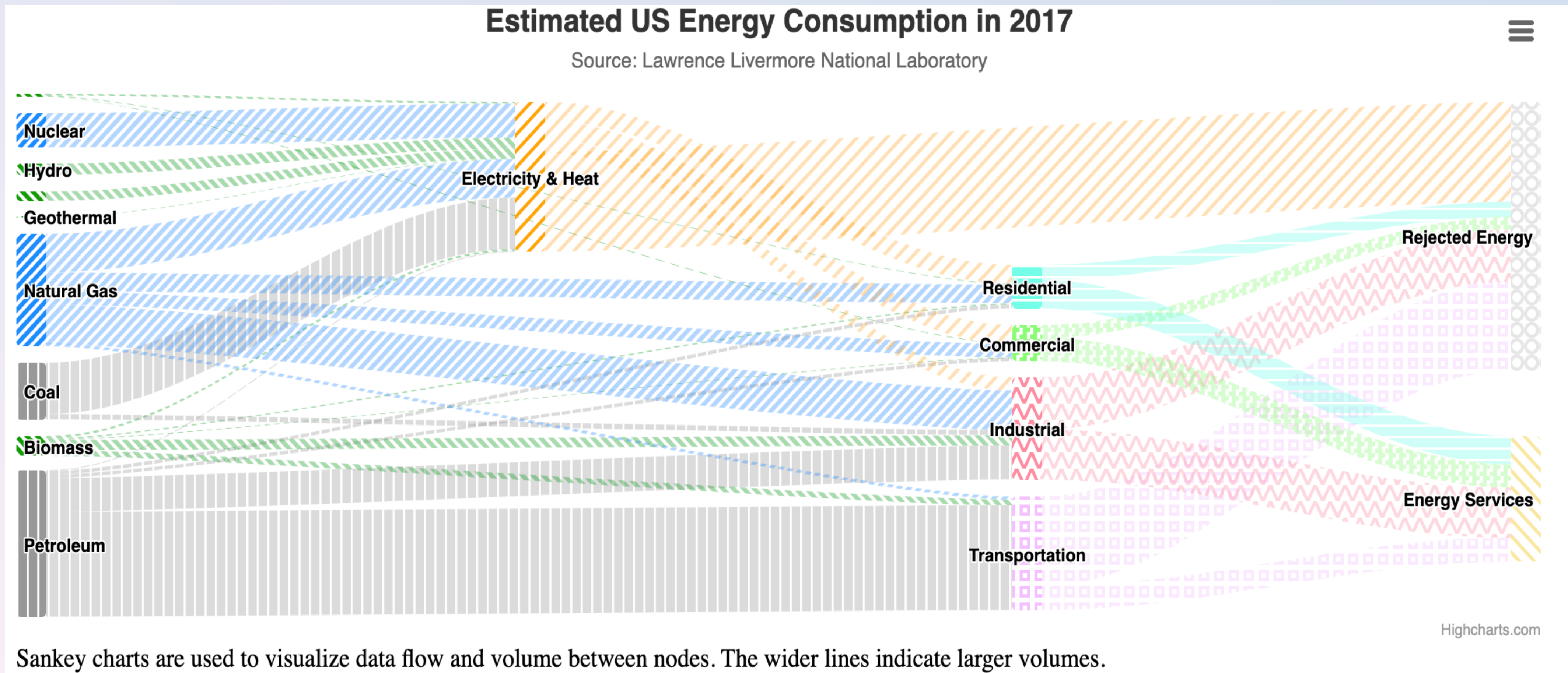


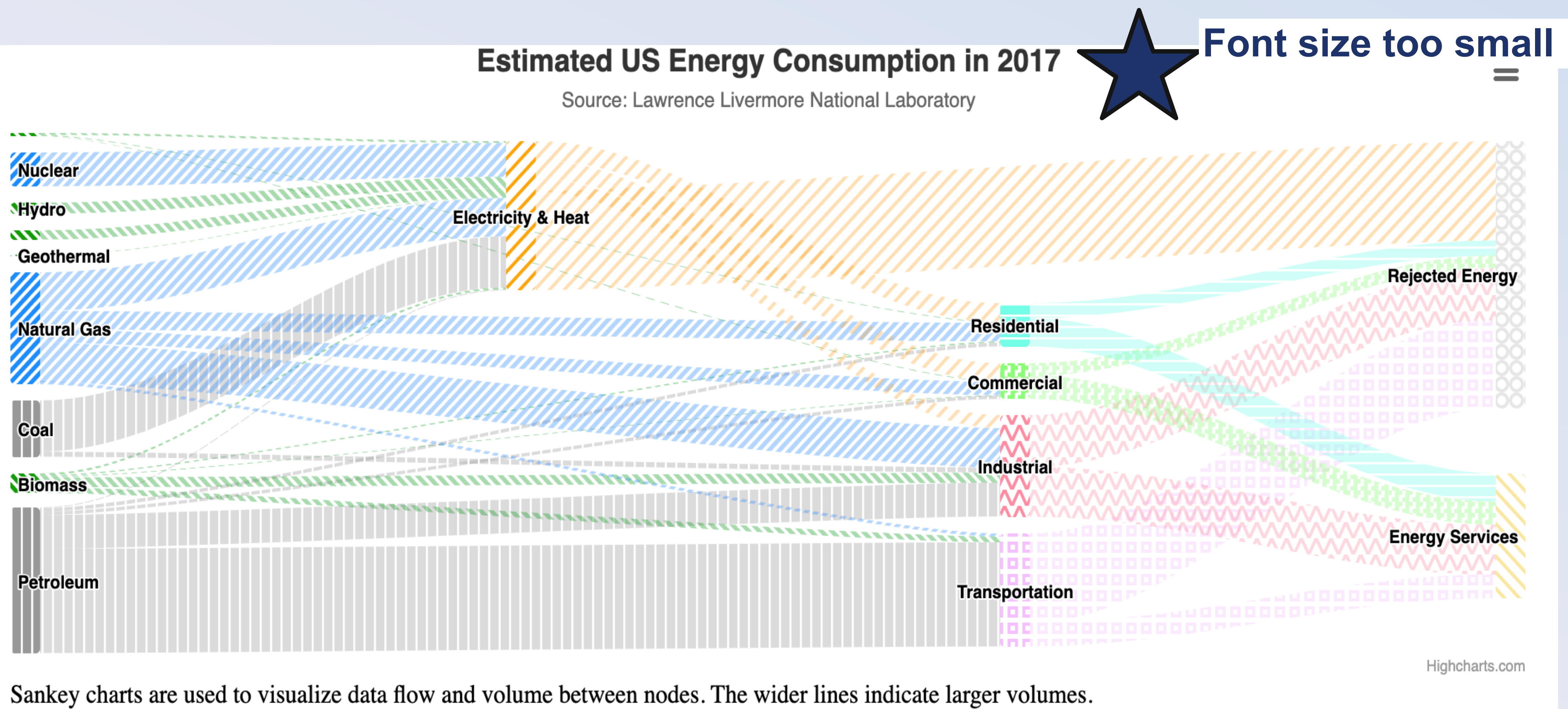
Chapter 3, Episode 4:

Flexible barriers

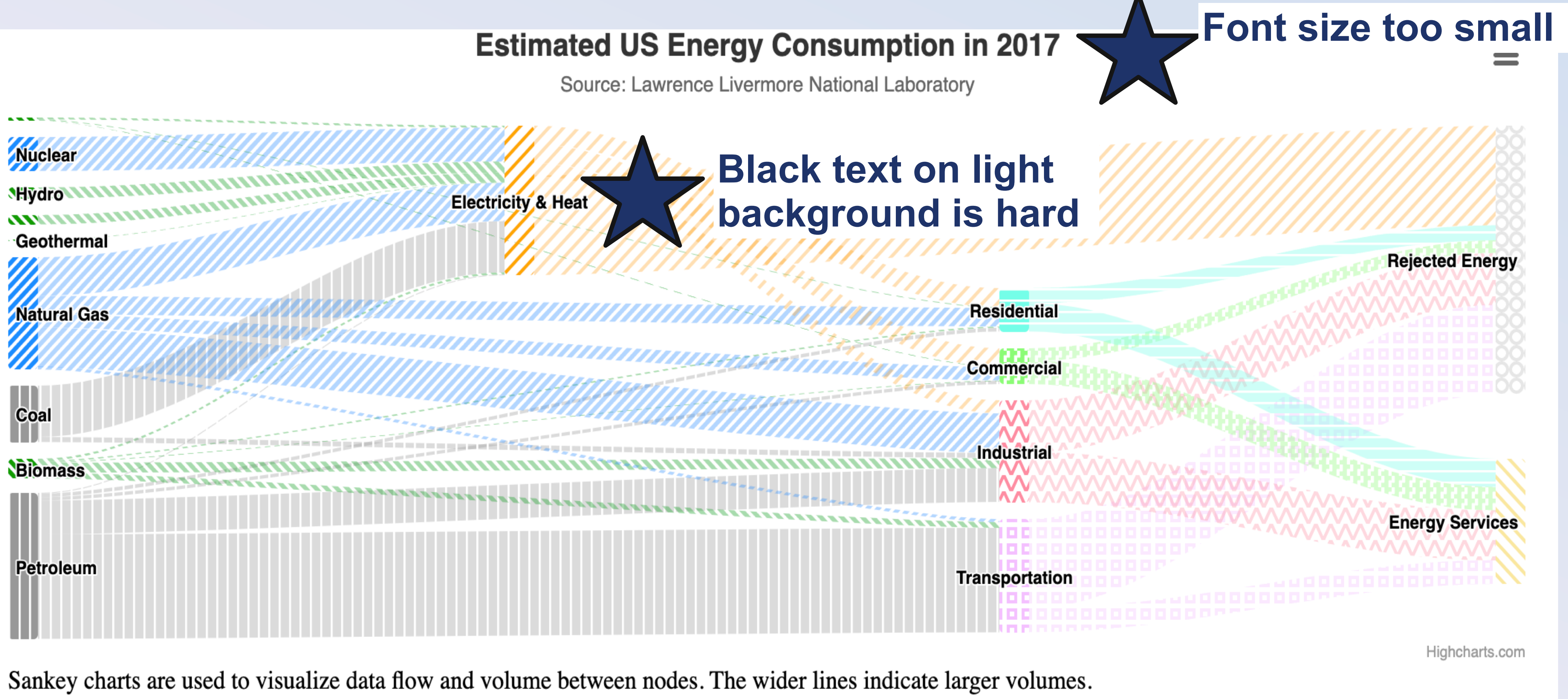
What about this visualization might be a barrier?



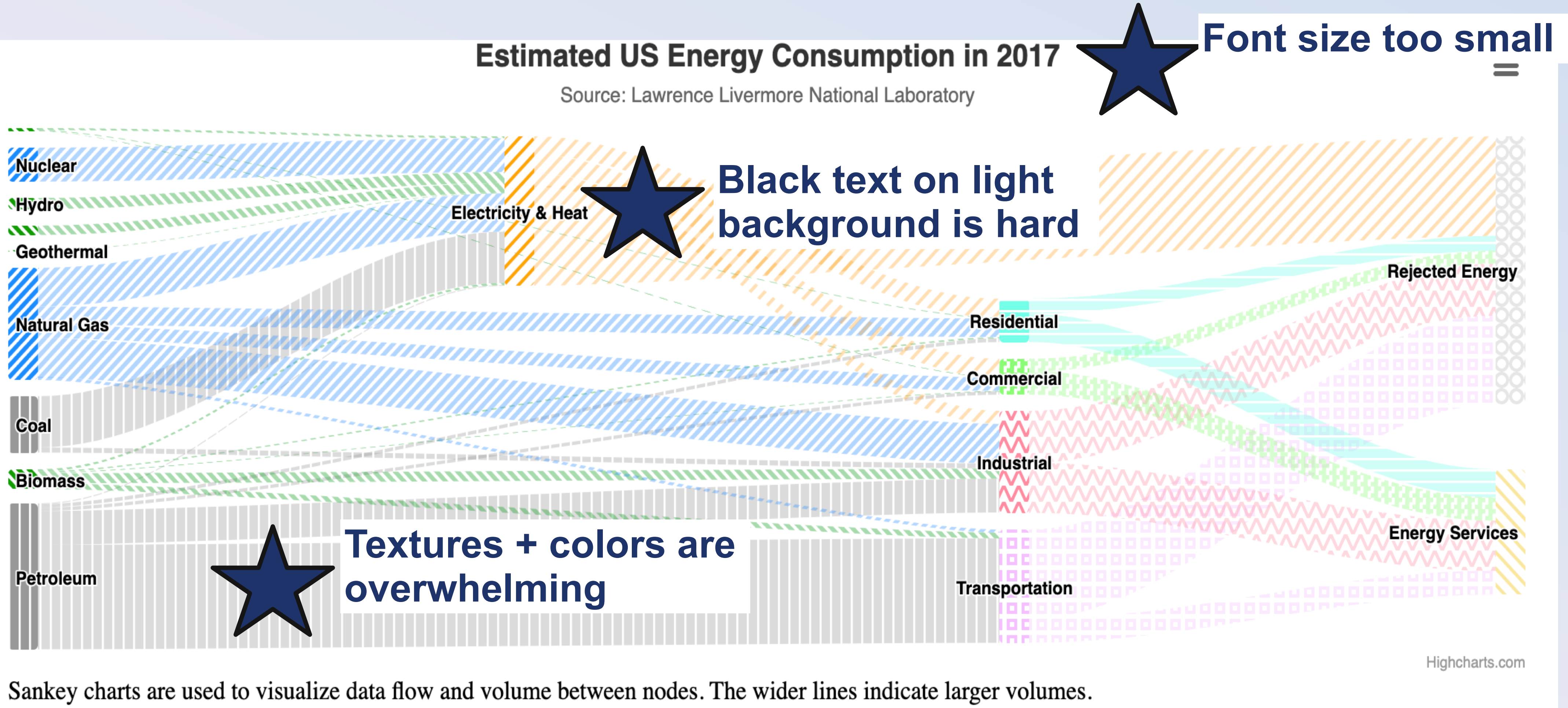
What about this visualization might be a barrier?



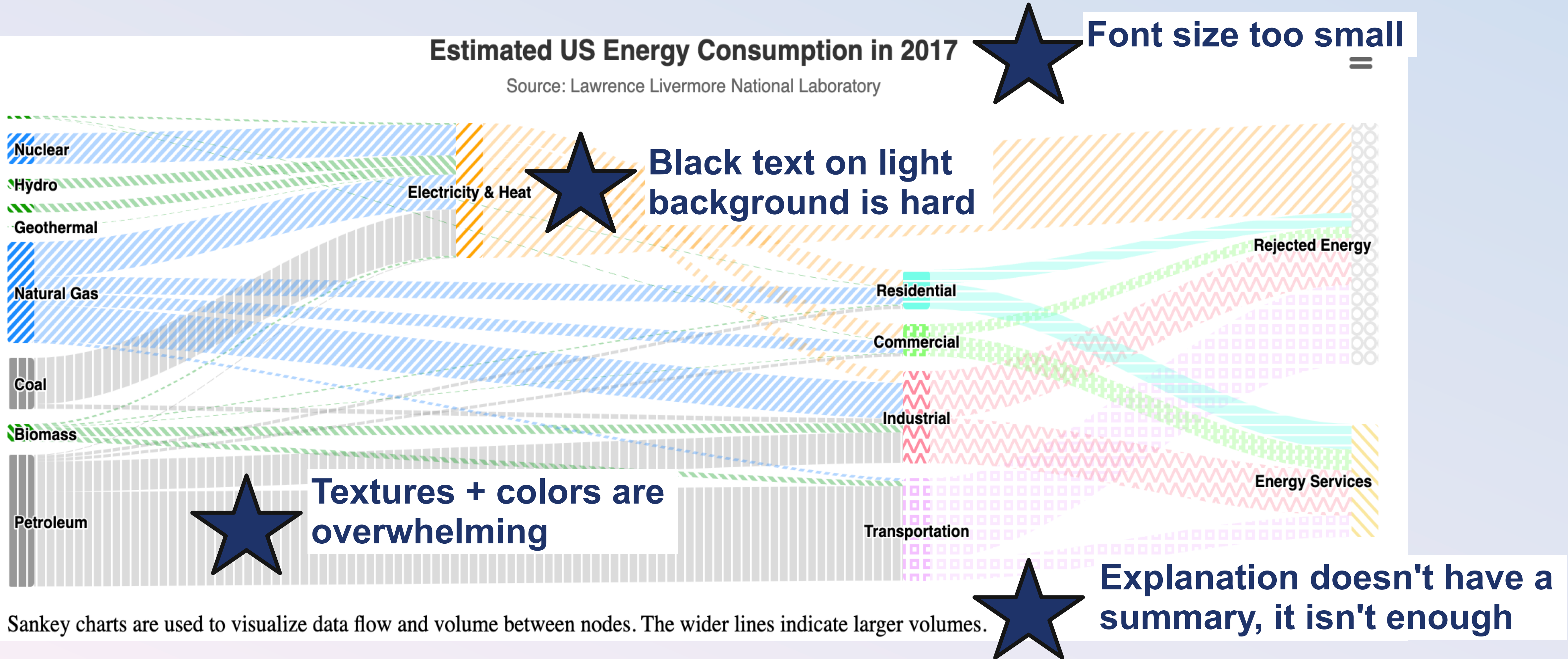
What about this visualization might be a barrier?



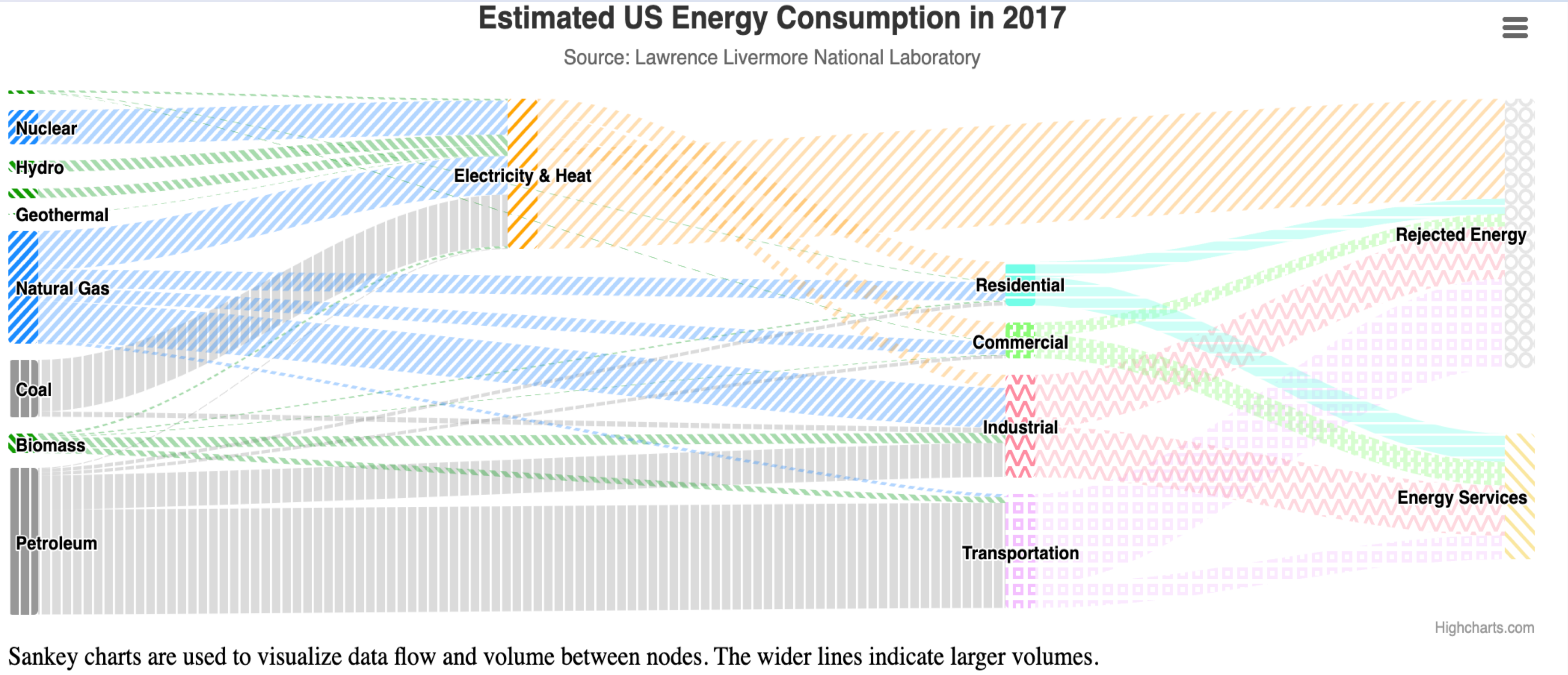
What about this visualization might be a barrier?



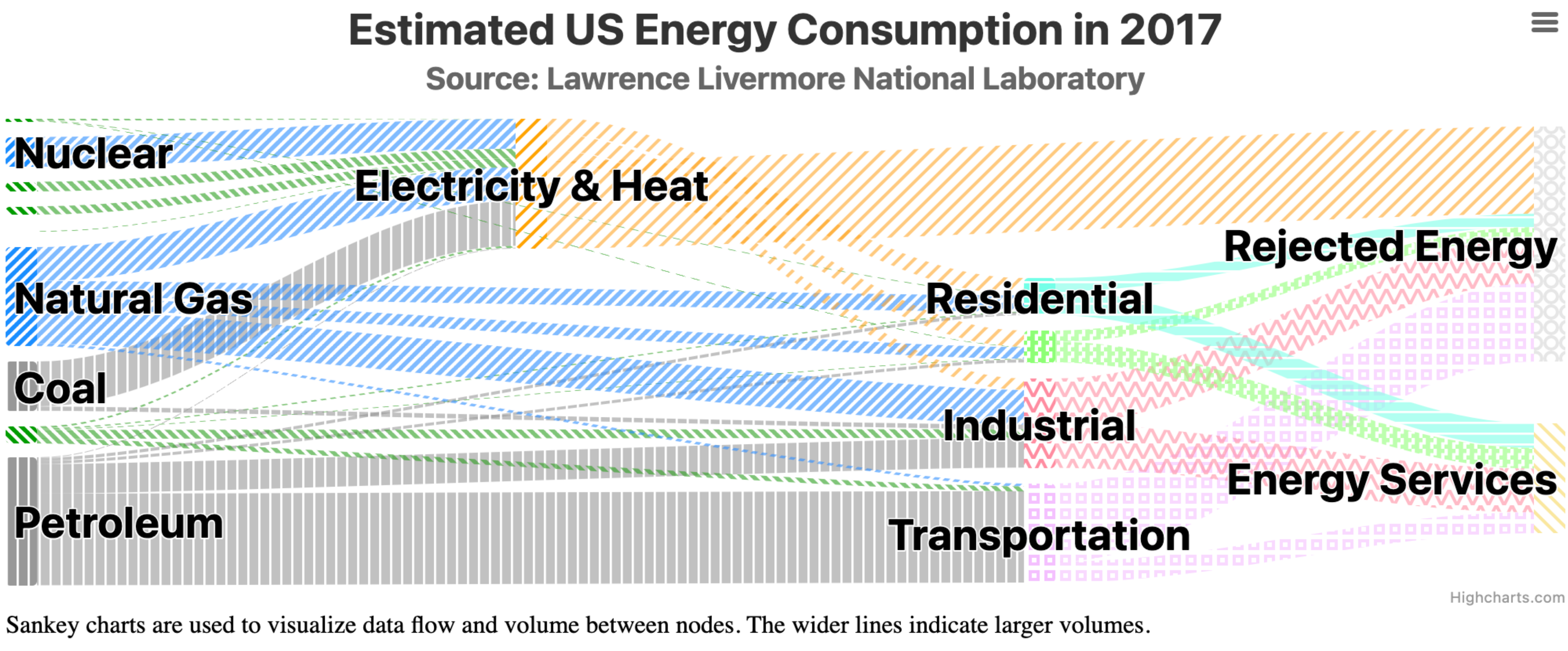
What about this visualization might be a barrier?



Can we fix this?



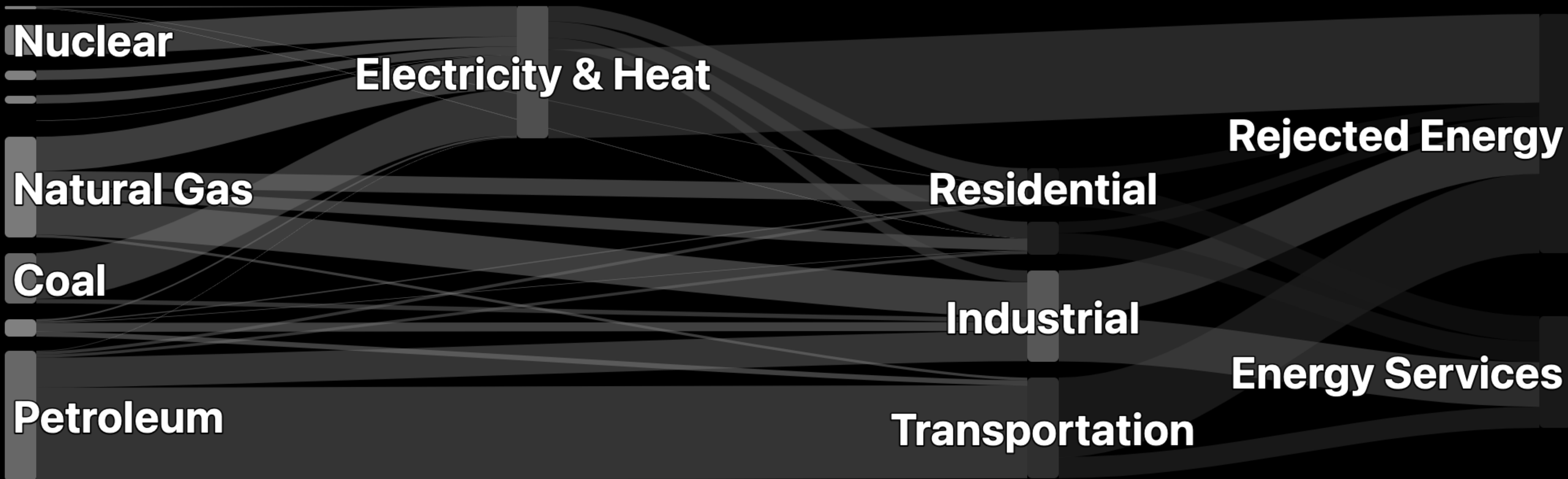
Maybe we can bump up the text size



We can reduce visual complexity too

Estimated US Energy Consumption in 2017

Source: Lawrence Livermore National Laboratory



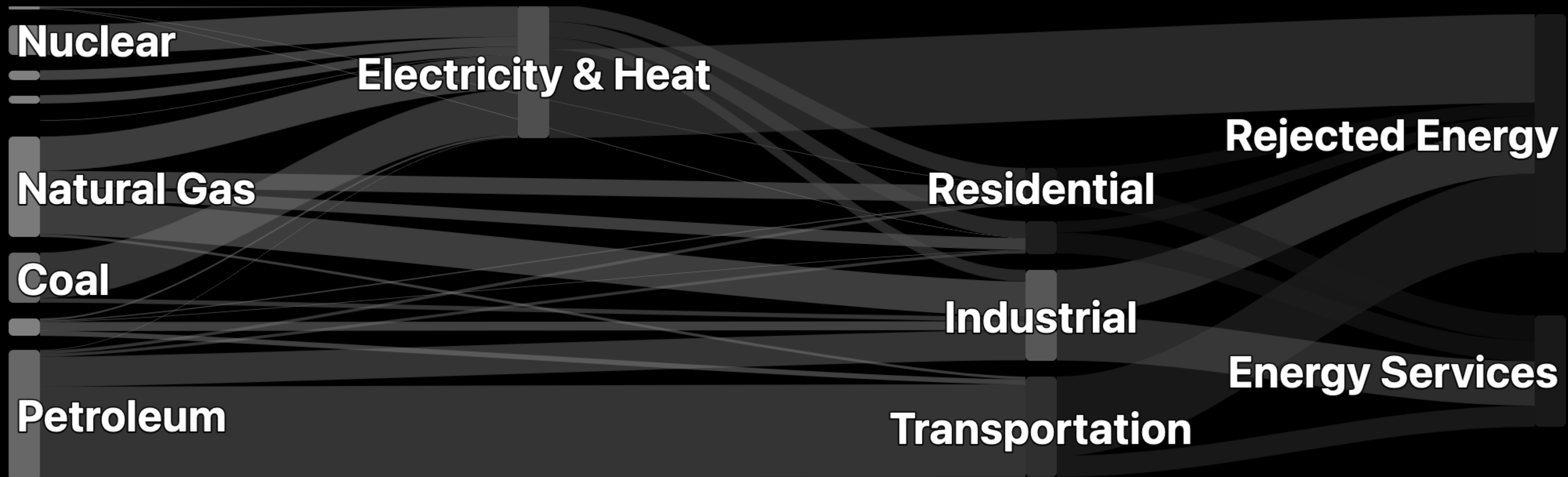
Highcharts.com

Sankey charts are used to visualize data flow and volume between nodes. The wider lines indicate larger volumes.

We can add a more descriptive explanation

Estimated US Energy Consumption in 2017

Source: Lawrence Livermore National Laboratory



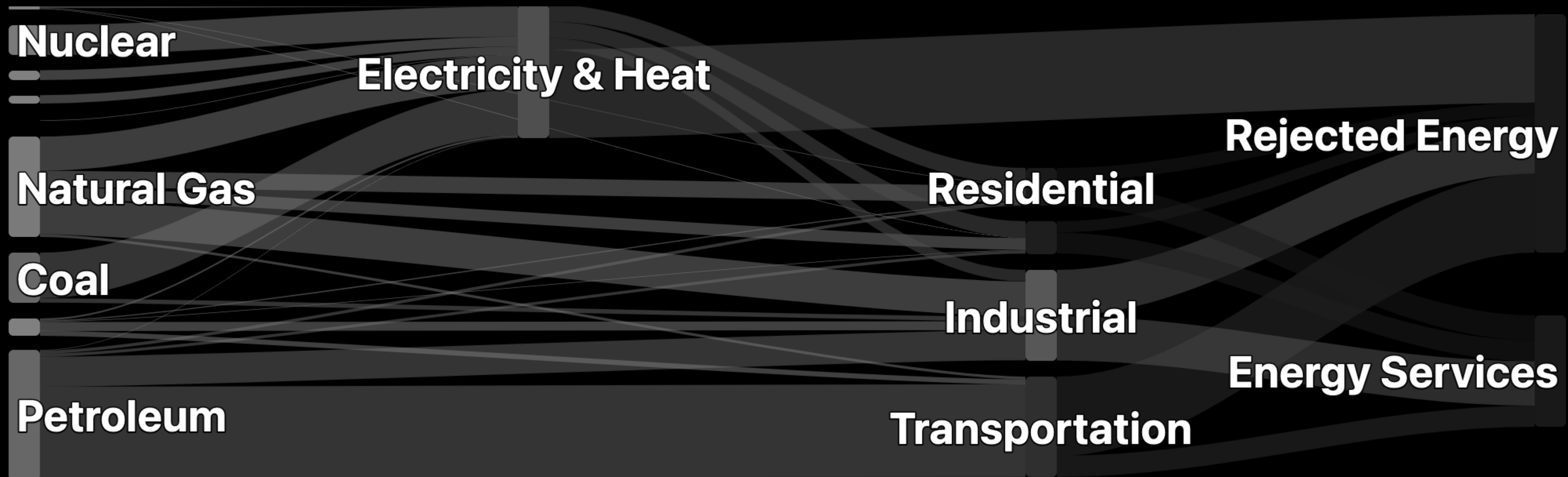
Highcharts.com

Sankey charts are used to visualize data flow and volume between nodes. Visually wider lines indicate larger volumes. This chart is showing energy consumption and types. Interacting with this chart by selecting a node or flow (such as with a click) will update the stacked bar chart below.

Is this the *perfect*, most accessible design?

Estimated US Energy Consumption in 2017

Source: Lawrence Livermore National Laboratory



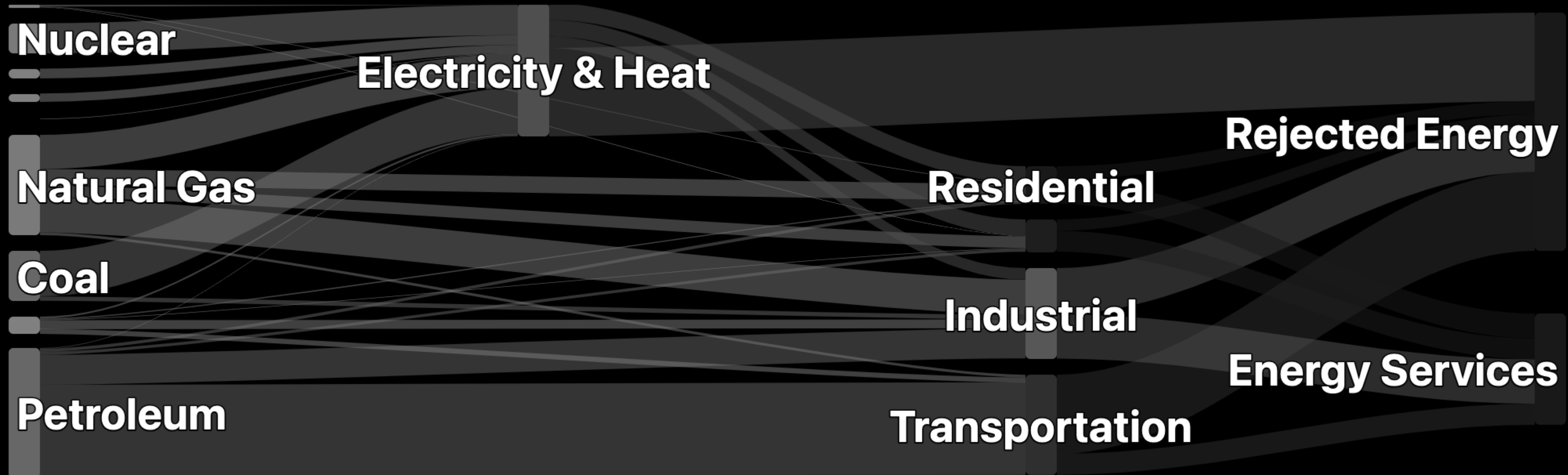
Highcharts.com

Sankey charts are used to visualize data flow and volume between nodes. Visually wider lines indicate larger volumes. This chart is showing energy consumption and types. Interacting with this chart by selecting a node or flow (such as with a click) will update the stacked bar chart below.

Bad news...

Estimated US Energy Consumption in 2017

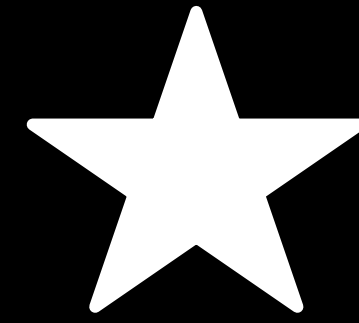
Source: Lawrence Livermore National Laboratory



Highcharts.com

Sankey charts are used to visualize data flow and volume between nodes. Visually wider lines indicate larger volumes. This chart is showing energy consumption and types. Interacting with this chart by selecting a node or flow (such as with a click) will update the stacked bar chart below.

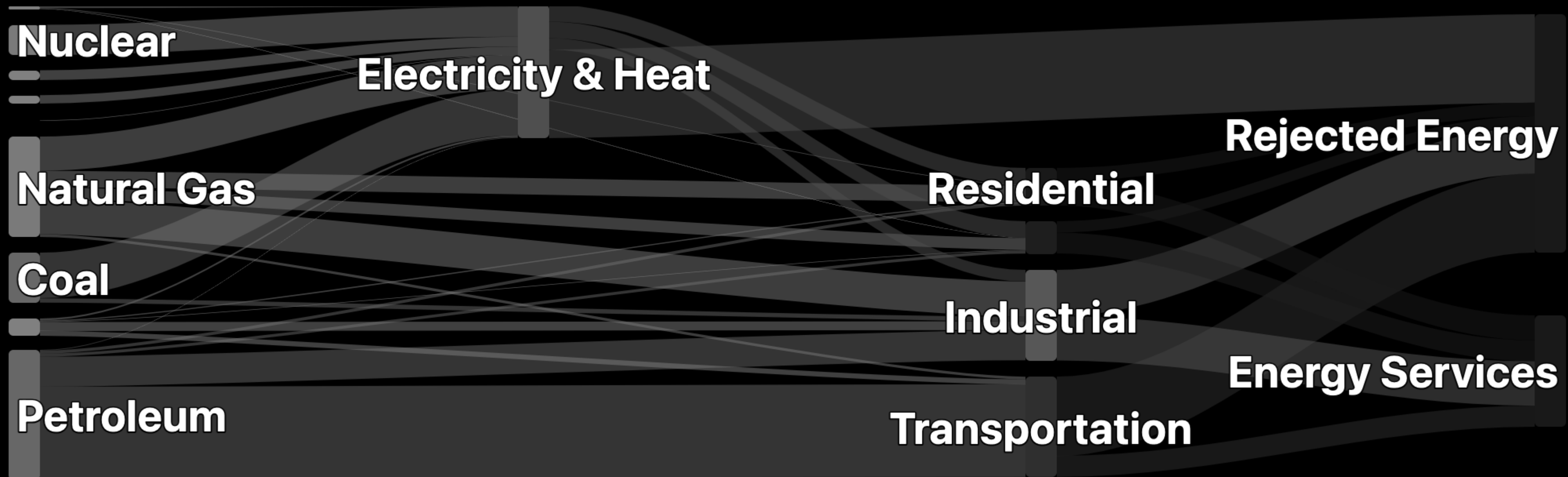
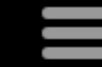
Bad news...



This design has
accessibility issues too

Estimated US Energy Consumption in 2017

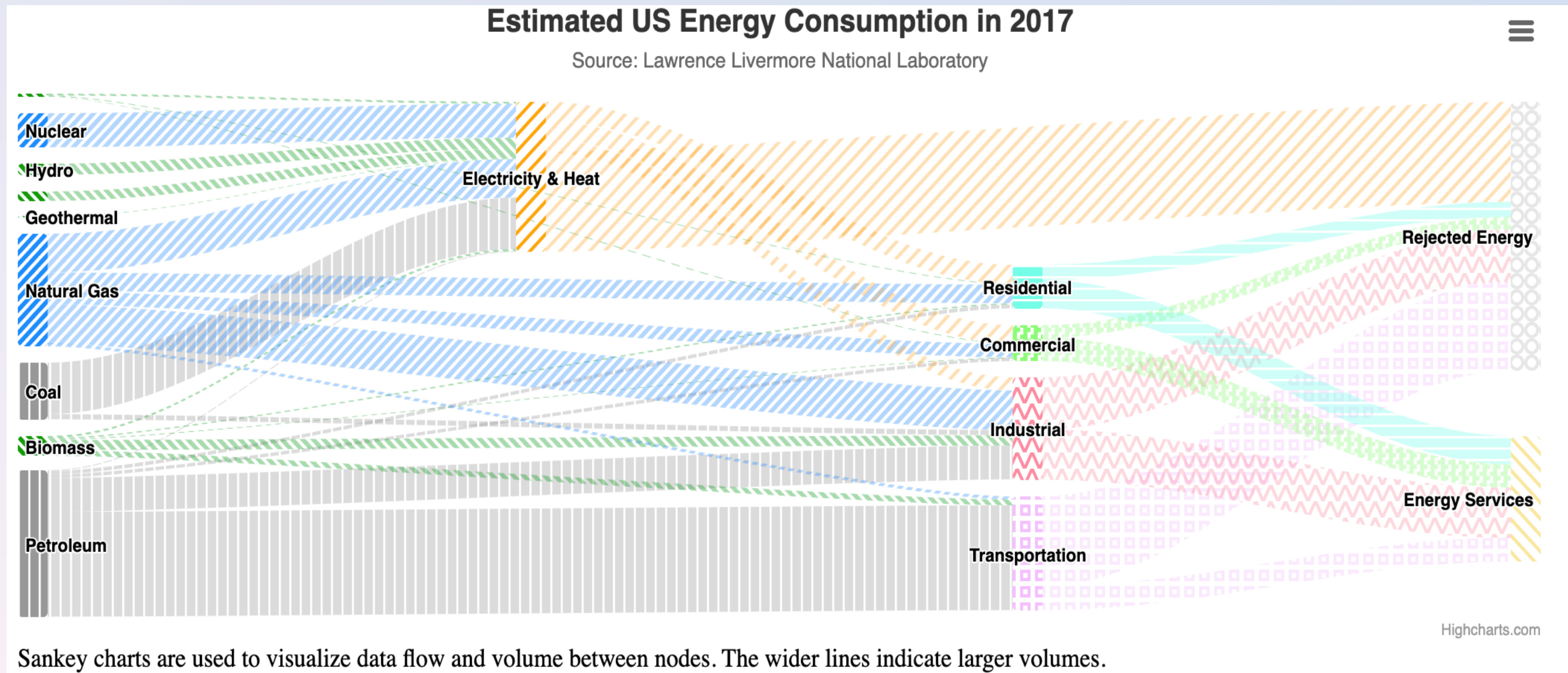
Source: Lawrence Livermore National Laboratory



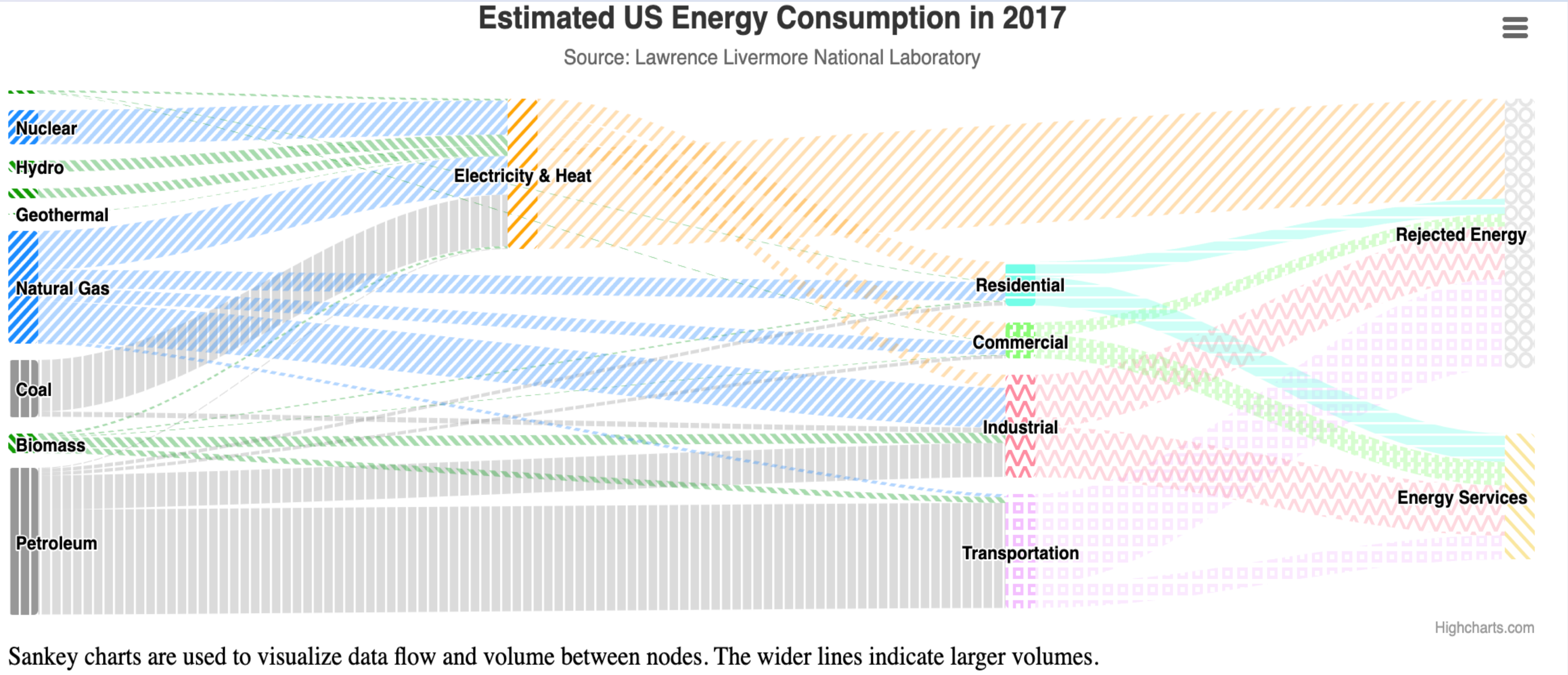
Highcharts.com

Sankey charts are used to visualize data flow and volume between nodes. Visually wider lines indicate larger volumes. This chart is showing energy consumption and types. Interacting with this chart by selecting a node or flow (such as with a click) will update the stacked bar chart below.

There is no such thing as a single, perfect visualization



One design *cannot* fit all



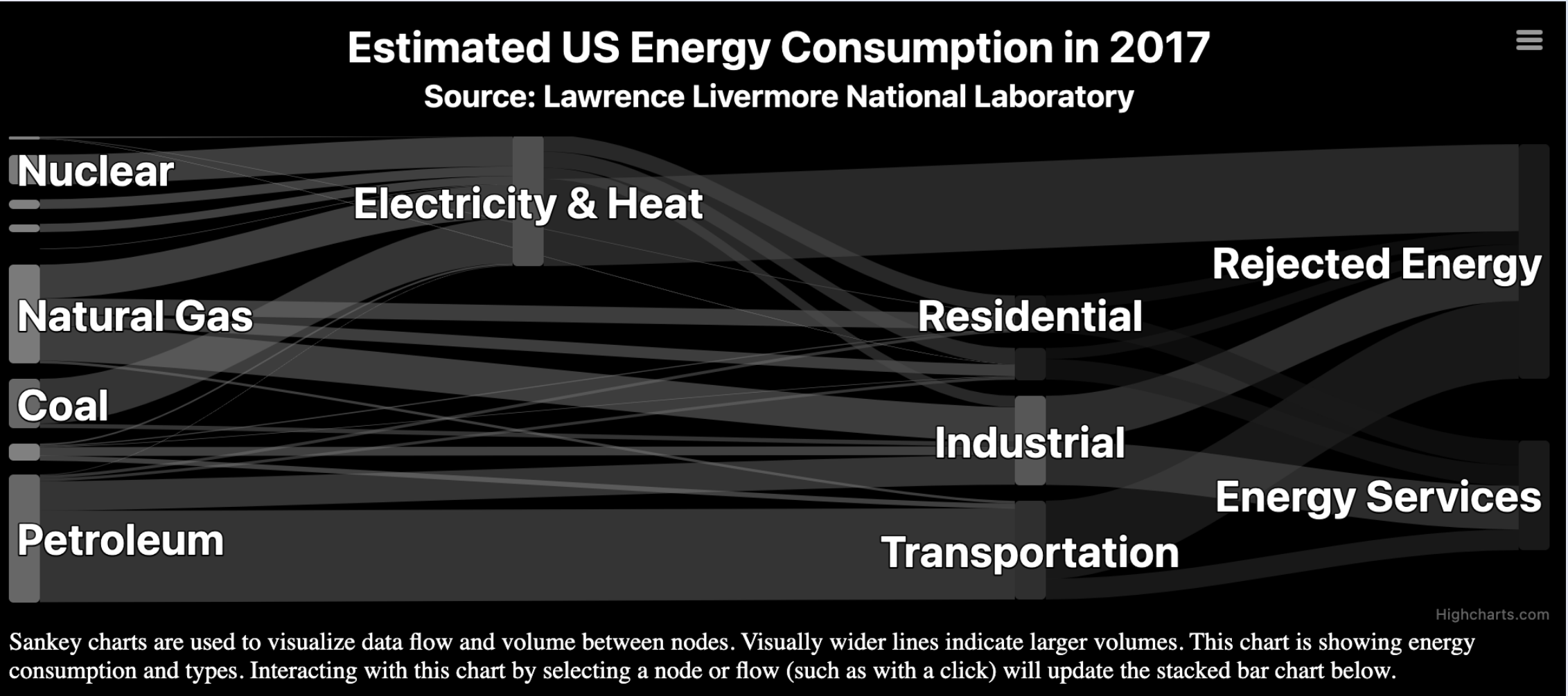
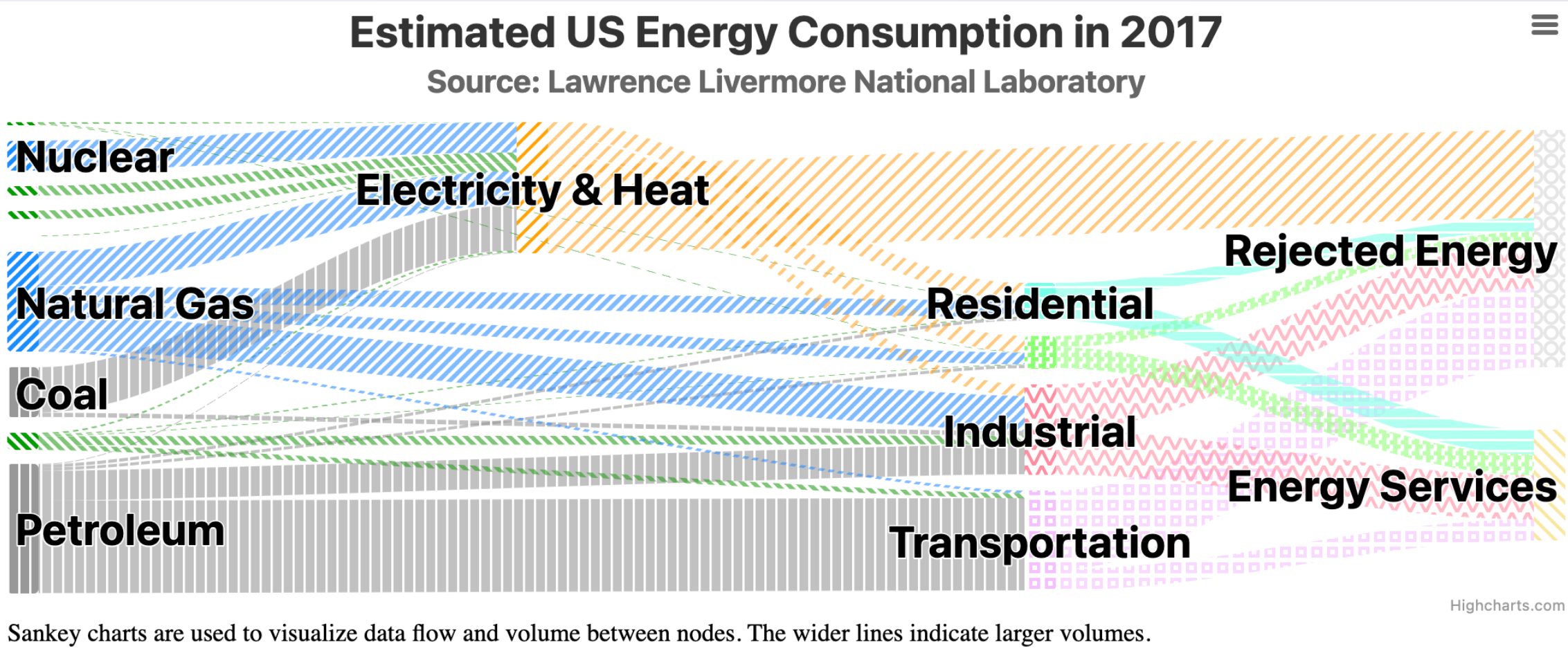
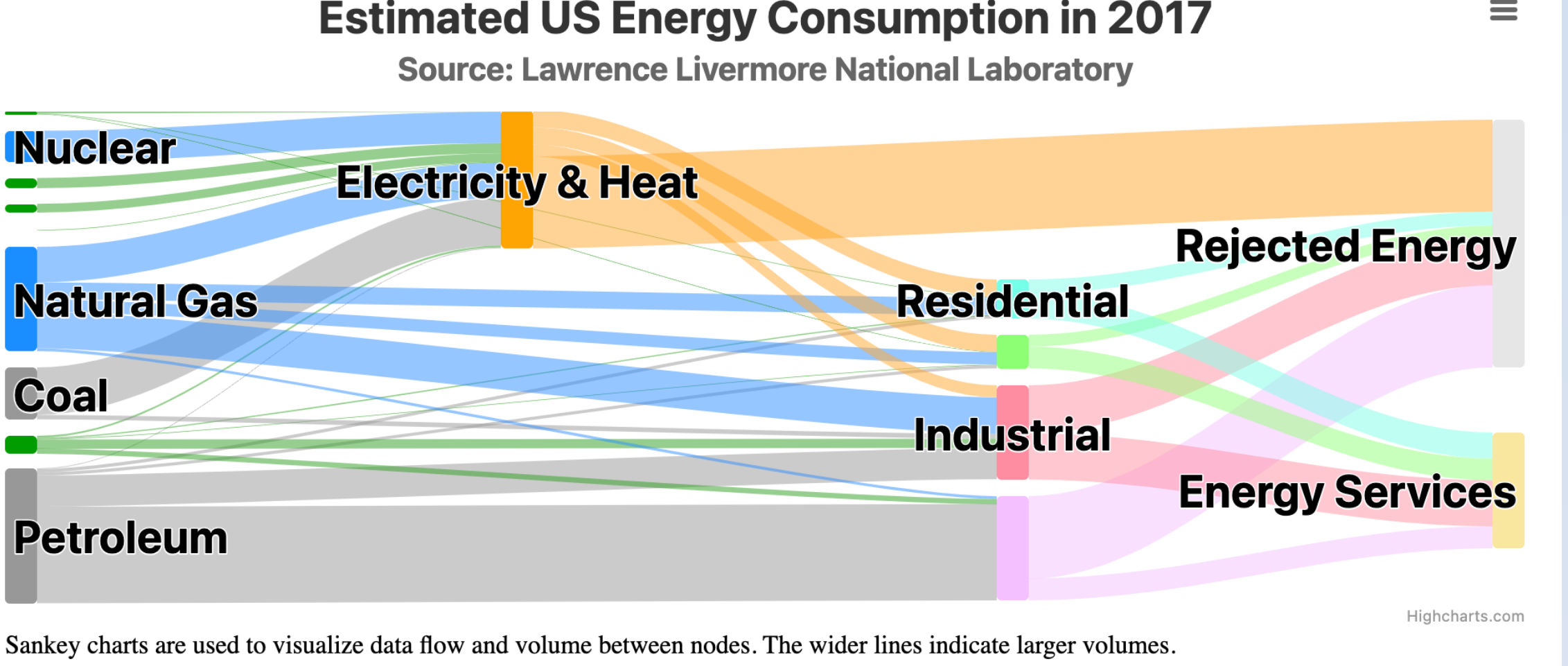
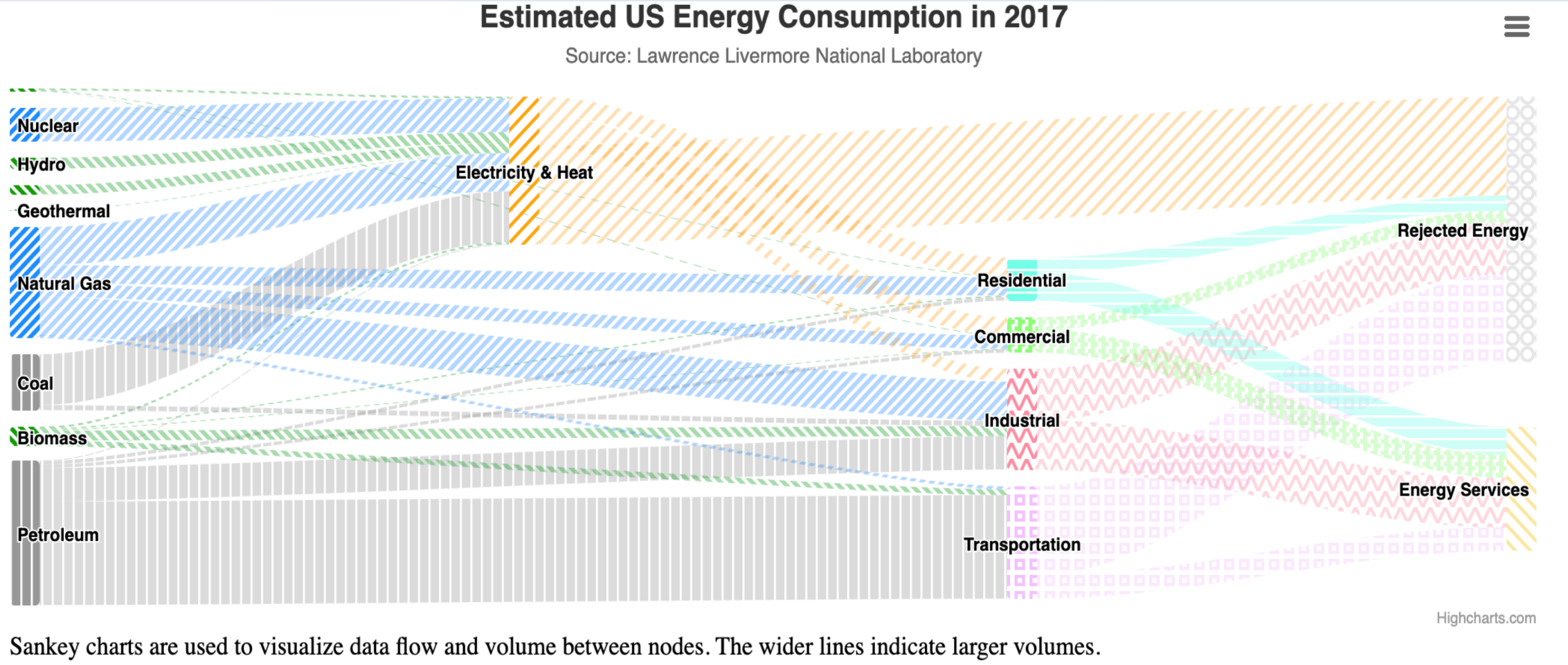
Why should our chart designs be one-size-fits-all?



Flexible

Does the user have ways to change or adjust presentational and operational aspects of this design, according to their needs and preferences?

Good design enables *personalization*



[Interactive demo link](#)

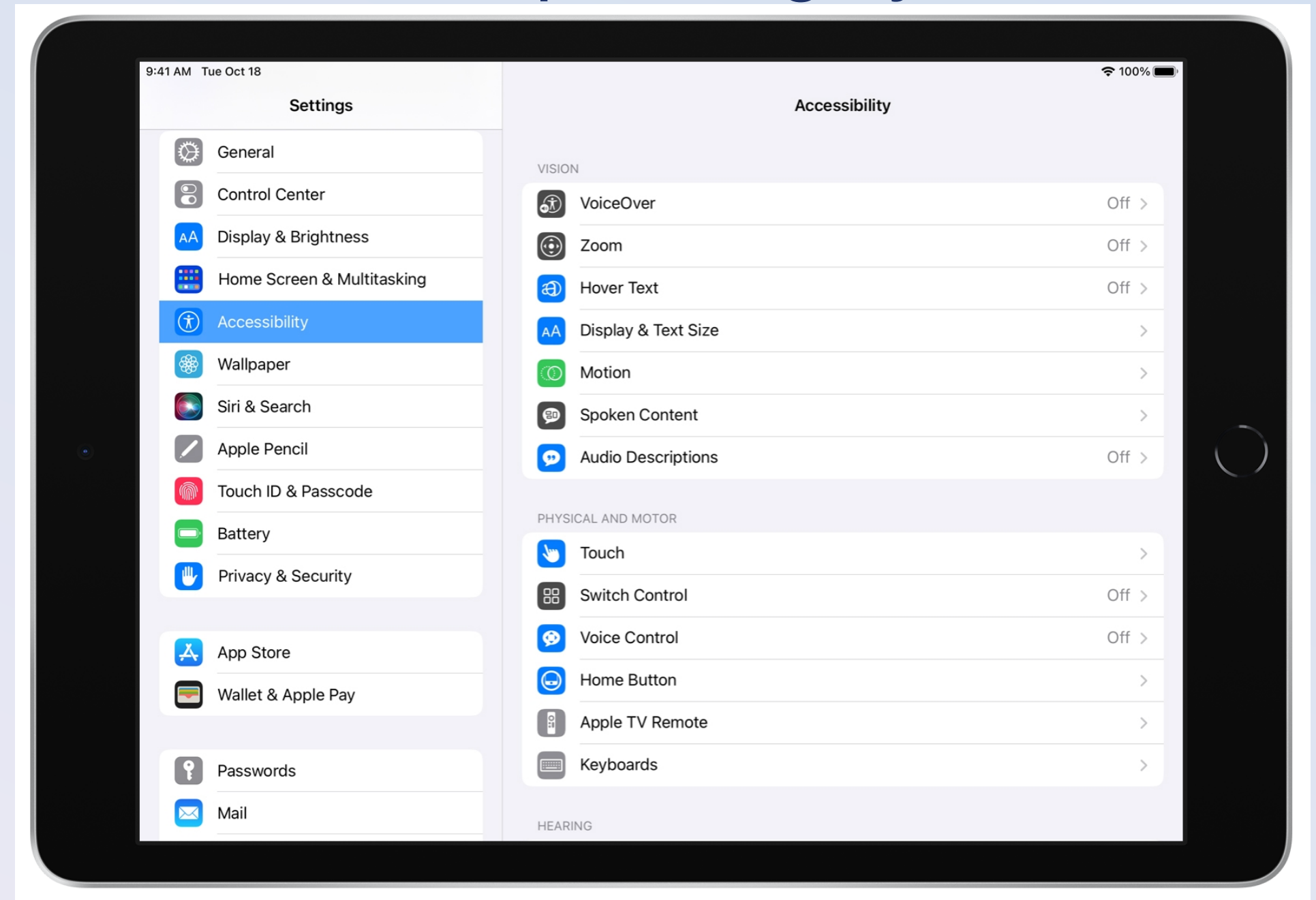
We have been enabling personalization for years

Video games



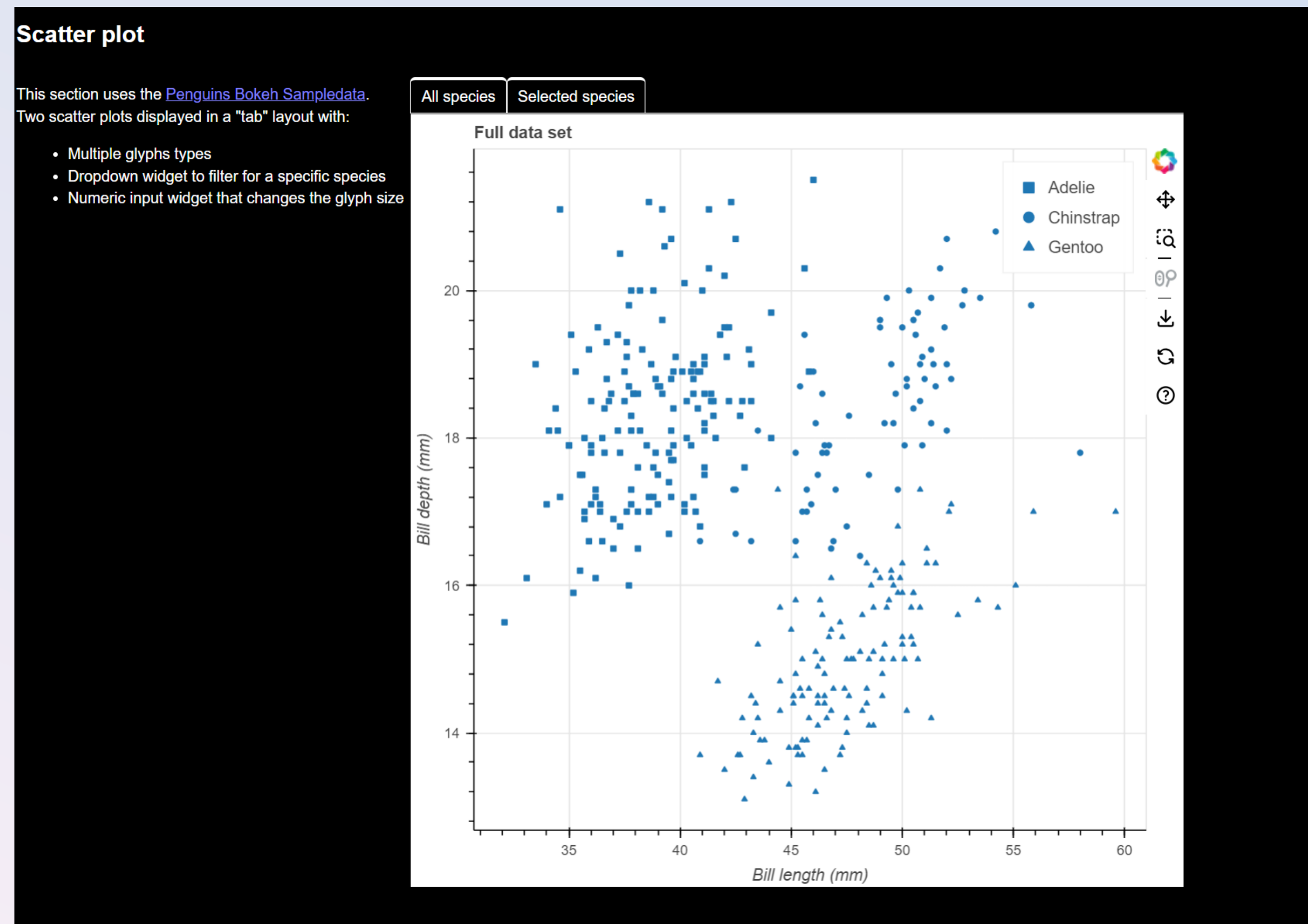
The Last of Us 2 has more than 60 settings

Devices and operating systems



"Make it yours" is the motto for Apple's accessibility personalization

Try changing contrast



Source: [Our audit of Bokeh's ecosystem](#)

Try changing font styling

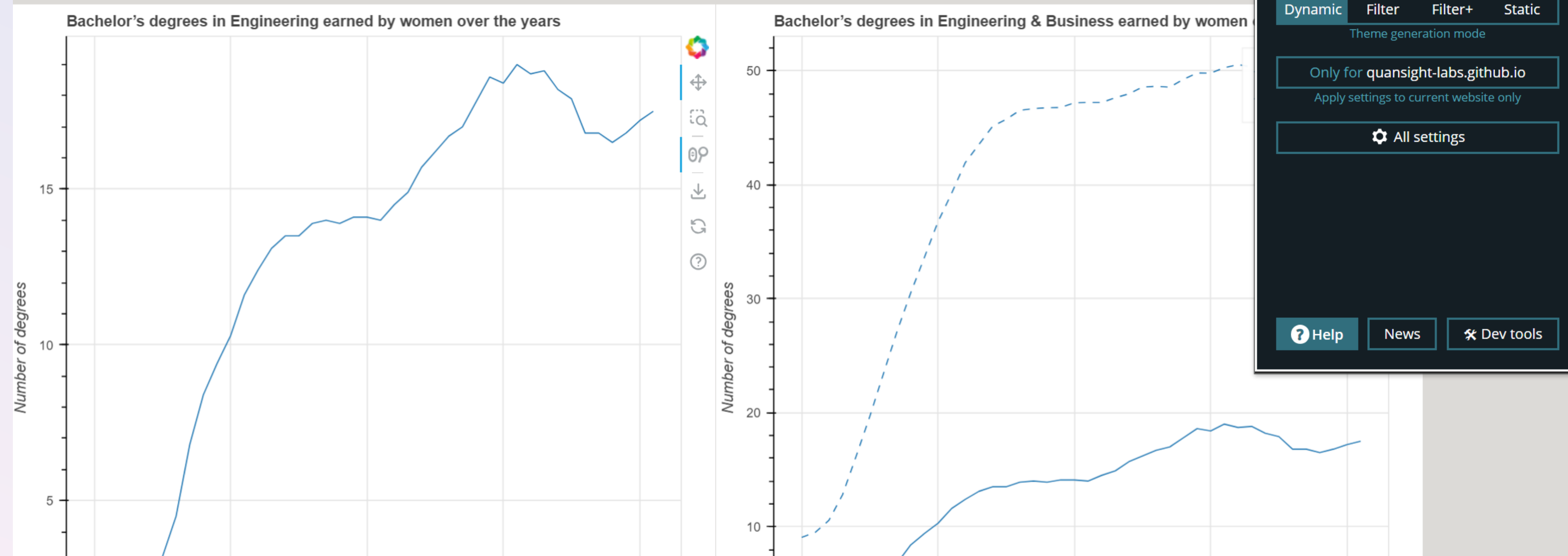
Bokeh dashboard for accessibility audit

Line and bar plots

This section uses data from the [Degrees Bokeh Sampledata](#).

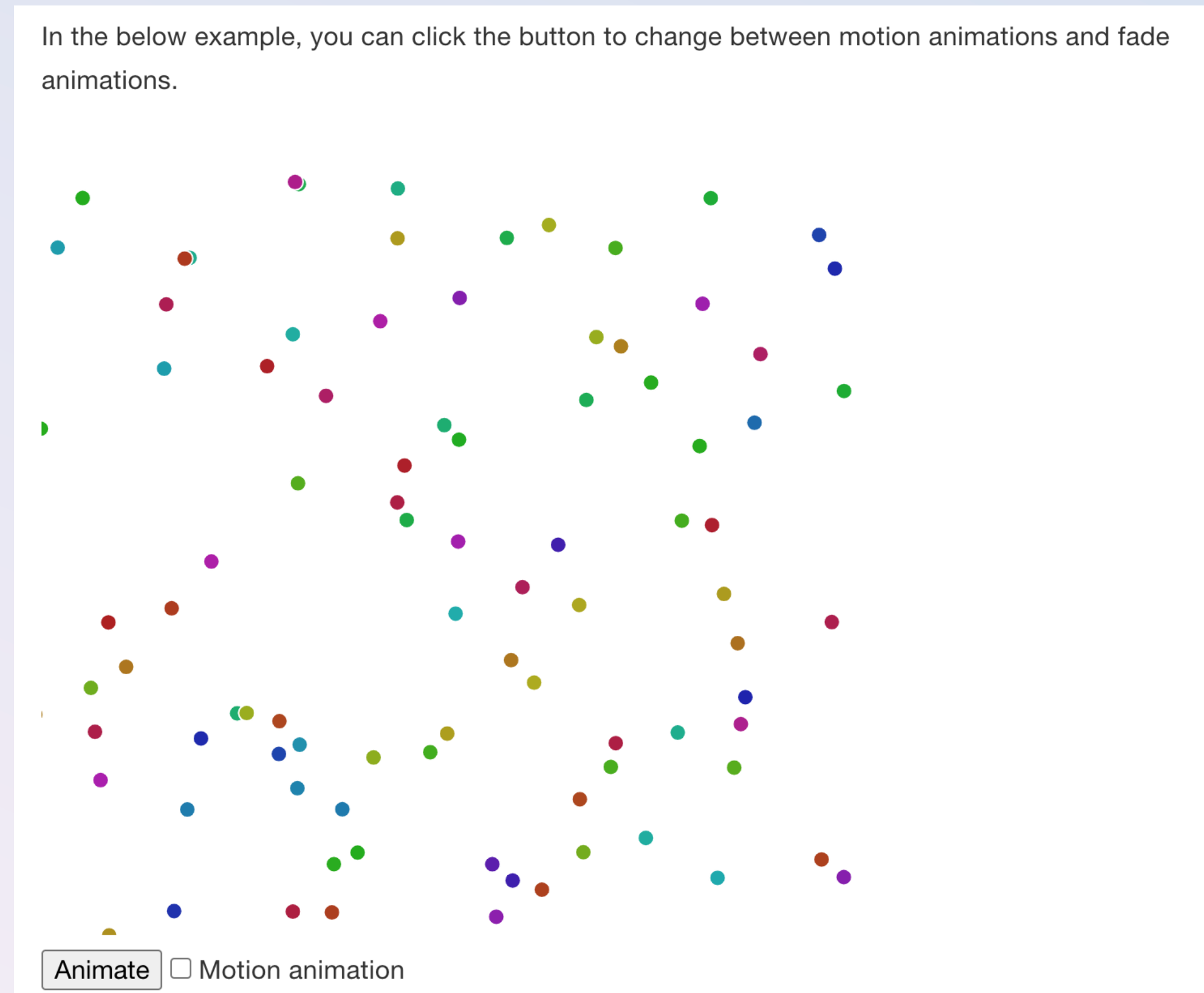
Left-to-right, top-to-bottom:

1. Basic line plot with default options.
2. A plot with two lines, hover tooltip interactions, and an interactive legend that can be "muted" by clicking on the legend labels.
3. Vertical bar plot that uses the [Viridis built-in color palette](#). It also uses the span, text (including mathematical notation), and arrow annotations to show the mean value.
4. The raw data used to create the bar plot displayed with a [DataTable widget](#).



Source: Our audit of Bokeh's ecosystem

Try reducing motion



Source: [Counterpoint](#), by Sivaraman et al

And consider enabling *more* personalization too!

Preferences

This menu provides a way to customize charts and graphs. The menu is organized into categories, and adjusting the settings at the category level will adjust all of the settings within that category. Some settings within categories also have sub-settings which will also inherit higher level settings that they belong to. If wording for a category's setting is hard to understand, try changing that setting and then navigating into the menu to see which children settings it affected.

Hide unavailable options ☒

Comprehension

default moderate robust

☒ ☐ ☐

► Show more comprehension options...

Text visuals

default minimalist moderate maximalist

☒ ☐ ☐ ☐

▼ Show more text visuals options...

Font Size

default small medium large

☐ ☐ ☐ ☒

► Show more font size options...

Font Weight

default 100 400 700

☒ ☐ ☐ ☐

► Show more font weight options...

Color and contrast

default minimalist maximalist

☒ ☐ ☐

▼ Show more color and contrast options...

Estimated US Energy Consumption in 2017

Source: Lawrence Livermore National Laboratory

Sankey charts are used to visualize data flow and volume between nodes. The wider lines indicate larger volumes.

Energy Source	Electricity & Heat	Residential	Industrial	Transportation	Rejected Energy	Energy Services
Nuclear	8.42	0.00	0.00	0.00	0.00	0.00
Natural Gas	13.96	0.00	0.00	0.00	0.00	0.00
Coal	0.77	0.00	0.00	0.00	0.00	0.00
Petroleum	2.76	0.00	0.00	0.00	0.00	0.00

Energy Sources

Energy Source	Total Quads
Geothermal	0.77
Solar	2.76
Wind	8.42
Hydro	13.96
Biomass	36.2
Nuclear	
Coal	
Natural Gas	
Petroleum	

Monthly Energy Consumption

Line chart for comparing change in data across categories. Line charts are often used to visualize change in data over time, showing important trends. Sonification will play all values selected in legend.

Play chart sonification

Flexible Evaluation Toolkit:

1. **Does your visualization import existing personalization?**
 1. Test system contrast (light and dark, see: our [Bokeh Audit](#))
 2. Test font color/size/stroke/spacing (see: our [Bokeh Audit](#))
 3. Test for motion reduction (see: [Counterpoint](#))
2. **Is your flexibility also *assistive*?** Is personalization easy to find, convenient to use, and persistent?