

The logo for TEP (Texas Eastern Power) features the letters 'TEP' in a bold, white, sans-serif font. A yellow swoosh underline is positioned above the 'P' and extends to the right.A solid yellow horizontal bar is located above the main title.

WRRC - Energy 101

Water Use in Energy Systems

Agenda

01

Electricity & Water

02

Withdrawal vs. Consumption

03

Arizona's Context

04

Q&A



Electricity & Water

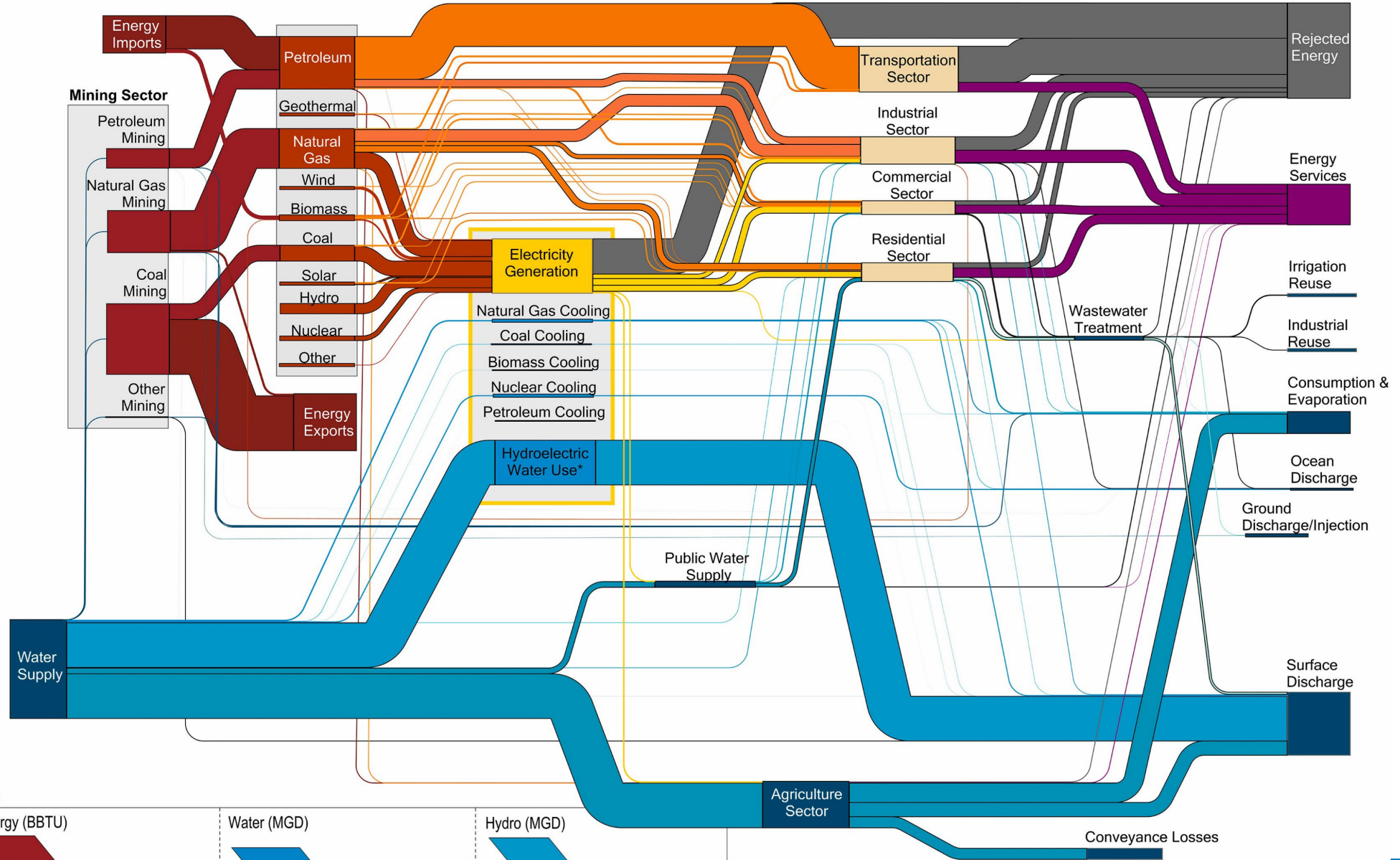
The Energy-Water Nexus



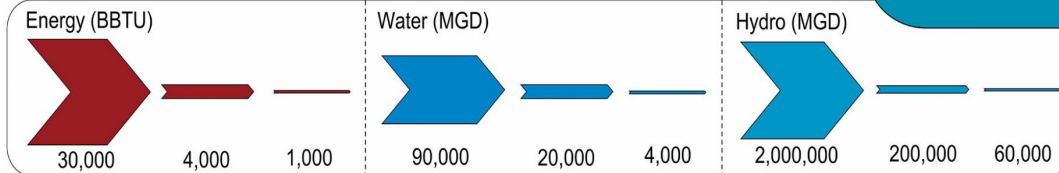
Water and Energy in the Western Interconnection

Water units: Million gallons per day

Energy units: Billion British thermal units per day



Scale

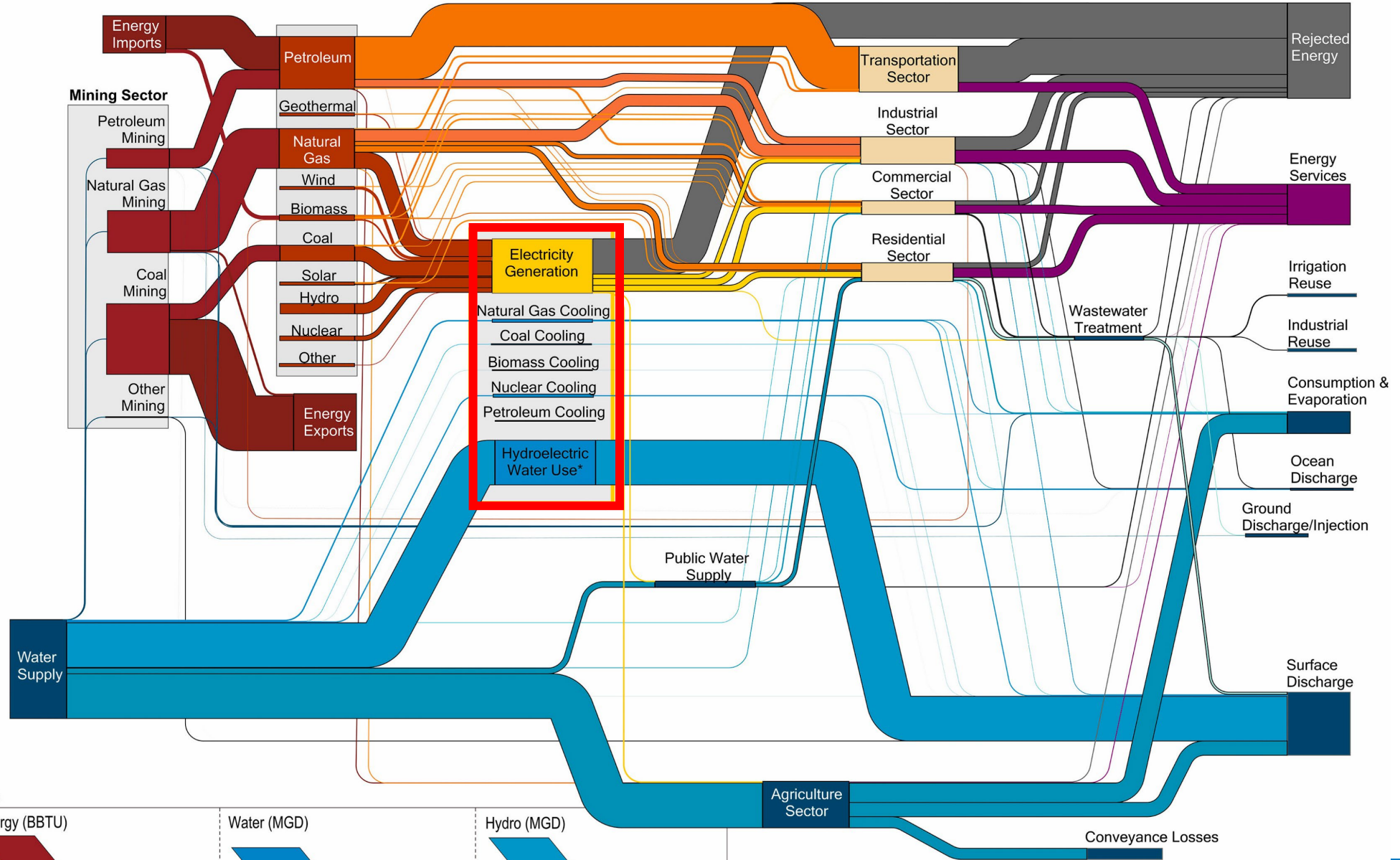


* Hydroelectric water use and discharge flows are not sized relative to other water flows in the diagram due to scale.

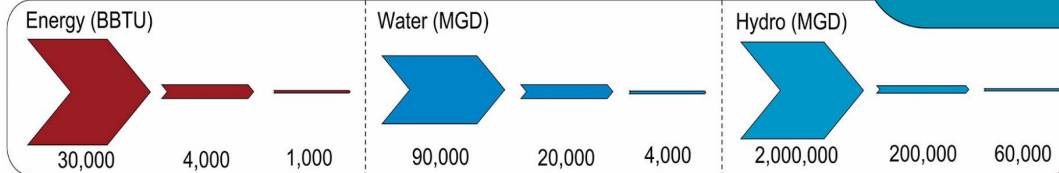
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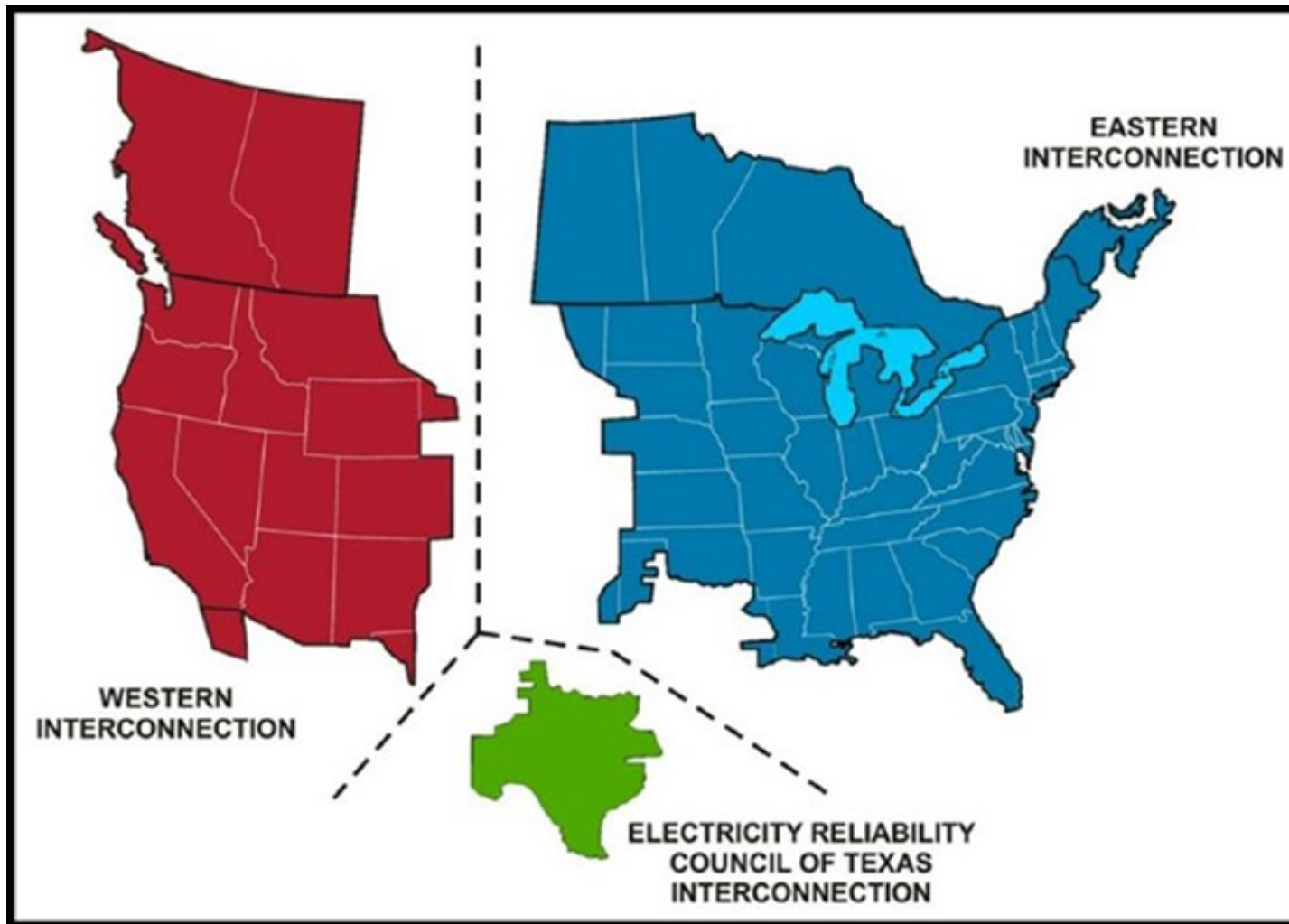


Scale



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For Context. What's the "Western Interconnection?"



There are thousands of individual electric distribution utilities operating across North America

Those local systems interconnect to form a massive grid we call the "bulk power system"

Most utilities are in the Western or Eastern Interconnection – Texas is an island unto itself

According to EIA data, **only 16%** of water withdrawn for electricity generation occurs within the Western half of the U.S., while 84% occurs in the Eastern half

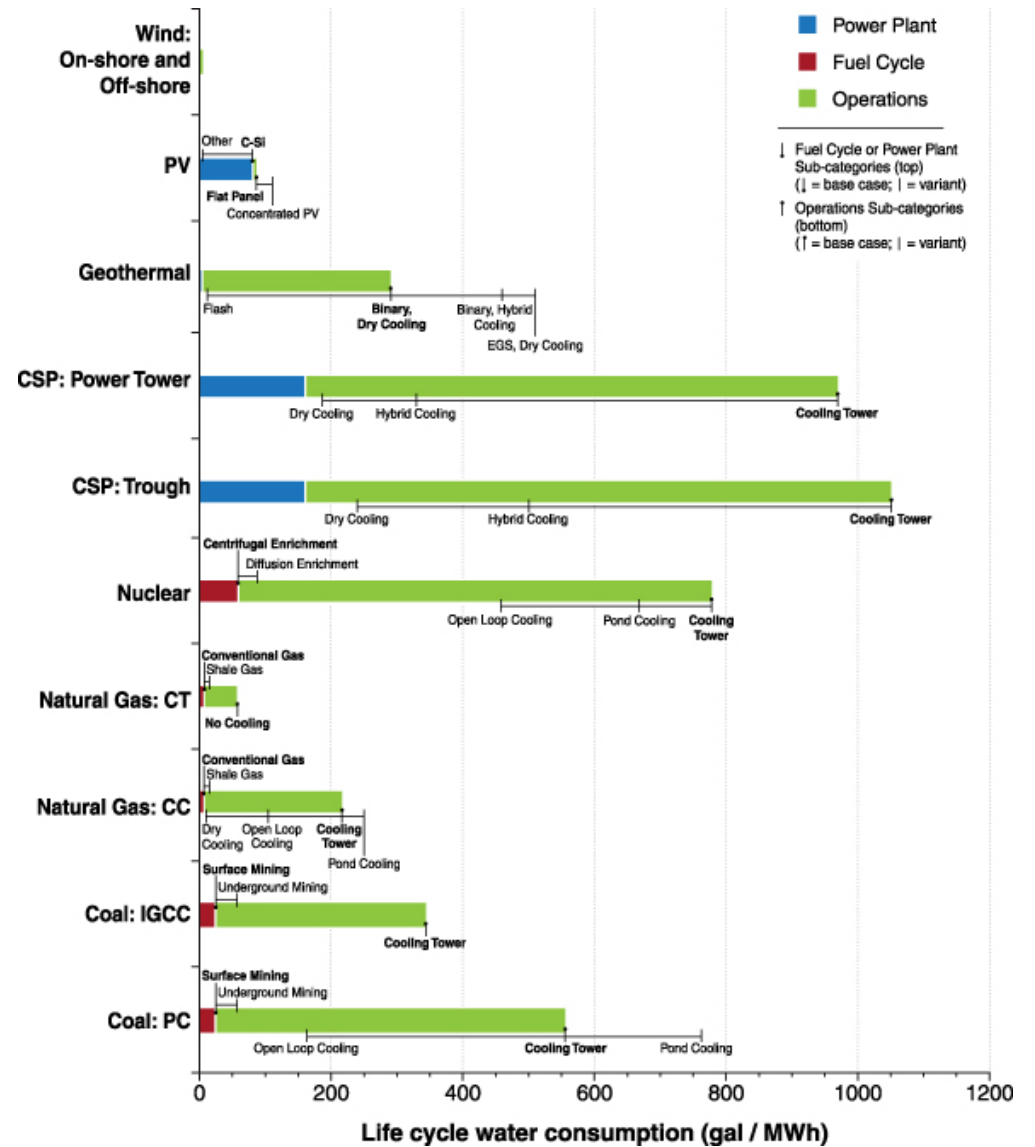
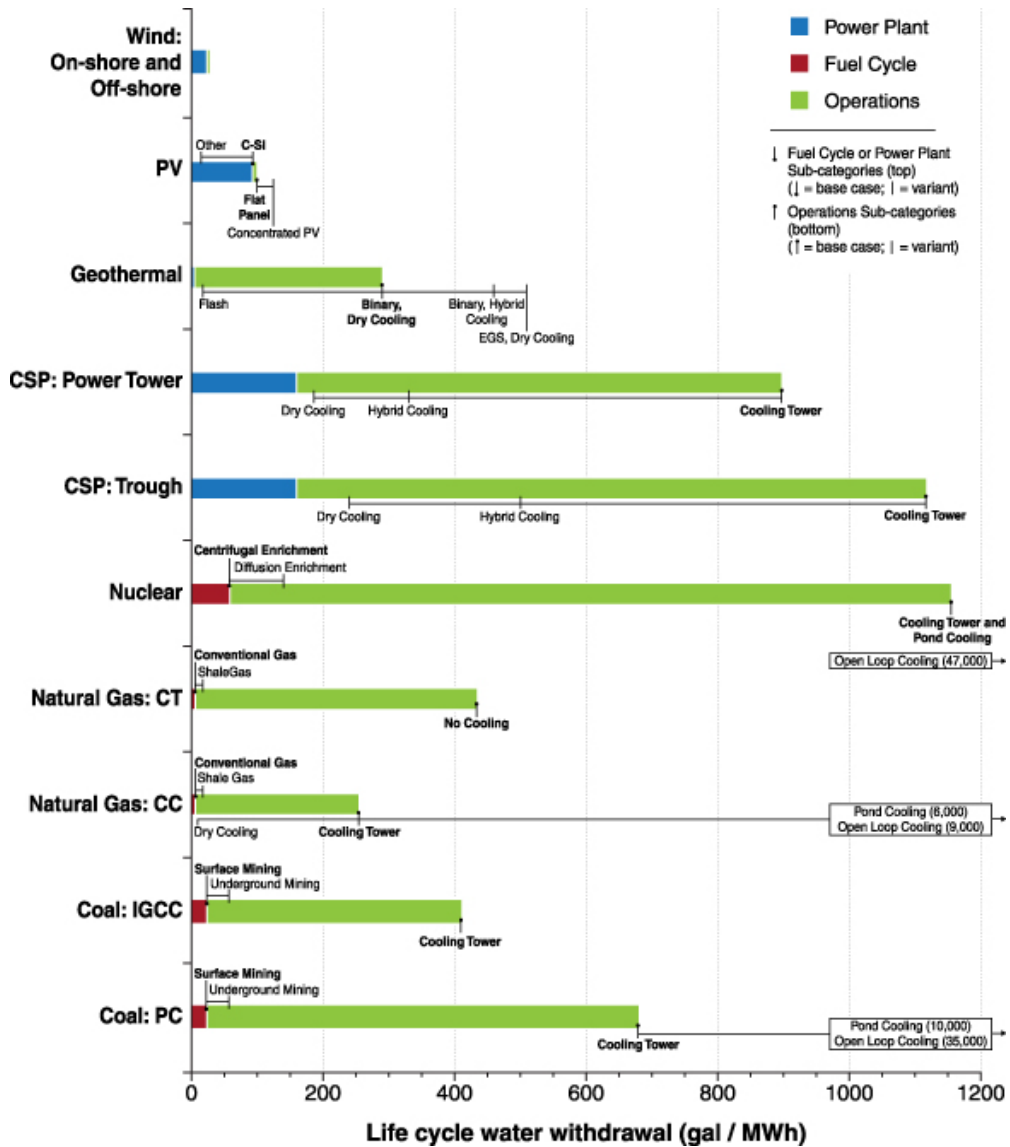


Water Withdrawal & Use

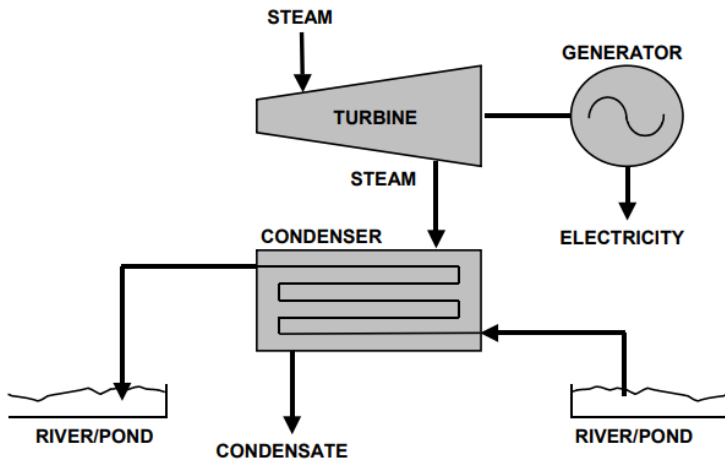
For Electricity Generation



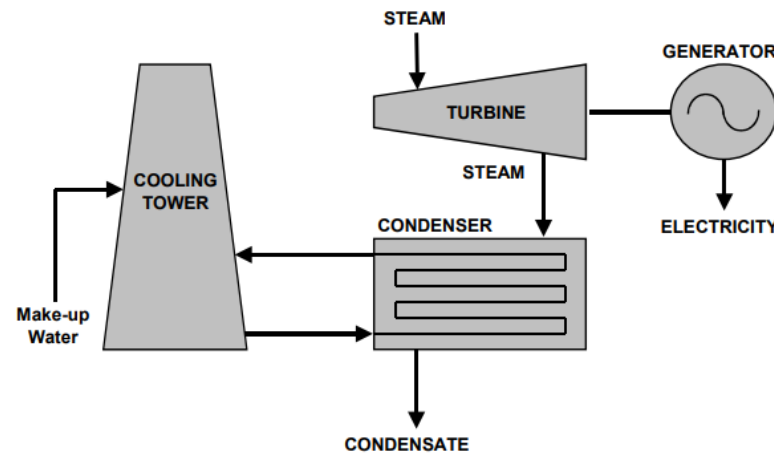
Lifecycle water use – withdrawal vs. consumption



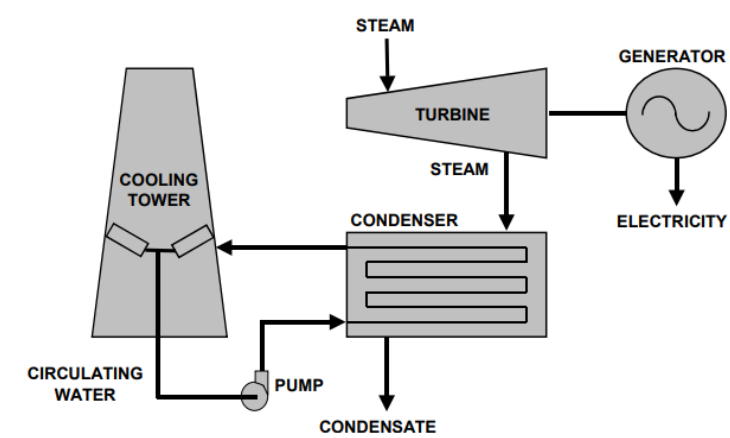
How water is used for cooling in steam power plants



Open-loop (once through) cooling system



Closed-loop (recirculating) cooling system



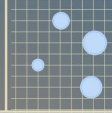
Dry cooling system

2020

THERMOELECTRIC CONSUMPTIVE WATER USE BY FUEL TYPE

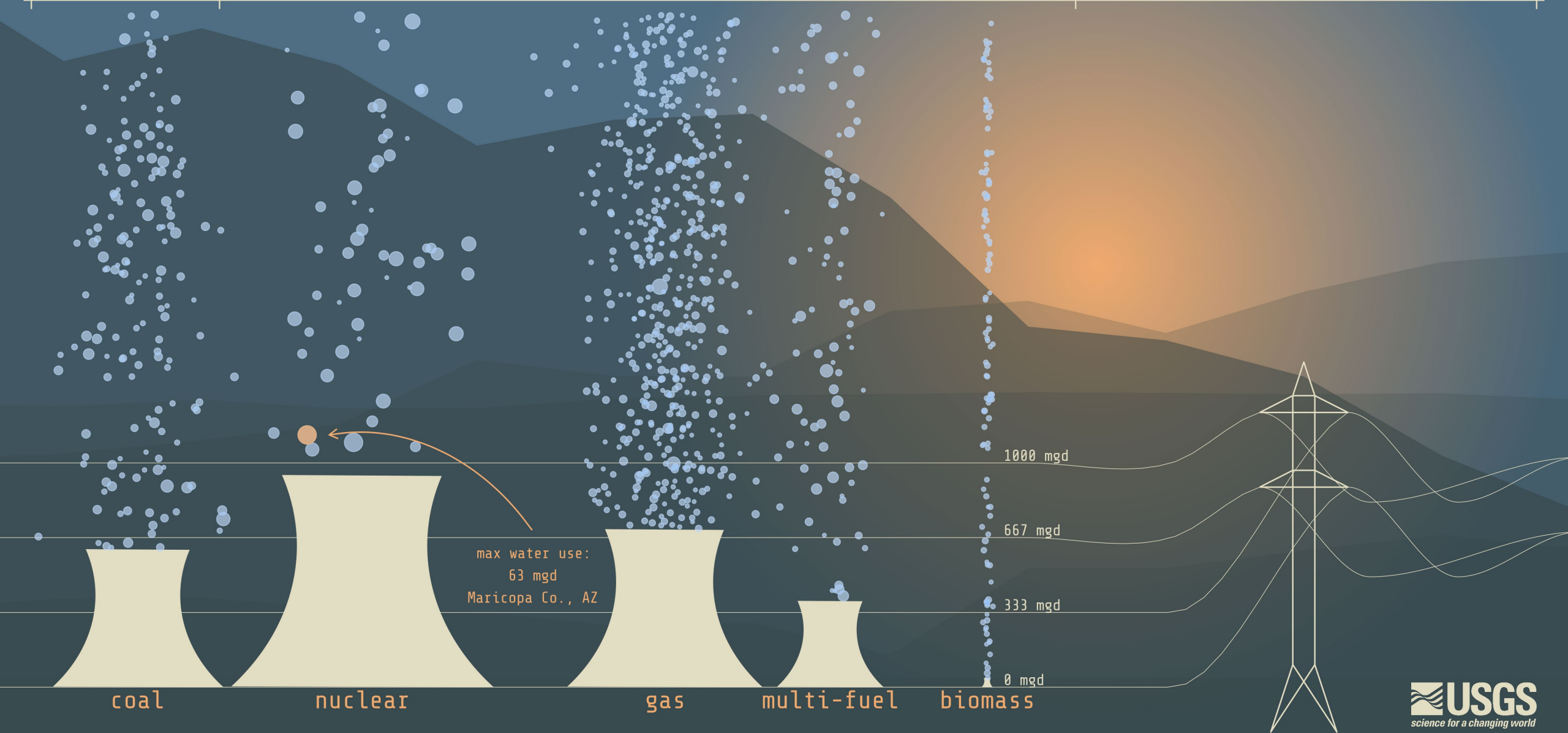


TOTAL WATER USE BY FUEL TYPE



BUBBLE SIZE: WATER USE IN MILLION GALLONS PER DAY (MGD) BY THERMOELECTRIC POWER PLANT

VIZ AUTHOR: ALTHEA A. ARCHER, DATA: DOI.ORG/10.5066/P9ZE2FVM





Arizona's Context

Our Local Water-Energy Nexus



Palo Verde Nuclear Power Plant



The single largest power plant in Arizona @ 3.3 GW – delivers more than 1/3 of all AZ electricity

The second largest power plant in the U.S. by total electricity output

Also, highest water consumption

Reported to be the only nuclear power plant in the world not sited near a large body of water

Recycled wastewater from Phoenix metro is used to cool the plant

How water gets used in hydroelectric power plants

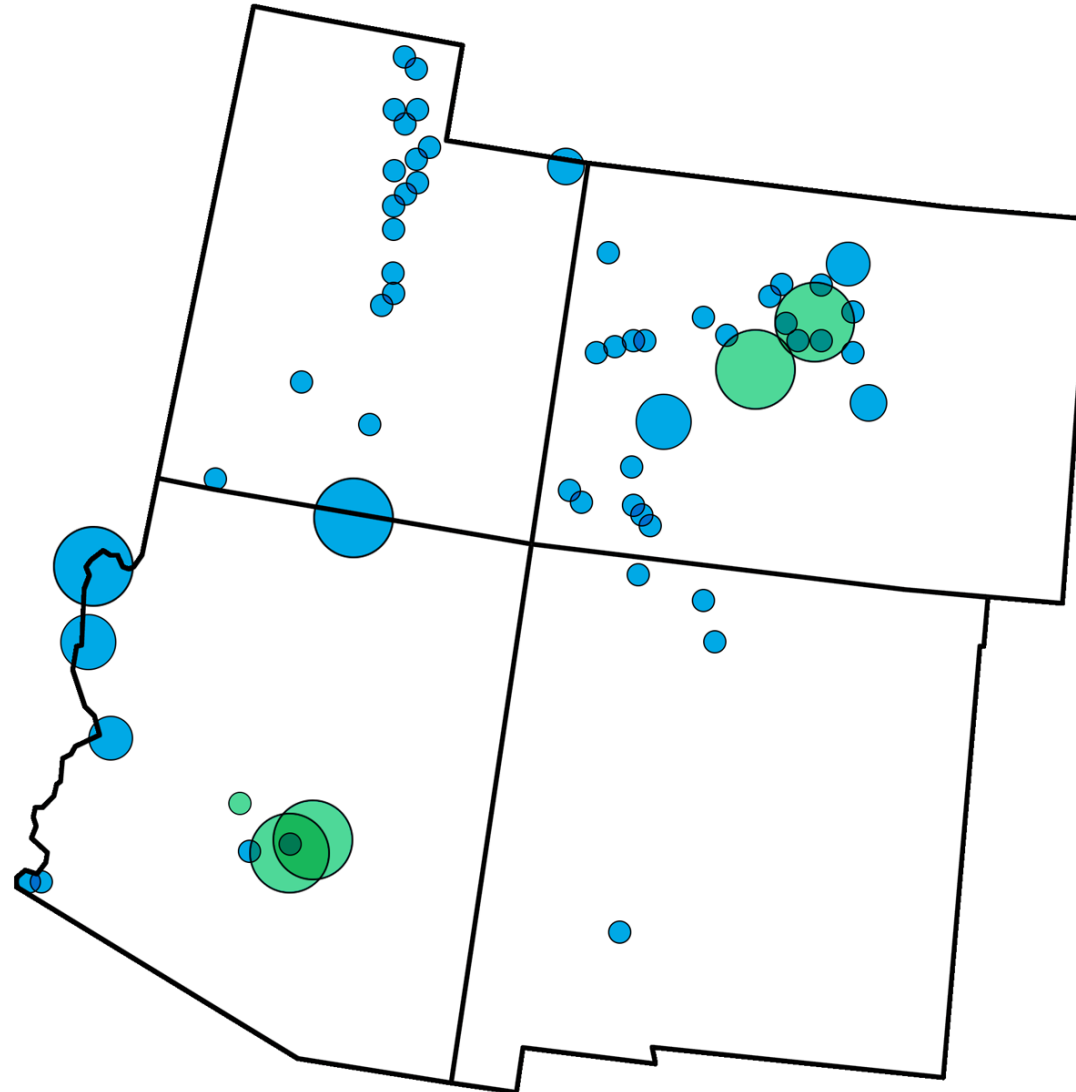




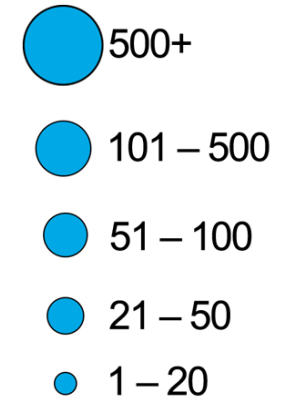
Hydroelectric power plants in AZ and neighboring states

Not including exported power, hydroelectric power serves ~ 4% of state energy use for Arizona

While most hydroelectric dams only flow water one way (conventional), some recirculate to store energy (pumped storage)

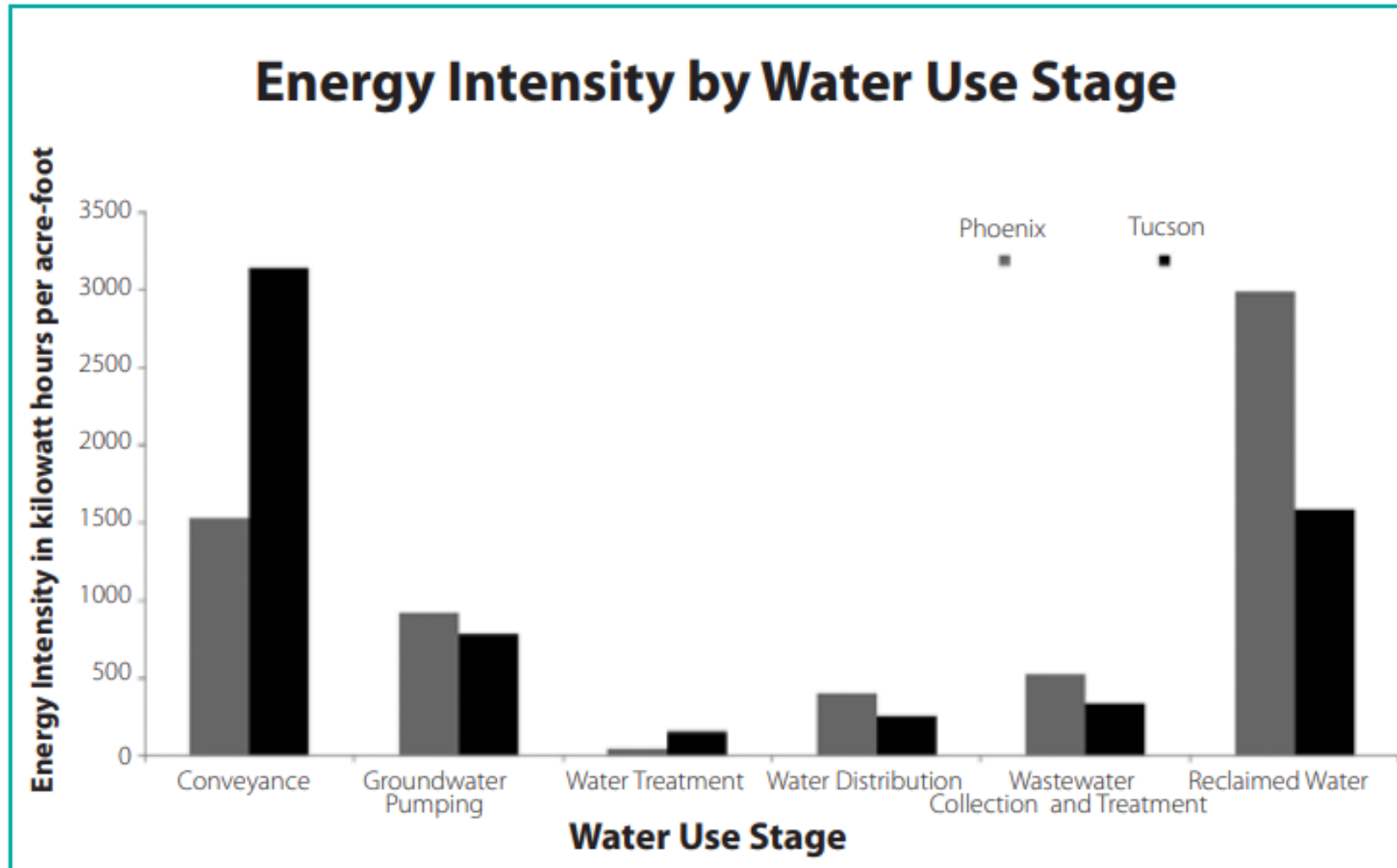


Conventional Hydroelectric Power Plants Size by Capacity (MW)



Conventional hydro
Pumped storage

On the flip side – electricity use in the water system



Source: <https://wrrc.arizona.edu/sites/default/files/attachment/Arroyo-2010-Water-Energy-Nexus.pdf>



Questions?

Thank you!

