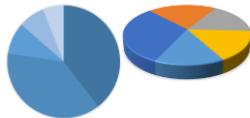


Creating more effective charts

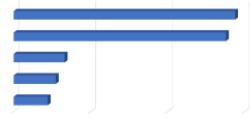
Richard Layton

2026-02-10

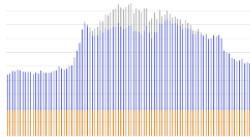
Perception, reasoning, and credibility



Effective alternatives to pie charts



Effective alternatives to bar charts



Aligning the design to the story



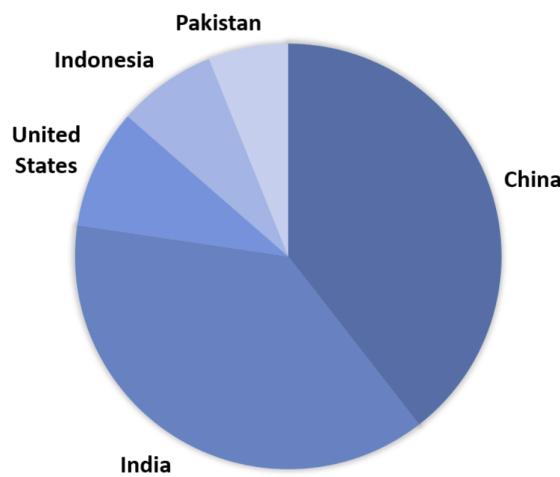
Advice from experts

Richard Layton is online at <https://graphdr.github.io/data-stories/> (charts) and <https://www.youtube.com/@RichardLayton99> (songs).

Creating More Effective Graphs by Naomi Robbins (2013) inspired the session title and Chapter 2, “Limitations of some common graphs,” inspired our exercises.

§ Effective alternatives to pie charts

Judging pie slices is a low-accuracy task



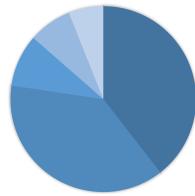
- Visually estimate each country's percentage
- Fill-in the blanks in the table
- Total should be 100%

Country	Percentage
China	
India	
United States	
Indonesia	
Pakistan	

Data source: World Bank (2022)

Judging values along a common axis is a high-accuracy task

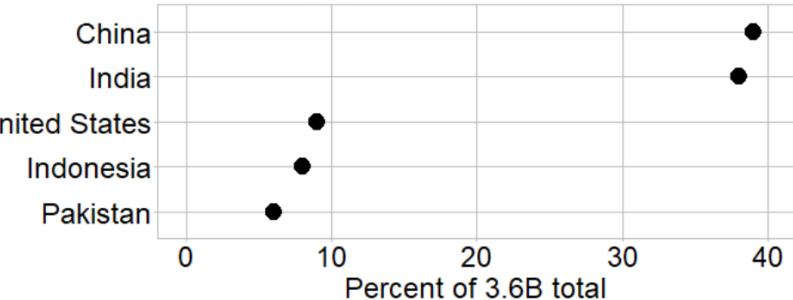
- The new chart displays the same data
- *Visually estimate* the percentages using the new chart
- Fill-in the blanks in the table



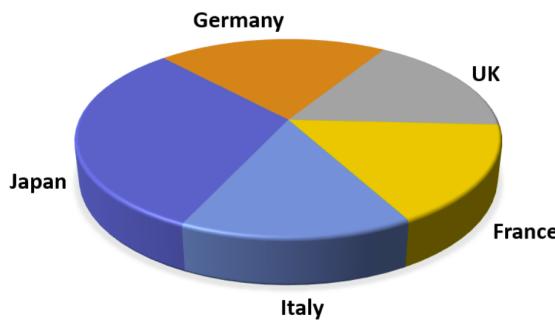
The data from the pie chart is shown below as dots along a common scale.

Country	Percentage
China	
India	
United States	
Indonesia	
Pakistan	

The 5 most populous countries in 2021



3D effects distort our judgment even further



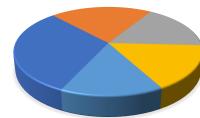
- *Visually estimate* each country's percentage
- Fill-in the blanks in the table
- Total should be 100%

Country	Percentage
Japan	
Germany	
UK	
France	
Italy	

Data source: World Bank (2022)

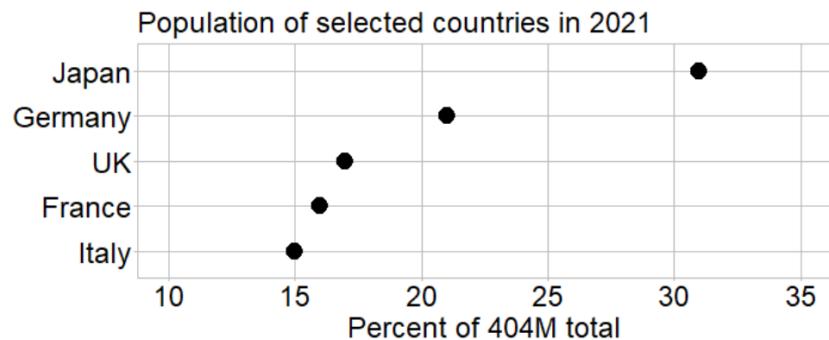
Again, a common scale improves our visual judgments

- The new chart displays the same data
- *Visually estimate* the percentages using the new chart
- Fill-in the blanks in the table



The data from the pie chart is shown below as dots along a common scale.

Country	Percentage
Japan	
Germany	
UK	
France	
Italy	

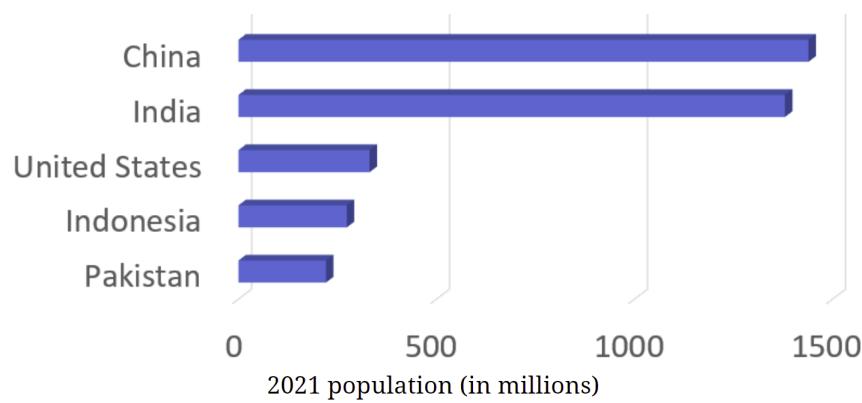


§ Effective alternatives to bar charts

3D effects always distort our judgment

- *Visually estimate* each country's population in millions
- Fill-in the blanks in the table

Country	Millions
China	
India	
United States	
Indonesia	
Pakistan	

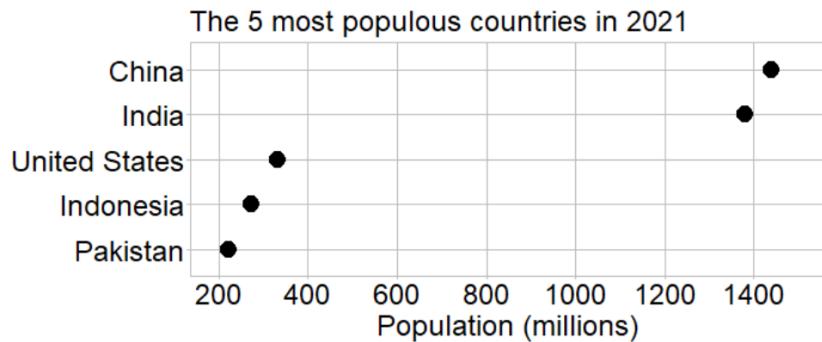


Data source: World Bank (2022)

Same data—without 3D effects—along a common scale

- The new chart displays the same data
- Visually estimate the percentages using the new chart
- Fill-in the blanks in the table

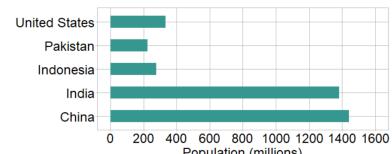
Country	Millions
China	
India	
United States	
Indonesia	
Pakistan	



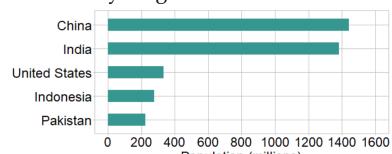
With a zero baseline and no 3D effects, bars are OK

- Zero baseline avoids deception
- Ordered by data values
- Only the endpoint encodes information

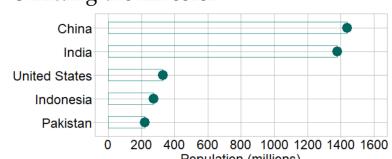
Default bar chart:



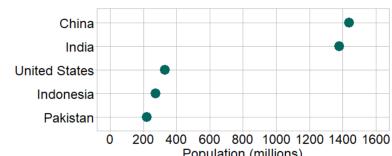
Ordered by magnitude:



Omitting the fill color:



Produces a dot chart:



Consider dot charts for

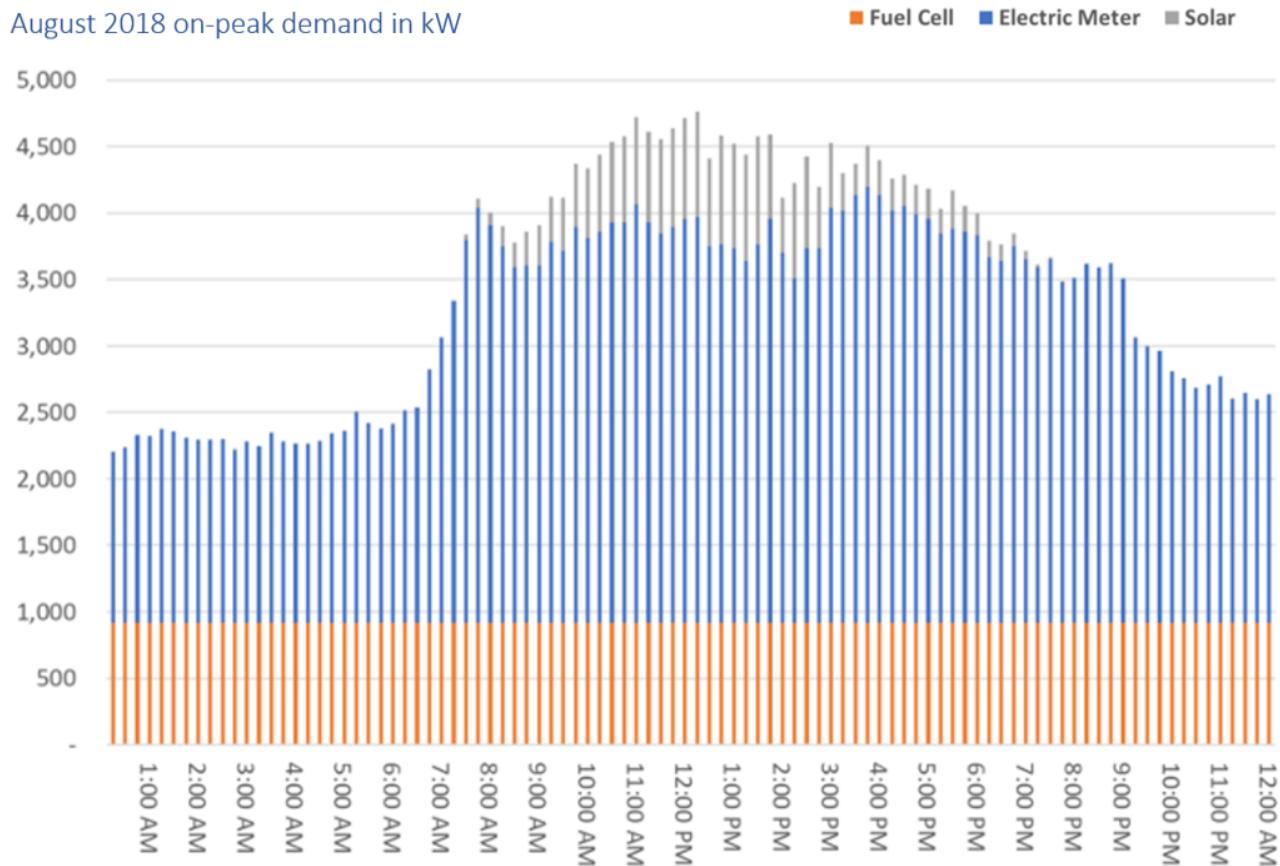
- Visually comparing quantities
- Replacing most pie and bar charts

Notes

§ Aligning the design to the story

Redesigning a chart to find what stories might be in the data

THE APPENDIX OF THE USD ENERGY REPORT includes 12 stacked-column charts like the one shown below. Electrical power is reported for the day of maximum power usage (*peak demand day*) in a month, yielding one chart of 24 hours of power usage per month.



AFTER WE DISCUSS THESE DATA, write your thoughts in response to these prompts:

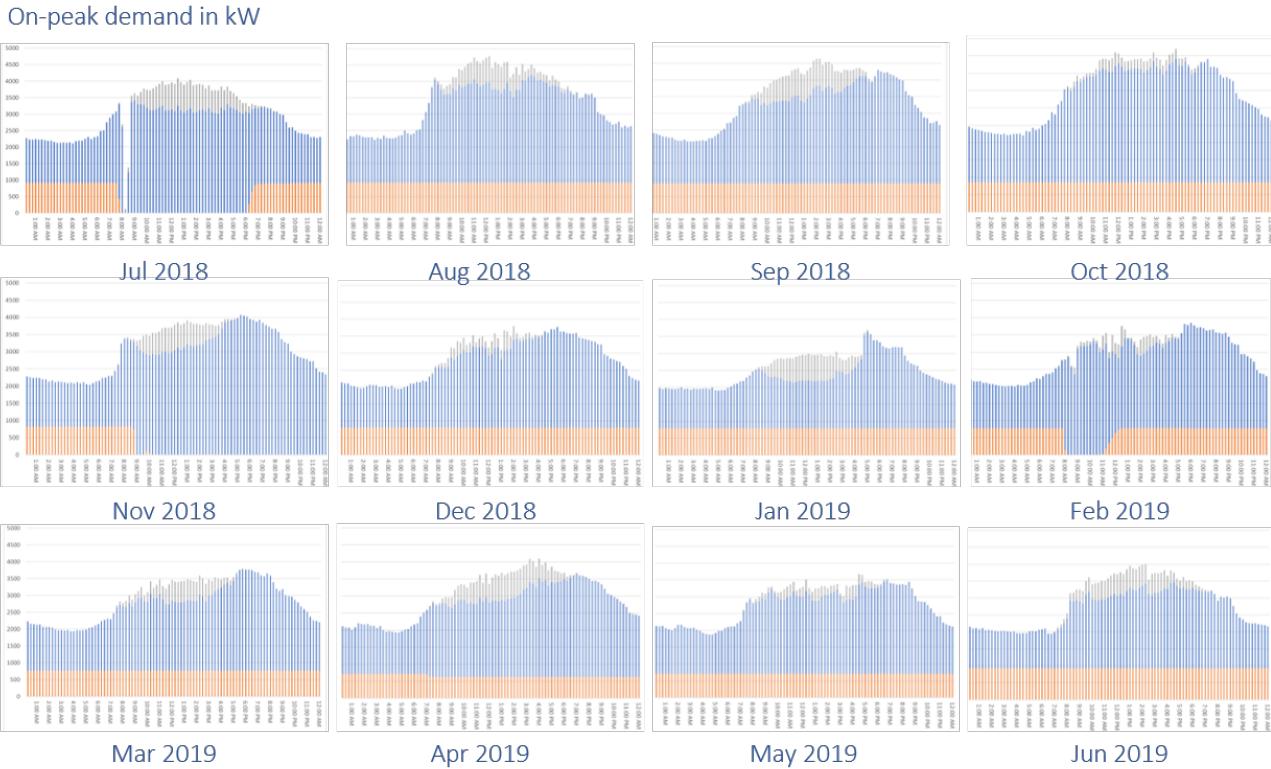
- What information is easy to extract?
- What information is not easy to extract?

Redesign 1: Small multiples

The report displays the full data set in 12 full-size charts, a format that makes visualizing annual trends quite cumbersome.

A simple redesign is shown below—reduce the charts to thumbnails and collect them in a single chart.¹ This format is similar to what Edward Tufte calls *small multiples*. We sacrifice some detail, but we are more likely to be able to see a story.

¹ To do this properly, the scales should be made readable. I didn't bother because we still have to contend with the deficiencies of the stacked-column design.

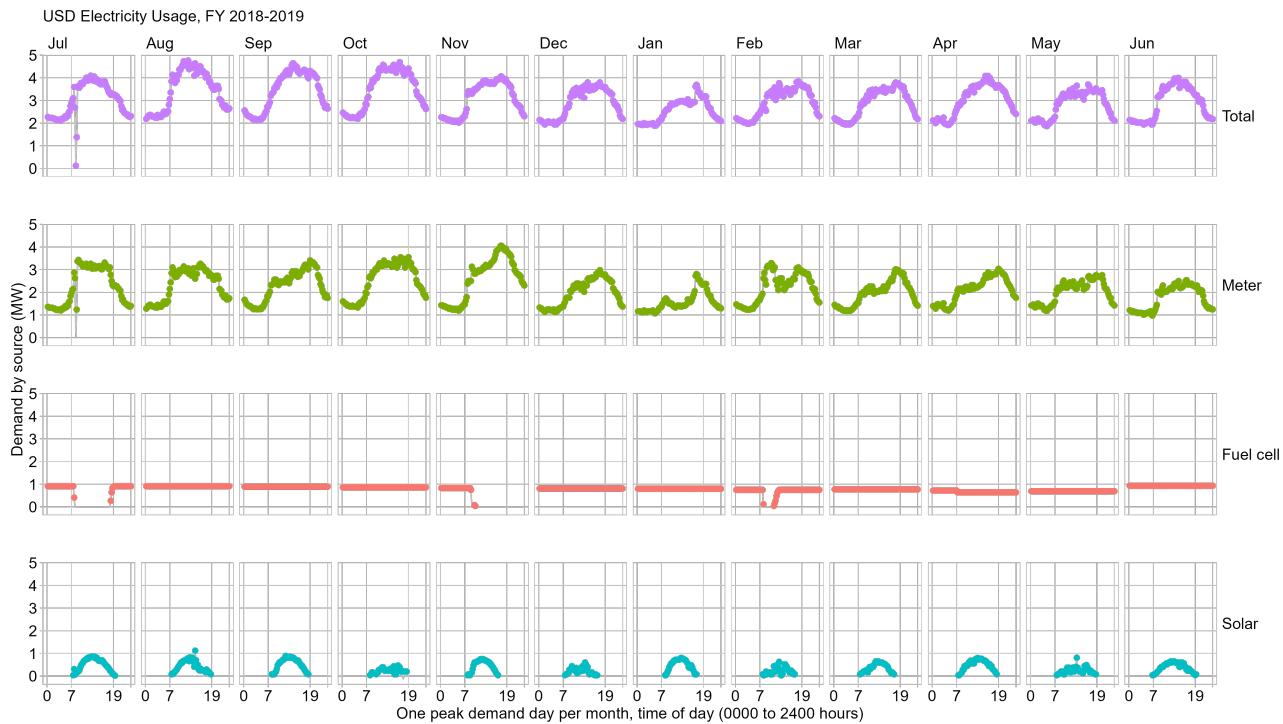


WRITE YOUR THOUGHTS in response to these prompts:

- What new stories (if any) do you see now? What do you see at a glance?
- Why do you suppose the authors used a stacked-column design?

Redesign 2: Unstacking the stacked columns

The simplest approach to redesigning a stacked-column chart is to plot the components of the stacks as line-charts in separate panels. Now we can see the trends for each of the three demand sources independently of one another, plus the total in the top row, with all 12 peak-demand days shown in one chart.



WRITE YOUR THOUGHTS in response to these prompts:

- What new stories (if any) do you see now? What do you see at a glance?
- What attributes of this design *enhance the reader's ability* to make definitive assertions about these data?

Redesign 3: Cycle chart

The previous charts display two obvious types of behavior: fuel-cell data is essentially constant; solar and meter data are clearly *cyclical*.

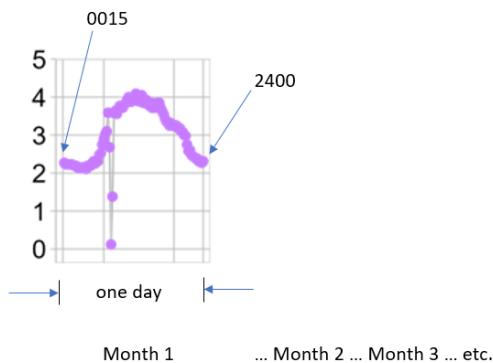
Trends within cyclical data can often be revealed using a *cycle chart* in which we switch the graphical roles of two time-based variables, in our case:

month twelve months of the fiscal year, using measurements from the one peak-demand day in each month

time-of-day in 15-minute intervals from 0015 to 2400 on the peak-demand day

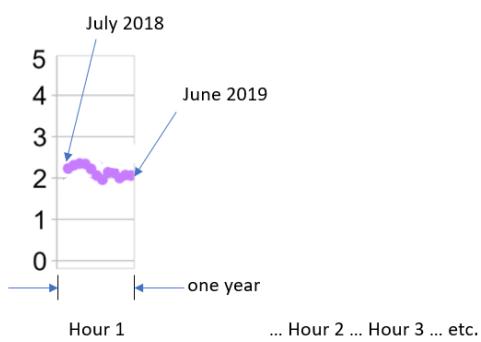
In the previous, conventional time-series design:

- each panel shows 24 hours of data for a particular month
- the panel sequence is month to month



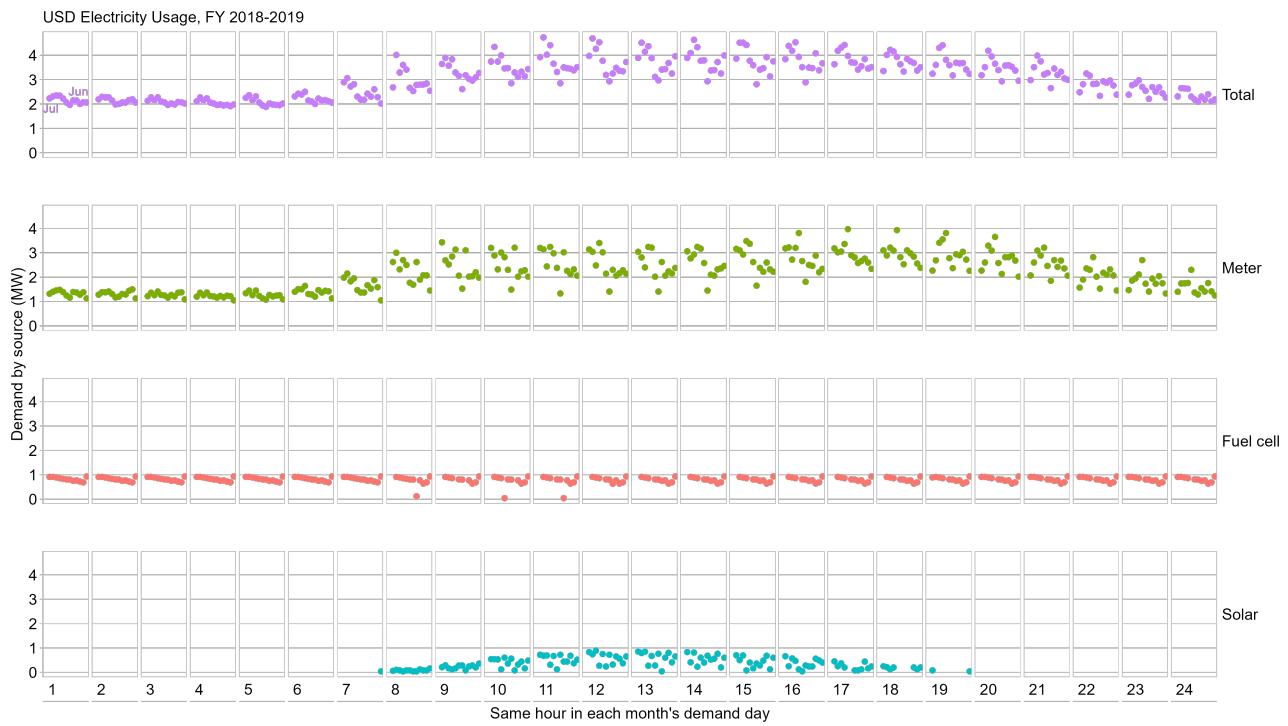
In the new design, we switch the graphical roles of the two discrete-time variables, such that:

- each panel shows 12 months of data for a particular hour
- the panel sequence is hour to hour



Redesign 3: Cycle chart (in MW)

Here, the first panel shows 12 months of data for hour 1, the next panel shows 12 months of data for hour 2, and so on.

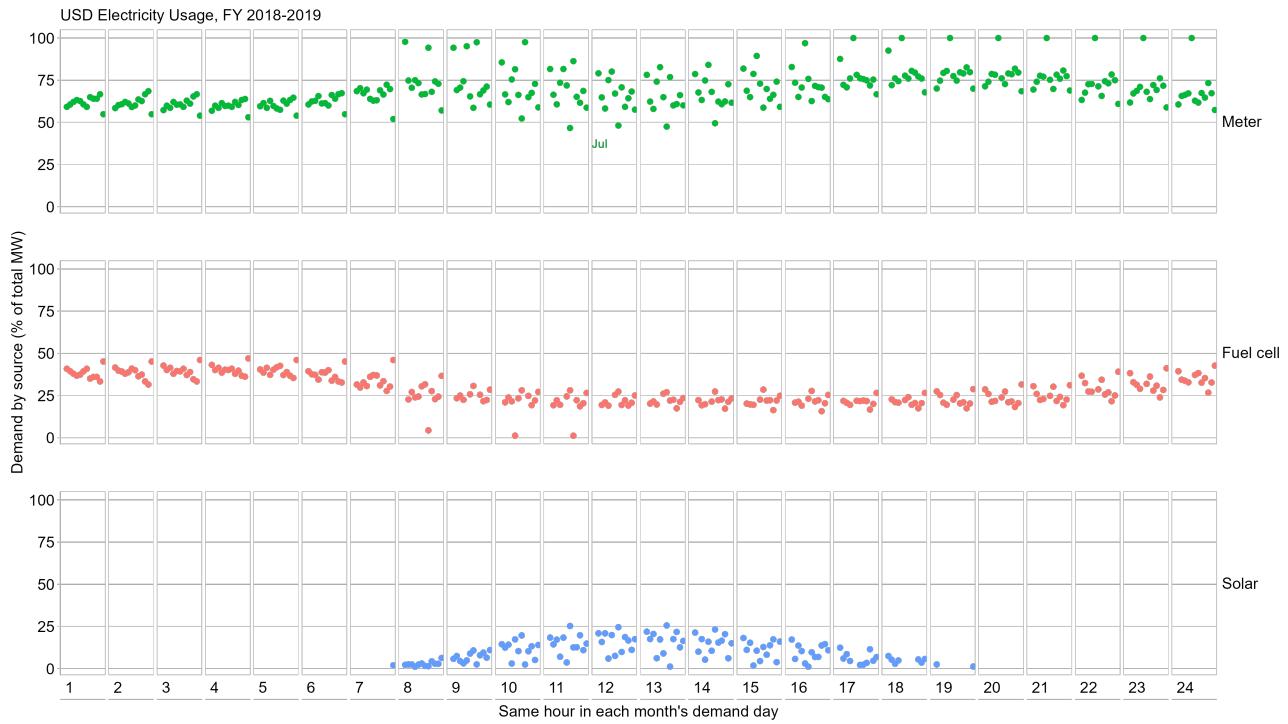


WRITE YOUR THOUGHTS in response to these prompts:

- What new stories (if any) do you see now? What do you see at a glance?

Redesign 4: Cycle chart (percent of total)

Another way to look at these data is to determine the percentage of total demand is met by each of the three sources.



WRITE YOUR THOUGHTS in response to these prompts:

- What new stories (if any) do you see now? What do you see at a glance?

§ Advice from experts

Match the expert to the advice.

FILL IN THE BLANKS with letters A–D.

Expert	Letter	Emphasizes the importance of
A. Alberto Cairo	_____	message
B. Jean-luc Doumont	_____	variables
C. Stephanie Evergreen	_____	revealing the complex
D. Edward Tufte	_____	knowing your main point
	_____	not lying to yourself

Ideas to consider

- Know your data. Characterize the number and type of variables.
- What's the story? Revise until you have aligned the logic of the chart with the logic of that story.
- Avoid lying to yourself. Are you seeing only what you want to believe?
- Compared to what? Is there adequate context?
- Find ways to reveal (rather than dumbing down) complexity.
- Expand your repertoire of chart types. Avoid using easy-to-make charts that don't suit your rhetorical goals.
- Know your audience. Edit your charts to meet their needs.
- Control every pixel. Default software settings are generally wrong.

References

- Cairo, Alberto. 2019. *How Charts Lie*. New York: W.W. Norton.
- Clarke, Steven, Michael Anderson, Daniela Aramayo, Dominic Molinari, Arthur Tseng, Zoe Warp, and John Ko. 2021. “University of San Diego Energy Master Plan.” Anaheim, CA: Willdan Energy Solutions.
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- World Bank. 2022-01. “Population total for United States.” <https://fred.stlouisfed.org/series/POPTOTUSA647NWDB>. Federal Reserve Bank of St. Louis