

Value of Capacity

Capacity is just as important, maybe more so

Hydropower Workshop
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Capacity vs. Energy

Capacity — the potential to generate electricity when needed, measured in watts (kW)

Energy — electricity sold for use by customers, measured in watt-hours (kWh)

What can you power with 1 kWh?



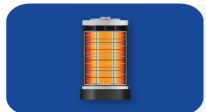
100 hours of a 10-watt light bulb



20 hours of a 50-watt laptop



4 hours of a 250-watt refrigerator

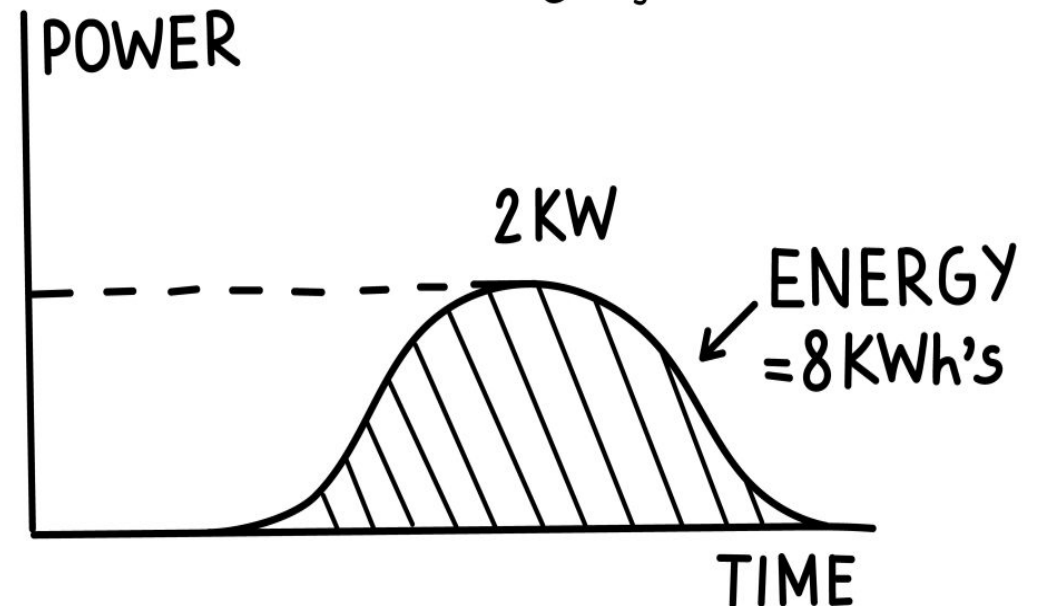


40 minutes of a 1,500-watt space heater



20 minutes of a 3,000-watt oven

©Bluegum Electrical Solutions





My power bill at home only shows kilowatt-hours. I've never heard of being charged for capacity.

- Residential electrical customers do pay for capacity use, but it's typically embedded in their rate.
- Your electricity supplier bundles the cost of securing generation capacity with the cost of the electricity itself, all into a single per-kilowatt-hour (kWh) rate. This is easier for homeowners to understand.
- For large commercial and industrial customers, capacity costs are often broken out as "demand charges" to encourage them to manage peak energy use.

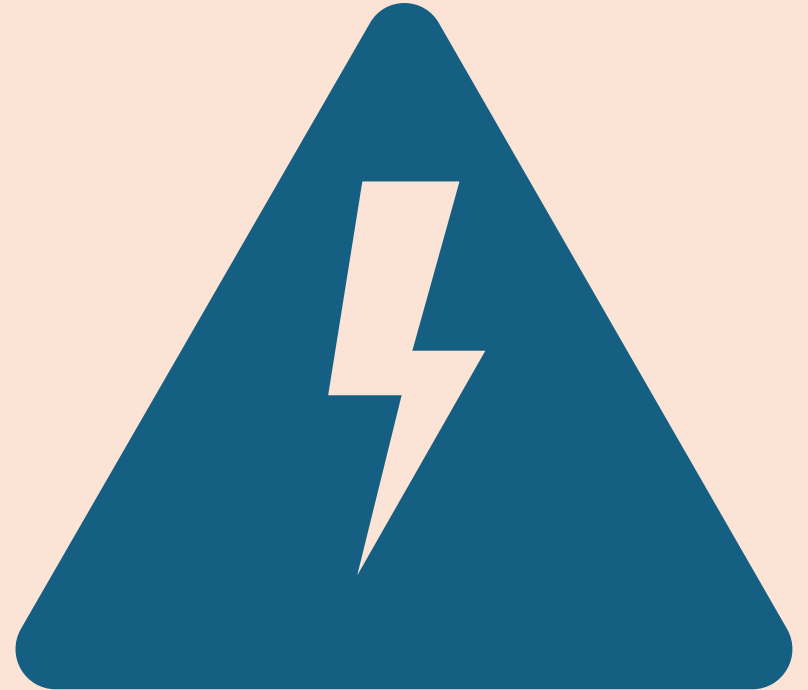
Things are Different for Commercial Customers

- **"Capacity Charge":** A large customer's capacity charge is determined by a capacity charge — a measure of their highest usage during the most demanding hours of the previous year. This incentivizes companies to manage consumption on those anticipated high-demand days
- **Higher impact:** A single large factory or data center has a much greater and more concentrated impact on the grid during peak times than a single home. An explicit demand charge forces these customers to pay for their disproportionate impact.
- **Greater control:** Explicit demand charges give them a clear financial incentive to do so and lower their bills.



Power Generators Can Sell Capacity

- Generators don't just sell energy; they can also sell capacity, which is their commitment to be ready to produce power when needed.
- This helps grid operators ensure there's enough power during high demand times, like hot summers or cold winters.
- Range of generator types: coal, natural gas, hydropower, solar, wind, nuclear, and oil plants.
- Peaker plants: generally, gas- or oil- fired, only run during peak demand. These plants are important because they can quickly start and stop producing electricity.



Capacity Can Be Analogous to a Bucket Brigade

Each person in the brigade has a certain “bucket capacity”, which is the maximum amount of water they can carry.

However, each person’s actual value isn’t just based on their bucket size. It also depends on:

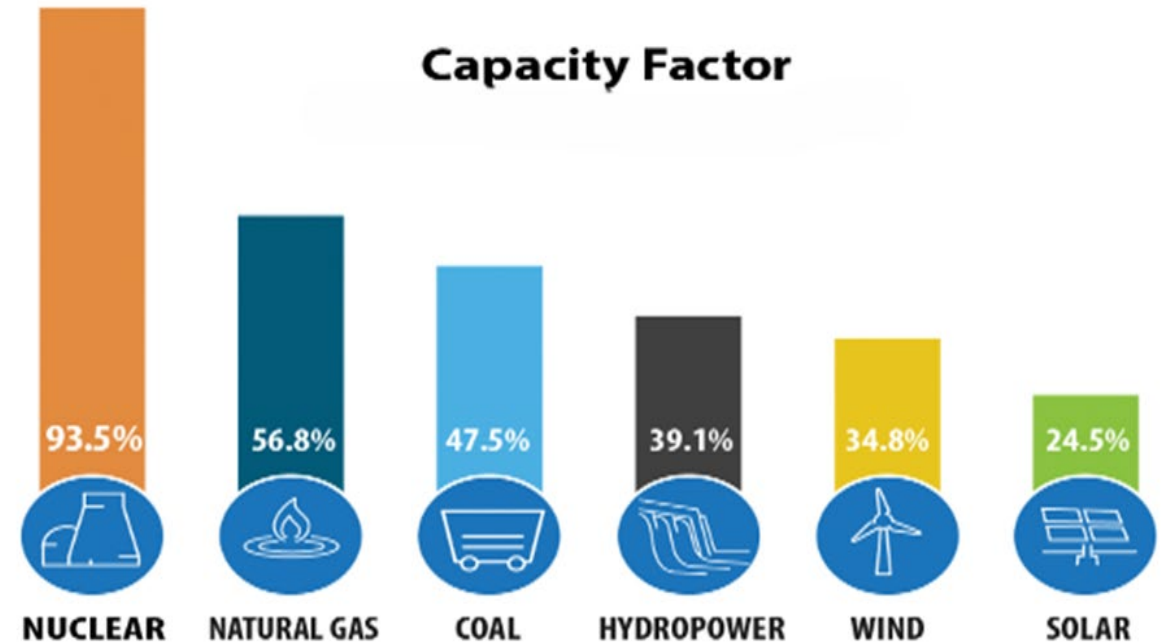
- how consistently they can deliver water?
- how quickly they can refill their buckets?
- how reliably they show up when needed most?

‘Capacity Value’ is not just the size of the bucket, but the actual volume of water effectively delivered when it matters most.



Generation Types and Characteristics

- Different generation technologies have vastly different operational profiles.
- How consistently and reliably can this capacity can be depended upon to meet the fluctuating demands of the electricity grid?
 - That reliability metric is known as capacity factor.



US National Averages – Source: U.S. Energy Information Administration

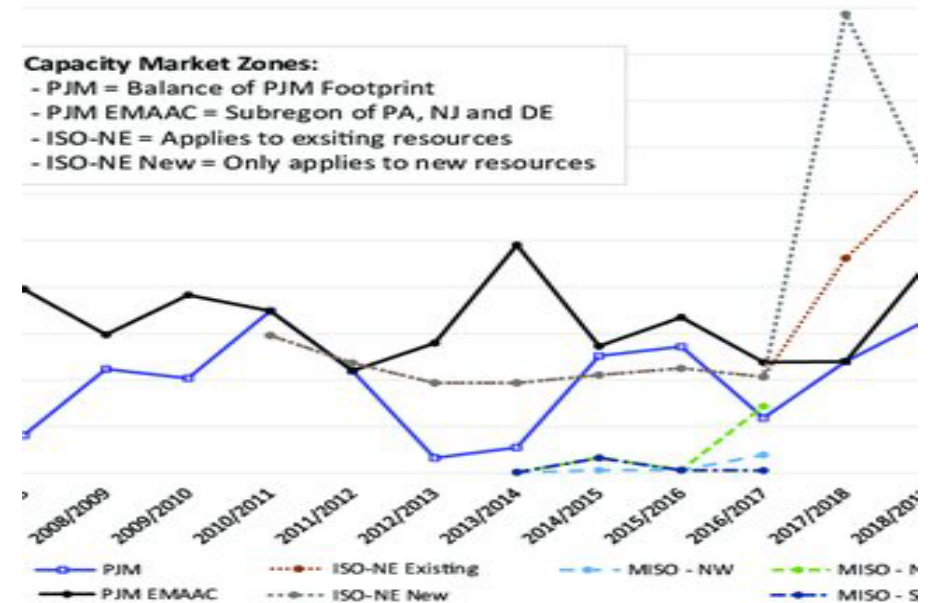
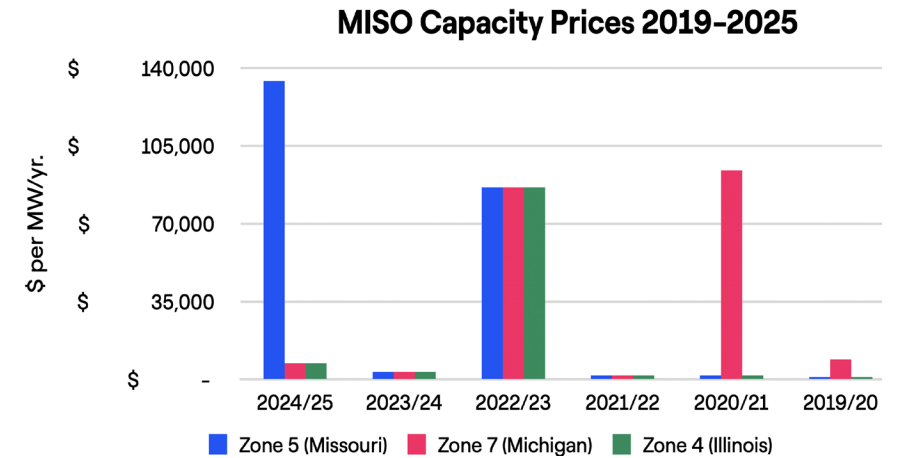
Fossil fuel and nuclear plants, as dispatchable resources, generally have higher Capacity Values due to their ability to operate on demand. Renewable sources like wind and solar, being variable, typically have lower Capacity Values.

Is the Value of Capacity static?

Answer: No.

- Time-of-day, geography, transmission conditions, and seasonal variations in electricity demand impact Capacity Value.
- Value also varies from year-to-year, depending on overall market dynamics of loads and resources.

The diagrams to the right show that capacity values vary over time. Capacity at different locations have variable prices from year-to-year.



So why does capacity value change?

- Accelerated and unanticipated load growth
- Resource constrained environment
- Increasing risk from extreme weather events and drought
- Large delays in generation interconnection
- Long lead times for transmission construction
- Problem of oversupply and undersupply of generation at times, often in same day



The Electricity Industry is Undergoing Significant Change

Generation evolving from deterministic to stochastic

Significant influx of Variable Energy Resources (VERs)

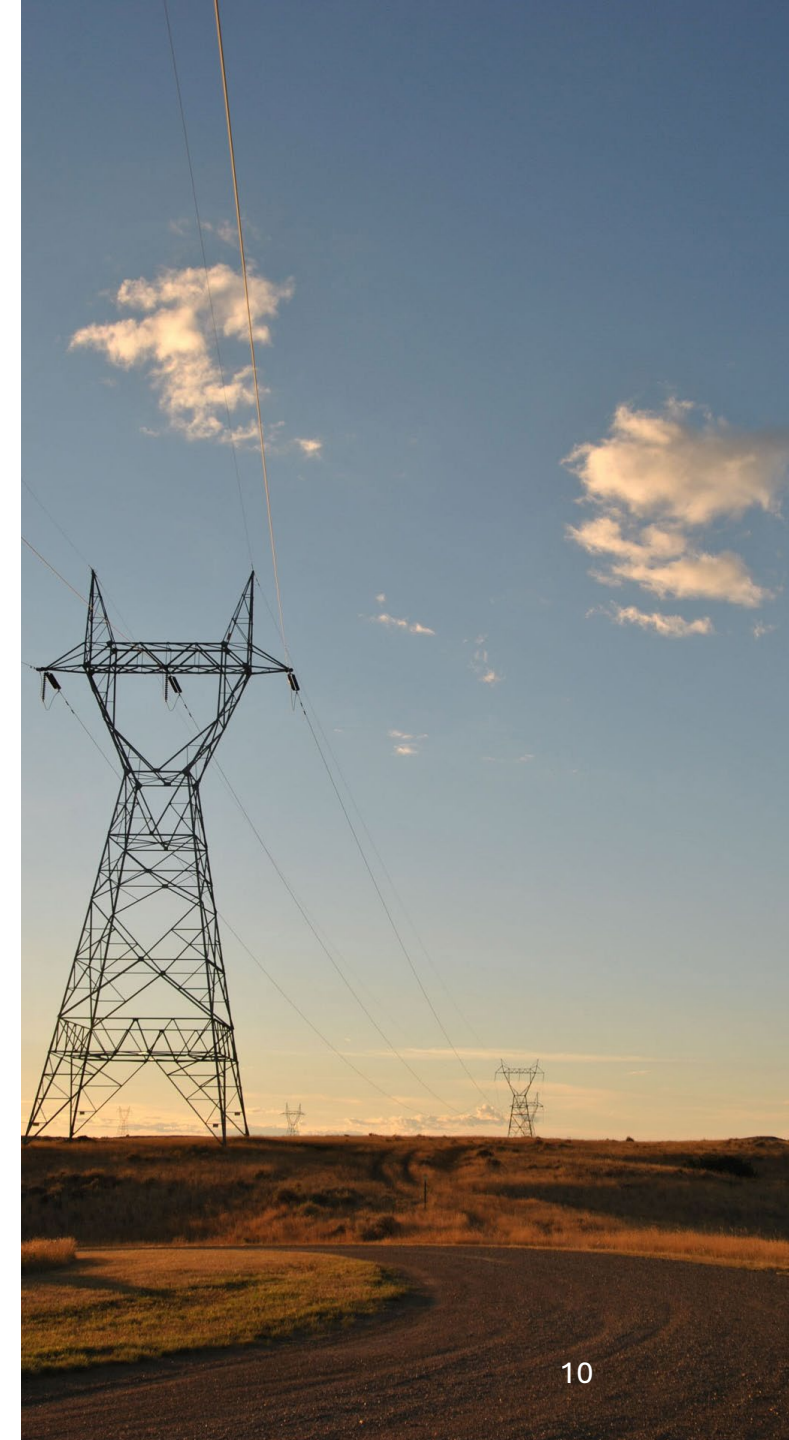
- Driven by state/federal policy
- Economics

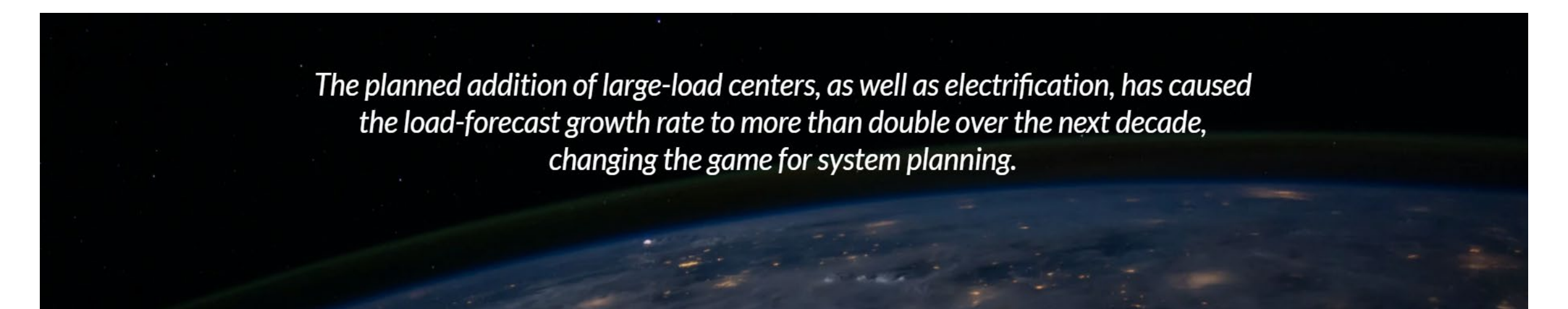
10 years ago, there were 445 coal-fired power plants in the U.S.

- Today, the number is cut in half. 211 plants remain.
- Natural gas replaced some but not all lost coal generation.
- Variable Energy Resources (VERs) added

Dynamic industry driven by:

- Addition of solar and wind generation (VERs)
- Significant load growth
- Severe weather events





The planned addition of large-load centers, as well as electrification, has caused the load-forecast growth rate to more than double over the next decade, changing the game for system planning.

Large loads like data centers, manufacturing facilities, and cryptocurrency mining operations add a large amount of concentrated load to the system.

This is where power goes today:

Residential = 38%, Commercial = 35%, Industry = 26%

- Integrating large loads often requires changes or additions to power system infrastructure.
- Large-load facilities can be built relatively quickly, as fast as 18 months, while building new generation resources and transmission infrastructure can take years.

Cost of Capacity

The image to the right is a rate schedule for large customers of PacifiCorp in Utah. Effective 2025.

State regulators reviewed and approved this rate schedule in a public process. PacifiCorp provided justification and documentation.

Power Charge = Capacity Charge

PacifiCorp charges \$14.92/kW-month in Summer

PacifiCorp charges \$13.21/kW-month in Winter

For comparison, WAPA charges \$5.25/kW-month

<https://www.rockymountainpower.net/about/rates-regulation/utah-rates-tariffs.html>



P.S.C.U. No. 52

First Revision of Sheet No. 9.1
Canceling Original Sheet No. 9.1

ROCKY MOUNTAIN POWER

ELECTRIC SERVICE SCHEDULE NO. 9

STATE OF UTAH

General Service - High Voltage

AVAILABILITY: At any point on the Company's interconnected system where there are facilities of adequate capacity.

APPLICATION: This Schedule is for alternating current, three-phase electric service supplied at approximately 46,000 volts or 69,000 volts or greater, through a single point of delivery. Seasonal service will be available only under other appropriate schedules.

MONTHLY BILL:

Customer Service Charge:

\$399.00 per Customer

Facilities Charge:

\$2.37 per kW

Power Charge:

Billing Months - June through September inclusive

On-Peak: \$14.92 per kW

Off-Peak: None

Billing Months - October through May inclusive

On-Peak: \$13.21 per kW

Off-Peak: None

(continued)

Industrial Capacity Charge Depends on Time of Day



P.S.C.U. No. 51

Original Sheet No. 8.3

Summer Season (June-Sept):

Capacity charge of \$14.92/kW-month

- Only applies from 3 to 10 p.m.
- For the other 16 hours a day, there is no capacity charge at all!

Winter Season (Oct-May):

Capacity charge is \$13.21/kW-month

- Only applies from 6 to 9 a.m. and 6 to 10 p.m.
- For the other 16 hours a day, there is no capacity charge at all!

ELECTRIC SERVICE SCHEDULE NO. 8 - Continued

TIME PERIODS:

- On-Peak: October through May inclusive
6:00 a.m. to 9:00 a.m., 6:00 p.m. to 10:00 p.m., Monday thru Friday, except holidays.
June through September inclusive
3:00 p.m. to 10:00 p.m., Monday thru Friday, except holidays.
- Off-Peak: All other times.

Holidays include only New Year's Day, President's Day, Memorial Day, Independence Day, Pioneer Day, Labor Day, Thanksgiving Day, and Christmas Day. When a holiday falls on a Saturday or Sunday, the Friday before the holiday (if the holiday falls on a Saturday) or the Monday following the holiday (if the holiday falls on a Sunday) will be considered a holiday and consequently Off-Peak.

WAPA hydropower replaces more expensive power for a customer. Capacity savings because of hydropower deliveries are slightly greater than the energy savings.

	Reduced Facilities Charge to PacifiCorp	\$	4,768.44
	Reduced Capacity Charge to PacifiCorp	\$	30,019
Energy Savings On Peak	\$	17,363	
Energy Savings Off Peak	\$	15,698	
	Total Reduced Energy Charge Paid to PacifiCorp	\$	33,061
Reduction to PacifiCorp Invoice paid by Hill AFB*		\$	67,848.61

*There is \$33,164 in total savings because of the WAPA Power

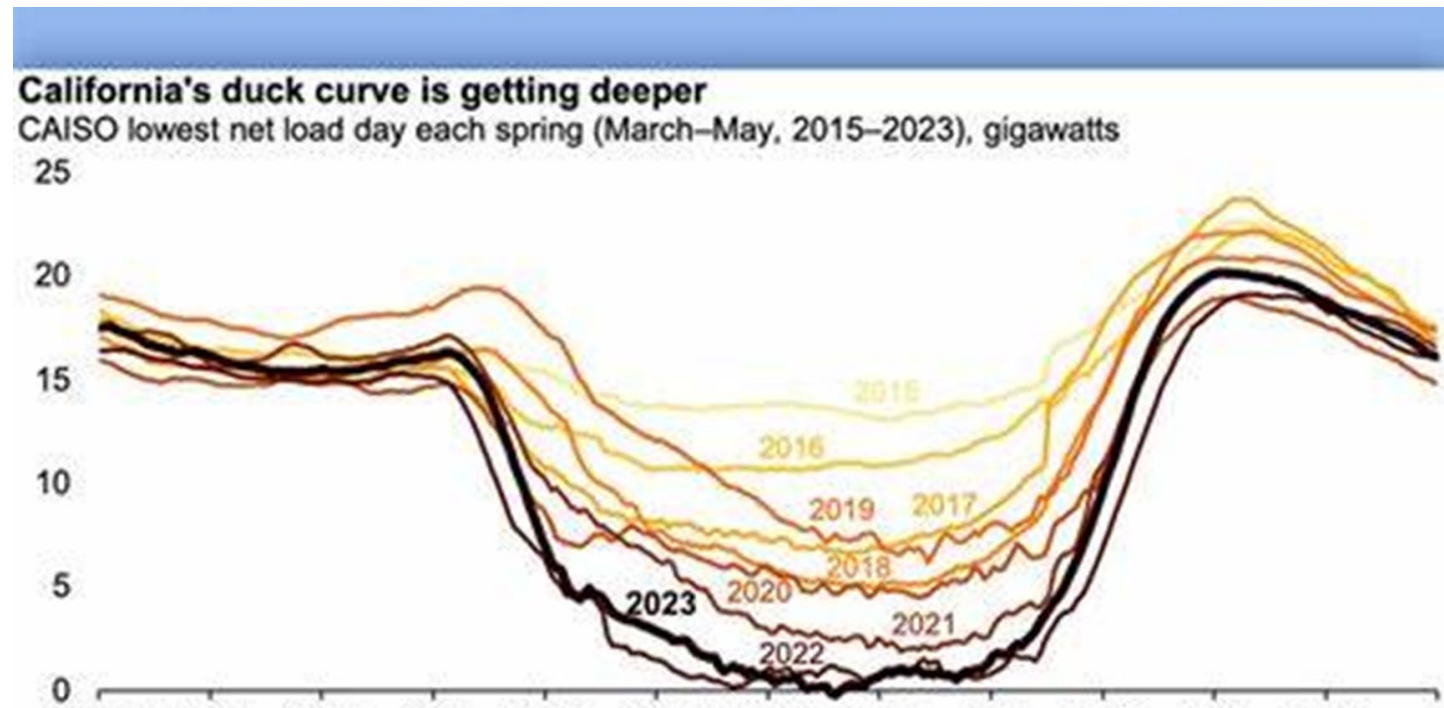
51% of value of hydropower comes from the capacity side. 49% from energy side.

Savings from Capacity Value of WAPA Power	51%
Savings from Off Peak Energy Value of WAPA Power	26%
Savings from Off Peak Energy Value of WAPA Power	23%

Example above using data for Hill Air Force Base in Utah. WAPA and PacifiCorp supply electricity to the base.

Future CRSP Power Scheduling and Capacity

- Aridification/drought is causing reductions in generation at Glen Canyon Dam
- Addition of non-dispatchable renewable resources is changing the way customers schedule CRSP power.
- Customers are increasingly scheduling CRSP power to meet “net demand” (retail demand minus solar/wind power)
- Can WAPA meet customer load with the anticipated changes in customer schedules because of the above?



Over past 10 years, the value of capacity has changed in response to market dynamics. 2015 is different than today.

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