



The Energy-Water Nexus: Challenges, Tradeoffs & Opportunities

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The Energy-Water Nexus

Electricity Sector:

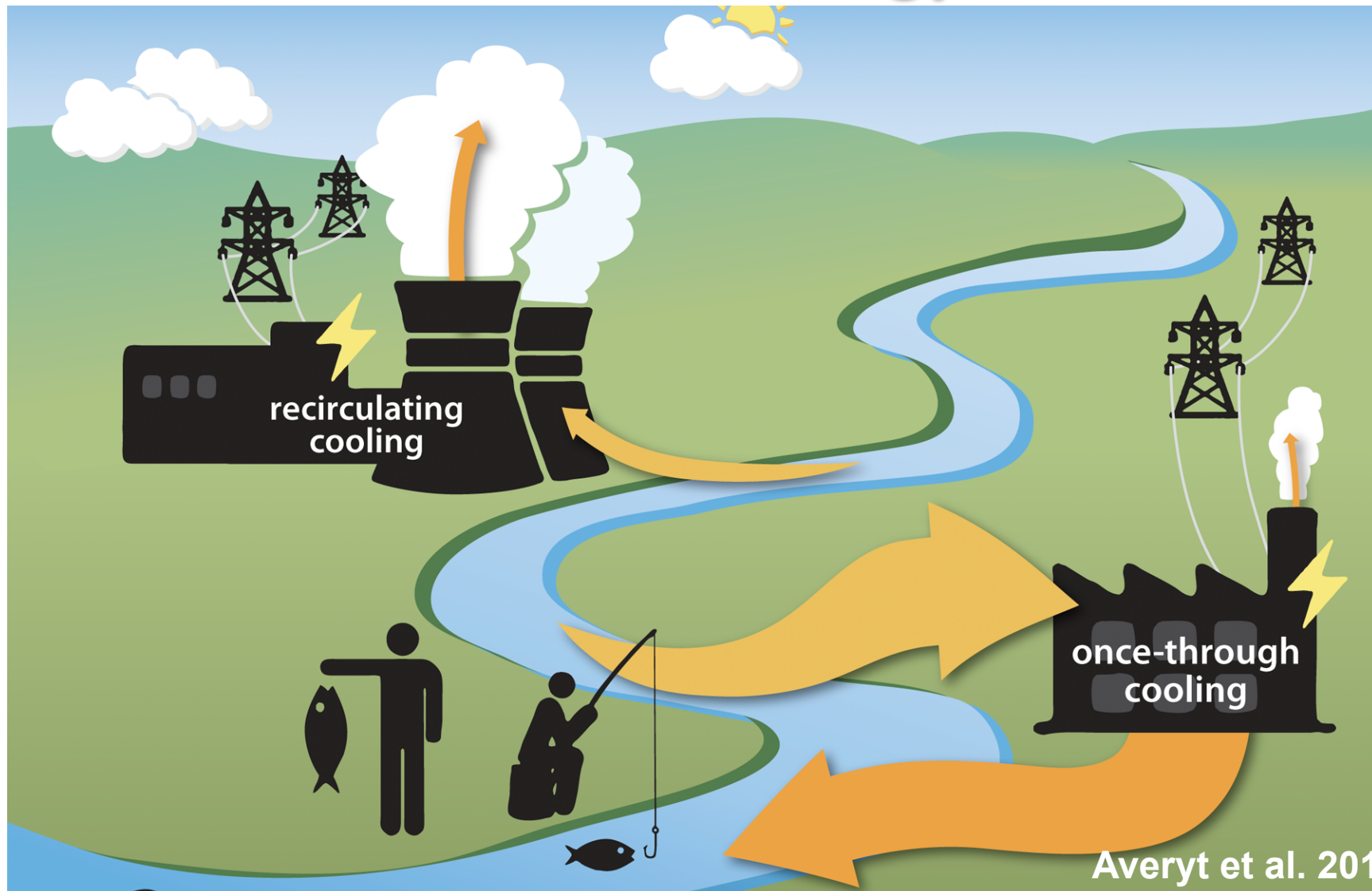
- ~35% of total US GHG emissions
- 41% of total withdrawals
- 5% of total consumptive use

Water Sector:

- ~13% of the US electricity supply

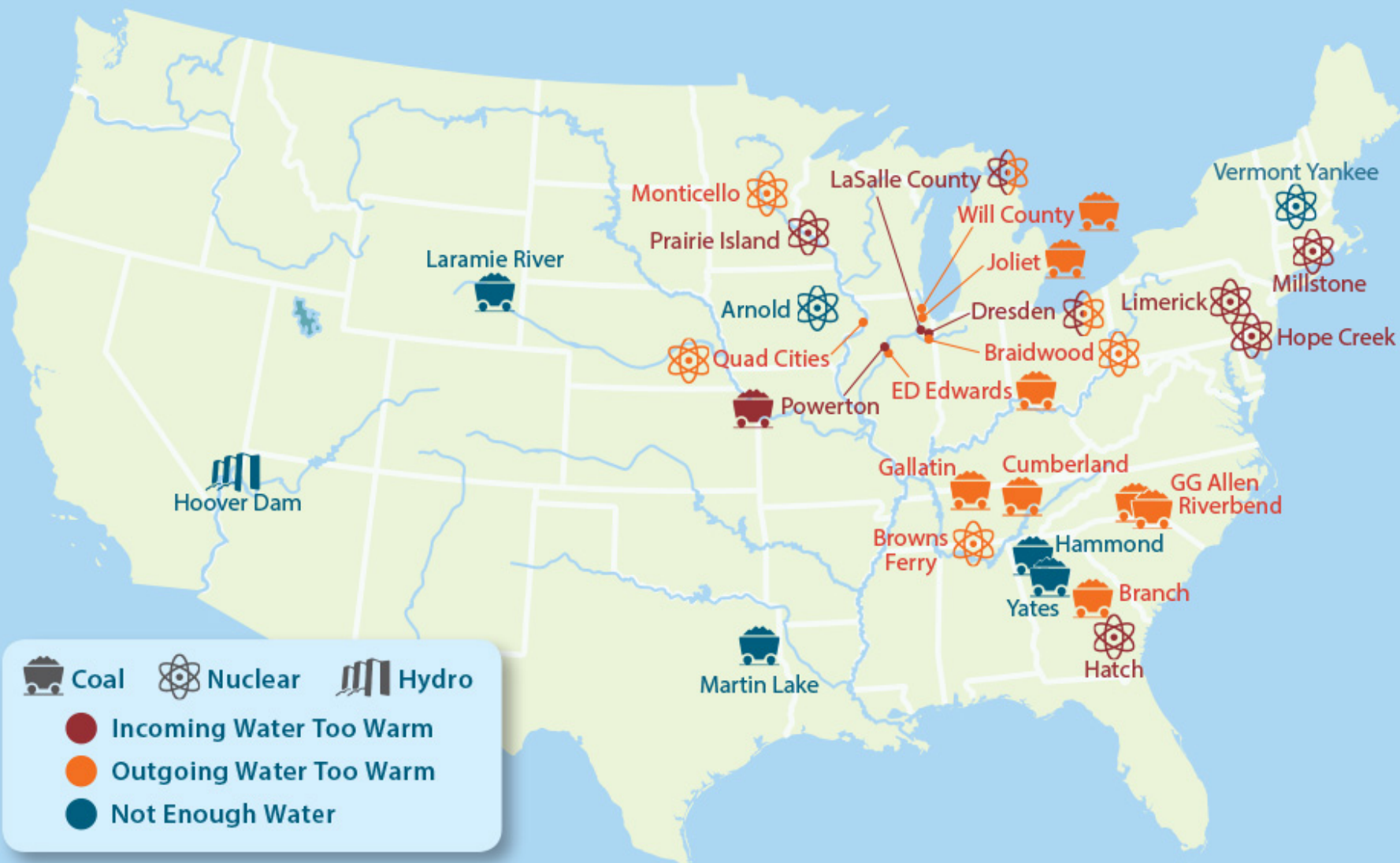


Water for Energy

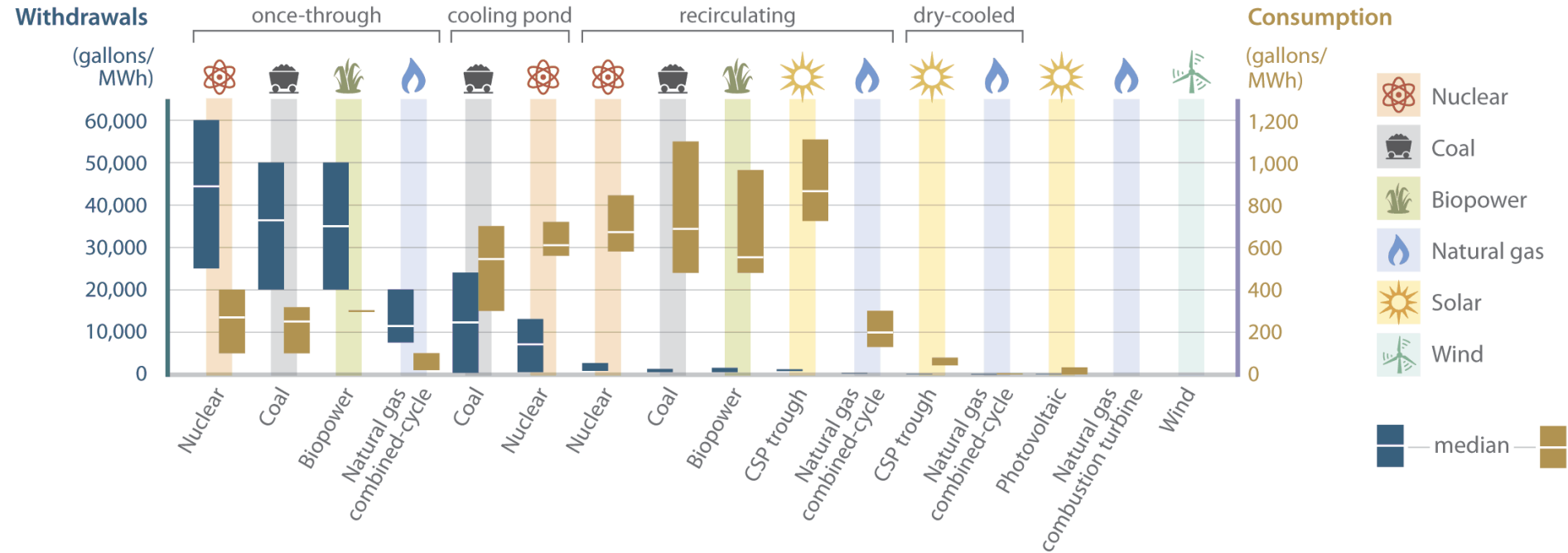


Averyt et al. 201

Water for Energy Collisions: 2006–2012



Water for Energy



Water use at a given power plant is a function of fuel type and cooling technology

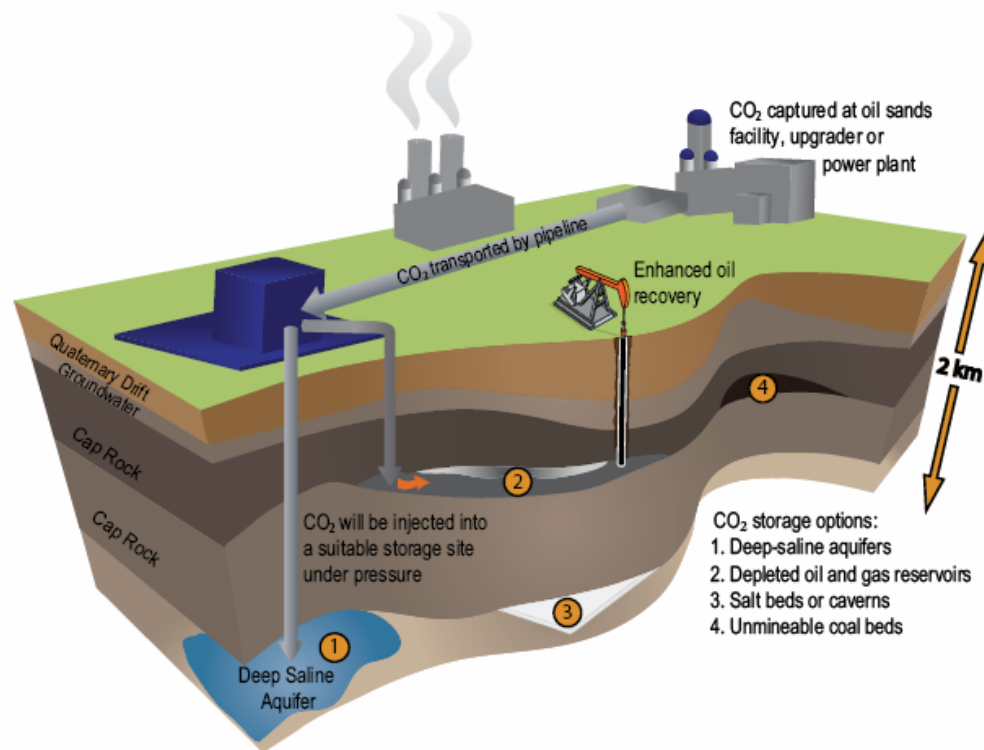
Water for Energy

Coal-fired power plant



Water for Energy

Supplement coal plant with carbon capture and storage



Decrease C emissions by ~90% per kWh
Increase water use by 90 to 100%

Water for Energy

Nuclear Power



Solar Power (parabolic trough)



Decrease C emissions by >95% per kWh
Little change in water use

Water for Energy

Wind



Solar power (PV)



Decrease C emissions by >95% per kWh
Decrease water use by >95% per kWh

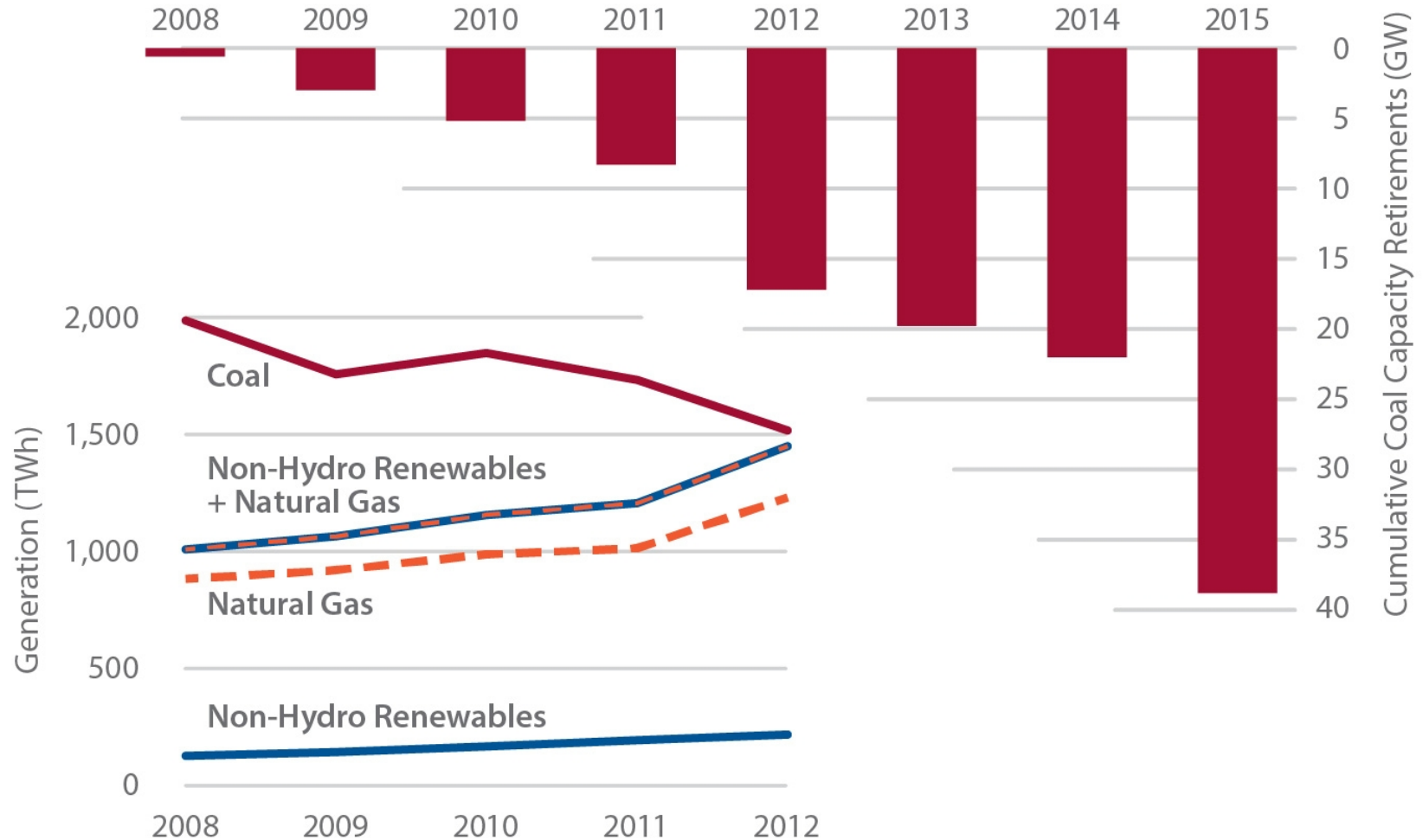
Water for Energy

Replace coal plant with natural gas:



Decrease C emissions by ~50% per kWh
Decrease water use by ~30% per kWh

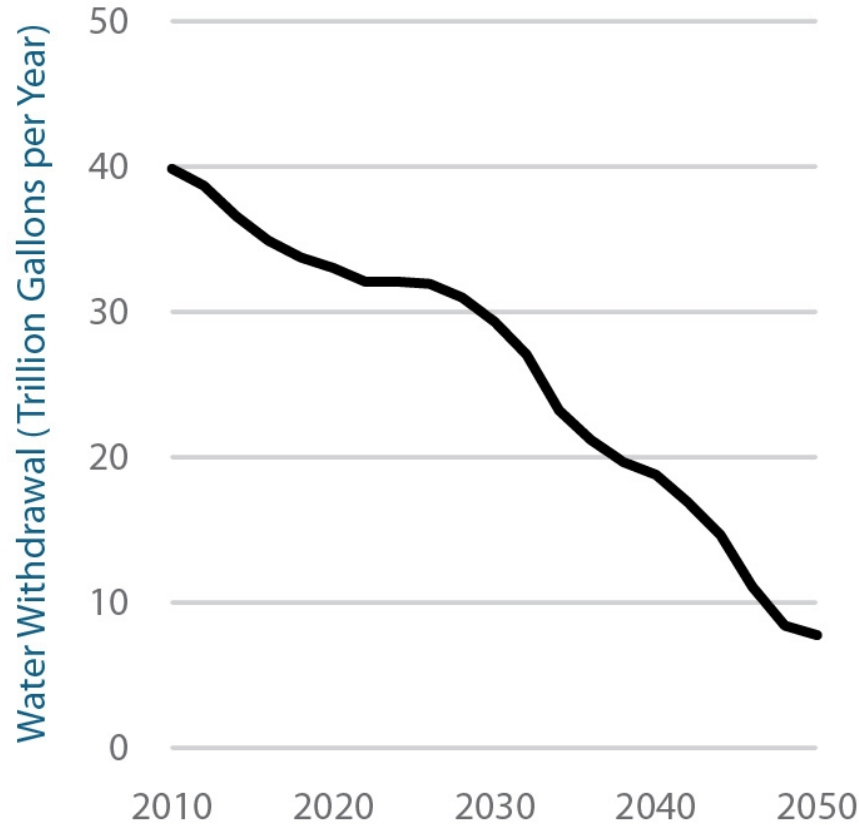
Electricity Sector in Transition



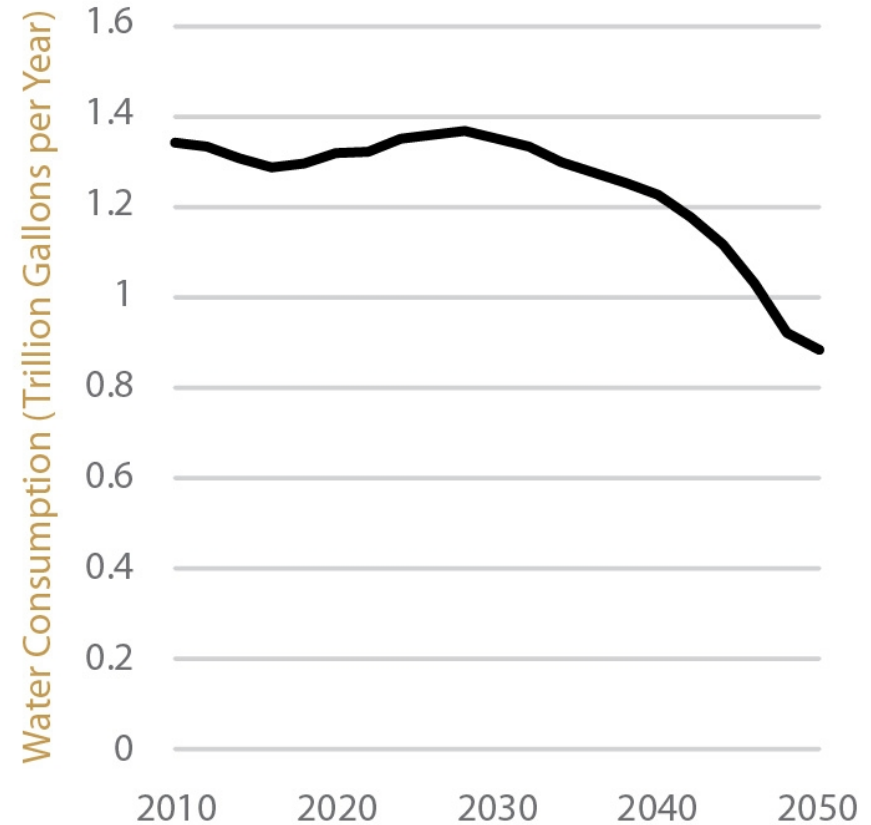
What are the implications for water resources of different electricity portfolios out to 2050?

Business as Usual: Water

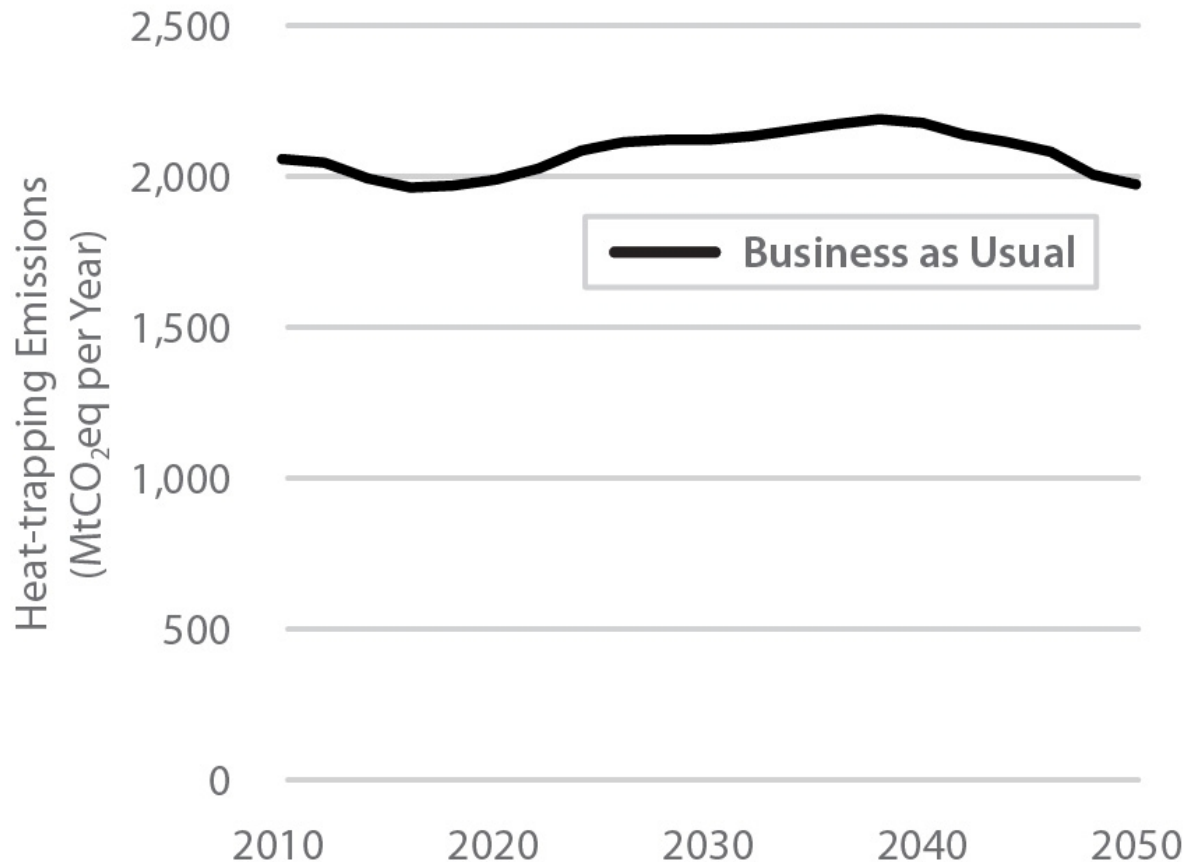
Withdrawal



Consumption



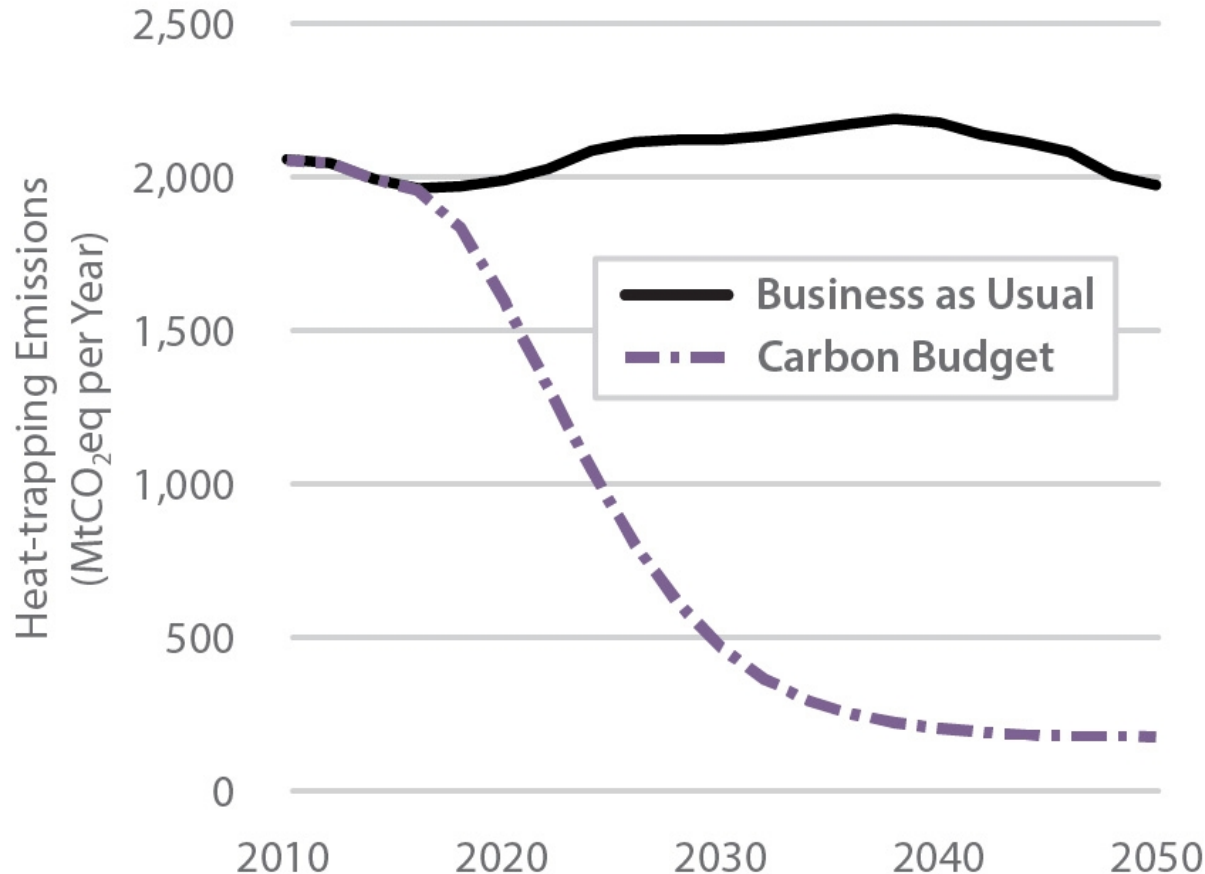
Business as Usual: Carbon Emissions



**Business as usual:
emissions stable, concentrations increase**

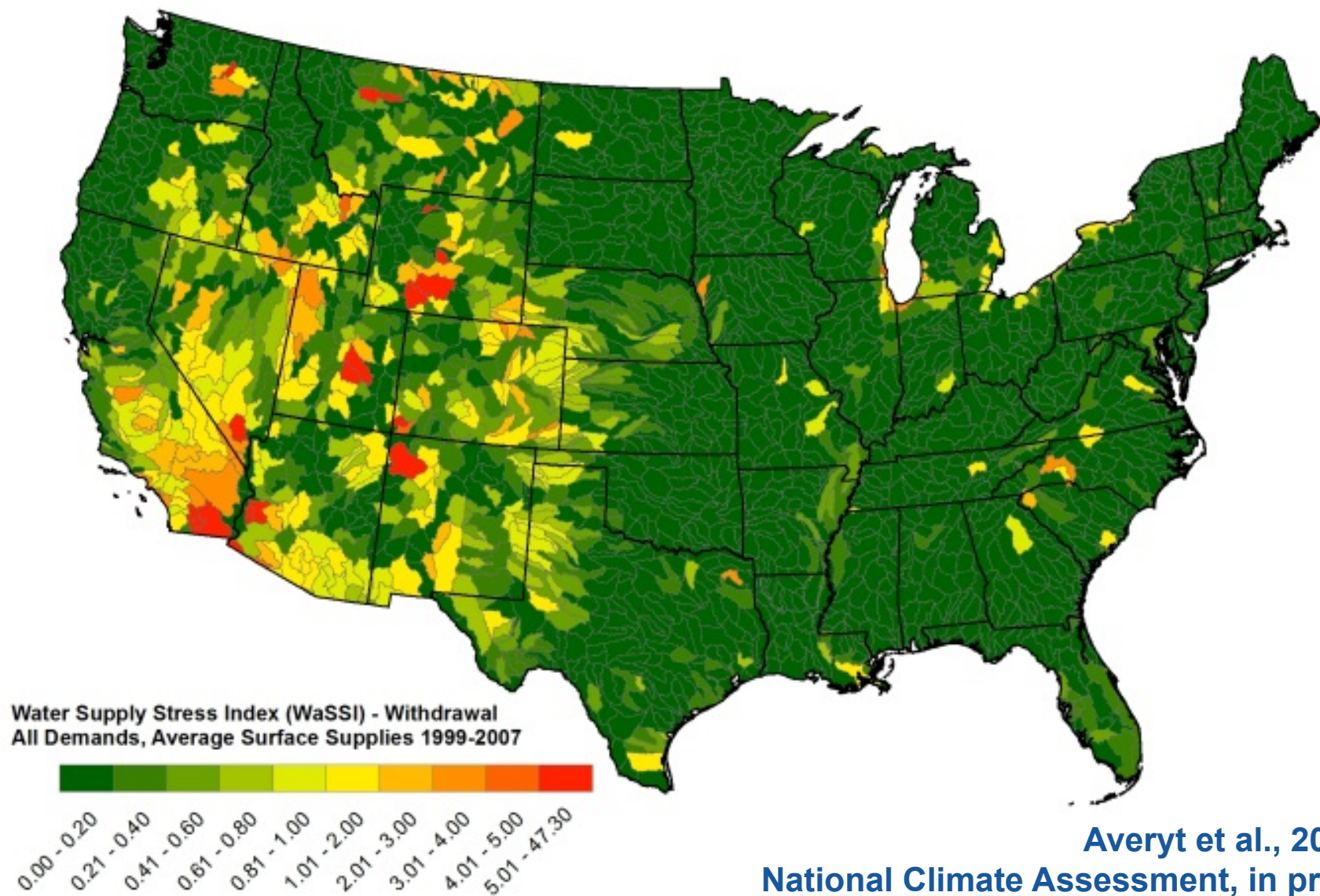
Rogers et al., 2013; Clemmer et al., 2013

Business as Usual vs. Carbon Budget

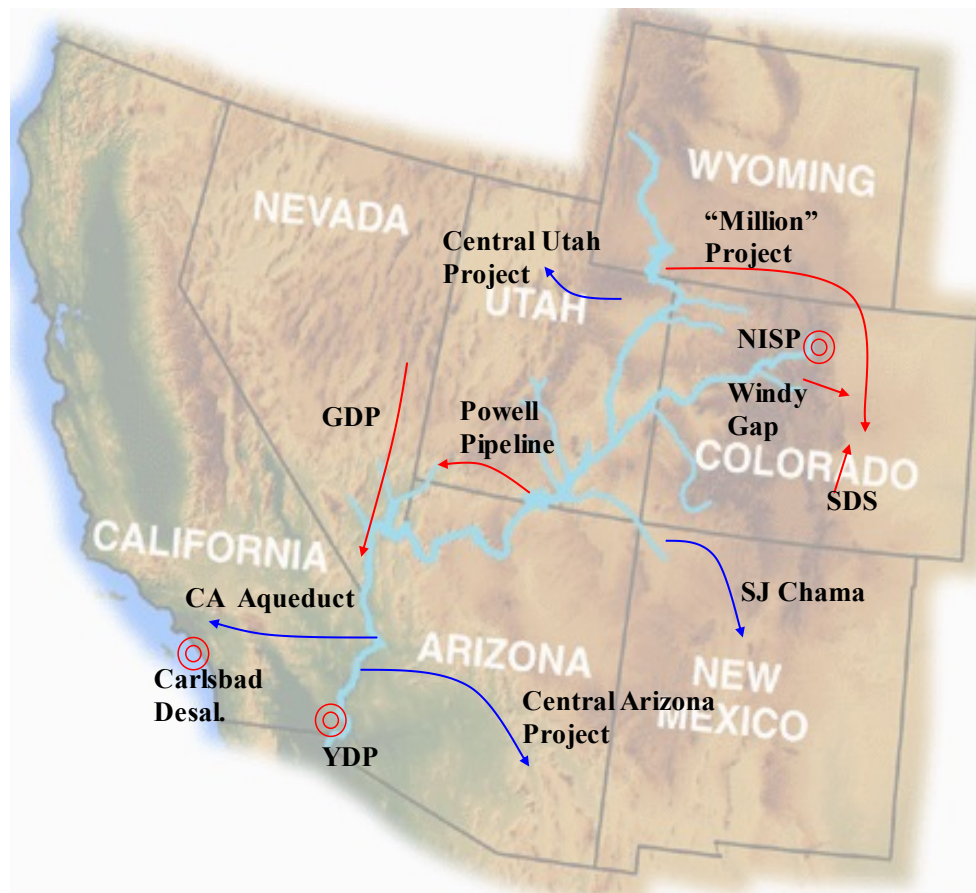
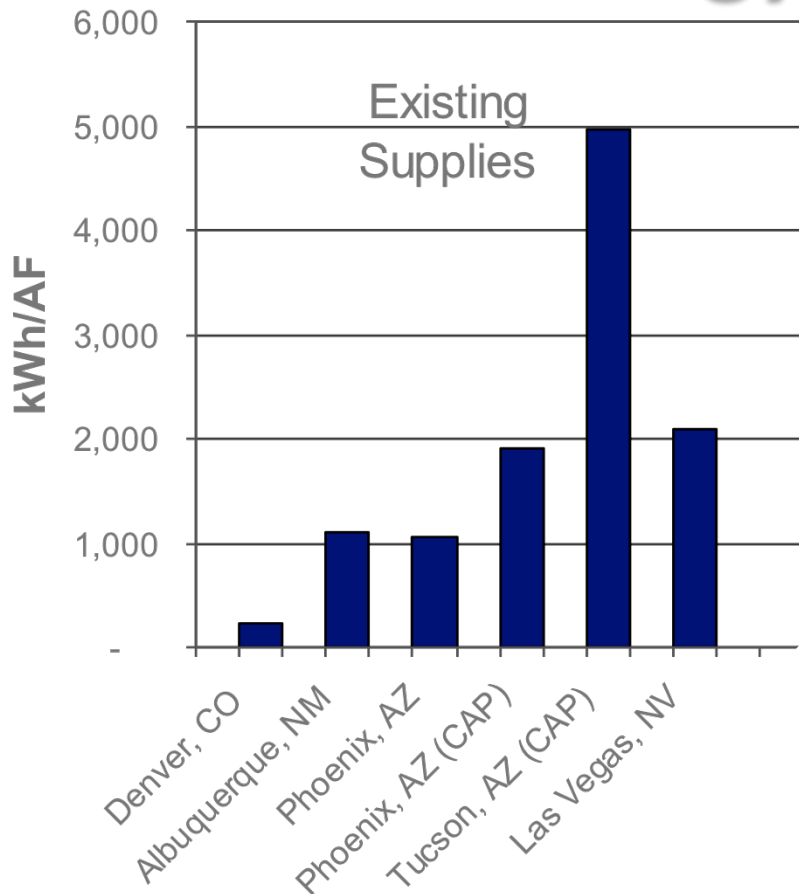


carbon budget: 170 GT CO₂ (eq) by 2050

Energy for Water: Water Stress (1999–2007)

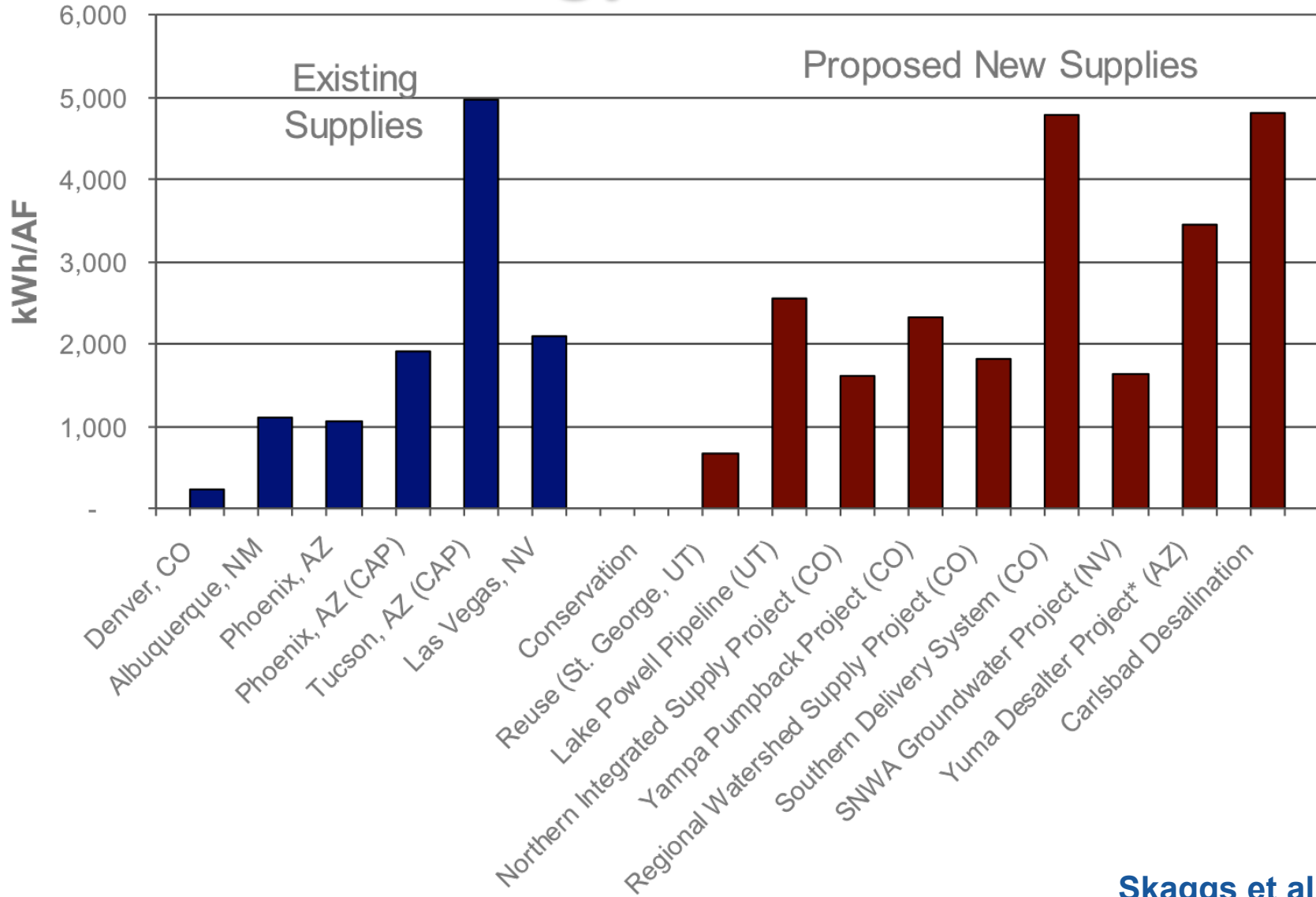


Energy for Water



>20% of SW electricity supply is used by the water sector

Energy for Water





Risk & Resilience

Are power plants resilient to future extreme weather?

Will there be enough power to get clean water where it needs to be when it needs to be there?



THANK YOU

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