AWARE-US and Cumulative R&D Benefits

NETL and Argonne National Laboratory

Water Management for Power Systems
FWP 1022428 - Task 5
Performer: RIC/SEA

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AWARE-US

Project Description and Objectives

AWARE-US

Project Description

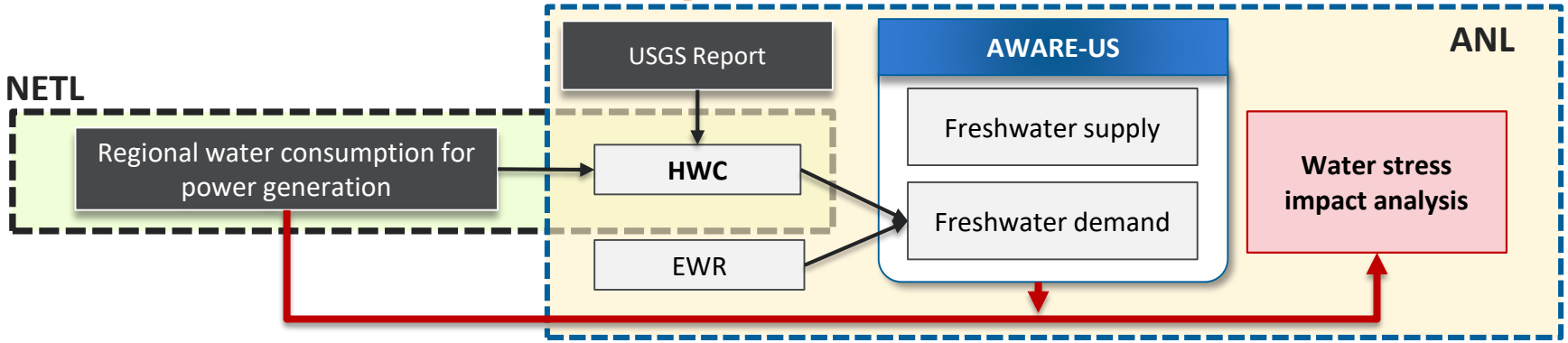
- Partnership with Argonne National Laboratory to quantify water stress at the county level, monthly, based on corrected EIA data
- Thermoelectric water consumption was scaled based on Water Scarcity Factors(WSF) to contextualize its impact on available water remaining

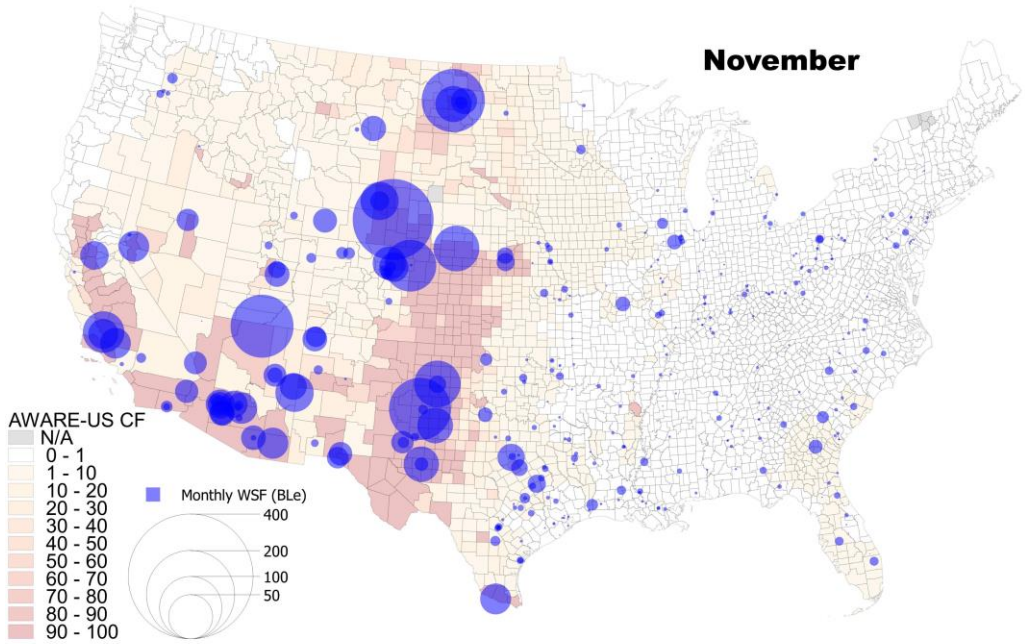
Strategic alignment of project to Fossil Energy objectives

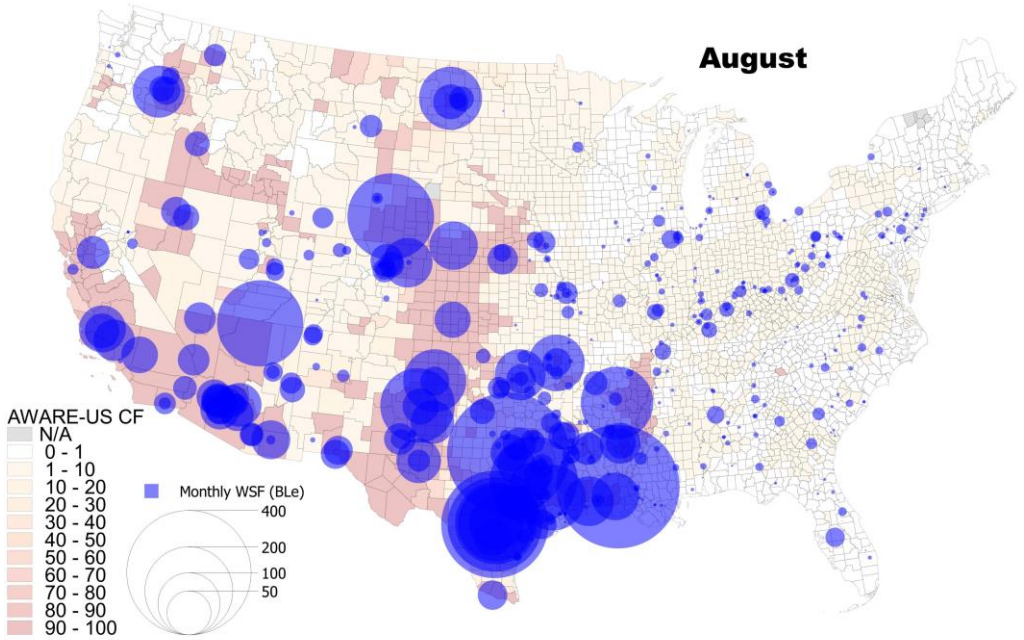
- Water scarcity is an indicator of locations that may benefit from improved water efficiency technologies
- This is a piece of the puzzle that can work with other Fossil Energy tools and models to identify projects, plants, and locations that can benefit from reduced water consumption

Project Description and Results

AWARE-US – Phase I completed work



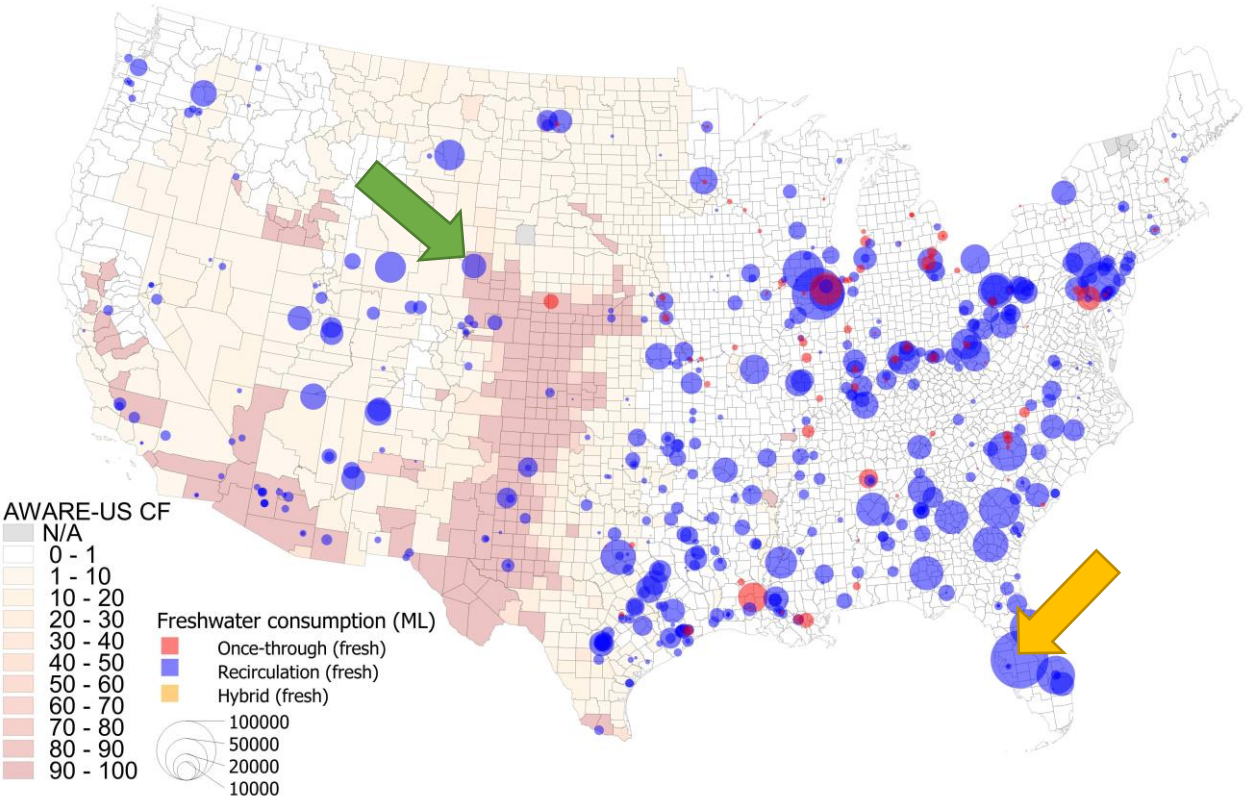


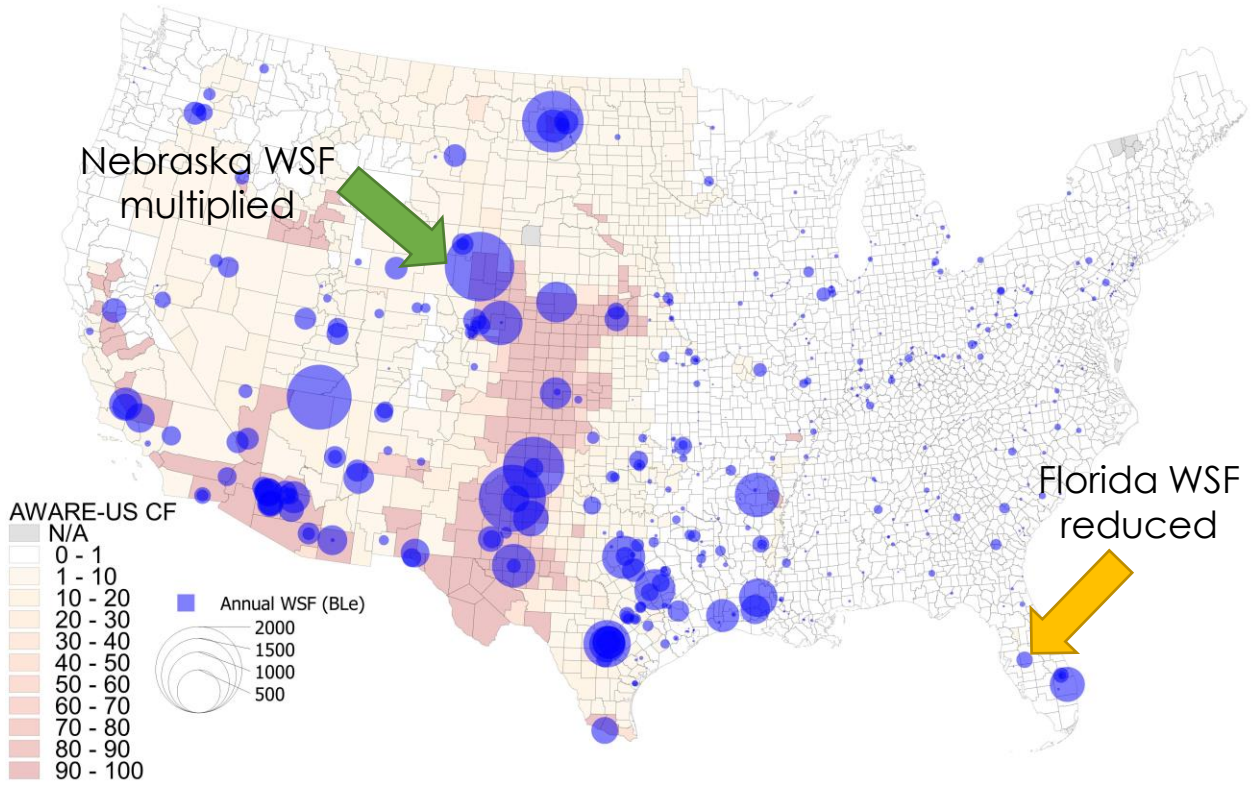


Water Stress by AWARE-US

Thermoelectric Cooling Consumption (Left) vs. Water Stress Impacts (Right)

Larger water stress from thermoelectric demand where AWARE-US WSF is higher





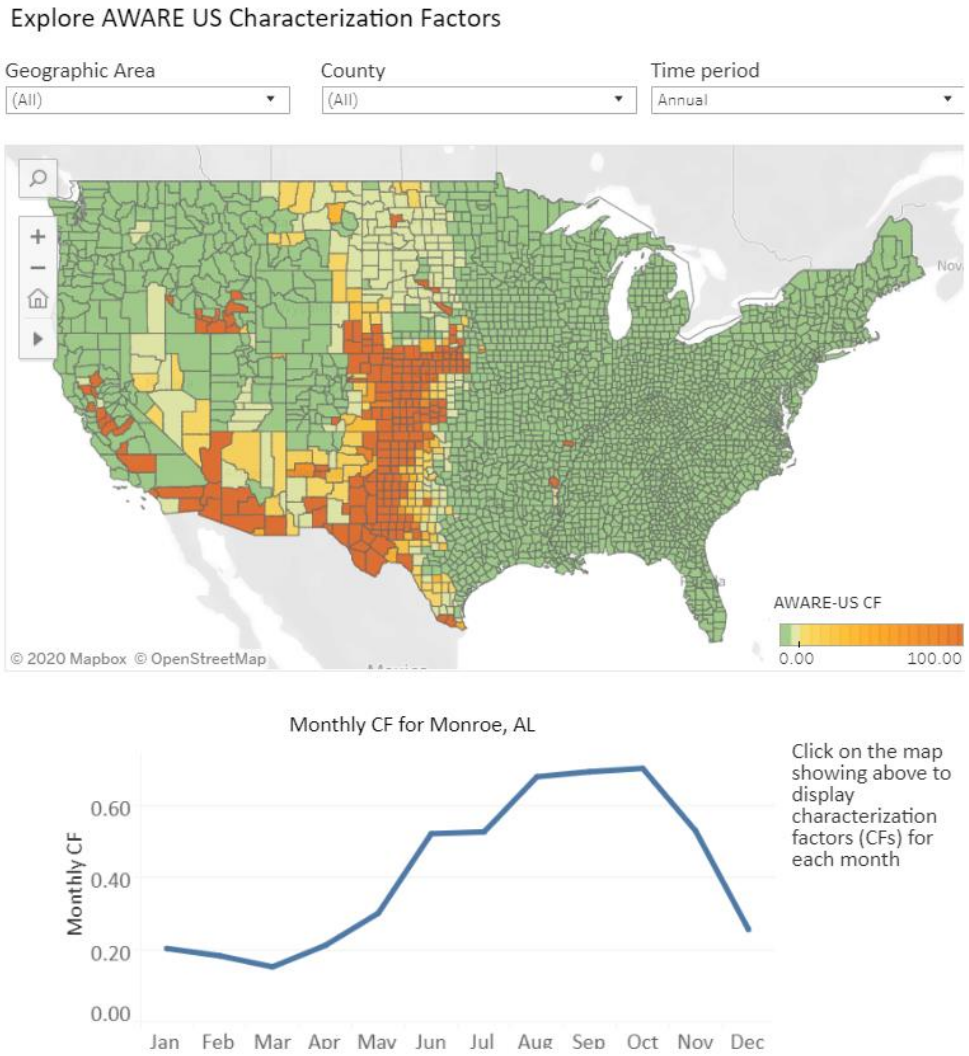
AWARE-US Model

Tableau version

- https://greet.es.anl.gov/aware
- Potential applications to analyze the regional/seasonal water stress.

Excel version

- https://netl.doe.gov/crosscutting/publications
- Baseline AWARE-US with and without the power sector
- Good to analyze the impact of current power sector



Publication and Webinar

Publication

- Journal of Cleaner Production
  - Lee, Uisung, Joseph Chou, Hui Xu, Derrick Carlson, Aranya Venkatesh, Erik Shuster, Timothy J. Skone, and Michael Wang. "Regional and seasonal water stress analysis of United States thermoelectricity." *Journal of Cleaner Production* (2020): 122234.

Conference Presentations

- ISSST 2020 (Online)
- ACLCA (Online September)

Upcoming Webinar with ANL

- Targeting mid-to-late September

Water Needs and Cumulative R&D Benefits

Project Description and Objectives

Water Needs and Cumulative R&D Benefits

Project Description

- Forecasts water withdrawal and consumption for thermoelectric power generating fleet
- Quantifies cumulative benefits of NETL funded R&D technologies

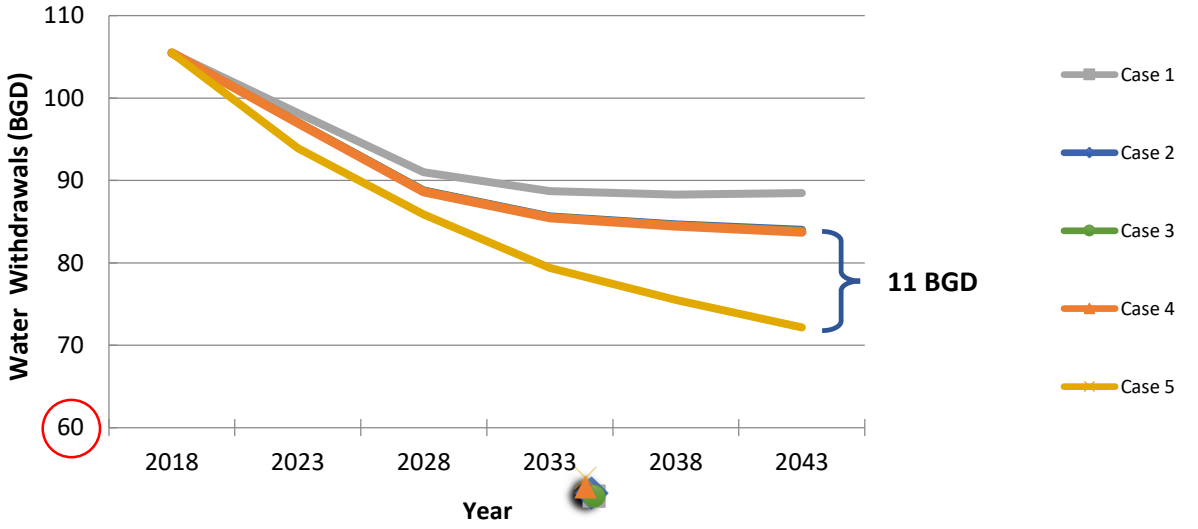
Strategic alignment of project to Fossil Energy objectives

- Analyzes and explores plant water technologies that can reduce the amount of water required for fossil energy operations

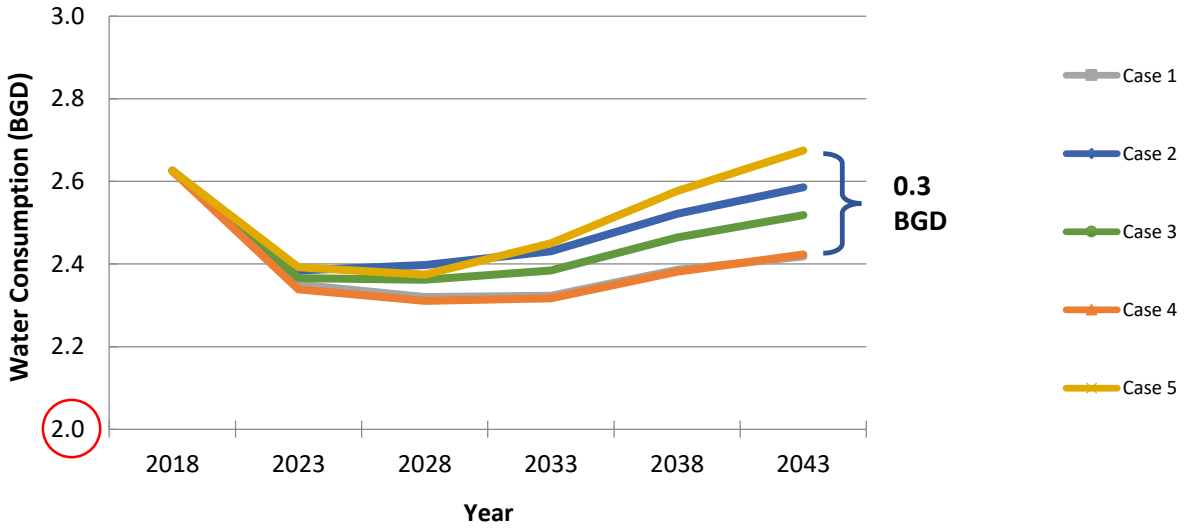
Project Description and Results

Water Needs and Cumulative R&D Benefits

Average Daily National Freshwater Withdrawal for Thermoelectric Power Generation



Average Daily National Freshwater Consumption for Thermoelectric Power Generation



Case Definitions

1 – A + R all proportional

2 – A (100% wet recirculating) + R are proportional

3 – A (90% wet recirculating/10% saline once through) + R are proportional

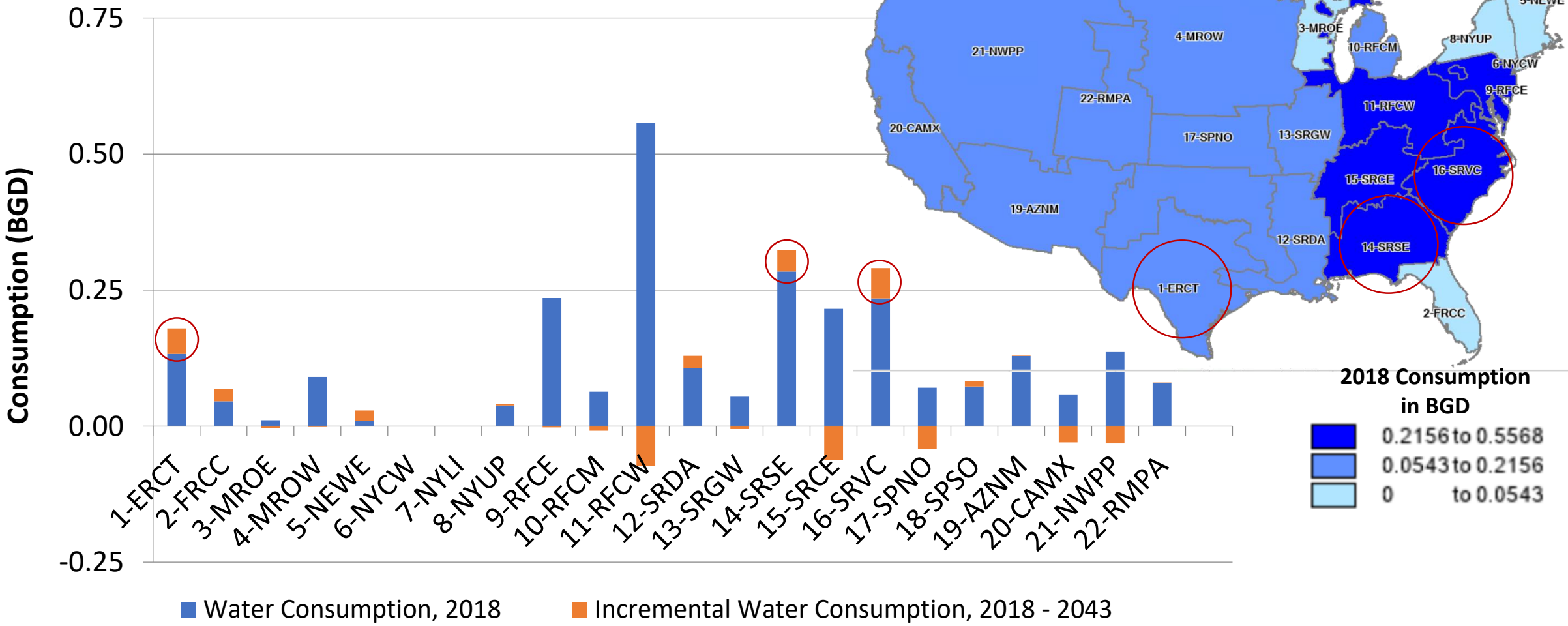
4 – A (75% wet recirculating/25% saline once through) + R are proportional

5 – A + R all proportional, 5% of existing freshwater once through retrofitted to wet recirculating every 5 years

- Water Withdrawals in 2043 remain bout the same, except for the cooling tower retrofits case 5
- Water Consumption goes up for case 5 but decreases for cases 3 and 4.
- Difference between Case 1 and Case 2 is largely policy driven

Regional Consumption Results: Base Case

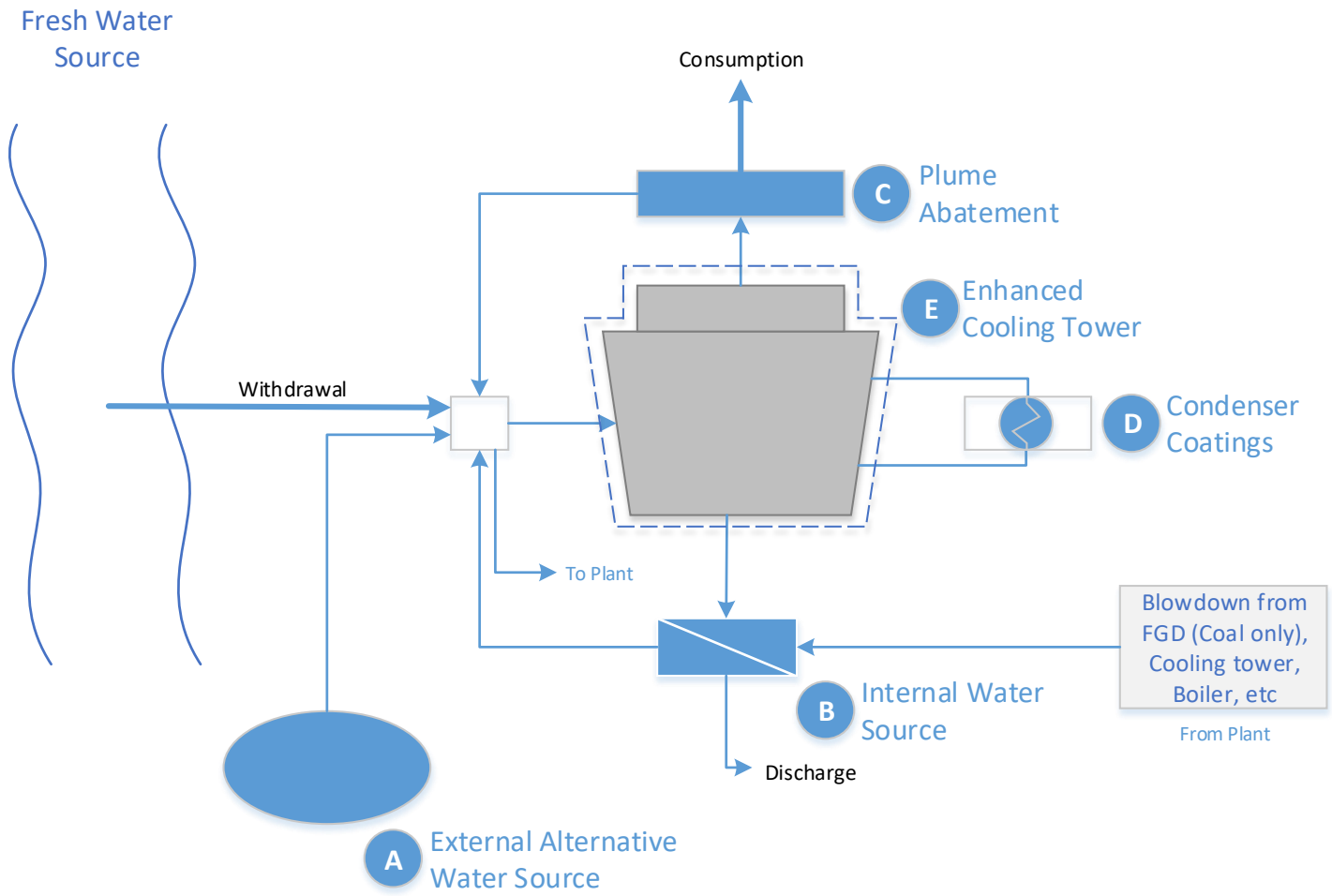
Change from base year



Red circle show 3 largest increase in water consumption from 2018 to 2043

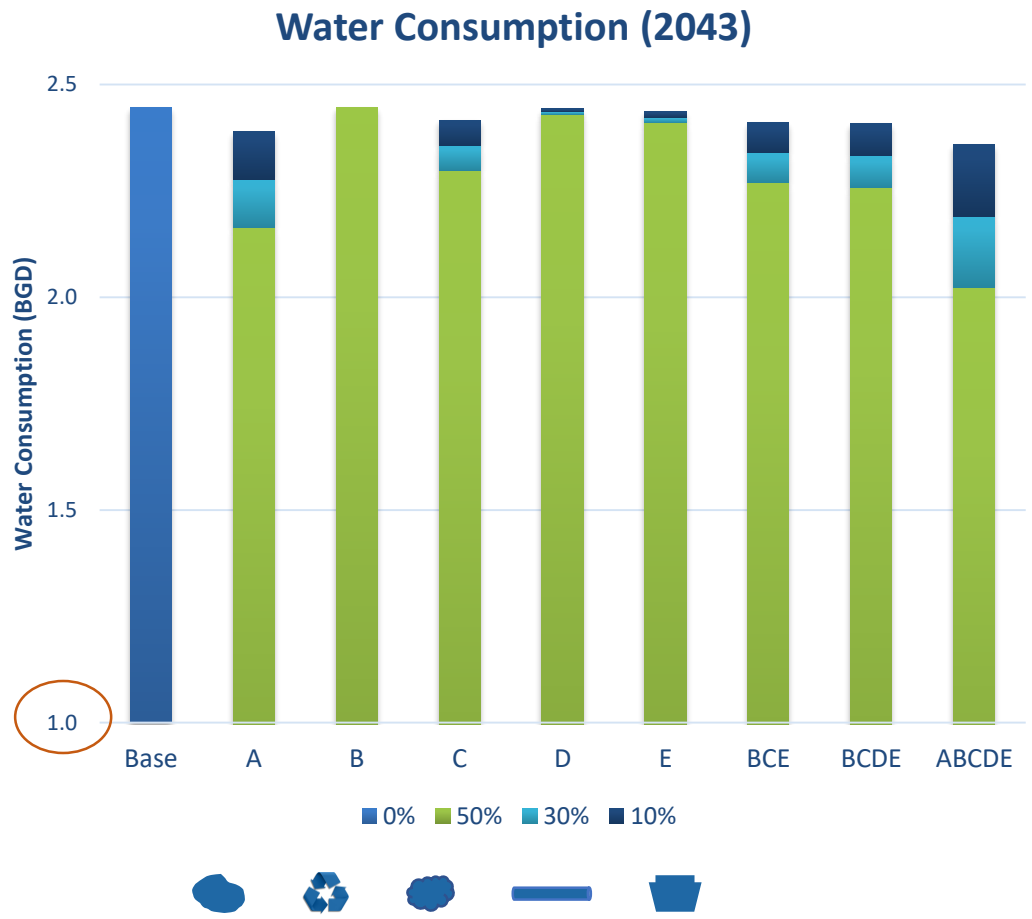
Freshwater Reduction Technologies

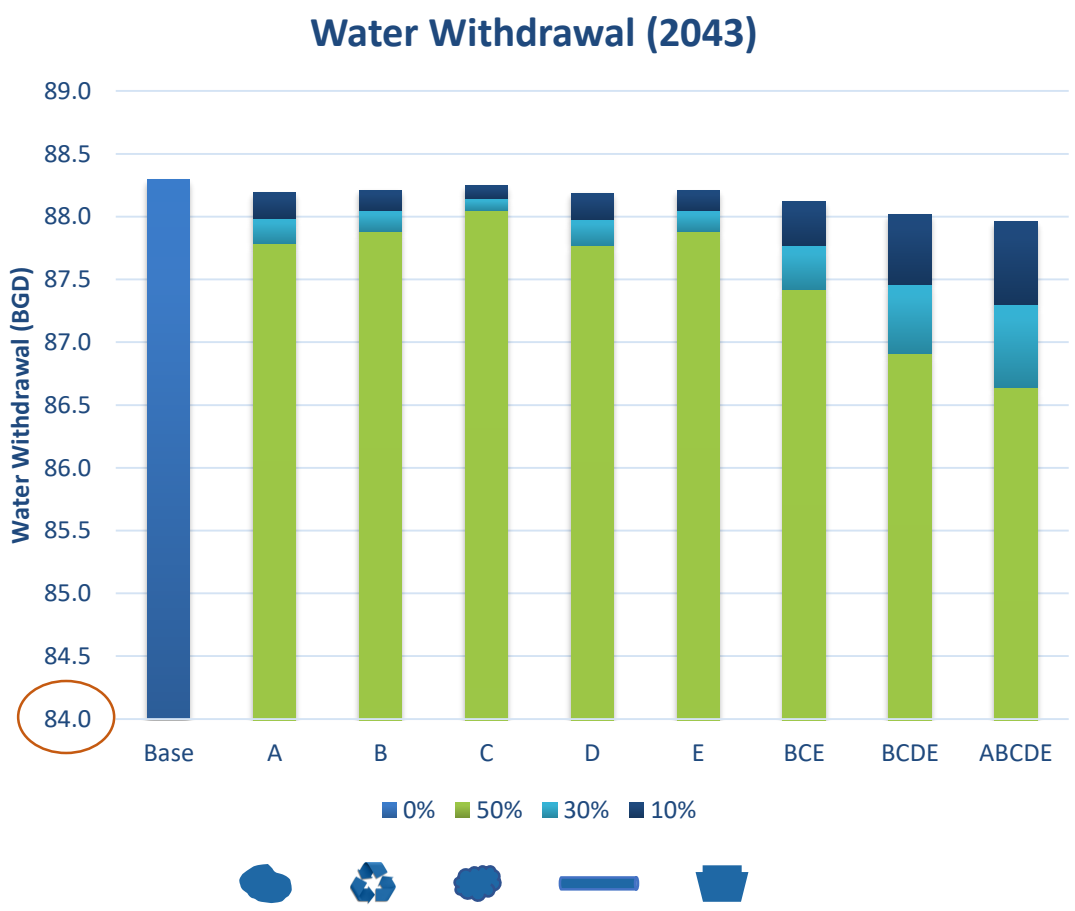
Applied to all thermoelectric power plants



Water Saving Technology Benefits

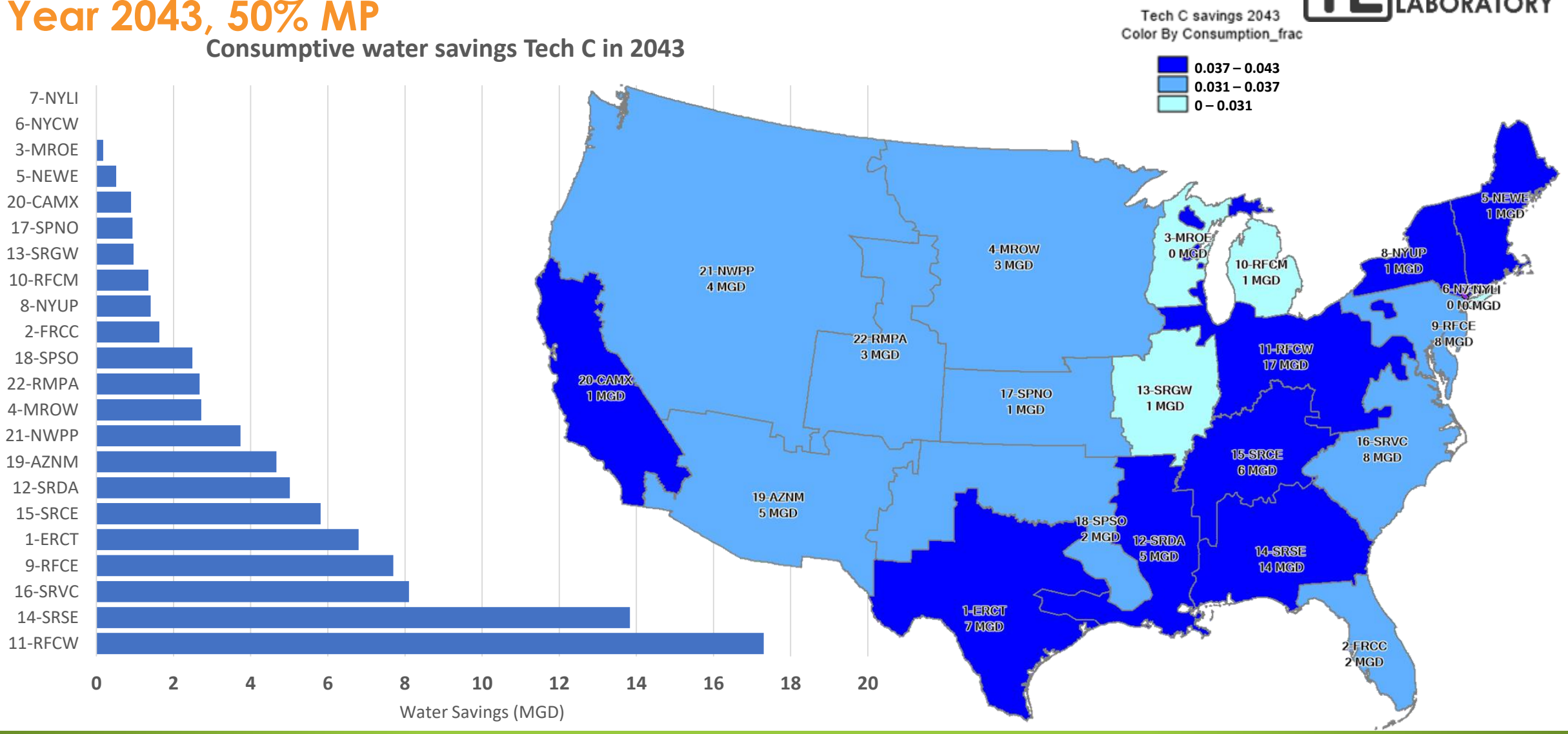
A – External Water Sources **B – Internal Water Sources** **C – Advanced Cooling** **D – Condenser** **E – Cooling Tower**





Regional Results: Technology C (Plume Abatement)

Year 2043, 50% MP



Concluding Remarks

- **Thermoelectric consumption does not drive Water Stress Factors (WSF)**
  - Mostly driven by resource availability rather than use
- **Greater water consumption during summer months contributes to WSF**
  - AWARE-US can be used to value potential water saving technologies for new or existing thermoelectric power plants
- **Combined technologies could reduce thermoelectric water**
  - Withdrawal by 603 BGY
  - Consumption by 154 BGY

- **Future Work (Phase II)**
  - AWAE-US Outreach and Model Refinement
  - Integrate AWARE-US model into water needs and benefits model
  - Add more technologies to model

Thank You!

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