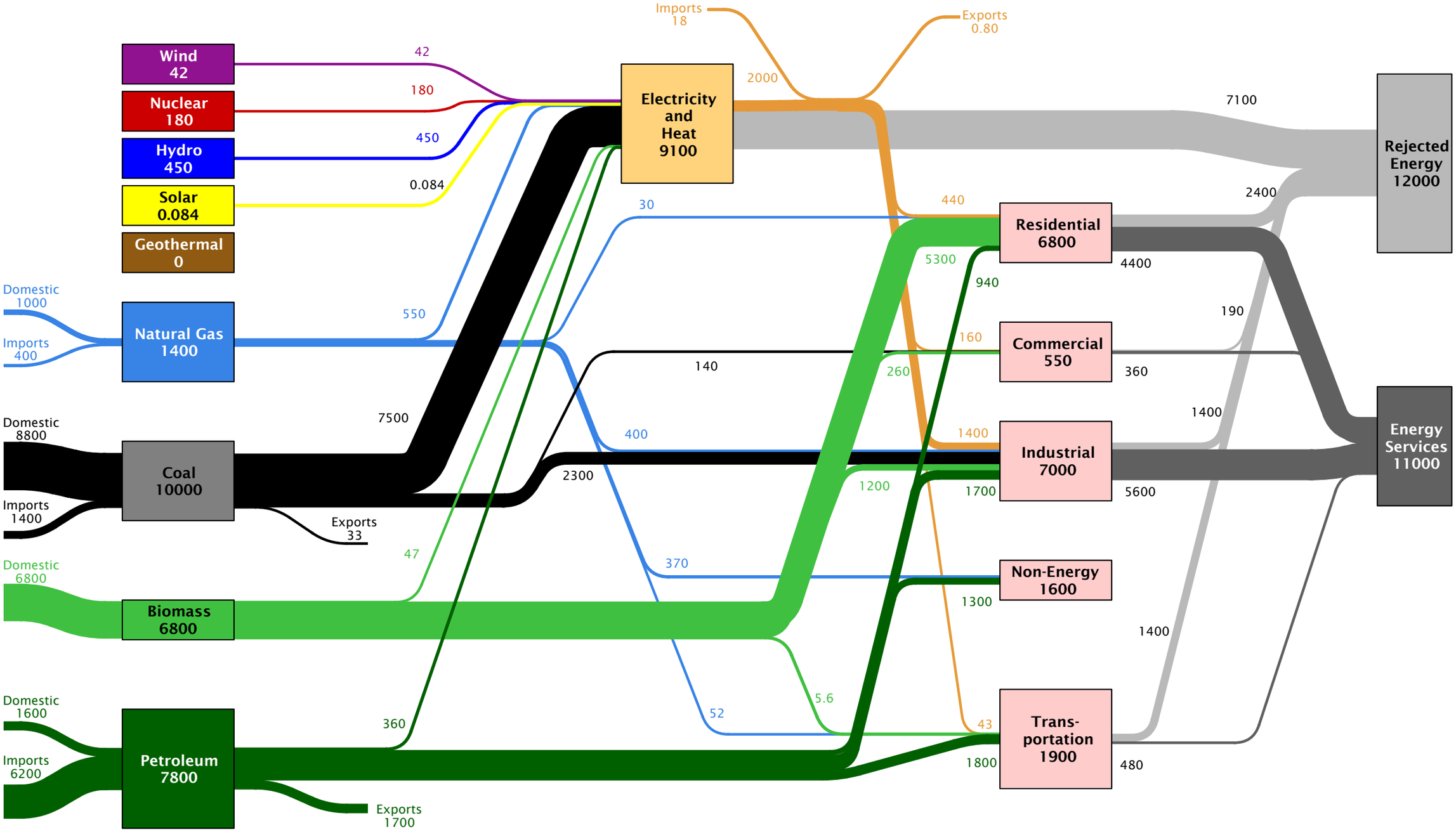
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

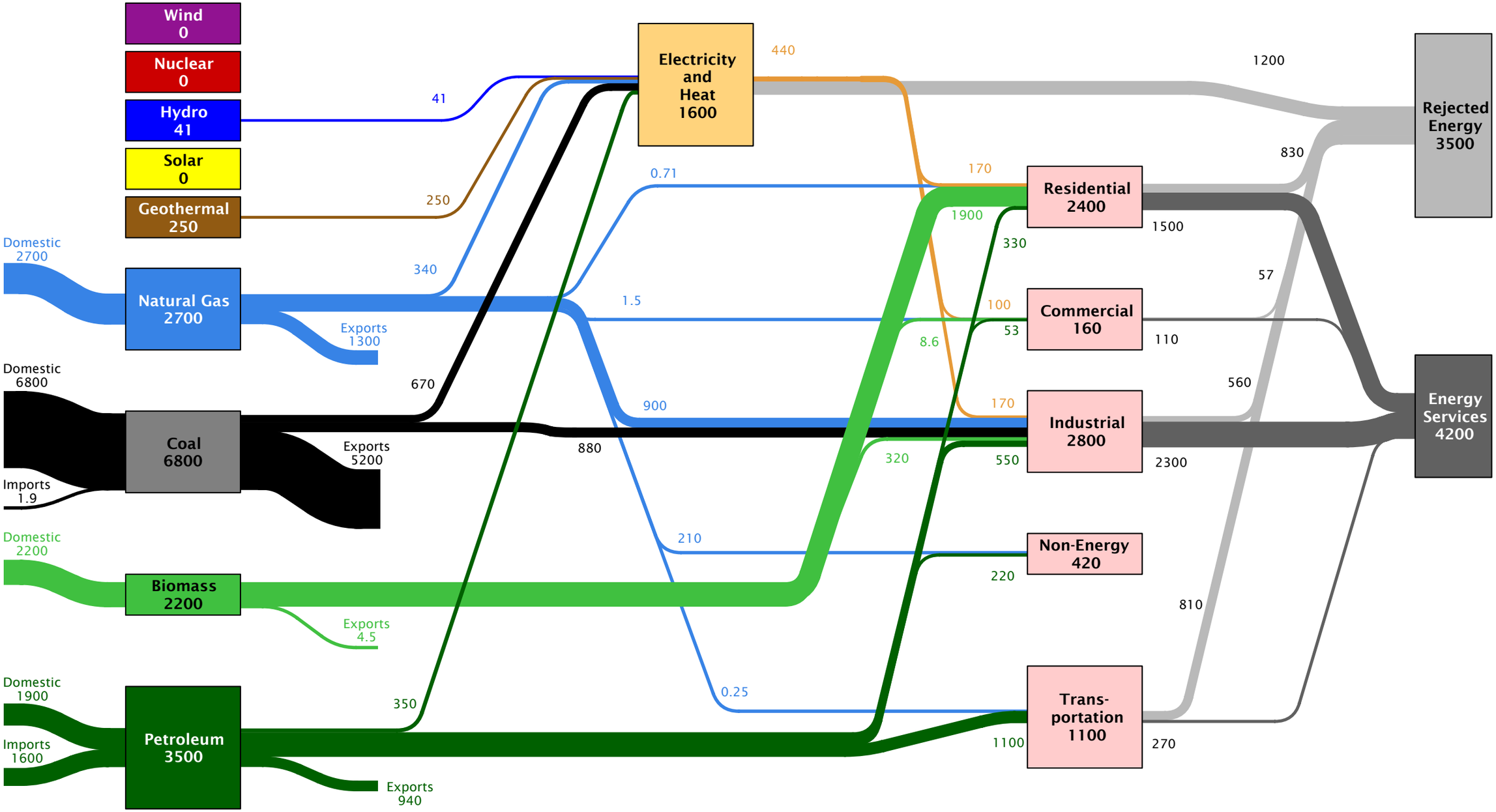
# India Energy Flow in 2007: ~25000 PJ

Lawrence Livermore National Laboratory



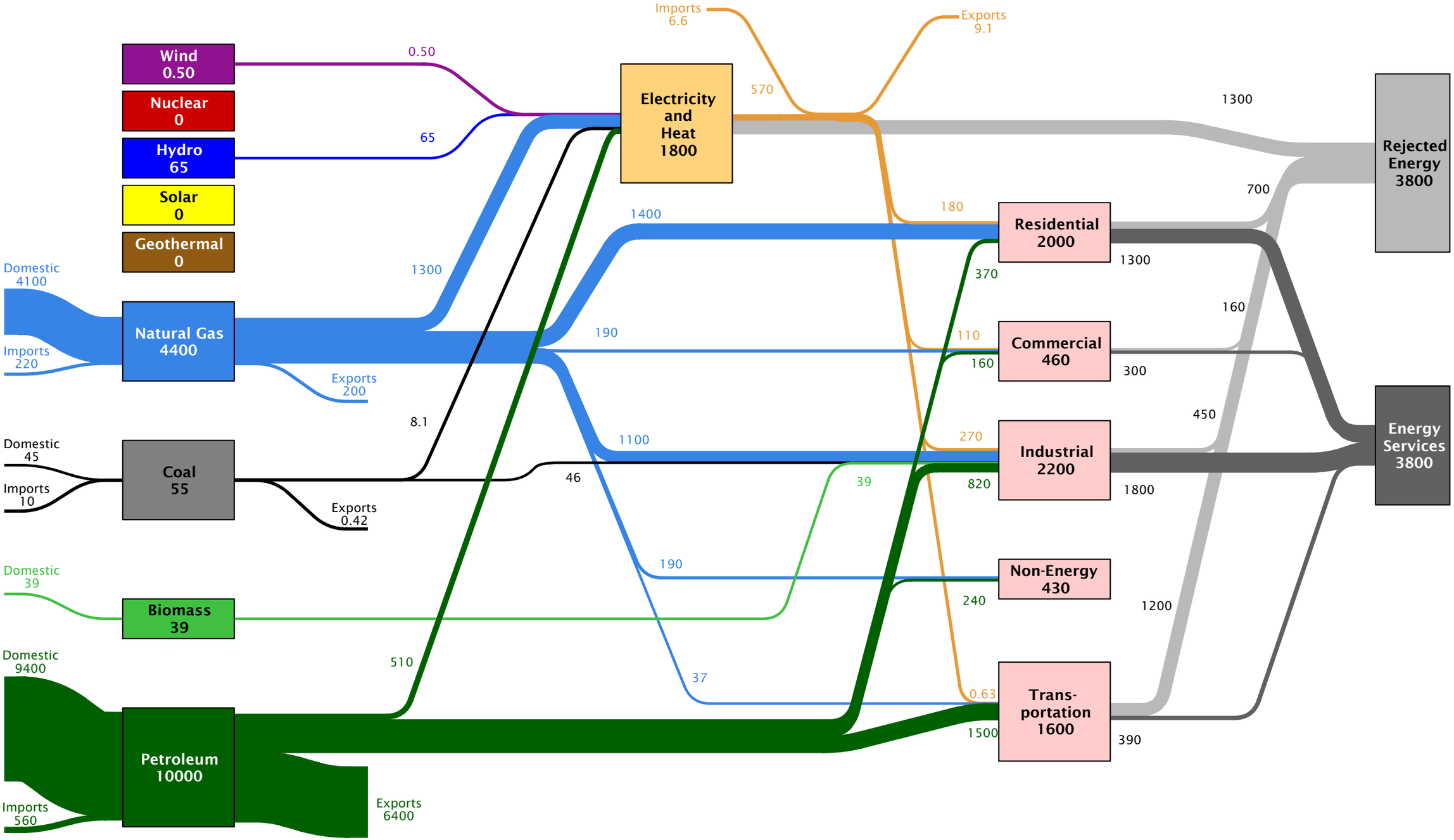
# Indonesia Energy Flow in 2007: ~8100 PJ

Lawrence Livermore National Laboratory



# Iran Energy Flow in 2007: ~8000 PJ

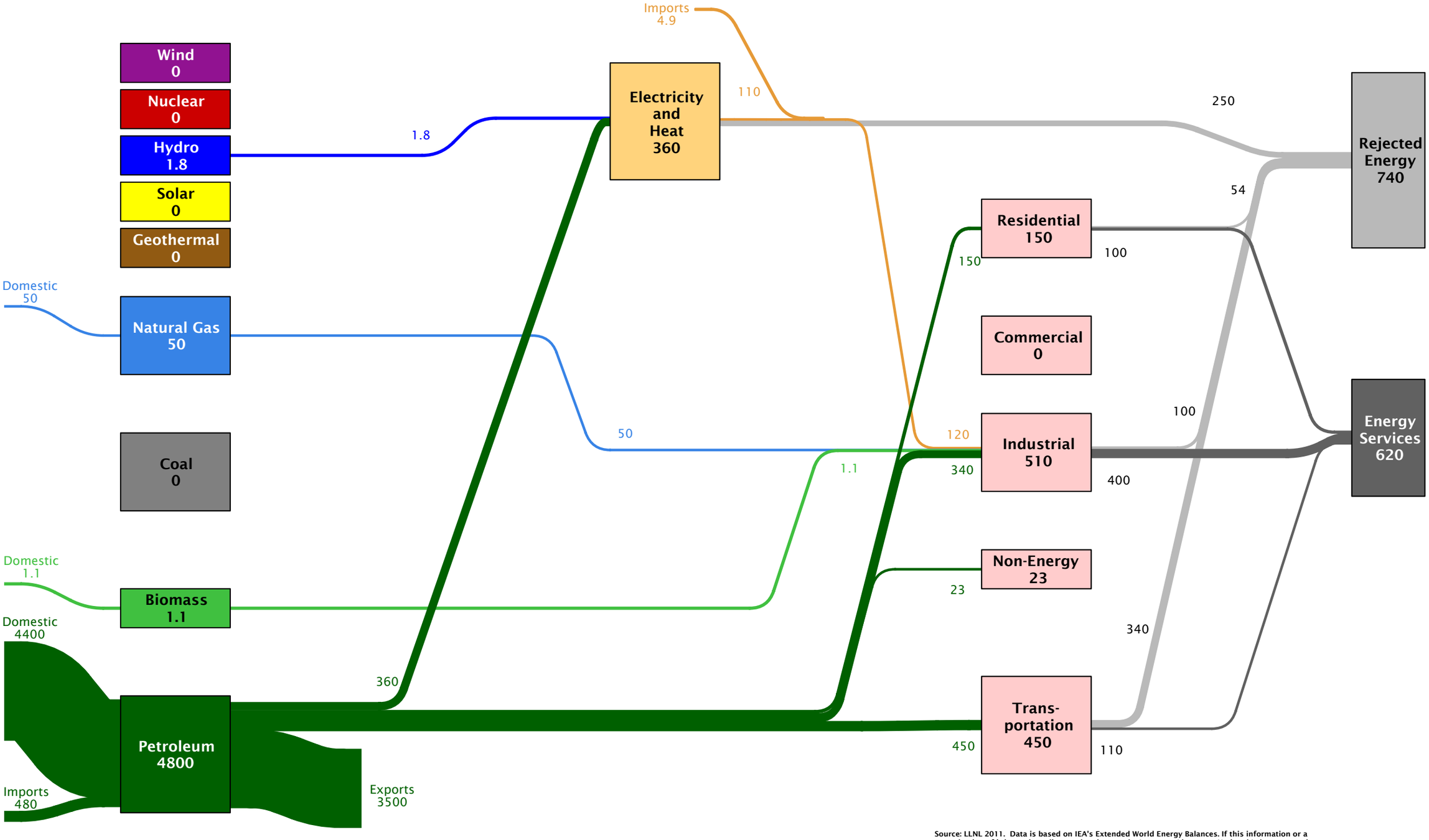
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Iraq Energy Flow in 2007: ~1400 PJ

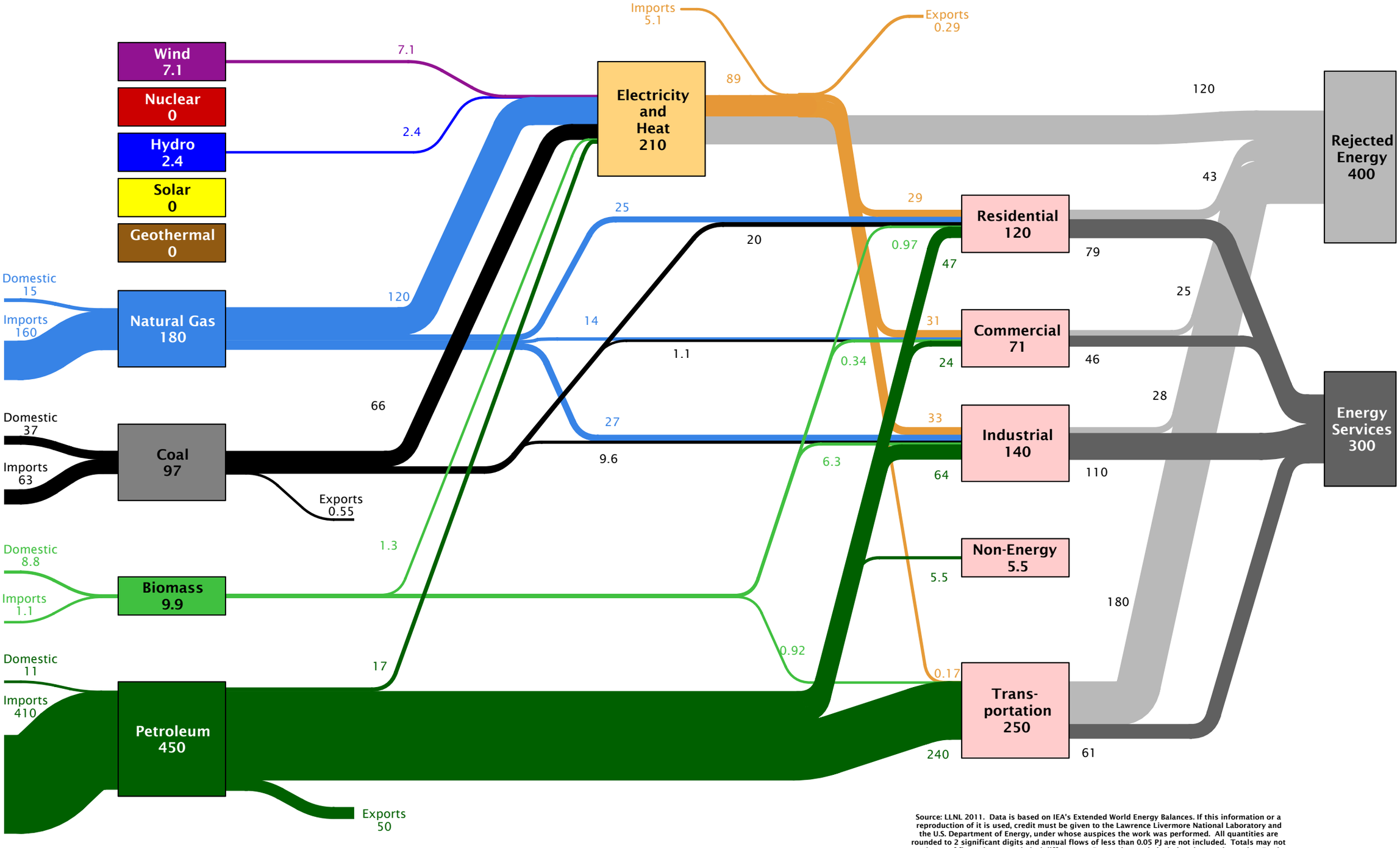
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

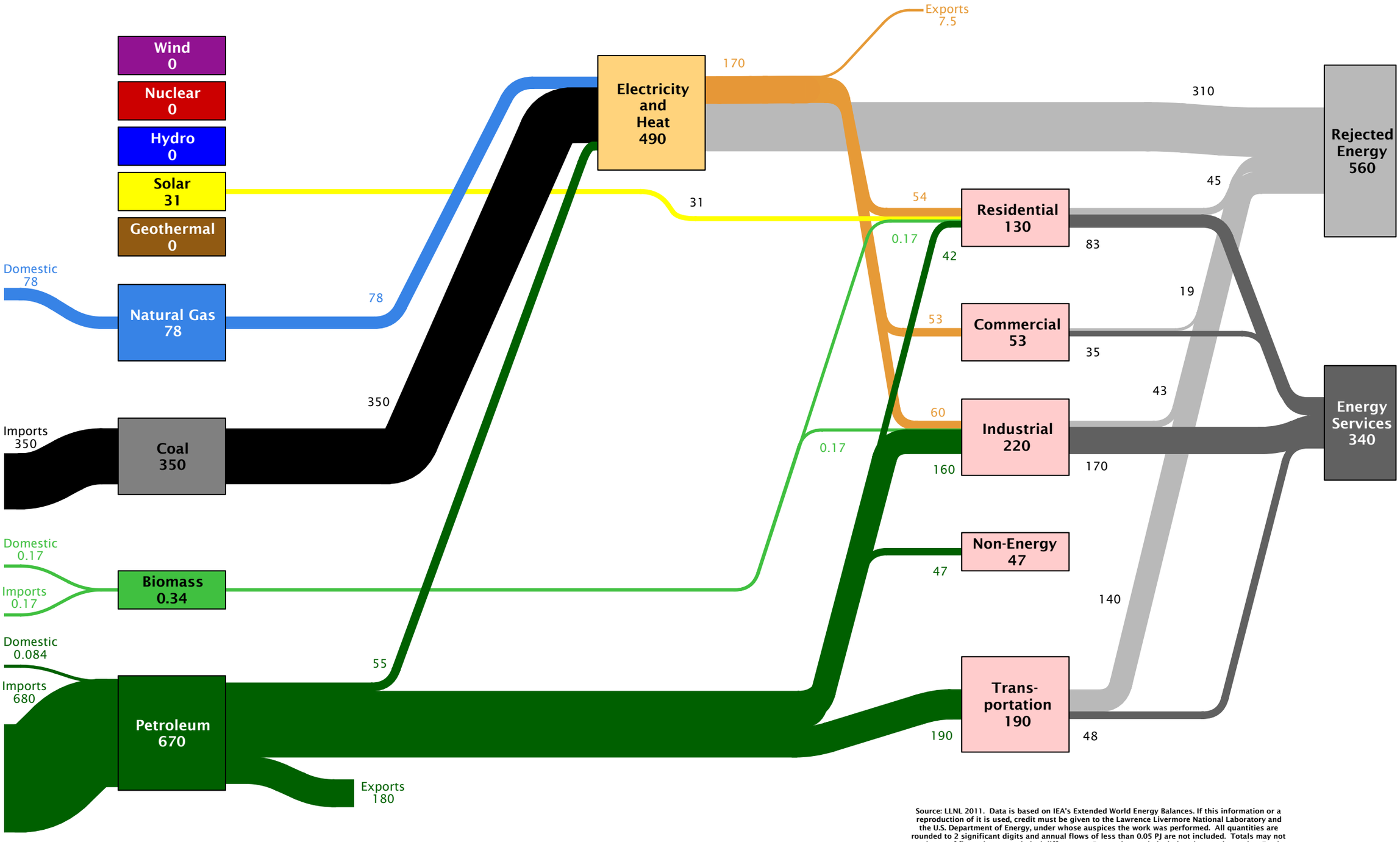
# Ireland Energy Flow in 2007: ~710 PJ

Lawrence Livermore National Laboratory



# Israel Energy Flow in 2007: ~950 PJ

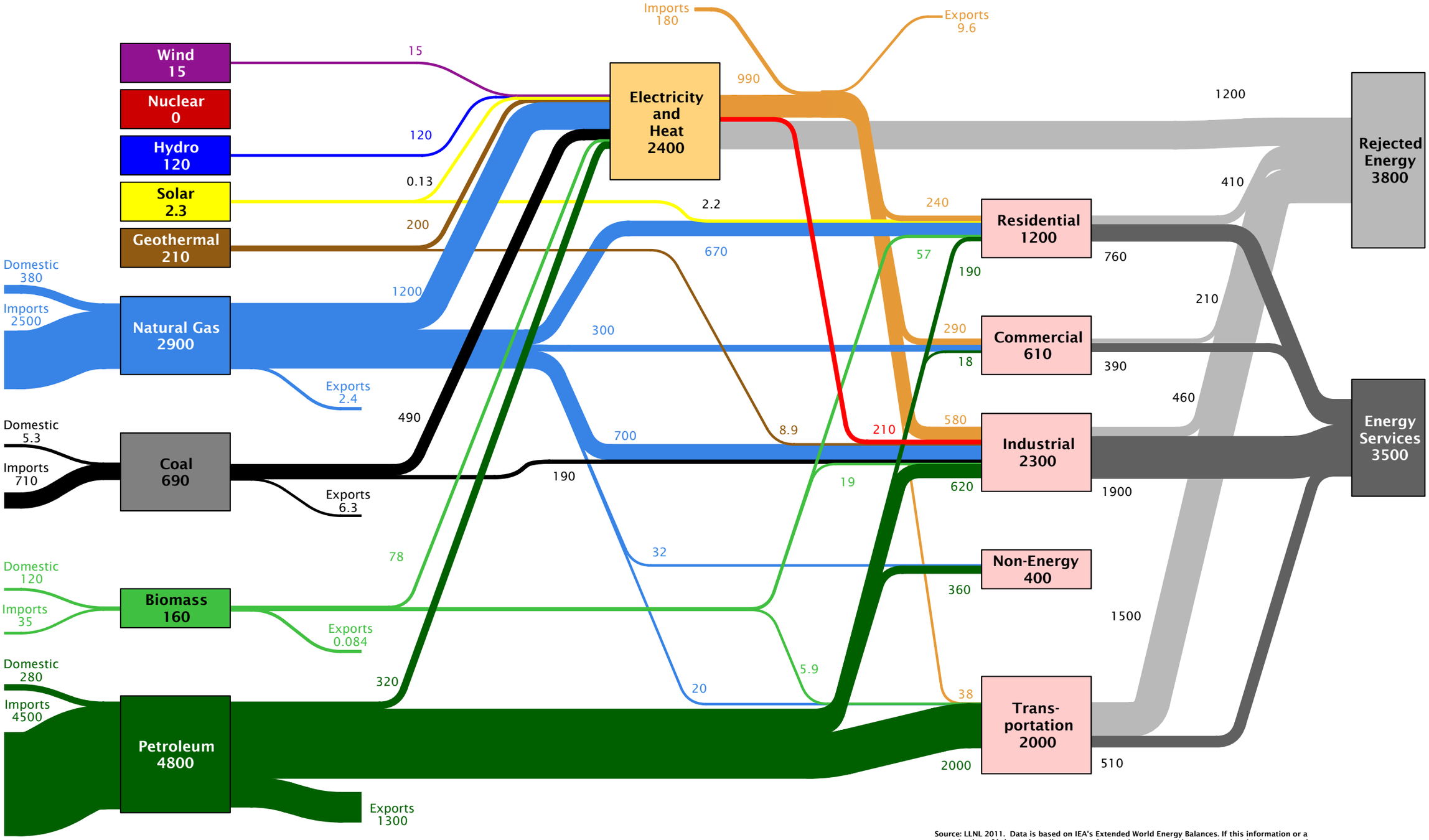
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

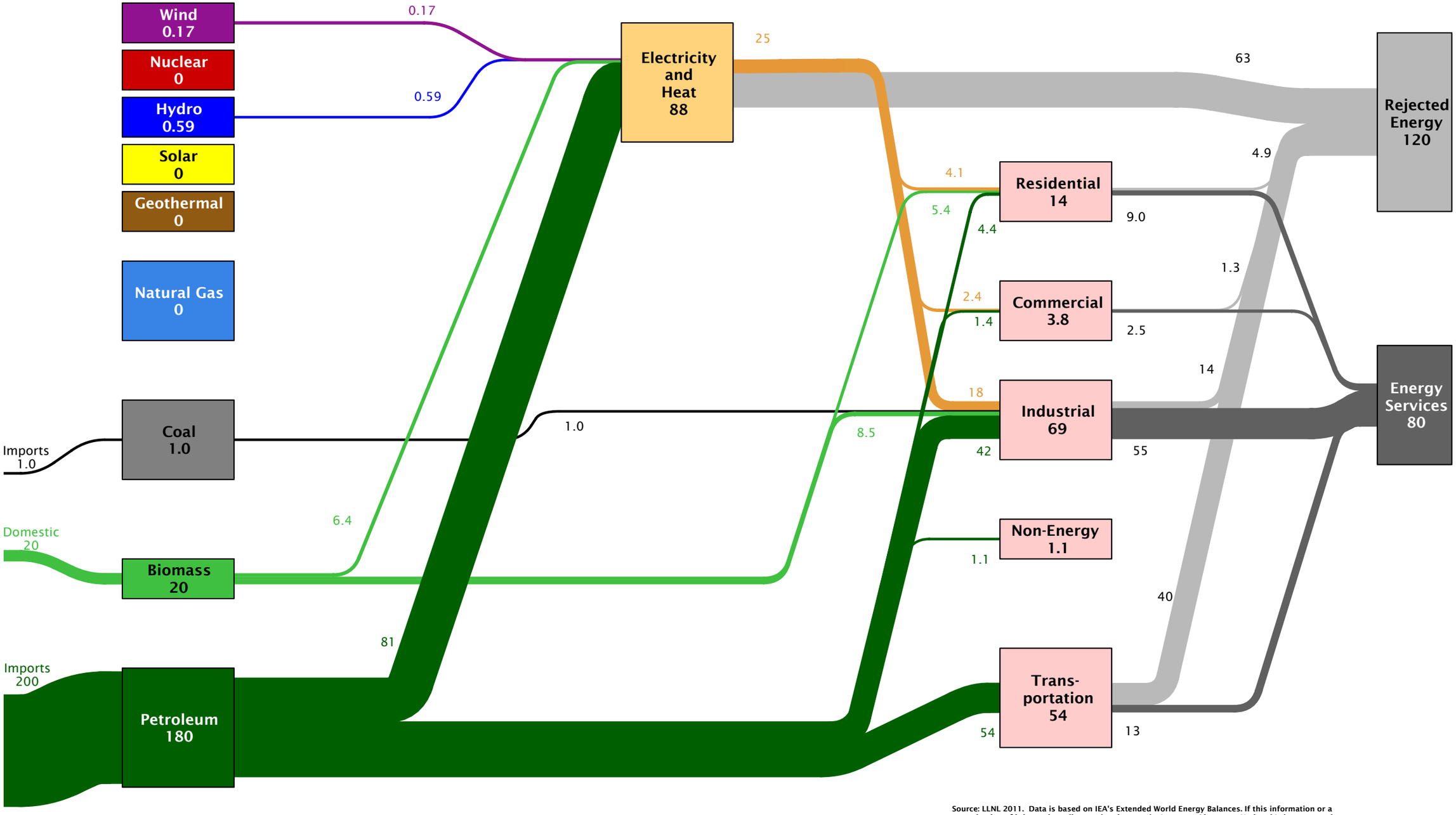
# Italy Energy Flow in 2007: ~7700 PJ

Lawrence Livermore National Laboratory



# Jamaica Energy Flow in 2007: ~200 PJ

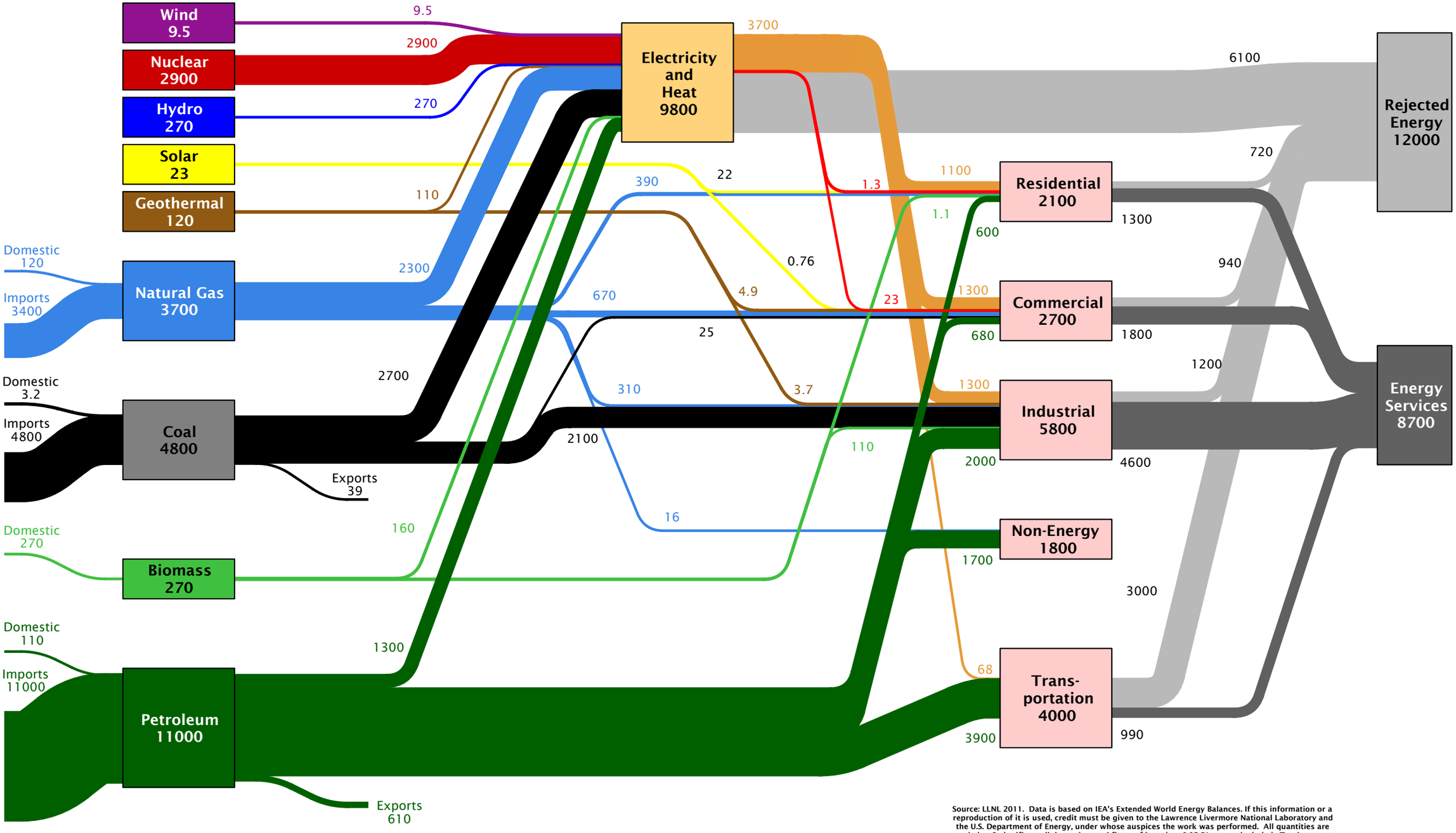
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Japan Energy Flow in 2007: ~22000 PJ

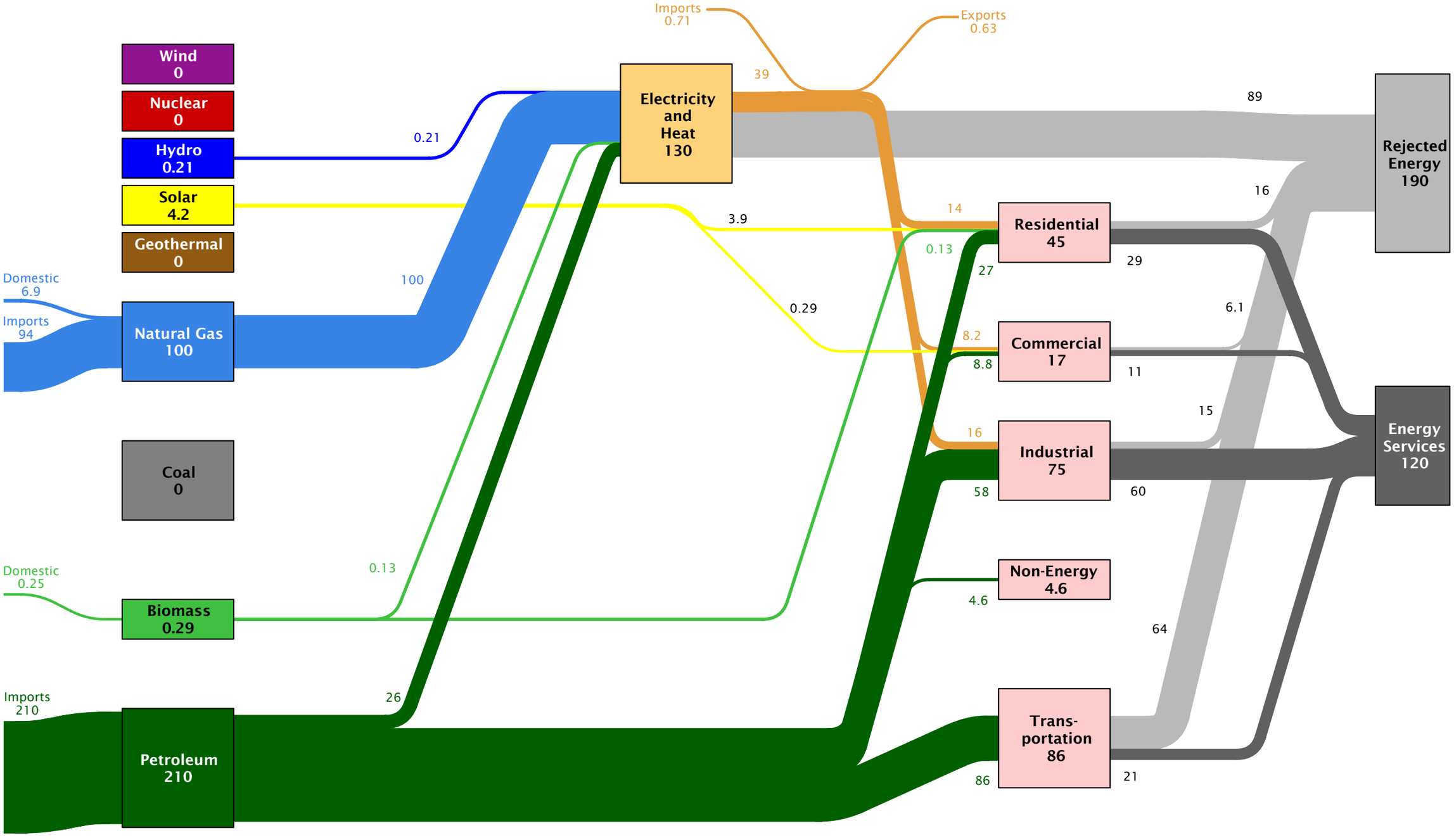
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Jordan Energy Flow in 2007: ~320 PJ

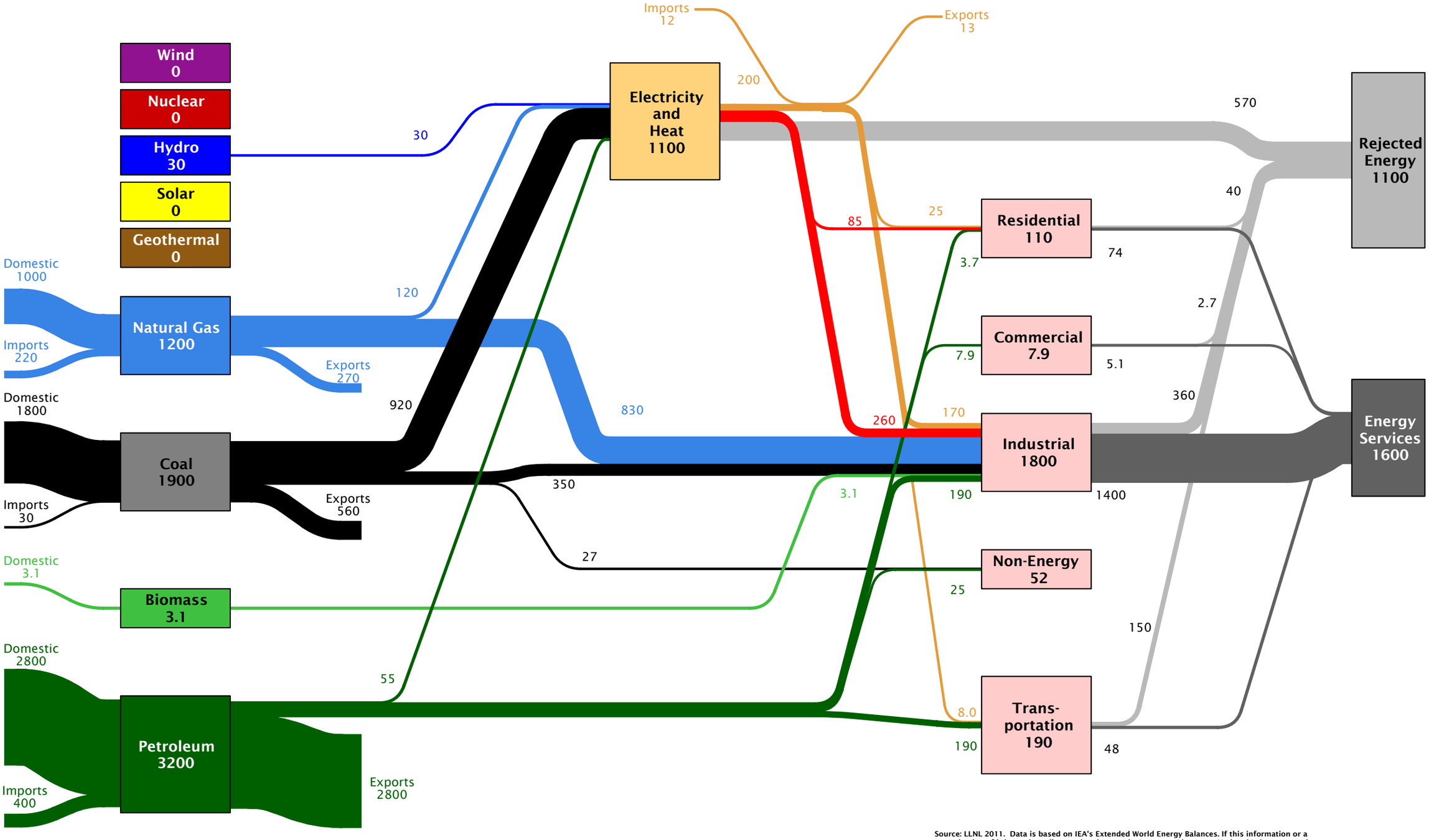
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

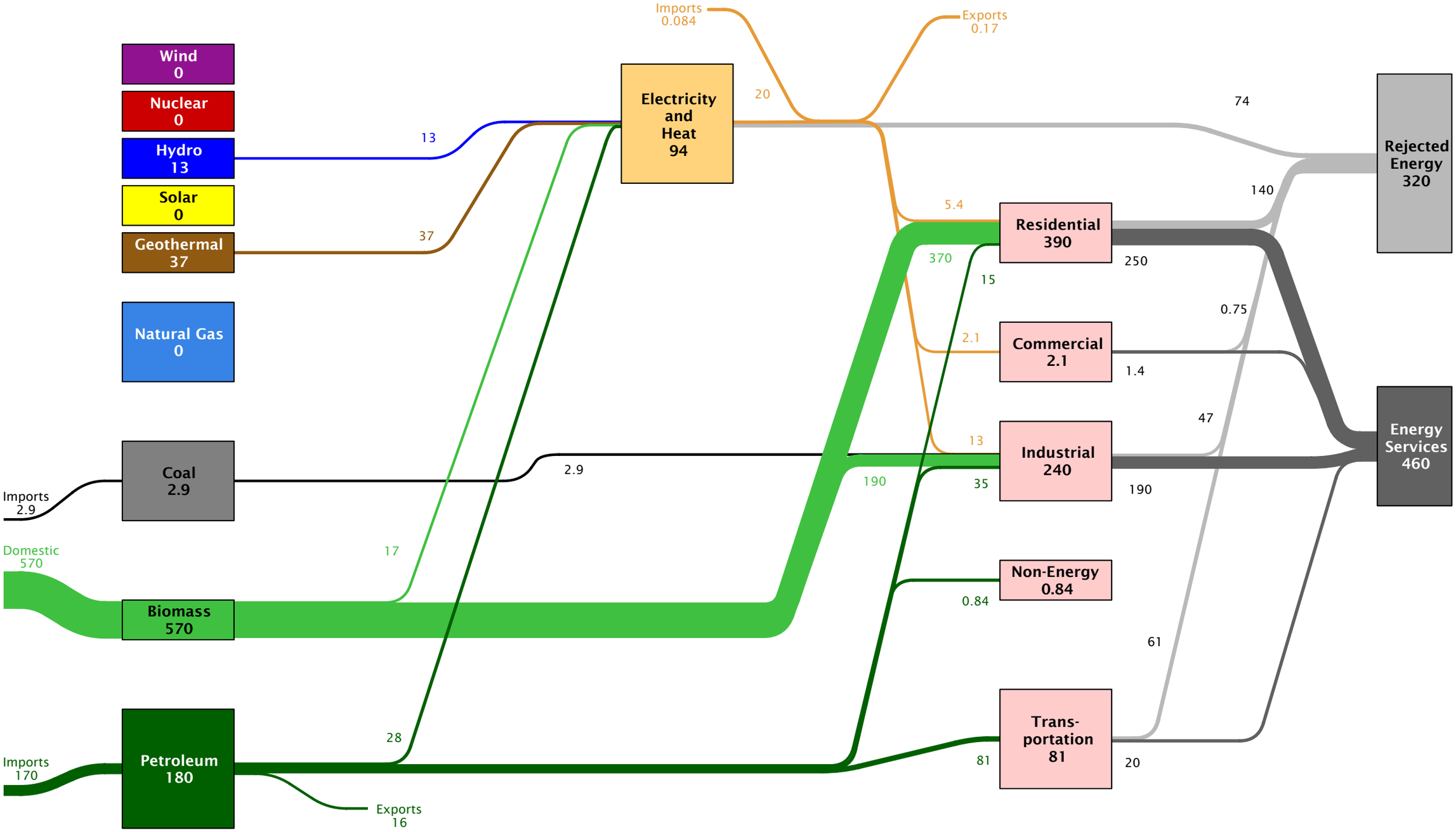
# Kazakhstan Energy Flow in 2007: ~2700 PJ

Lawrence Livermore National Laboratory



# Kenya Energy Flow in 2007: ~780 PJ

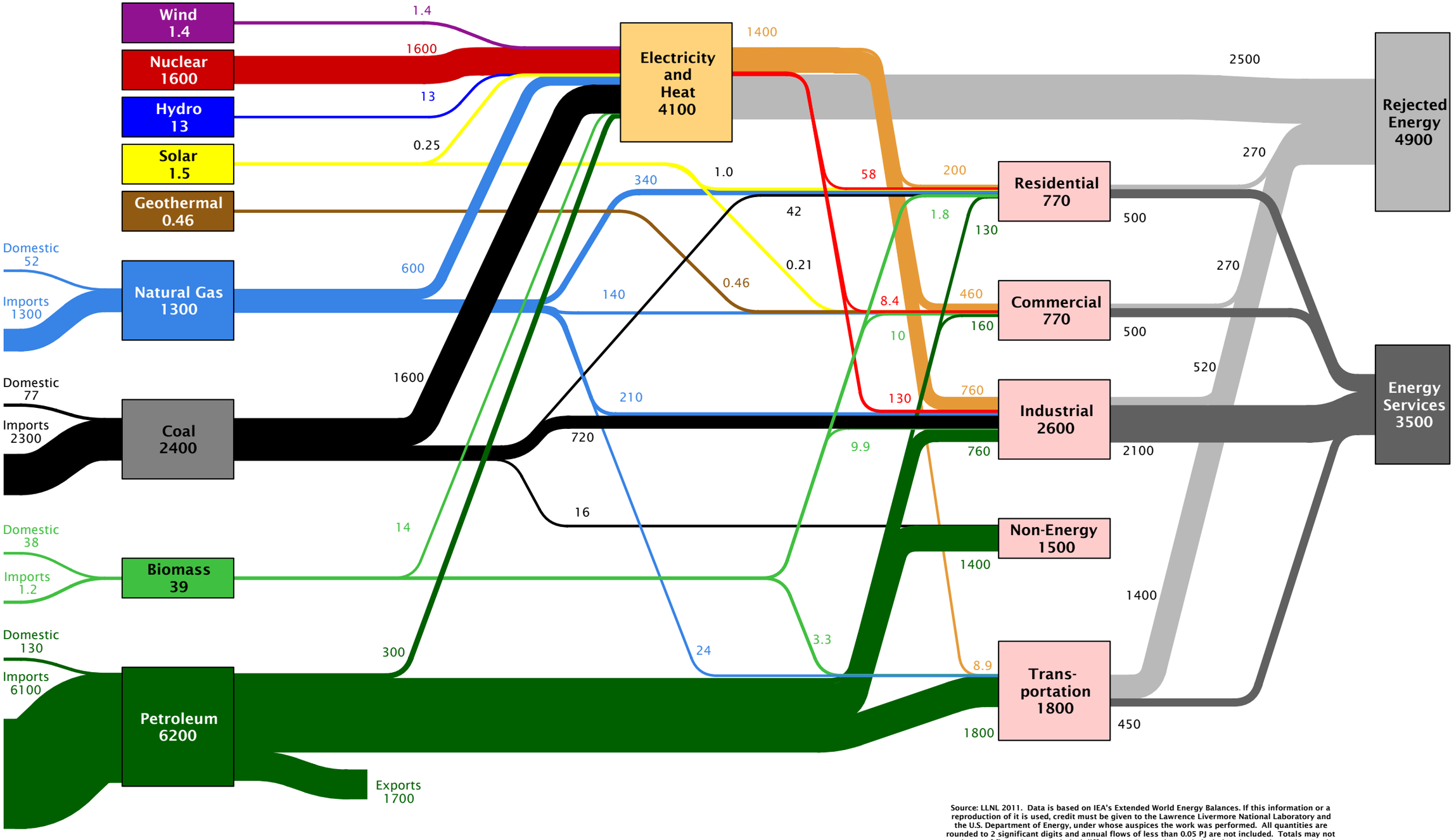
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Republic of Korea (South Korea)
# Energy Flow in 2007: ~9900 PJ

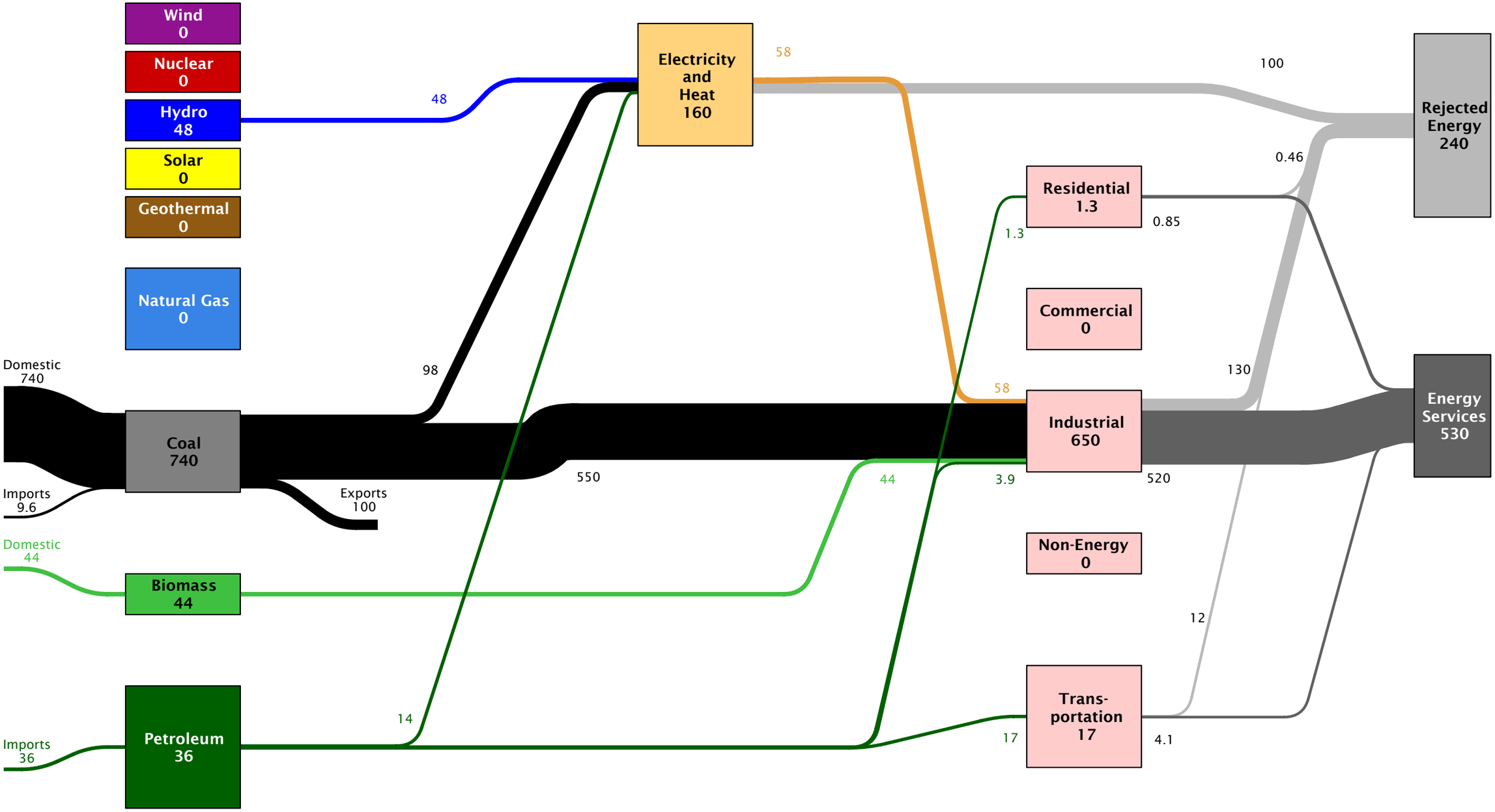
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

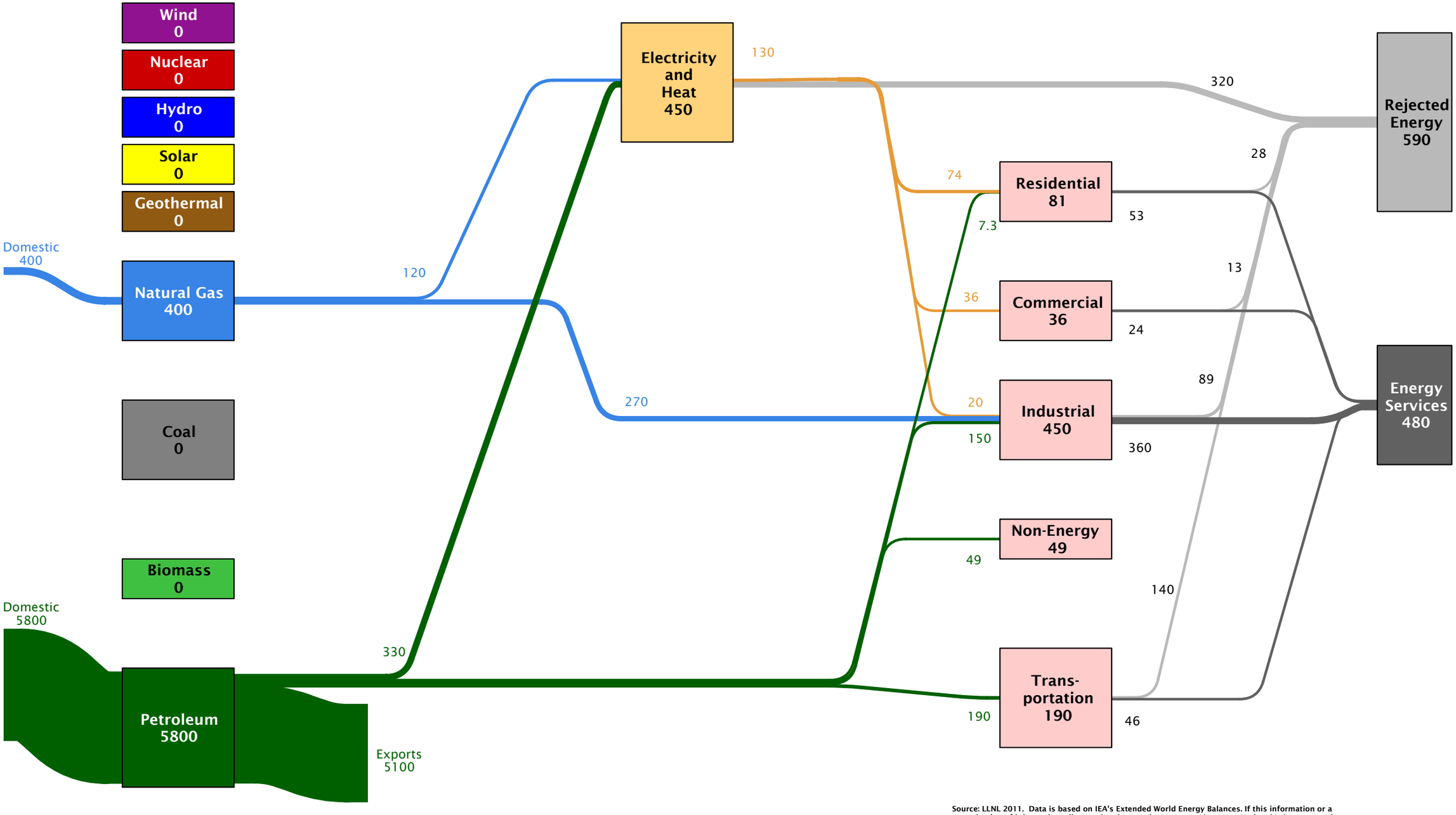
# Democratic People's Republic of Korea (North Korea) Energy Flow in 2007: ~770 PJ

Lawrence Livermore National Laboratory



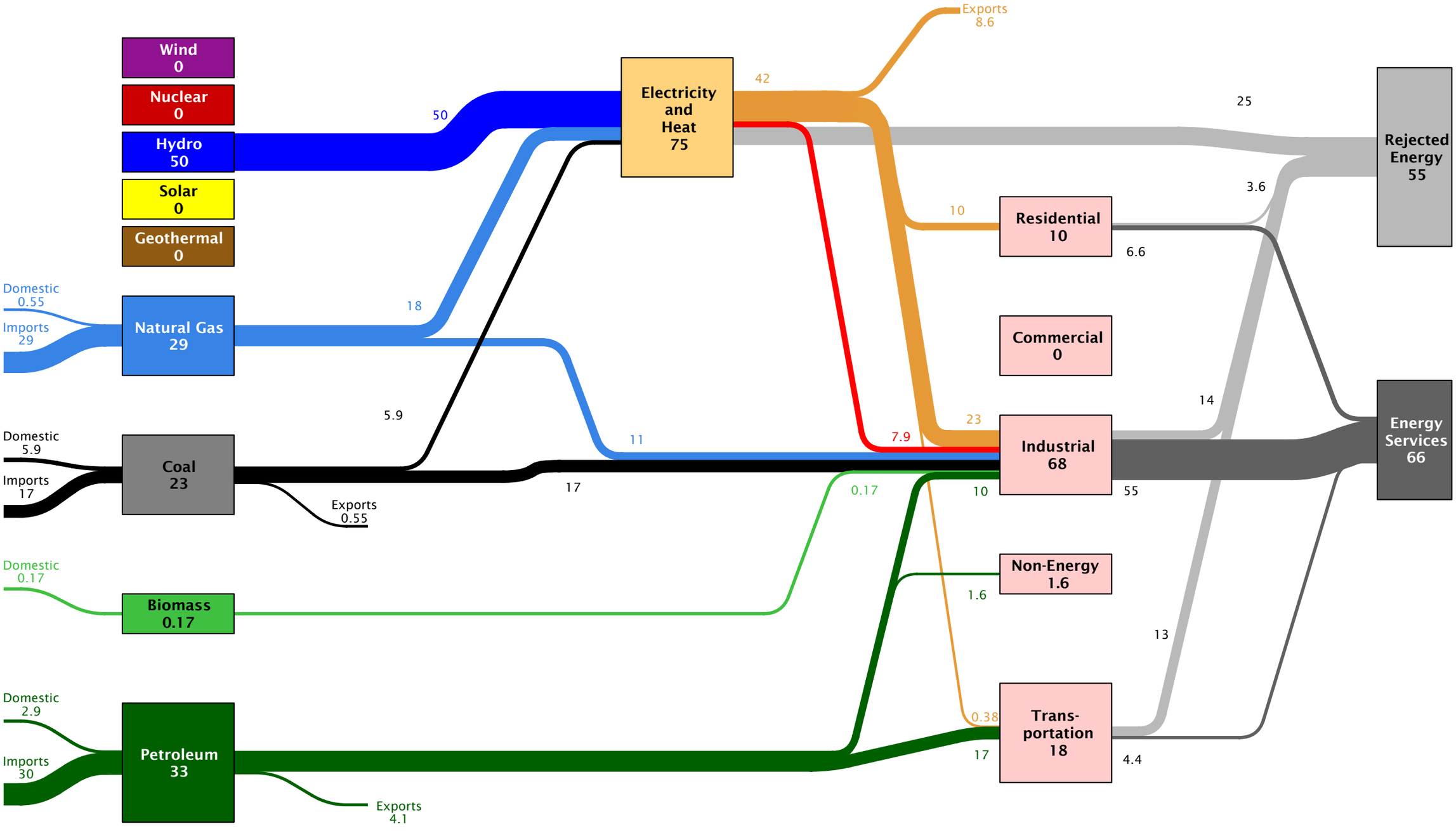
# Kuwait Energy Flow in 2007: ~1100 PJ

Lawrence Livermore National Laboratory



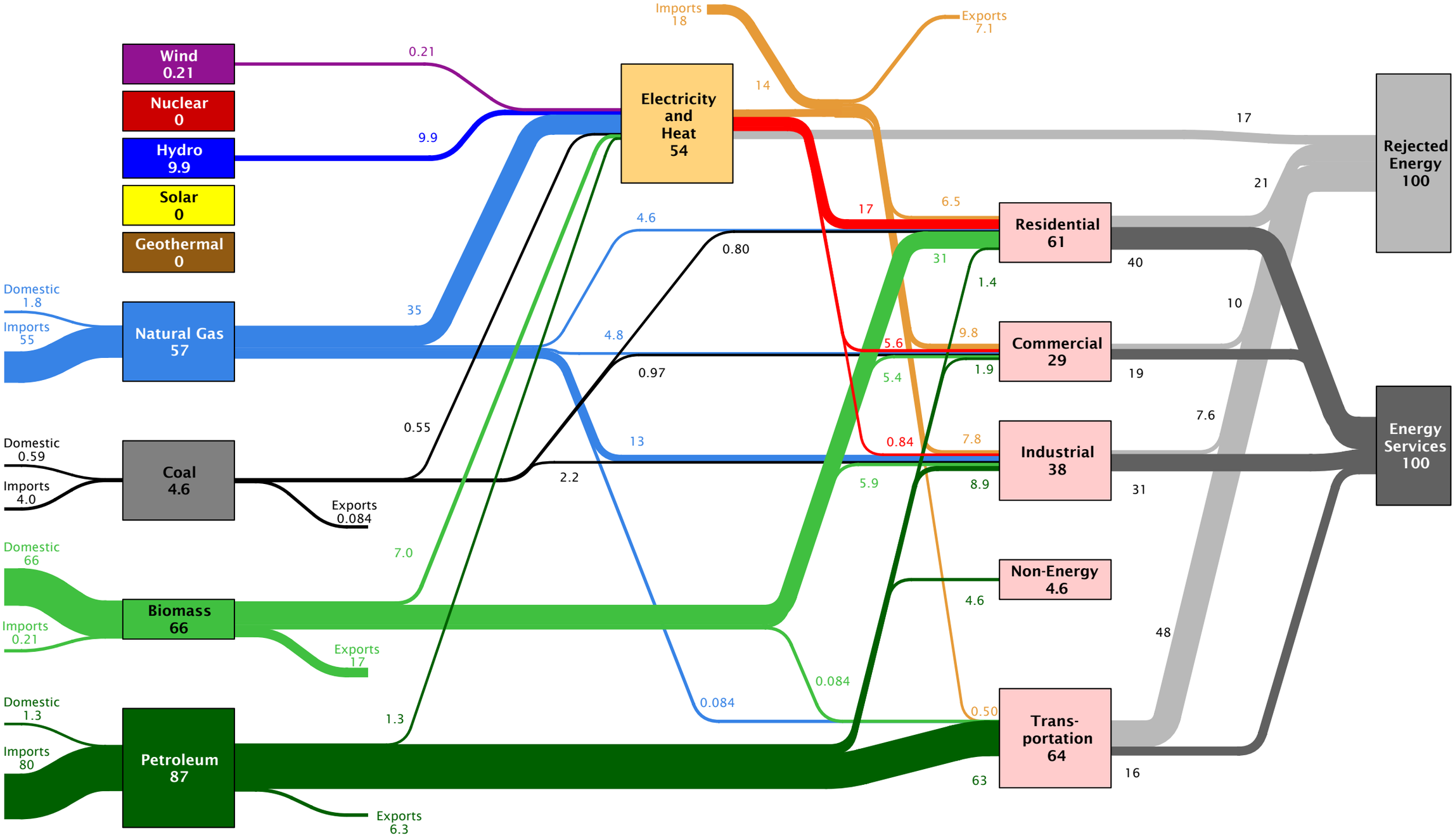
# Kyrgyzstan Energy Flow in 2007: ~120 PJ

Lawrence Livermore National Laboratory



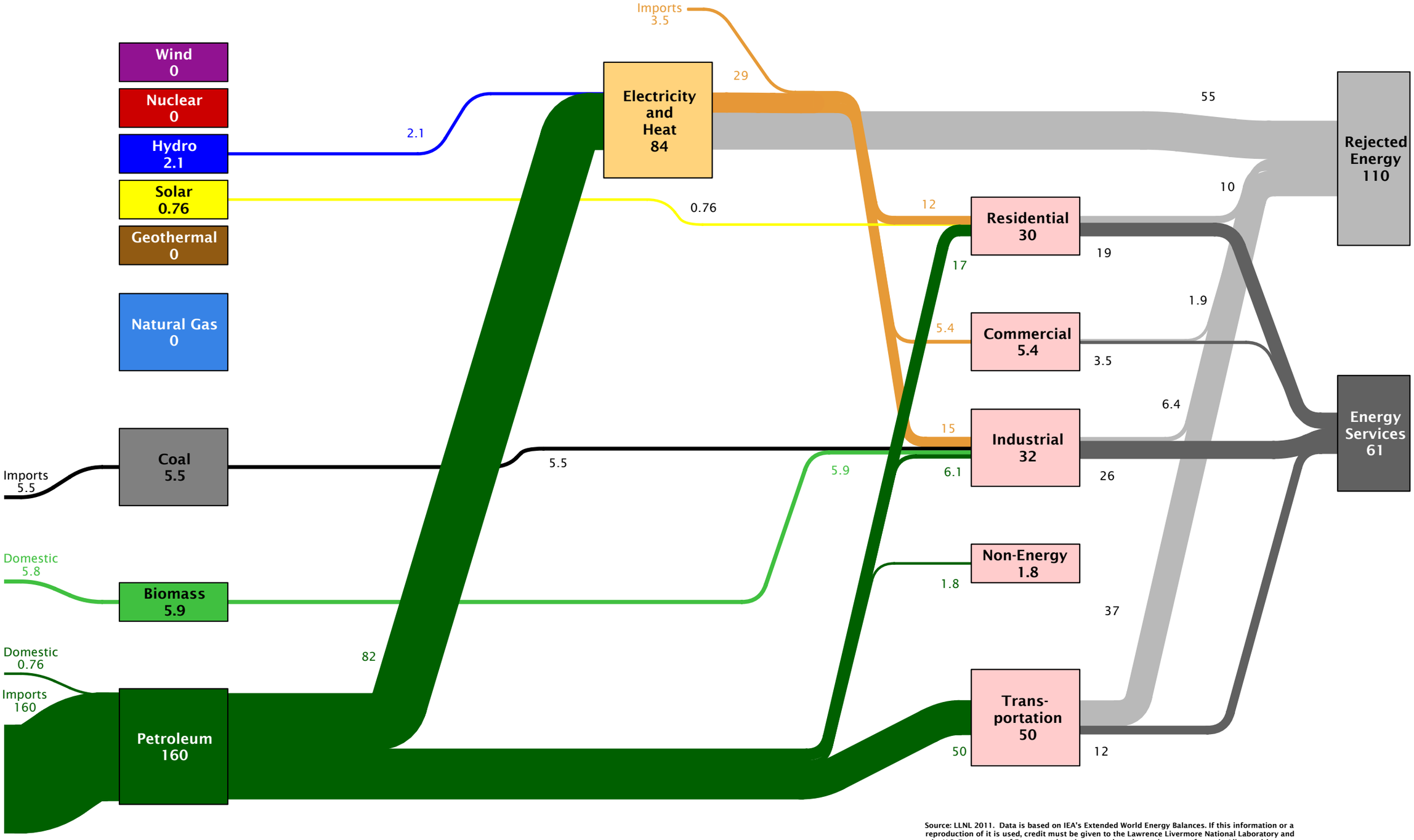
# Latvia Energy Flow in 2007: ~210 PJ

Lawrence Livermore National Laboratory



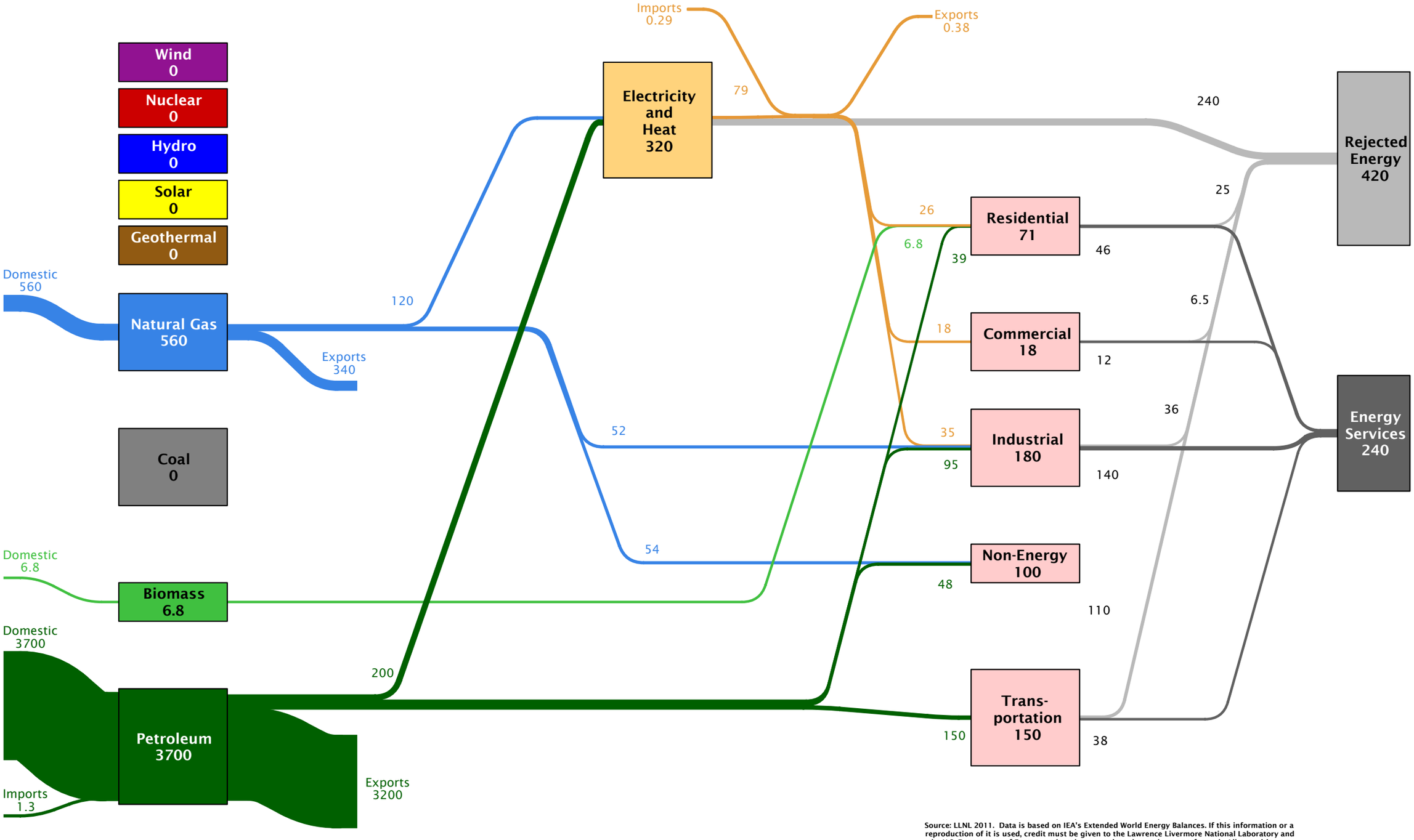
# Lebanon Energy Flow in 2007: ~170 PJ

Lawrence Livermore National Laboratory



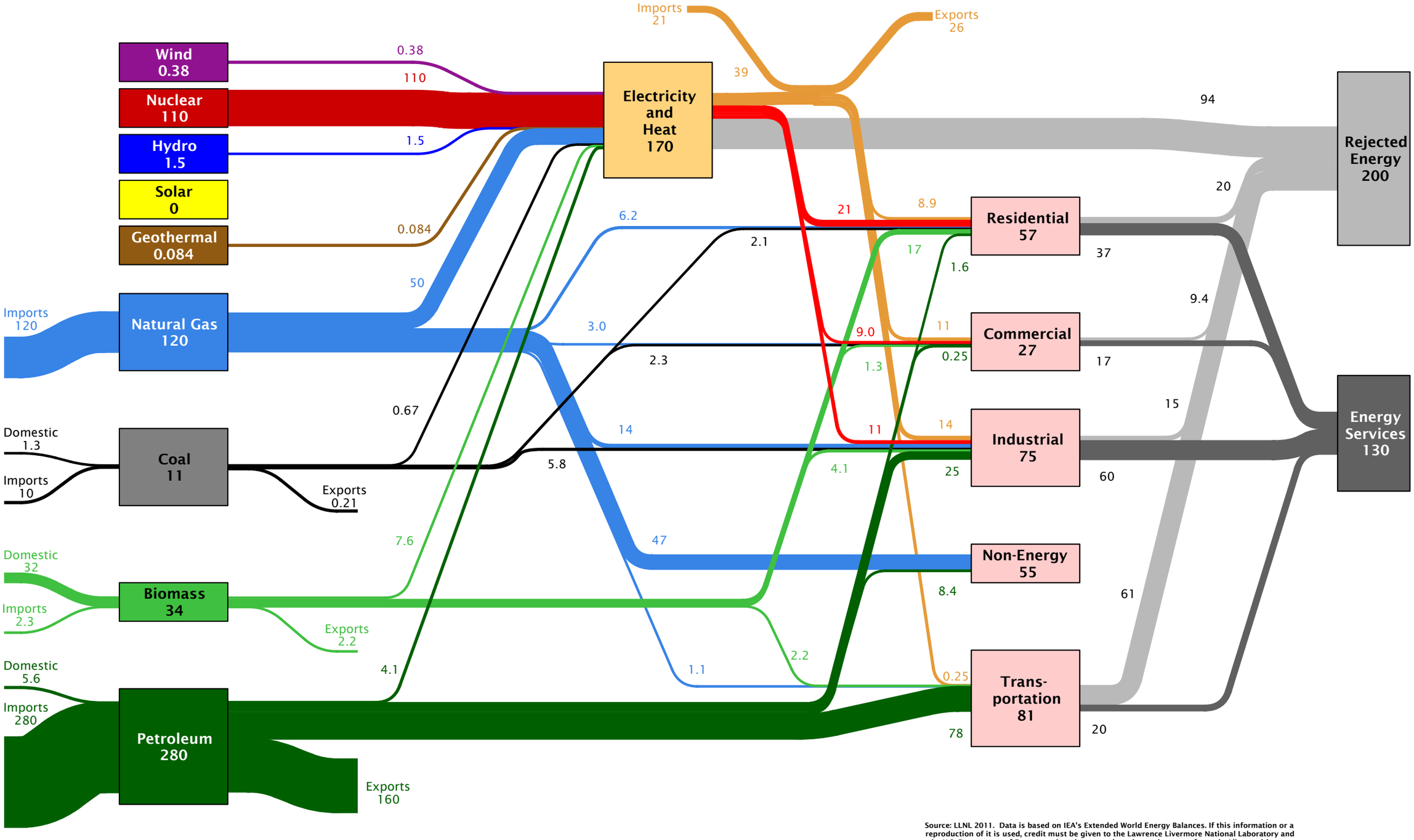
# Libya Energy Flow in 2007: ~760 PJ

Lawrence Livermore National Laboratory



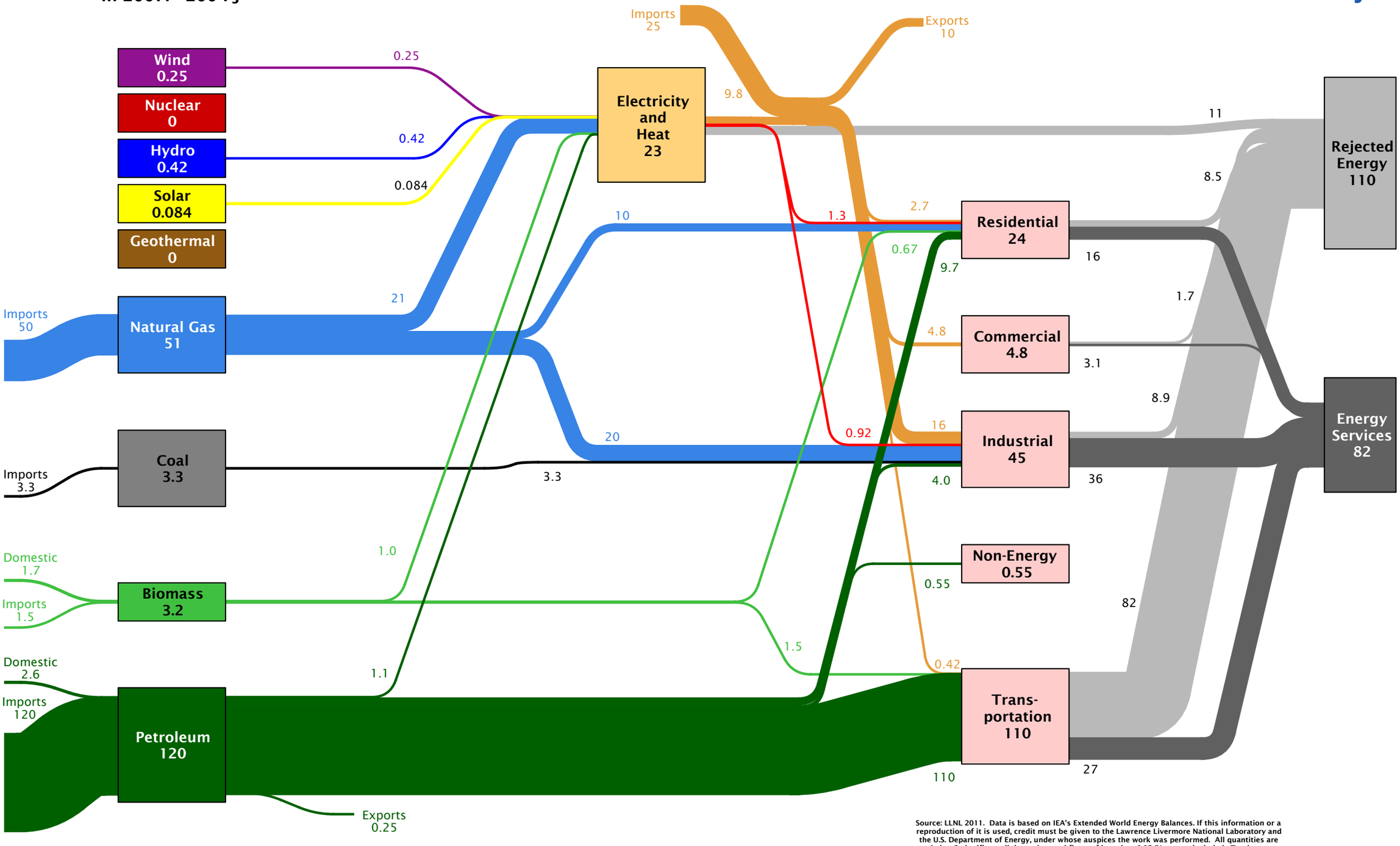
# Lithuania Energy Flow in 2007: ~390 PJ

Lawrence Livermore National Laboratory



# Luxembourg Energy Flow in 2007: ~200 PJ

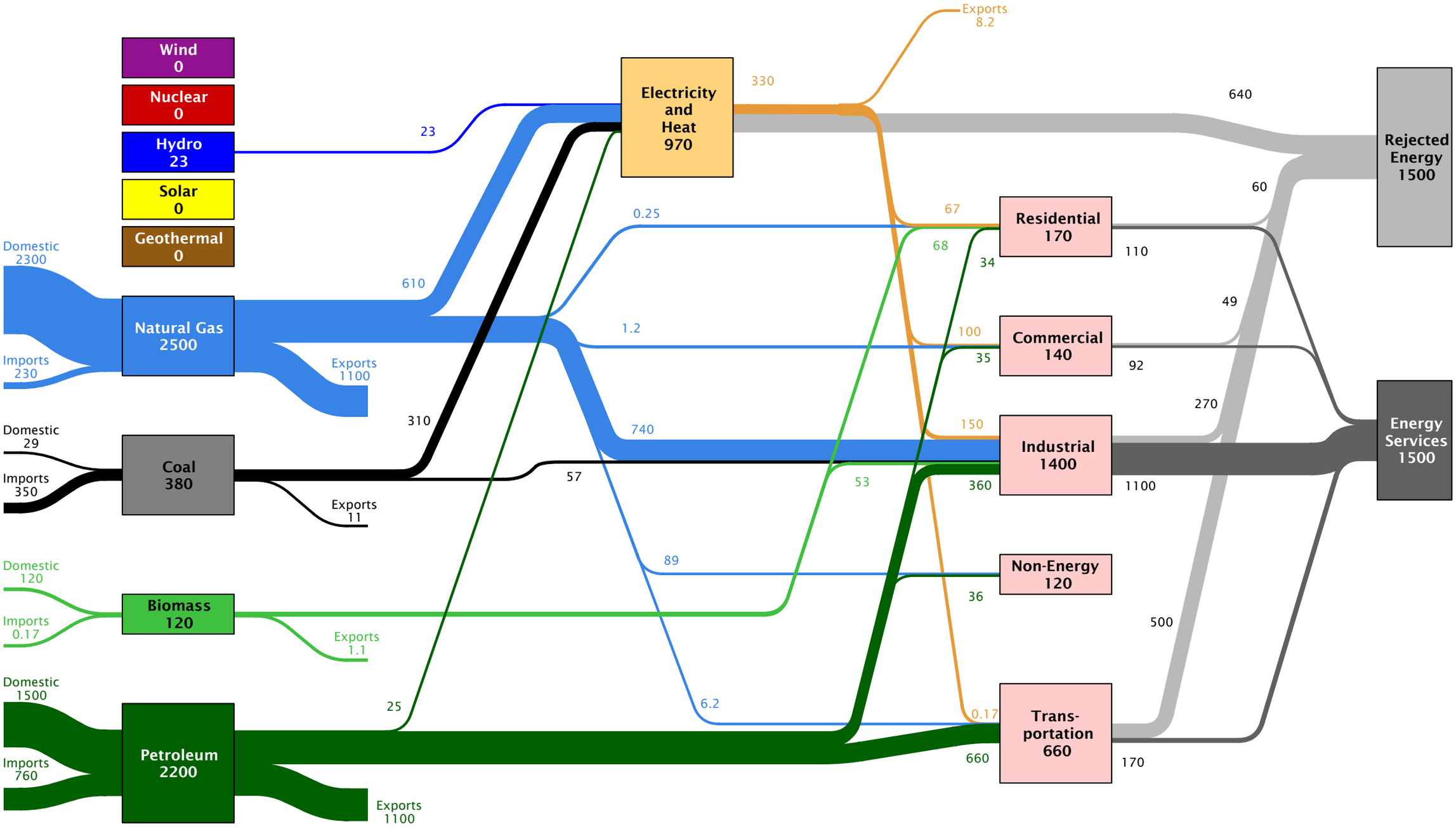
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

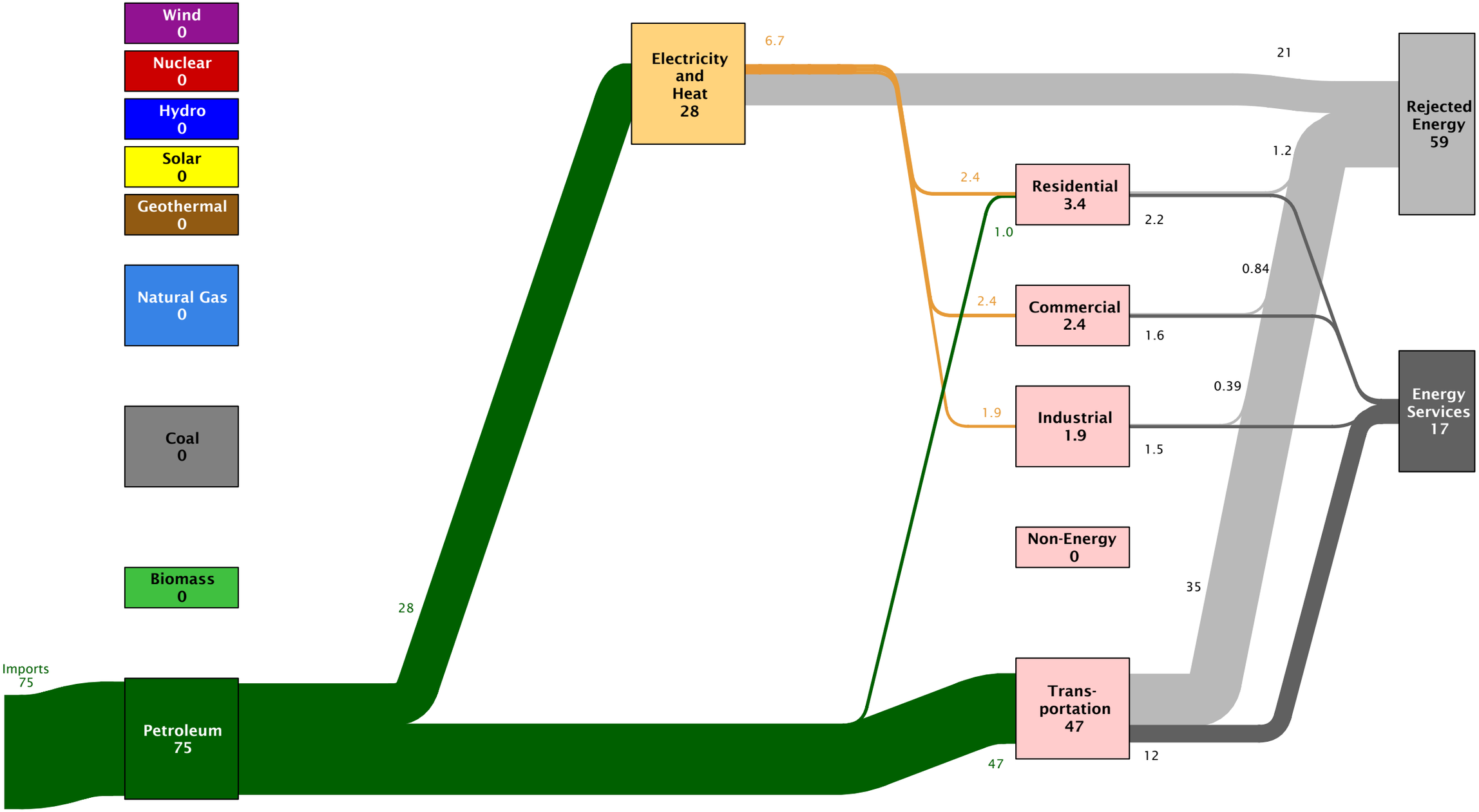
# Malaysia Energy Flow in 2007: ~3100 PJ

Lawrence Livermore National Laboratory



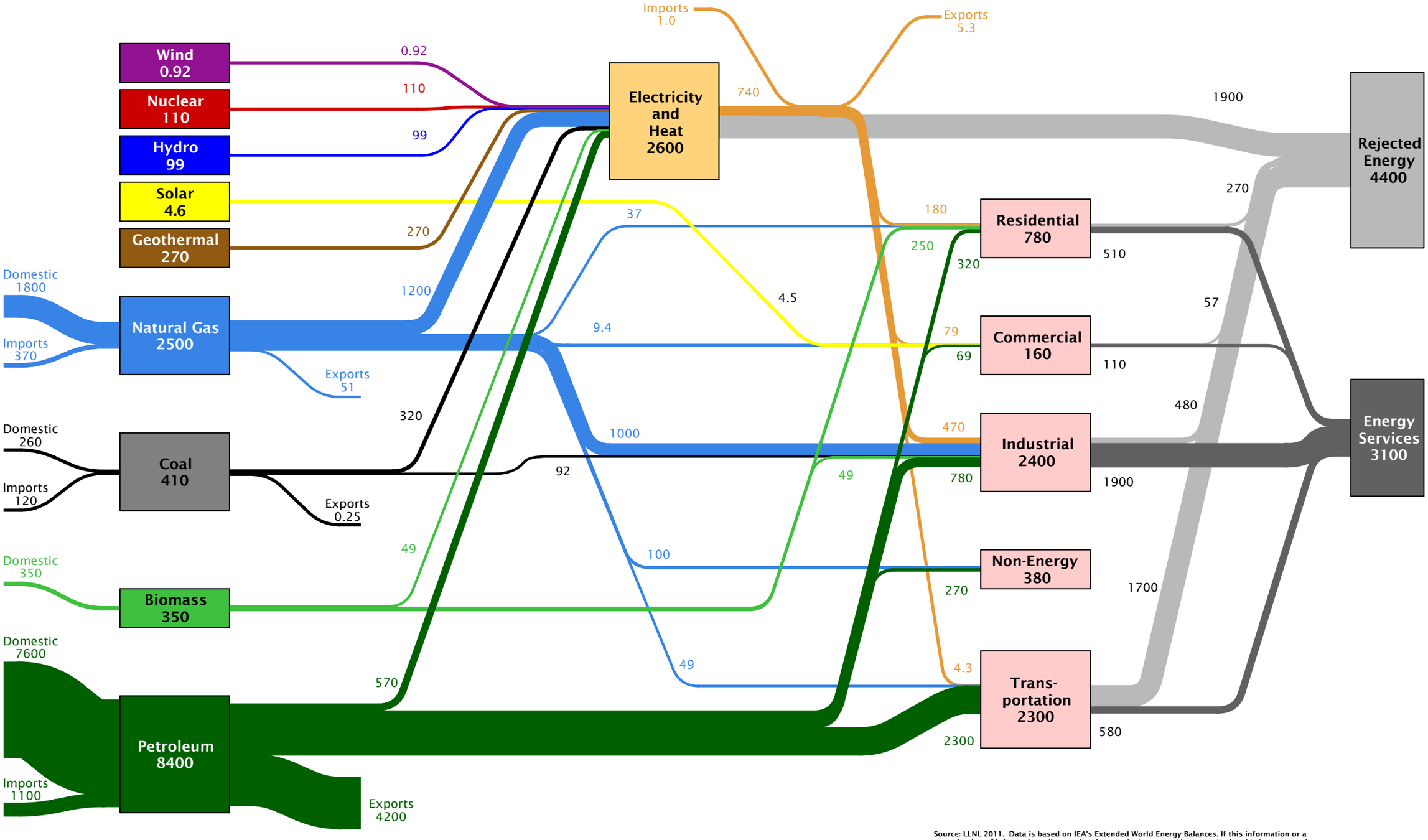
# Malta Energy Flow in 2007: ~75 PJ

Lawrence Livermore National Laboratory



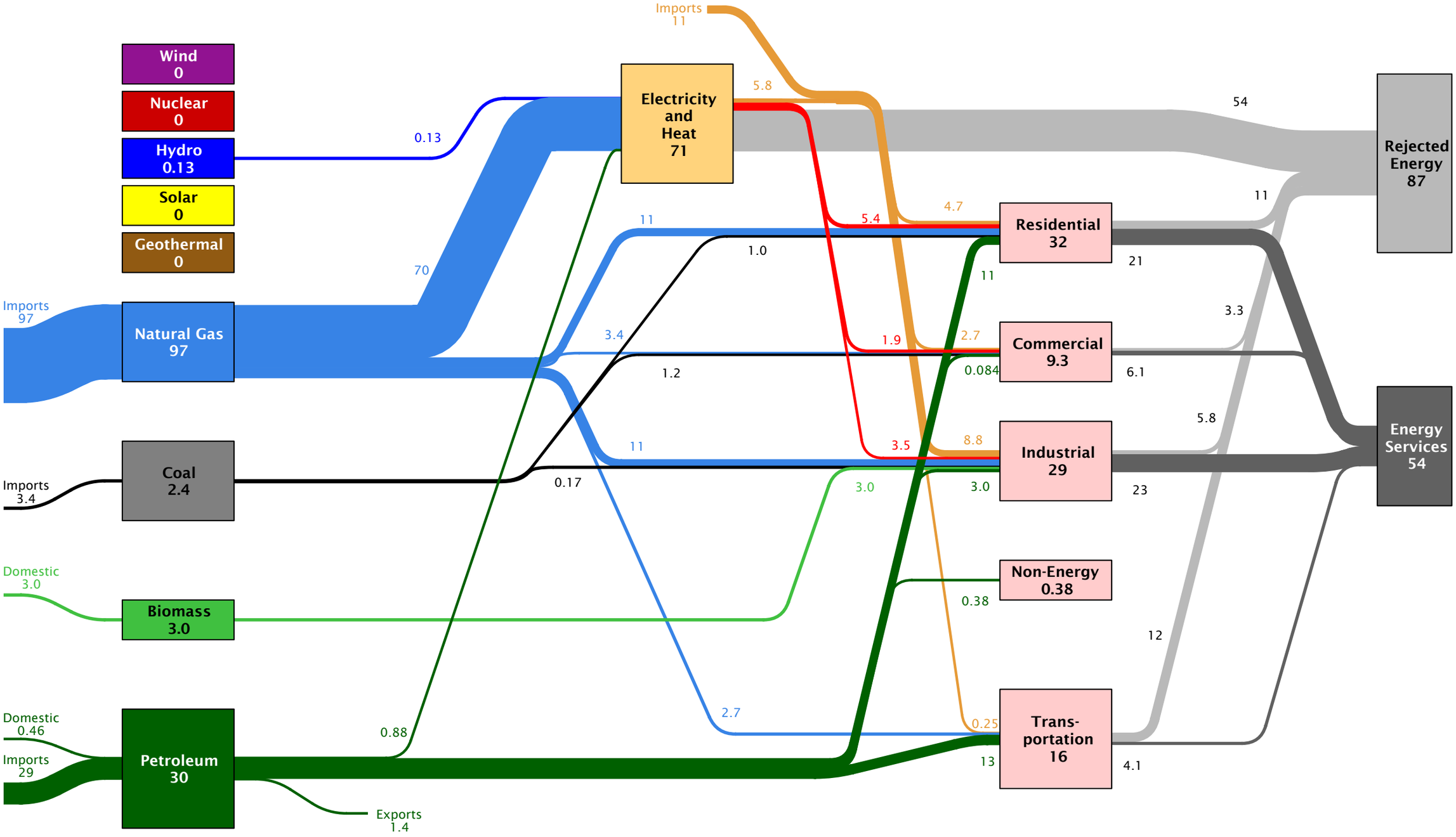
# Mexico Energy Flow in 2007: ~7900 PJ

Lawrence Livermore National Laboratory



# Moldova Energy Flow in 2007: ~140 PJ

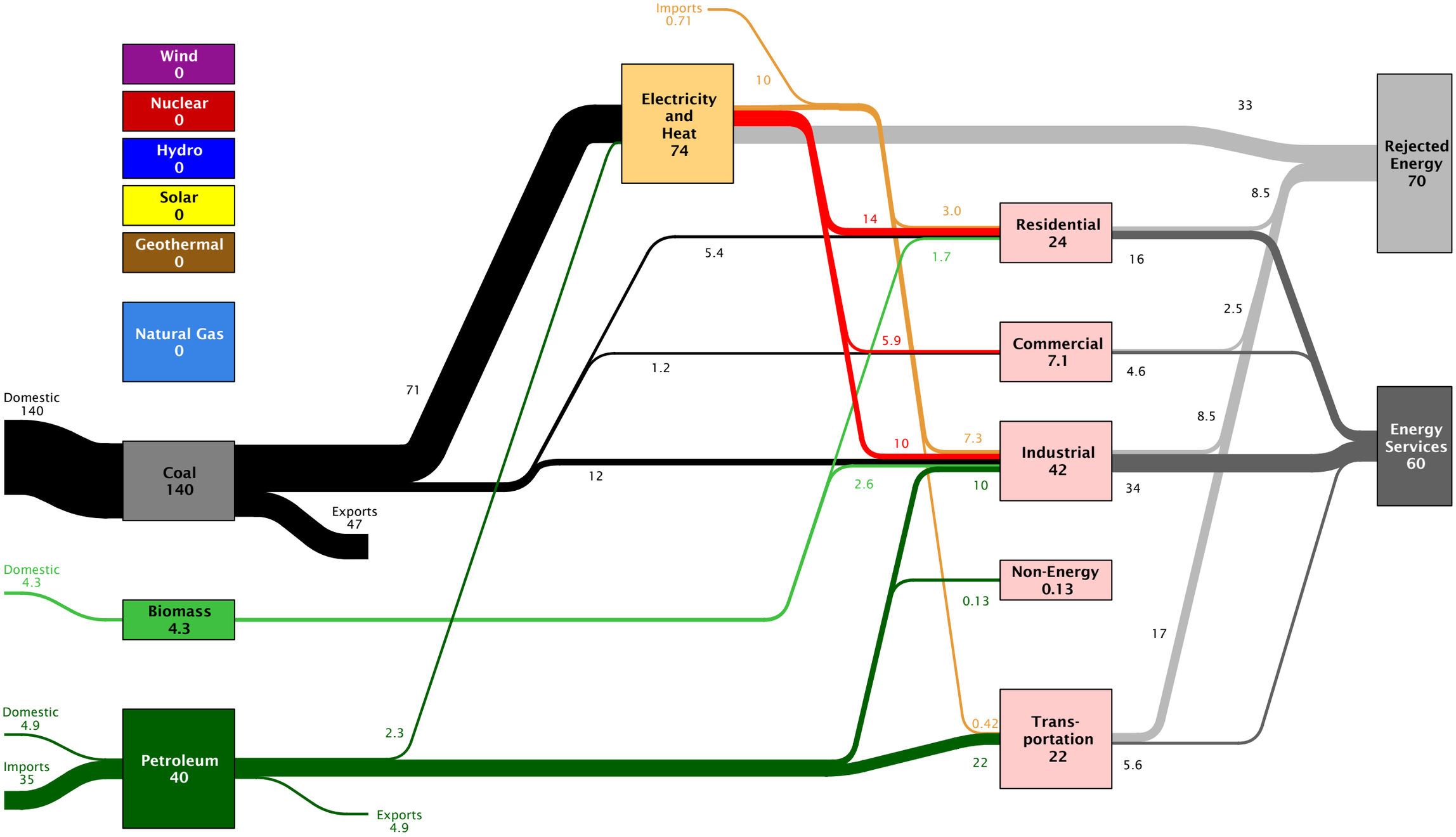
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

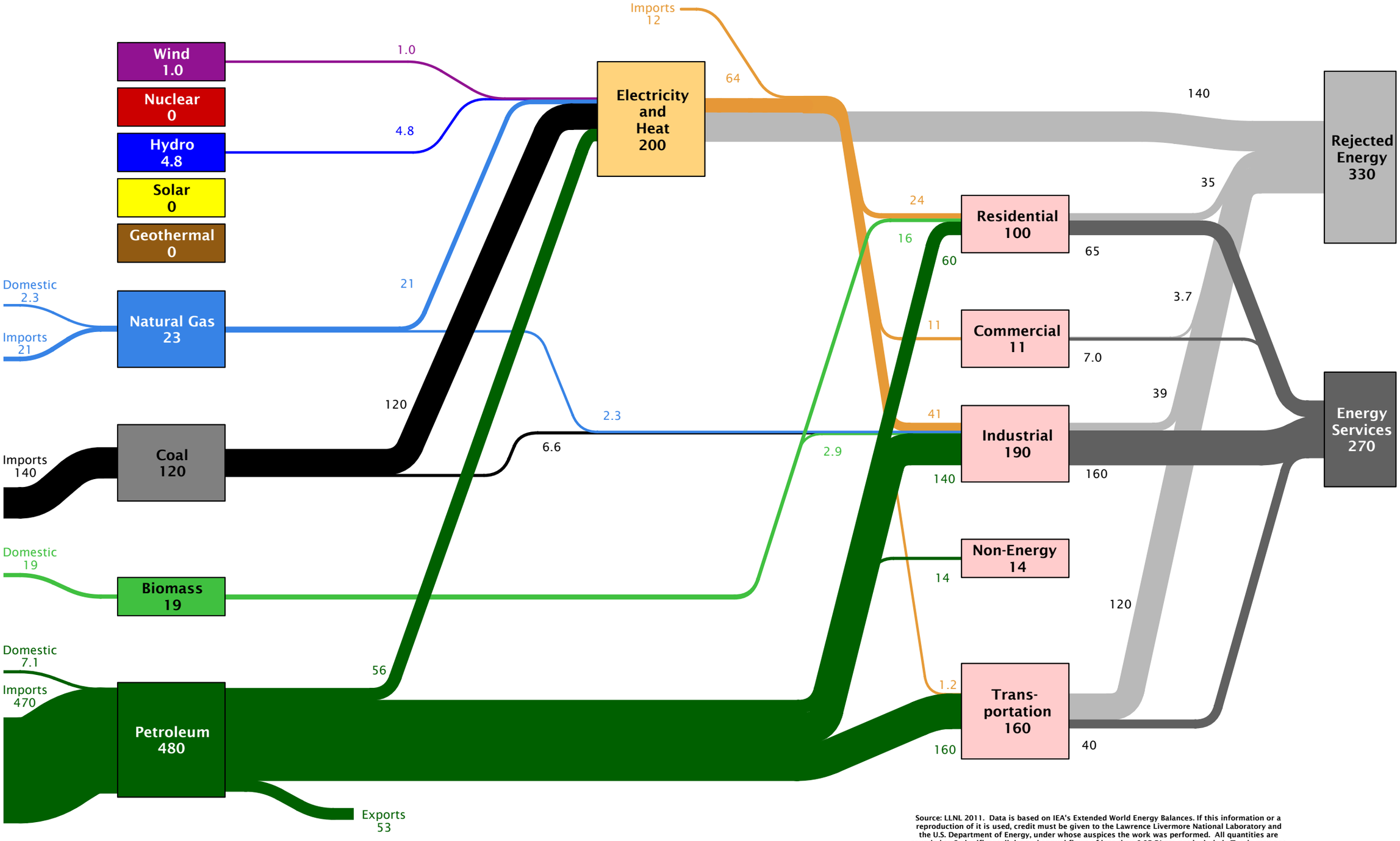
# Mongolia Energy Flow in 2007: ~130 PJ

Lawrence Livermore National Laboratory



# Morocco Energy Flow in 2007: ~610 PJ

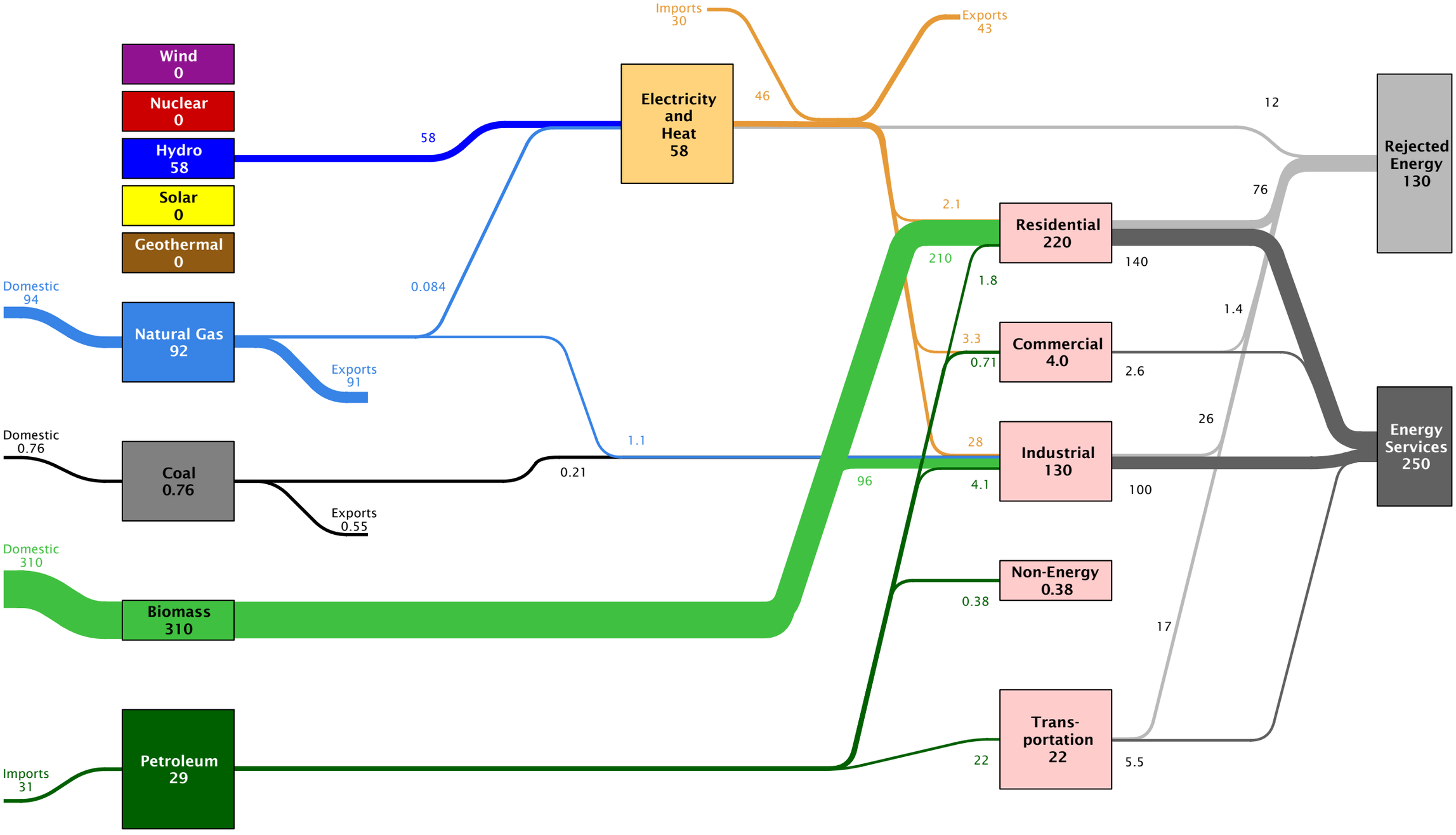
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Mozambique Energy Flow in 2007: ~380 PJ

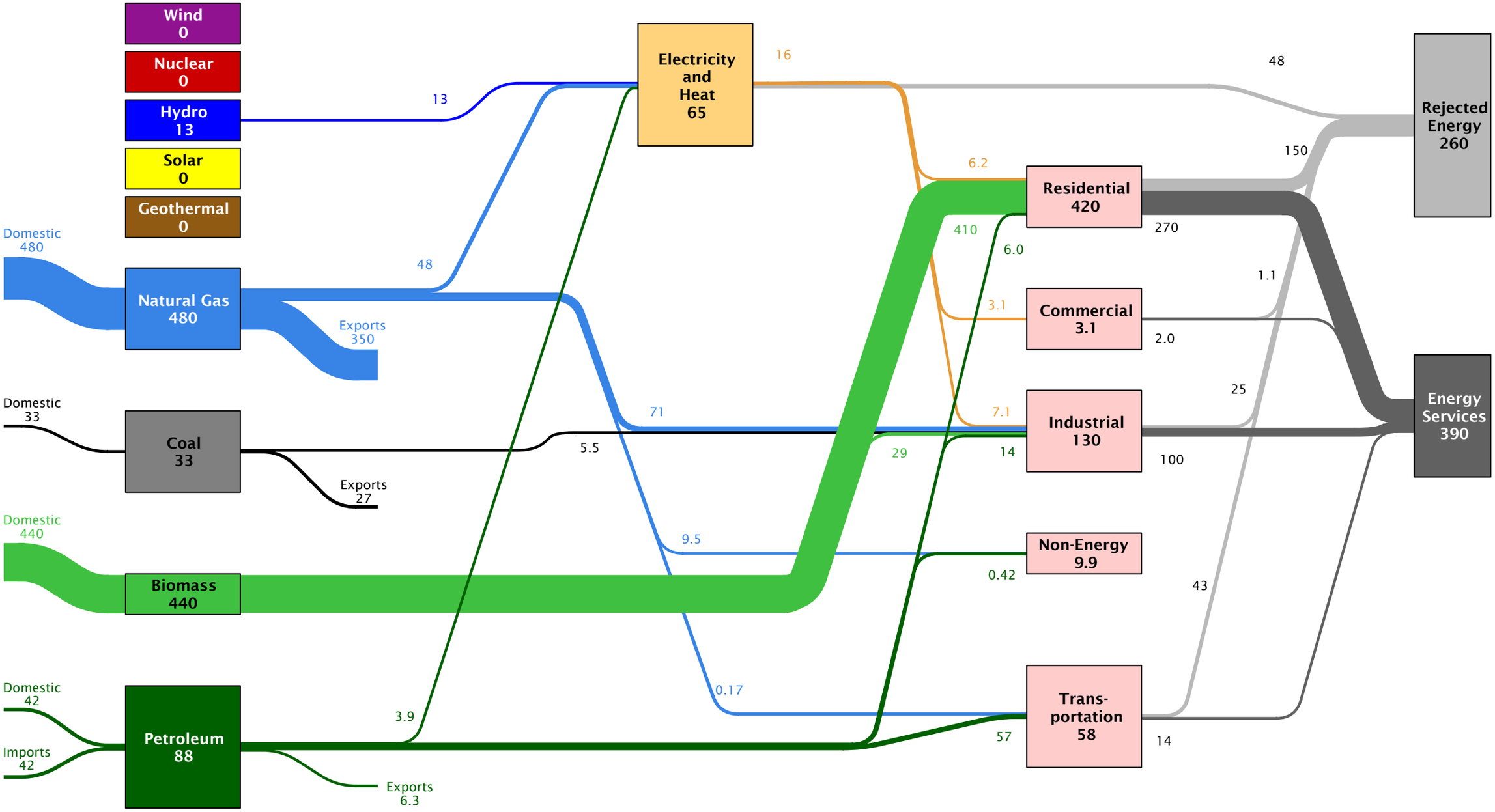
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

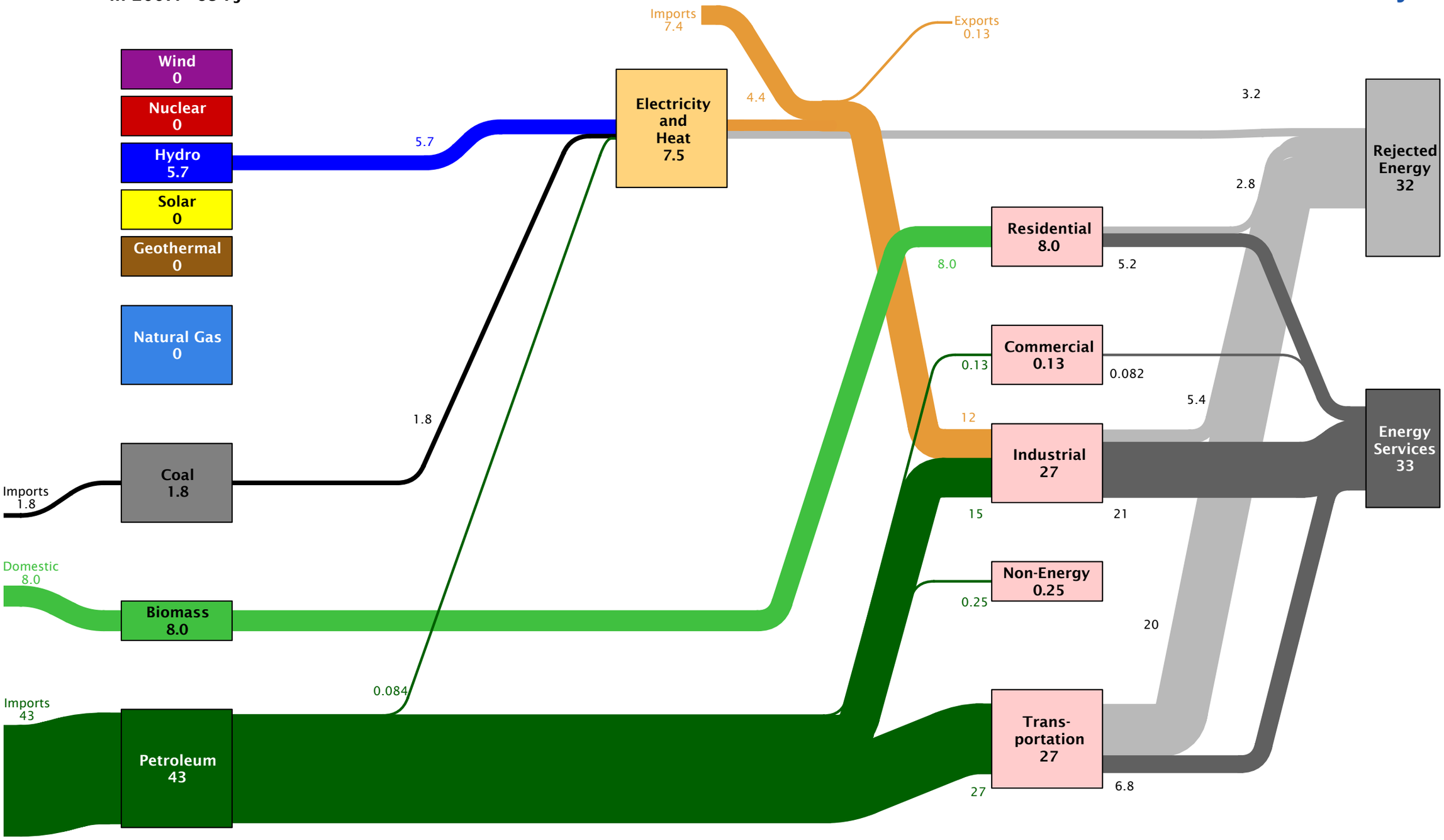
# Myanmar Energy Flow in 2007: ~660 PJ

Lawrence Livermore National Laboratory



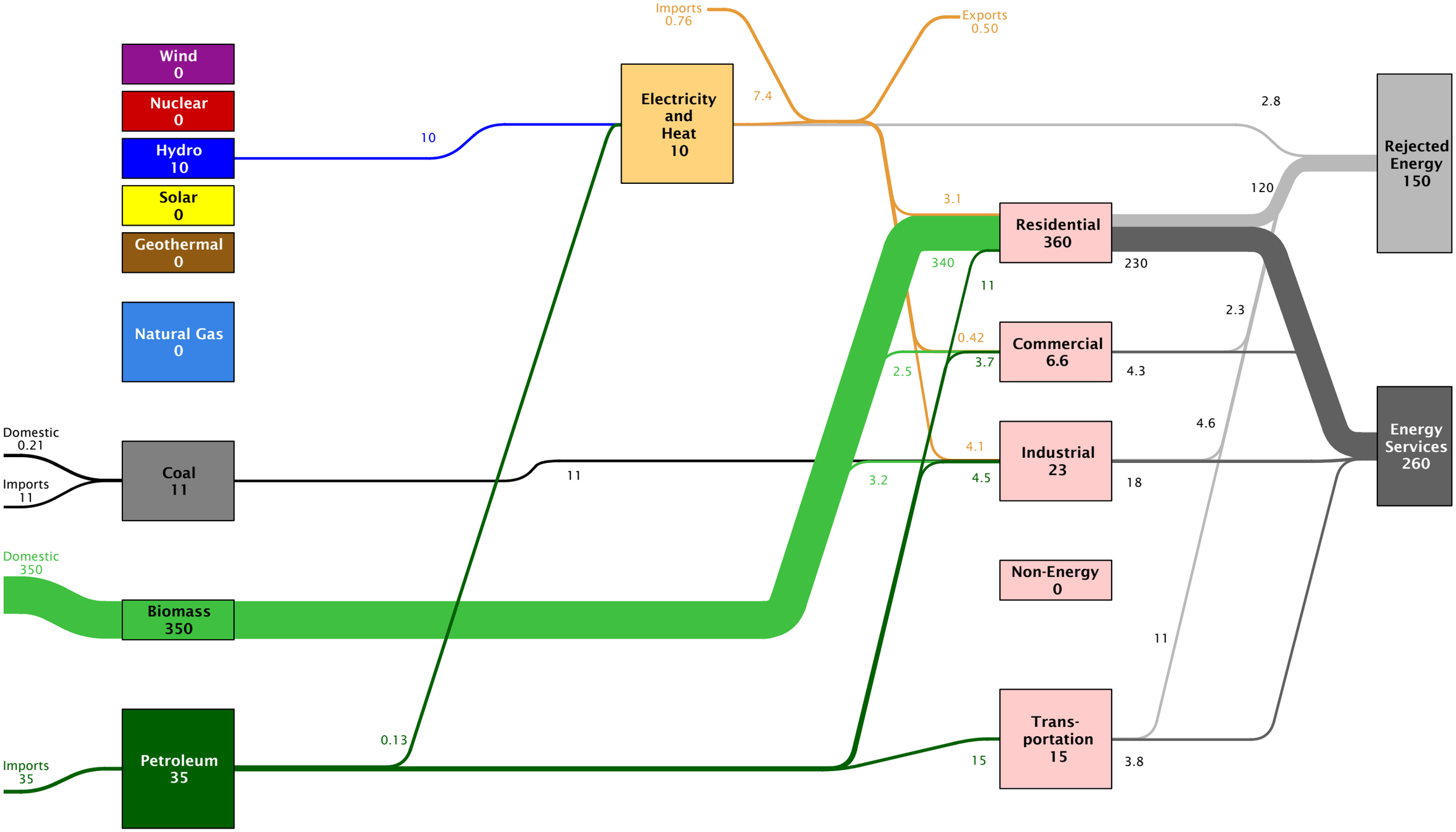
# Namibia Energy Flow in 2007: ~65 PJ

Lawrence Livermore National Laboratory



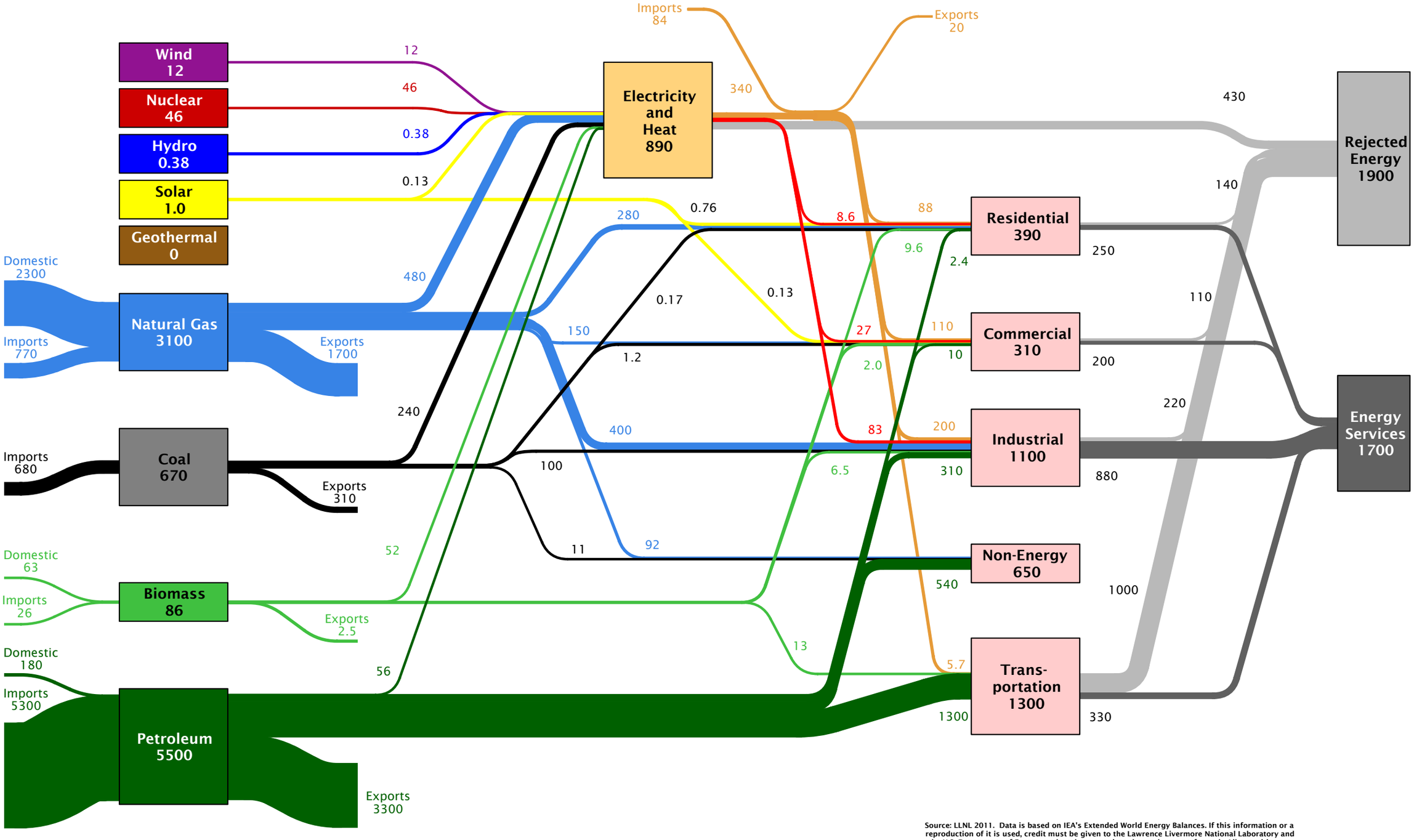
# Nepal Energy Flow in 2007: ~400 PJ

Lawrence Livermore National Laboratory



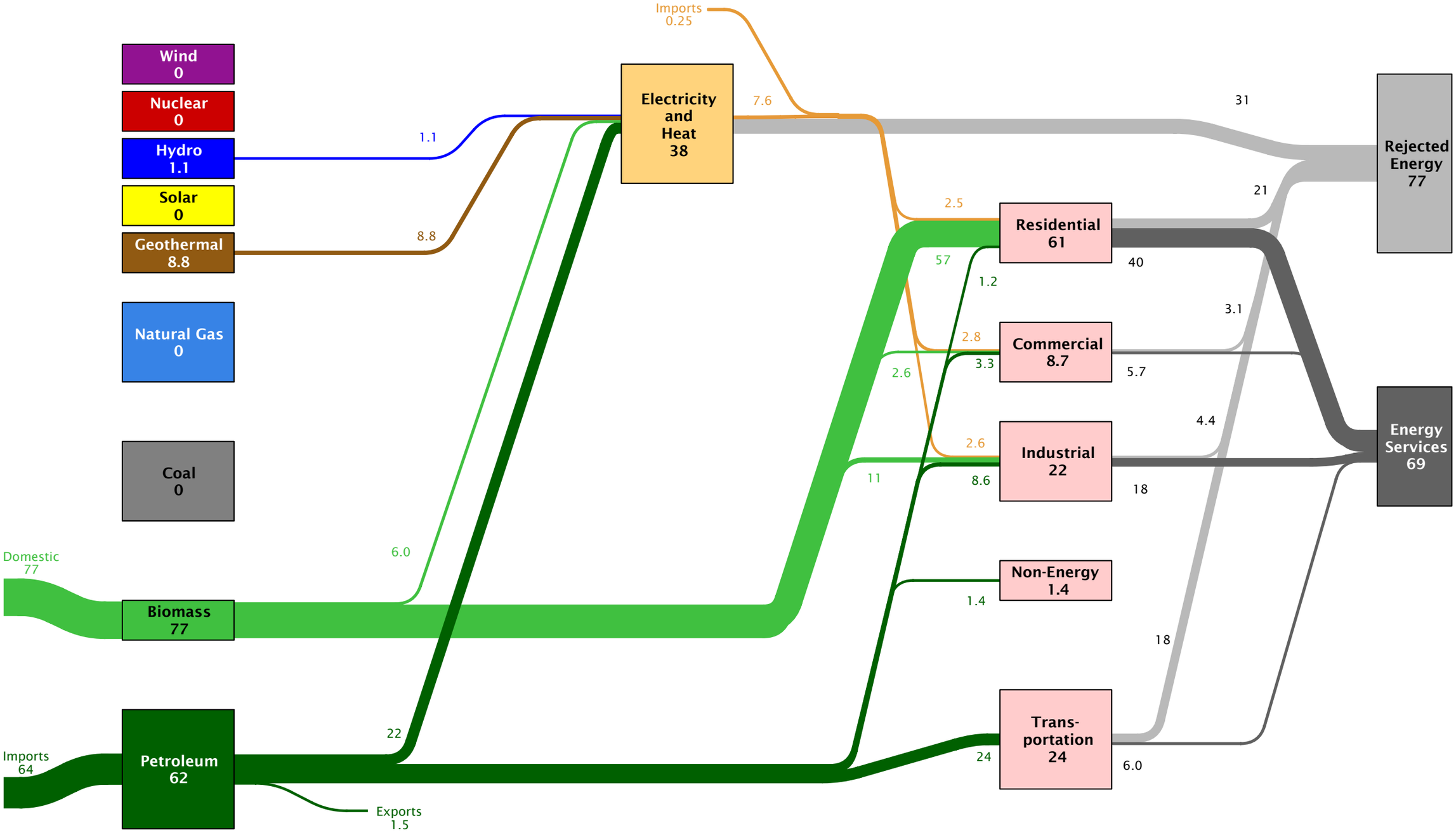
# Netherlands Energy Flow in 2007: ~4200 PJ

Lawrence Livermore National Laboratory



# Nicaragua Energy Flow in 2007: ~150 PJ

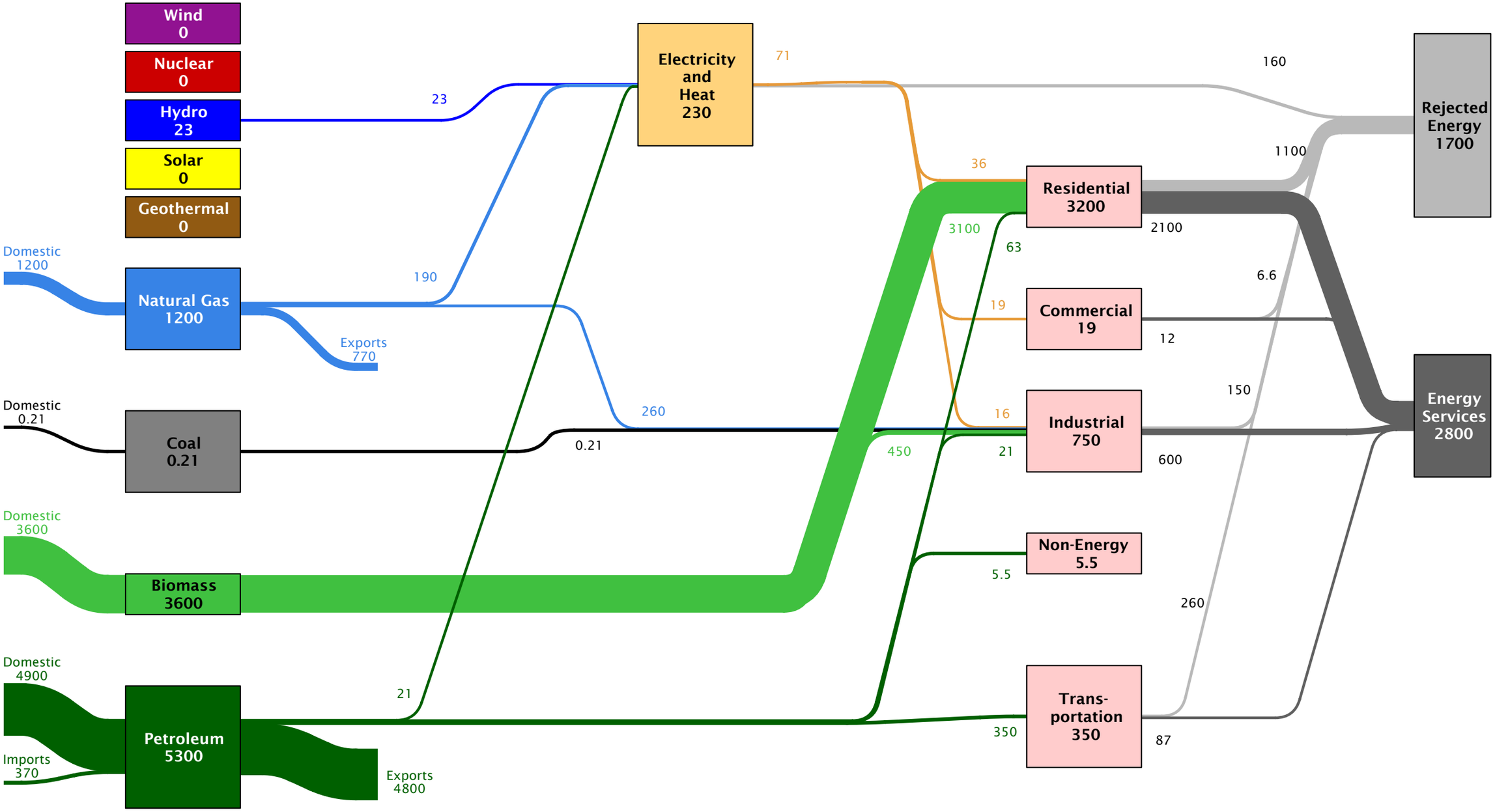
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

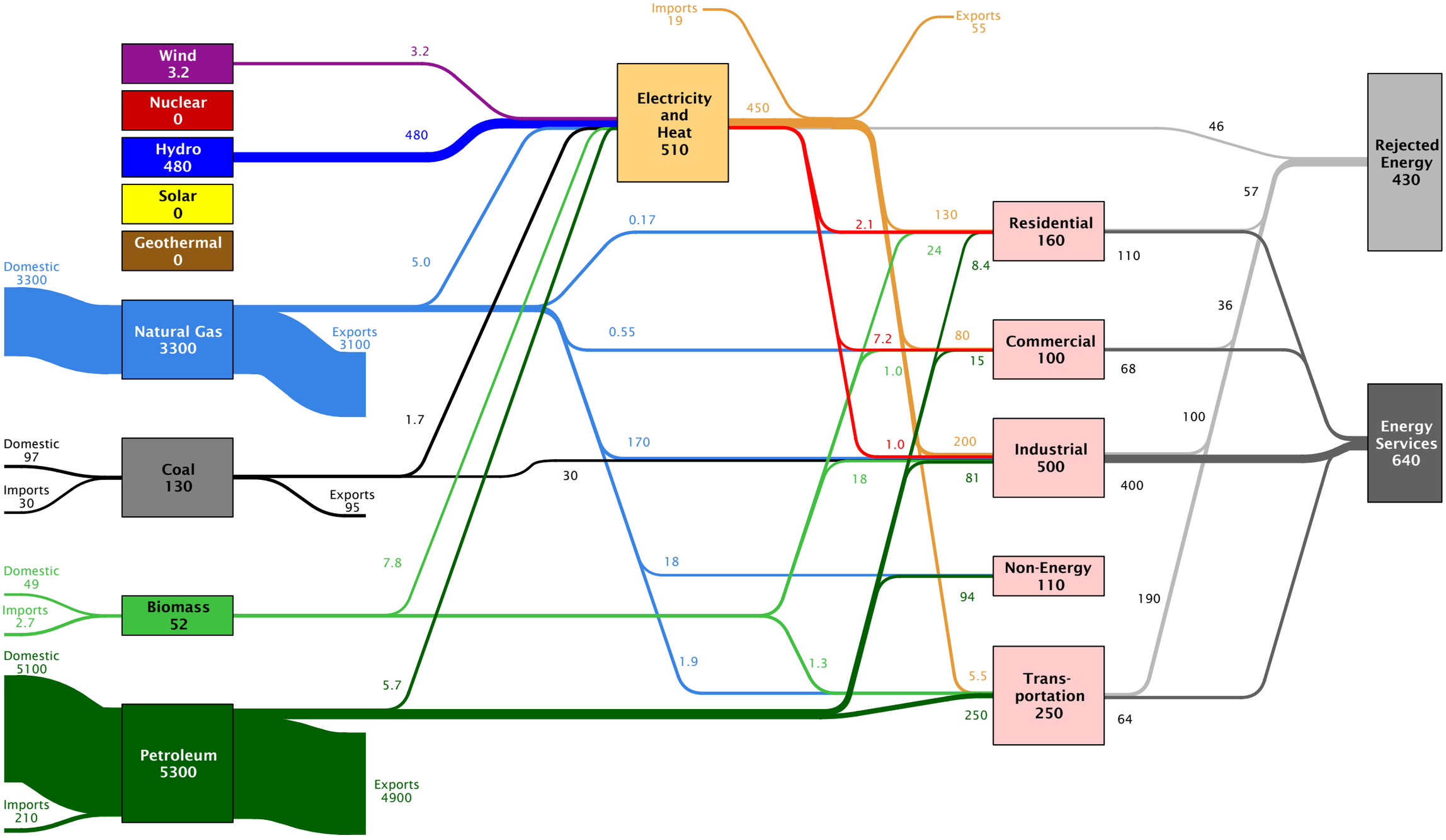
# Nigeria Energy Flow in 2007: ~4500 PJ

Lawrence Livermore National Laboratory



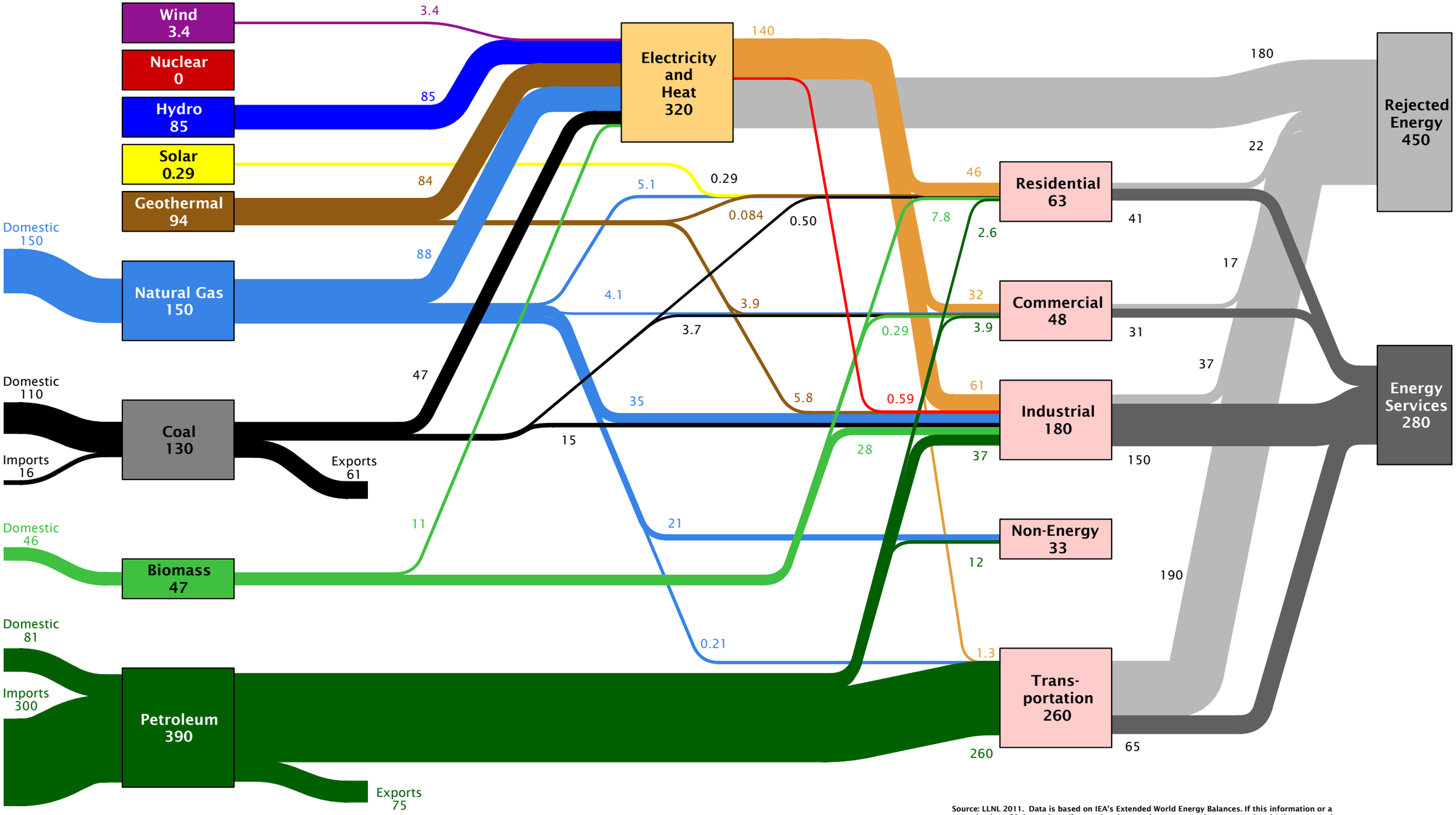
# Norway Energy Flow in 2007: ~1200 PJ

Lawrence Livermore National Laboratory



# New Zealand Energy Flow in 2007: ~760 PJ

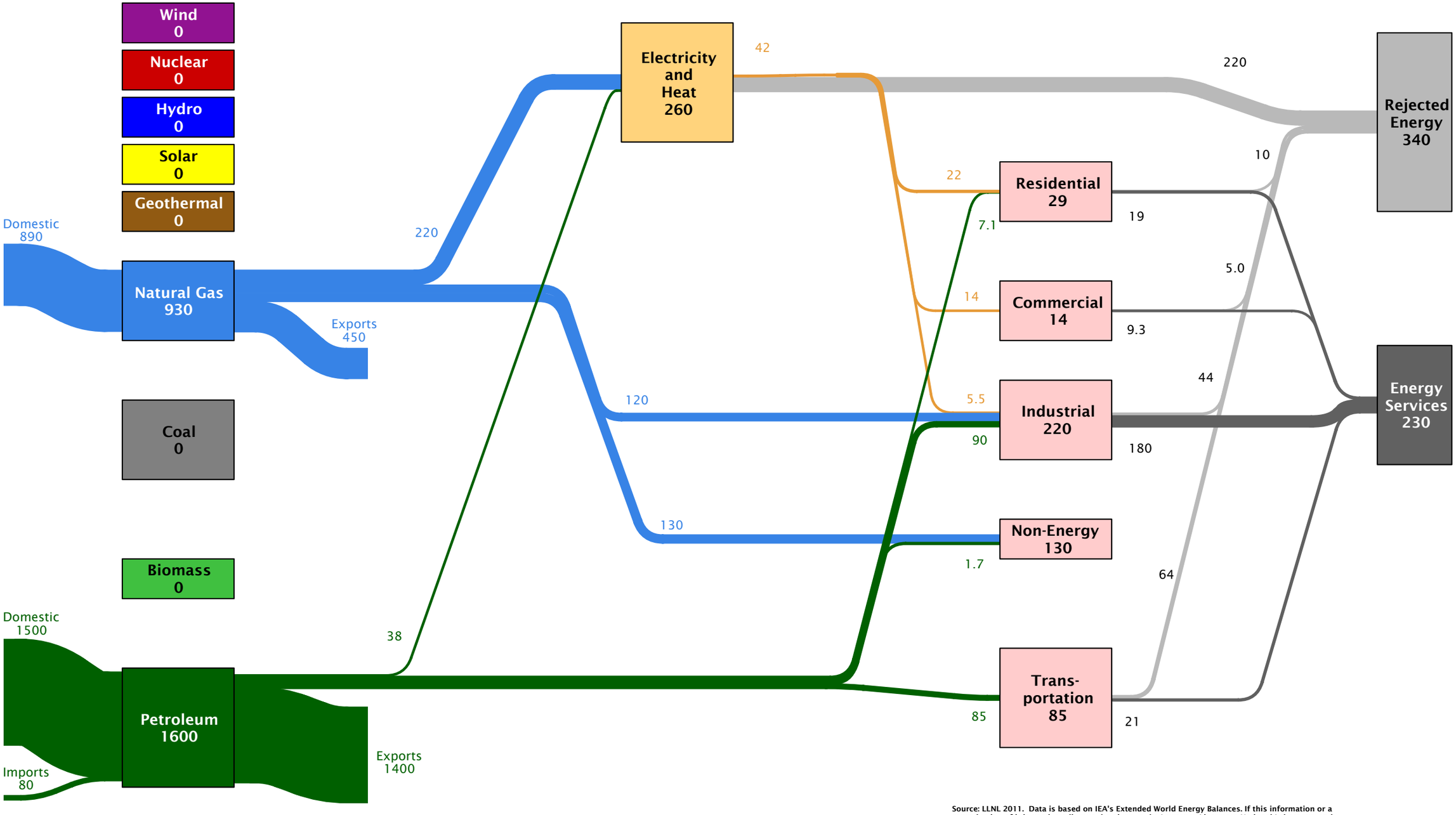
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

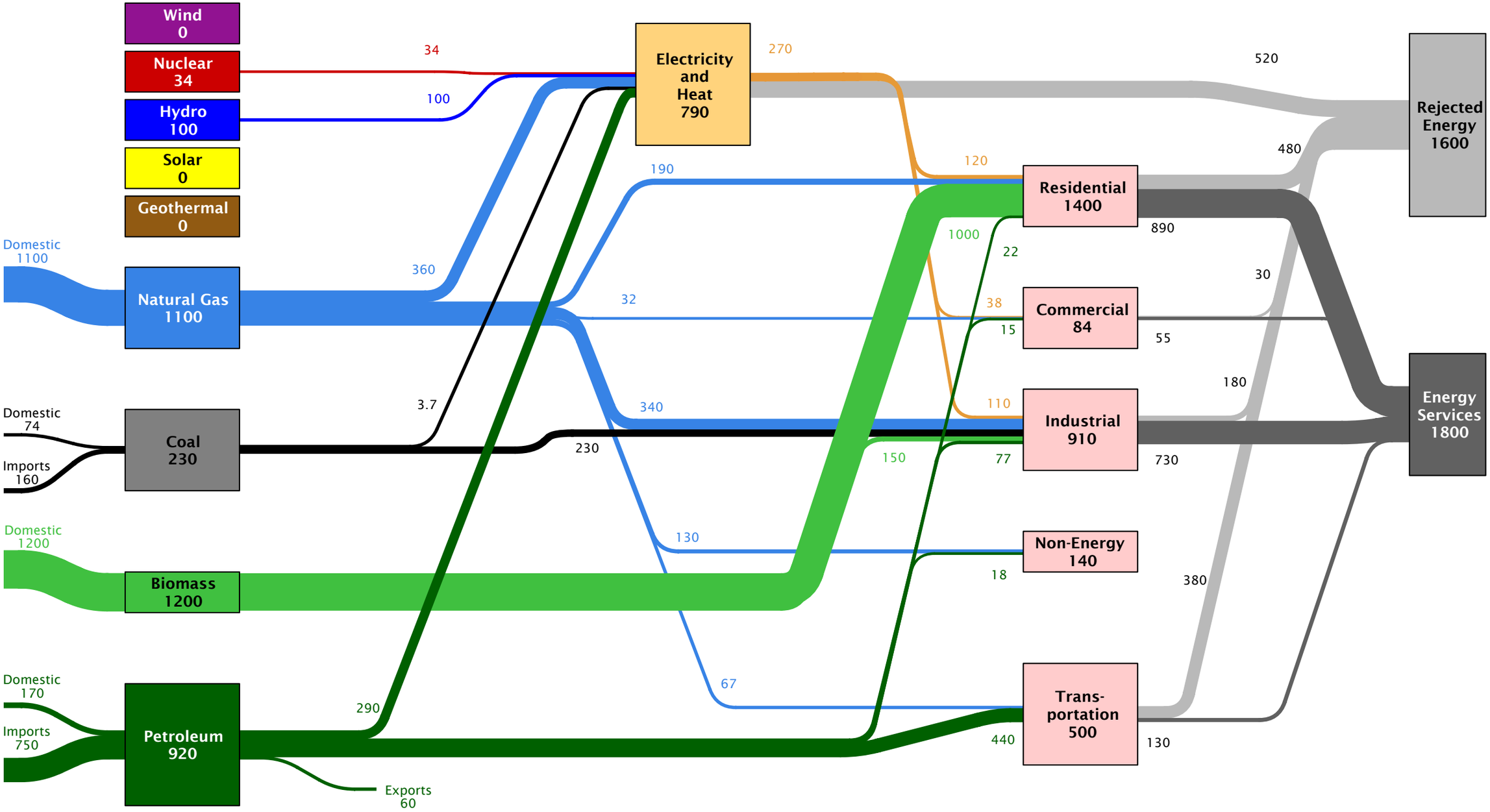
# Oman Energy Flow in 2007: ~700 PJ

Lawrence Livermore National Laboratory



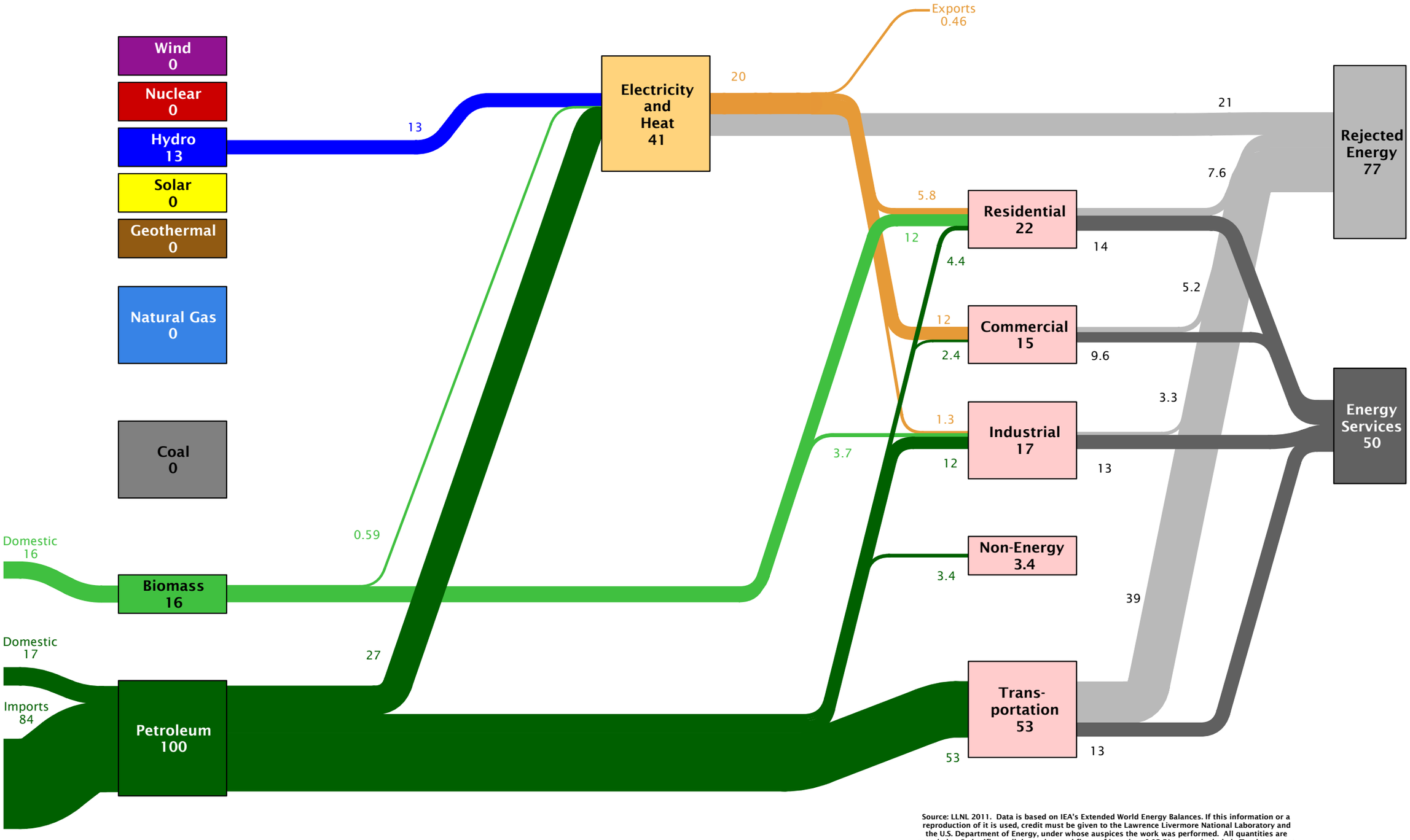
# Pakistan Energy Flow in 2007: ~3500 PJ

Lawrence Livermore National Laboratory



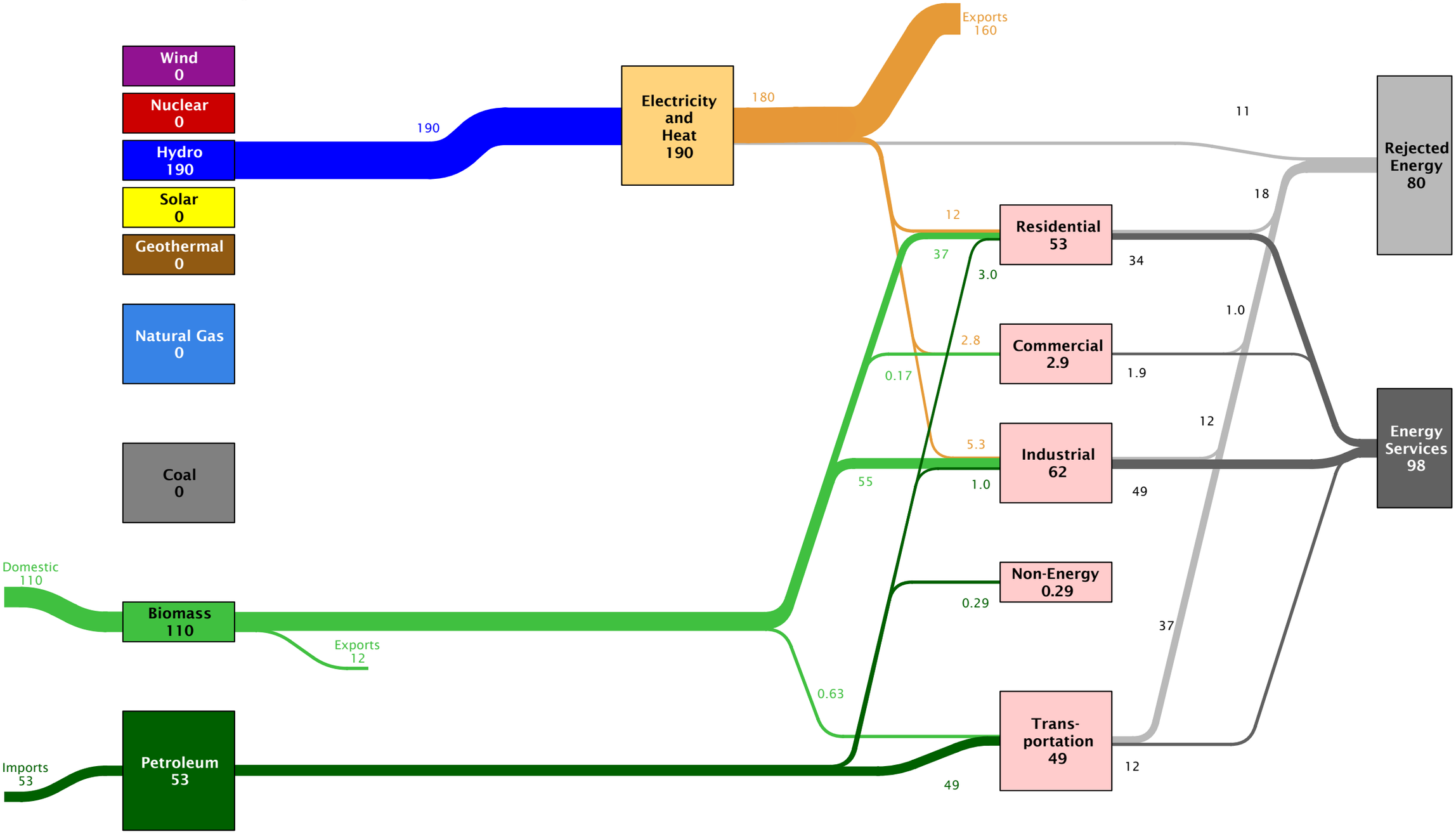
# Panama Energy Flow in 2007: ~130 PJ

Lawrence Livermore National Laboratory



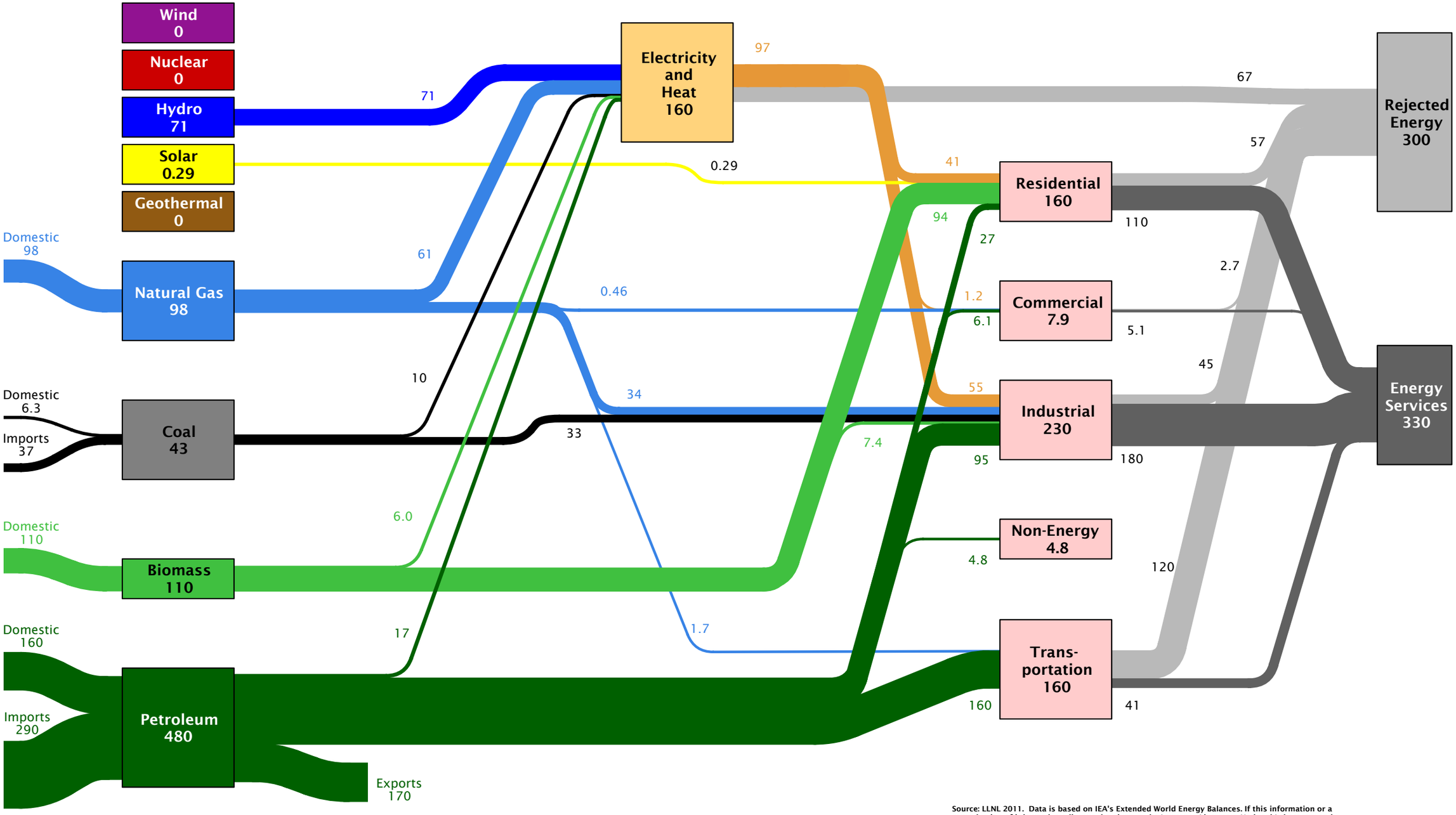
# Paraguay Energy Flow in 2007: ~180 PJ

Lawrence Livermore National Laboratory



# Peru Energy Flow in 2007: ~630 PJ

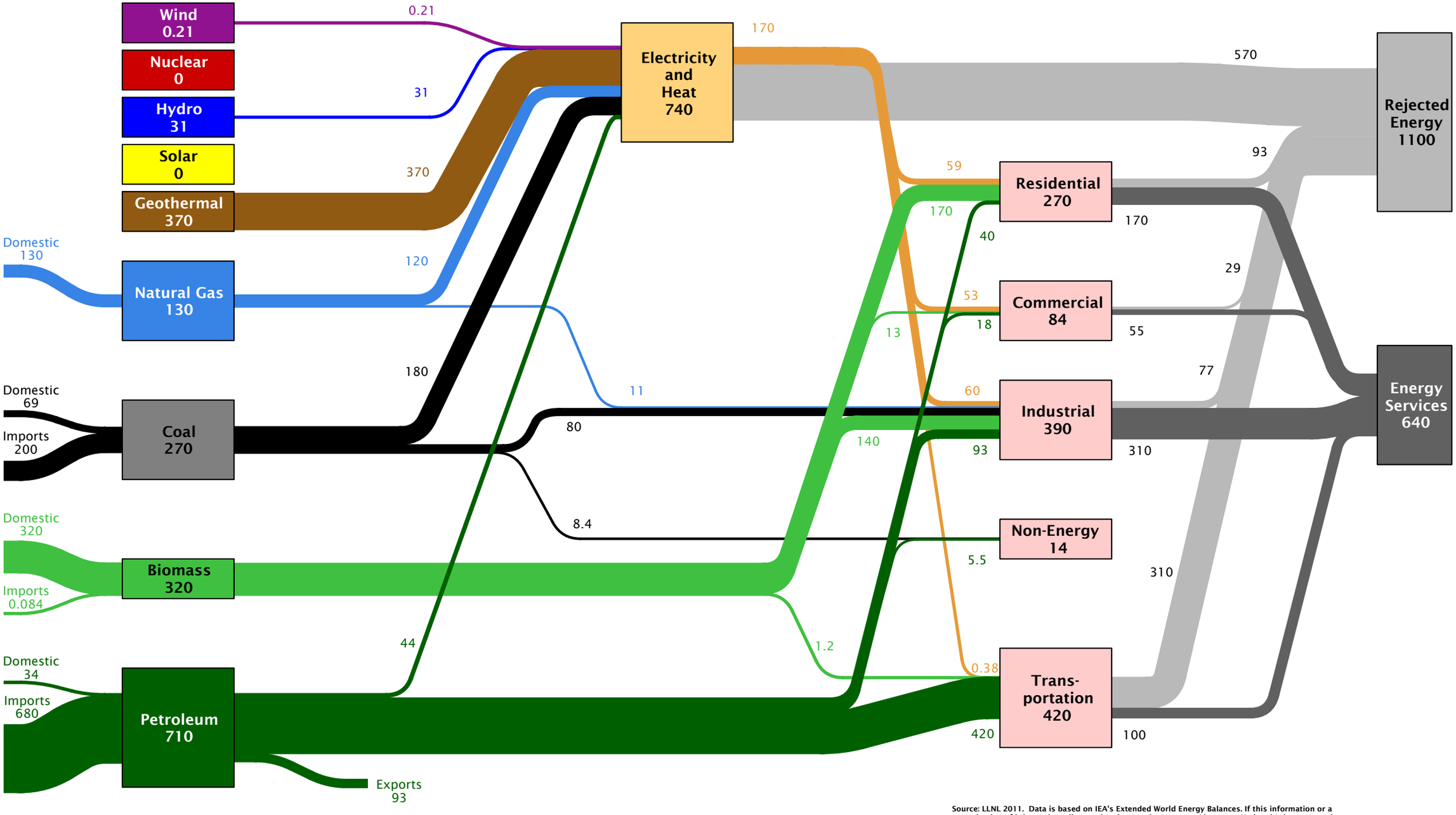
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

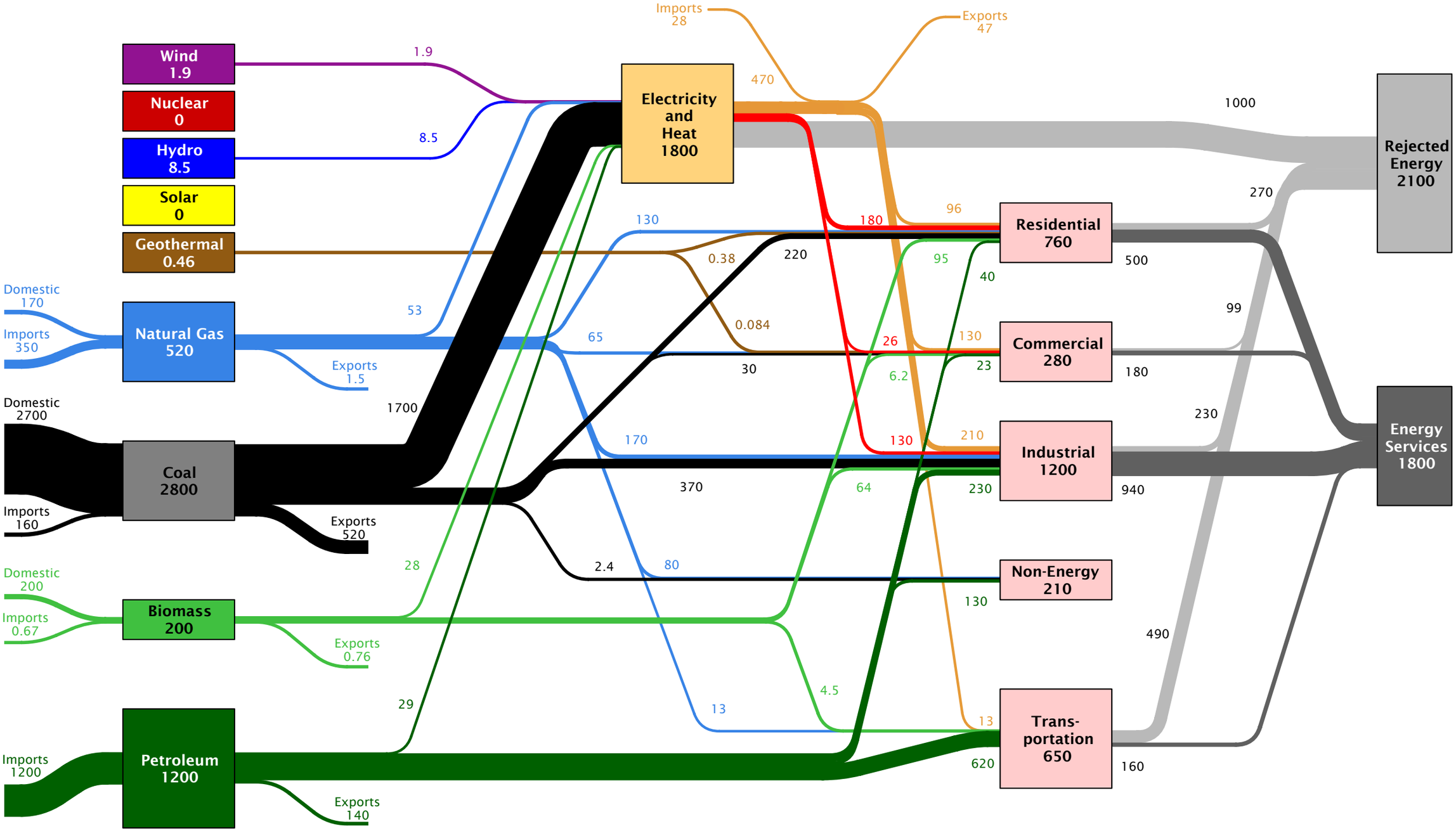
# Philippines Energy Flow in 2007: ~1700 PJ

Lawrence Livermore National Laboratory



# Poland Energy Flow in 2007: ~4100 PJ

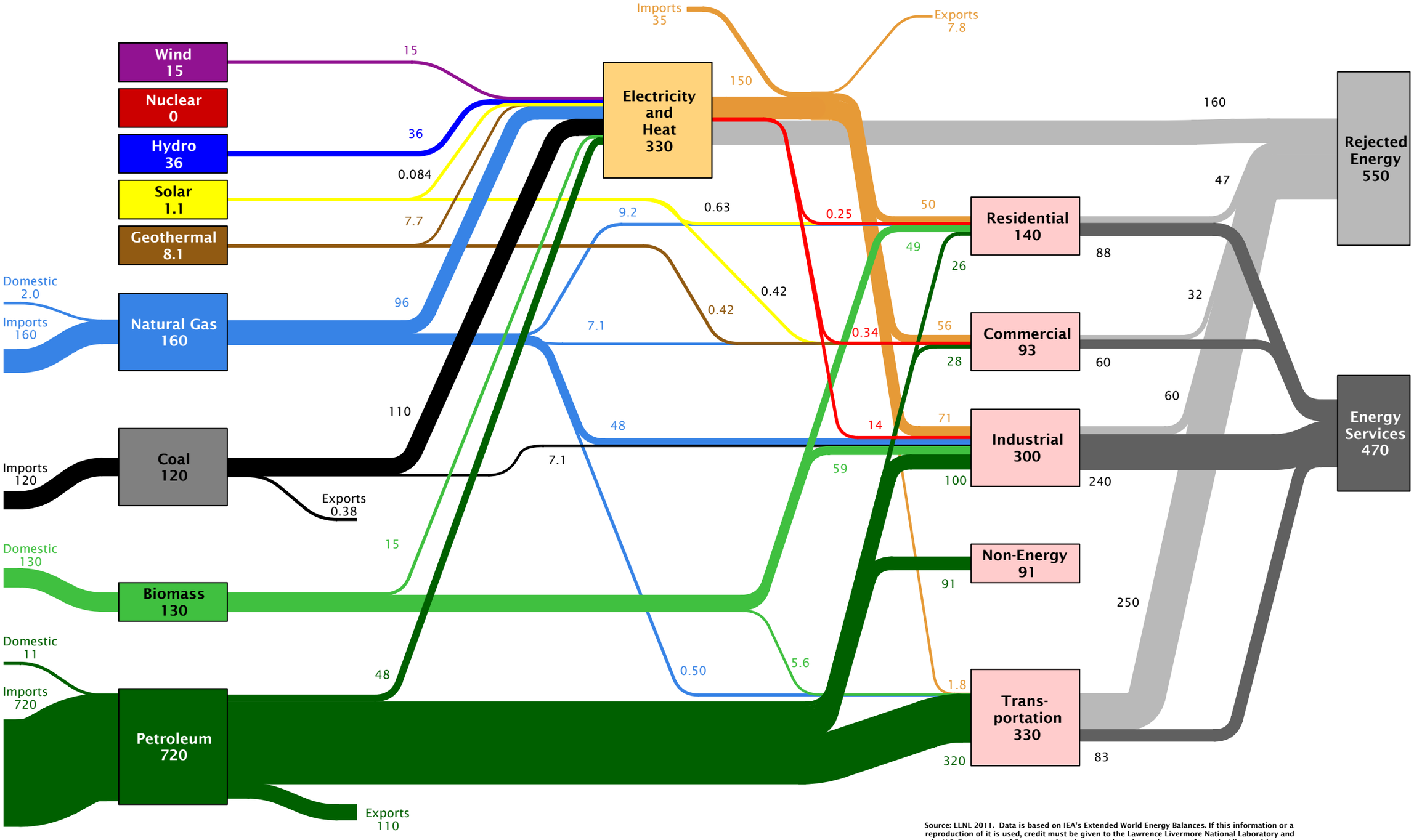
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Portugal Energy Flow in 2007: ~1100 PJ

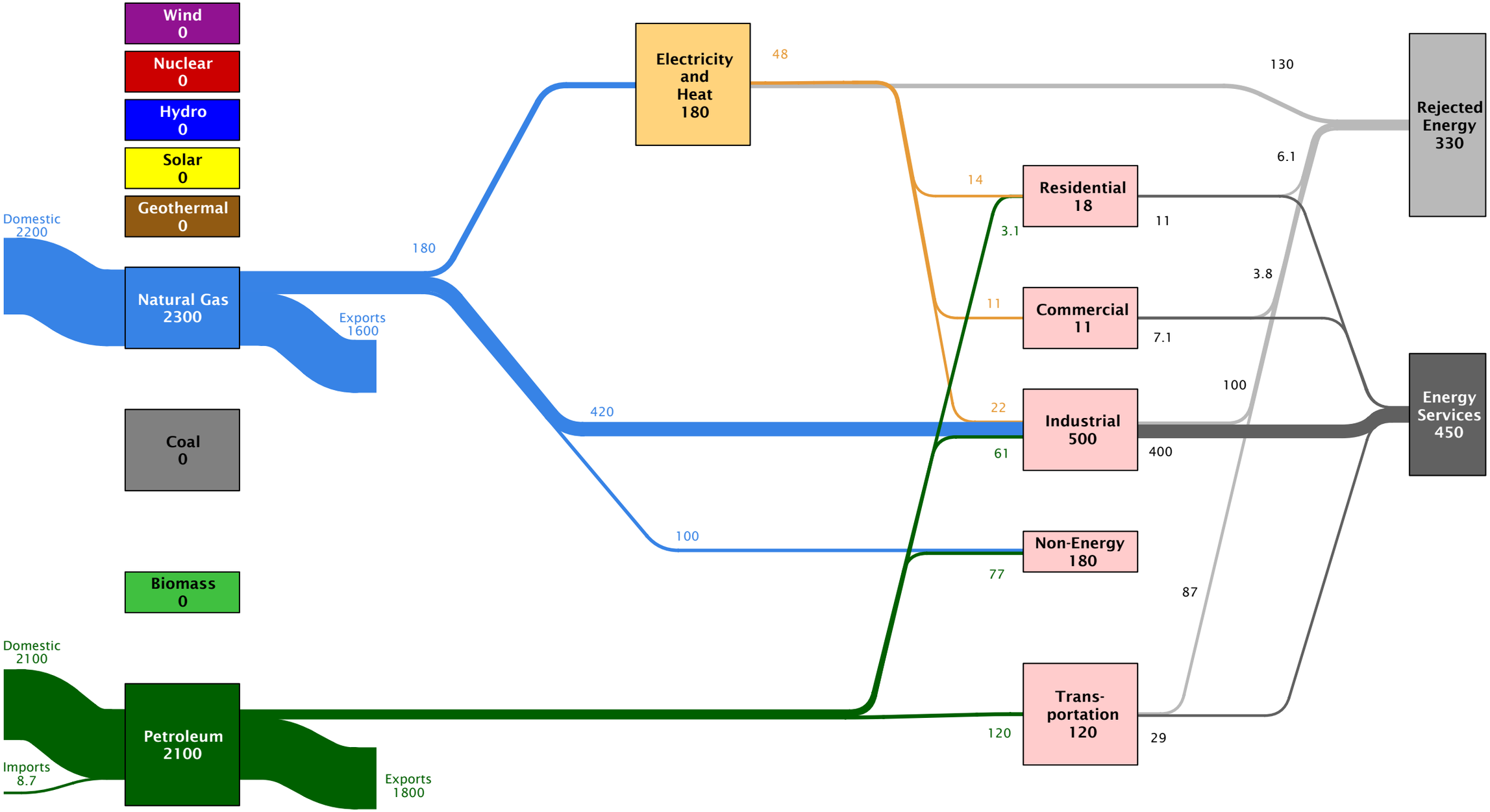
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

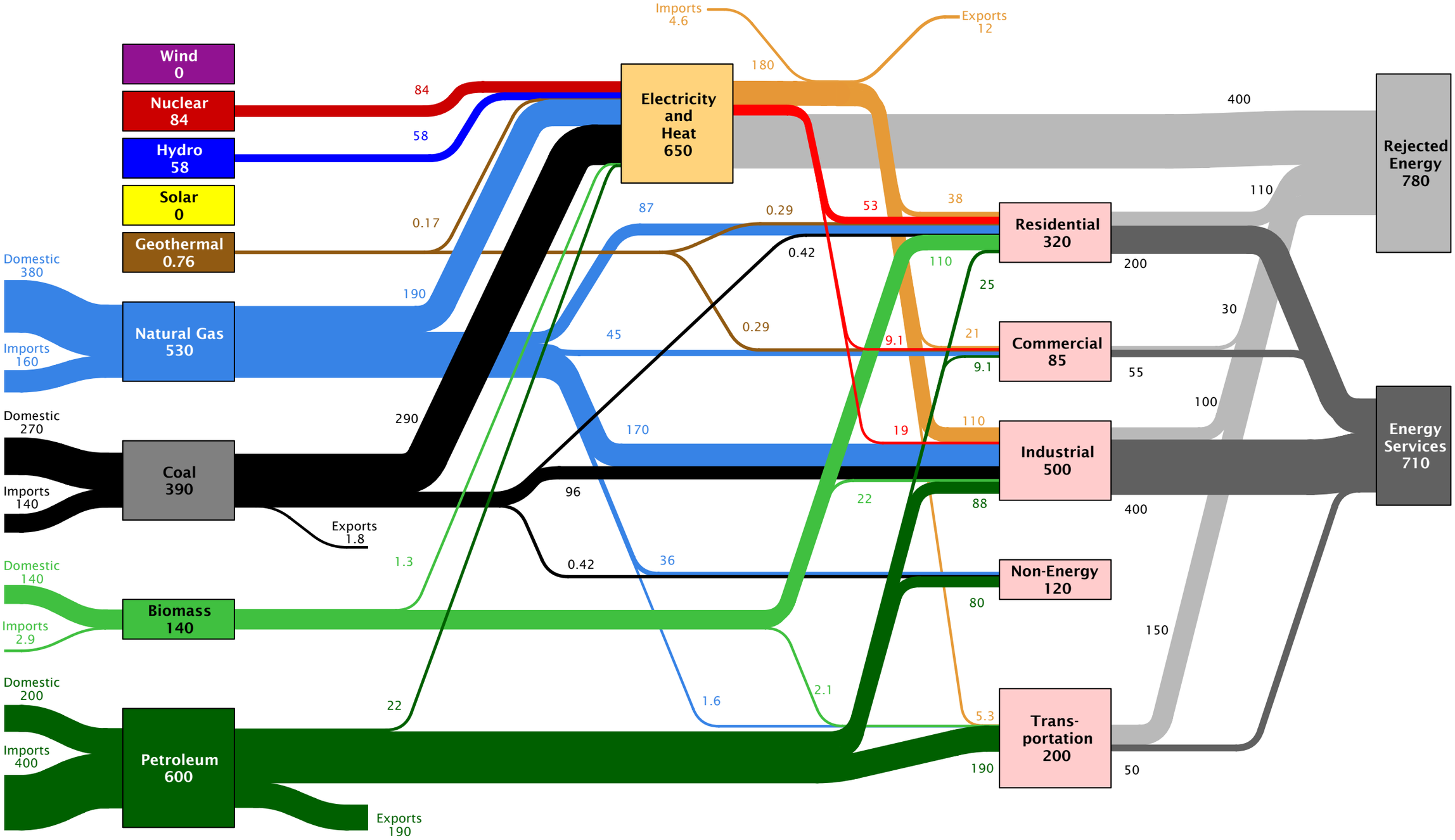
# Qatar Energy Flow in 2007: ~960 PJ

Lawrence Livermore National Laboratory



# Romania Energy Flow in 2007: ~1600 PJ

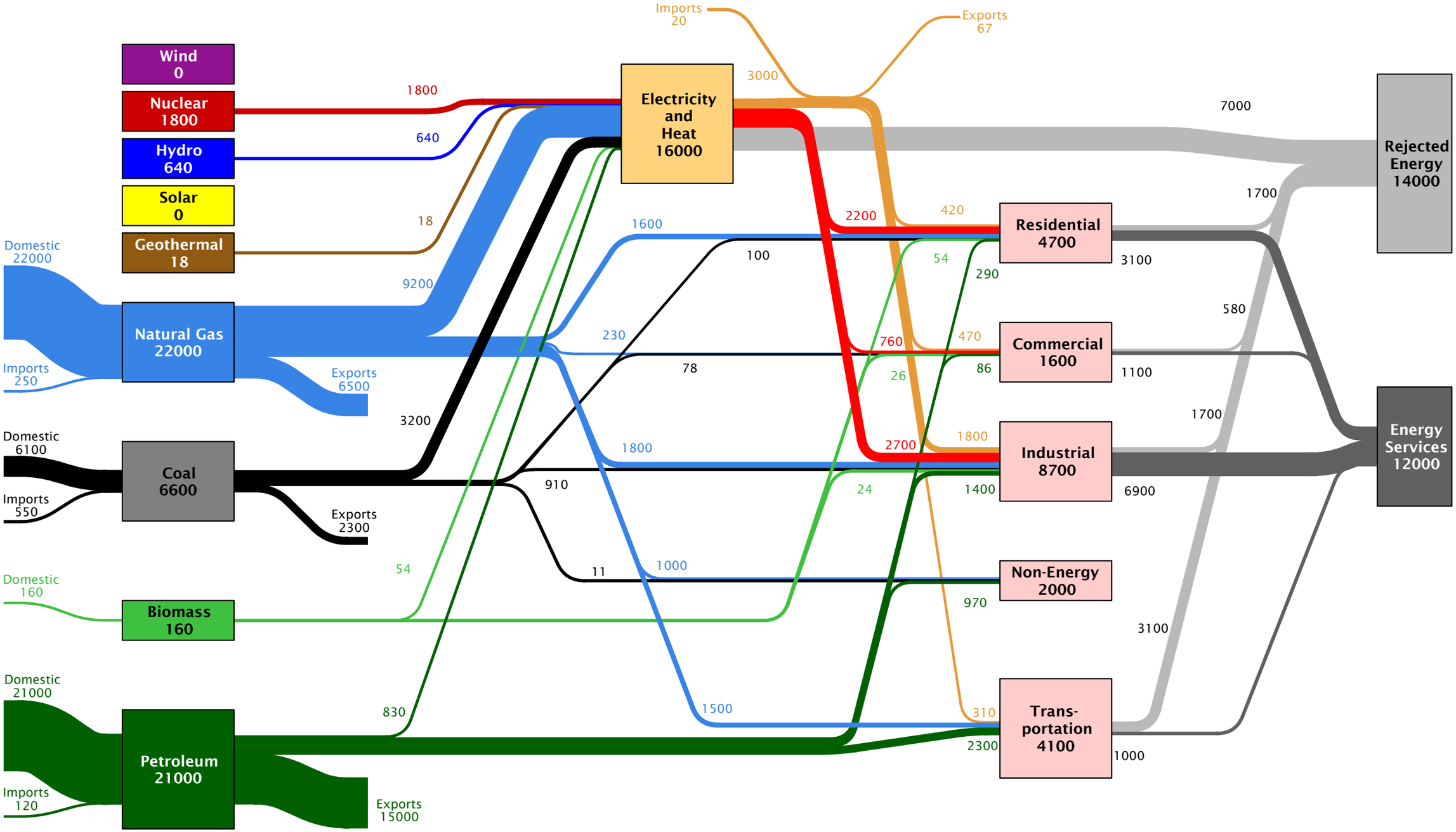
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

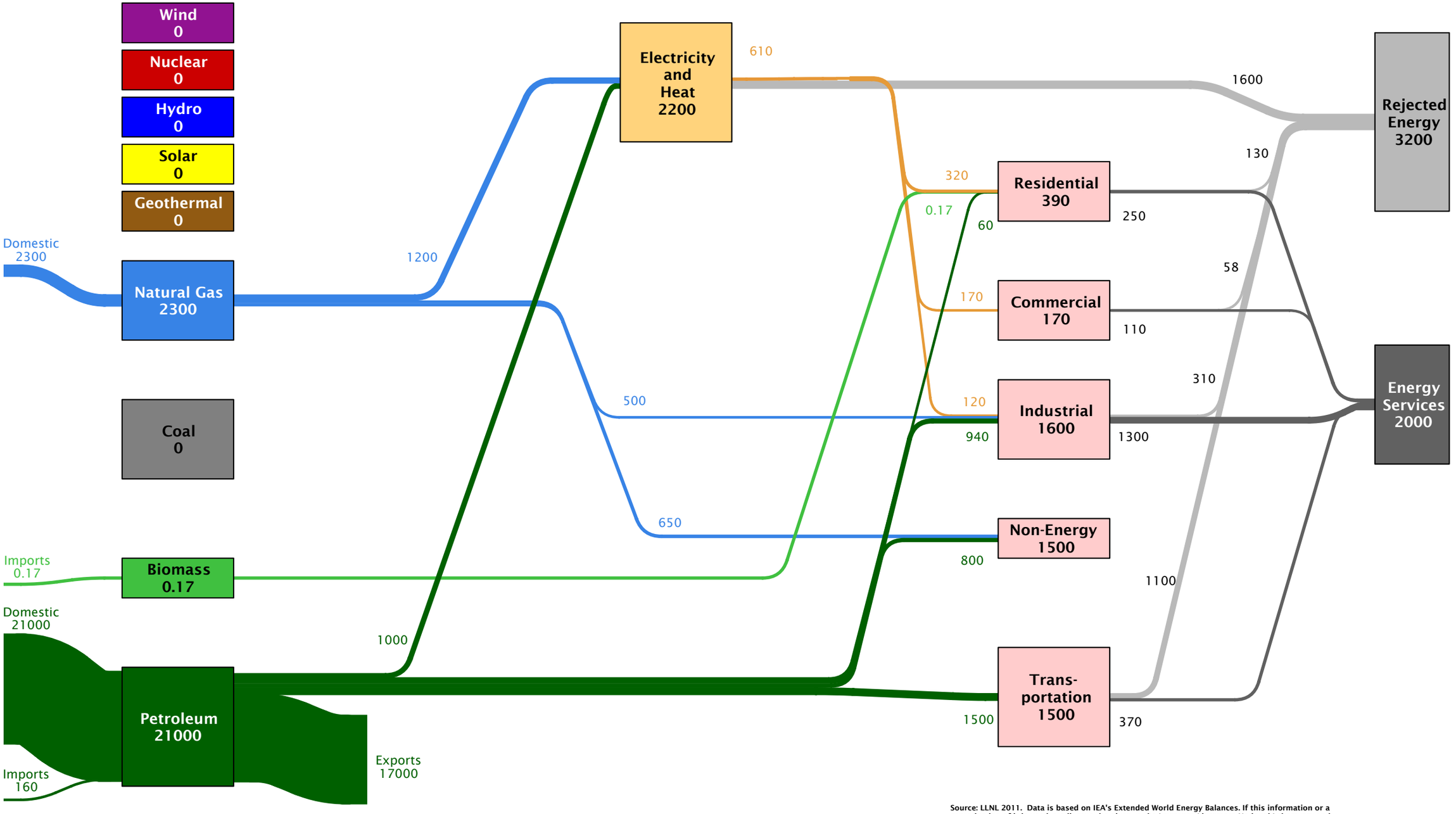
# Russian Federation Energy Flow in 2007: ~28000 PJ

Lawrence Livermore National Laboratory



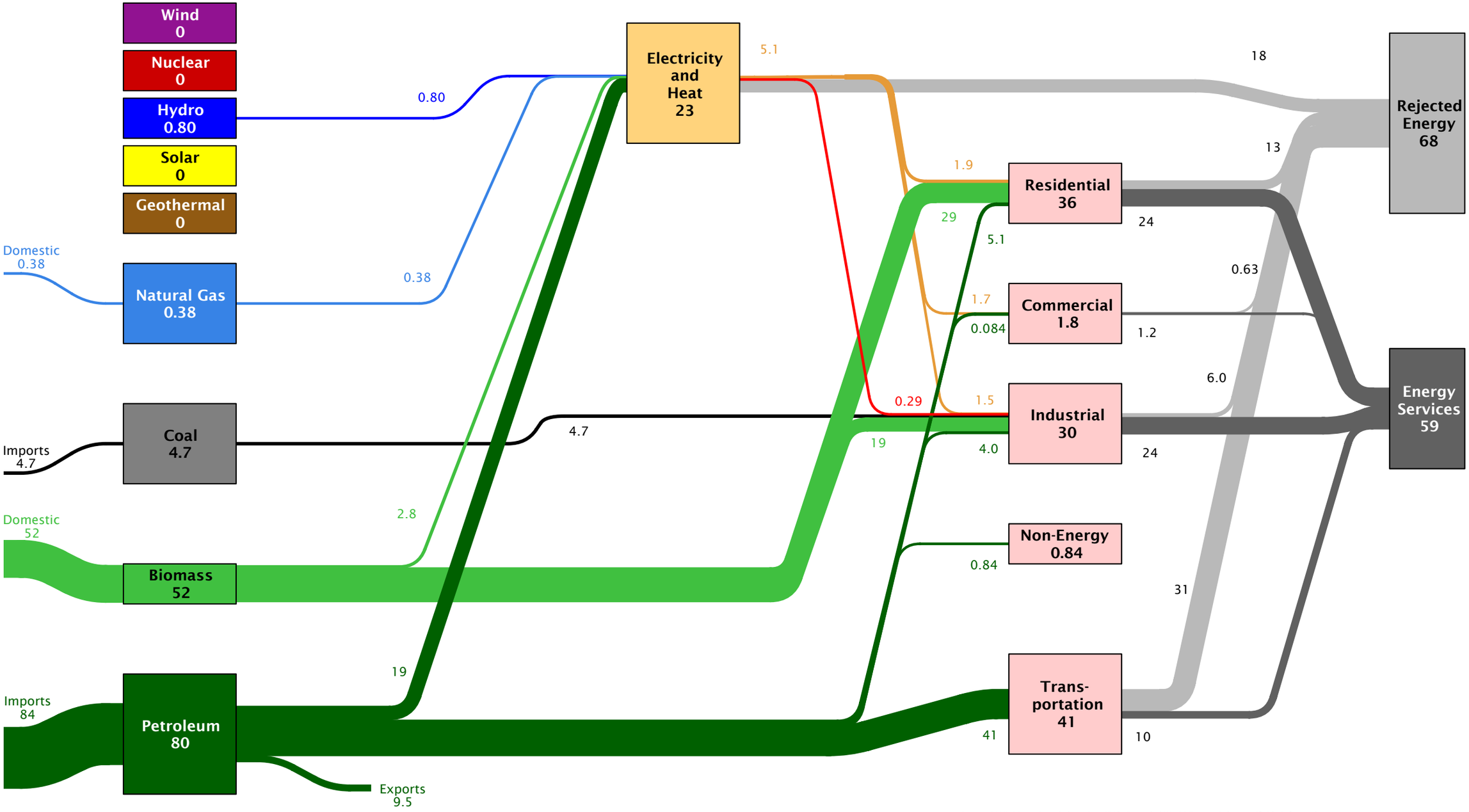
# Saudi Arabia Energy Flow in 2007: ~6600 PJ

Lawrence Livermore National Laboratory



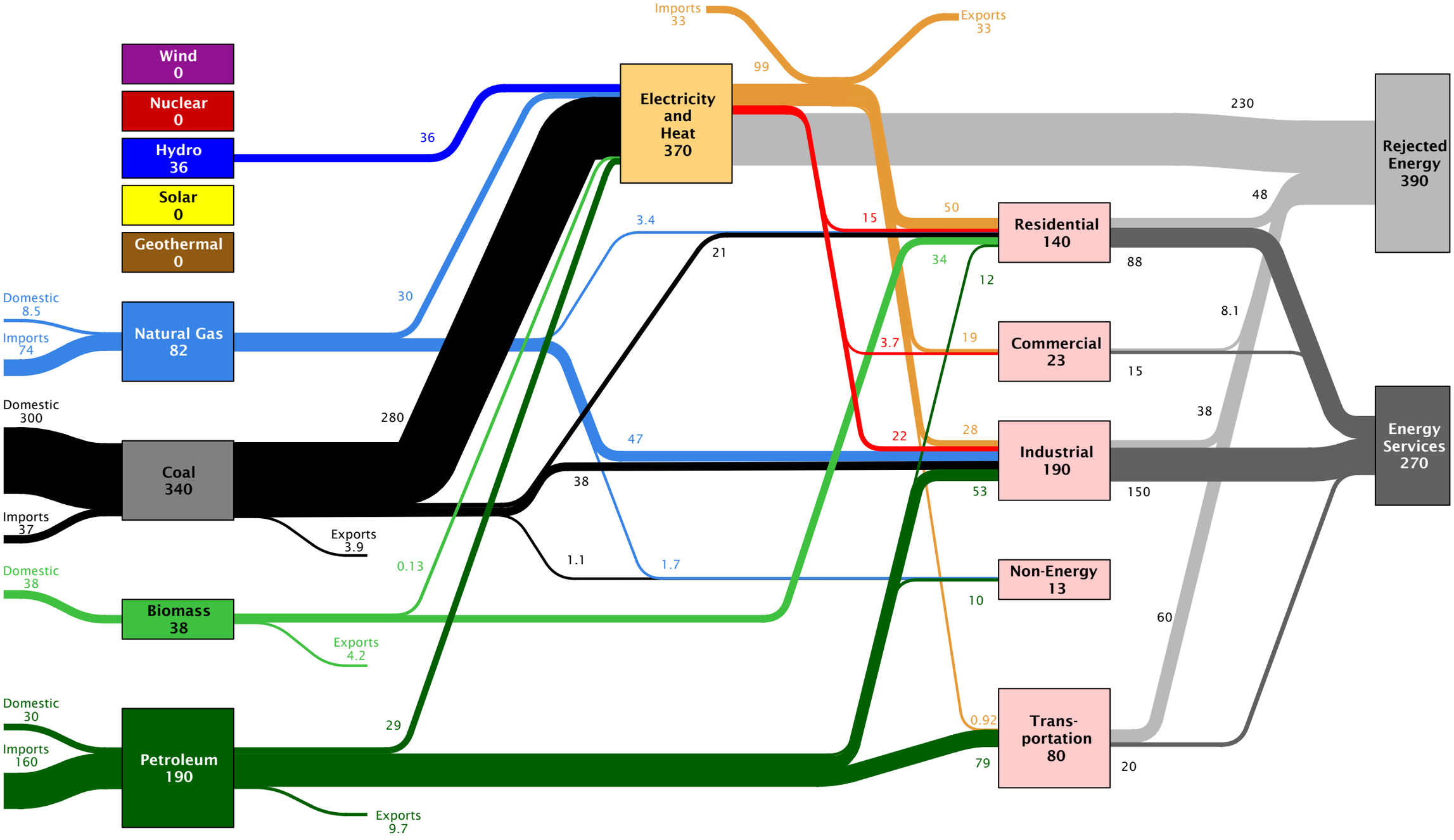
# Senegal Energy Flow in 2007: ~130 PJ

Lawrence Livermore National Laboratory



# Serbia Energy Flow in 2007: ~680 PJ

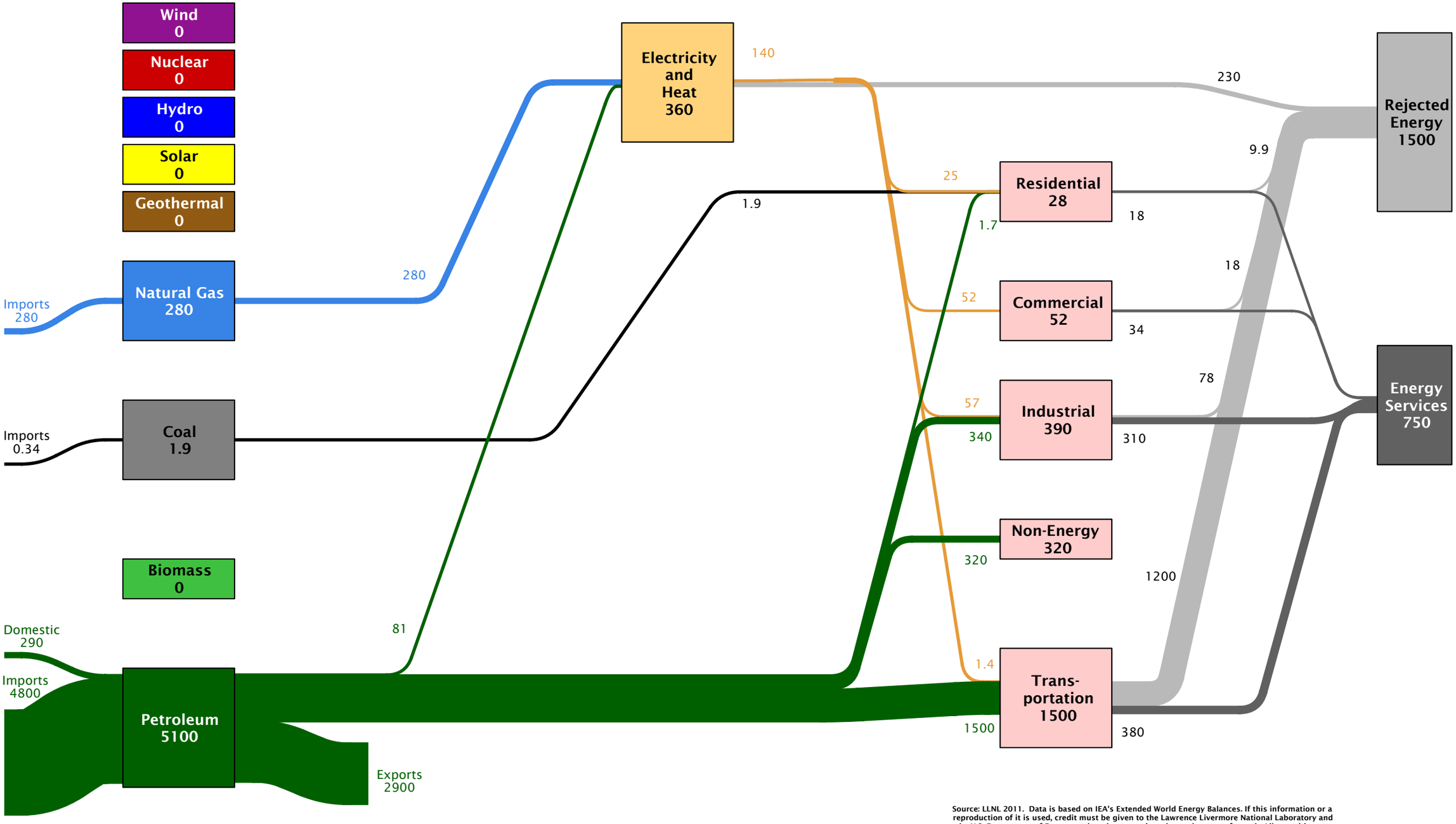
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

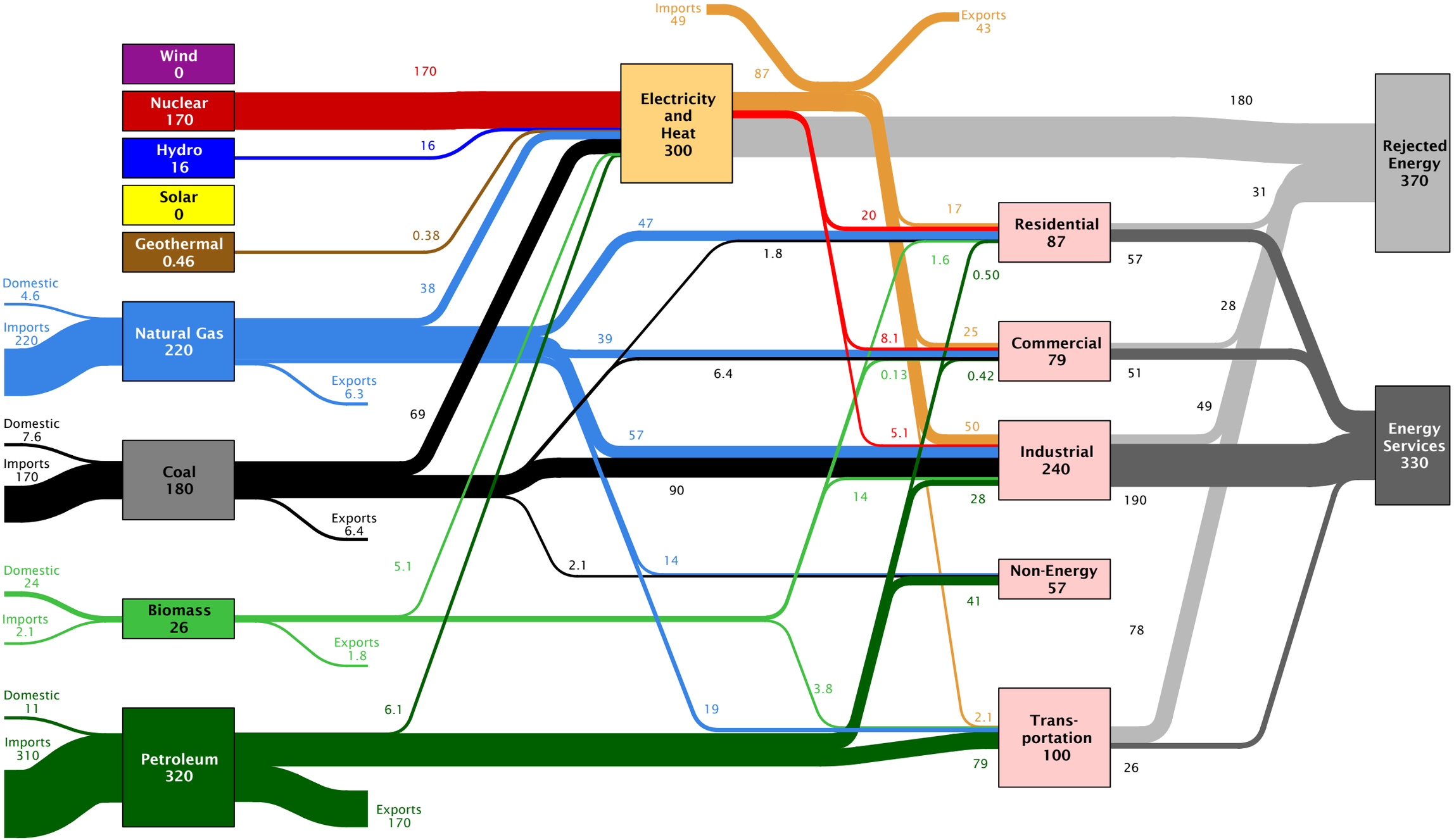
# Singapore Energy Flow in 2007: ~2600 PJ

Lawrence Livermore National Laboratory



# Slovak Republic Energy Flow in 2007: ~750 PJ

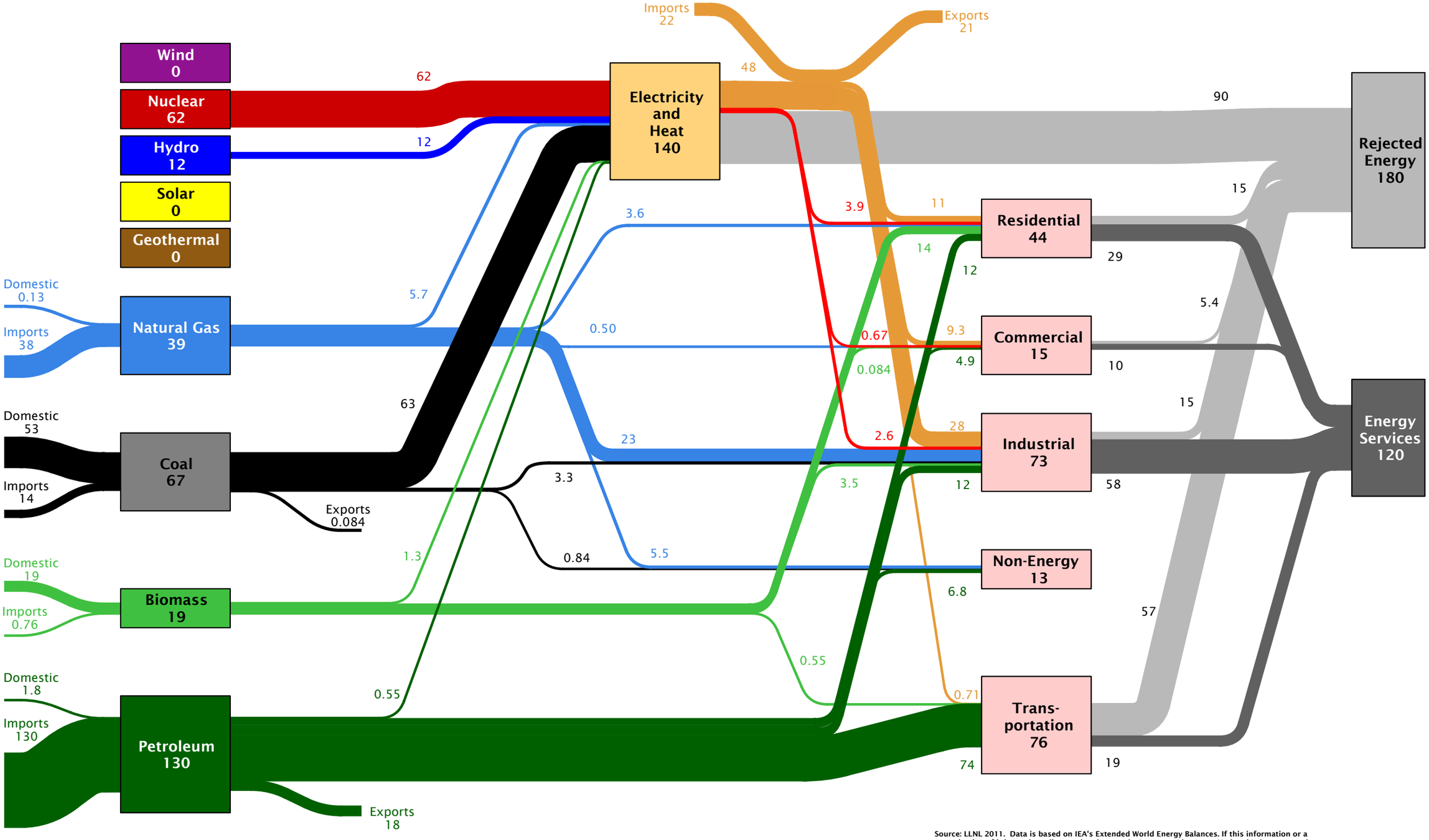
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

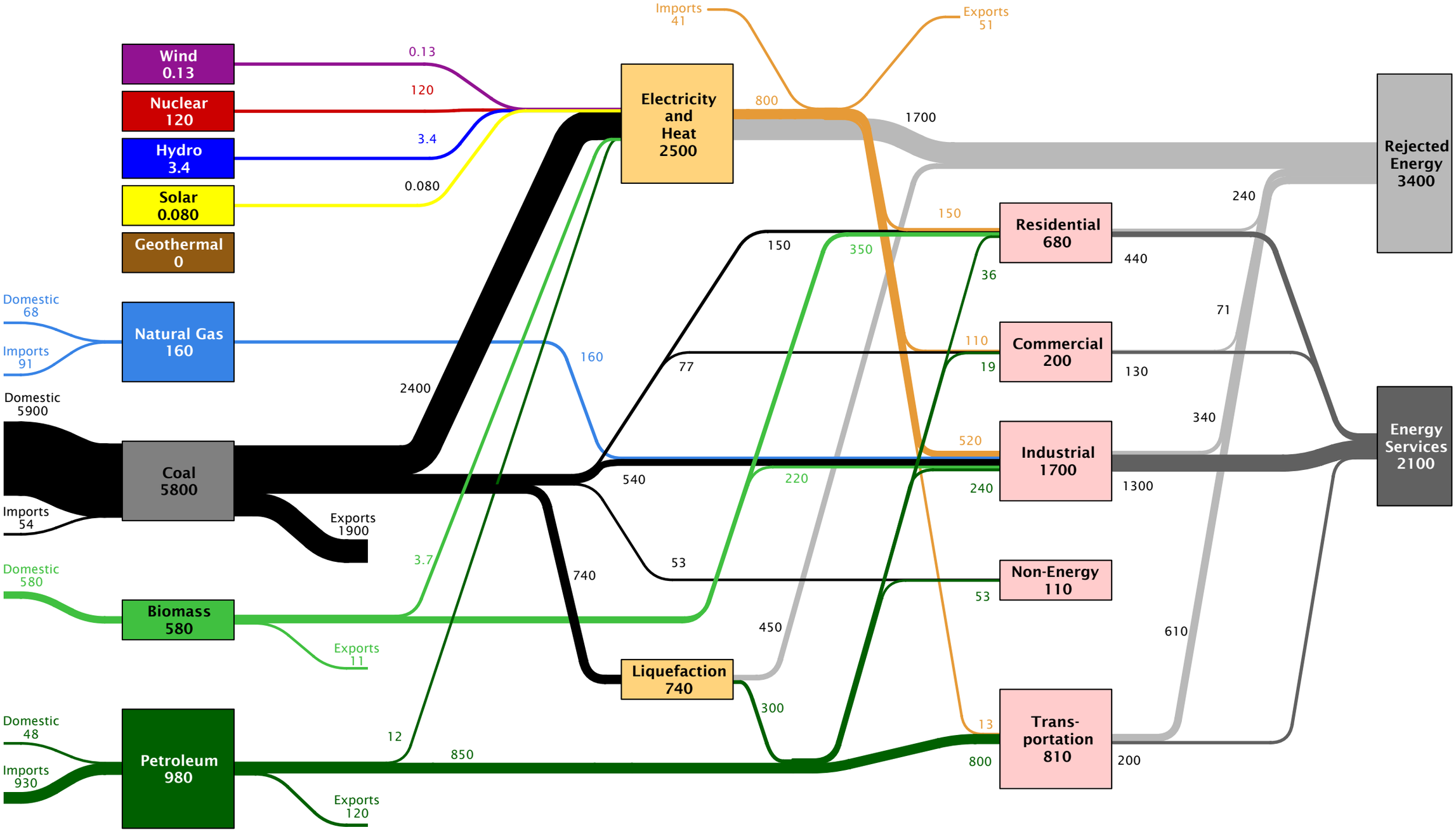
# Slovenia Energy Flow in 2007: ~310 PJ

Lawrence Livermore National Laboratory



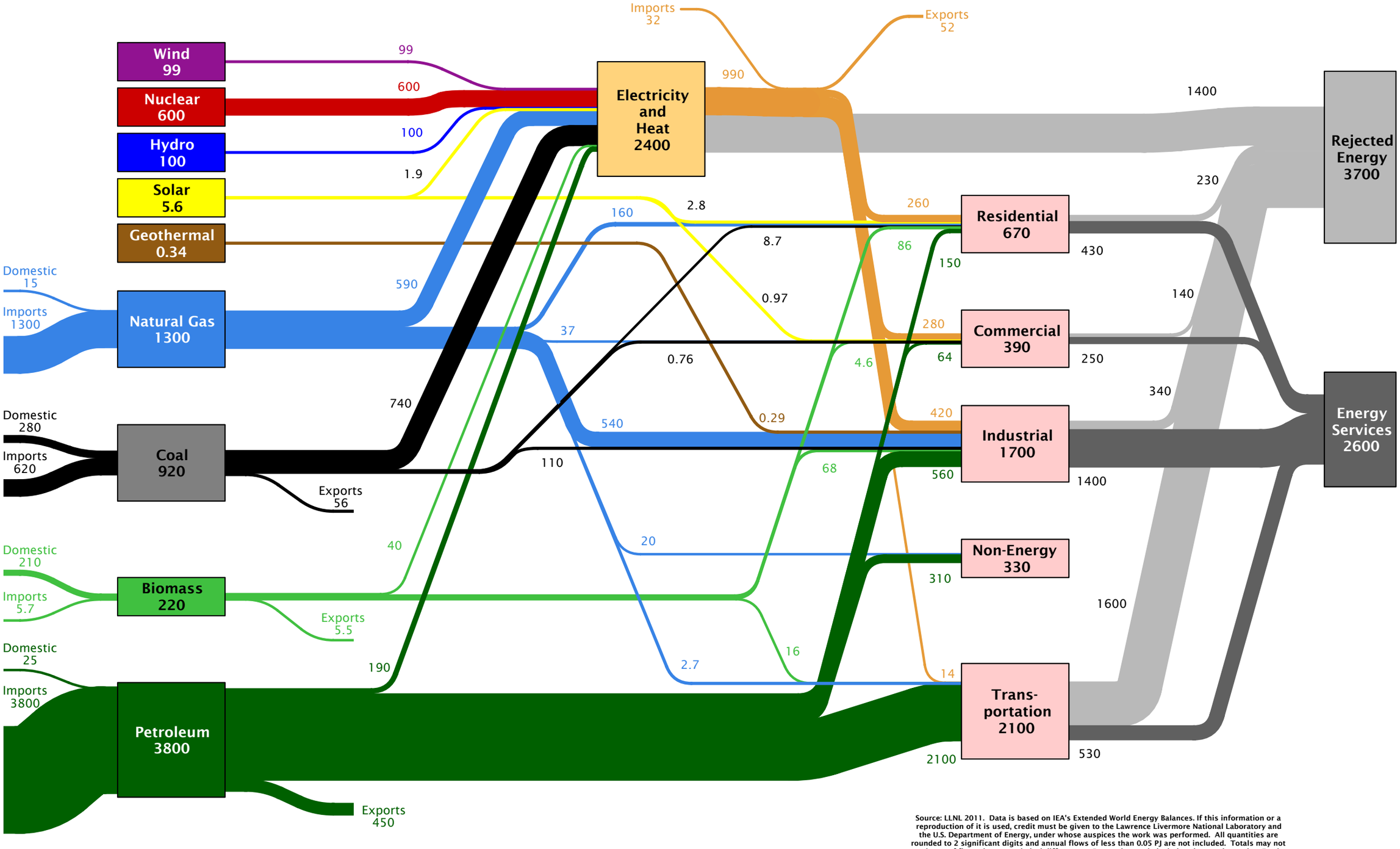
# South Africa Energy Flow in 2007: ~5600 PJ

Lawrence Livermore National Laboratory



# Spain Energy Flow in 2007: ~6600 PJ

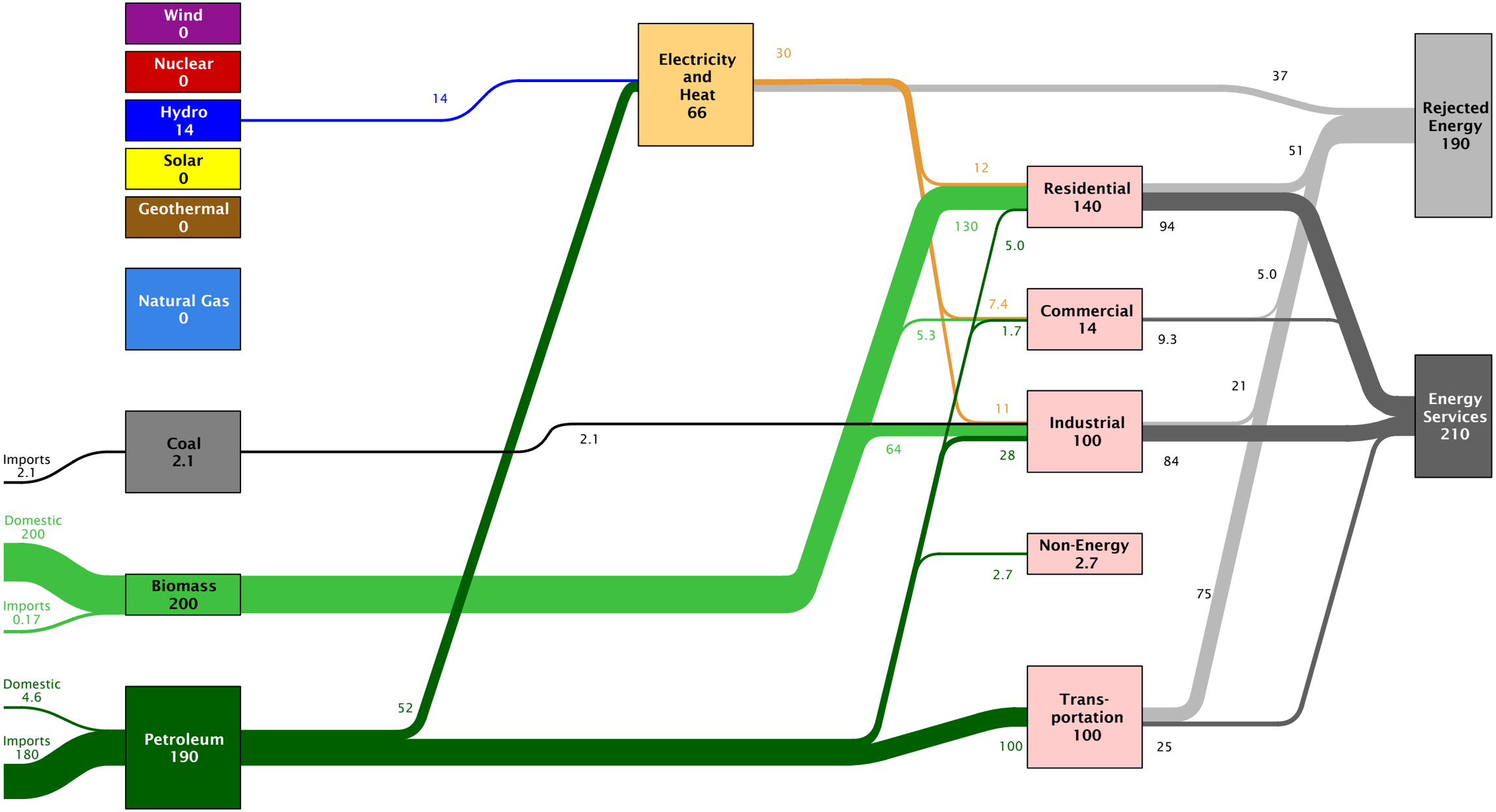
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

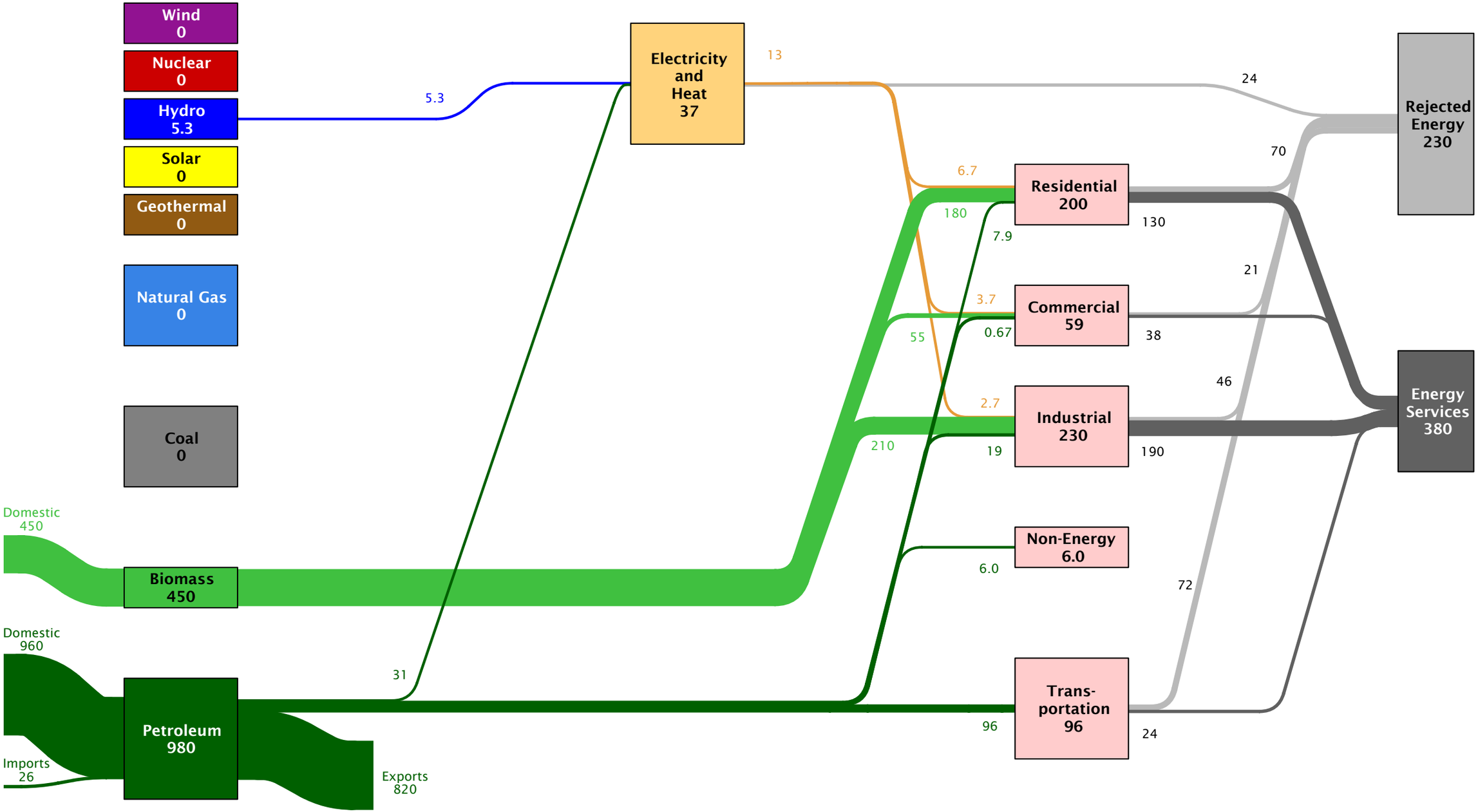
# Sri Lanka Energy Flow in 2007: ~400 PJ

Lawrence Livermore National Laboratory



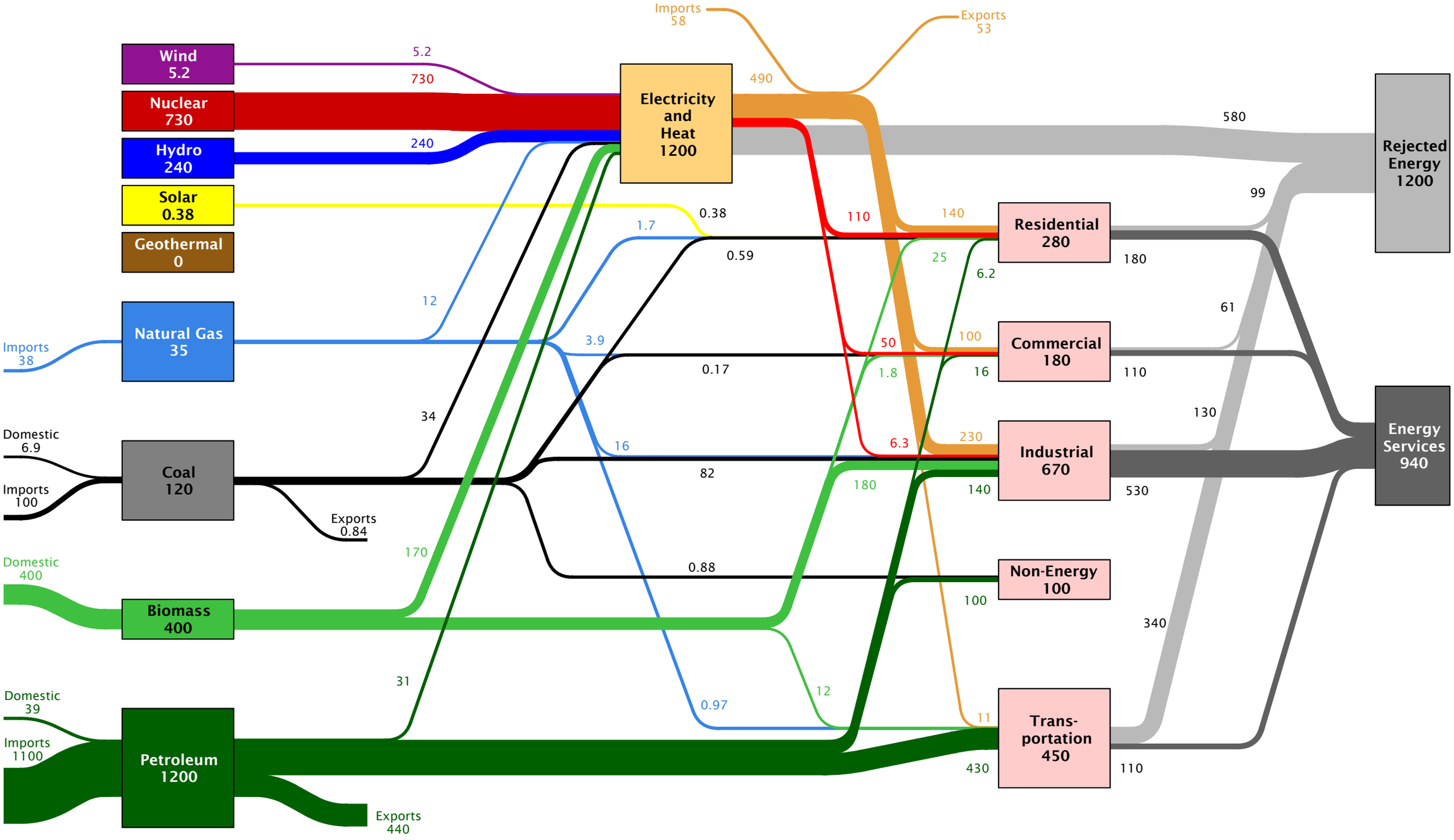
# Sudan Energy Flow in 2007: ~620 PJ

Lawrence Livermore National Laboratory



# Sweden Energy Flow in 2007: ~2300 PJ

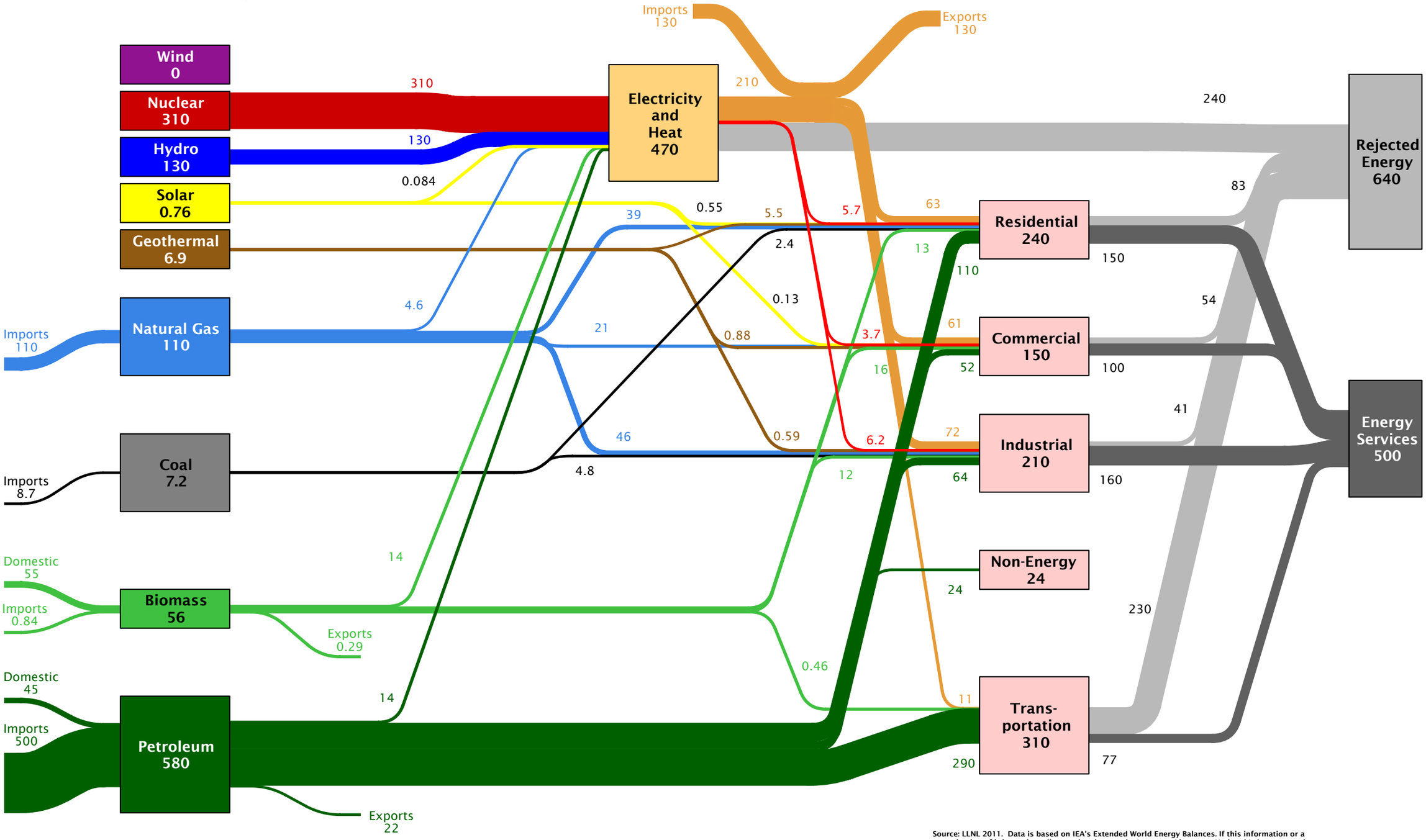
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Switzerland Energy Flow in 2007: ~1200 PJ

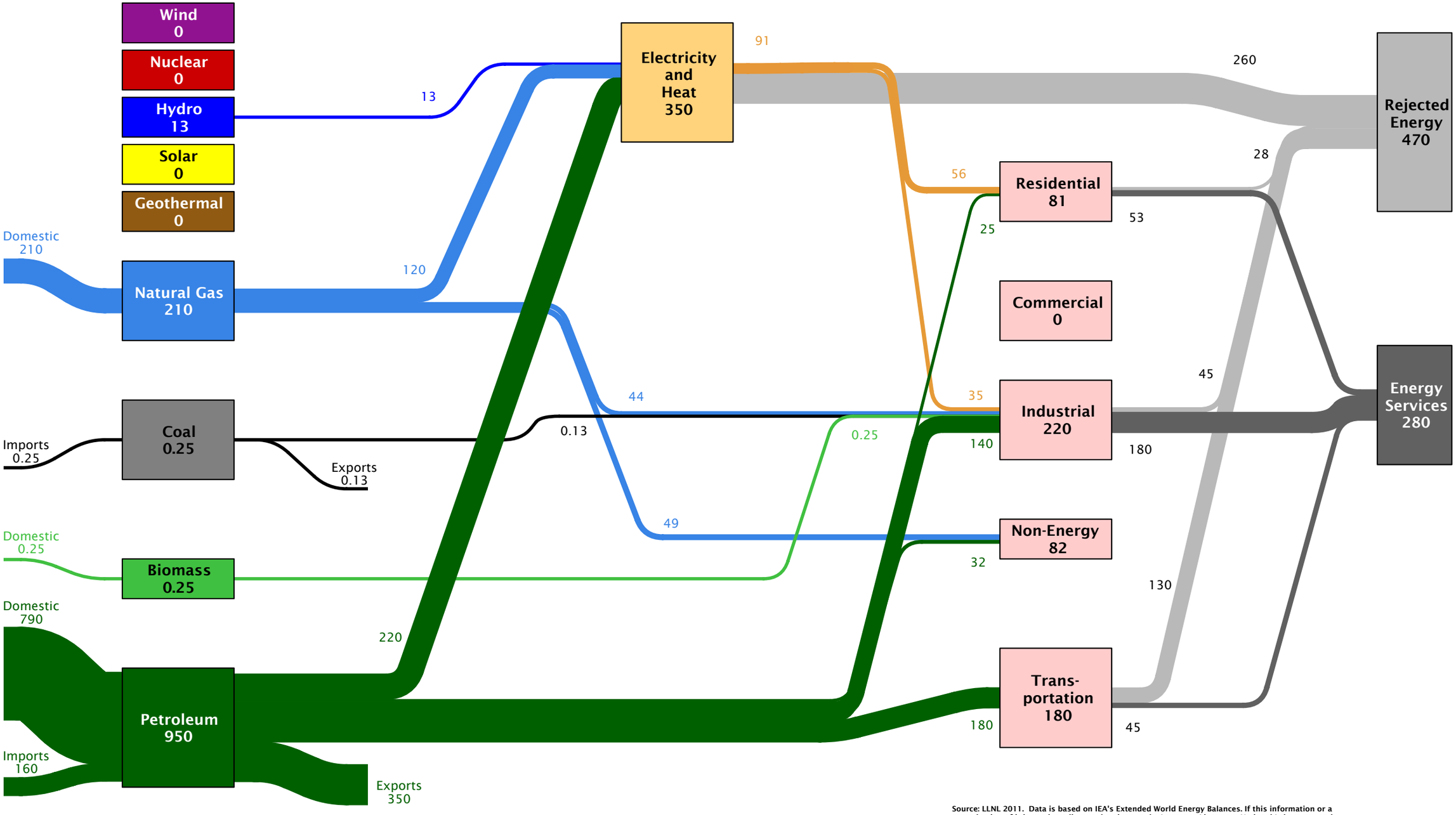
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

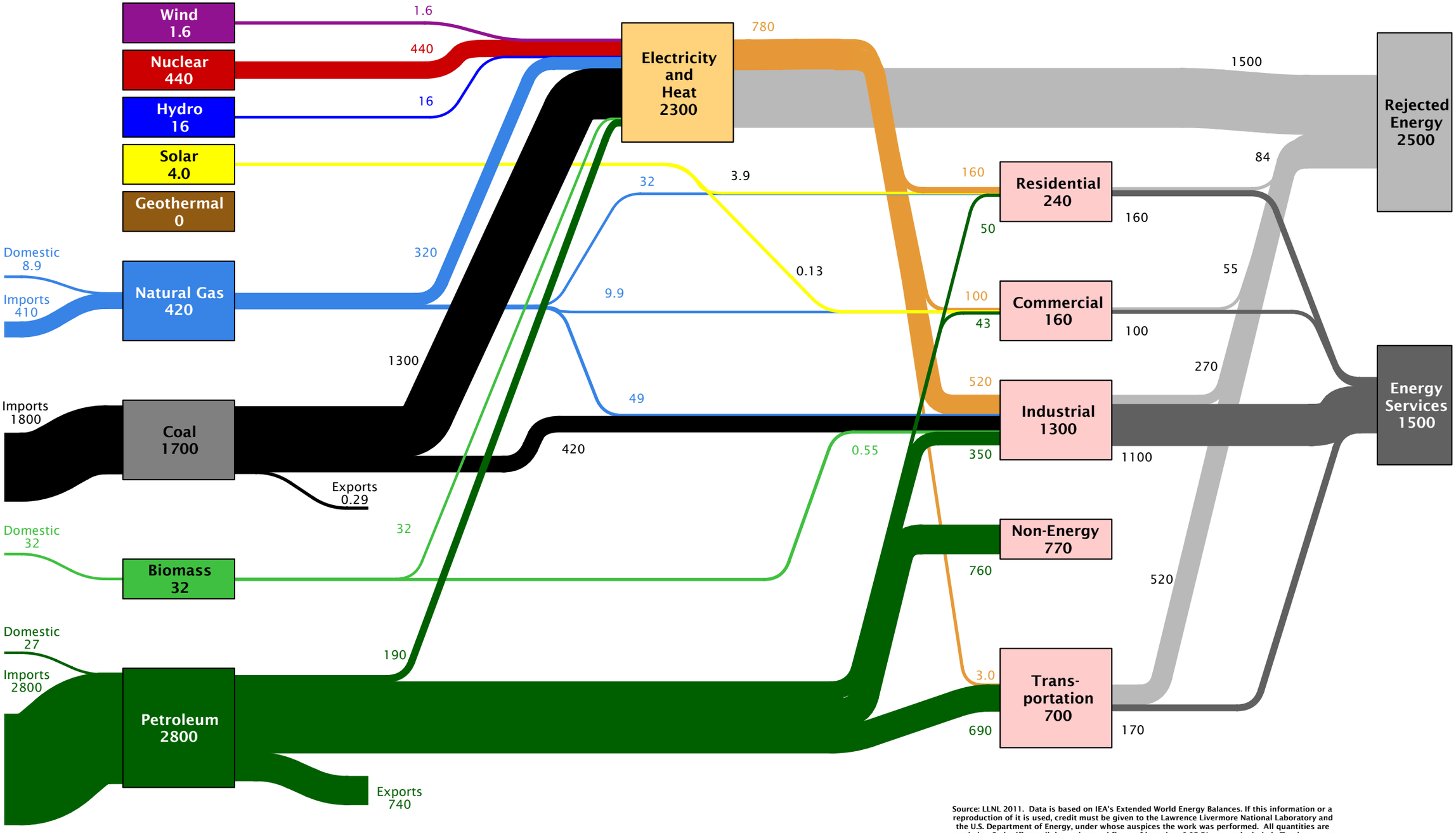
# Syria Energy Flow in 2007: ~830 PJ

Lawrence Livermore National Laboratory



# Chinese Taipei (Taiwan) Energy Flow in 2007: ~4700 PJ

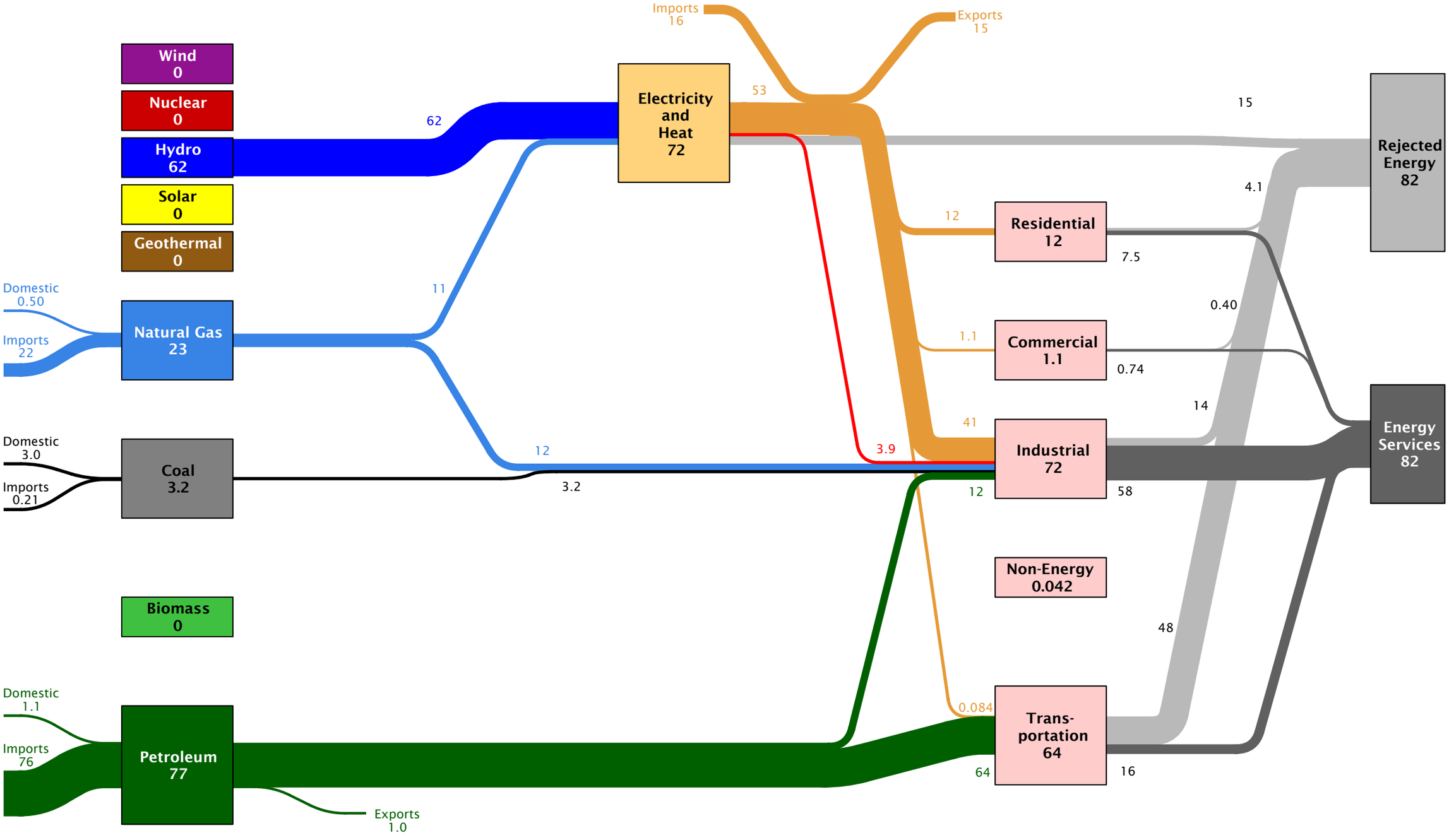
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Tajikistan Energy Flow in 2007: ~160 PJ

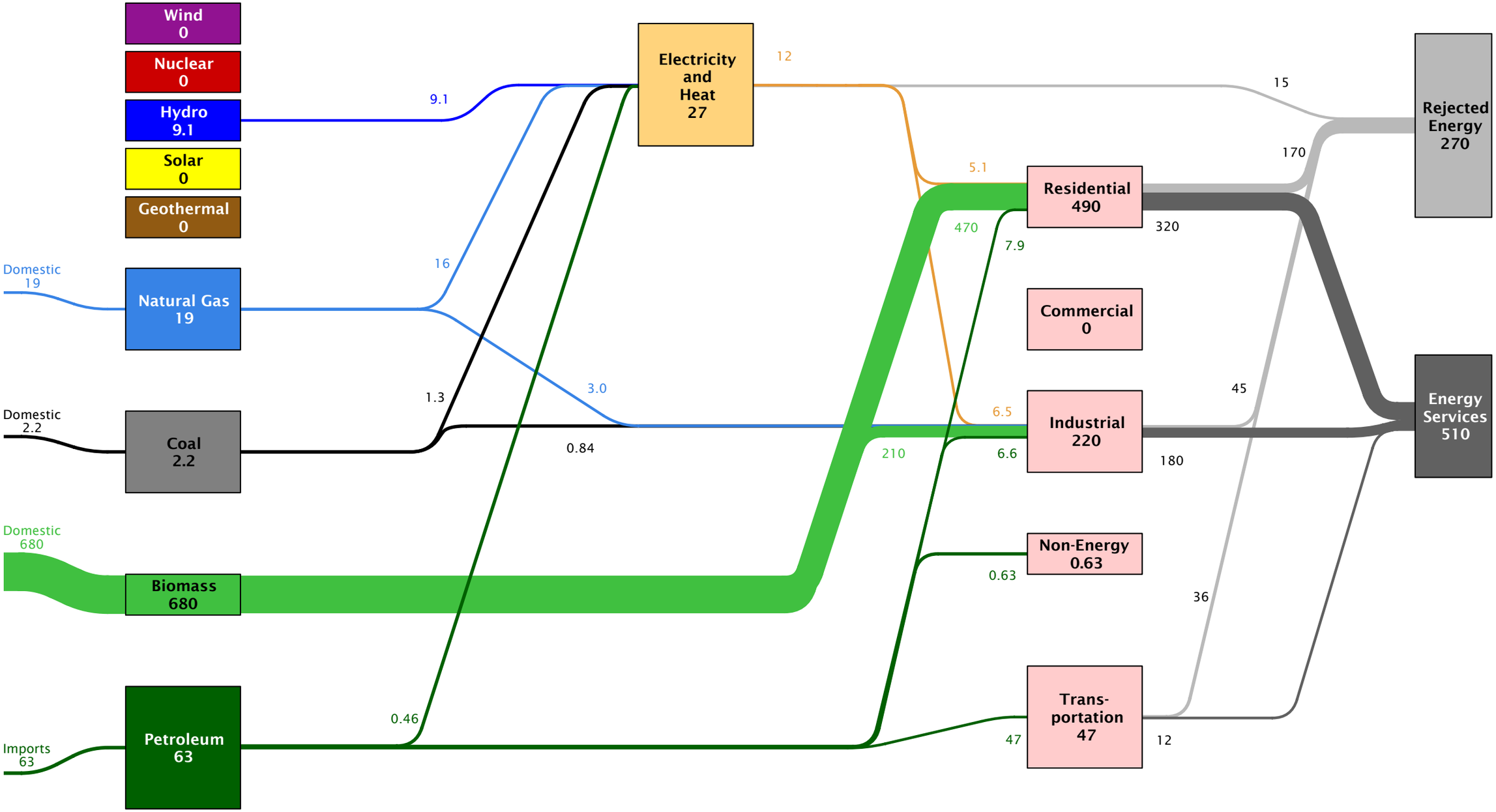
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

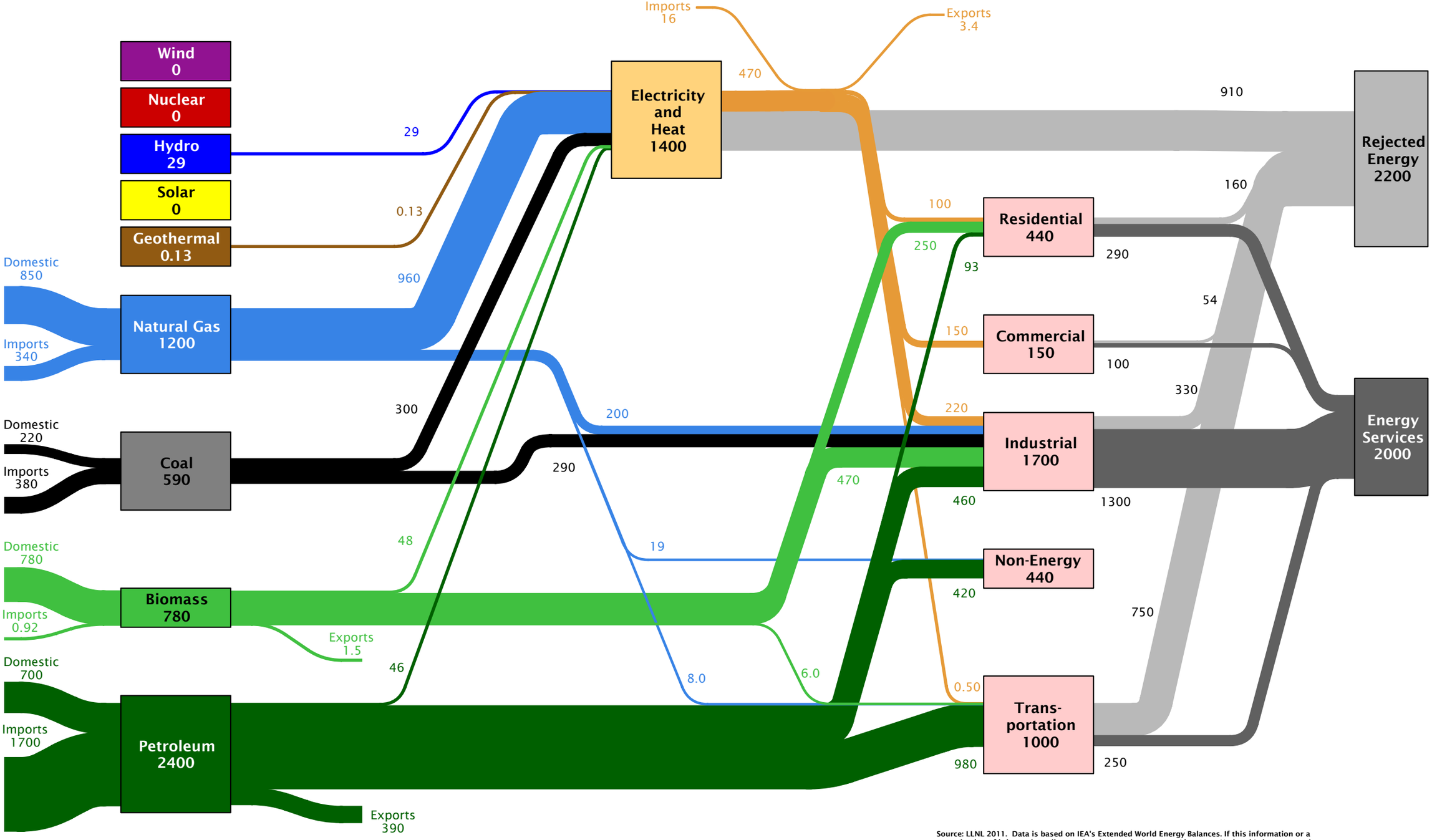
# Tanzania Energy Flow in 2007: ~770 PJ

Lawrence Livermore National Laboratory



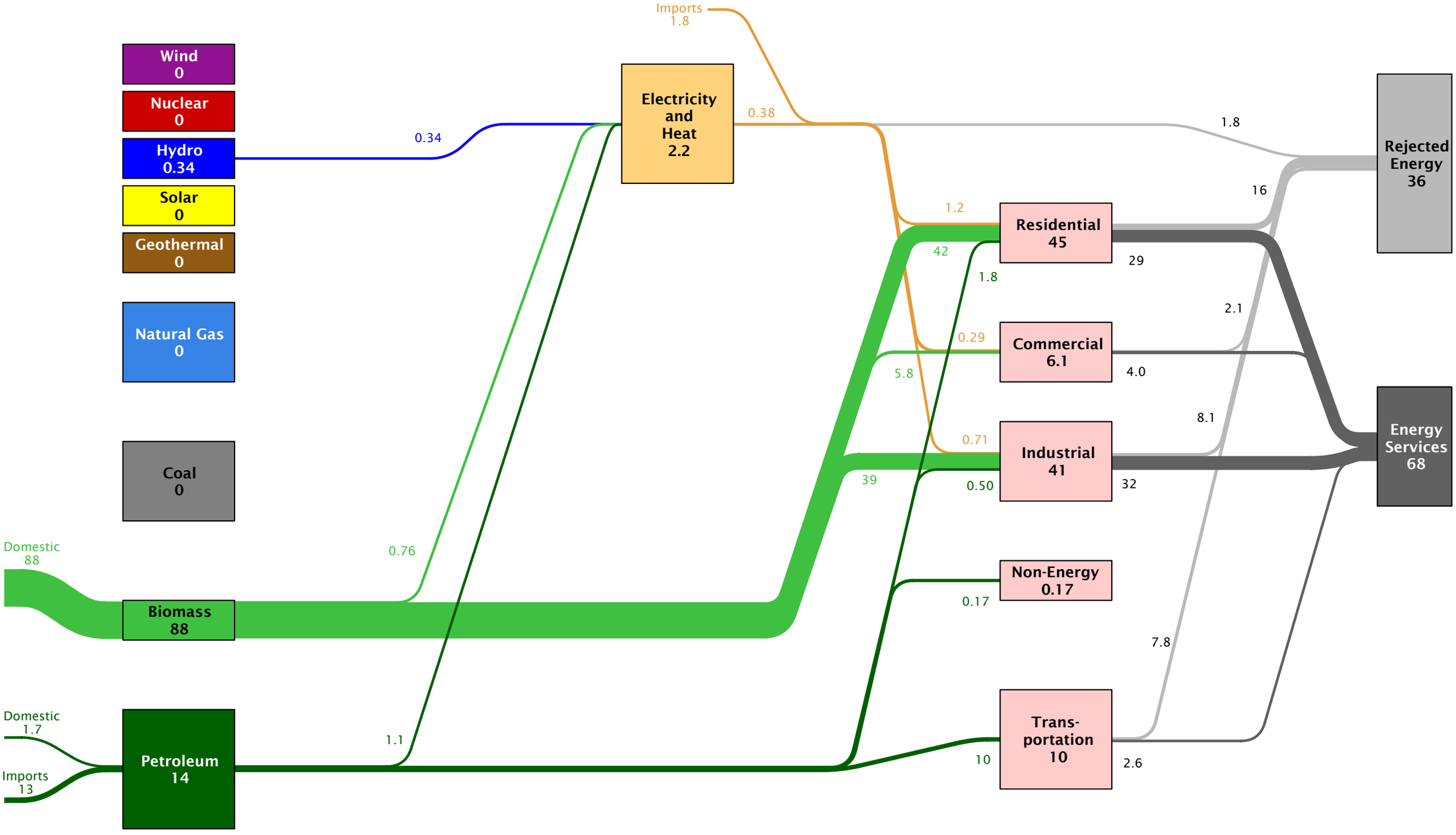
# Thailand Energy Flow in 2007: ~4600 PJ

Lawrence Livermore National Laboratory



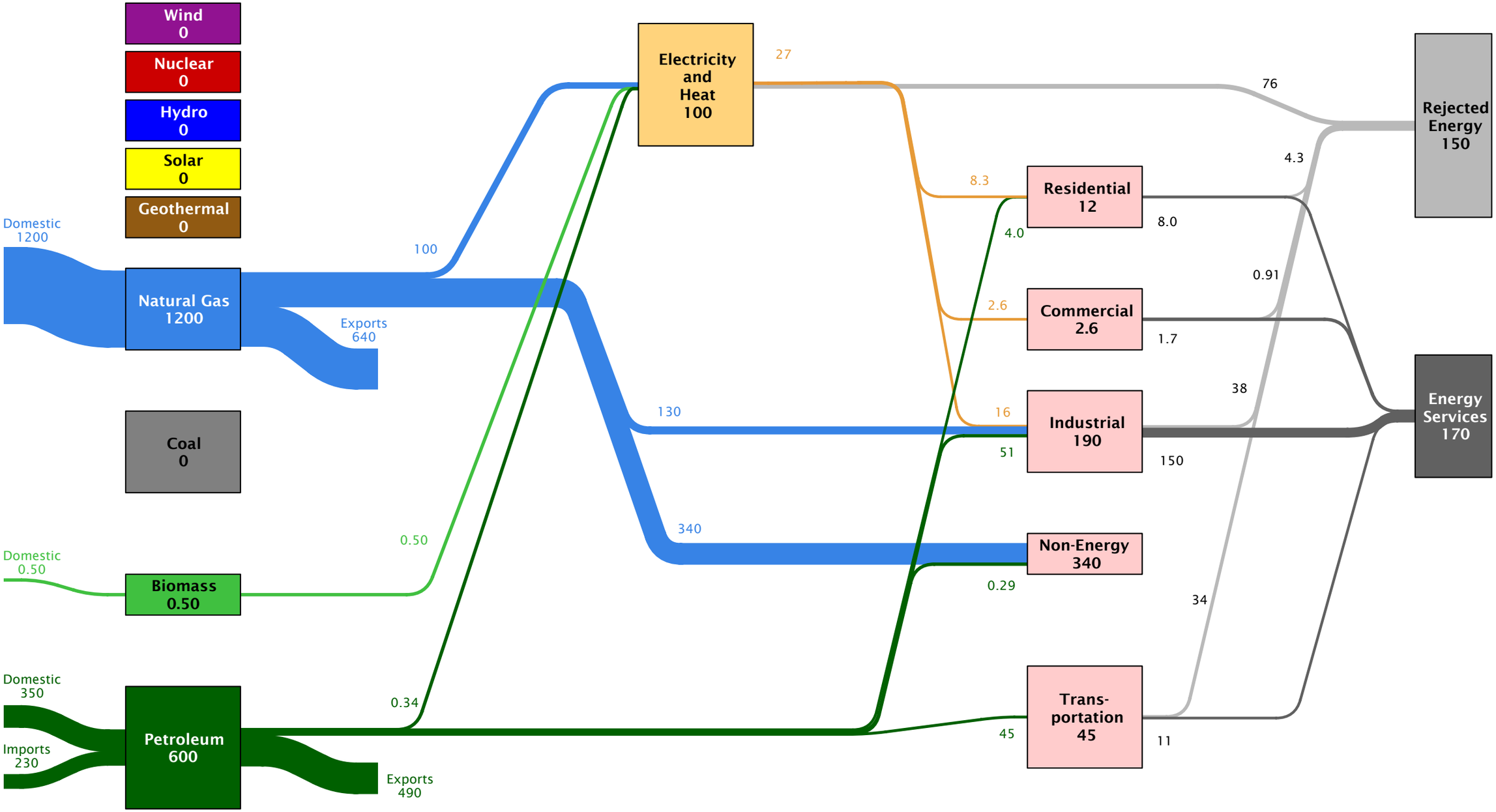
# Togo Energy Flow in 2007: ~100 PJ

Lawrence Livermore National Laboratory



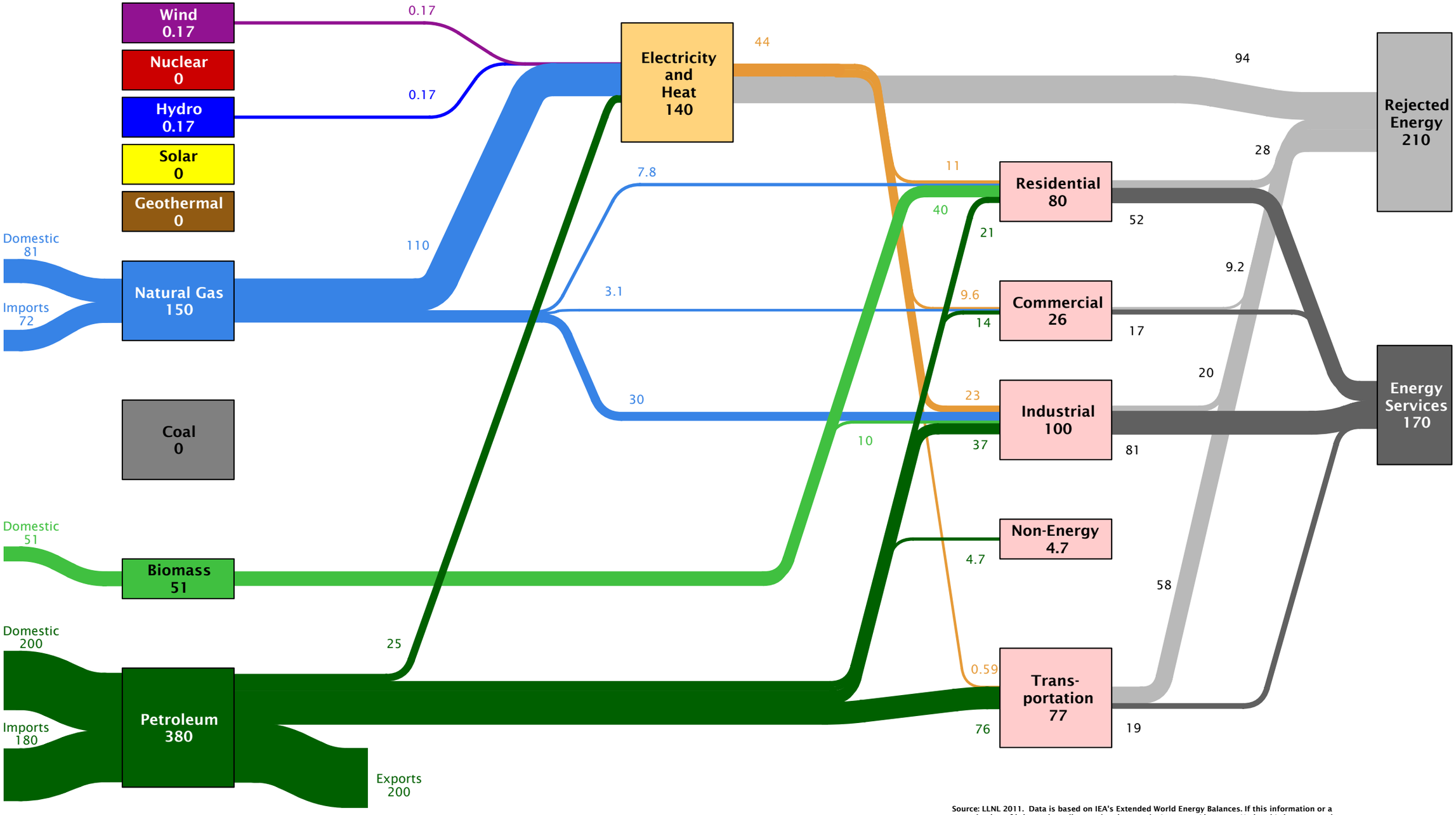
# Trinidad and Tobago Energy Flow in 2007: ~670 PJ

Lawrence Livermore National Laboratory



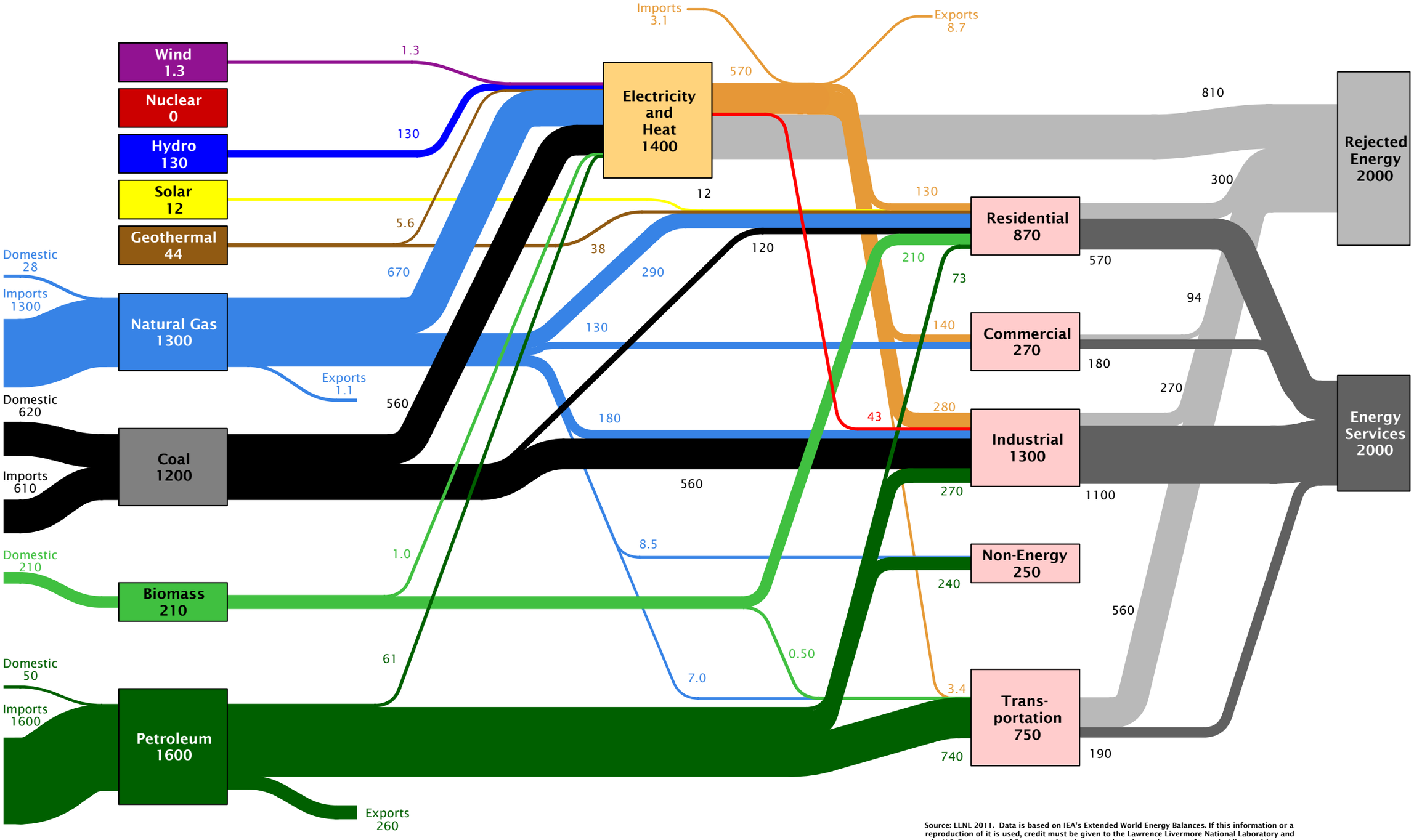
# Tunisia Energy Flow in 2007: ~380 PJ

Lawrence Livermore National Laboratory



# Turkey Energy Flow in 2007: ~4300 PJ

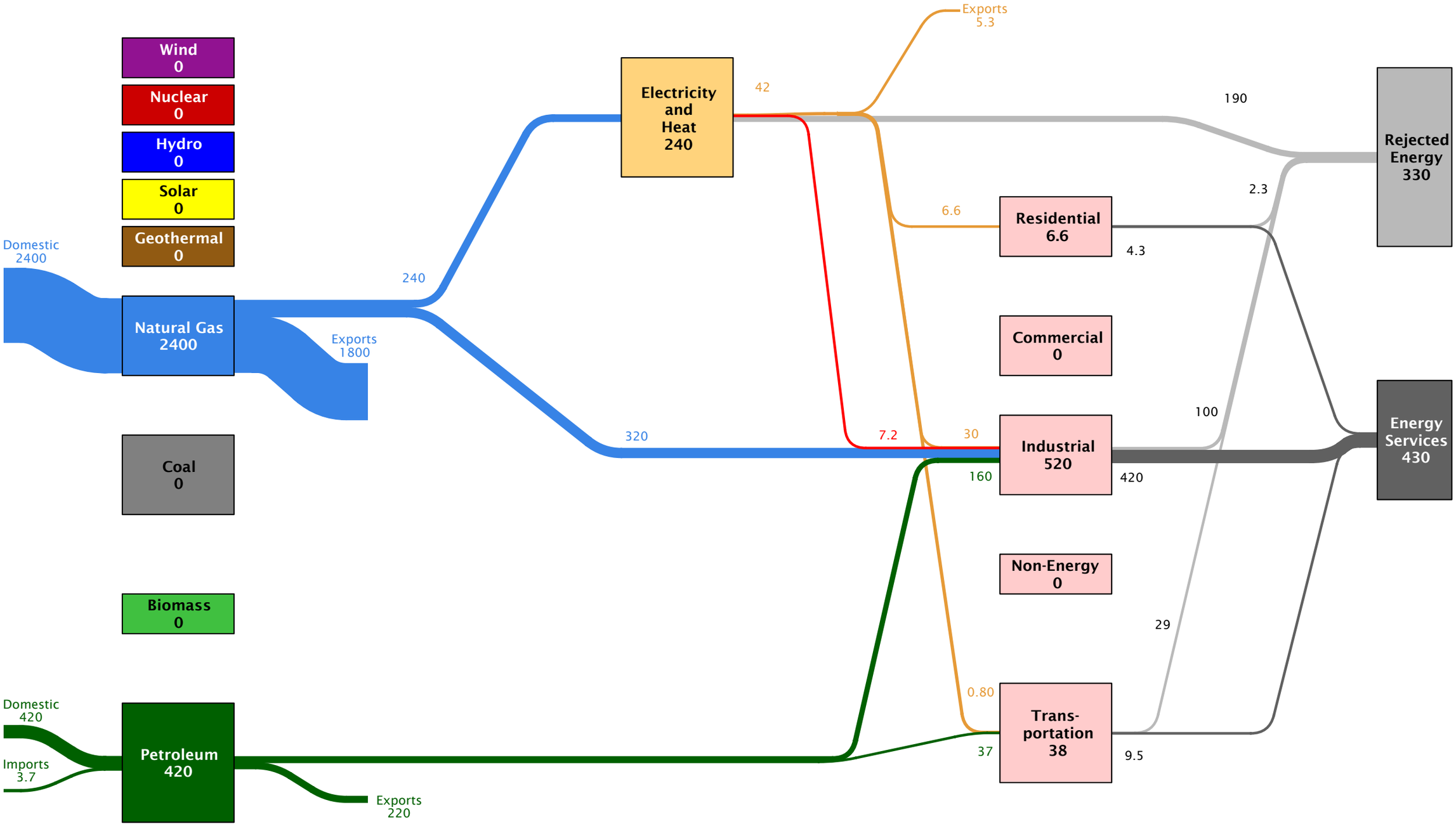
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

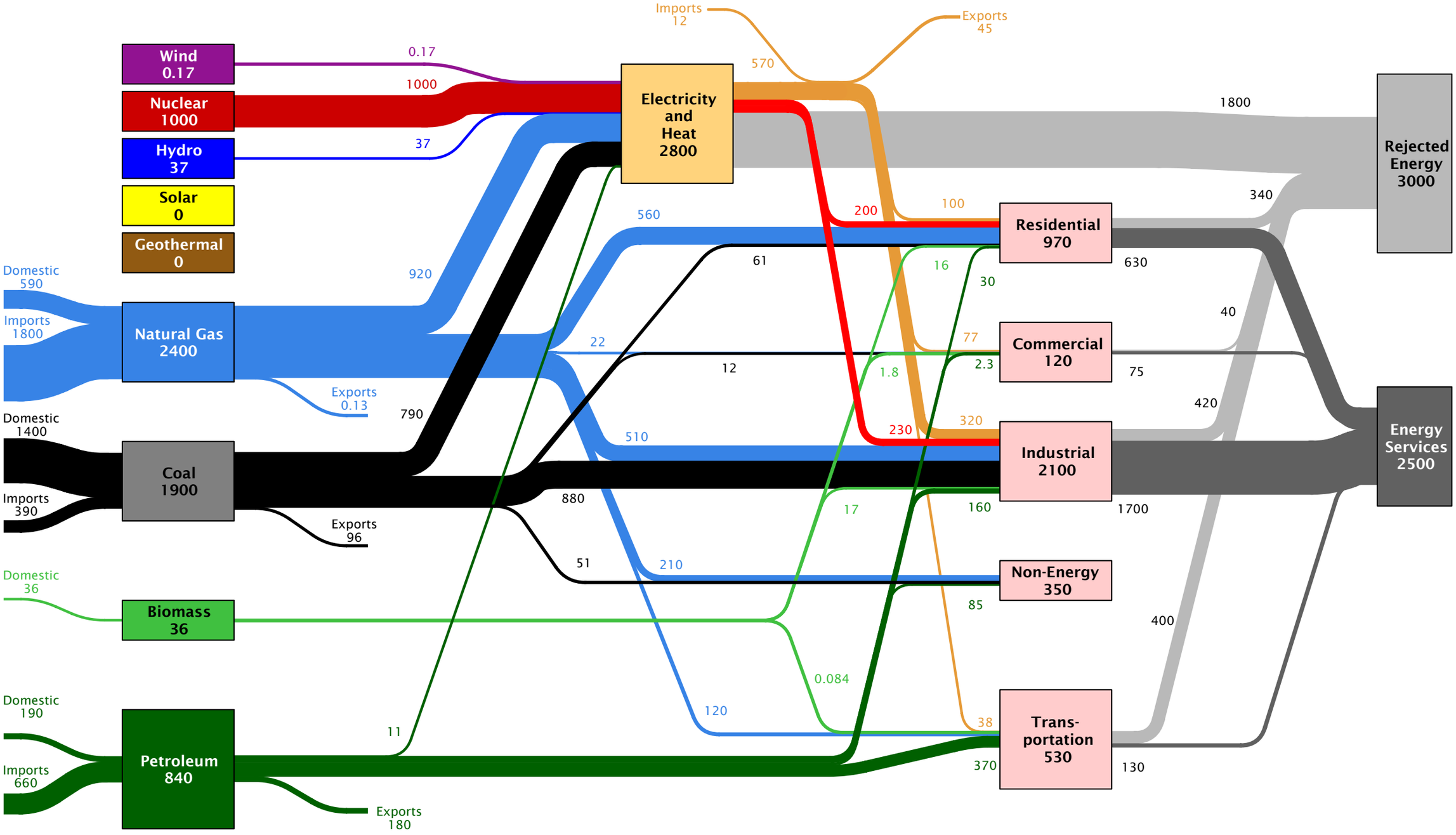
# Turkmenistan Energy Flow in 2007: ~760 PJ

Lawrence Livermore National Laboratory



# Ukraine Energy Flow in 2007: ~5900 PJ

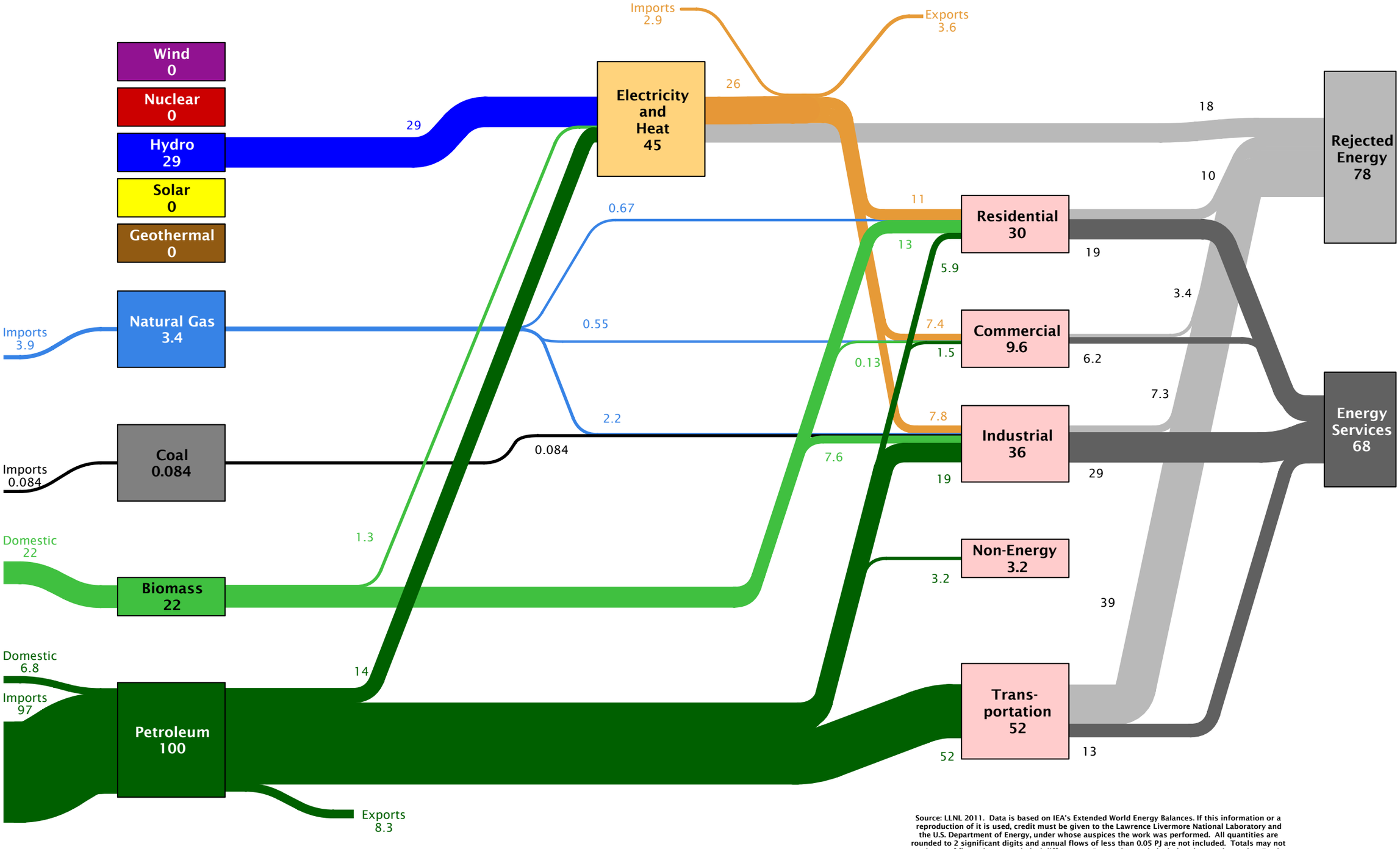
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

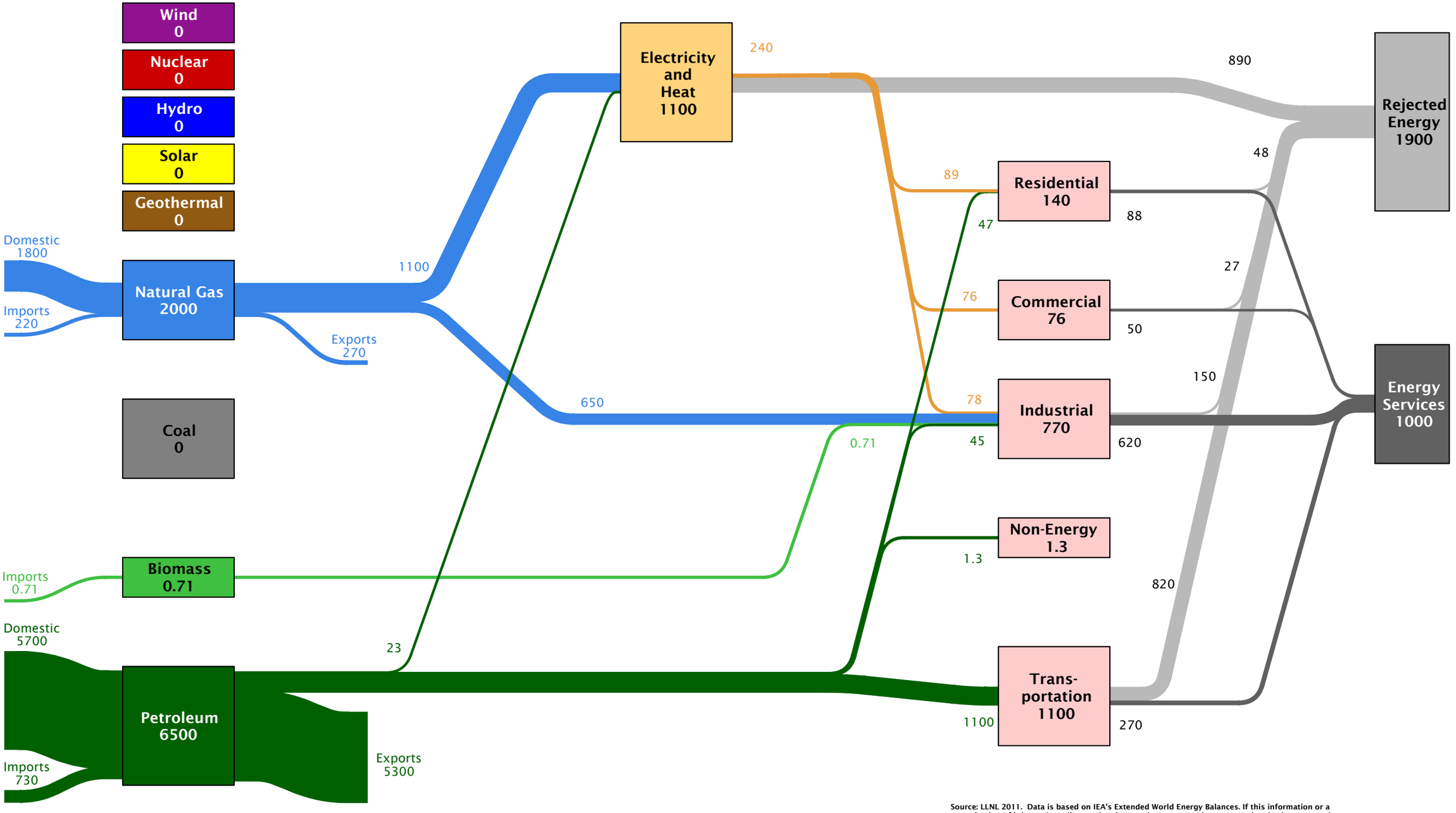
# Uruguay Energy Flow in 2007: ~150 PJ

Lawrence Livermore National Laboratory



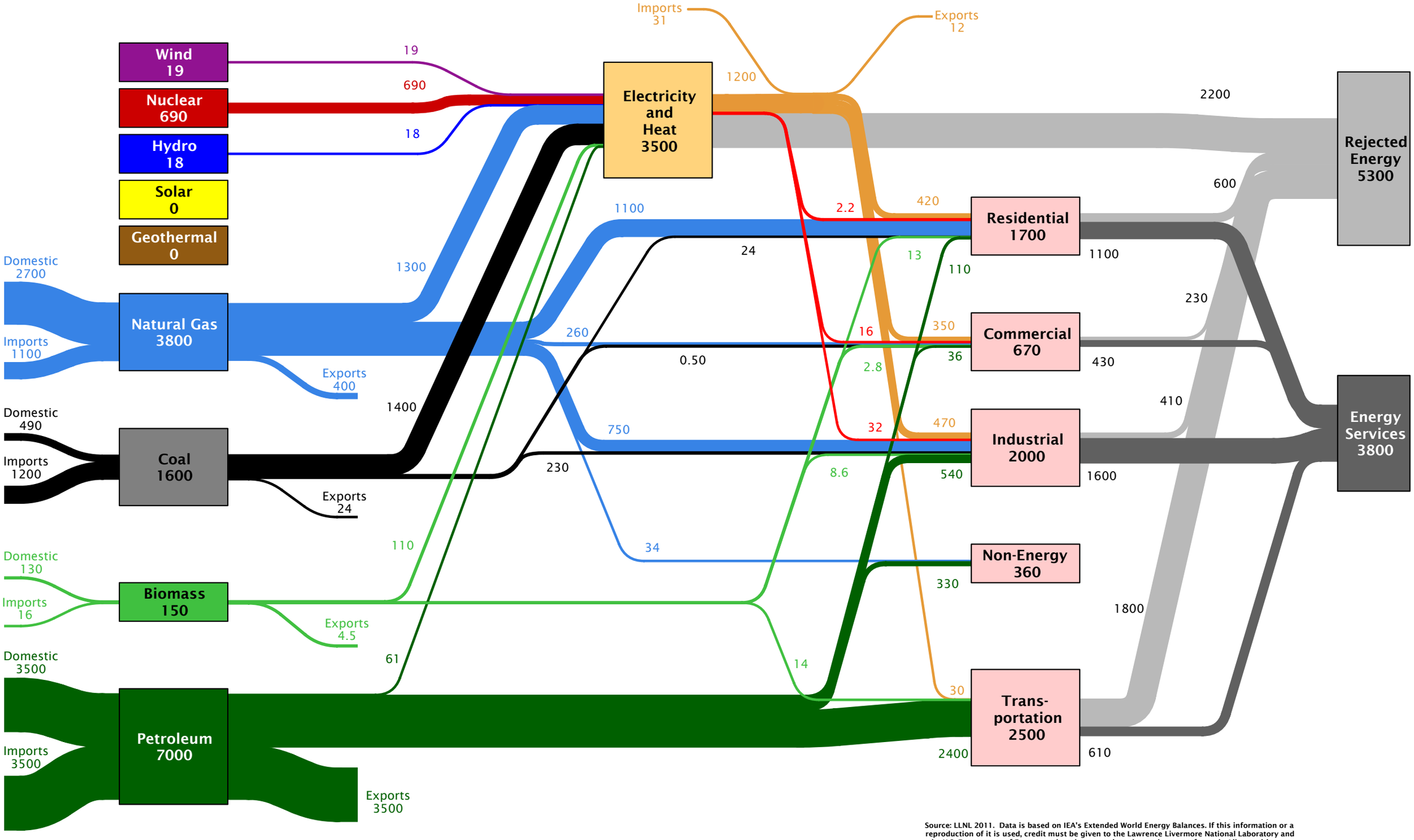
# United Arab Emirates Energy Flow in 2007: ~3000 PJ

Lawrence Livermore National Laboratory



# United Kingdom Energy Flow in 2007: ~9400 PJ

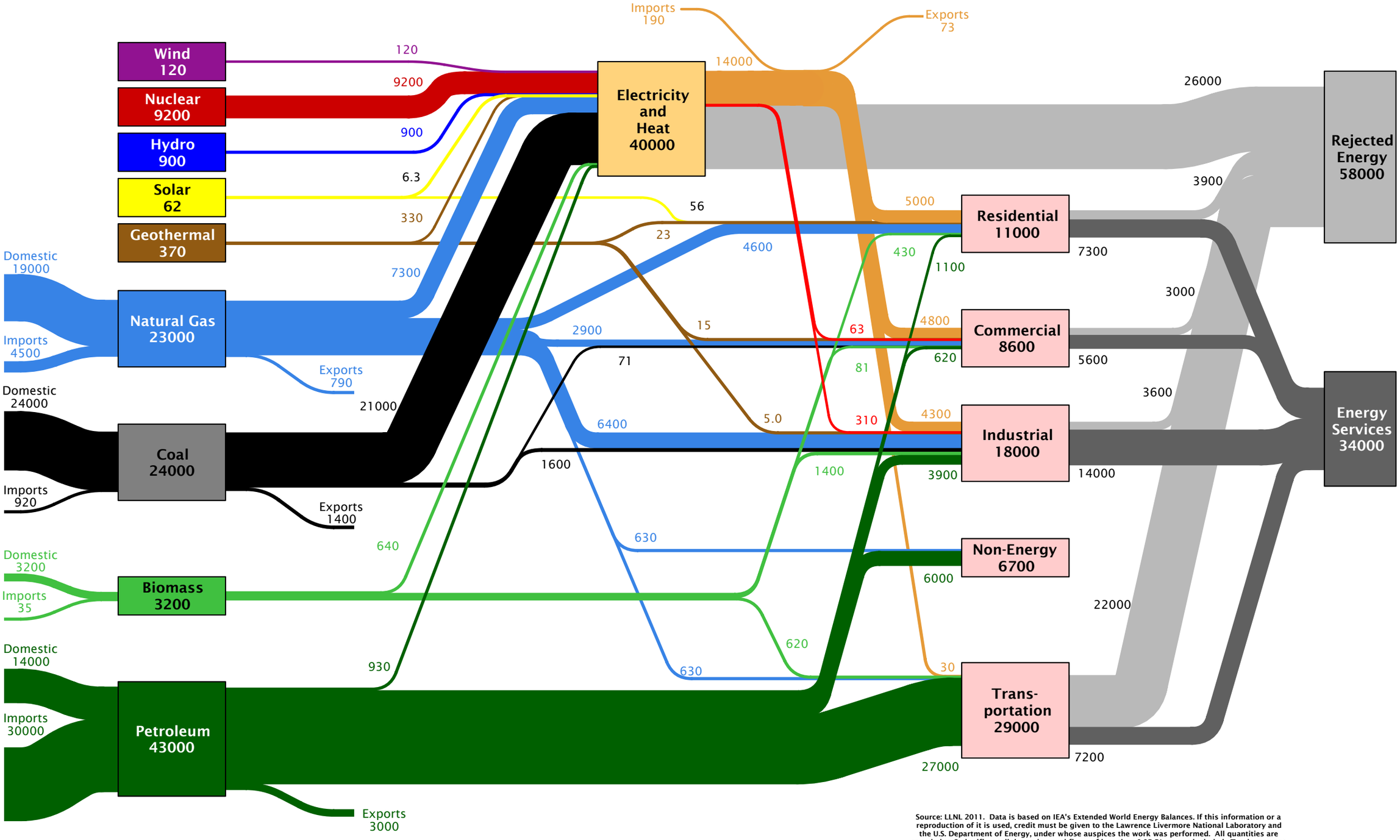
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

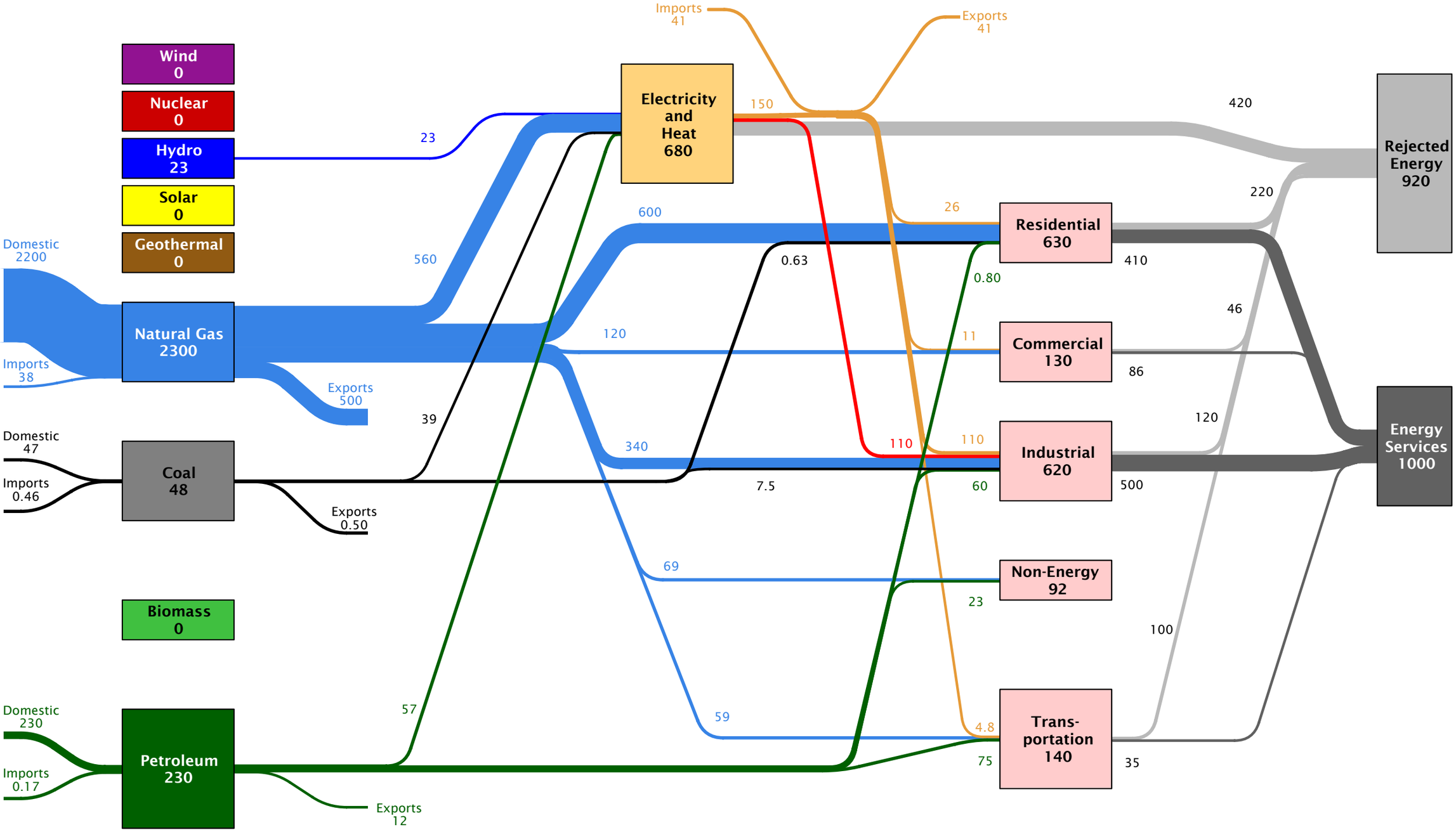
# United States Energy Flow in 2007: ~99000 PJ

Lawrence Livermore National Laboratory



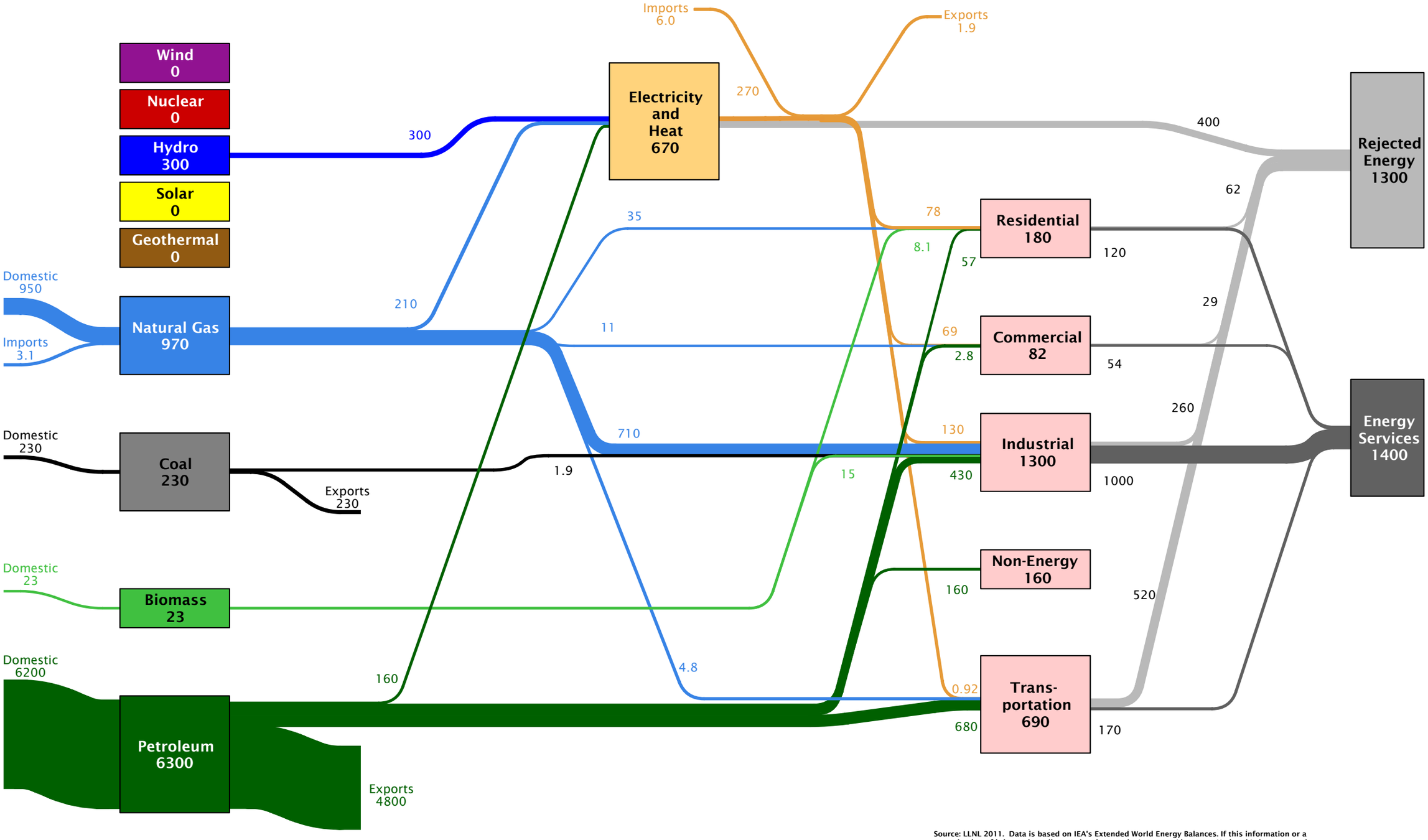
# Uzbekistan Energy Flow in 2007: ~2000 PJ

Lawrence Livermore National Laboratory



# Venezuela Energy Flow in 2007: ~2800 PJ

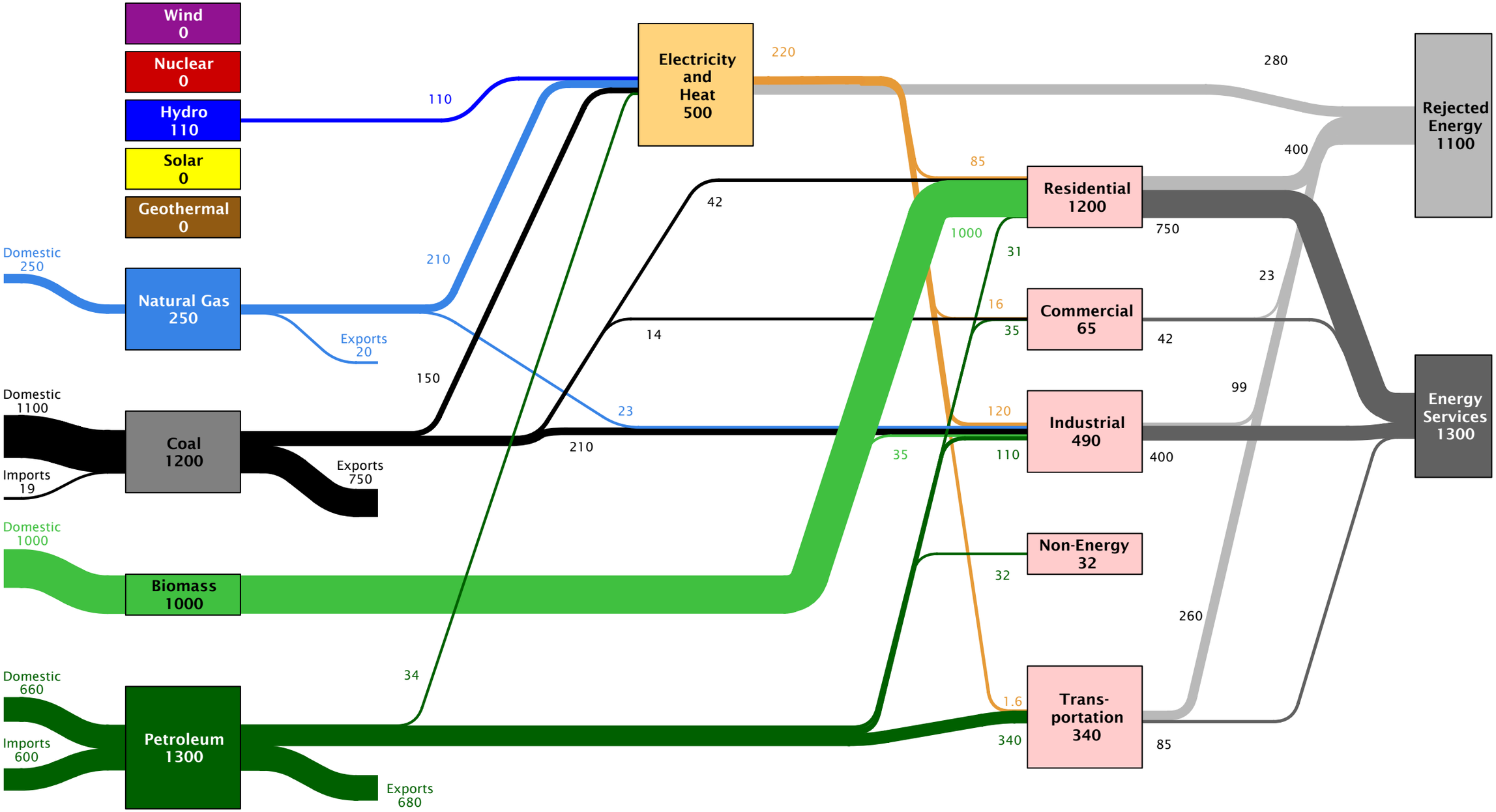
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

# Vietnam Energy Flow in 2007: ~2400 PJ

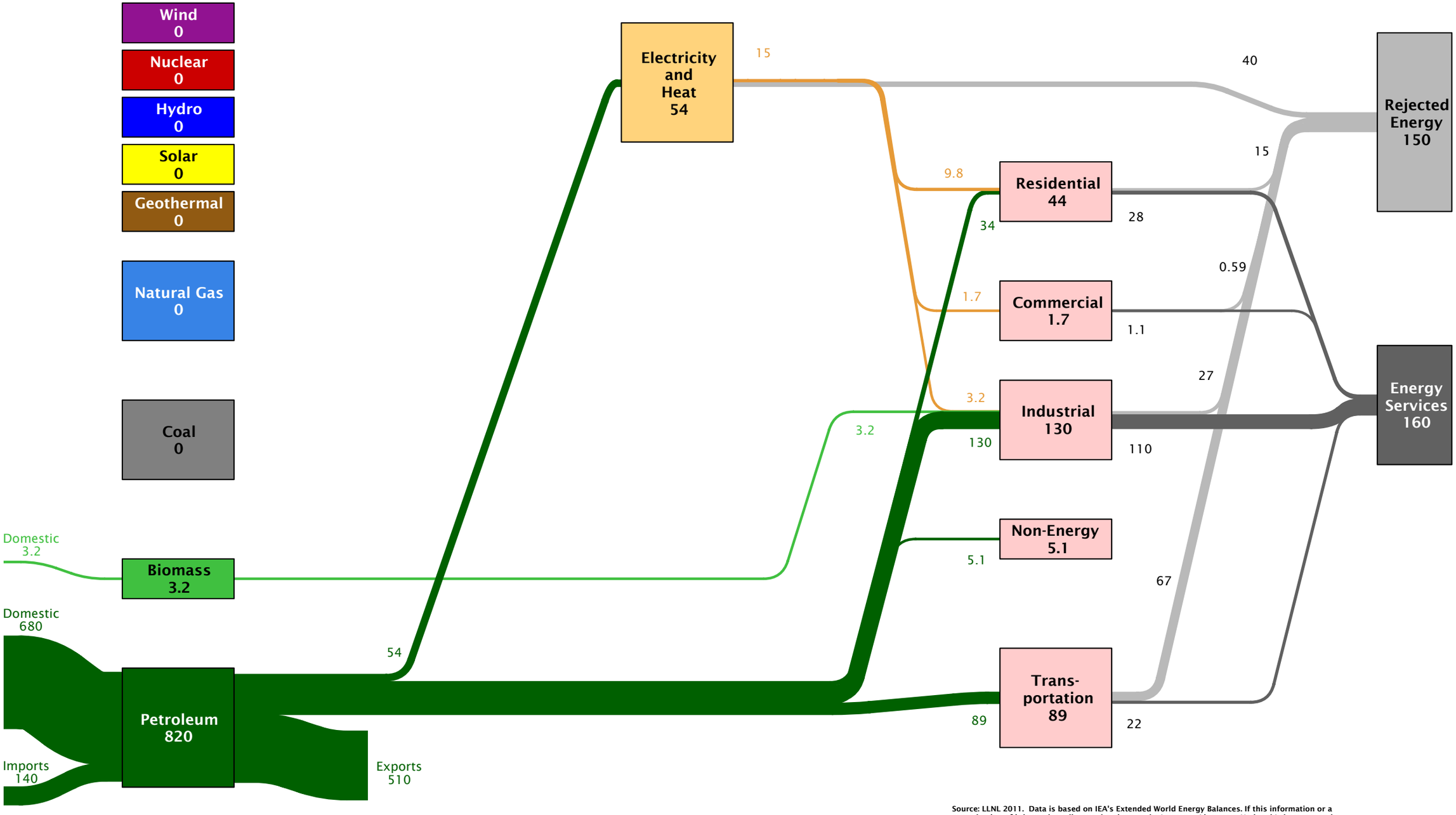
Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

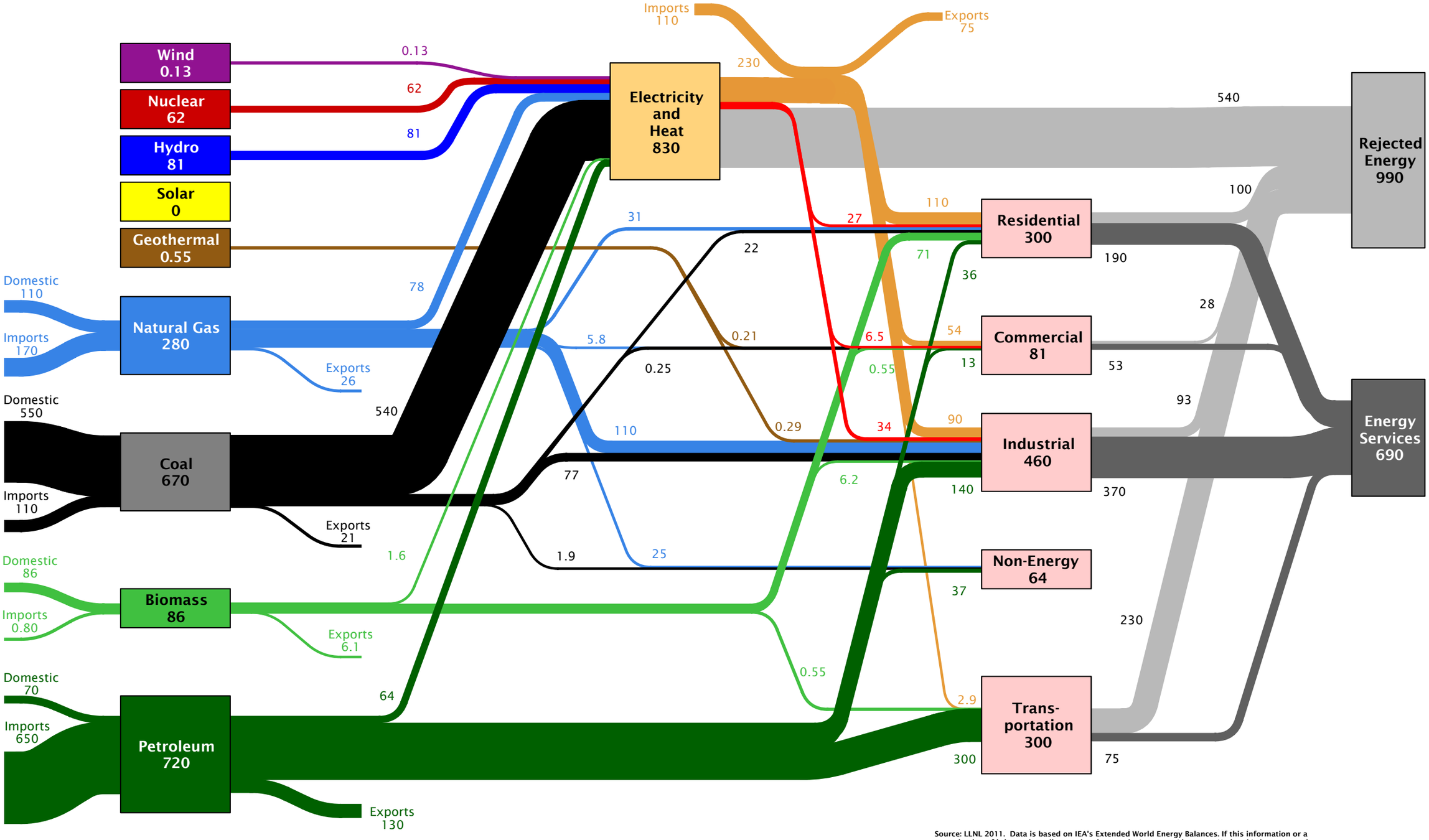
# Yemen Energy Flow in 2007: ~310 PJ

Lawrence Livermore National Laboratory



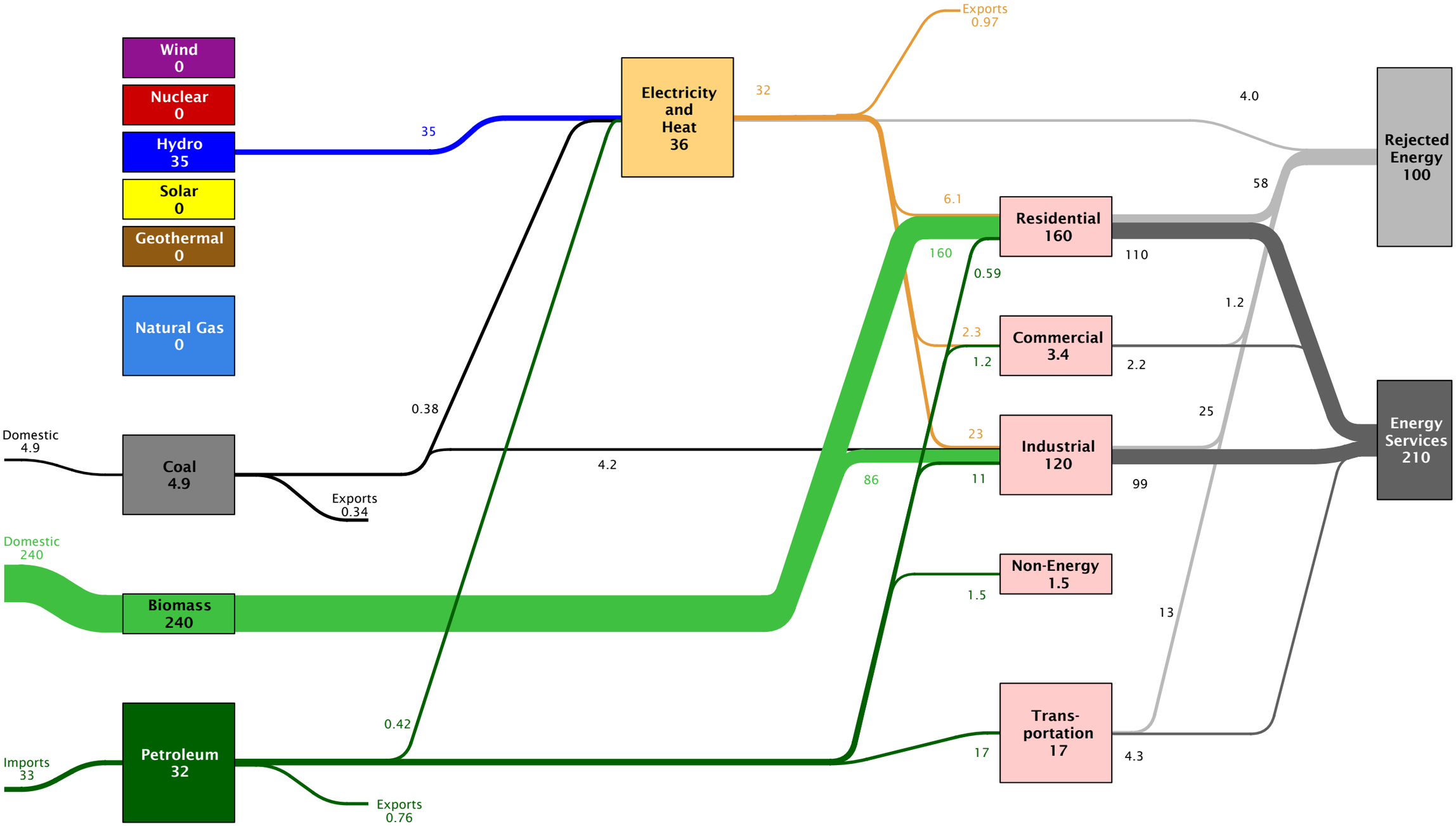
# Former Yugoslavia Energy Flow in 2007: ~1700 PJ

Lawrence Livermore National Laboratory



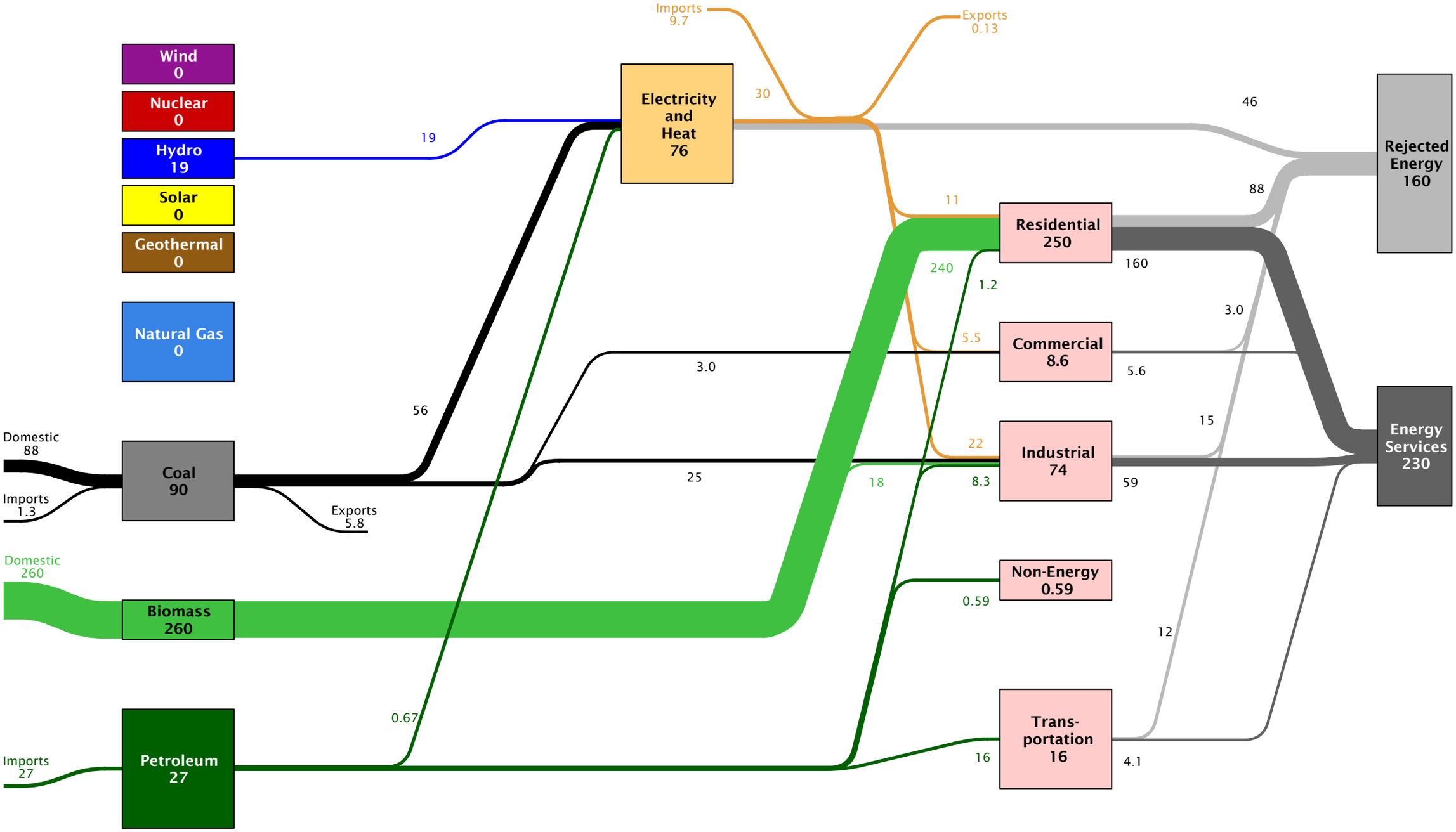
# Zambia Energy Flow in 2007: ~320 PJ

Lawrence Livermore National Laboratory



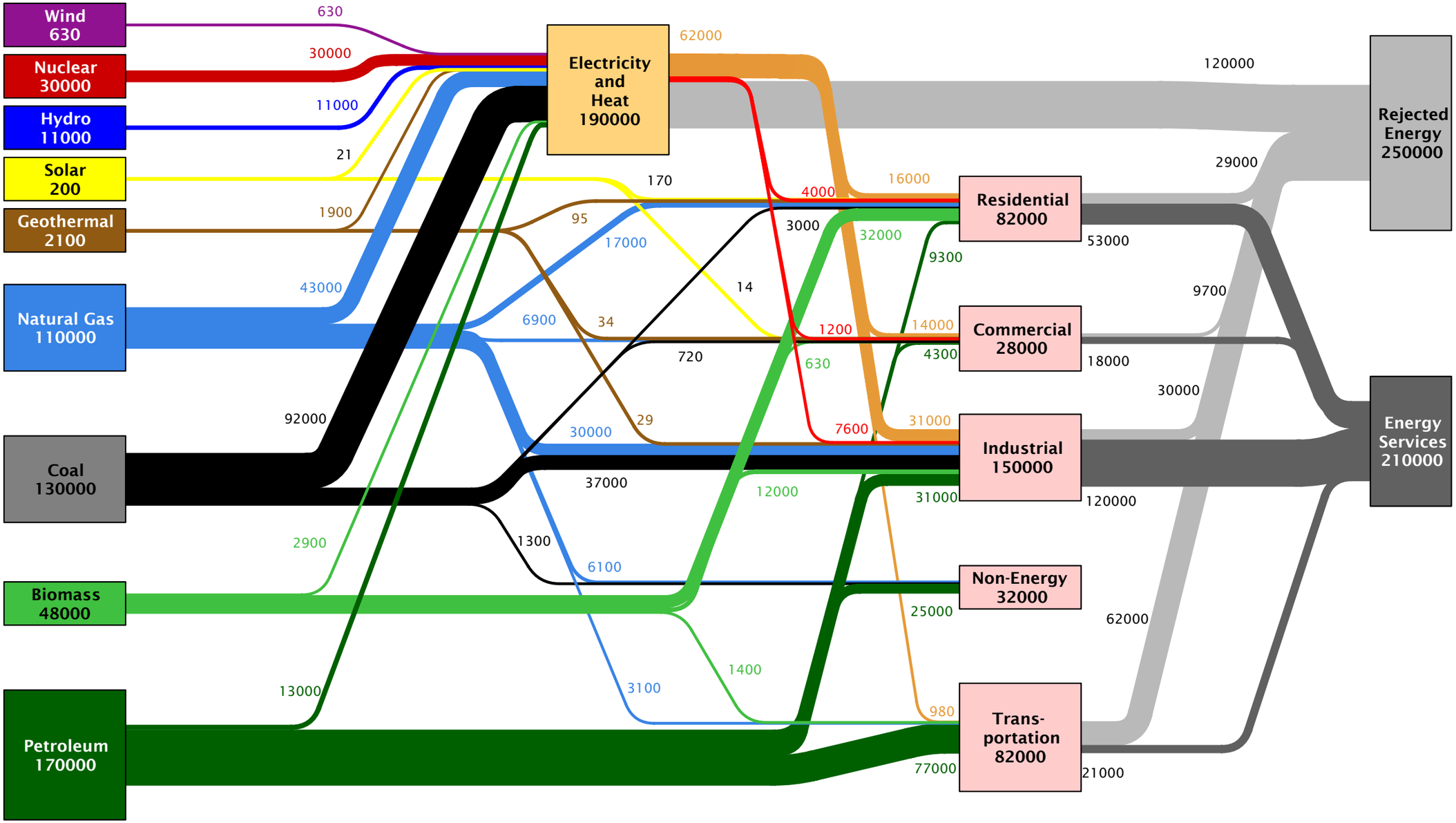
# Zimbabwe Energy Flow in 2007: ~400 PJ

Lawrence Livermore National Laboratory



# World Energy Flow in 2007: ~490000 PJ

Lawrence Livermore National Laboratory




Source: LLNL 2011. Data is based on IEA's Extended World Energy Balances. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the U.S. Department of Energy, under whose auspices the work was performed. All quantities are rounded to 2 significant digits and annual flows of less than 0.05 PJ are not included. Totals may not equal sum of flows due to statistical differences. Domestic supply includes changes in stocks. Further detail on how all flows are calculated can be found at http://flowcharts.llnl.gov. LLNL-TR-473098.

**Analysis**

IEA's extended world energy balances report energy transfers of 63 different commodities between 74 different economic activities. In order to concisely represent these energy flows, this analysis groups these commodities and activities as follows:

Commodities

**Coal and Coal-Based Fuels:**
Hard coal
Brown coal
Anthracite
Coking coal
Other bituminous coal
Sub-bituminous coal
Lignite/brown coal
Peat
Patent fuel
Coke oven coke
Gas coke
Coal tar
BKB/peat briquettes
Gas works gas
Coke oven gas
Blast furnace gas
Oxygen steel furnace gas
Elec/heat output from non-spec. manuf. Gases

**Wind:**
Wind

**Nuclear:**
Nuclear

**Hydro:**
Hydro

**Solar:**
Solar photovoltaic
Solar thermal

**Geothermal:**
Geothermal

**Natural Gas:**
Natural Gas

**Biomass and Renewable Waste:**
Renewable municipal waste
Primary solid biomassBiogas
Biogasoline
Biodiesels
Other liquid biofuels
Non-specified combust. renewables + wastes
Charcoal

**Electricity:**
Electricity

**Heat:**
Heat
Heat output from non-specified combustion fuels

**Other:**
(*IEA reports no significant flows of these forms of energy in any country*)
Tide, wave and ocean
Other sources

**Petroleum and Petroleum-Derived Fuels:**
Crude oil
Natural gas liquids
Industrial waste
Non-renewable municipal waste
Refinery feedstocks
Additives/blending components
Other hydrocarbons
Refinery gas
Ethane
Liquefied petroleum gases (LPG)
Motor gasoline
Aviation gasoline
Gasoline type jet fuel
Kerosene type jet fuel
Kerosene
Gas/diesel oil
Heavy fuel oil
Naphtha
White spirit & SBP
Lubricants
Bitumen
Paraffin waxes
Petroleum coke
Non-specified petroleum products

Economic Activities

**Industrial:**
(includes energy extraction and fuel production)
Heat pumps
Charcoal production plants
Gas-to-liquids (GTL) plants
Electric boilersNon-specified (transformation)
Nuclear industry
Chemical heat for electricity production Coal mines
Charcoal production plants
Blast furnaces Oil and gas extraction
Non-specified (energy)
Gas works
Blast furnaces Iron and steel
Coke ovens
Gas works
Chemical and petrochemical
Patent fuel plants
Gasification plants for biogas
Non-ferrous metals
BKB plants
Coke ovens
Non-metallic minerals
Petroleum refineries
Patent fuel plants
Transport equipment
Petrochemical industry
BKB plants
Machinery
Coal liquefaction plants
Petroleum refineries

*Industrial (cont.):*
Mining and quarrying
Gas-to-liquids (GTL) plants
Coal liquefaction plants
Food and tobacco
For blended natural gas
Liquefaction (LNG) / regasification plants
Paper, pulp and print
Agriculture/forestry
Construction
Wood and wood products
FishingTextile and leather
Non-specified (industry)
Non-specified (other)

**Non-Energy:**
(conversion of energy feedstock to durable products)
Non-energy use
Non-energy use industry/transformation/ energy
Non-energy use in transport

**Transportation:**
Domestic aviation
Road
Rail
Pipeline transportDomestic navigation
Non-specified (transport)
International marine bunkers
International aviation bunkers

**Electricity and Heat Production:**
Main activity producer electricity plants
Autoproducer electricity plants
Main activity producer CHP plants
Autoproducer CHP plants
Main activity producer heat plants
Autoproducer heat plants
Own use in electricity, CHP and heat plants
Used for pumped storage
Distribution losses

**Residential:**
Residential

**Commercial:**
Commercial and public services

Balance of Trade:
In addition to economic activity, IEA's extended energy balances also report the domestic production ("Production"), Imports, and Exports associated with each commodity.

**Flow Definitions:**

Wind:

Wind -> Electricity and Heat
Sum of flows of all items in *Wind* to all activities in *Electricity and Heat Production*

Nuclear:

Nuclear -> Electricity and Heat
Sum of flows of all items in *Nuclear* to/from all activities in *Electricity and Heat Production*

Hydro:

Hydro -> Electricity and Heat
Sum of flows of all items in *Hydro* to/from all activities in *Electricity and Heat Production*

Solar:

Solar -> Electricity and Heat
Sum of flows of all items in *Solar* to/from all activities in *Electricity and Heat Production*

Solar -> Residential
Sum of flows of all items in *Solar* to/from all activities in *Residential*

Solar -> Commercial
Sum of flows of all items in *Solar* to/from all activities in *Commercial*

Geothermal:

Geothermal -> Electricity and Heat
Sum of flows of all items in *Geothermal* to/from all activities in *Electricity and Heat Production*

Geothermal -> Residential
Sum of flows of all items in *Geothermal* to/from all activities in *Residential*

Geothermal -> Commercial
Sum of flows of all items in *Geothermal* to/from all activities in *Commercial*

Geothermal (con't):

Geothermal -> Industrial
Sum of flows of all items in *Geothermal* to/from all activities in *Industrial*

Natural Gas:

Domestic -> Natural Gas
Sum of *Production* of all items in *Natural Gas*

Imported -> Natural Gas
Sum of *Imports* of all items in *Natural Gas*

Natural Gas -> Exports
Sum of *Exports* of all items in *Natural Gas*

Natural Gas -> Electricity and Heat
Sum of flows of all items in *Natural Gas* to/from all activities in *Electricity and Heat Production*

Natural Gas -> Residential
Sum of flows of all items in *Natural Gas* to/from all activities in *Residential*

Natural Gas -> Commercial
Sum of flows of all items in *Natural Gas* to/from all activities in *Commercial*

Natural Gas -> Industrial
Sum of flows of all items in *Natural Gas* to/from all activities in *Industrial*

Natural Gas -> Non Energy
Sum of flows of all items in *Natural Gas* to/from all activities in *Non-Energy*

Natural Gas -> Transportation
Sum of flows of all items in *Natural Gas* to/from all activities in *Transportation*

Coal:

Domestic -> Coal
Sum of *Production* of all items in *Coal and Coal-Based Fuels*

Imported -> Coal
Sum of *Imports* of all items in *Coal and Coal-Based Fuels*

Coal -> Exports
Sum of *Exports* of all items in *Coal and Coal-Based Fuels*

Coal (con't):

Coal -> Electricity and Heat
Sum of flows of all items in *Coal and Coal-Based Fuels* to/from all activities in *Electricity and Heat Production*

Coal -> Residential
Sum of flows of all items in *Coal and Coal-Based Fuels* to/from all activities in *Residential*

Coal -> Commercial
Sum of flows of all items in *Coal and Coal-Based Fuels* to/from all activities in *Commercial*

Coal -> Industrial
Sum of flows of all items in *Coal and Coal-Based Fuels* to/from all activities in *Industrial*

Coal -> Non Energy
Sum of flows of all items in *Coal and Coal-Based Fuels* to/from all activities in *Non-Energy*

Biomass:

Domestic -> Biomass
Sum of *Production* of all items in *Biomass and Renewable Waste Fuels*

Imported -> Biomass
Sum of *Imports* of all items in *Biomass and Renewable Waste Fuels*

Biomass -> Exports
Sum of *Exports* of all items in *Biomass and Renewable Waste Fuels*

Biomass -> Electricity and Heat
Sum of flows of all items in *Biomass and Renewable Waste Fuels* to/from all activities in *Electricity and Heat Production*

Biomass -> Residential
Sum of flows of all items in *Biomass and Renewable Waste Fuels* to/from all activities in *Residential*

Biomass -> Commercial
Sum of flows of all items in *Biomass and Renewable Waste Fuels* to/from all activities in *Commercial*

Biomass -> Industrial
Sum of flows of all items in *Biomass and Renewable Waste Fuels* to/from all activities in *Industrial*

Biomass (con't):

Biomass -> Transportation
Sum of flows of all items in *Biomass and Renewable Waste Fuels* to/from all activities in *Transportation*

Petroleum:

Domestic -> Petroleum
Sum of *Production* of all items in *Petroleum and Petroleum-Derived Fuels*

Imported -> Petroleum
Sum of *Imports* of all items in *Petroleum and Petroleum-Derived Fuels*

Petroleum -> Exports
Sum of *Exports* of all items in *Petroleum and Petroleum-Derived Fuels*

Petroleum -> Electricity and Heat
Sum of flows of all items in *Petroleum and Petroleum-Derived Fuels* to/from all activities in *Electricity and Heat Production*

Petroleum -> Residential
Sum of flows of all items in *Petroleum and Petroleum-Derived Fuels* to/from all activities in *Residential*

Petroleum -> Commercial
Sum of flows of all items in *Petroleum and Petroleum-Derived Fuels* to/from all activities in *Commercial*

Petroleum -> Industrial
Sum of flows of all items in *Petroleum and Petroleum-Derived Fuels* to/from all activities in *Industrial*

Petroleum -> Non Energy
Sum of flows of all items in *Petroleum and Petroleum-Derived Fuels* to/from all activities in *Non-Energy*

Petroleum -> Transportation
Sum of flows of all items in *Petroleum and Petroleum-Derived Fuels* to/from all activities in *Transportation*

Electricity and Heat:

Electricity Imports-> Electricity
*Imports* of *Electricity*

Electricity -> Electricity Exports
*Exports* of *Electricity*

Electricity and Heat -> Residential (Electricity, Orange)
*Electricity* flow to/from *Residential*

Electricity and Heat -> Commercial (Electricity, Orange)
*Electricity* flow to/from *Commercial*

Electricity and Heat -> Industrial (Electricity, Orange)
*Electricity* flow to/from all activities in *Industrial*

Electricity and Heat -> Transportation (Electricity, Orange)
*Electricity* flow to/from all activities in *Transportation*

Production of Electricity:
Sum of *Electricity* flow to/from *Residential, Commercial, Industrial* and *Transportation* sectors; plus the difference between *Electricity Exports* and *Electricity Imports*

Electricity and Heat -> Residential (Heat, Red)
Flow of all commodities in *Heat* to/from *Residential*

Electricity and Heat -> Commercial (Heat, Red)
Flow of all commodities in *Heat* to/from *Commercial*

Electricity and Heat -> Industrial (Heat, Red)
Flow of all commodities in *Heat* to/from all activities in *Industrial*

Electricity and Heat ->Rejected Energy (Gray)
Difference between the sum of all flows into Electricity and Heat (from *Wind, Nuclear, Hydro, Solar, Geothermal, Natural Gas, Coal, Biomass, and Petroleum)* and the sum of all flows out of Electricity and Heat (*Electricity* and *Heat* consumption by *Residential, Commercial, Industrial,* and *Transportation*)

Liquefaction[1]

Coal-> Liquefaction
Sum of flows of all items in *Coal and Coal-Based Fuels* to/from all activities in *Coal Liquefaction Plants*

Liquefaction -> Petroleum and Petroleum Derived Fuels
Sum of flows from *Coal Liquefaction Plants* that are considered *Petroleum and Petroleum Derived Fuels*

Liquefaction -> Rejected Energy
Difference between the inputs to *Liquefaction* (from *Coal and Coal Derived Fuels*) and the outputs of synthetic *Petroleum and Petroleum Derived Fuels*.

Rejected Energy:

Residential -> Rejected Energy
The residential sector is assumed to have an energy efficiency of 65%.
This flow is calculated as 35% of the sum of all inputs (*Solar, Geothermal, Natural Gas, Coal and Coal Derived Products, Biomass and Renewable Waste Fuels, Petroleum and Petroleum Derived Products, Electricity, and Heat*) to all activities in the *Residential* sector.

Commercial -> Rejected Energy
The Commercial sector is assumed to have an energy efficiency of 65%.
This flow is calculated as 35% of the sum of all inputs (*Solar, Geothermal, Natural Gas, Coal and Coal Derived Products, Biomass and Renewable Waste Fuels, Petroleum and Petroleum Derived Products, Electricity, and Heat*) to all activities in the *Commercial* sector.

Industrial -> Rejected Energy
The Industrial sector is assumed to have an energy efficiency of 80%.
This flow is calculated as 20% of the sum of all inputs (*Geothermal, Natural Gas, Coal and Coal Derived Products, Biomass and Renewable Waste, Petroleum and Petroleum Derived Products, Electricity, and Heat*) to all activities in the *Industrial* sector.

Transportation -> Rejected Energy
The Transportation sector is assumed to have an energy efficiency of 25%.
This flow is calculated as 75% of the sum of all inputs (*Natural Gas, Liquefaction, Biomass and Renewable Waste, Petroleum and Petroleum Derived Products, and Electricity*) to all activities in the *Transportation* sector.

[1] South Africa is the only country whose coal liquefaction sector is large enough to be shown outside of the industrial sector. In this case, the *Coal and Coal Based Fuels* inputs to *Coal Liquefaction Plants* are NOT included in the sum of industrial coal use, and the synthetic petroleum products of liquefaction are added to the flow of *Petroleum and Petroleum Derived Fuels*.

Energy Services:

Residential -> Energy Services
The residential sector is assumed to have an energy efficiency of 65%.
This flow is calculated as 65% of the sum of all inputs (*Solar, Geothermal, Natural Gas, Coal and Coal Derived Products, Biomass and Renewable Waste Fuels, Petroleum and Petroleum Derived Products, Electricity, and Heat*) to all activities in the *Residential* sector.

Commercial -> Energy Services
The Commercial sector is assumed to have an energy efficiency of 65%.
This flow is calculated as 65% of the sum of all inputs (*Solar, Geothermal, Natural Gas, Coal and Coal Derived Products, Biomass and Renewable Waste Fuels, Petroleum and Petroleum Derived Products, Electricity, and Heat*) to all activities in the *Commercial* sector.

Industrial -> Energy Services
The Industrial sector is assumed to have an energy efficiency of 80%.
This flow is calculated as 80% of the sum of all inputs (*Geothermal, Natural Gas, Coal and Coal Derived Products, Biomass and Renewable Waste, Petroleum and Petroleum Derived Products, Electricity, and Heat*) to all activities in the *Industrial* sector.

Transportation -> Energy Services
The Transportation sector is assumed to have an energy efficiency of 25%.
This flow is calculated as 25% of the sum of all inputs (*Natural Gas, Liquefaction, Biomass and Renewable Waste, Petroleum and Petroleum Derived Products, and Electricity*) to all activities in the *Transportation* sector.

## Conclusion

The flow charts described in this report are compact depictions of the energy use at the country and world-wide level in 2007. These diagrams will be made available at:

http://flowcharts.llnl.gov

## References

IEA Data Services: http://data.iea.org

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