

# Freshwater Use by U.S. Power Plants

## Electricity's Thirst for a Precious Resource

*A Report of the Energy and Water in a Warming World Initiative*

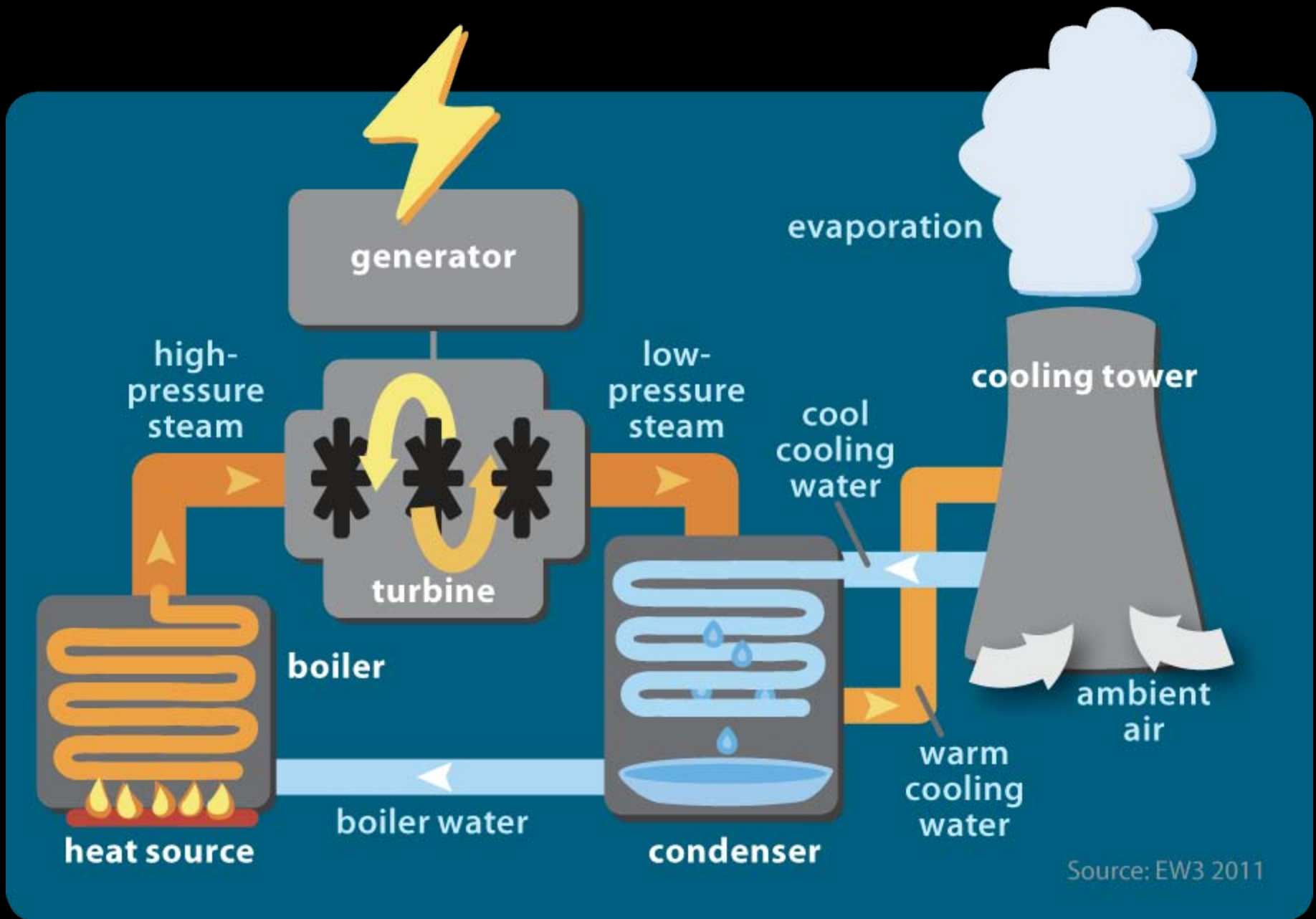




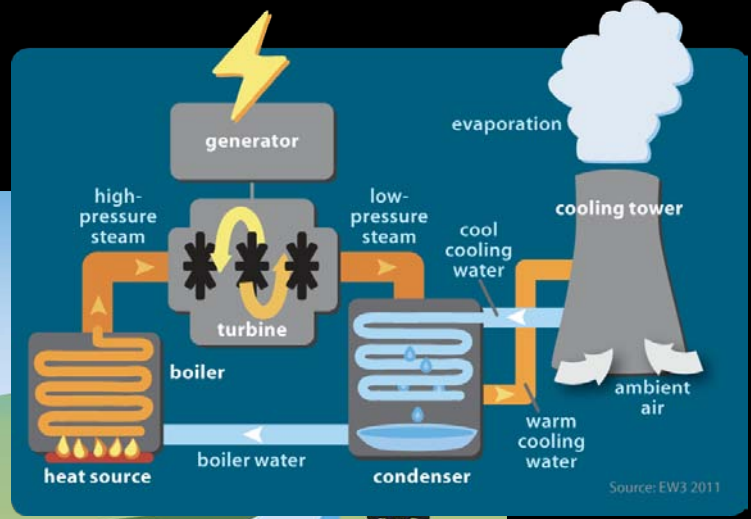
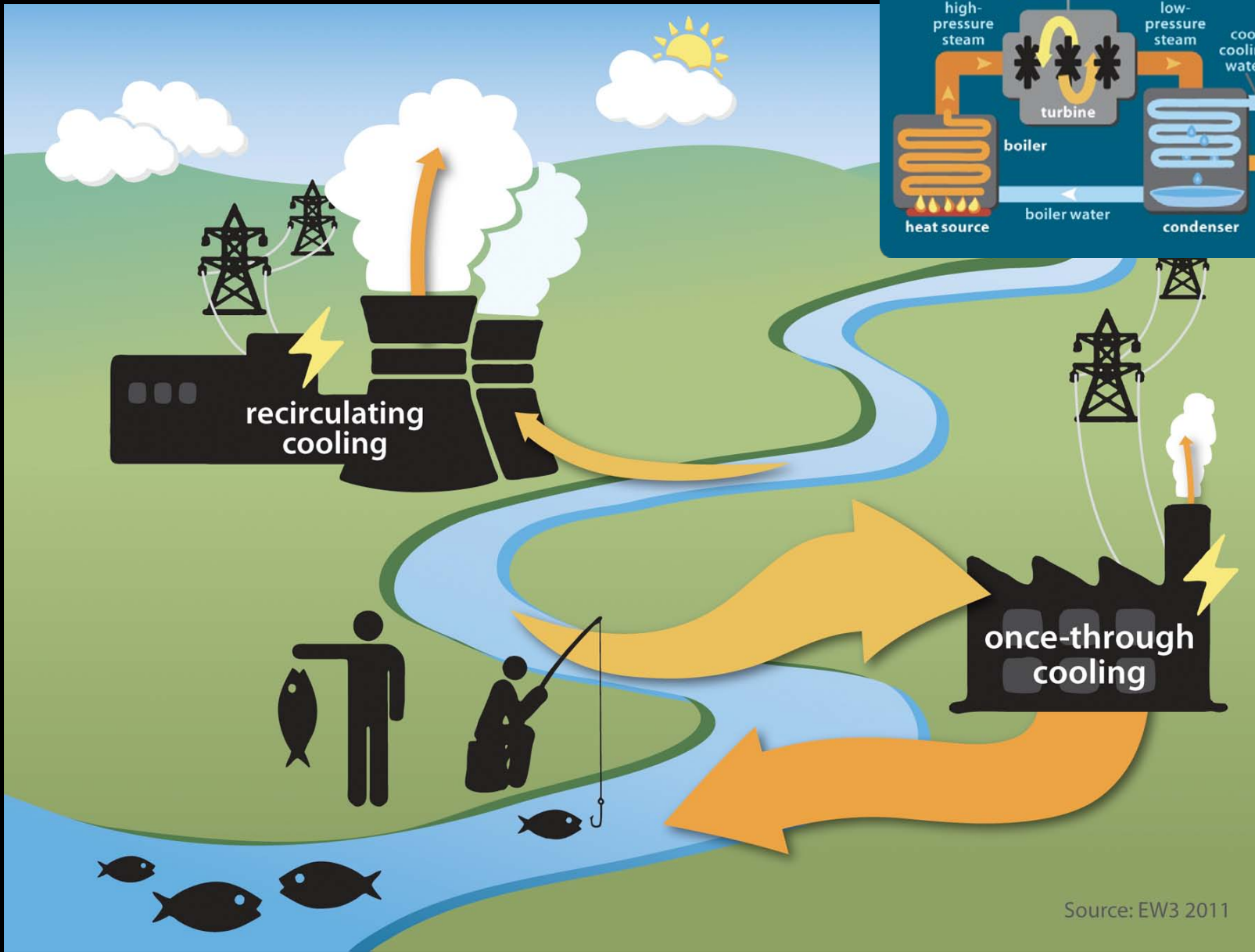
- Withdrawals: 200–500K acre-feet/day  
– 40% of freshwater withdrawals (2005)
- Consumption (evaporation): 10–20K acre-feet/day
- Coal: 2/3



- Electricity's water profile
- Gaps and errors
- Stress on water systems
- Opportunities: toward a water-smart energy future



Source: EW3 2011

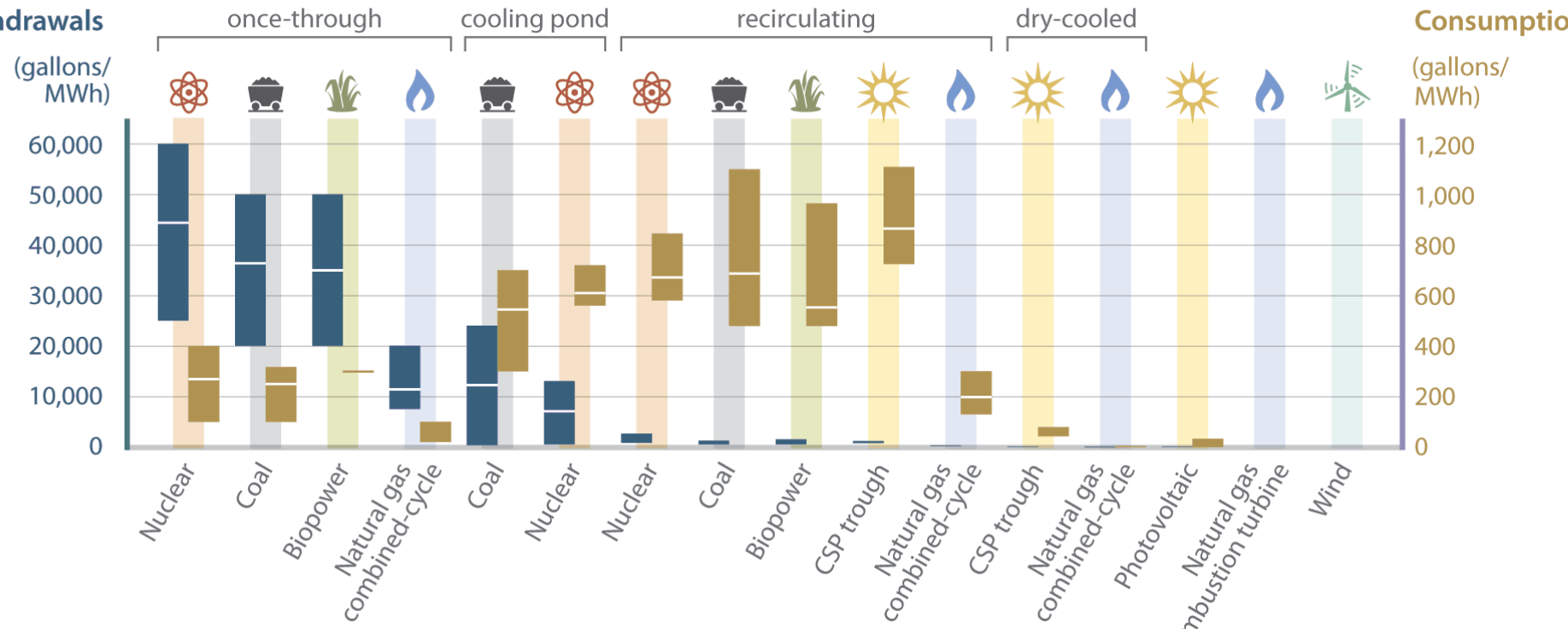


Source: EW3 2011

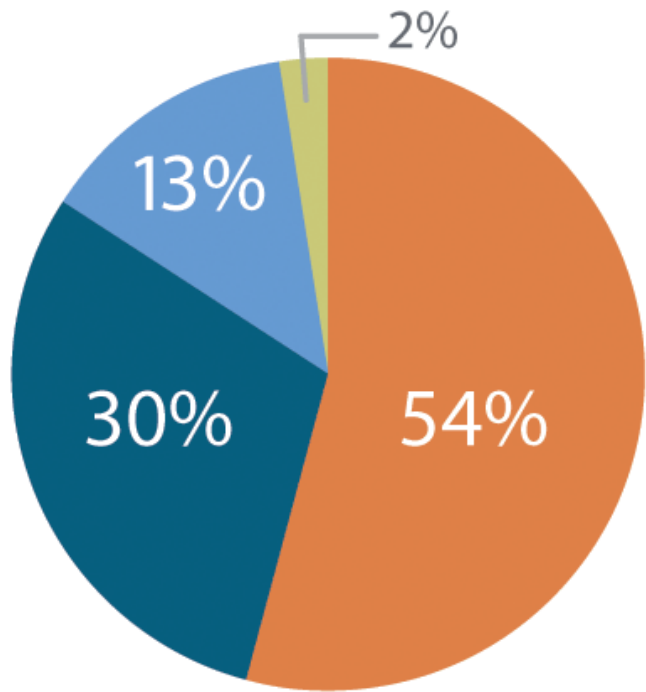
Source: EW3 2011



# Withdrawals

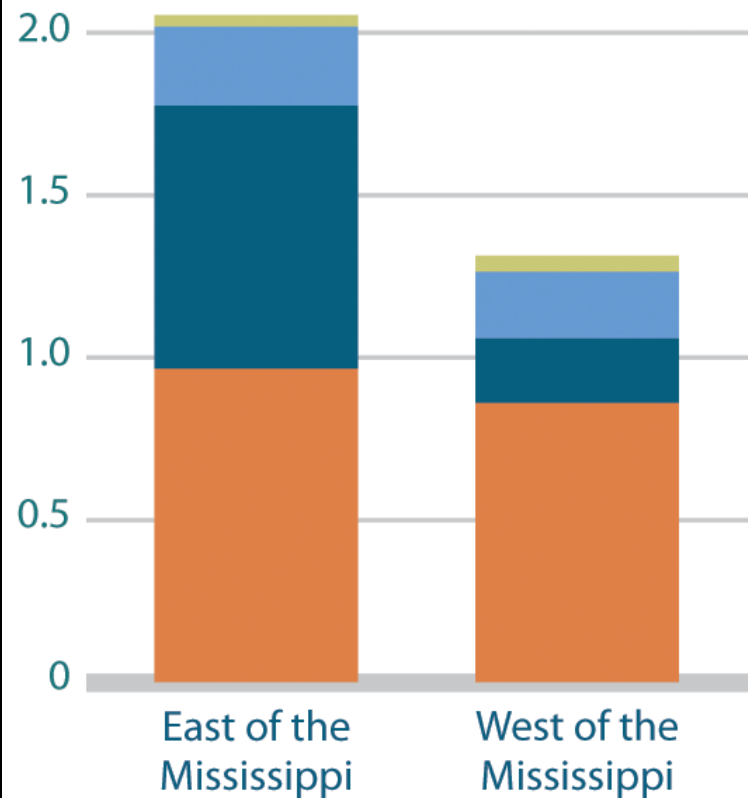


## Share of Total Generation

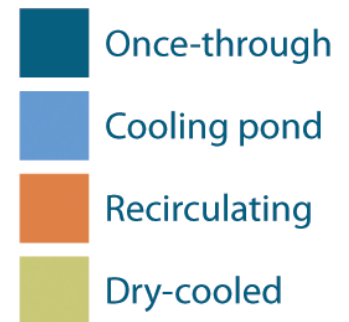


Percentage of total generation, for each cooling technology

## Generation (billions of MWh)

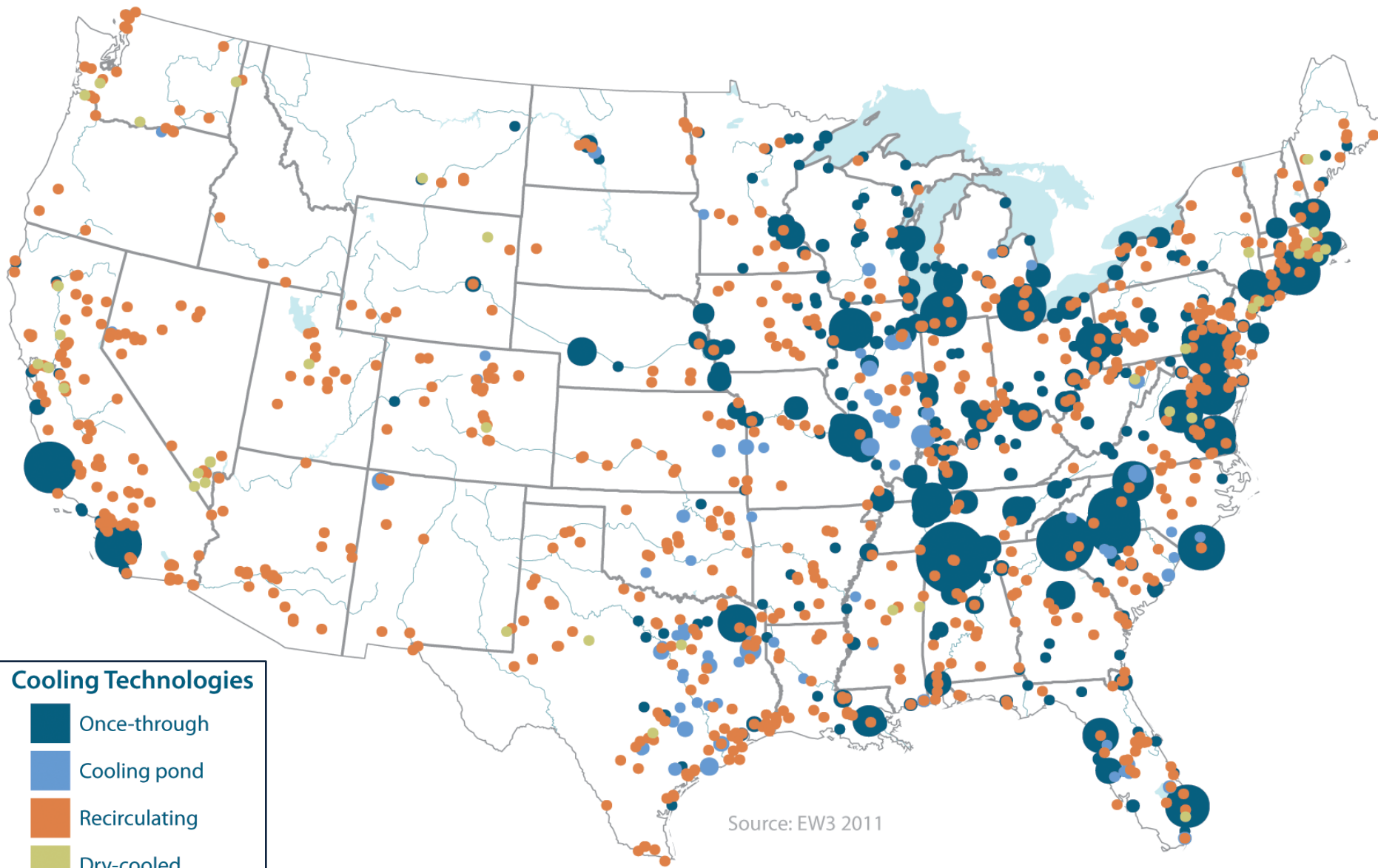


## Cooling Technologies



Source: EW3 2011

# Power Plant Water Withdrawals: East vs. West



### Cooling Technologies

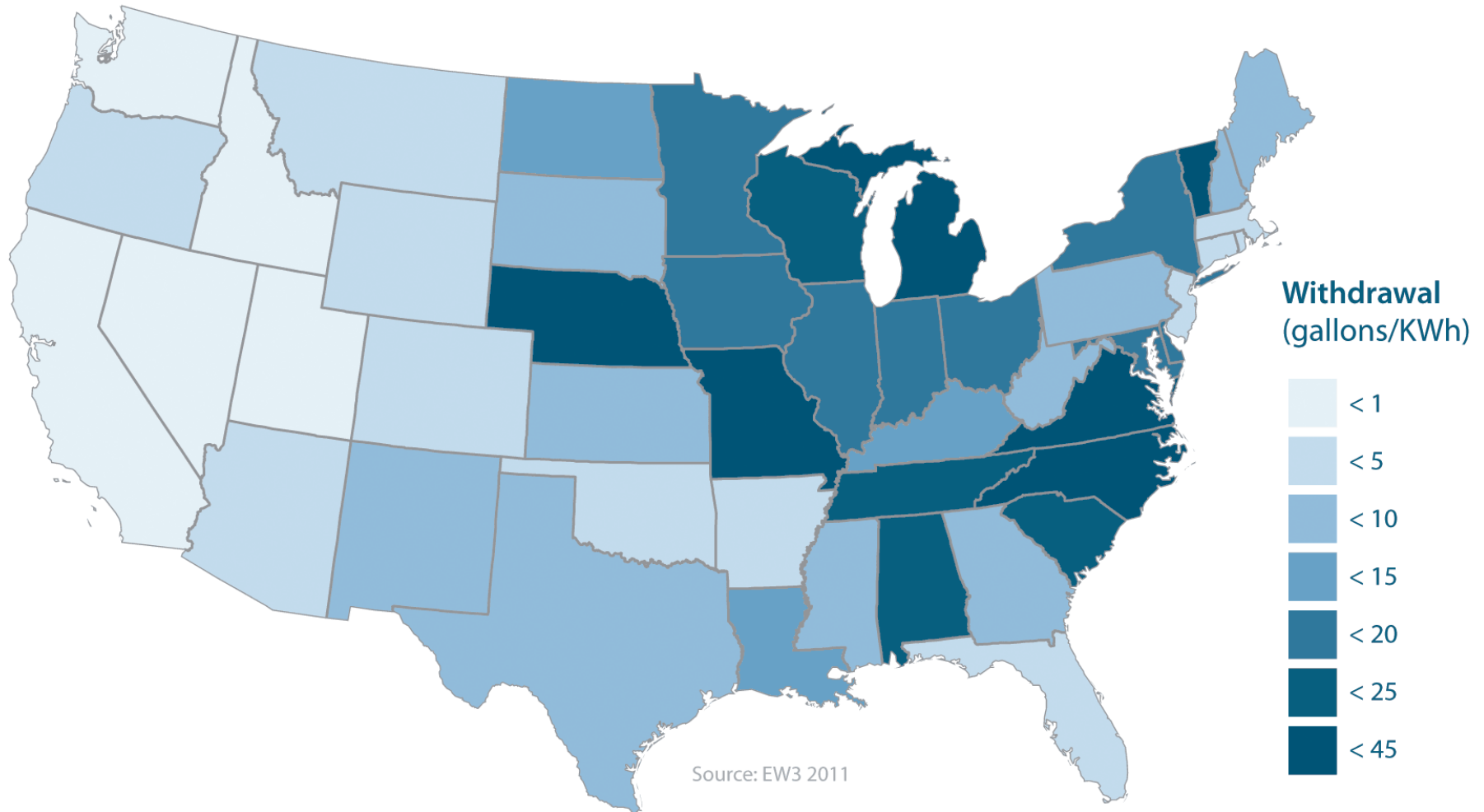
- Once-through
- Cooling pond
- Recirculating
- Dry-cooled

Source: EW3 2011

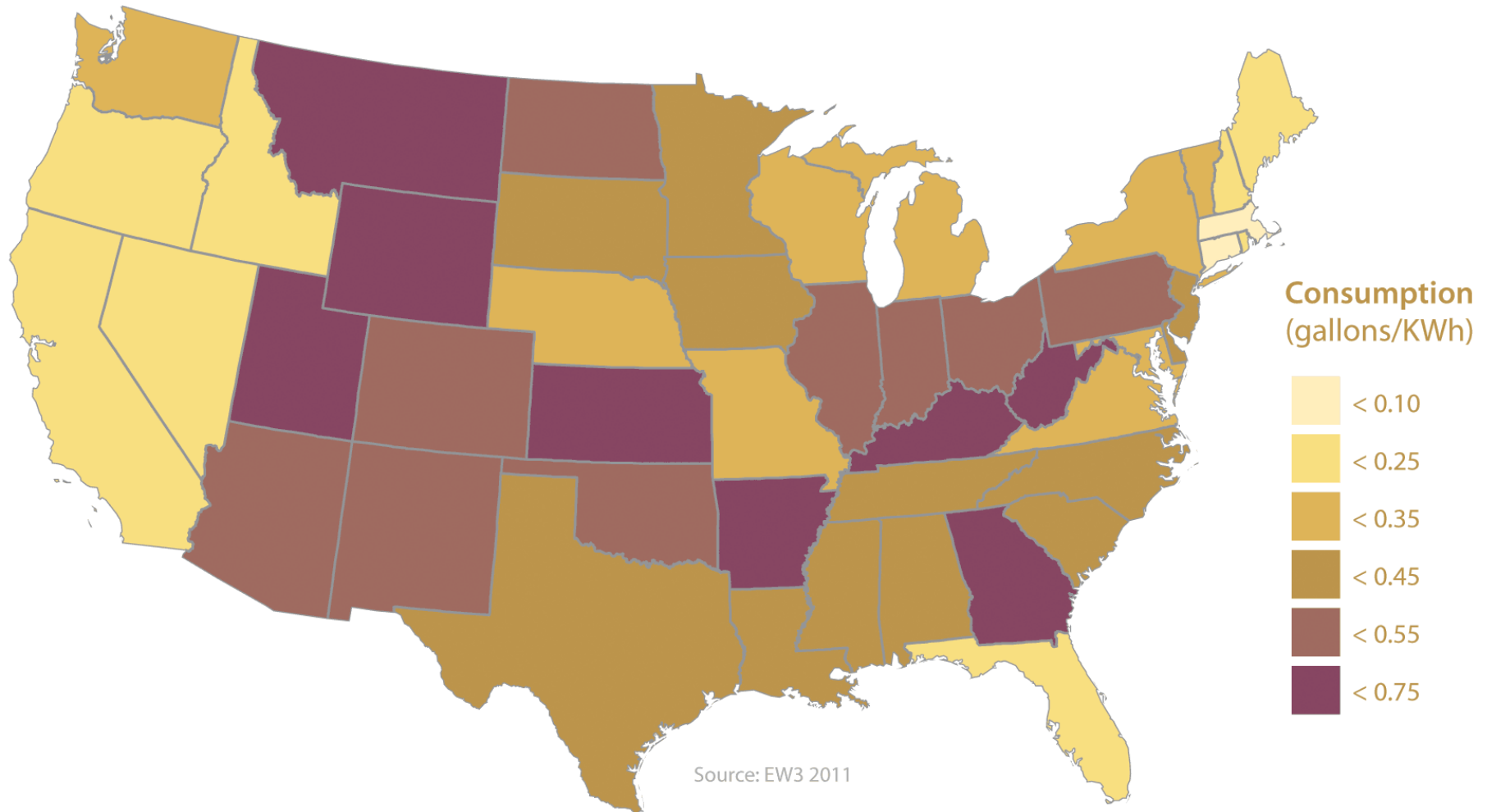
Source: EW3 2011



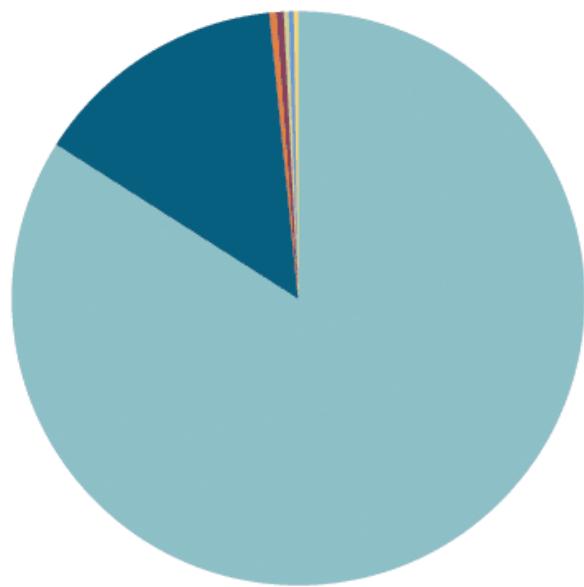
# Freshwater Withdrawal Intensity



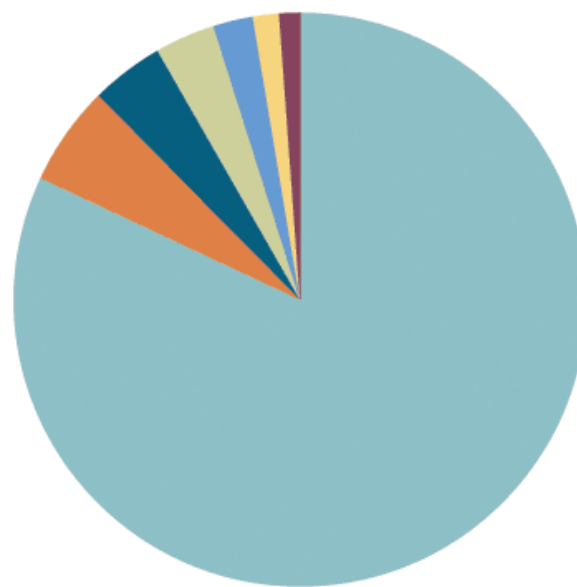
# Freshwater Consumption Intensity



# Sources of Cooling Water



**Withdrawal**



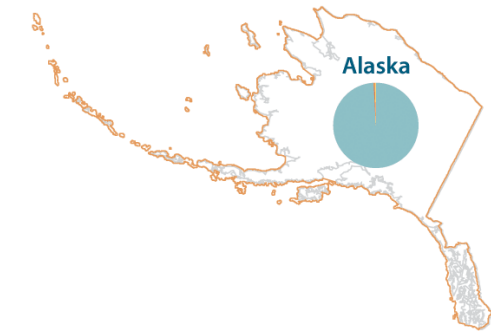
**Consumption**



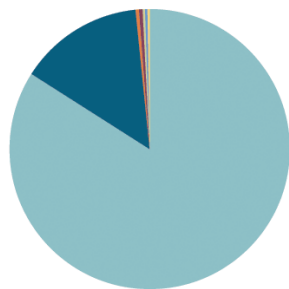
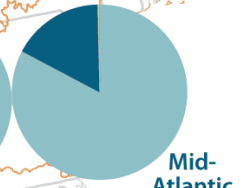
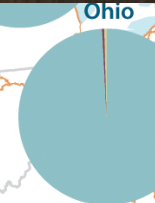
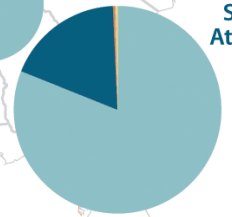
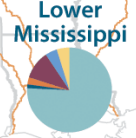
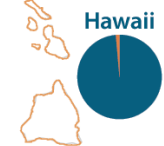
Source: EW3 2011



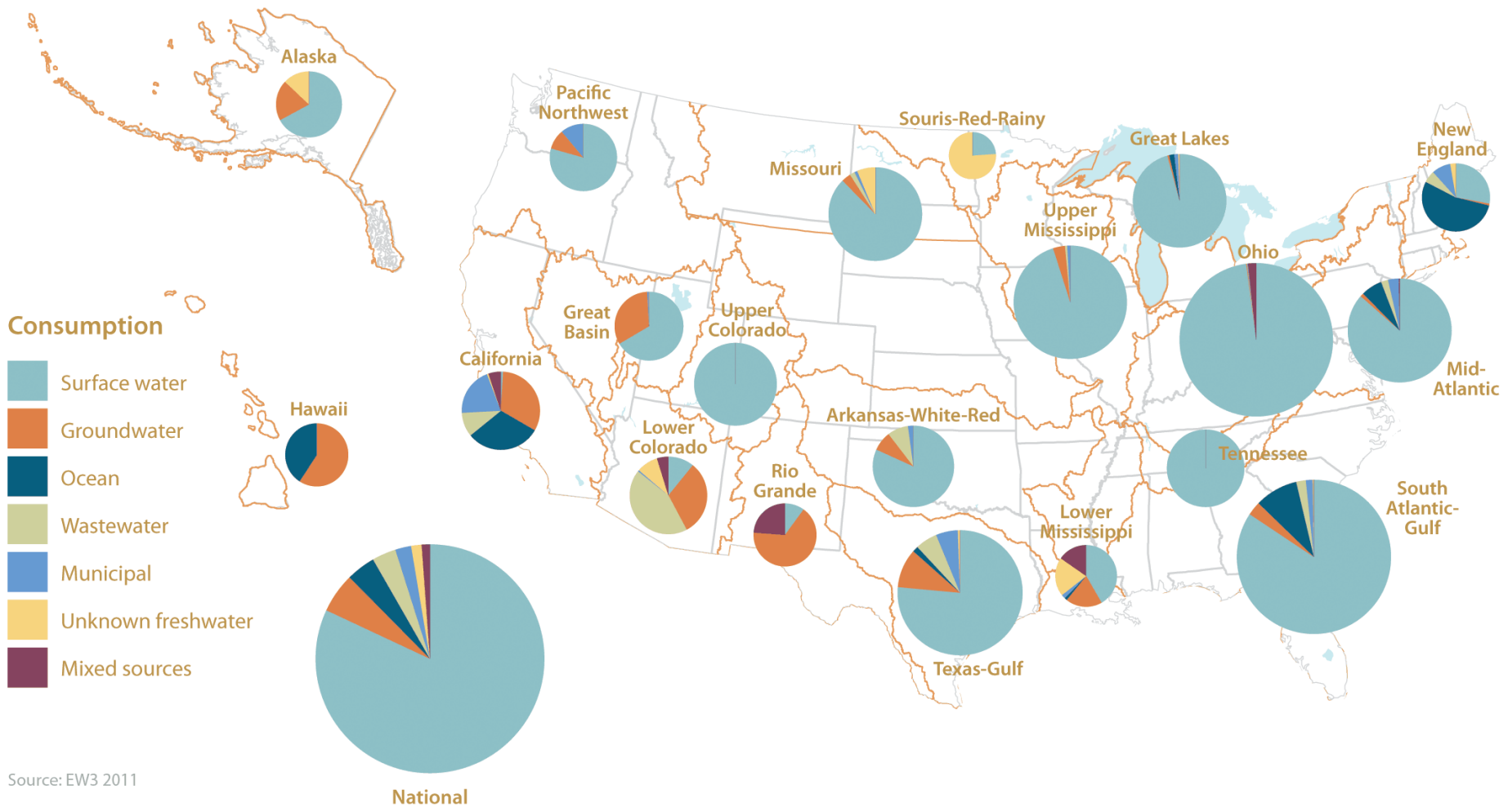
Flickr/Lance and Erin



### Withdrawal

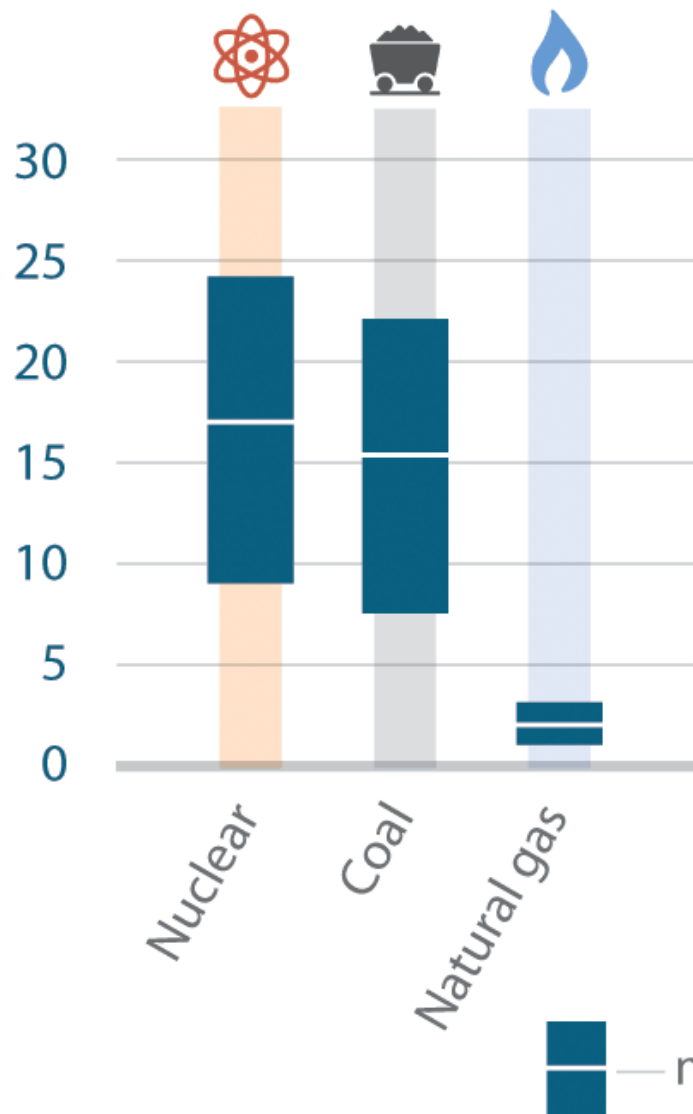


Source: EW3 2011

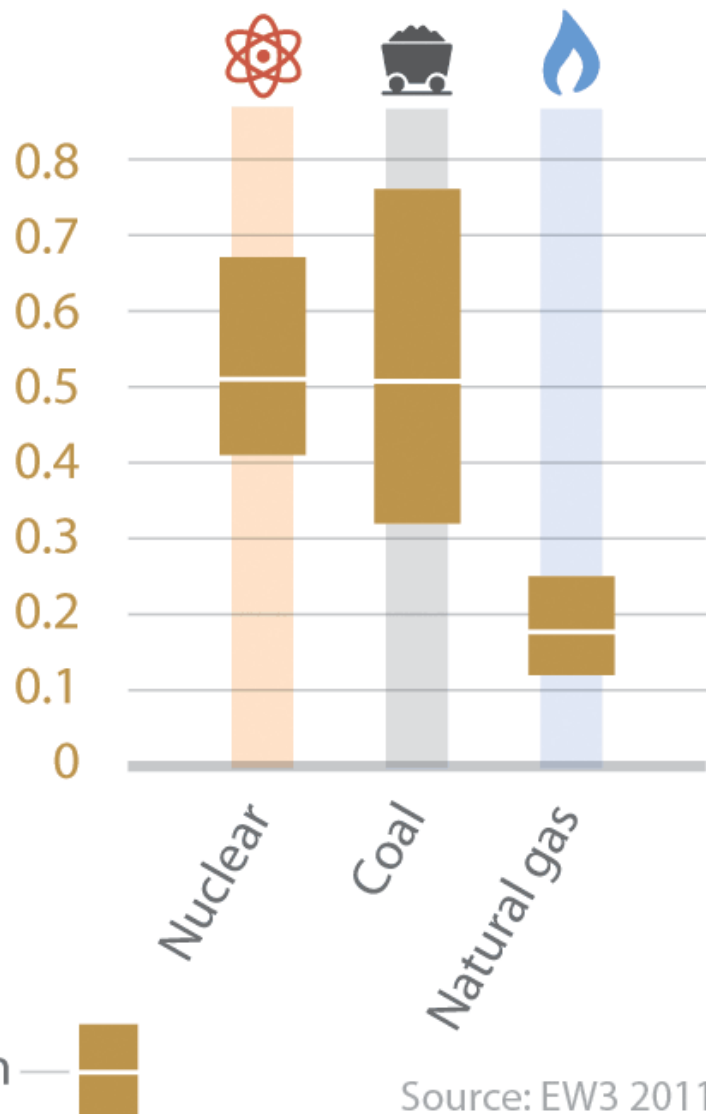


Source: EW3 2011

## Withdrawal Intensity (gallons/kWh)

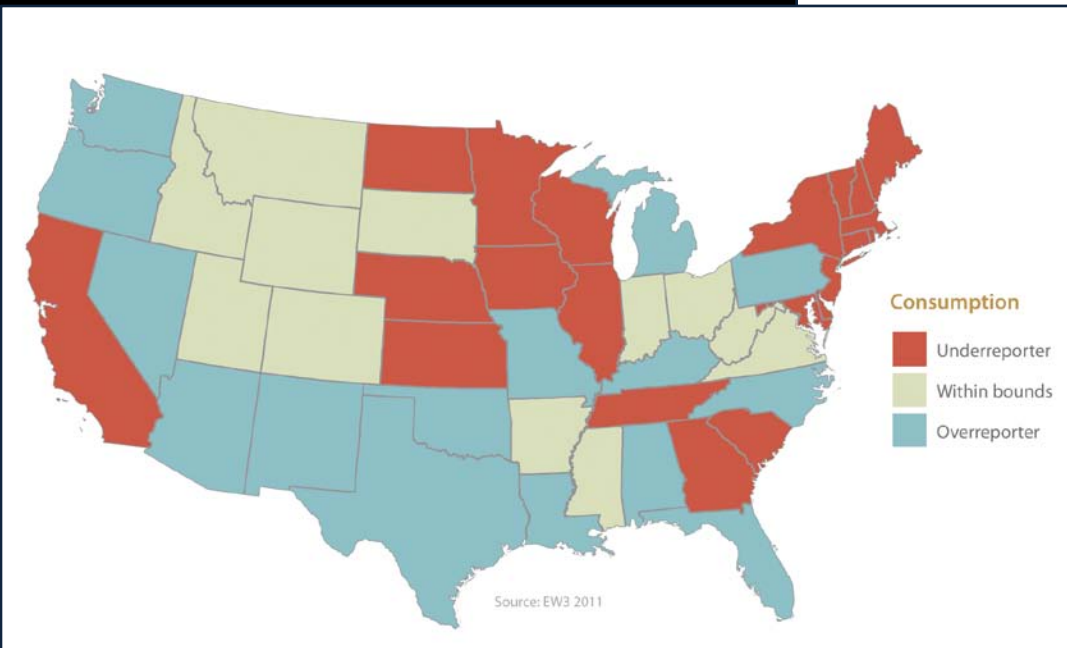
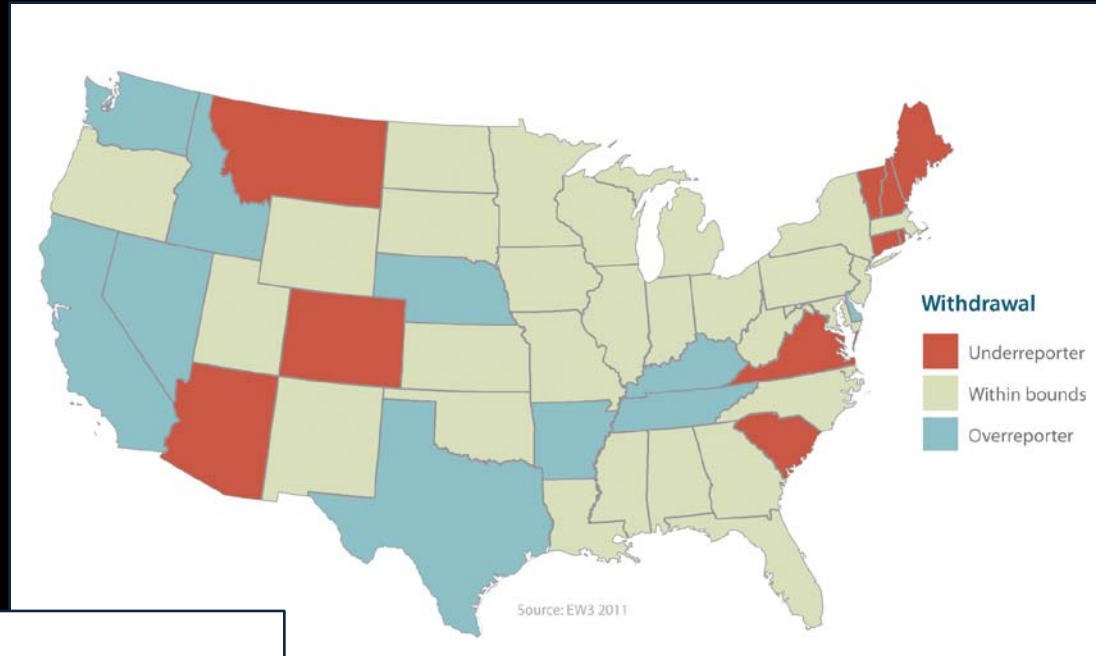
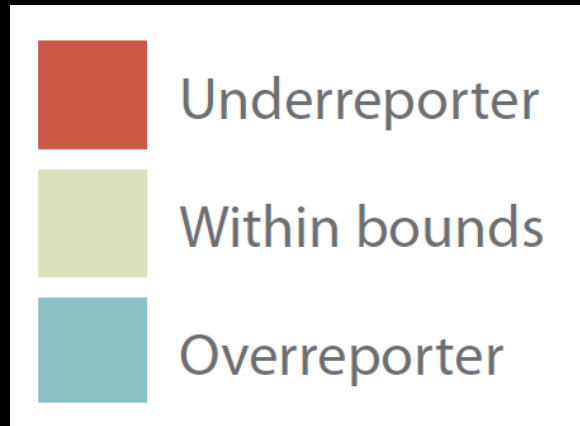


## Consumption Intensity (gallons/kWh)



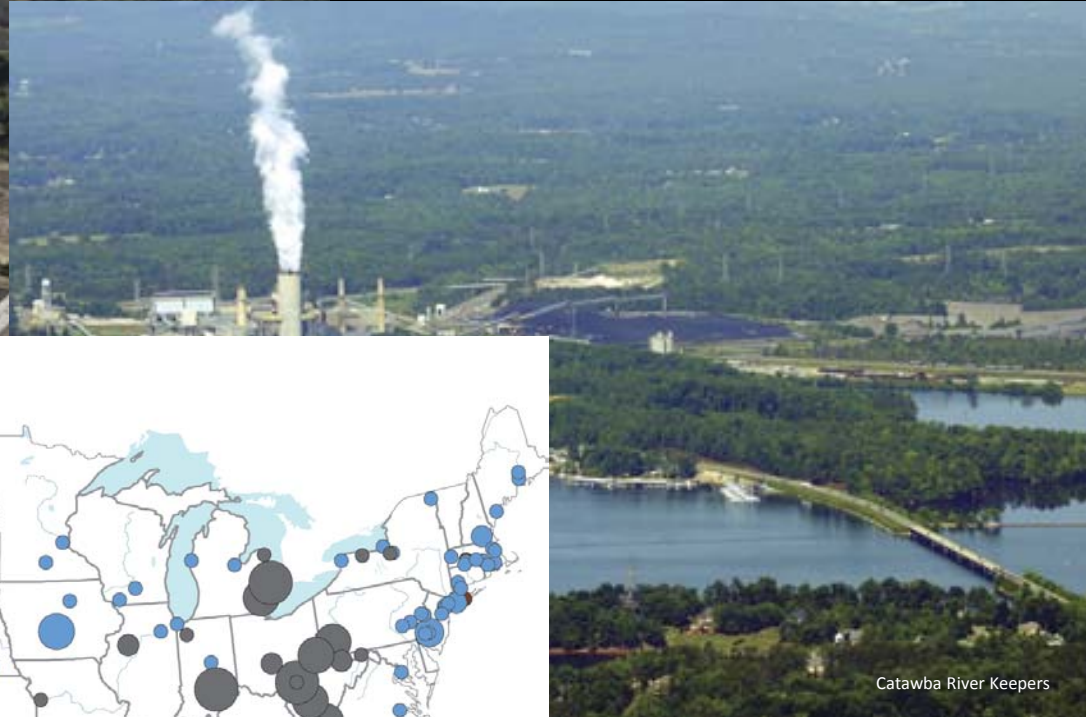
Source: EW3 2011

# Gaps and Errors

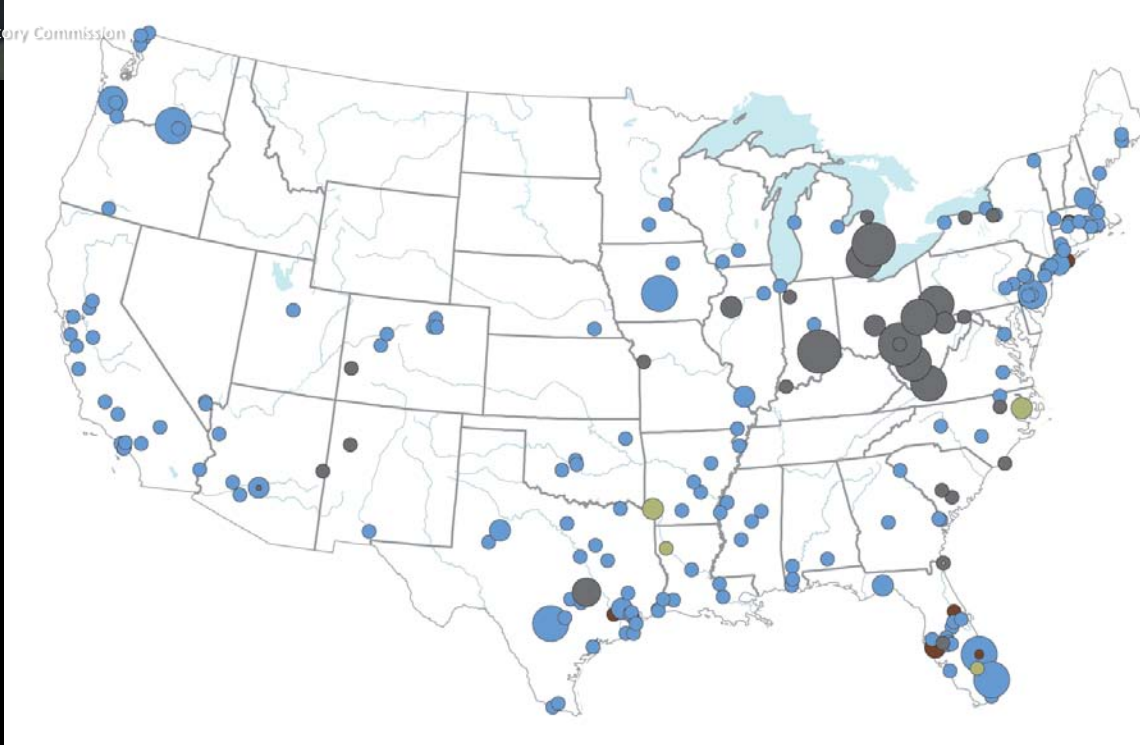


Reported vs.  
Calculated

# What's Going On?



U.S. Nuclear Regulatory Commission



Catawba River Keepers

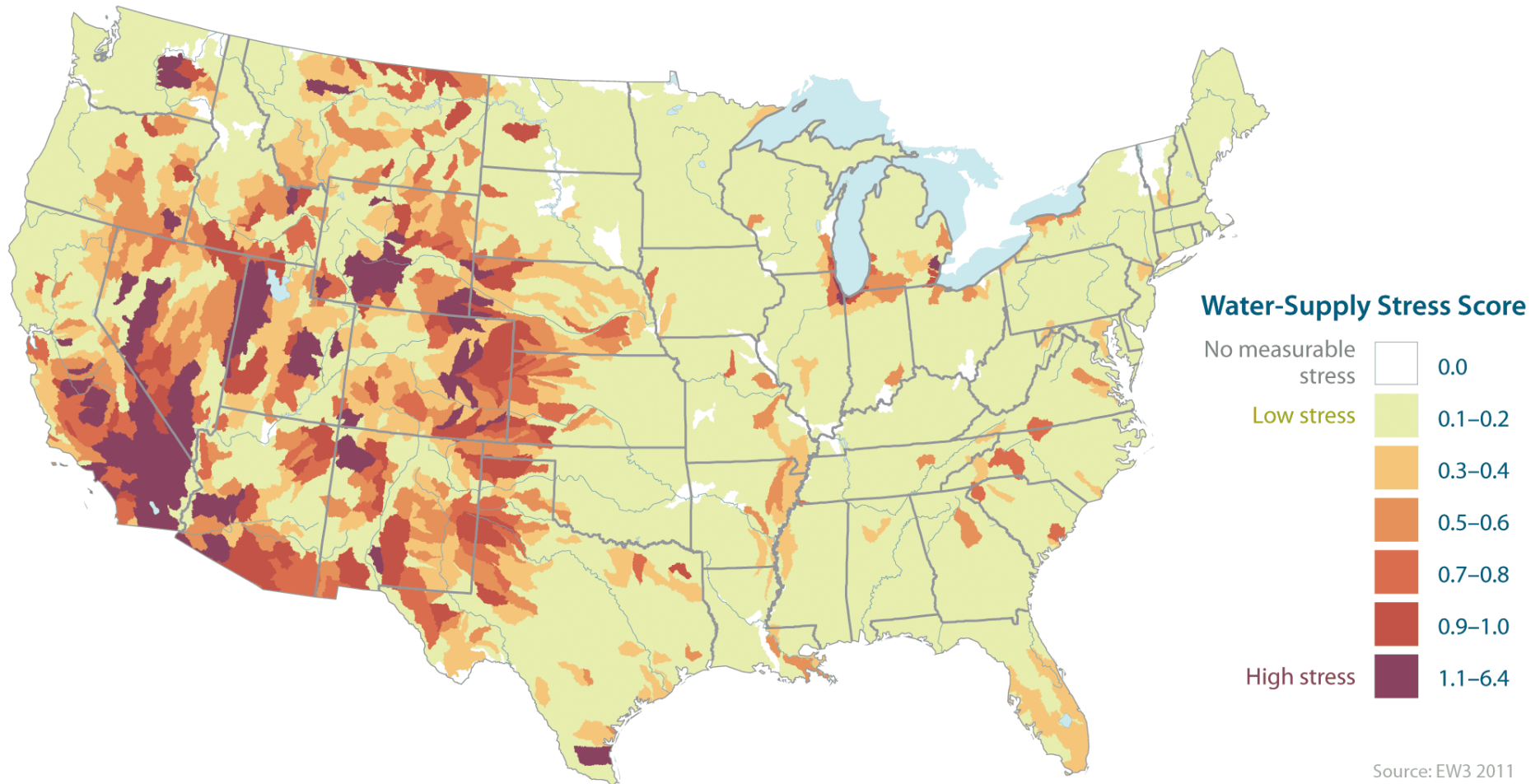


# Stress on Water Systems (and Power Plants)

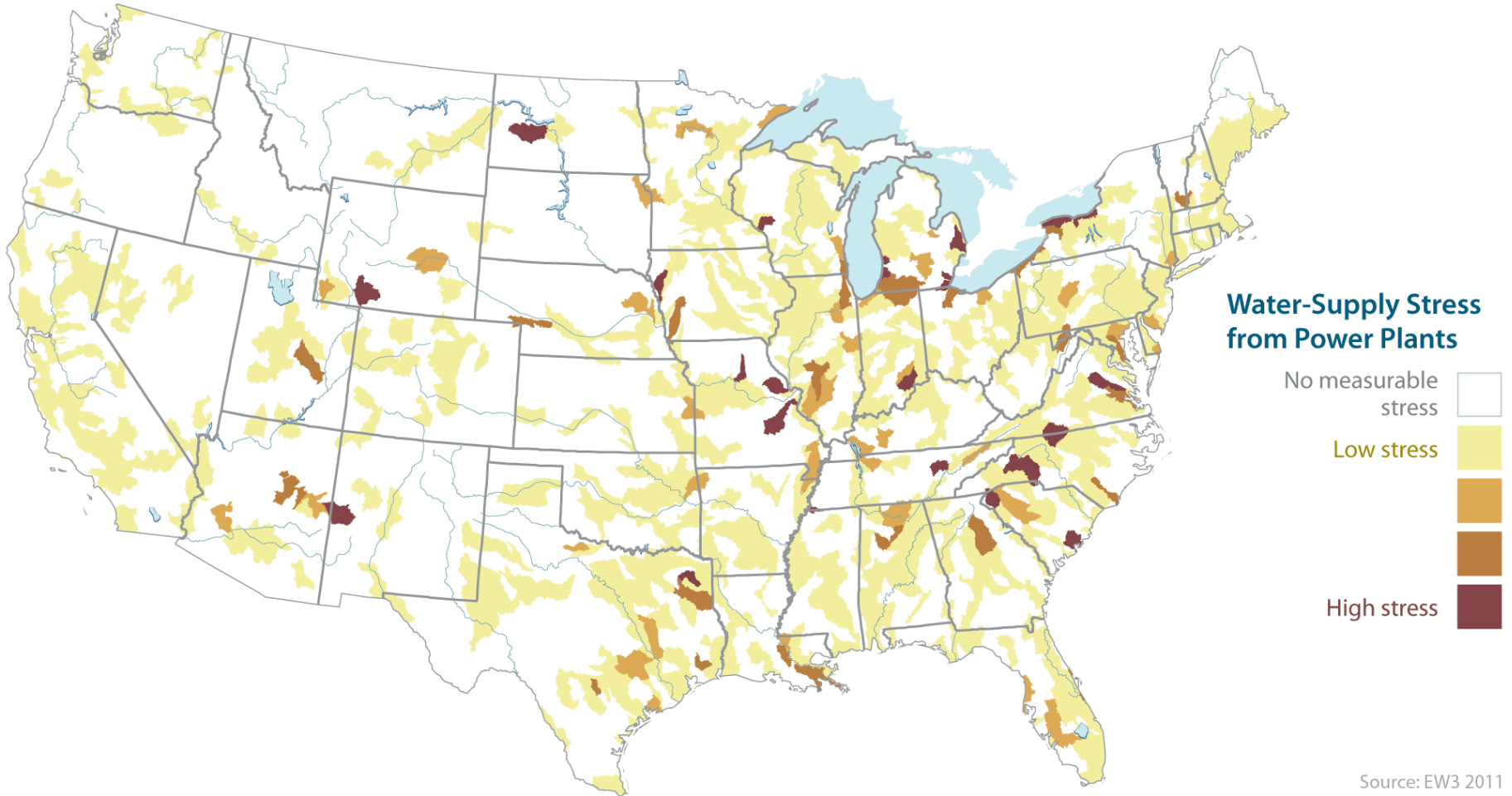


- Power plants across the country contribute to water-supply stress.
- Good analysis requires good information.
- High-temperature water discharges are common.
- The mix of power plants in the nation's fleet matters.

# Water-supply Stress

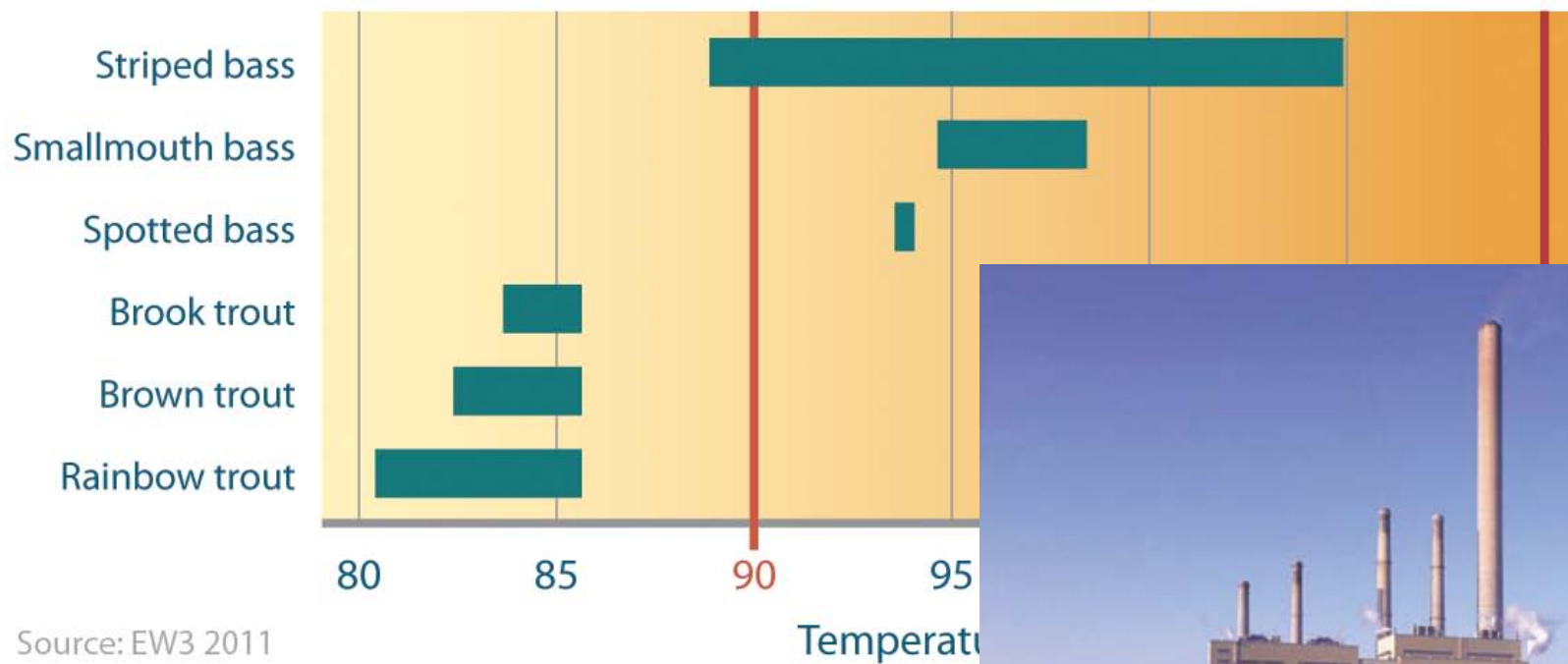


# Water-supply Stress from Power Plants



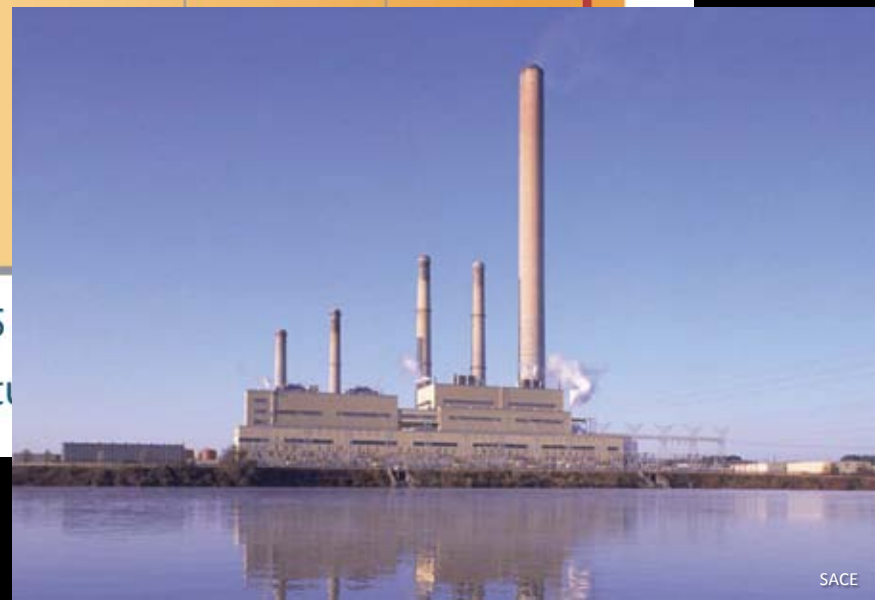


## Critical Thermal Maximum for Fish



Source: EW3 2011

Flickr/Andy Shapiro

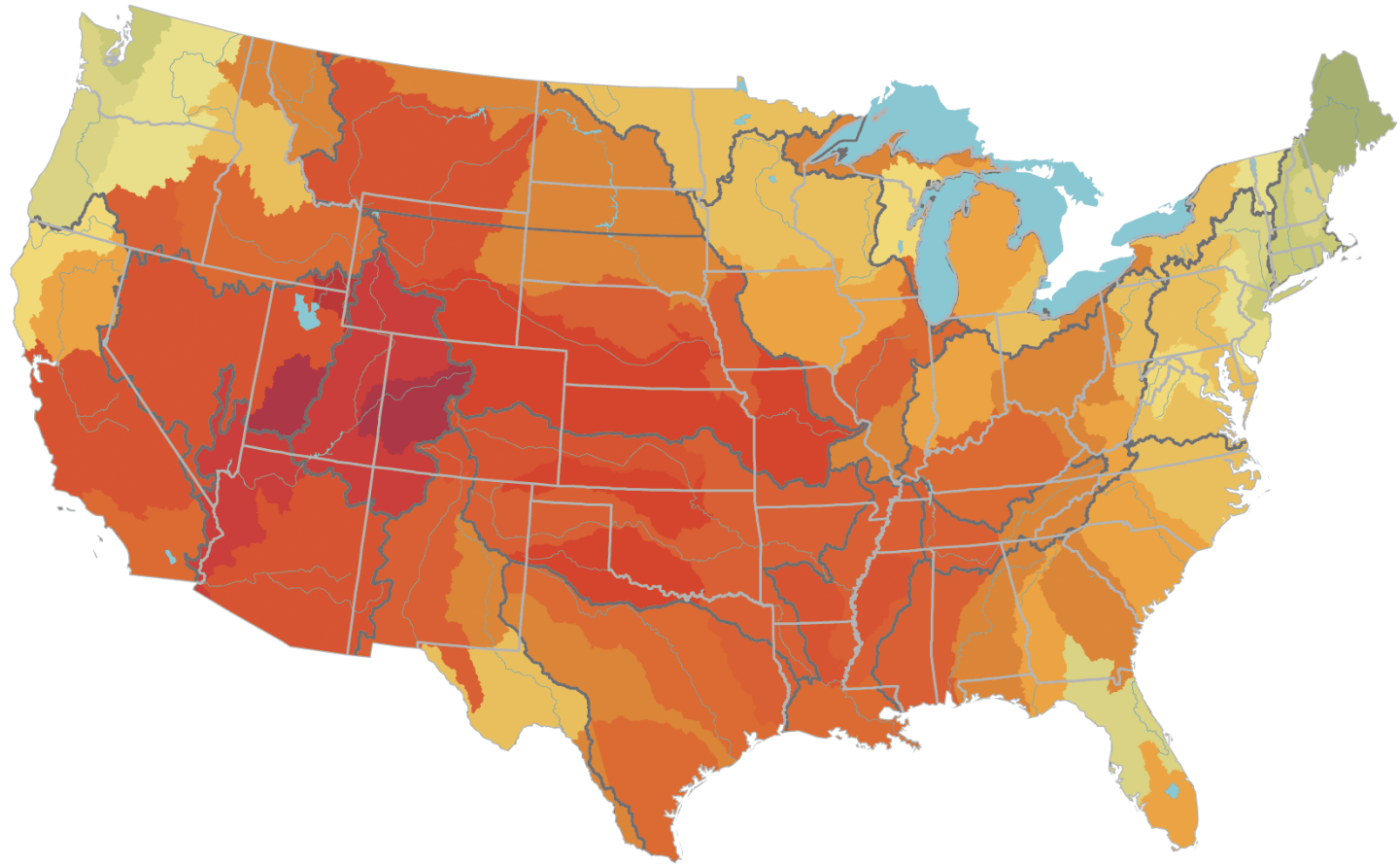
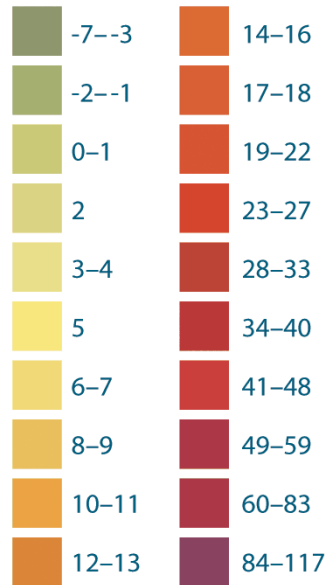




Nuclear Regulatory Commission

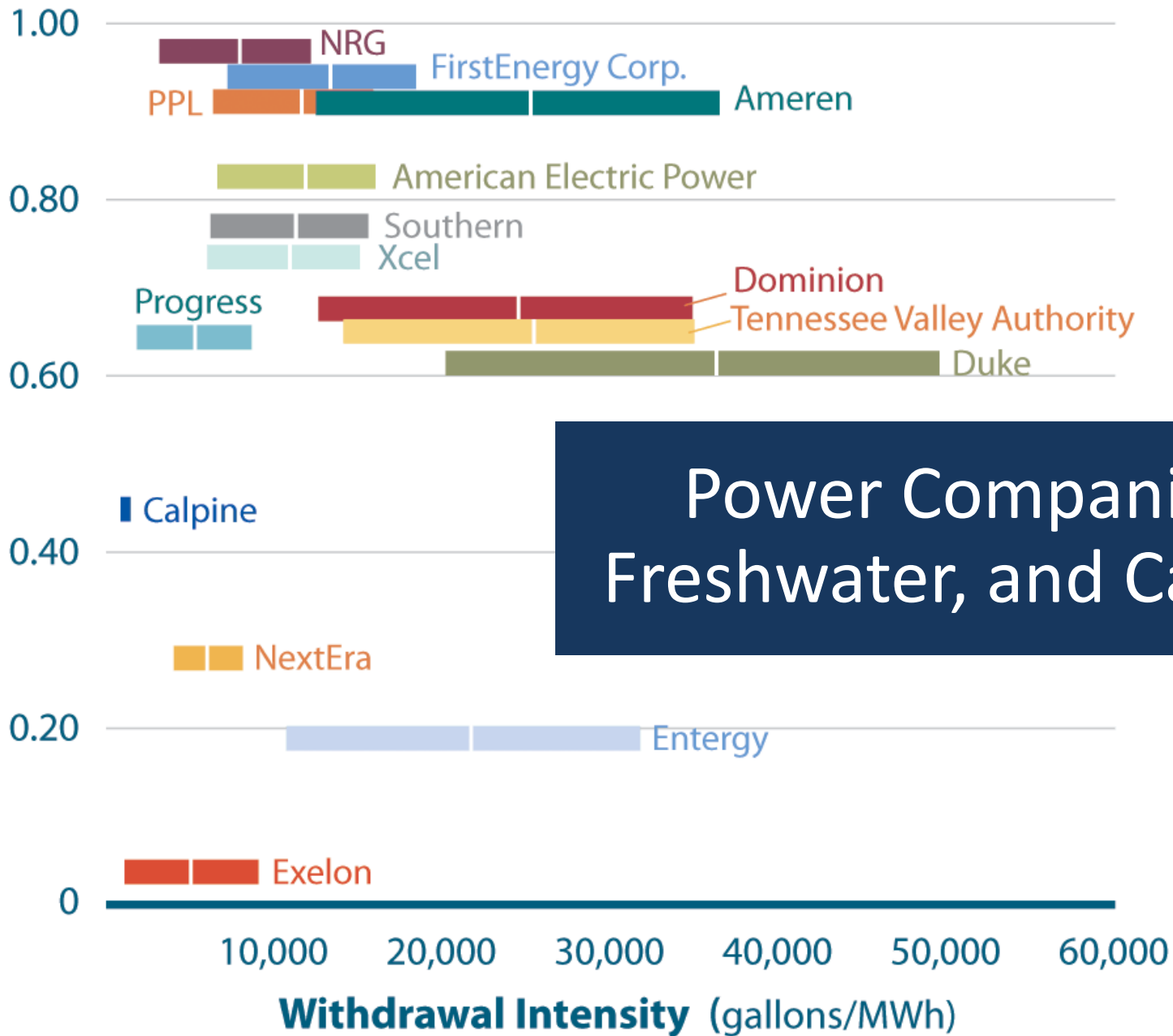
# What Droughts May Come

Mean of differences in number of drought months (out of a total of 360 months, or 30 years)

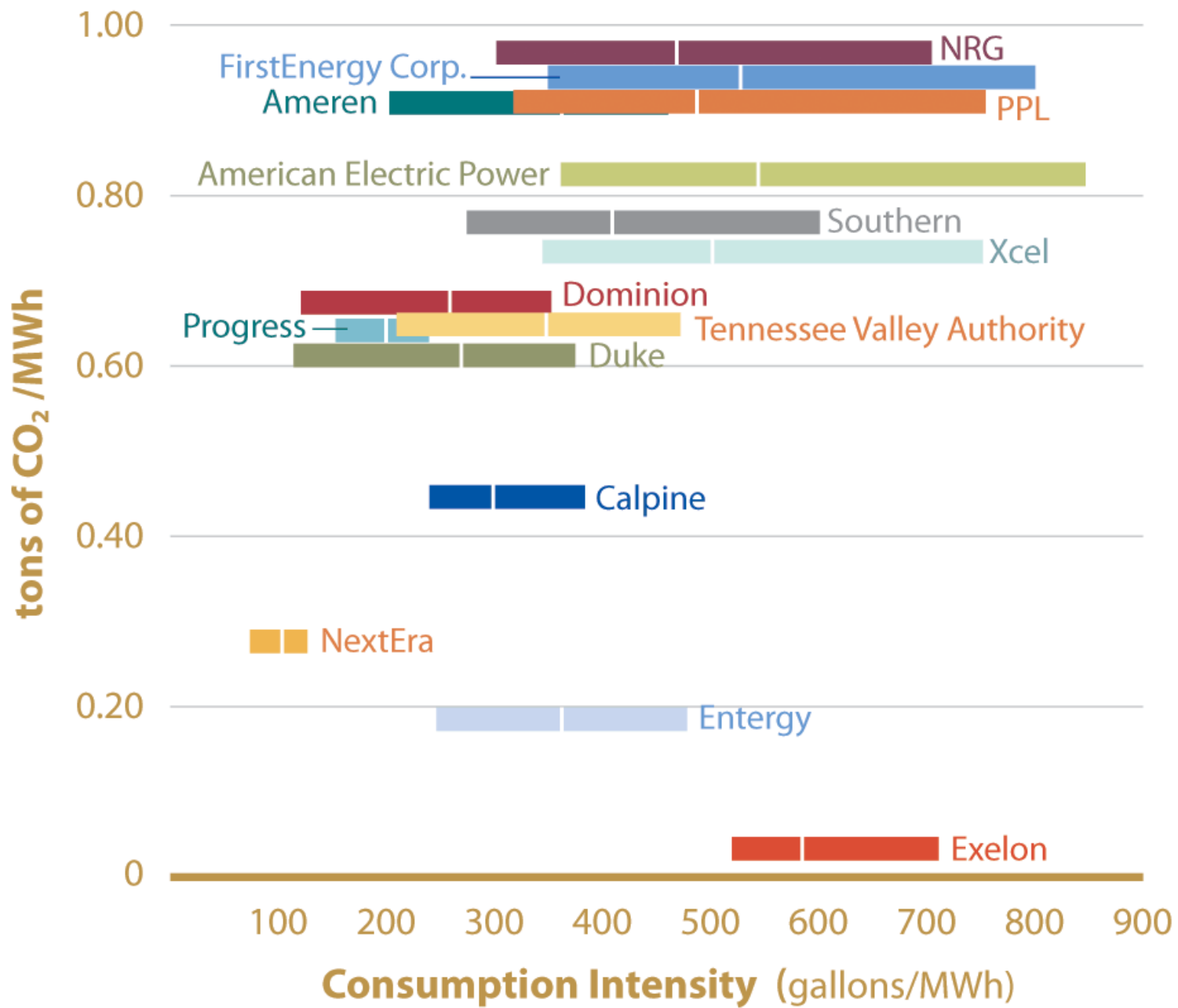


Source: Strzepek et al. 2010

tons of CO<sub>2</sub>/MWh



Power Companies,  
Freshwater, and Carbon





# A River Runs Dry



# Toward a Water-smart Energy Future



- Pressure will continue to grow.
- Good information matters.
- Indicators of water stress show where to look deeper.

# Opportunities

- Get it right the first time.
- Retool existing plants.
- Set strong guidelines for power plant water use.
- Engage diverse stakeholders.
- Reduce power plant carbon emissions.





Ecologypress.com

[www.ucsusa.org/electricity-water-use](http://www.ucsusa.org/electricity-water-use)



[Extra Slides]