

Energy and Water a Co-dependency

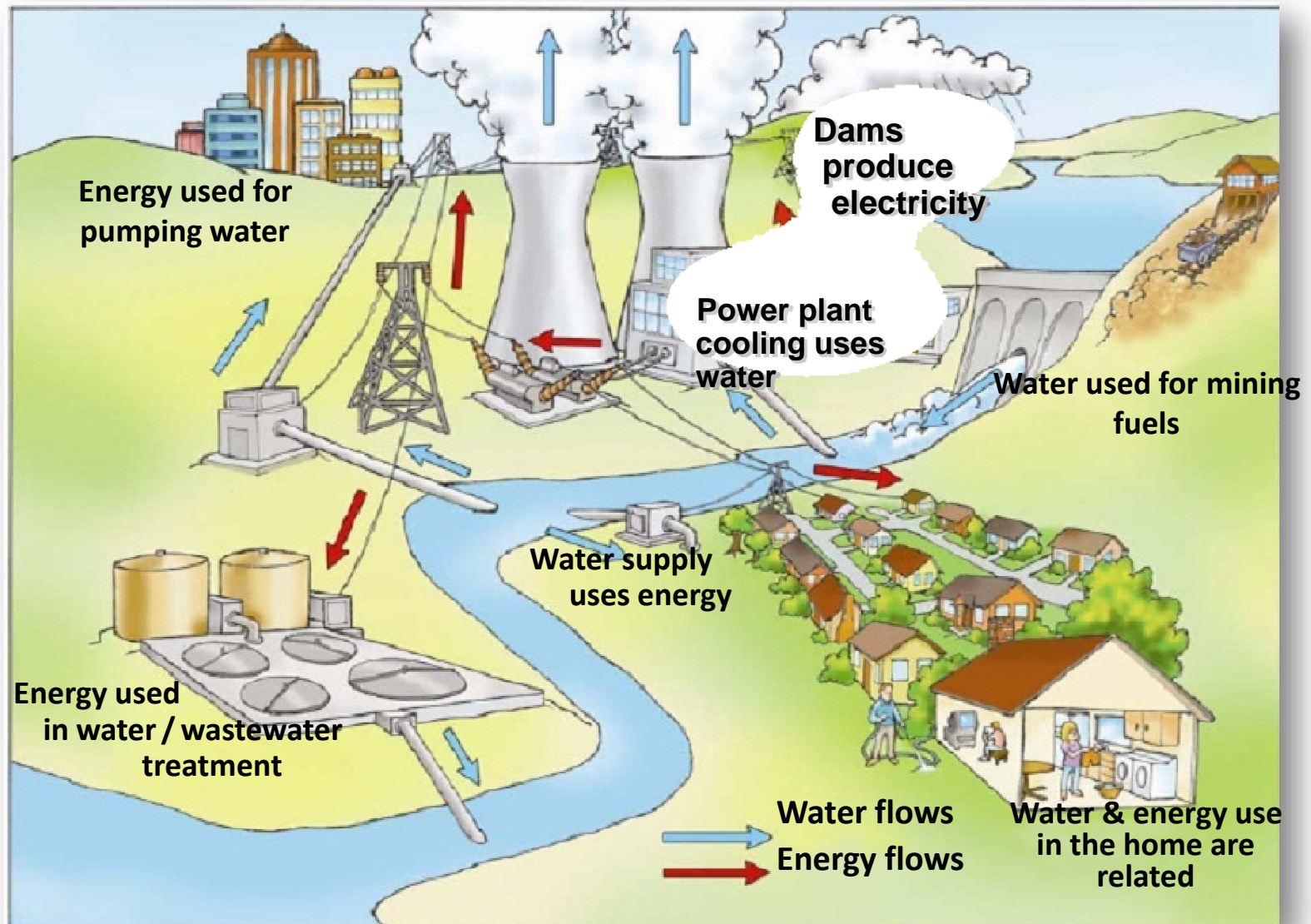
Ohio River Valley Water Sanitation Commission
(ORSANCO)

Congressional Caucus Briefing
April 6, 2011

Carl O. Bauer, Former Director
National Energy Technology Laboratory



The Water-Energy Nexus

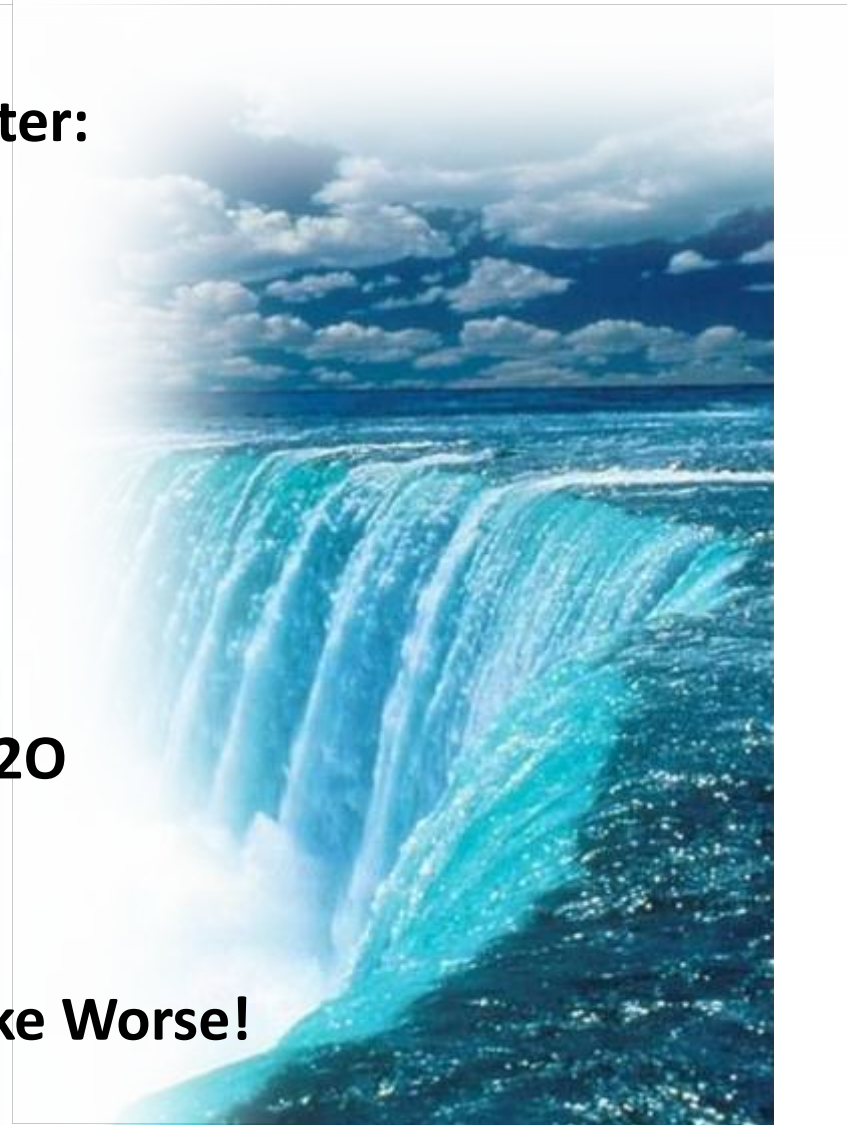


Energy and Water a Co-dependency

- **~10% national energy used for water:
produce, treat, move & heat**
- **Largest municipality energy user**
- **Most WWTP municipally-owned**
- **California is an extreme example**

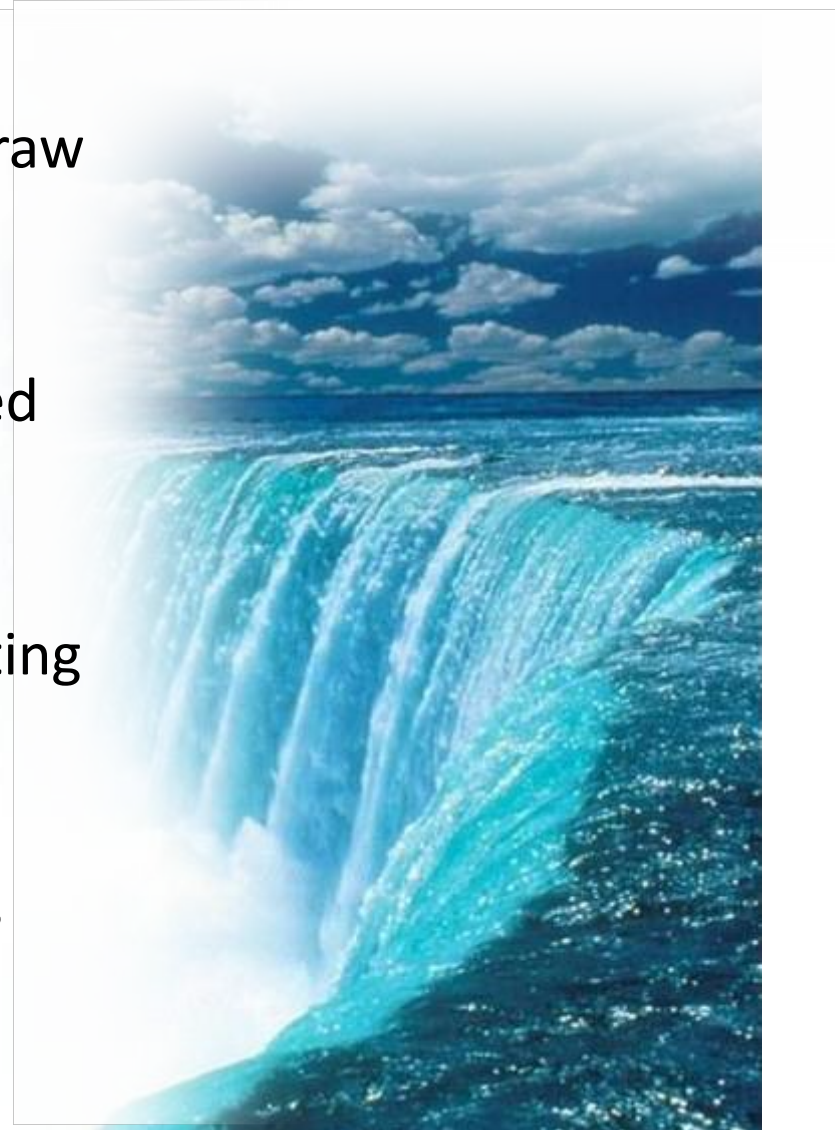
CA ~19% electricity & 30% gas for H₂O

Increased Demand For H₂O Will Make Worse!



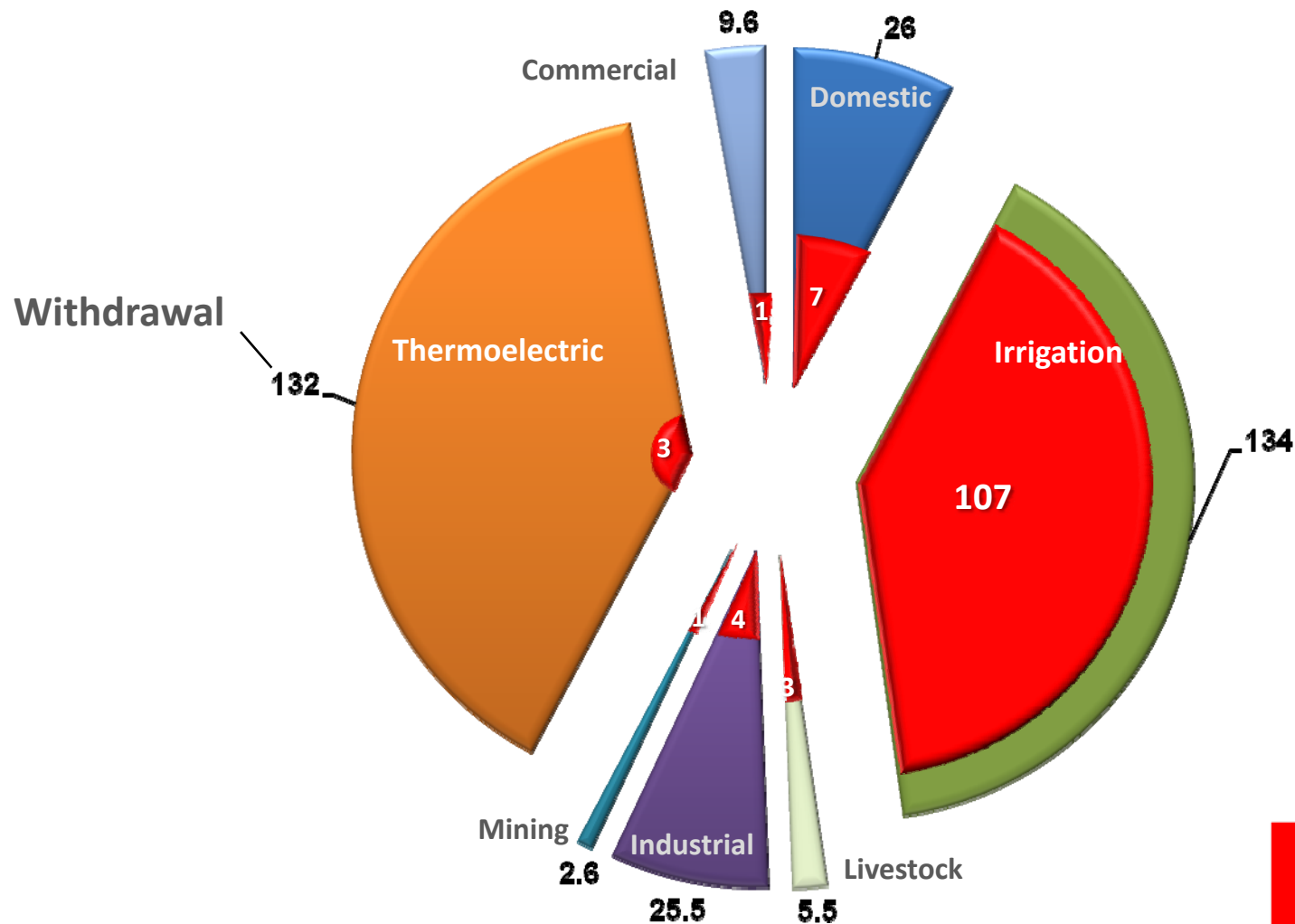
Energy and Water a Co-dependency

- Thermoelectric power plants withdraw more freshwater than all other use sectors except irrigation
- Freshwater consumption is projected to increase to meet future energy demand
- Power plant operations and permitting of new plants are impacted by constraints on water availability
- Marcellus Shale Fracking consumes 4.5 -6 Million Barrels per well.



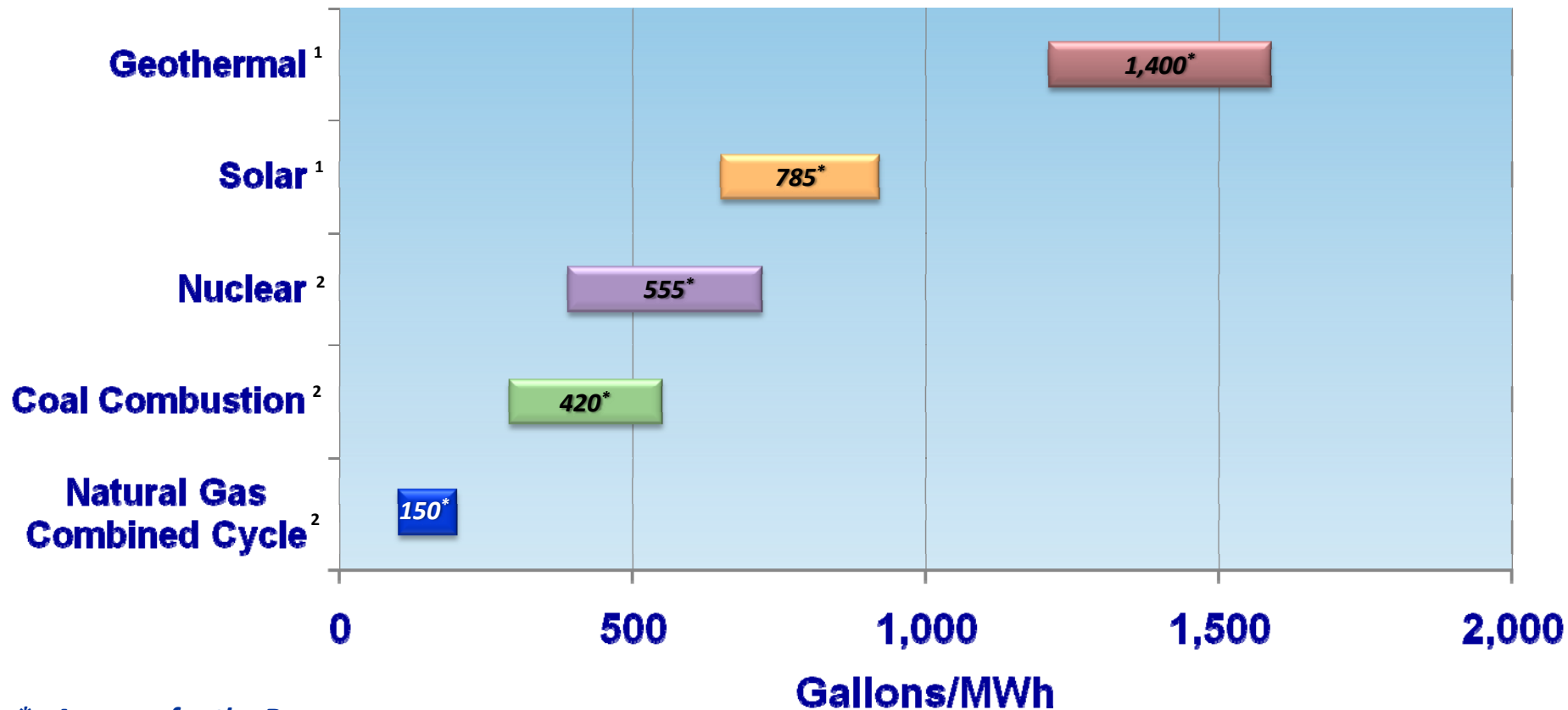
Withdrawal vs. Consumption

An Important Distinction



Water Consumption for Power Generation

Steam Generating Technologies

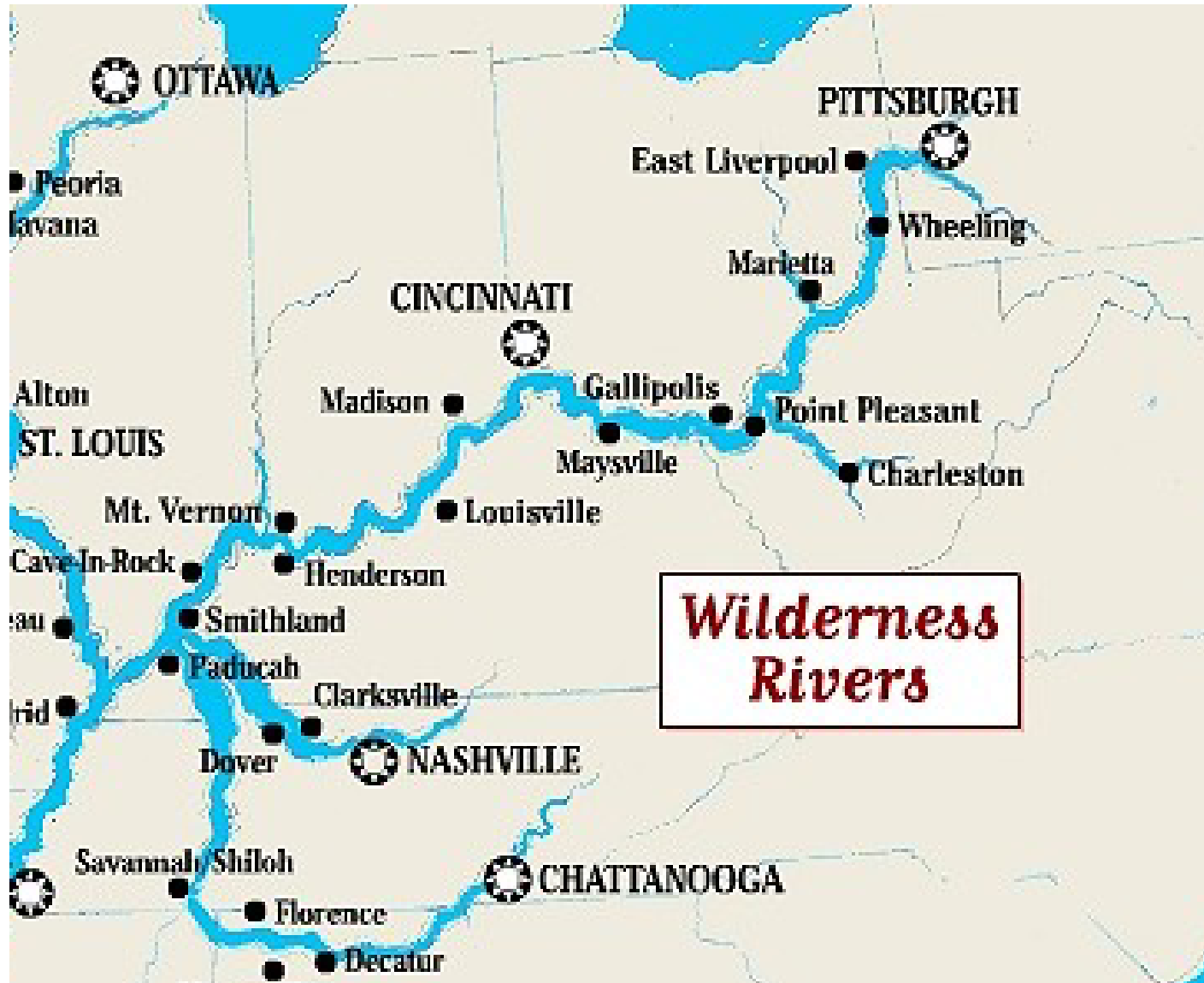


* Average for the Range

¹ Recirculating Cooling

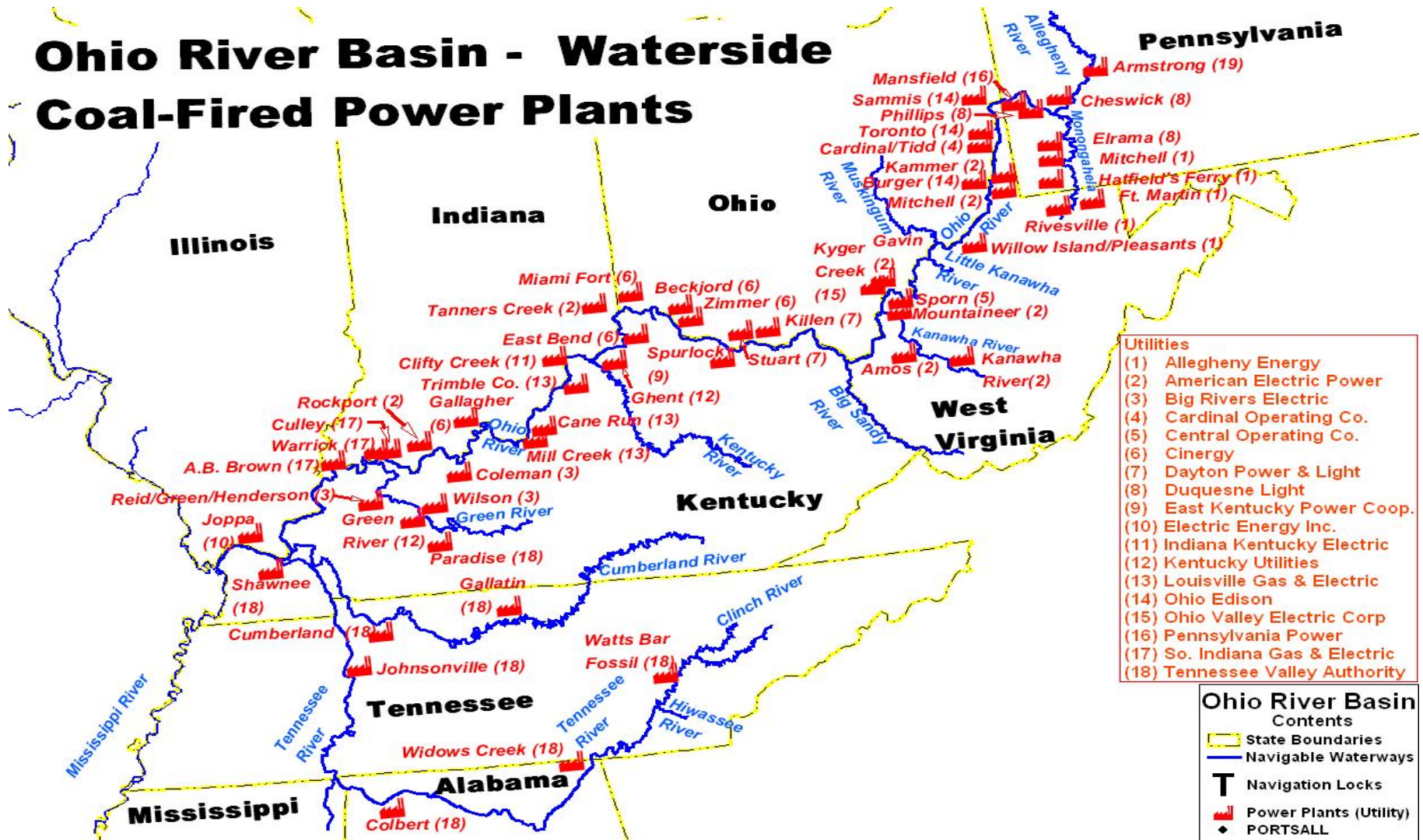
² Recirculating & Once Through Cooling

The Ohio River Valley



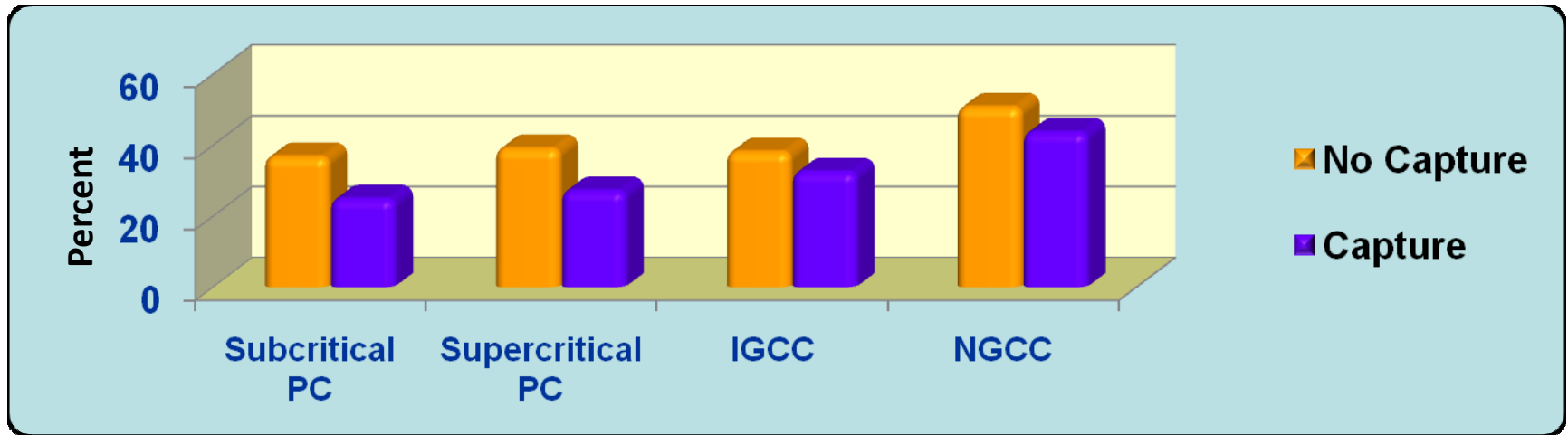
Ohio River Basin, Major Appalachian and Illinois Basin Coal Prod. & Domestic Use

Ohio River Basin - Waterside Coal-Fired Power Plants

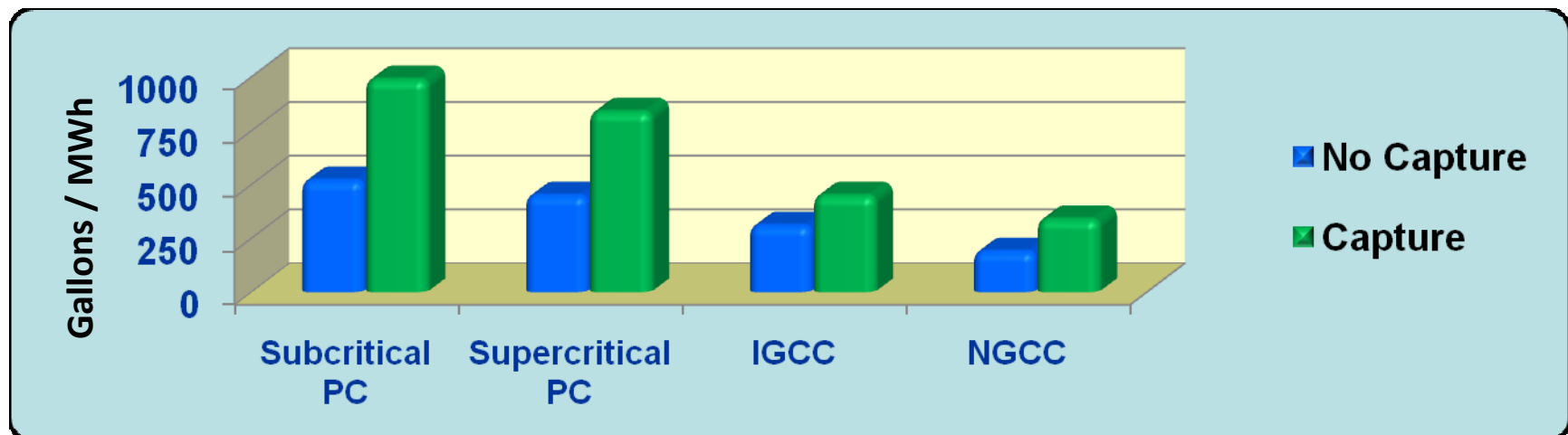


GHG Control Increases Power & Water Demands

Net Plant Efficiency with and without Carbon Capture



Water Consumption with and without Carbon Capture



Future transportation fuels especially thirsty

- Unconventional fossil fuels (2-4x worse)**
- Natural Gas (better to 1-2x worse)**
- Electricity (2-3x worse)**
 - Good with wind/solar PV, worse with nuclear**
- Hydrogen (1-500x worse)**
 - Good with wind/solar PV, worse with nuclear**
- Biofuels (1-1000x worse)**