In this EcoWest presentation, we break down energy trends in the U.S. and Western states by using a graphic known as a Sankey diagram. Energy flows through everything so it’s only fitting to use this type of flow chart to depict our complex energy economy.
Narrative: Sankey diagrams are named after an Irish military officer who used the graphic in 1898 in a publication on steam engines. Since then, Sankey’s diagrams have won a dedicated following among data visualization nerds. The graphics summarize flows through a system by varying the width of lines according to the magnitude of energy, water, or some other commodity.

Source: Wikipedia.org

URL: http://en.wikipedia.org/wiki/Matthew_Henry_Phineas_Riall_Sankey
Narrative: One of the earliest and most famous examples of the form illustrates Napoleon’s disastrous Russian campaign in the early 19th century.

Source: Napoleon's retreat from Moscow, by Adolph Northen (1828–1876)
Narrative: Created by Charles Joseph Minard, a French civil engineer, the graphic depicts the army’s movement across Europe and shows how their ranks were reduced from 422,000 troops in June 1812, when they invaded Russia, to just 10,000, when the remnants of the force staggered back into Poland after retreating through a brutal winter. Data visualization guru Edward Tufte says it’s “probably the best statistical graphic ever drawn.”

Source: Wikipedia.org
Narrative: Sankey diagrams created by the Lawrence Livermore National Laboratory depict both the source and use of energy. The boxes on the left show the nation’s power portfolio and the lines moving to the right show where that energy ends up, with the width varying by the magnitude of the flow. This graphic, using 2008 data, shows that petroleum in the transportation sector accounts for the biggest overall energy flow. In 2008, more than half of electricity generation came from coal, followed by nuclear and natural gas.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
Here's the next year's data. Total energy use actually fell slightly as the U.S. economy fell into the recession, but the overall pattern of the flows remained the same. In all of the energy diagrams, you’ll notice that a significant share of energy is “rejected.” A good example of rejected energy is waste heat from power plants. The greater the percentage of rejected energy, the less efficient the system is.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
Here’s 2010. It’s worth noting that in this sequence of slides, the size of the rectangles do not vary according the amount—it’s only the thickness of the lines that changes from year to year.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Here’s 2011, the most recent version. Between 2010 and 2011, the thickness of the coal line decreased as the nation shifted toward natural gas. Besides being used to fuel power plants, natural gas is used directly in homes, business, and factories.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Here’s another Sankey diagram for U.S. energy flows that was created by the Department of Energy.

Source: U.S. Department of Energy
URL: http://science.energy.gov/bes/news-and-resources/energy-flow/energy-flow-diagram/
This version includes some interesting facts and statistics in the margins.

Source: U.S. Department of Energy

URL: http://science.energy.gov/bes/news-and-resources/energy-flow/energy-flow-diagram/
Narrative: Now let’s shift to energy flows in the 11 Western states.

Source: Lawrence Berkeley National Laboratory

URL: https://flowcharts.llnl.gov/index.html
First off, it’s worth noting that the region’s energy economy is heavily influenced by California, which accounts for 41 percent of the flows.

Source: Lawrence Berkeley National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Here’s the picture for California. As you might expect, petroleum used in the transportation sector dominates the system in a state that is known for its car culture and is home to major transportation hubs. Looking at the electricity generation box, you can see that natural gas now provides the biggest share of the state’s power portfolio, but nuclear, hydro, and geothermal are also major contributors. There’s barely any coal used for power generation within California, but you’ll notice that the state also imports a fair amount of energy from other states, including coal-fired plants in the Southwest.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
It’s a totally different story in Wyoming, where virtually all of the electricity generated in the state comes from coal. Some of that power is also exported to other states. Compared to California, far less energy flows into the transportation sector in this sparsely populated state. As with the national slides, it’s important to note that the rectangles don’t change size from state to state. That means the width of the flow lines are not comparable from slide to slide: they merely show, within a single state, how the energy flows are divided.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
Narrative: It’s no surprise that Wyoming, home to the Powder River Basin coal deposit, is so heavily reliant on coal, but so are some other inland states, such as New Mexico.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Narrative: And Utah, both of which export some of that electricity.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Narrative: Colorado is heavily dependent on coal, but natural gas is also critical and about 6 percent of electricity generation comes from wind, a higher fraction than any other Western state.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Montana also uses lots of coal, but hydropower makes up nearly one-third of the power portfolio.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
In Arizona, the Palo Verde nuclear power plant, the nation’s largest, accounts for 27 percent of the state’s electricity generation, although some of that power is exported to places like California.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
Narrative: In Nevada, natural gas is the top source for power plants, while geothermal accounts for 9 percent.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
Coal may be king for electricity generation in many states in the intermountain West, but it’s hydropower that dominates the power portfolios in the Pacific Northwest. Here’s Idaho, which imports a good deal of its electricity from surrounding states.

Source: Lawrence Livermore National Laboratory
URL: https://flowcharts.llnl.gov/index.html
Narrative: In Oregon, hydropower dams account for 64 percent of electricity generation.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
Narrative: While in Washington state it’s 71 percent.

Source: Lawrence Livermore National Laboratory

URL: https://flowcharts.llnl.gov/index.html
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