NATIONAL GOVERNORS ASSOCIATION

# Water Energy Nexus Learning Lab

## September 1-3, 2020

## Day 1

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National Governors Association
Center for Best Practices

NATIONAL GOVERNORS ASSOCIATION

# Welcome & Opening Remarks

Bevin Buchheister, Senior Policy Analyst, National Governors Association

Chuck Podolak, Natural Resources Policy Advisor, Office of Arizona Governor Doug Ducey

Megan Levy, Local Energy Programs Manager & Energy Assurance Coordinator, Wisconsin Office of Energy Innovation

# Water Energy Nexus Learning Lab Agenda

| Day 1 - Tuesday | | | |
|---|---|---|---|
| 12:00-12:15 pm (ET) | Welcome | 2:20-2:40 pm | Wisconsin Benchmarking Energy Performance |
| 12:15 - 12:40 pm | State Participant Introductions | 2:40-3:15 pm | State Team Time |
| 12:40-1:05 pm | The Big Picture: Nationwide Drivers and Strategies for Water-Energy Savings | *3:15-3:30 pm* | *Break* |
| 1:05-1:30 pm | State Integrated Water & Energy Planning | 3:30-4:00 pm | State and Partner Best Practices for Education & Outreach |
| *1:30-2:00 pm* | *Break* | 4:00-4:15 | Report Out and Conclude Day 1 |
| 2:00-2:20 pm | Wisconsin Focus on Energy Program | | |

| Day 2 - Wednesday | |
|---|---|
| 12:00-12:30 pm | Data Use and Benchmarking for Energy and Water Efficiencies |
| 12:30-1:15 | Cross Sector Savings Opportunities at Water and Power Utilities |
| 1:15-2:00 pm | Agricultural Sector Water Use Efficiency |
| *2:00-2:30 pm* | *Break* |
| 2:30-3:15 pm | Funding & Financing |
| 3:15-4:00 pm | State Team Time |
| 4:00-4:20 pm | Report Out and Conclude Day 2 |

| Day 3 – Thursday (Optional) | |
|---|---|
| 12:00-12:30 pm | Virtual Site Visit – 91st Ave WWTP |
| 12:30-1:30 pm | Facilitated State Team Time and Action Planning |
| 1:30-2:00 pm | State Final Report Out |

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# States Participant Introductions

Bevin Buchheister, Senior Policy Analyst, National Governors Association

# State Introductions

5:00

- For state attendees, in 5 minutes or less, please introduce your state team and briefly describe your governor's energy and water policy priorities and your state team's goals for this Learning Lab.

- Guidance: Please remember to unmute yourself. I'll ask for introductions in alphabetical order by state based on the participant's list.

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# The Big Picture: Nationwide Drivers and Strategies for Water-Energy Savings

Vincent C. Tidwell, PhD, Principle Member of the Technical Staff, Sandia National Laboratories

# The Big Picture: Nationwide Drivers and Strategies for Water-Energy Savings


PRESENTED BY

Vincent Tidwell
Sandia National Laboratories


*National Governors Association*
*Water-Energy Nexus Learning Lab*
*September 1, 2020*

Sandia National Laboratories


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# Acknowledgements



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- Tom Iseman
- Sara Larsen
- Charlie Vorosmarty
- Ariel Miara

EPRI ELECTRIC POWER RESEARCH INSTITUTE

Argonne NATIONAL LABORATORY

THE UNIVERSITY OF TEXAS AT AUSTIN

INL Idaho National Laboratory

NETL

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THE GRADUATE CENTER
CITY UNIVERSITY OF NEW YORK

- Thushara Gunda
- Natalie Gayoso
- Barbie Moreland
- Katie Zemlick
- Mike Hightower

Sandia National Laboratories

- Nathalie Voisin
- Sean Turner
- Mark Wigmosta

Pacific Northwest NATIONAL LABORATORY

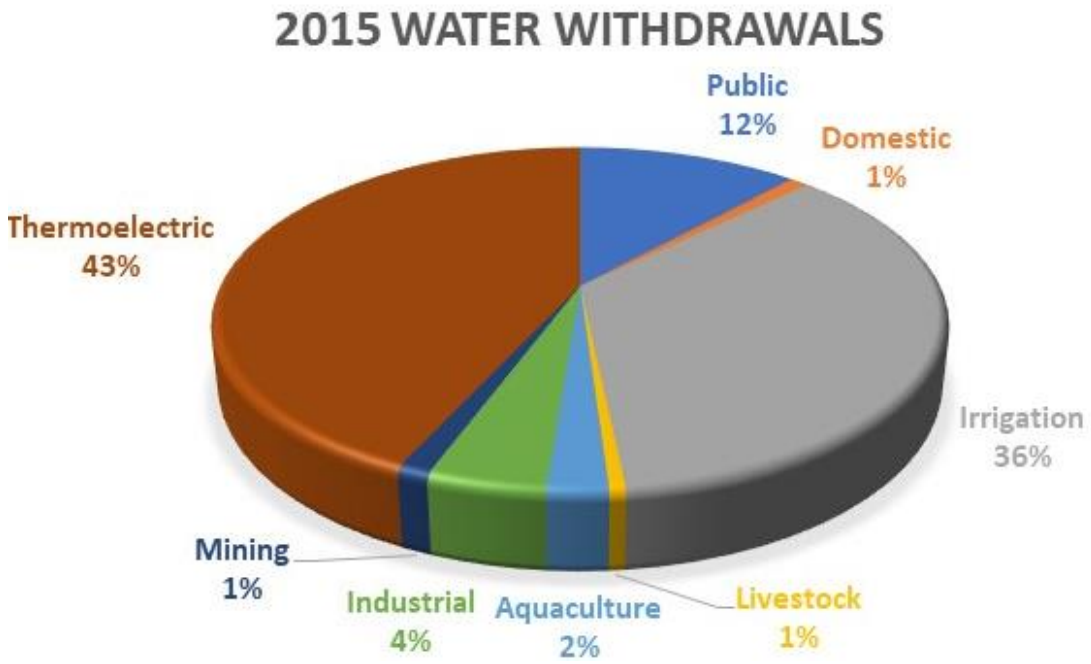
- Jordan Macknick
- Stuart Cohen
- Ana Dyreson
- Robin Newmark

NREL NATIONAL RENEWABLE ENERGY LABORATORY

- Michael Bailey
- Byron Woertz

WECC

# Water for Energy

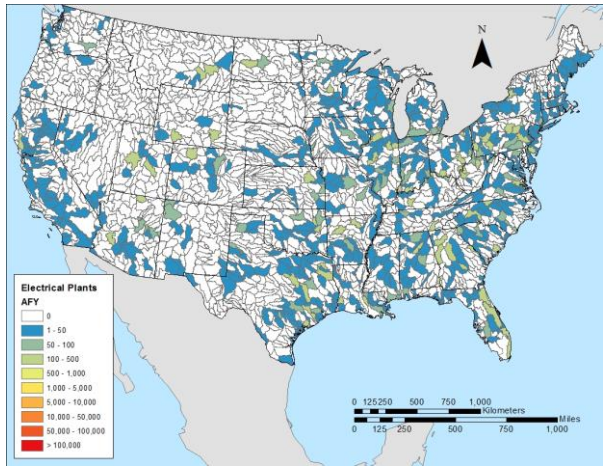



Source: USGS 2018

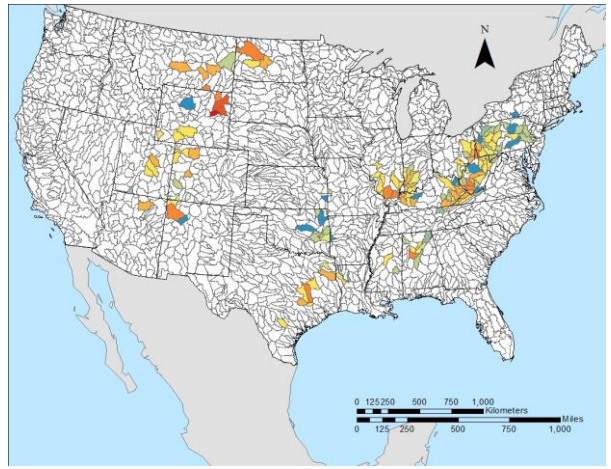
322 BGD Total Withdrawals
~7-8 BGD Total Consumption

## Water Consumption by County

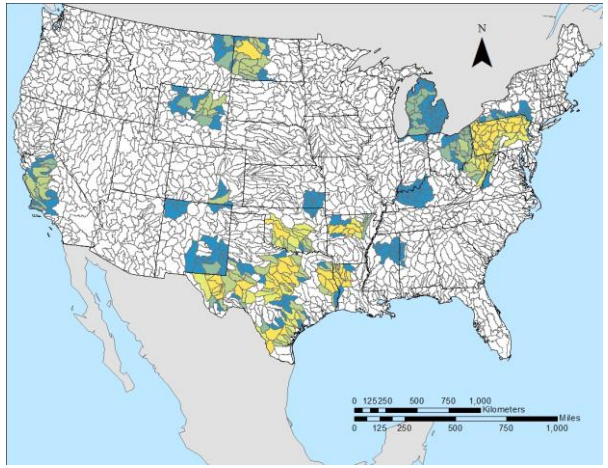
### Thermoelectric



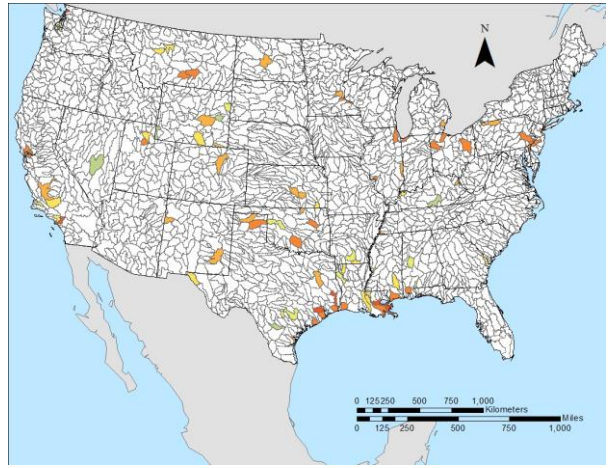

### Coal




### Unconventional Oil and Gas




### Refineries



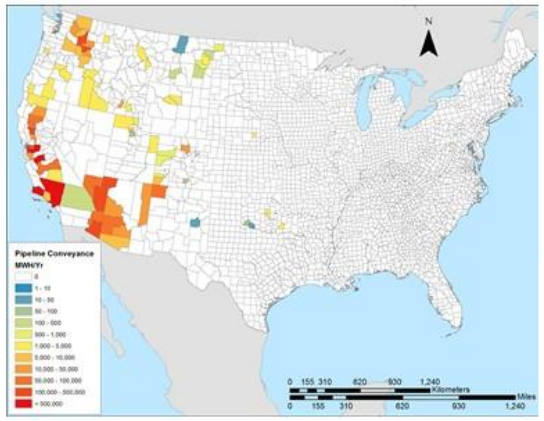

*Source: Tidwell et al. 2016*

# Energy for Water

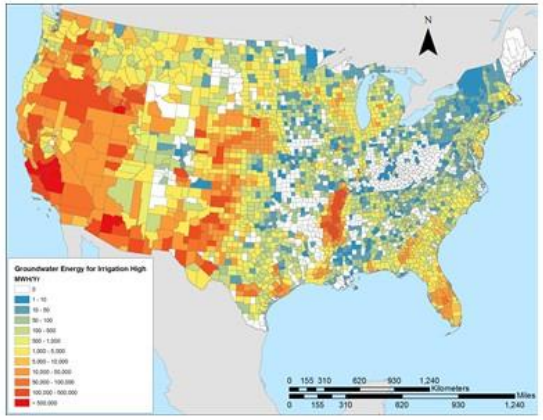
## Water Sector Consumes 4-8% of Total U.S. Energy Production

### Energy Consumption by County

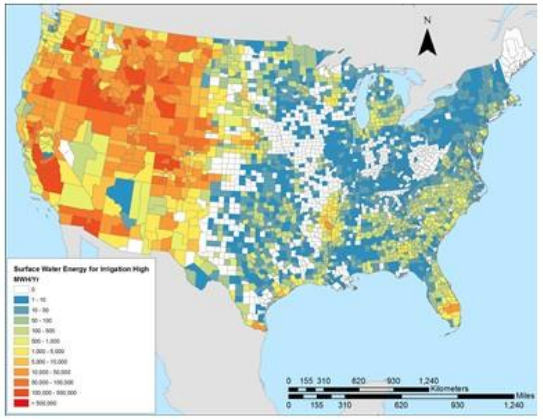
Large-Scale Conveyance



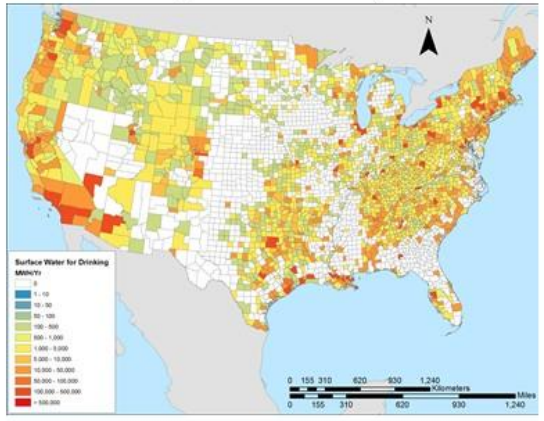
Agricultural Pumping (Groundwater)



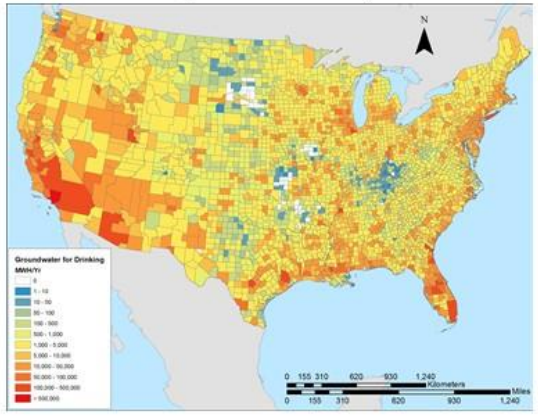
Agricultural Pumping (Surface Water)



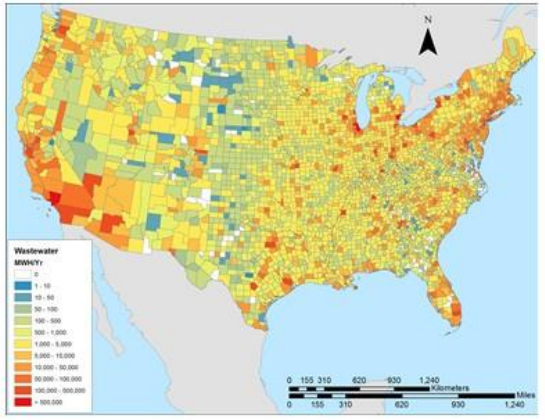
Drinking Water (Surface Water)



Drinking Water (Groundwater)

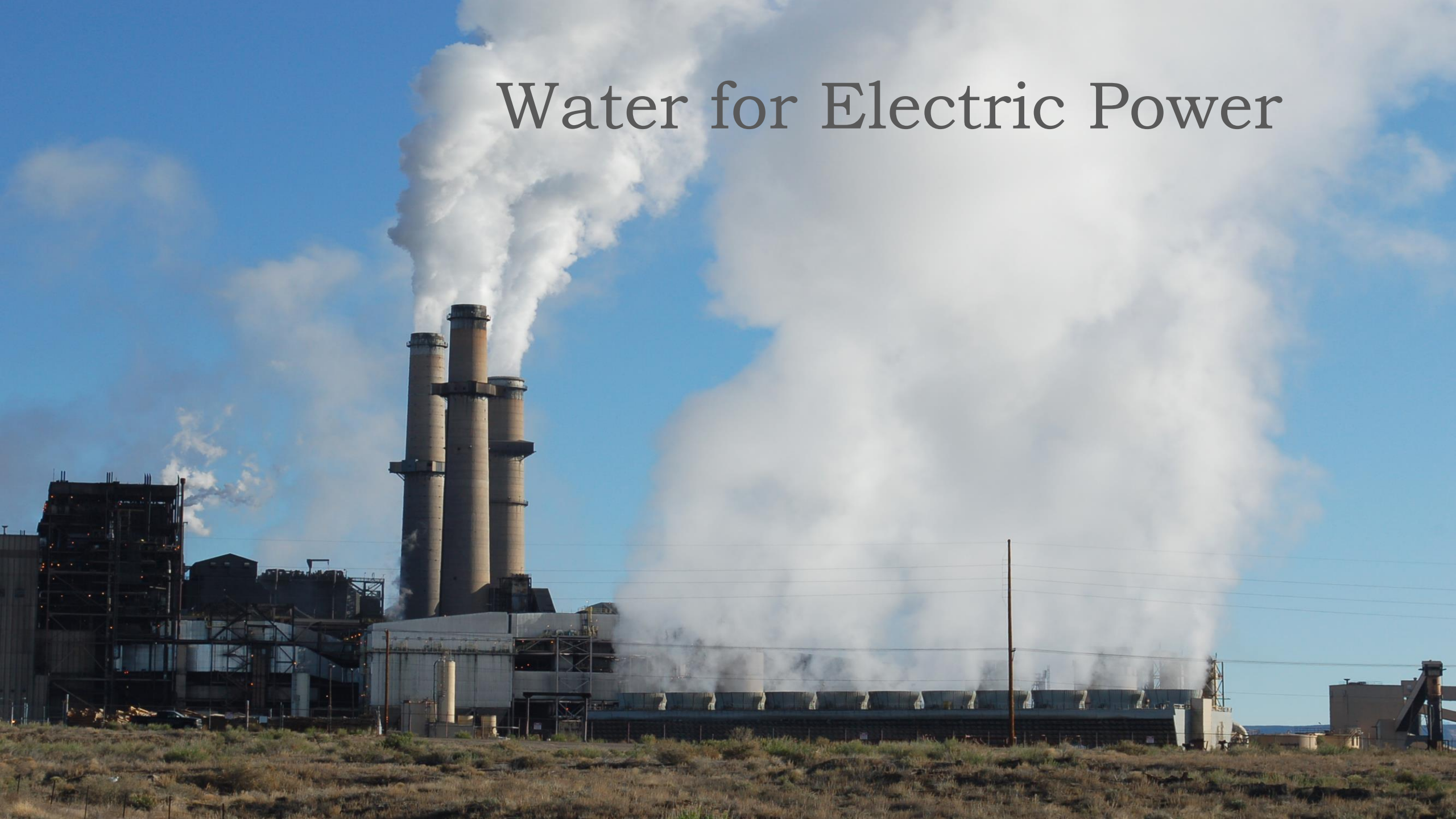


Municipal Wastewater



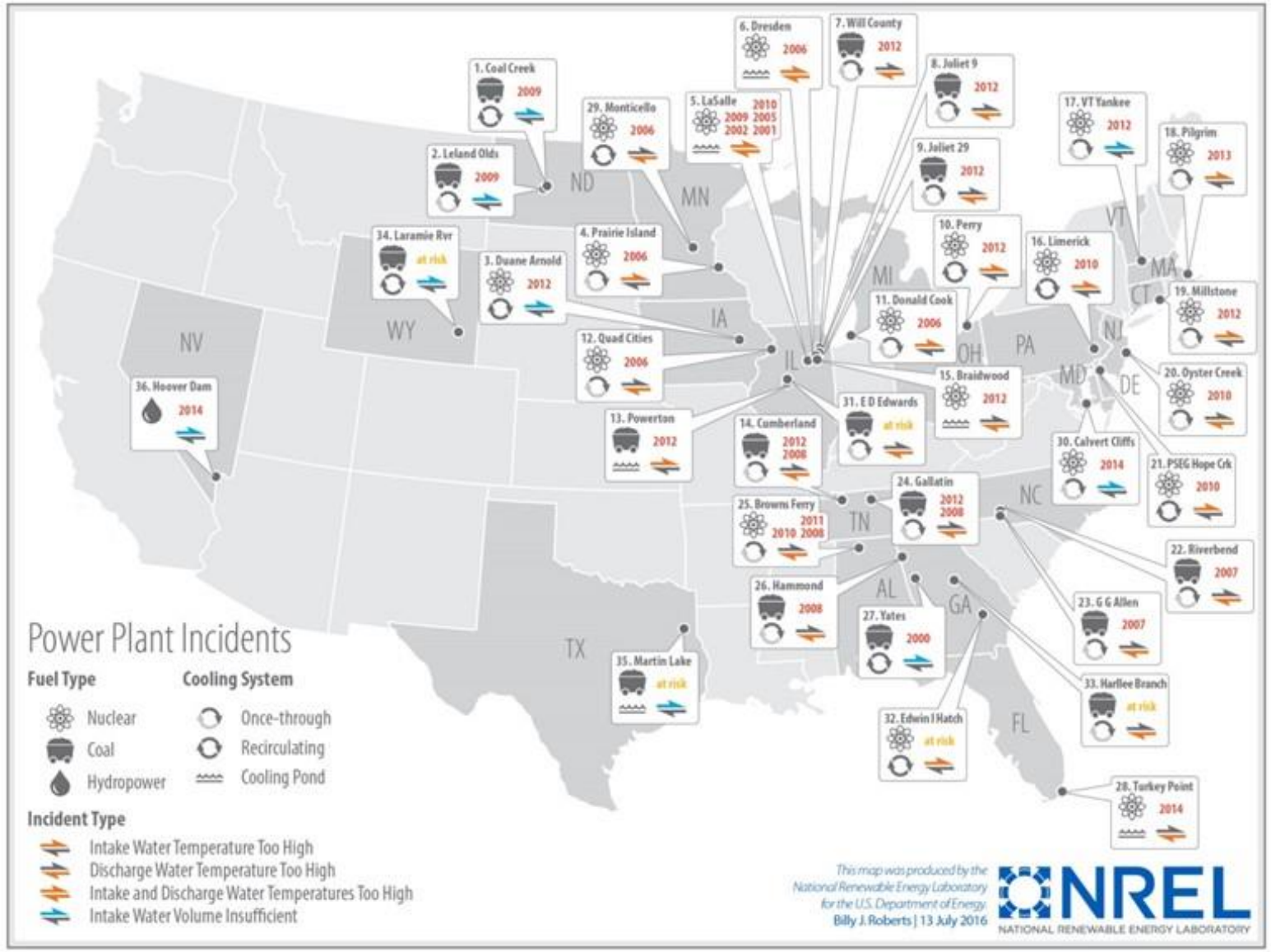
Source: Tidwell et al. 2014

# Water for Electric Power



# Current Impacts

## Climate Extremes Impact Power Production




## Water Scarcity Impacts Plant Siting

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**Idaho Places Moratorium on Coal-Fired Power Plants**

May 24, 2006

Idaho has established a two-year moratorium on the construction of most types of coal-fired power plants. Idaho is the only Western state currently without any coal-fired power plants. The moratorium does not prohibit construction of all coal-fired plants, but will make such construction unlikely at least for the next two years or until the Idaho legislature, through the Idaho Interim Committee on Energy, Environment, and Technology, develops a comprehensive state energy plan.

The legislation was inspired in part by a controversial plan by California-based Sempra Generation to build a 600 mega-watt plant in Jerome County, approximately 120 miles southeast of Boise. Following the Senate's passage of H. 791, Sempra announced that it would end efforts to construct the Jerome County project and a similar project in northern Nevada. Craig D. Rose, *Nevada, Idaho Projects Ran Into Stiff Opposition*, San Diego Union Tribune (March 30, 2006). In a letter to Idaho Governor Kempthorne, Sempra stated that it withdrew from the Idaho project because it was focusing on its natural gas related business. *Id.* Sempra plans on seeking buyers for the development work it has already done at the sites. *Id.*

Introduced by House Speaker Bruce Newcomb (R), H. 791 was passed by the Idaho House on a 65-4-1 vote on March 21, 2006, and by the Senate on a 30-5 vote eight days later. Rebecca Meany, *Power Plant Moratorium Bill on Governor's Desk*, Idaho Mountain Express (March 31, 2006). The Idaho Legislature found that it was "in the public interest to adopt an integrated energy plan ... that provides for the states' power generation needs and protects the health and safety of the citizens of Idaho." H. 791. The Legislature also found that "certain coal fired power plants may have a significant negative impact upon the health, safety and welfare of the population, the quality and financial security of existing agricultural business ... and the environmental quality and natural resources of [the] state." *Id.*

H. 791 amends the Idaho Environmental Protection and Health Act, Idaho Code Ann. § 39-101, *et seq.* Under the act, as amended, municipalities, counties, and the Idaho Department of Environmental Quality are prohibited

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6/20/2019

**State denies permit to Burrillville power plant**

BURRILLVILLE – In a gripping decision that followed several
debate, the state Energy Facility Siting Board today denied an a
Chicago-based Invenergy to build an oil-and-gas-burning powe
Wallum Lake Road.

The decision came after just a few hours of public debate durin
members of the state board expressed doubt about the state's n
energy produced by the plant, a key argument made by representatives of the company.

The decision was a victory for conservationists and local residents, many of

AP NEWS

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**Company's bid to use groundwater for nuclear plant denied**

November 12, 2019

PHOENIX (AP) — Arizona water regulators have rejected an application by an electr
nuclear power plant west of Phoenix because the water is being used by nearby resid

The state Department of Water Resources denied the request from Arizona Public Se
Buckeye area and study it as an alternative to expensive reclaimed water because it is
Monday.

The permit requires water has no other beneficial use, state department officials said

"The Department finds that this groundwater is currently being used beneficially and
deny the application," officials said in the rejection letter.

CENTER for BIOLOGICAL DIVERSITY

Because life is good.

For Immediate Release, February 9, 2006

Contact: Amy Atwood, Center for Biological Diversity, (541) 914-8372

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**Statement on NV Energy Inc.'s Abandonment of Plans to Construct Coal-Fired Power Plant in Eastern Nevada**

LAS VEGAS, Nev. — The Center for Biological Diversity is celebrating NV Energy Inc.'s announcement today that it will abandon original plans to construct the Ely Energy Center, a coal-fired power plant in eastern Nevada. Citing growing environmental and economic concerns, the company stated that the project has been postponed until greenhouse gas capture and storage capture technology becomes commercially viable, which is "not likely before the end of the next decade."

"Today's announcement reflects the fact that power companies are starting to recognize coal's bleak future," said Amy Atwood, public lands energy director at the Center for Biological Diversity. "The Obama administration should take swift action to halt regulatory approvals for other coal-fired power plants that are still proposed for the region. Not another acre of public lands should be destroyed for coal combustion in an age of global warming."

Ely Energy Center, which would have been located about 20 miles north of Ely in White Pine County, Nevada, would have consisted of two coal-fired 750-megawatt (MW) ultra-supercritical steam turbine units, two 500-MW integrated gasification combined cycle units, and associated facilities. The Center would have had a 2,500-MW generating capacity and an estimated lifespan of 50 years.

Ely Energy Center would consume approximately 8,000 acre-feet of water per year during the first phase alone, compromising the viability of local threatened and endangered species while contributing an estimated 10.6 million tons of $CO_2$ to the atmosphere every year. Additional greenhouse gas emissions would have resulted from the mining and transportation of coal between eastern Nevada and the Powder River Basin in Wyoming.

The Center will continue to monitor developments to see that regulatory permitting processes for the Ely Energy Center are halted or withdrawn.

The Center for Biological Diversity is dedicated to ensuring that atmospheric $CO_2$ pollutant levels are reduced to below 350 ppm, which leading climate scientists warn is necessary to prevent devastating climate change. Further development of greenhouse gas-intensive energy sources, including oil shale, tar sands, and coal-fired power plants, is fundamentally incompatible with achieving this goal. If greenhouse gas emissions are not immediately reduced, the current atmospheric $CO_2$ level of 385 ppm will rise to approximately 500 ppm by mid-century, triggering mass wildlife extinctions, catastrophic global weather and ecosystem changes, and tragic human suffering.

Arizona • California • Colorado • Florida • N. Carolina • New York • Oregon • Virginia • Washington, D.C. • La Paz, Mexico

BiologicalDiversity.org

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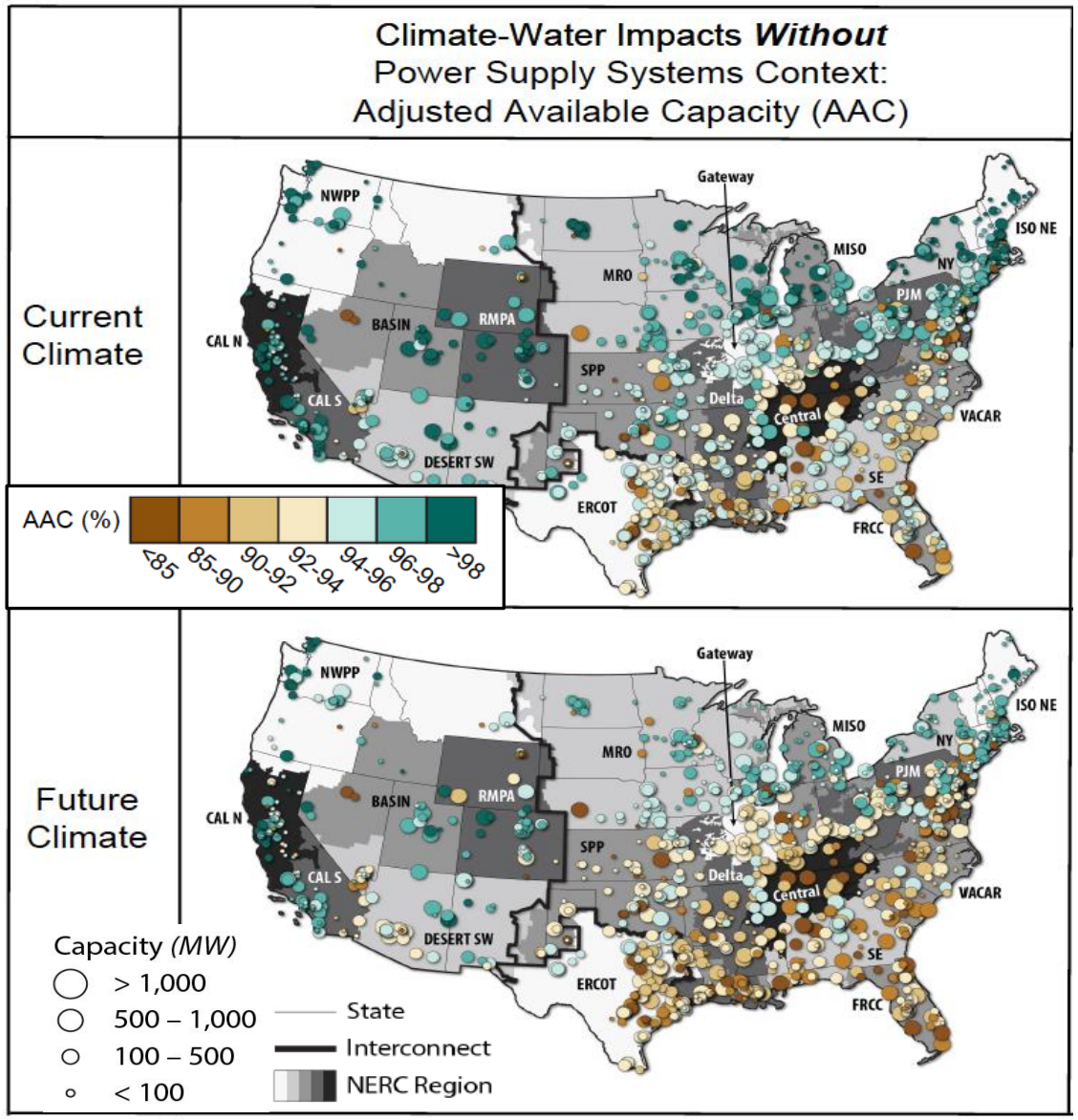
# Intensifying Drought




- Power generation at risk from drought.
- Elevated water temperatures can necessitate plants to limit their generation.
- Shown is the potential impact on current generation capacity:
  - Under current climate, and
  - Under future climate conditions.

Source: Miara et al. 2017

# Reduced Water Use

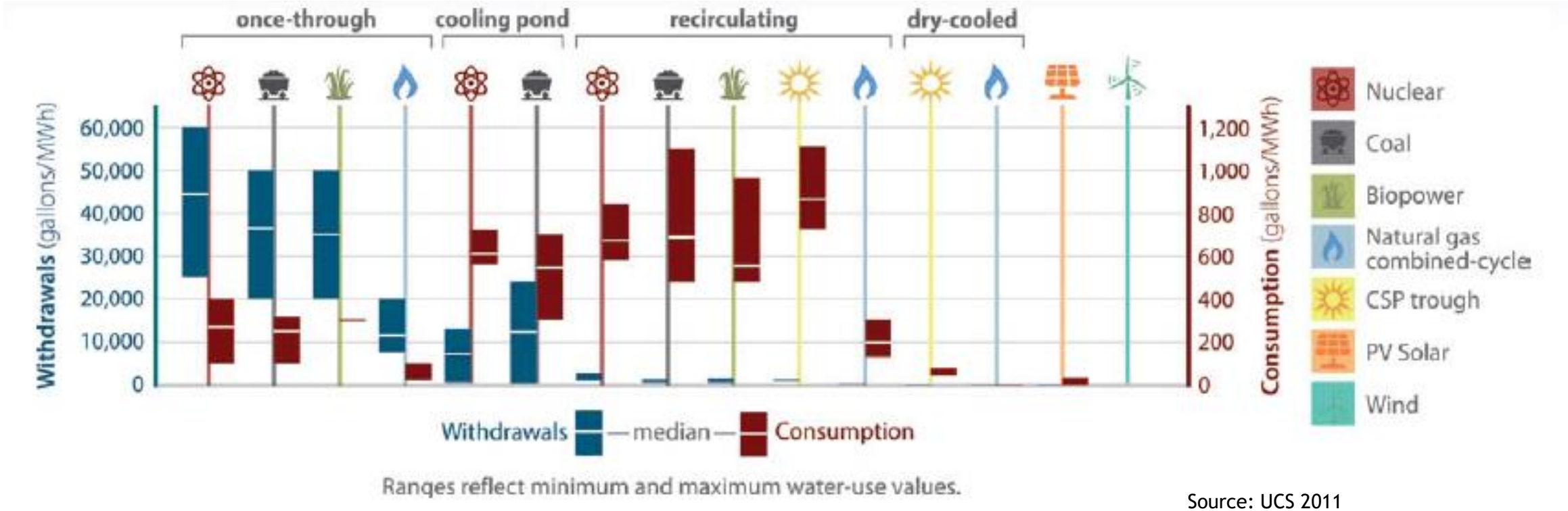
*Systems are Moving to Less Water Intensive Forms of Generation*

Current generation relies on high-water use technology:

- Coal
- Gas-Steam
- Nuclear

New capacity favors low-water use technology:

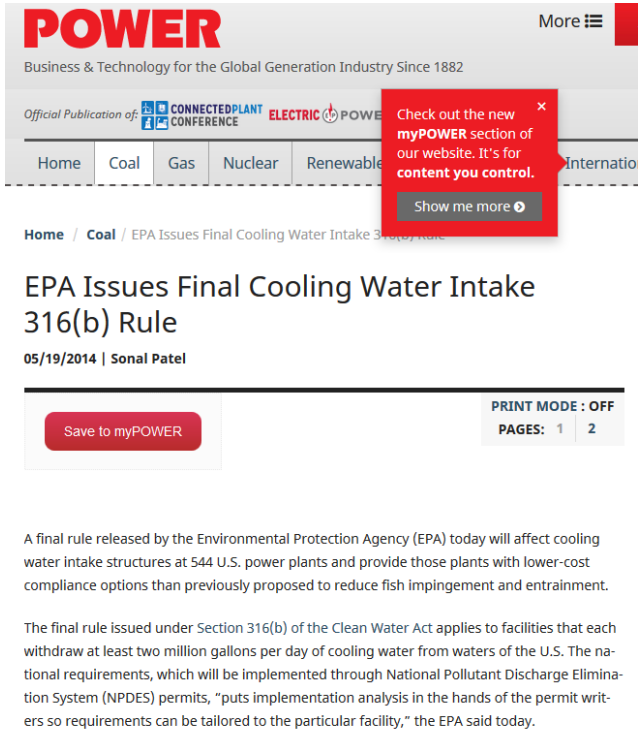
- Natural gas combined cycle
- Wind
- Solar PV




Source: UCS 2011

# Reduced Withdrawals

*Systems are Moving to Less Water Intensive Forms of Cooling*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## EPA Issues Final Cooling Water Intake 316(b) Rule

05/19/2014 | Sonal Patel

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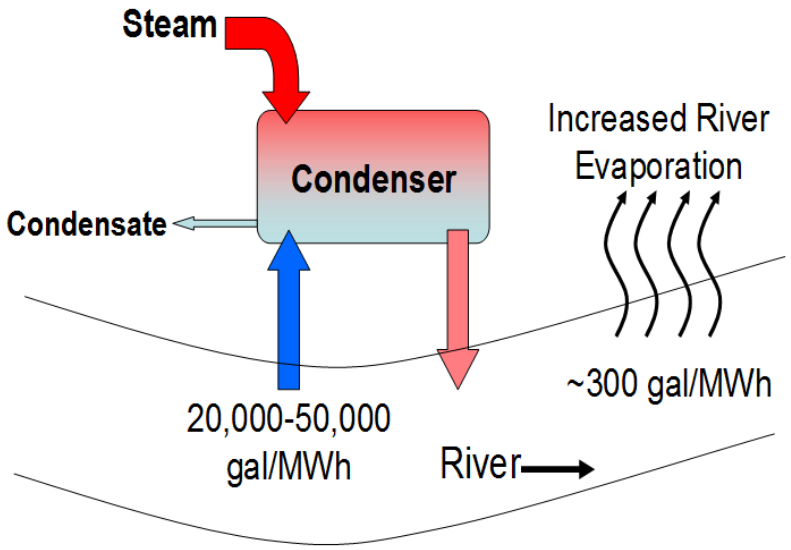
PAGES: 1 2

A final rule released by the Environmental Protection Agency (EPA) today will affect cooling water intake structures at 544 U.S. power plants and provide those plants with lower-cost compliance options than previously proposed to reduce fish impingement and entrainment.

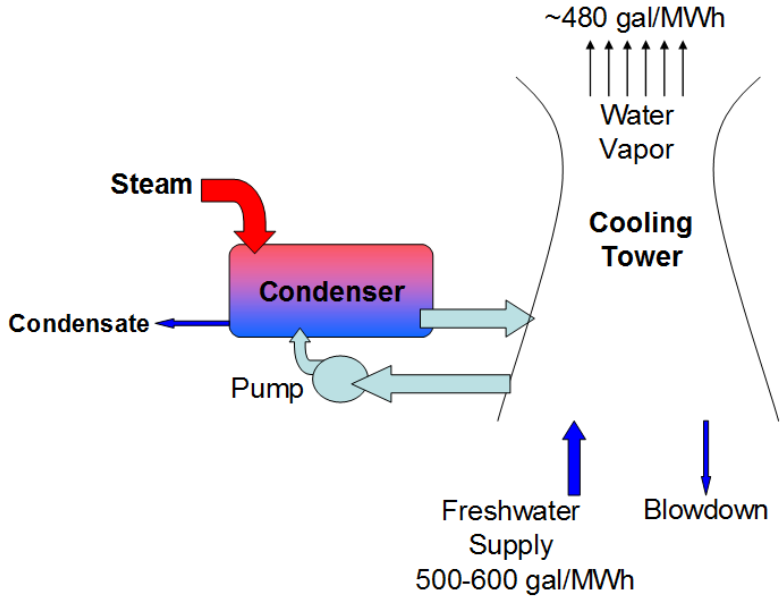
The final rule issued under Section 316(b) of the Clean Water Act applies to facilities that each withdraw at least two million gallons per day of cooling water from waters of the U.S. The national requirements, which will be implemented through National Pollutant Discharge Elimination System (NPDES) permits, "puts implementation analysis in the hands of the permit writers so requirements can be tailored to the particular facility," the EPA said today.

## High Water Withdrawal
## Low Water Consumption




Open-loop "once-through" cooling cycle

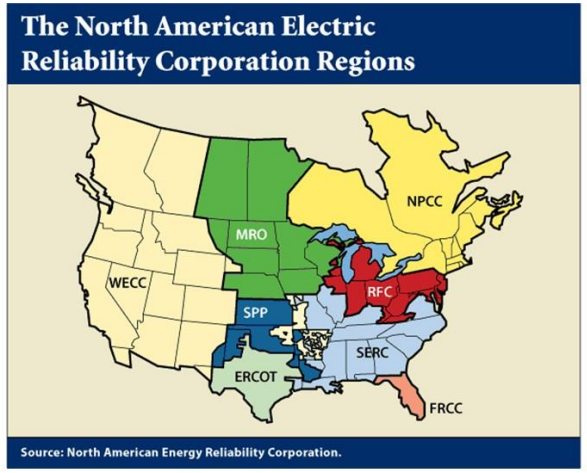
## Low Water Withdrawal
## High Water Consumption




Closed-loop cooling cycle

***Source: EPRI 2002***

# Integrated Planning




- Integrated climate into WECC's capacity expansion planning exercise
- Explored how water extremes influence planning decisions

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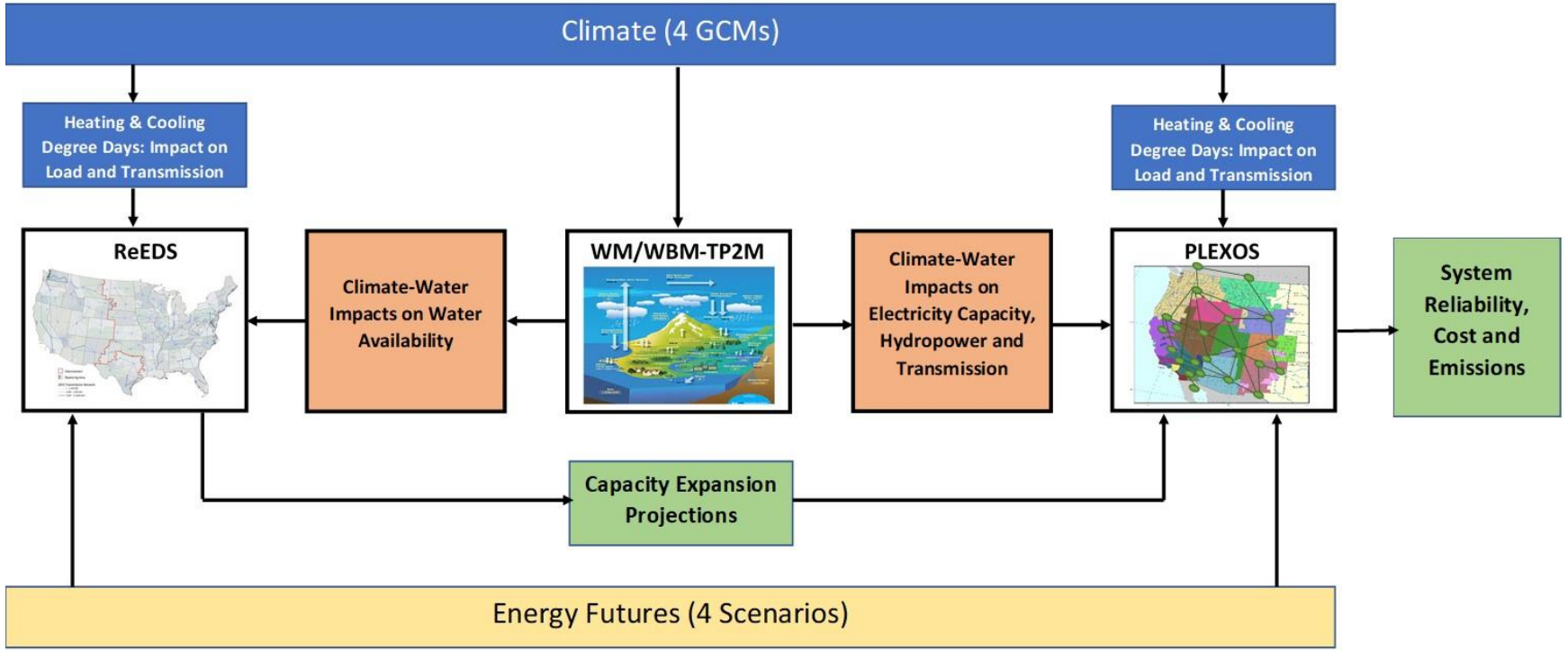
WECC

WSWC Western States Water Council

## Analysis platform included:

- Hydrologic modeling,
- Capacity expansion modeling, and
- Production Cost Modeling



# Climate Impact on Planning

Pacific Northwest NATIONAL LABORATORY

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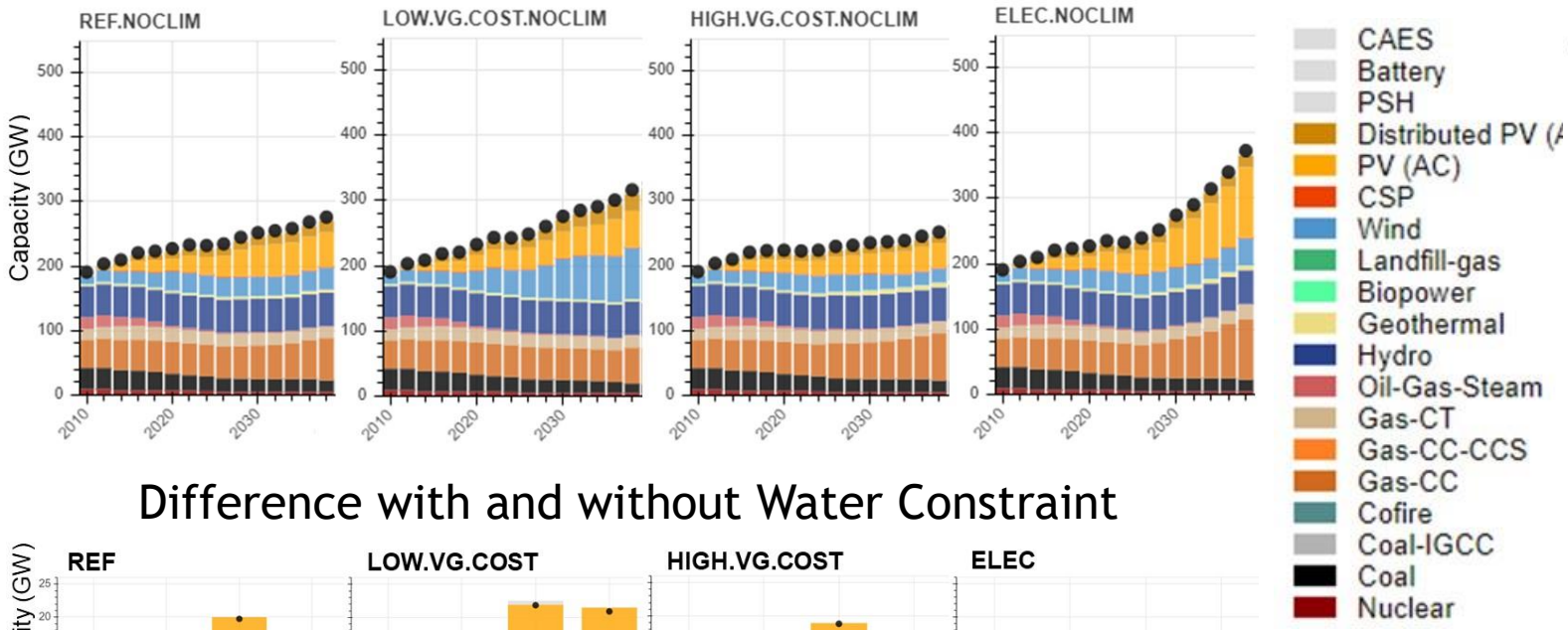
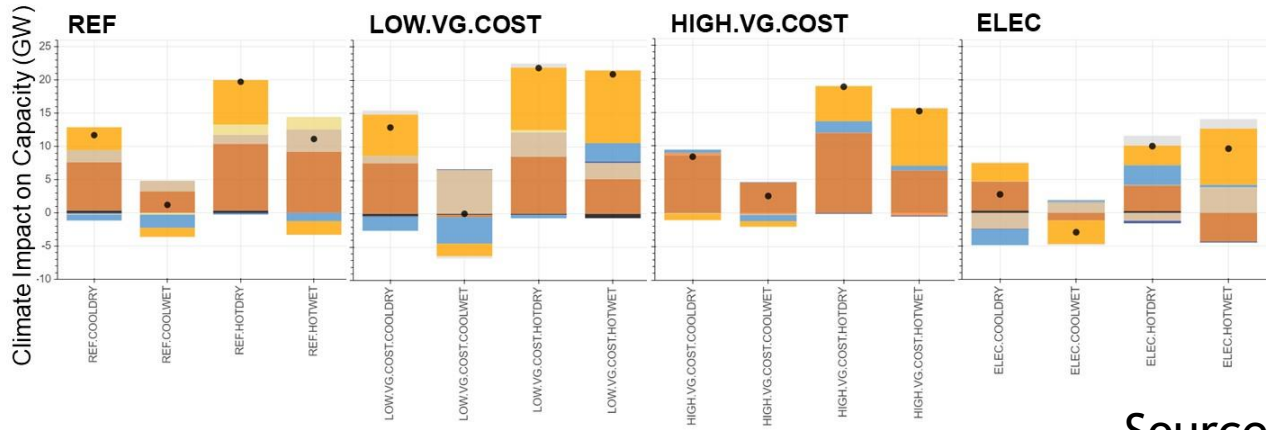
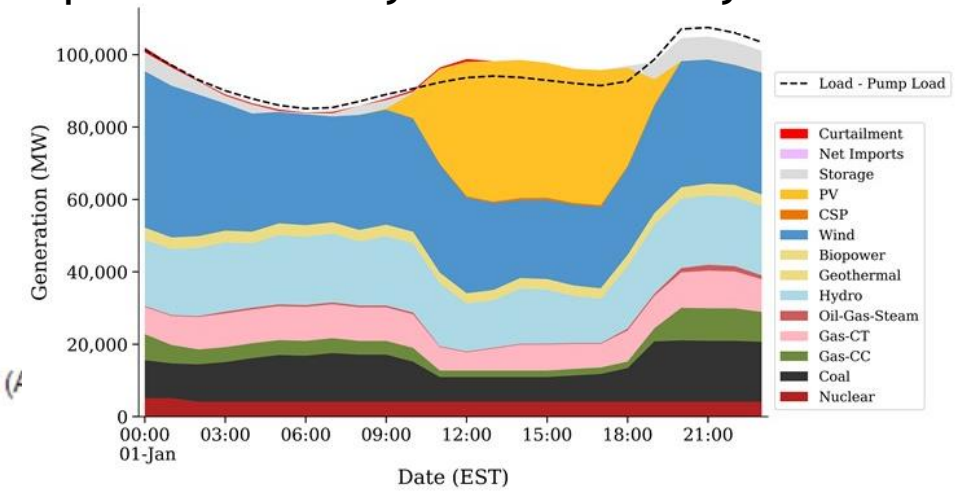
## Generation Expansion Profiles




## Difference with and without Water Constraint




## Implications for System Reliability and Cost

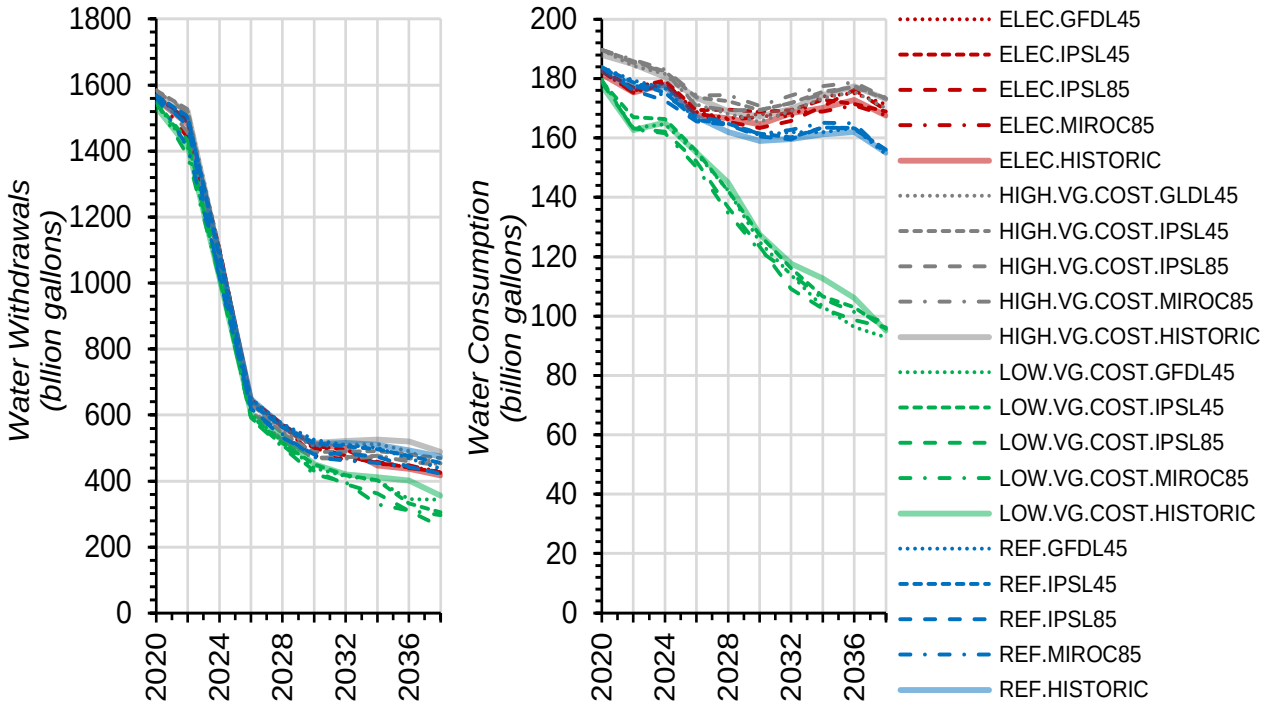



- Additional capacity needed to meet peak load.
- Hydropower production is key uncertainty.
- Considerable adaptive capacity available in the grid.

Source: Tidwell et al 2020

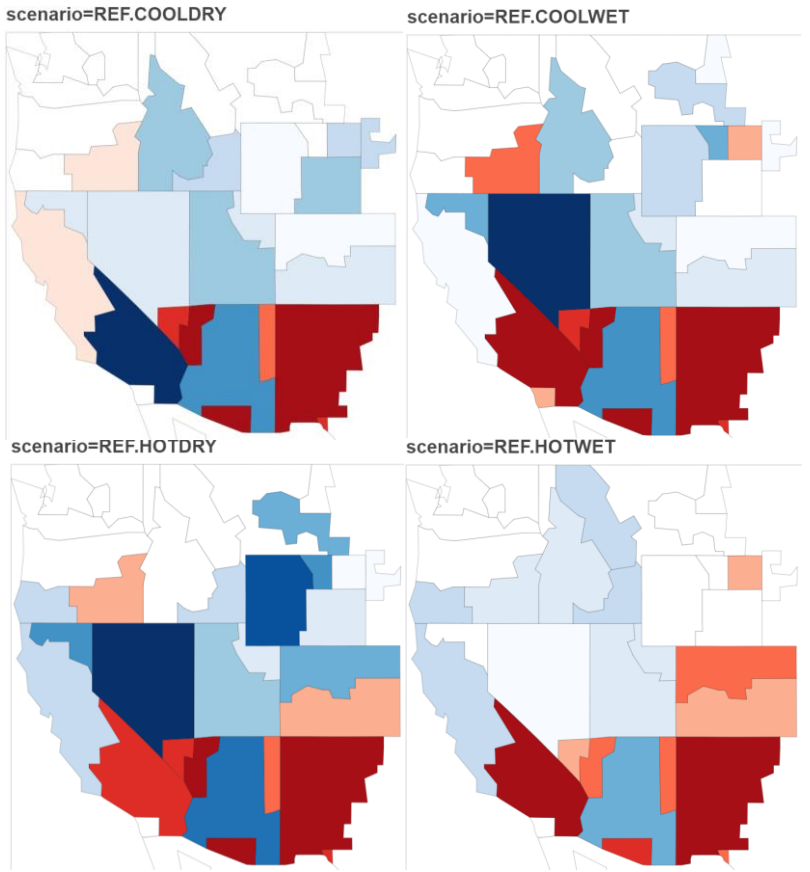
# Climate Impact on Planning

## Implications for Future Water Use



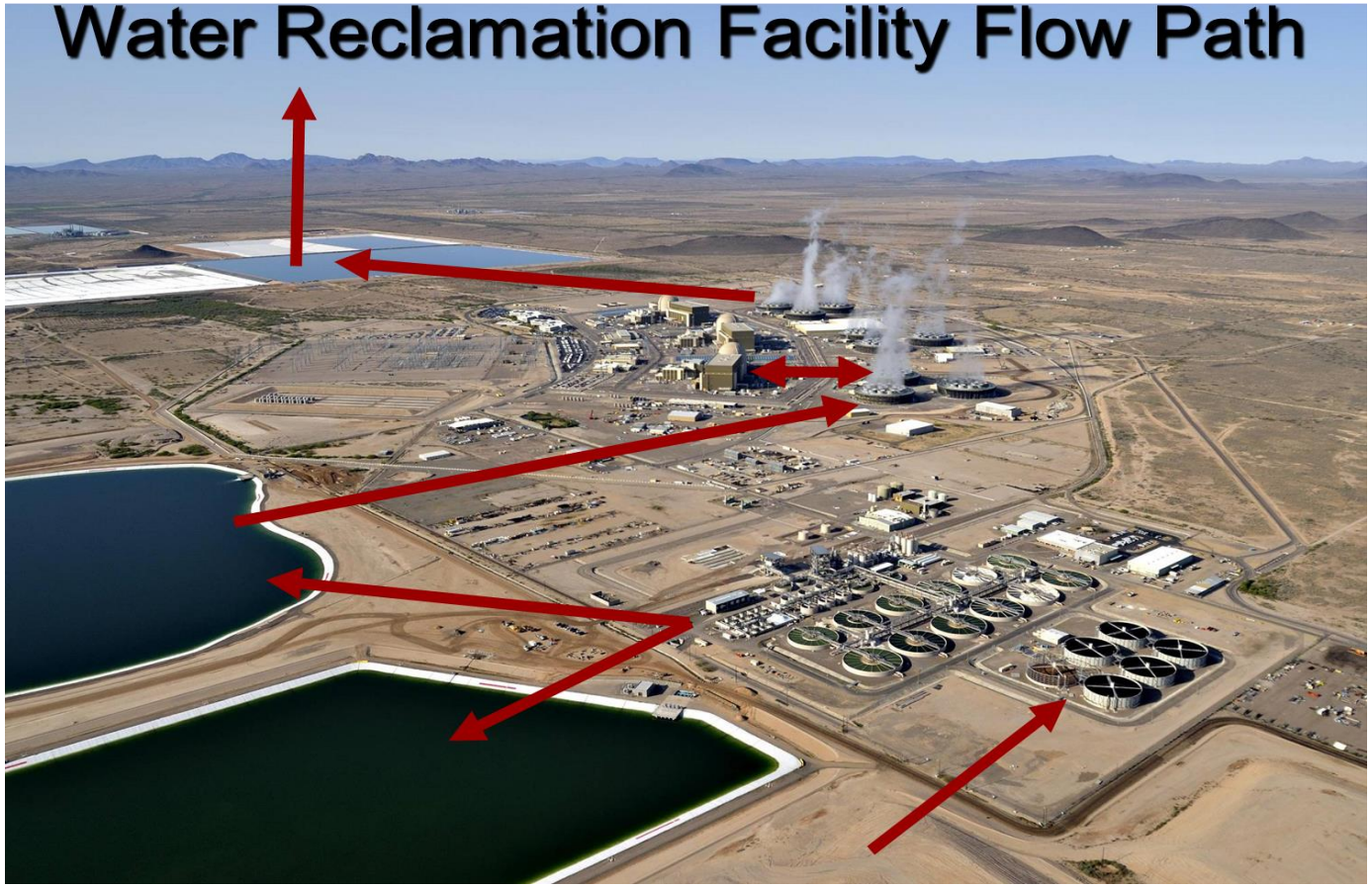

Source: Tidwell et al 2020

Combined influence of climate and water availability influence siting decisions



# Integrated Plant-Level Planning

*Techno-economic assessment of water options for the Palo Verde Nuclear Power Plant, Phoenix, AZ*



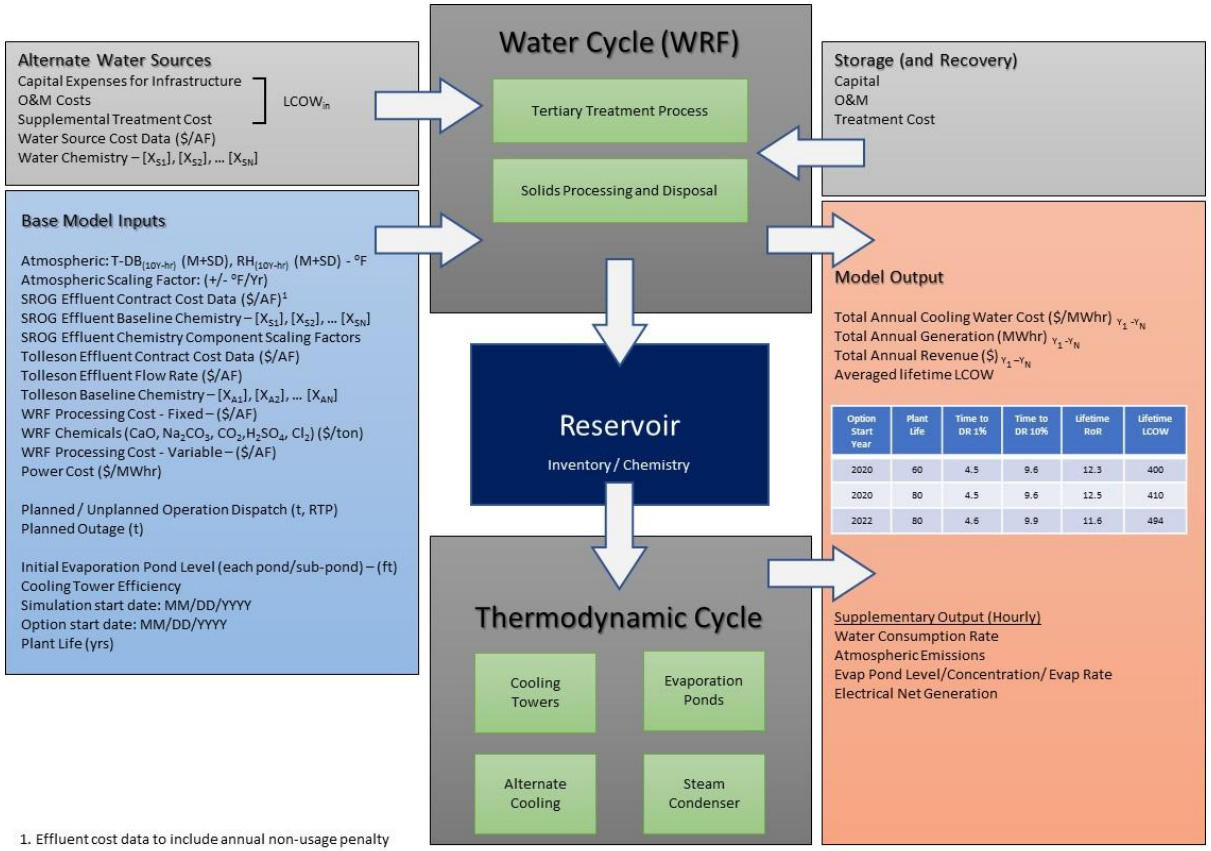

Source: Middleton and Brady 2020

There are many dimensions to a power plant's water footprint:

- Water supply reliability and cost.
- Variable/changing chemistry of water supply.
- Changing cost of cooling and water treatment technology.
- Wastewater management options and costs.

# Integrated Plant-Level Planning

## *Interactive Decision Platform to Support Water Planning*

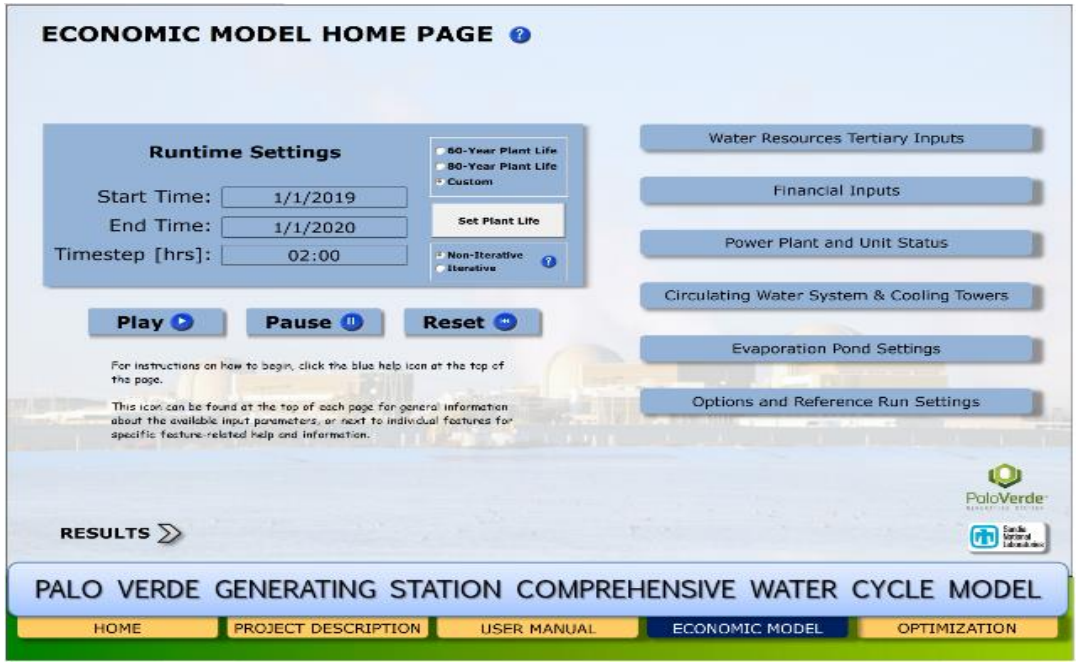



1. Effluent cost data to include annual non-usage penalty

Source: Middleton and Brady 2020

## Presents tradeoffs in plant economics due to:

- Alternative cooling technologies,
- Water usage and treatment,
- Water disposal options, and
- Influent water chemistry



# Water for Oil and Gas Production

# Current Impacts

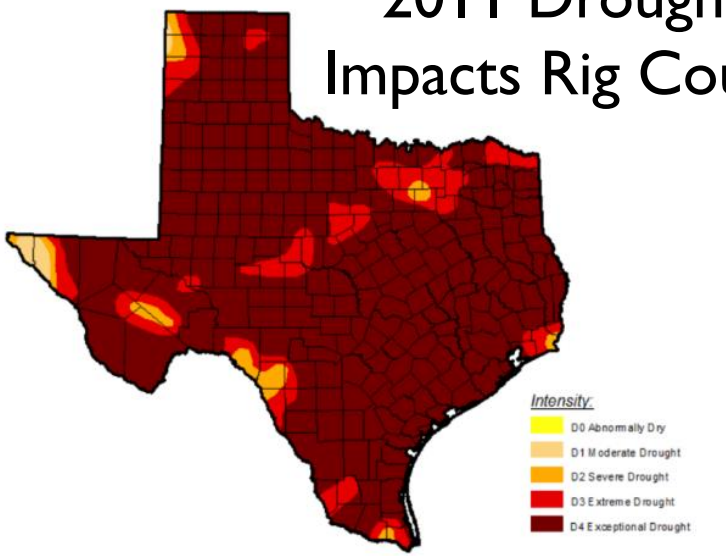
Water extremes impact oil and gas production:

- Water policy,
- Water cost.

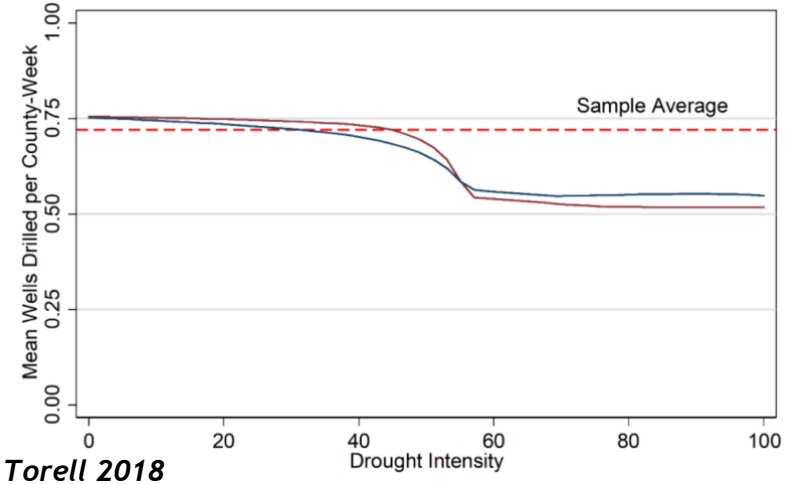
## Disruptions Caused by Drought and Storm Damage

*Source: DOE 2013*

## 2011 Drought Impacts Rig Count




Source: US Drought Monitor.




*Source: Stevens and Torell 2018*

CNN Money Companies Markets Tech Media

### Drought strains U.S. oil production

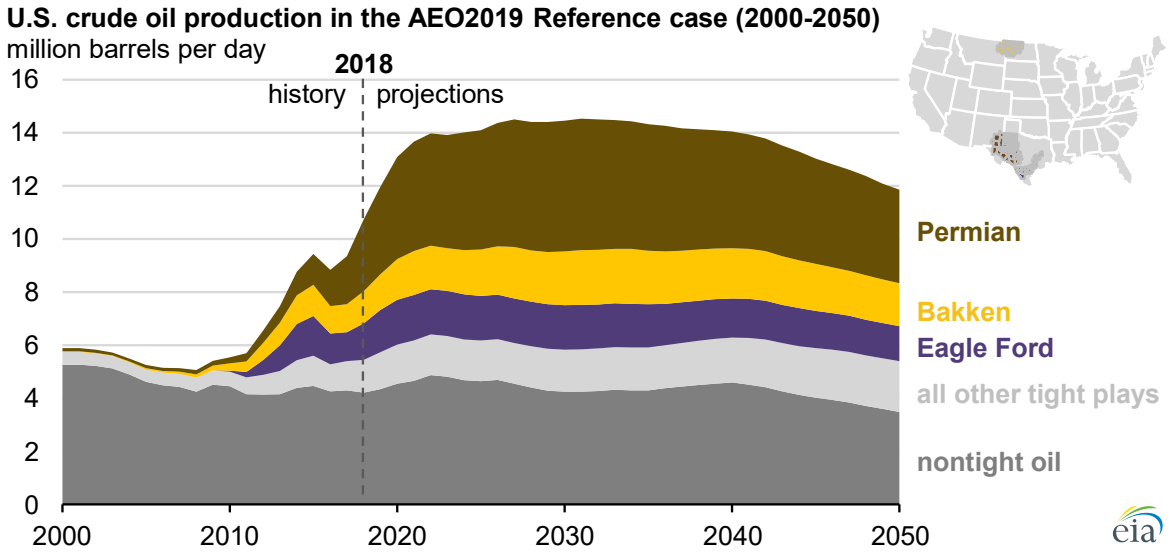
By Steve Hargreaves @CNNMoney July 31, 2012: 4:55 AM ET

PHOTO: BLAKE ELLIS/CNNMONEY

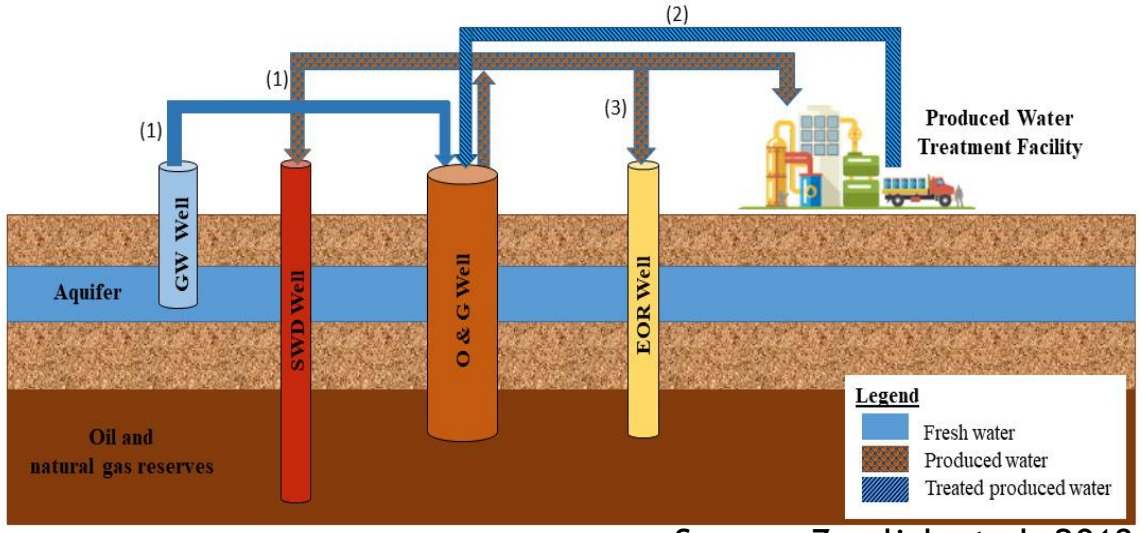
Excavators prepare water for the oil industry in Kansas. The drought is restricting water available for fracking, which could harm U.S. oil production.

# Intensifying Demands

## Projected Increases in Production




## Much of Production in Water-Limited Regions


Source: Zemlick et al. 2018

## Water choices are complicated:

- Alternative water sources,
- Water disposal options,
- Intensity of production, and
- Produced water use options.

# Produced Water Solutions

## Recycle produced water

Source: American Oil and Gas Reporter 2020

- 25BG of water used in unconventional oil production each year
- Over one trillion gallons of produced water generated in 2012
- $40B in annual disposal costs

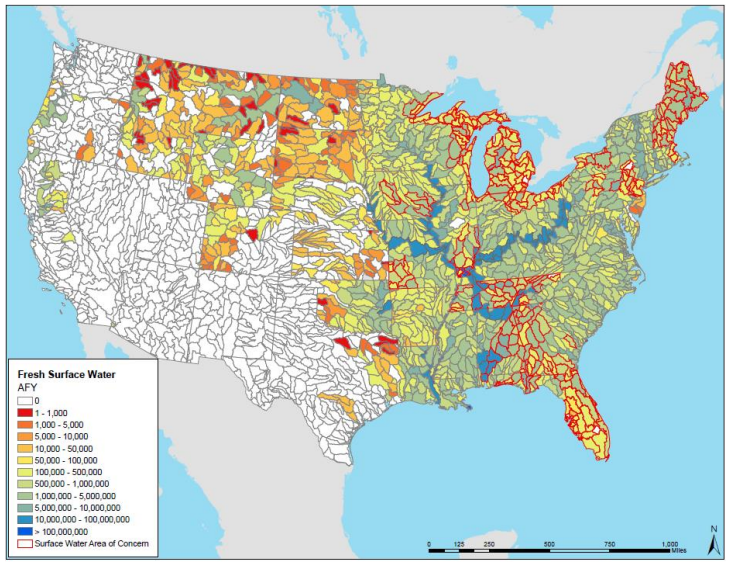
## Fit-for-use treatment: Reclaiming well pads

Source: Dwyer and McDonald 2016

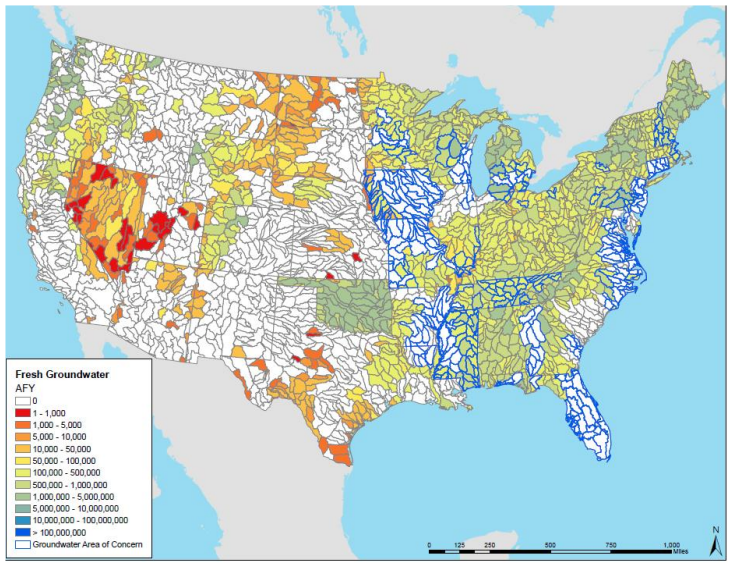

Energy for Water

# Supply and Demand

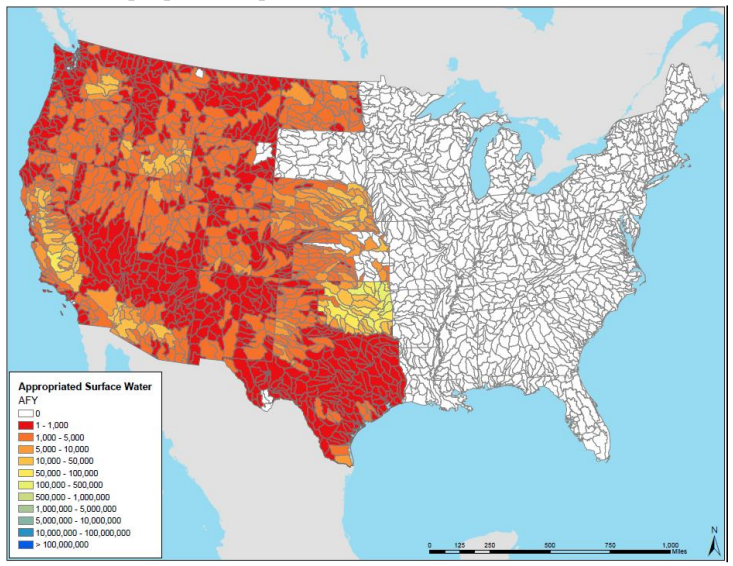
## Fresh Surface Water



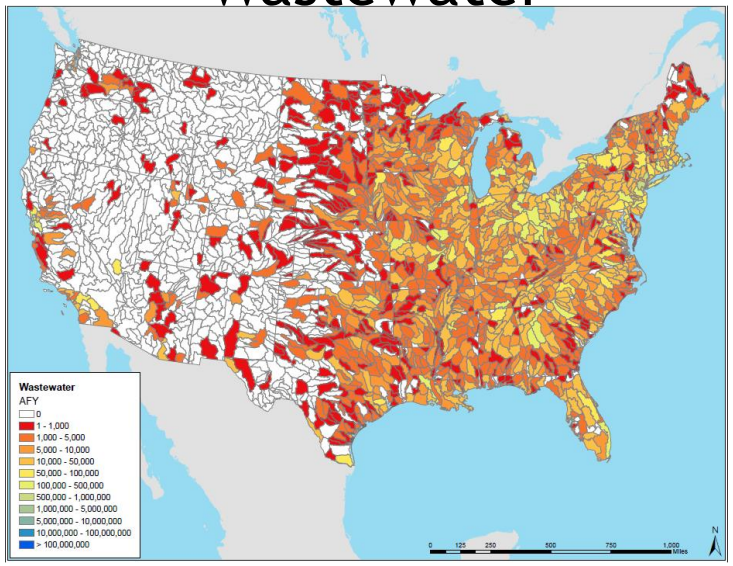

## Fresh Groundwater



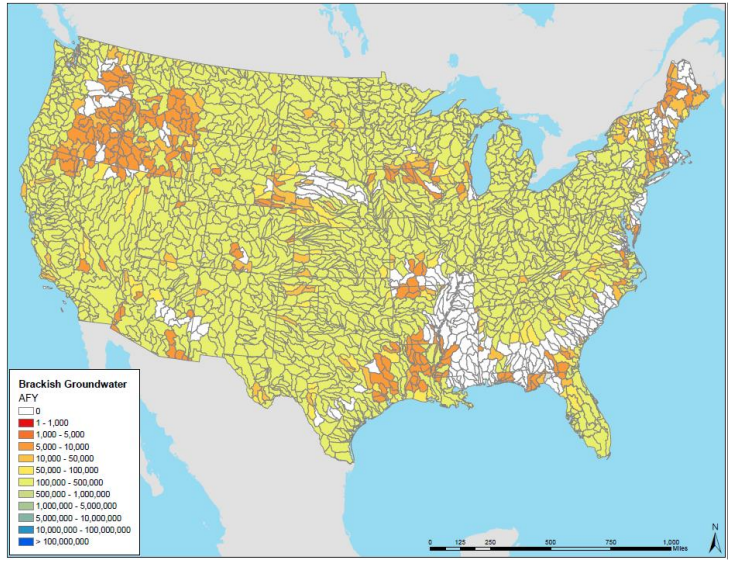

## Appropriated Water



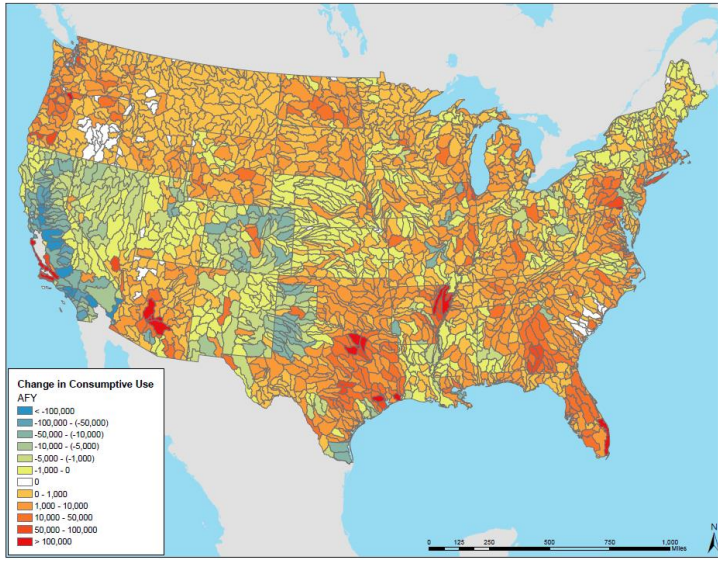

## Wastewater




## Brackish Water



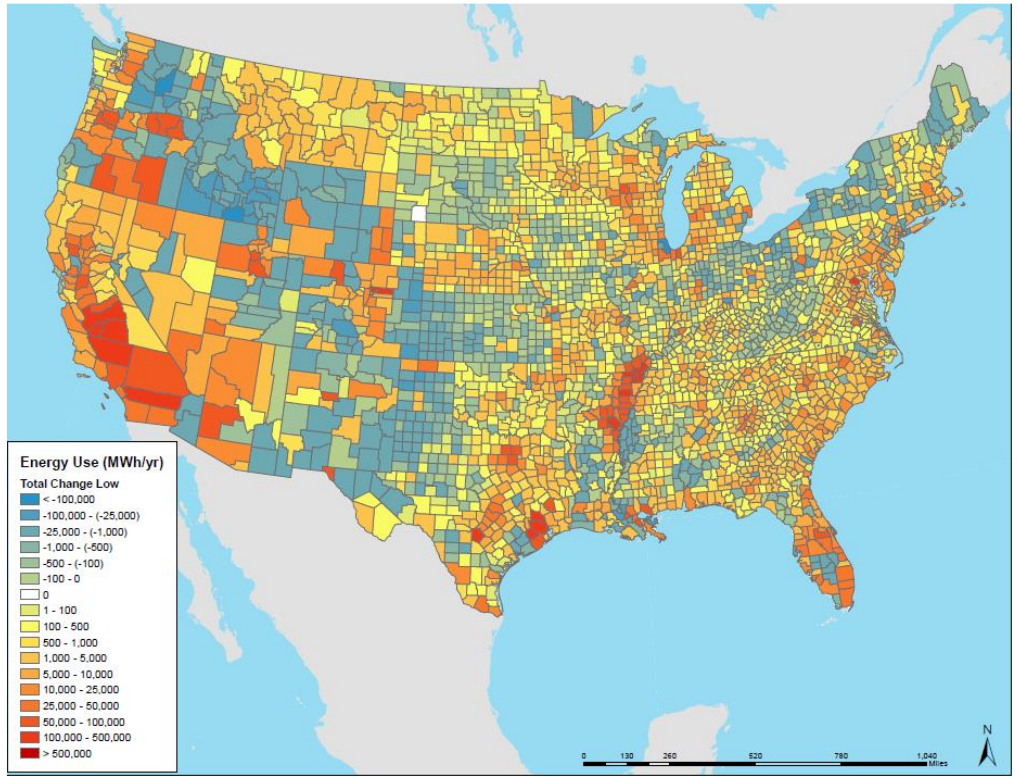

## Growth in Demand 2015-2035




Source: Tidwell et al. 2018

# Intensifying Demands

## Projected Change in Energy Demand for Water Services 2015-2030

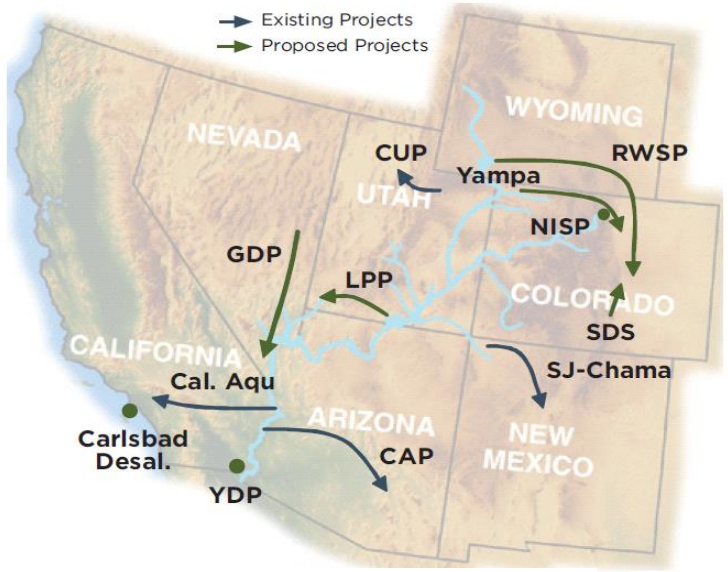



Source: Tidwell and Moreland 2020

*7-13% increase projected over 15 yrs.*

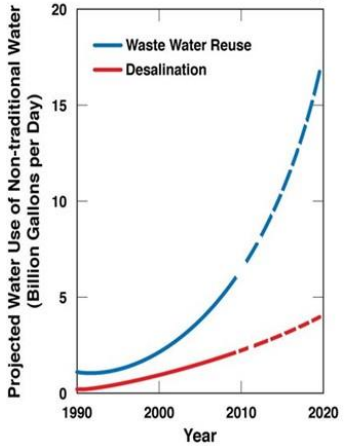

Source: detoxifynow.com

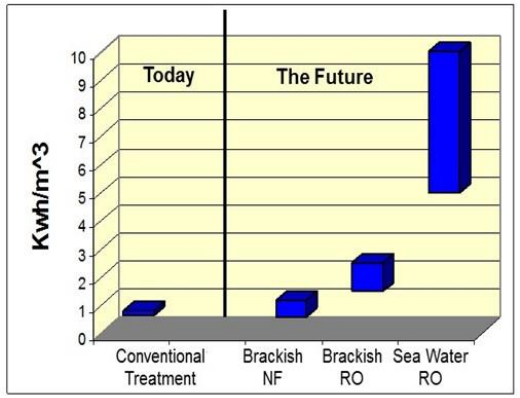
*Existing and Proposed Western Water Supply Projects*




Source: Western Resource Advocates 2010

## Power Requirements For Treatment



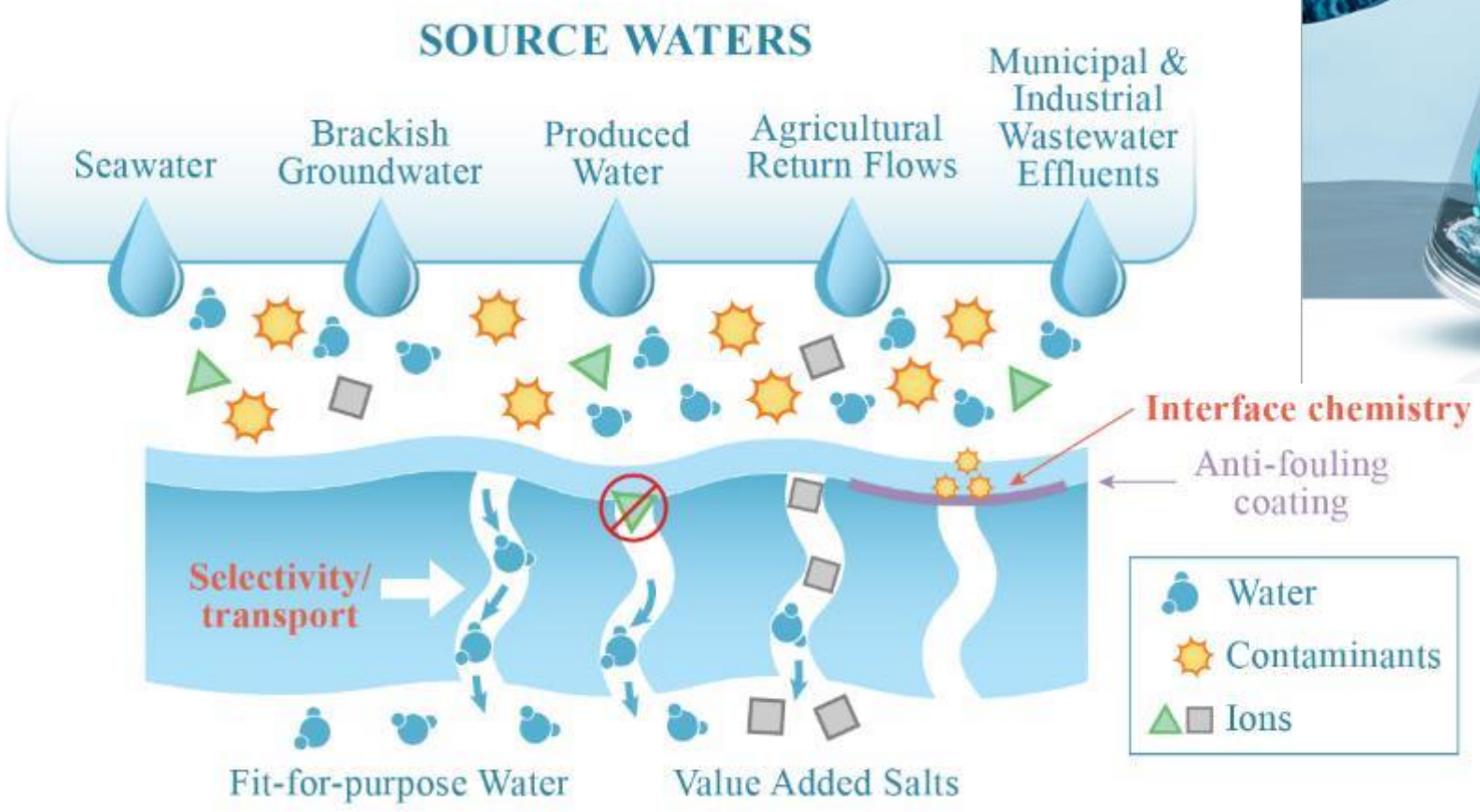




Modified from Water Reuse 2007, EPA 2004, Mickley 2003

Source: Einfeld 2007

# Advanced Treatment Technologies

## *Treatment Paradigm*



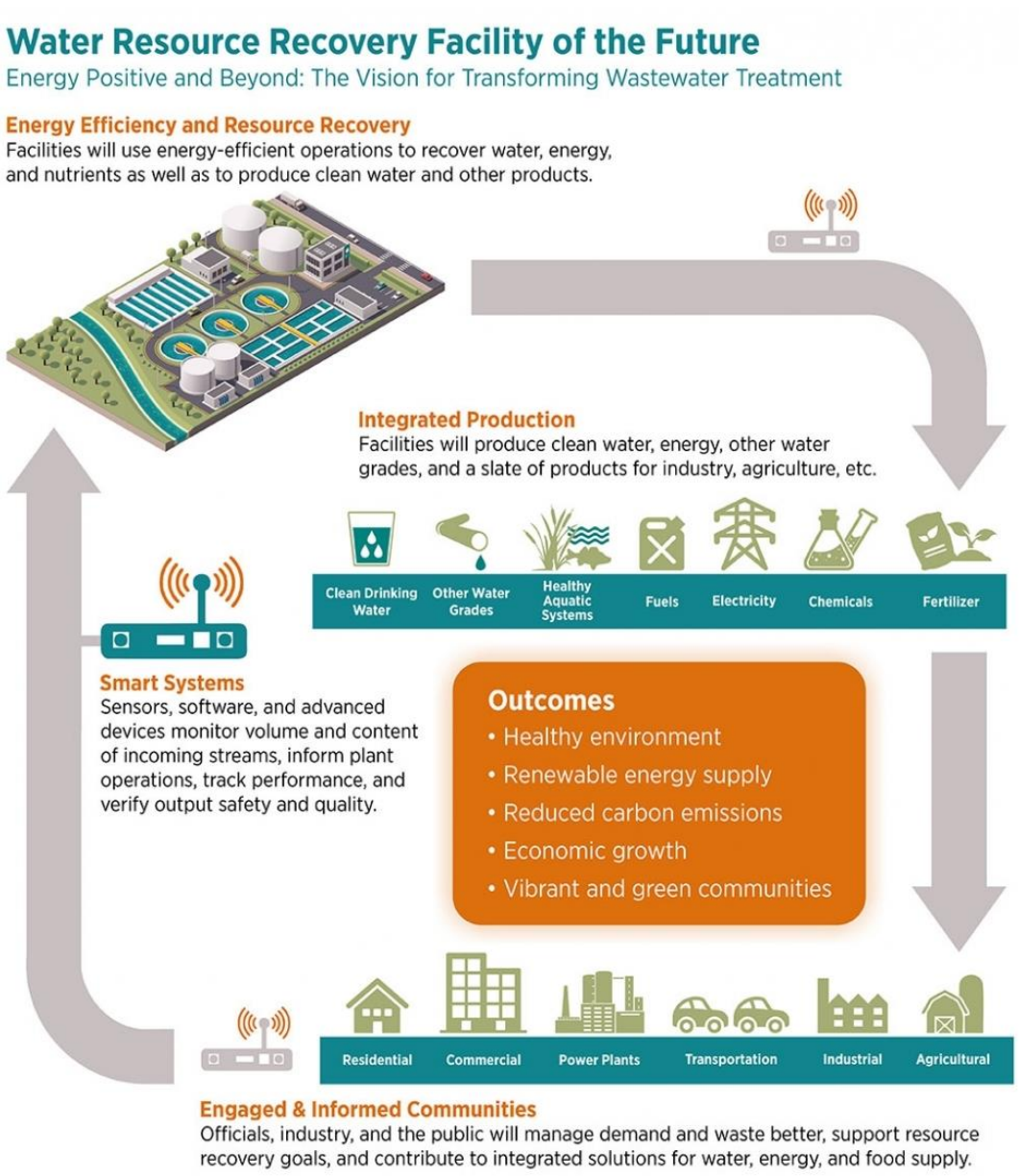

## *DOE Water Security Grand Challenge*

- **Goal 1:** Desalination
- **Goal 2:** Produced Water
- **Goal 3:** Cooling Water
- **Goal 4:** Energy Recovery
- **Goal 5:** Modular Systems

Municipal Supply | Manufacturing | Thermoelectric Cooling | Agriculture | Oil & Gas

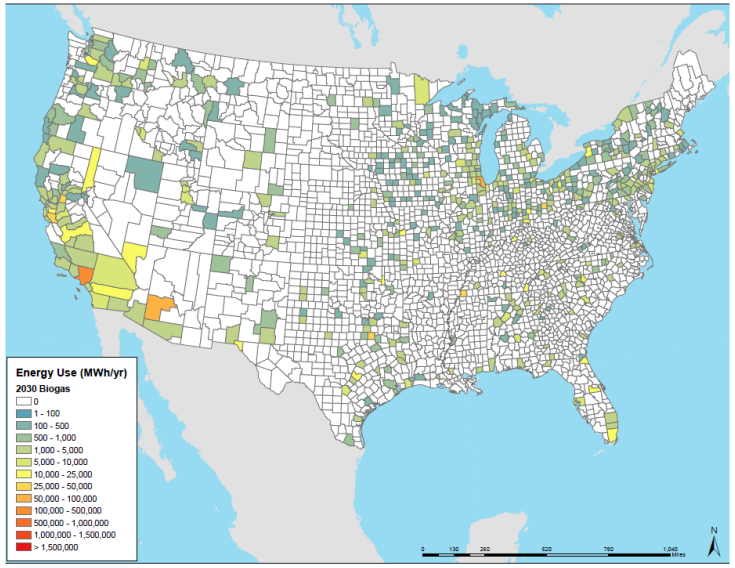
Source: Sandia 2019

# Resource Recovery




Source: DOE 2015


## *Biogas Potential*




Source: Tidwell and Moreland 2020

- $2 billion of electricity each year.
- $200 billion in future capital investment.
- Wastewater treatment plants can account for a third or more of municipal energy bills.
- Recoverable resources include:
  - Energy,
  - Nutrients for fertilizer, and
  - Clean water.

# Key Points

1. Energy-Water-Climate issues are affecting energy and water production today.

2. Without attention these issues will intensify.

3. Changes in the energy and water sectors are mitigating some climate vulnerabilities.

4. Options are available to adapt to a changing and uncertain future.

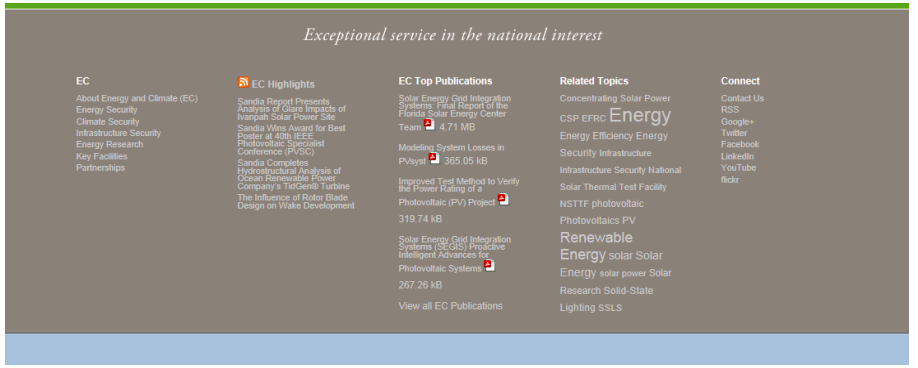
Vincent Tidwell

Sandia National Laboratories

vctidwe@sandia.gov

(505)844-6025

http://water.sandia.gov

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# State Integrated Water & Energy Planning

Carol Ward, Deputy Assistant Director, Water Planning and Permitting,
Arizona Department of Water Resources

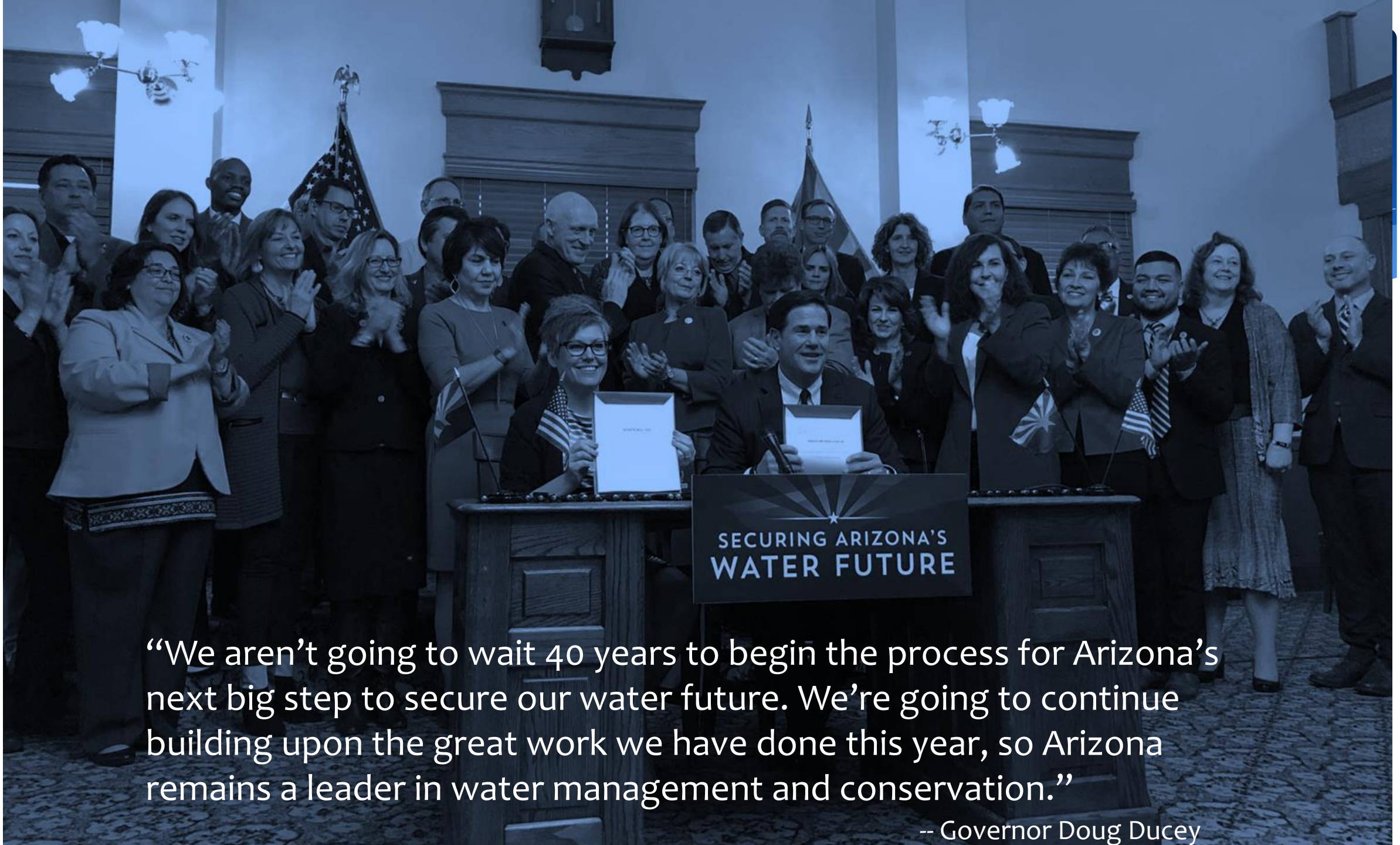
# Governor's Water Augmentation, Innovation and Conservation Council

## National Governor's Association

*Carol M. Ward, Deputy Assistant Director*

*Arizona Department of Water Resources*

*September 1, 2020*




"We aren't going to wait 40 years to begin the process for Arizona's next big step to secure our water future. We're going to continue building upon the great work we have done this year, so Arizona remains a leader in water management and conservation."

-- Governor Doug Ducey

# Structure & Function

- 43 individuals from across the state, appointed by the Governor
- Chaired by the Director of the Arizona Department of Water Resources
- May form committees – open to public
- Committees work to identify and discuss issues and develop, evaluate, and prioritize recommendations for the Council to consider
- Staffing and technical support provided by ADWR
- Meets quarterly

credit: ADWR

# Council Members

| Governor's Water Augmentation, Innovation & Conservation Council Current Members | | | |
|---|---|---|---|
| Thomas Buschatzke (Chair) | | | |
| Basilio Aja | Glenn Hamer | Maria Dadgar | Spencer Kamps |
| Chris Camacho | Grady Gammage | Mark Smith | Stefanie Smallhouse |
| Christopher Udall | Doug Dunham | Misael Cabrera | Stephen Q. Miller |
| Cheryl Lombard | Jamie Kelley | Patrick Graham | Stephen Roe Lewis |
| Craig Sullivan | Jay Whetten | Philip Townsend | Timothy Thomure |
| Dave Roberts | John Kmiec | Philip Richards | Ted Cooke |
| David Brown | Kathleen Ferris | Ronald Doba | Virginia O'Connell |
| Dennis Patch | Kevin Rogers | Sandra Fabritz | Wade Noble |
| Edward P. Maxwell | Lisa Atkins | Sarah Porter | Warren Tenney |
| | | Chuck Podolak | William Garfield |

| Legislators Participating | |
|---|---|
| Council Members Appointed by Executive Order | |
| Representative Rusty Bowers, Speaker of the House | Representative Gail Griffin |
| Karen Fann, President of the Senate | Senator Sine Kerr |
| Senator David Bradley, Senate Minority Leader | Senator Lisa Otondo |
| Representative Charlene Fernandez, House Minority Leader | Senator Victoria Steele |

# A Forum for Discussion

**The Council is a forum for discussion of water issues**

- Convenes diverse stakeholders from across the state to discuss what are often difficult, complex issues
- Encourages stakeholders to confront issues and work collaboratively to identify and develop solutions to challenges
- Builds greater understanding among stakeholders

credit: ADWR

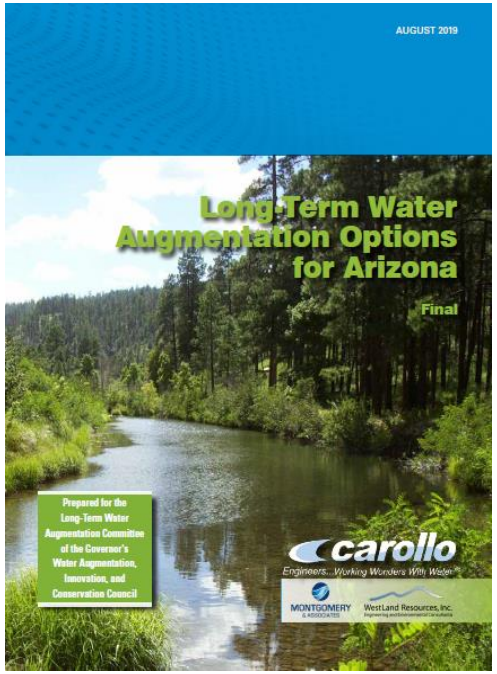
# Outcomes – Year One

**Recommendations regarding how the Council should proceed:**

- Provide direction to the Director of ADWR, upon the Director's request, on any issues that the Director determines may impact water management
- Advocate for continued implementation of water conservation measures and make additional recommendations regarding actions to be taken by ADWR with respect to conservation
- Identify augmentation opportunities, as a means to improve water supply availability to ensure legal certainty for water users and investors

# Outcomes

- In 2019, the Council released the report, *Long-Term Augmentation Options for Arizona*, which identifies the augmentation opportunities appropriate to each of the state's 22 planning areas, providing communities a prepared toolbox of solutions tailored to their area.
- Council recommended incremental increases to conservation requirements in the remaining Fourth Management Plans over what would have been essentially the status quo, in response to request from ADWR requesting their input. The Director implemented this recommendation.



# Outcomes

- Council recommended statute be amended to allow the underground storage of effluent to qualify for the accrual of long-term storage credits beyond 2025. This was achieved as part of the legislative package that enabled Arizona to enter into the Drought Contingency Plan.
- Council recommended ADWR assist providers outside of AMAs address distribution system water loss control. ADWR partnered with WIFA to implement a two-phased water loss control technical assistance program (TAP) pilot for small and mid-sized utilities. ADWR is currently funding a third phase for large utilities through the Arizona Municipal Water Users Association.

Credit: AMWUA

# Post-2025 Active Management Areas Committee

**Purpose**

identify challenges within Arizona's Active Management Areas (AMAs) and generate strategies and solutions beyond 2025

**Activities**

Groundwater Demands, Incidental Recharge & Artificial Replenishment Dashboard

First three Issue Briefs:

- Unreplenished Groundwater Withdrawals
- Exempt Wells
- Hydrologic Disconnect

**Currently under discussion:**

- Role of groundwater in the Assured Water Supply program and the Central Arizona Groundwater Replenishment District

# Non-AMA Groundwater Committee

**Purpose**

address groundwater issues outside of Active Management Areas (AMAs)

credit: cco

**Topics for Discussion**

Groundwater Management Strategies

- "Rural management areas" - alternative to the AMA or Irrigation Non-Expansion Area structures
- Water adequacy requirements
- Well spacing / well impact requirements
- Groundwater transportation basins

Data Needs, Understanding Impacts, Enabling Planning, Identifying Areas of Concern

Best Management Practices and Education

Well Monitoring or Measurement and Reporting

# Questions


Credit: ADWR

*The Council and committees' agendas, materials, presentations, recordings, summaries, and reports are available on the Council's page on the ADWR website at azwater.gov/gwaicc.*

*Carol M. Ward*
*Deputy Assistant Director*
cward@azwater.gov
azwater.gov/gwaicc

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# Break Until 2:00

NATIONAL GOVERNORS ASSOCIATION

# Wisconsin Focus on Energy Program

Joseph Cantwell, Senior Energy Engineer, Focus on Energy


# Energy Best Practices Guide: Water & Wastewater Industry Best Practice Manual

Presented by: **Joseph Cantwell**

September 1, 2020

focus on energy®
Partnering with Wisconsin utilities

# What is Focus on Energy?

focus on energy®
Partnering with Wisconsin utilities

## Wisconsin utilities' statewide program for energy efficiency and renewable energy


- Created in 2001 by Act 141 Wis. Stat. § 196.374(2)(a)
- Funded by rate payers of state's investor-owned and participating municipal & co-op utilities
- Provides financial and technical support to undertake projects that otherwise would not be implemented.

WISCONSIN

# About Us

focus on energy®
Partnering with Wisconsin utilities

- **FOCUS ON ENERGY®** empowers the people and businesses of Wisconsin to make smart energy decisions with enduring economic benefits. Since 2001, Wisconsin's energy efficiency and renewable resource program has stayed true to that mission statement. On behalf of 107 Wisconsin electric and natural gas utilities, Focus on Energy's information, resources and financial incentives benefit all Wisconsinites by implementing energy efficiency and renewable energy projects that otherwise wouldn't happen, or in some cases years sooner than scheduled.

WISCONSIN

# Introduction

- The objective of the Best Practice Manual was to provide information and resources to assist the W/WW industry to identify, assess and implement energy efficiency and renewable energy opportunities
- Provide information in a format that anyone can understand
- Developed because research did not identify an existing document to provide similar information
- Utilized as a tool to deliver the program and assist in implementation of the program
- Manual accepted because a committee of consultants, equipment suppliers, regulatory and program representatives were involved- actually a letter from the WDNR urging its use was obtained

# Why Energy Efficiency at W/WW

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- Water /Wastewater systems need to provide service continuously
- Wastewater treatment systems are generally biological systems thus they operate 8760 hours/year – no time off - vacation – holidays
- Operating 8760 hours compared to a 40 hour work week 2080 hours/year provides:  8760/2080 = **4.2** more time for savings

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# Why are there EE opportunities

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- Facilities sized per codes for twenty year projected flows and loadings
- Capability to meet 20 year projected peak conditions also required
- Redundant equipment required
- Usually assumed all equipment needs to operated
- Priority to meet water quality standards
- Rarely to never see their energy bills
- Not aware of the information on their energy bill

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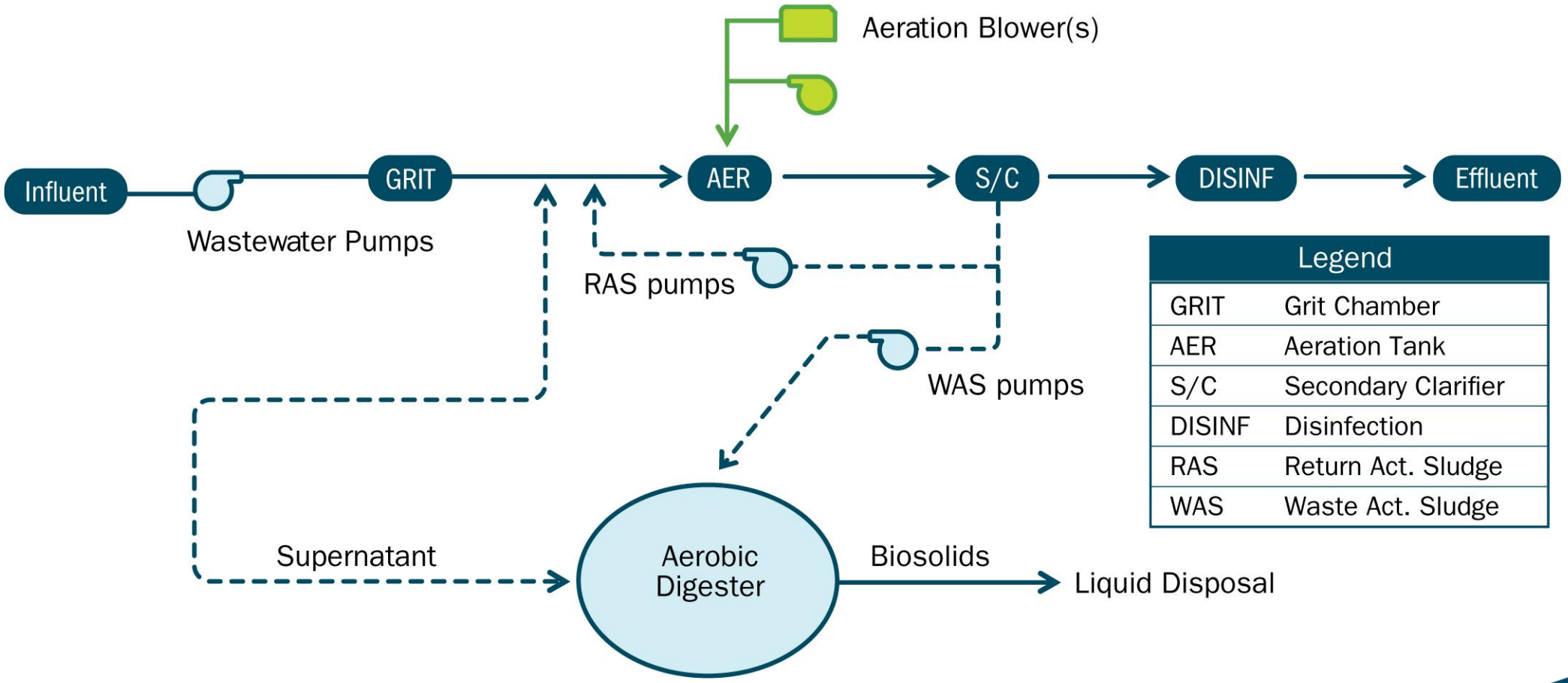
# Small Wastewater System Process Flow Diagram




| Legend | |
|---|---|
| GRIT | Grit Chamber |
| AER | Aeration Tank |
| S/C | Secondary Clarifier |
| DISINF | Disinfection |
| RAS | Return Act. Sludge |
| WAS | Waste Act. Sludge |

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# Large Wastewater System Process Flow Diagram

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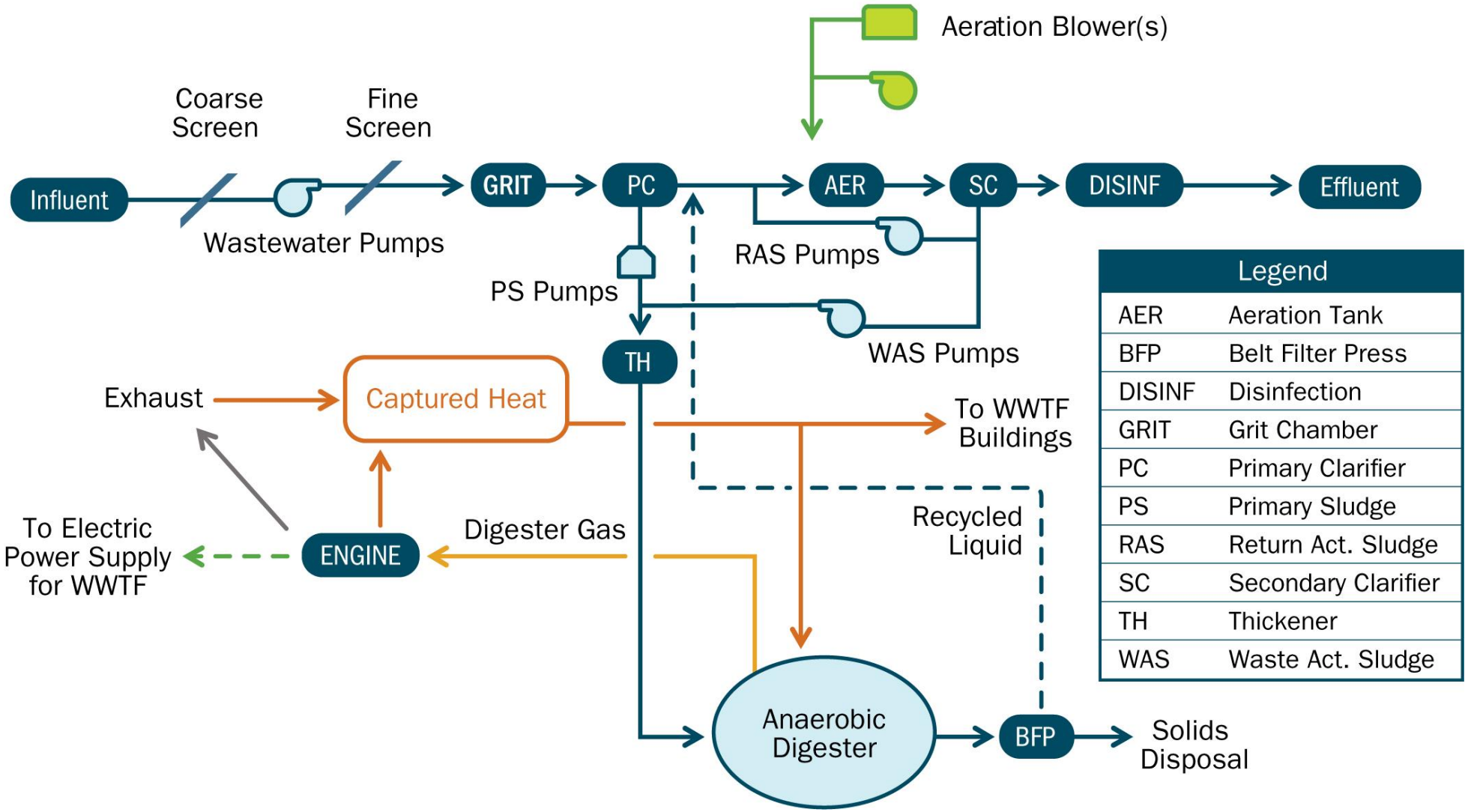


| Legend | |
|---|---|
| AER | Aeration Tank |
| BFP | Belt Filter Press |
| DISINF | Disinfection |
| GRIT | Grit Chamber |
| PC | Primary Clarifier |
| PS | Primary Sludge |
| RAS | Return Act. Sludge |
| SC | Secondary Clarifier |
| TH | Thickener |
| WAS | Waste Act. Sludge |

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# Table of Contents of Manual

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# Basic Steps in Building an Energy Management Program


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# Appendices

- Baseline Energy Use and KPI
- Understanding Your Electric Bill
- Economic Evaluation Process
- Small Utility Energy Management Checklists
- Additional Resources

# Questions – Comments - Contact Information

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Focus on Energy
Leidos Engineering, LLC
Telephone: 262-786 – 8221
Joe.Cantwell@focusonenergy.com

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# Wisconsin Benchmarking Energy Performance

Megan Levy, Local Energy Programs Manager & Energy Assurance Coordinator, Wisconsin Office of Energy Innovation

# Best Practices in Benchmarking Energy Performance at Water and Wastewater Treatment Facilities

## Examining Data From 584 Resource Recovery Facilities Across Wisconsin 2016-2018

Megan Levy
NGA Energy Water Nexus Learning Lab
September 2020

OEI
Wisconsin Office of Energy Innovation

# Presentation Overview

- Why Address Energy Use Through Regulatory Reports?
- Collaborative Process to Develop Questions
- Process Questions
- Facility Distribution
- What The Data Is Telling Us
- Summary – Actions – Q & A

# Why Address Energy Use Through the Regulatory Process

One of the primary purposes of the Compliance Maintenance Annual Report (CMAR) is to foster **communication**.

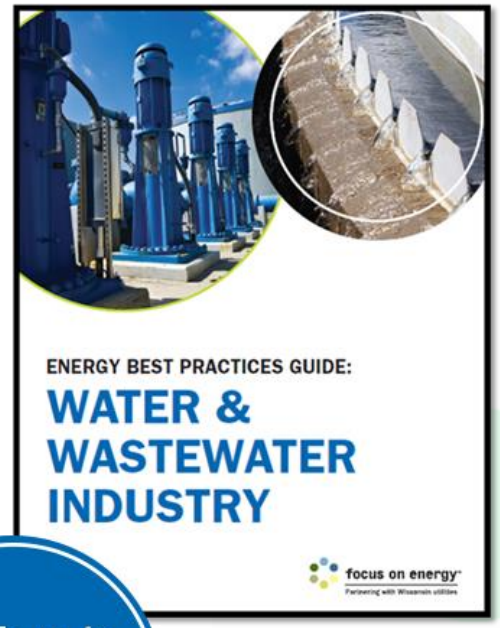
Communication of Wastewater Resource Recovery Facilities needs among **operators, governing bodies**, and the **DNR**.

This project allows the CMAR to become an educational tool that increases awareness of the importance and **value** of wastewater treatment **energy efficiency.**

# Why Address Energy Use Through the CMAR?

The Clean Water Loan Fund requires an Energy Audit, first step of energy audit is to create an energy use baseline.

Focus on Energy provides energy efficiency incentives to Wisconsin Wastewater Treatment Facilities.


Click here to download your free guide!



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Wisconsin Office of Energy Innovation

# Collaborative Process to Develop Questions

**Design Phase (2015)**

CMAR Energy External Workgroup with in-person meetings to develop the new questions and data table with the charge of keeping it short, simple and easy to complete.

**Jack Saltes** – DNR Madison
**Joe Cantwell**, Focus On Energy
**Jeremy Cramer**, Fond du Lac WWTP
**Kevin Freber**, Watertown WWTP
**Sharon Thieszen**, Sheboygan WWTP
**Gary Hanson**, Short Elliot Hendricksen
**Steve Ohm**, DNR-Rhinelander
**David Argall**, DNR-Madison
**Megan Levy**, OEI
**Kevin Splain**, OEI

WWOA Wisconsin Wastewater Operators' Association

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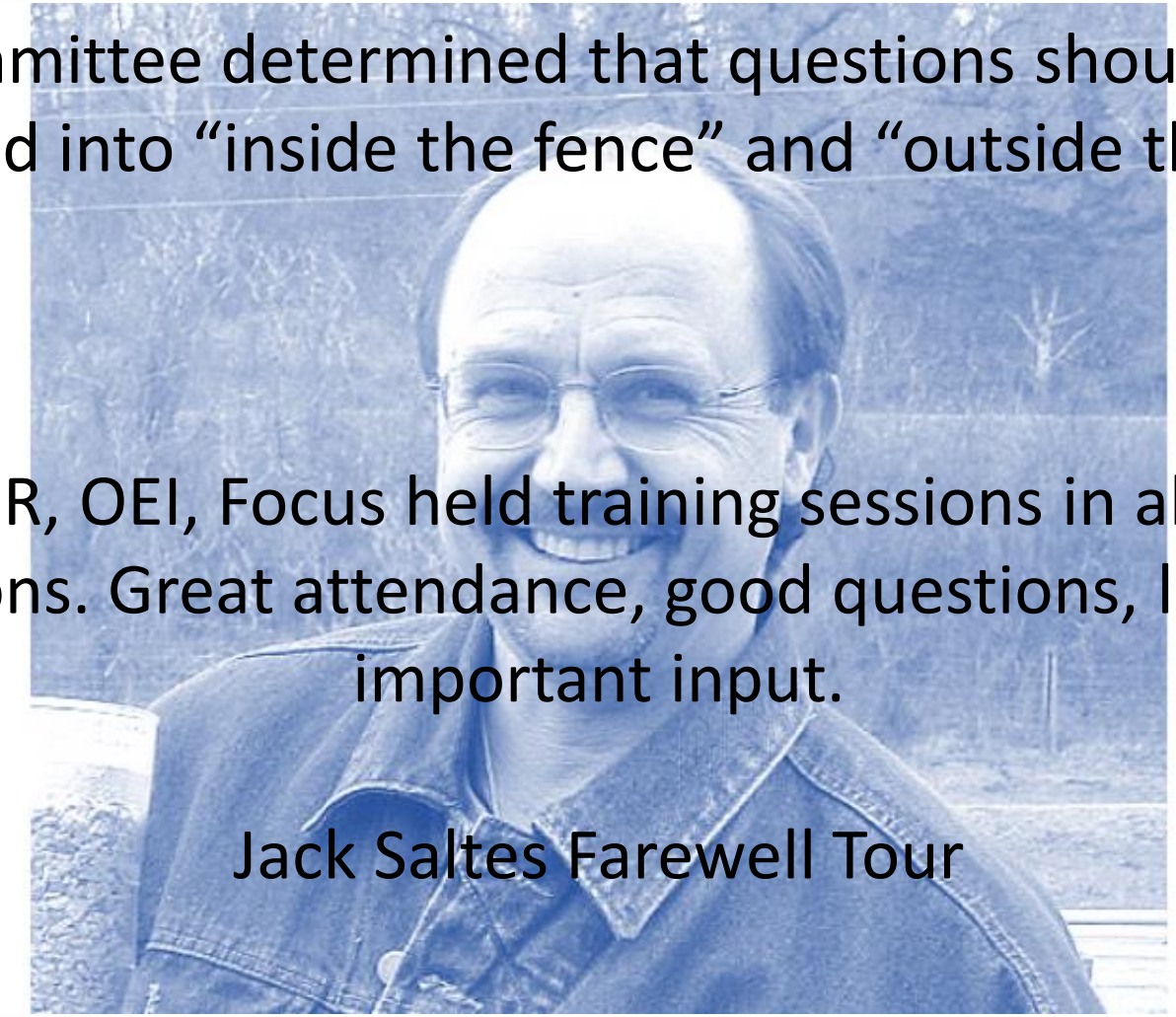
Wisconsin Department of Natural Resources

OEI
Wisconsin Office of Energy Innovation

# Initial Questions on Energy Use/ Training Initiative

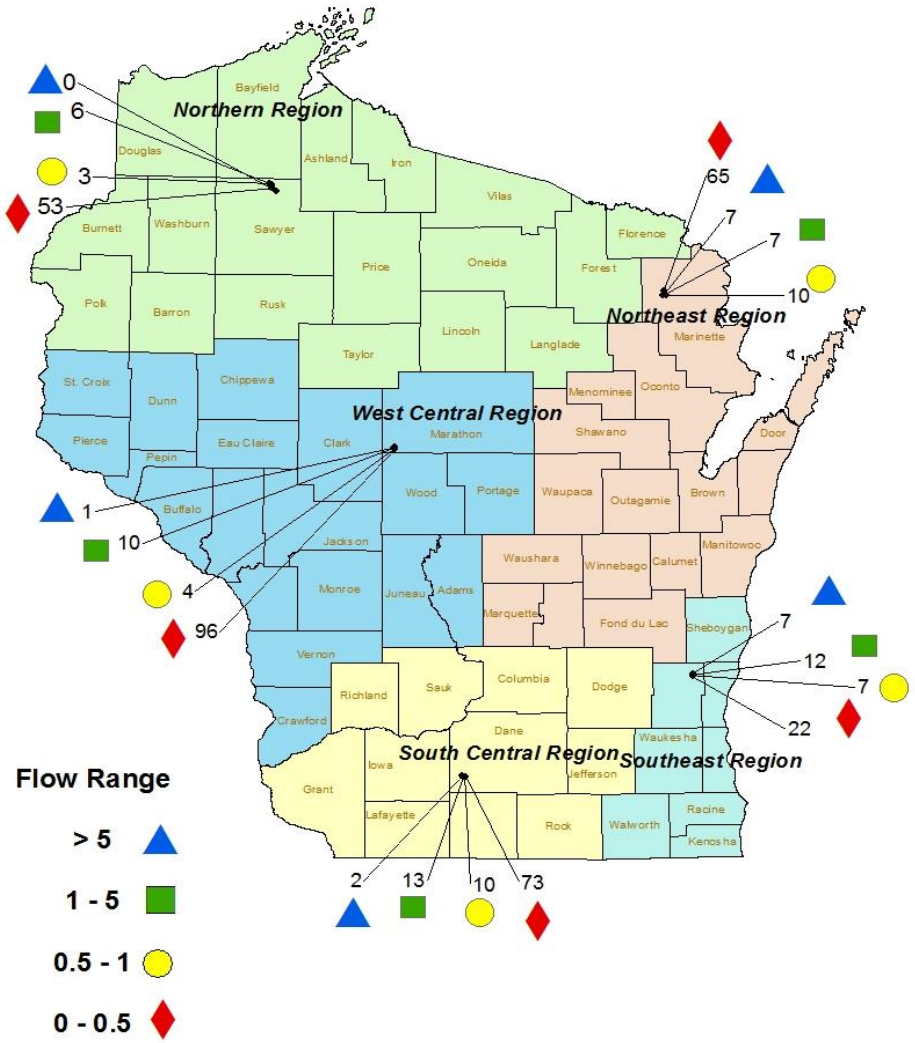
Committee determined that questions should be separated into “inside the fence” and “outside the fence”



WDNR, OEI, Focus held training sessions in all DNR regions. Great attendance, good questions, lots of important input.

Jack Saltes Farewell Tour

# Facility Distribution Across the State






Wisconsin Office of Energy Innovation

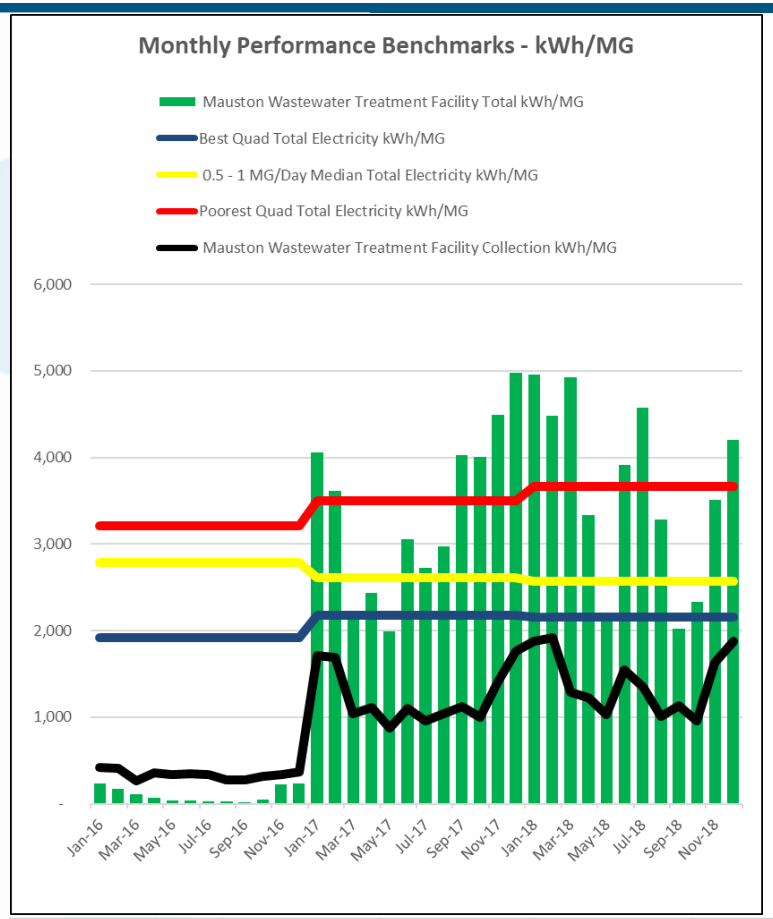
# Process Questions

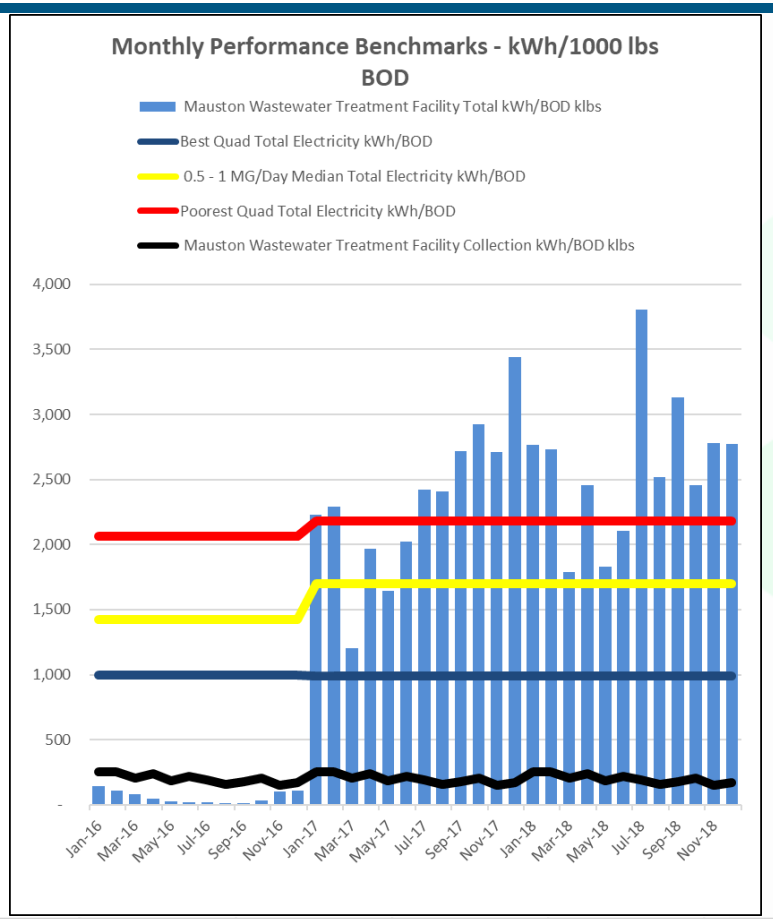
7.2 Energy Related Processes and Equipment

7.2.1 Indicate equipment and practices utilized at your treatment facility (Check all that apply):

- ☐ Aerobic Digestion
- ☐ Anaerobic Digestion
- ☐ Biological Phosphorus Removal
- ☐ Coarse Bubble Diffusers
- ☐ Dissolved O2 Monitoring and Aeration Control
- ☐ Effluent Pumping
- ☐ Fine Bubble Diffusers
- ☐ Mechanical Sludge Processing
- ☐ Nitrification
- ☐ SCADA System
- ☐ UV Disinfection
- ☐ Variable Speed Drives
- ☐ Other:

# Facility Performance and Benchmarking Analysis




Water and/or wastewater utility managers index their facility's energy usage through a production or demand index, such as kWh/MGD or kWh per 1,000lb of Biological Oxygen Demand (BOD). This index is called a Key Performance Index (KPI) or Energy Performance Index (EPI). Establishing an energy baseline helps facility managers understand the relative efficiency or change in efficiency relative to the core purpose of the operation, i.e., water production or wastewater treatment. It is recommended utilities set a goal to save five to ten percent of its energy after it has implemented energy efficiency measures, a new annual average line is set as the targeted KPI level with monthly Monitoring & Verification (M&V).

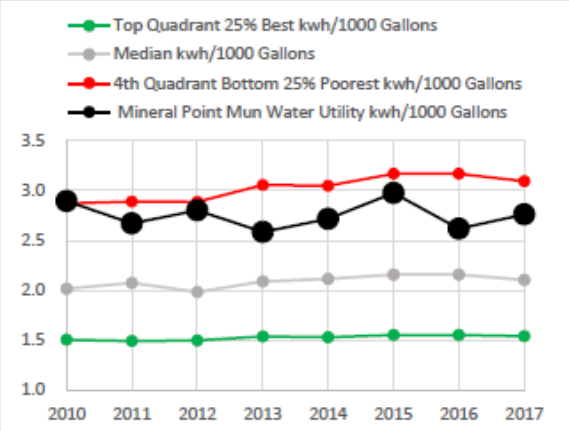
# Water Utility Analysis

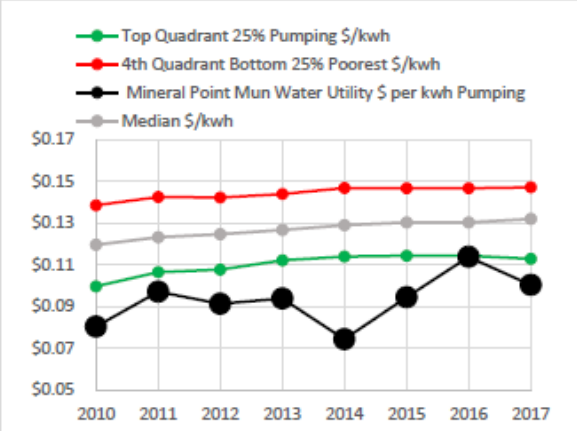
**Quartile Statistical Benchmarks where 1 = Top Quadrant 25% Best, 2 = 2nd Quadrant Good, 3 = 3rd Quartile below Median & 4 = 4th Quadrant Bottom 25% Poorest**

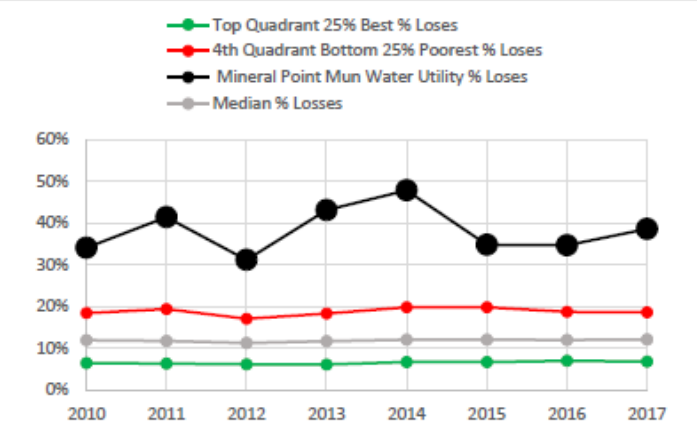
| Utility ID | Utility | Performance Benchmark | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2010-2017 Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3740 | Mineral Point Mun Water Utility | kwh/1000 Gal Quad | 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 3740 | Mineral Point Mun Water Utility | % Water Losses Quad | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 3740 | Mineral Point Mun Water Utility | $ per kwh Pumping Quad | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3740 | Mineral Point Mun Water Utility | $ per 1000 Gallons Quad | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |

*Water utilities with benchmarks of 3 (Yellow) and 4 (Red) can request that MEETAP prepare a system analysis of wells, towers and pumps to estimate demand, energy and cost savings (capacity and average operating characteristics – on-peak, capacity factor, constant flow high pressure control vs variable flow constant pressure, etc.).*

| Utility ID | Utility | Performance Benchmark | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2010-2017 Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3740 | Mineral Point Mun Water Utility | kwh/1000 Gallons | 2.89 | 2.67 | 2.80 | 2.58 | 2.72 | 2.97 | 2.62 | 2.76 | 2.75 |
| 3740 | Mineral Point Mun Water Utility | % Water Losses | 34.07% | 41.39% | 31.15% | 43.07% | 47.78% | 34.77% | 34.66% | 38.55% | 38.18% |
| 3740 | Mineral Point Mun Water Utility | $ per kwh Pumping | $ 0.08 | $ 0.10 | $ 0.09 | $ 0.09 | $ 0.07 | $ 0.09 | $ 0.11 | $ 0.10 | $ 0.09 |
| 3740 | Mineral Point Mun Water Utility | $ per 1000 Gallons | $ 0.23 | $ 0.26 | $ 0.26 | $ 0.24 | $ 0.20 | $ 0.28 | $ 0.30 | $ 0.28 | $ 0.26 |



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# Top 25 Low Cost No Cost Measures to Implement


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# 2017 Energy Advisor Territory Map

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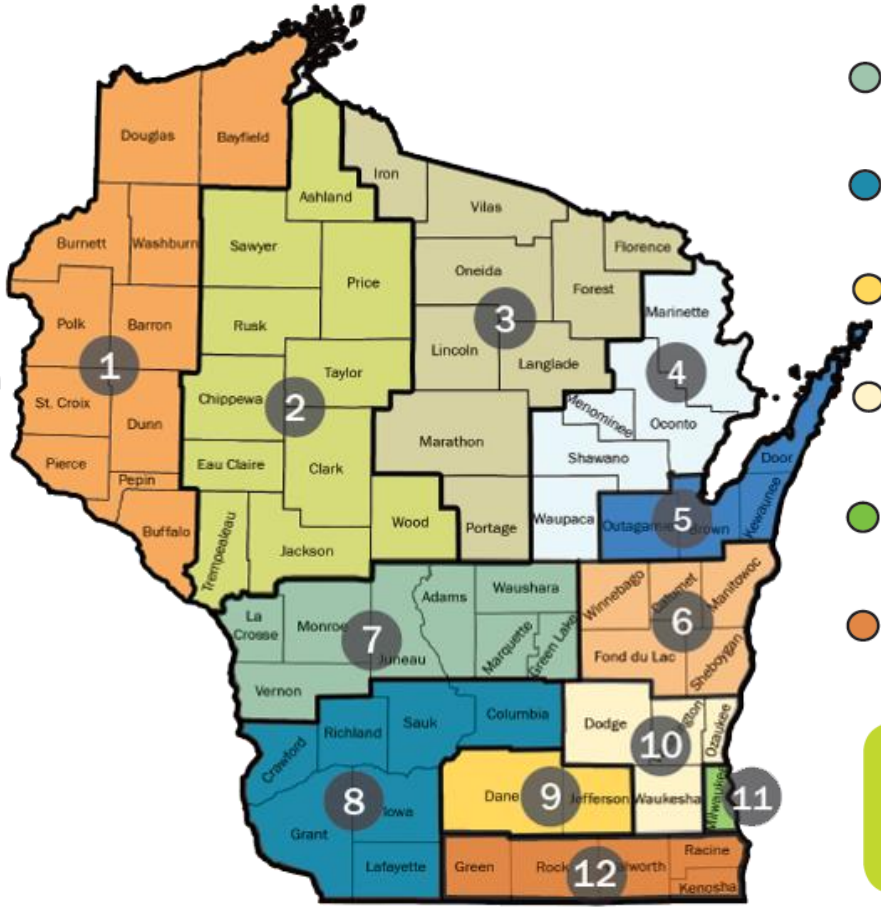


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715.720.2180

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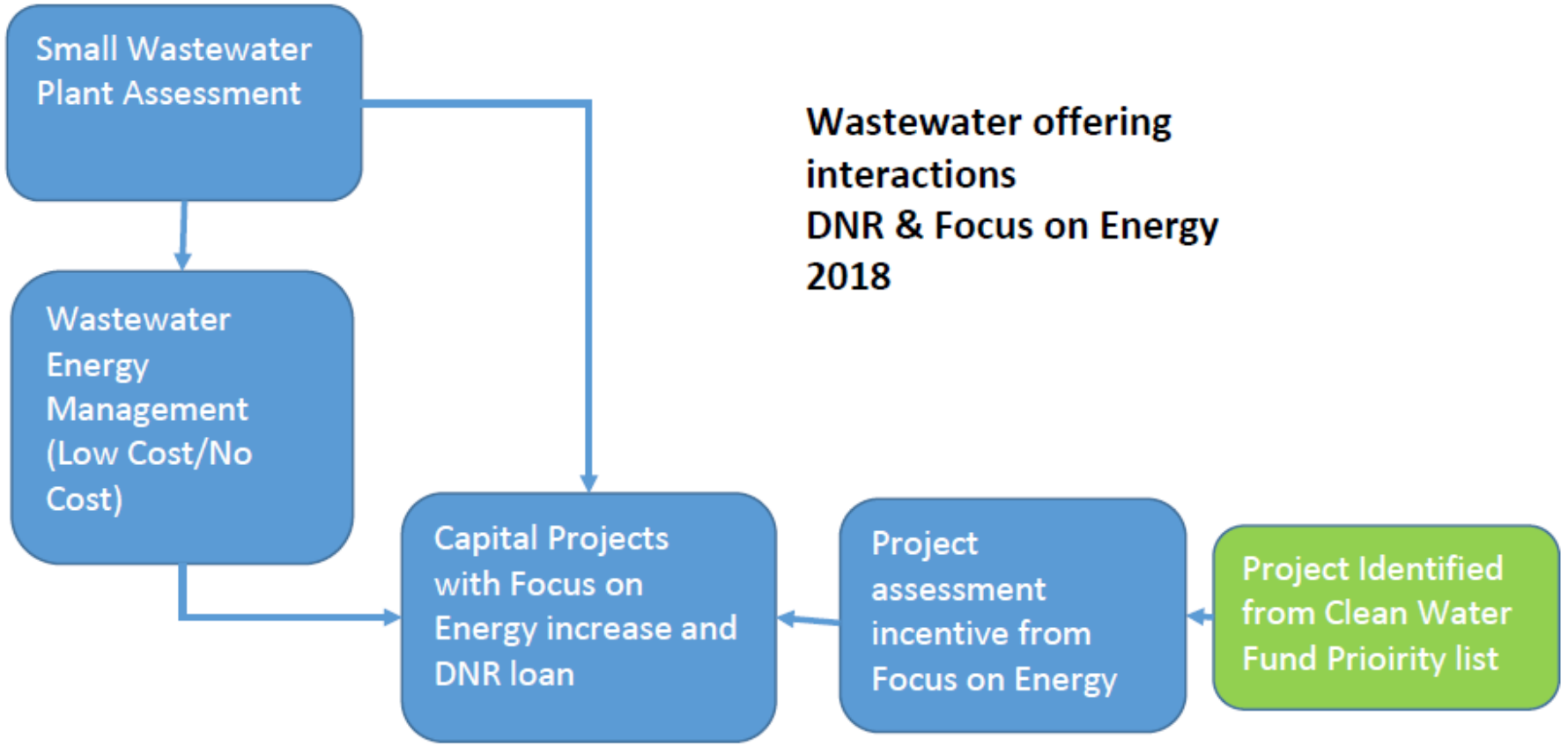
# Take Away & Actions






Wisconsin Office of Energy Innovation

NATIONAL GOVERNORS ASSOCIATION

# State Team Time

NATIONAL GOVERNORS ASSOCIATION

# Break Until 3:30

NATIONAL GOVERNORS ASSOCIATION

# State and Partner Best Practices for Education & Outreach

Speakers:

Megan Levy, Local Energy Programs Manager & Energy Assurance Coordinator, Wisconsin Office of Energy Innovation

Warren Tenney, Executive Director, Arizona Municipal Water Users Association

Facilitator:

Jessica Rackley, Program Director, NGA Center for Best Practices

# Connecting the Dots

## Best Practices in Outreach and Education

### Collaboration Between State Agencies to Better Serve Wisconsin's Citizens

Megan Levy

## NGA Energy Water Nexus Learning Lab

## September, 1 2020

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# Education and Outreach Initiative

One of the primary purposes of the Compliance Maintenance Annual Report (CMAR) is to foster **communication**.

Communication of Wastewater Resource Recovery Facilities needs among **operators, governing bodies**, and the **DNR**.

This project allows the CMAR to become an educational tool that increases awareness of the importance and **value** of wastewater treatment **energy efficiency.**

Further this project involved **OEI and Focus on Energy, non-regulatory partners.**

# Education and Outreach Initiative

Partnership with DNR enabled CEU for operators.
**Fostered very good attendance.**

# Benchmarking Tool for Communication

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## Wastewater Treatment Facility Energy Tracking Tool Dashboard

a MEETAP tool for energy usage tracking

Save & Close | Save & Create New

**Contact Info:**
Megan Levy, MEETAP Manager
megan.levy@wisconsin.gov
(608) 266 - 5054

Welcome to the Wastewater Treatment Facility Energy Tracking Tool!

ContactInformation

| Full Name | Phone | Email |
|---|---|---|
| | | |

Address 1 | City

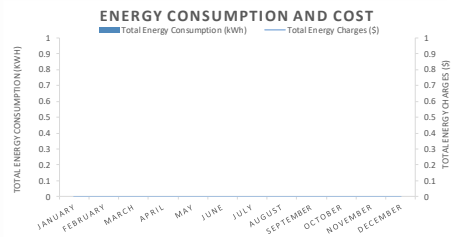
Address 2 | State | Zip

The Wastewater Treatment Facilitiy Energy Tracking Tool was developed by MEETAP to help WWTF operators easily track facility energy usage. For questions or comments, contact OEI staff. Follow the instructions below :

**1. Collect energy usage information** - gather all utility bills for all components of your facility (i.e. Lift Stations, Grinder Pumps, Administrative Offices, etc.)

**2. Enter bill data** - enter the appropriate bill data into the tables following the into their appropriate pages. Calculated columns won't allow you to edit them.

**3. Track your energy usage** - The Summary Data button will bring you to the summary dashboard. It will populate once you have entered billing data in the appropriate tables.




**Input Data**

- Electricity Other
- Lift Stations
- Grinder Pumps
- Natural Gas
- Flow Data

**Generate Graph**

- Energy Consumption & Cost
- On-Peak Demand
- Natural Gas Use and Cost
- Total Flow & Energy Efficiency

**Electricity Summary Table**

| Month | Total Energy Consumption (kWh) | Total Energy Charges ($) | On-Peak Demand (kW) | On Peak (kWh) | Total Demand Charges | Off Peak (kWh) | Daily Average Energy |
|---|---|---|---|---|---|---|---|
| January | - | $ - | - | - | $ - | - | - |
| February | - | $ - | - | - | $ - | - | - |
| March | - | $ - | - | - | $ - | - | - |
| April | - | $ - | - | - | $ - | - | - |
| May | - | $ - | - | - | $ - | - | - |
| June | - | $ - | - | - | $ - | - | - |
| July | - | $ - | - | - | $ - | - | - |
| August | - | $ - | - | - | $ - | - | - |
| September | - | $ - | - | - | $ - | - | - |
| October | - | $ - | - | - | $ - | - | - |
| November | - | $ - | - | - | $ - | - | - |
| December | - | $ - | - | - | $ - | - | - |
| Year Total | - | $ - | - | - | $ - | - | - |

**Natural Gas Summary Table**

| Month | Total therms used | Total Charges ($) | Therms/Day | Natural Gas Use (Mmbtu) | Average Cost ($/therm) |
|---|---|---|---|---|---|
| January | - | - | - | - | - |
| February | - | - | - | - | - |
| March | - | - | - | - | - |
| April | - | - | - | - | - |
| May | - | - | - | - | - |
| June | - | - | - | - | - |
| July | - | - | - | - | - |
| August | - | - | - | - | - |
| September | - | - | - | - | - |
| October | - | - | - | - | - |
| November | - | - | - | - | - |
| December | - | - | - | - | - |
| Year Total | - | - | | - | |

**Flow Summary Table**

| Month | Monthly Total Flow to Facility (MG) | Monthly Total BOD to Facility (lbs) | Total kWh/Total Flow (kWh/MG) | Total kWh/Total BOD (kWh/lb) |
|---|---|---|---|---|
| January | - | - | - | - |
| February | - | - | - | - |
| March | - | - | - | - |
| April | - | - | - | - |
| May | - | - | - | - |
| June | - | - | - | - |
| July | - | - | - | - |
| August | - | - | - | - |
| September | - | - | - | - |
| October | - | - | - | - |
| November | - | - | - | - |
| December | - | - | - | - |
| Year Total | - | - | | |



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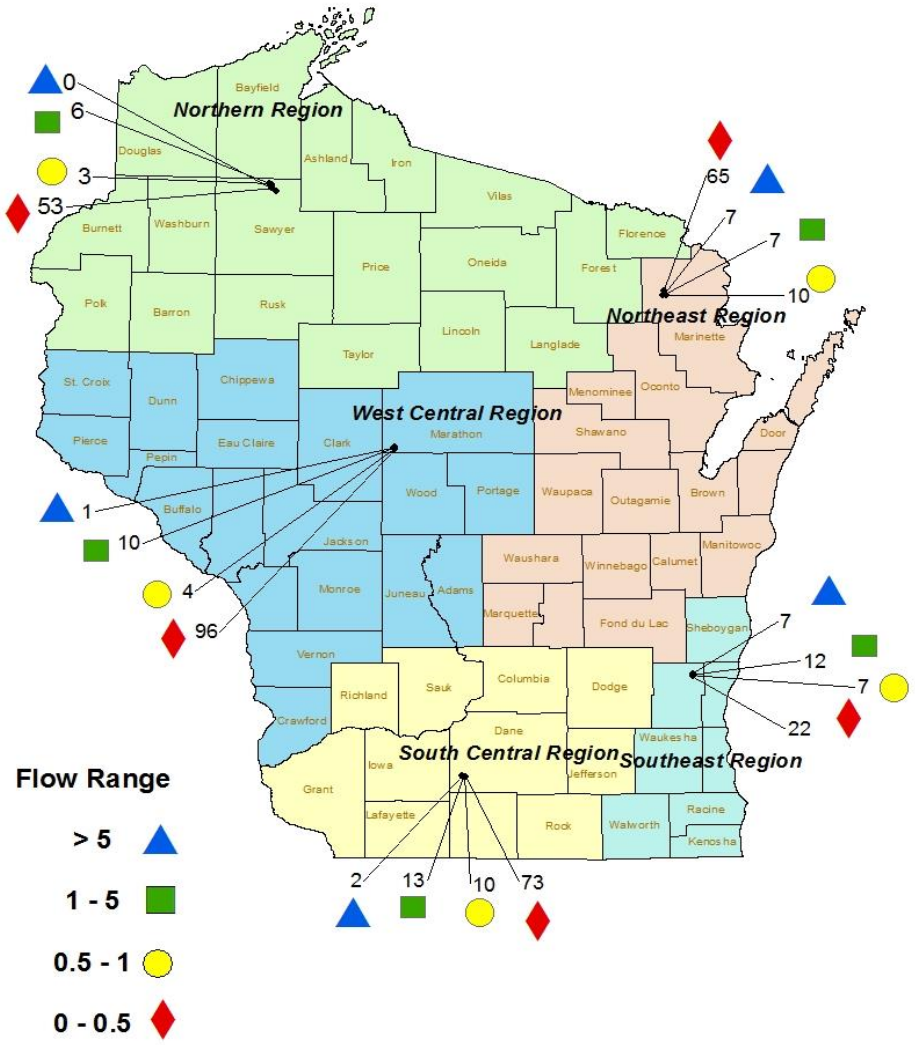
# Facility Distribution Across the State



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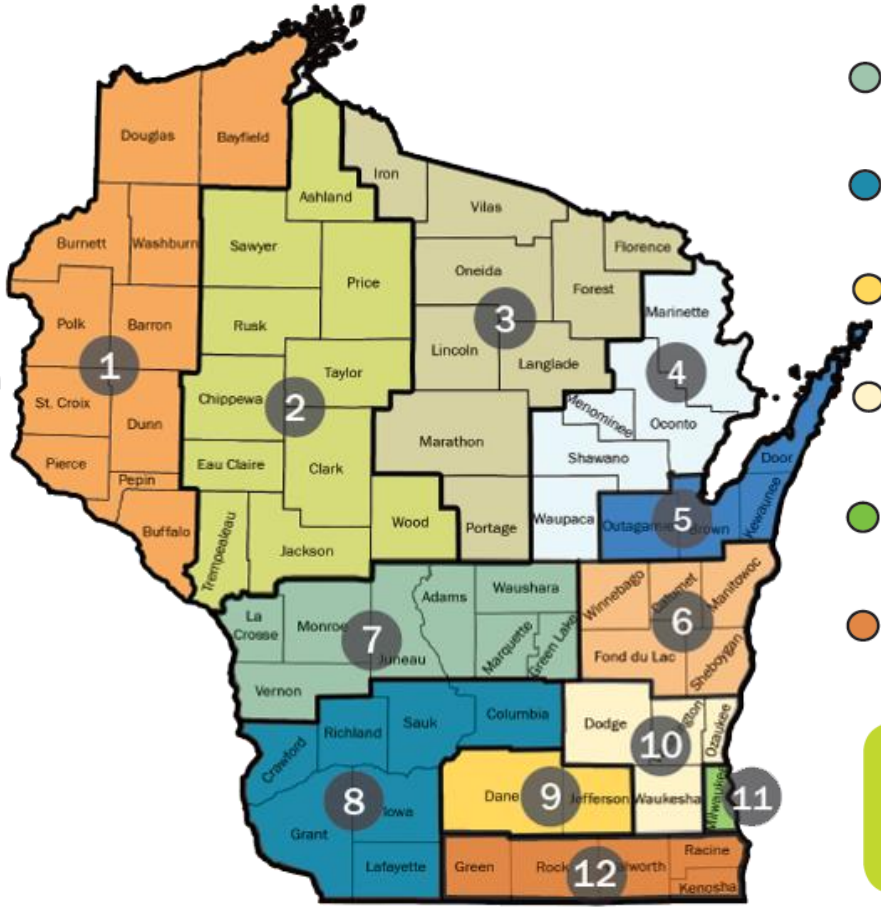


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# National Governors Association

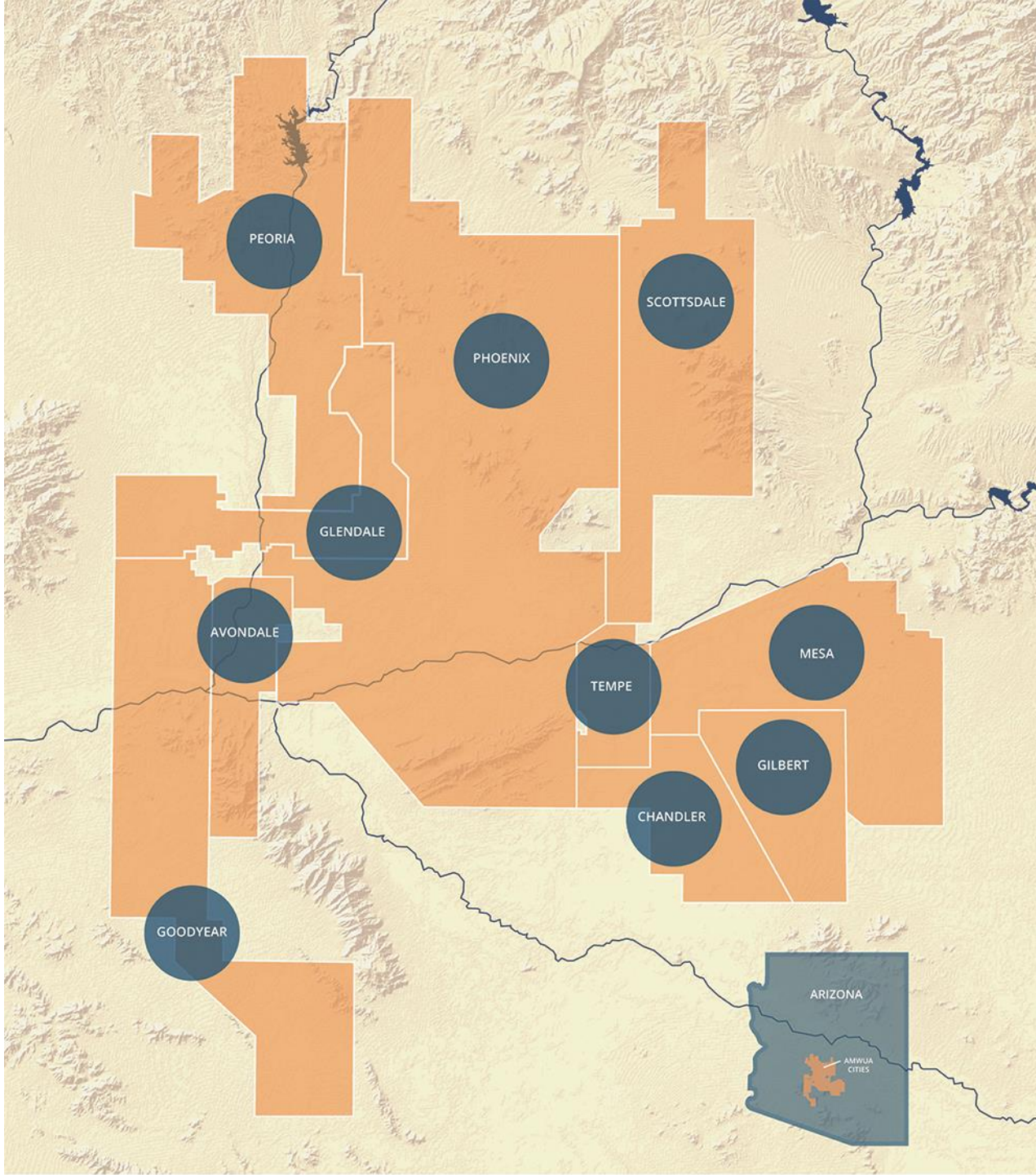
# Water Energy Nexus Learning Lab

*September 1, 2020*

amwua

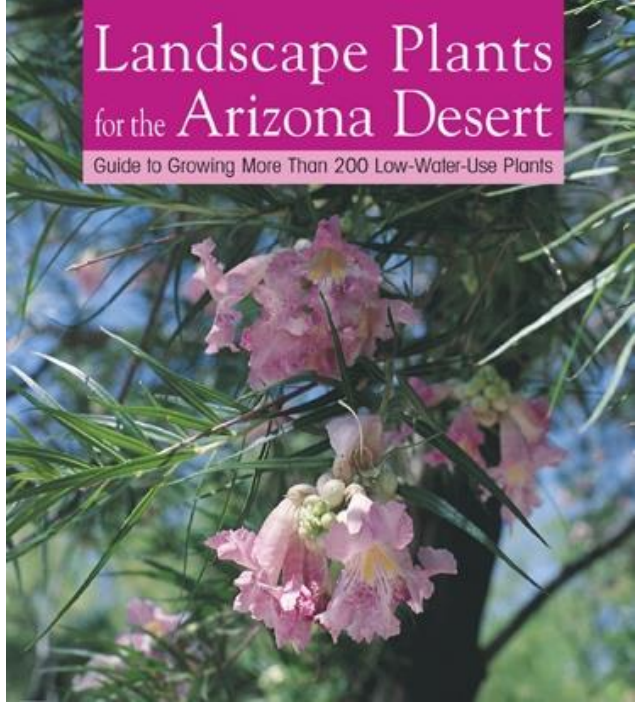
ONE FOR WATER™

# Arizona Municipal Water Users Association



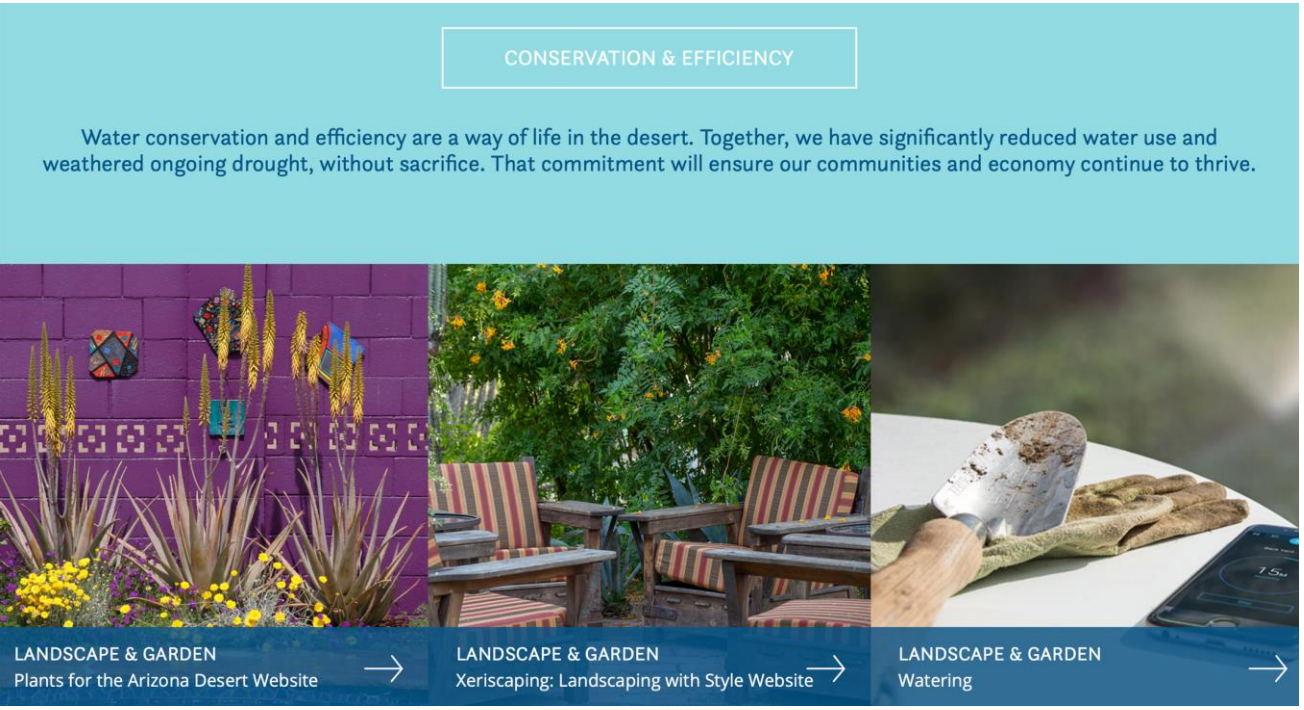
# Regional Approach to Water Conservation

- Collaborate with members and regional partners to create consistent messaging about the importance of appropriate landscapes in the desert.
- Creating a foundation for a conservation culture.

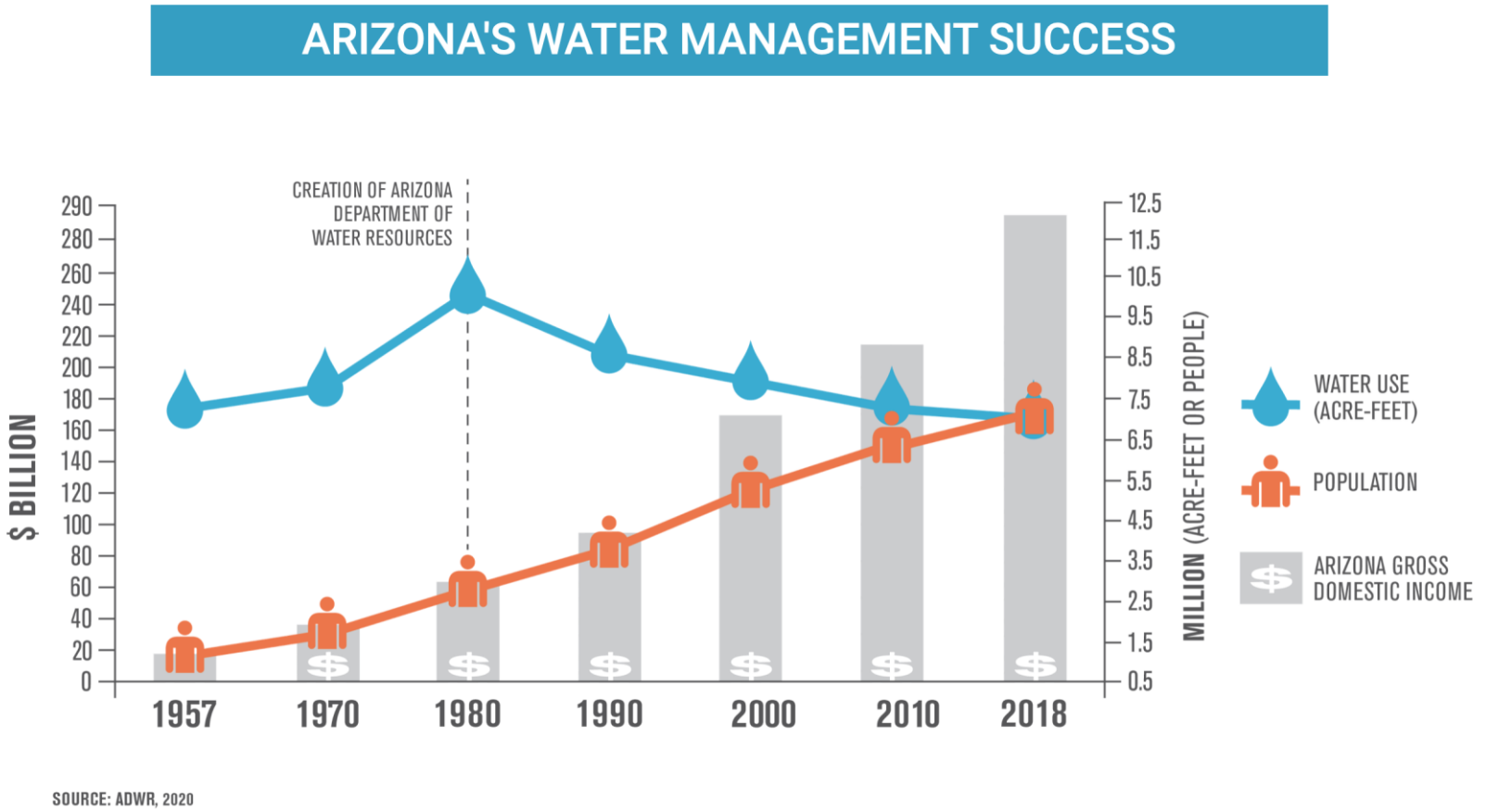

# Desert-Adapted Landscapes

- Printed and online resources were developed to educate the public on all elements of creating and maintaining a desert-adapted landscape.




# Water Efficiency

- Provide the forum for our members to share ways to improve efficiencies
  - WaterSense
  - Water Loss Control
  - Recycled Water


# Water Management Success

- Facilitate
- Collaborate
- Educate
- Advocate

NATIONAL GOVERNORS ASSOCIATION

# Report Out and Conclude Day 1

NATIONAL GOVERNORS ASSOCIATION

# Welcome Day 2

# Water Energy Nexus Learning Lab Agenda

| Day 2 - Wednesday | |
|---|---|
| 12:00-12:30 pm | Data Use and Benchmarking for Energy and Water Efficiencies |
| 12:30-1:15 pm | Cross Sector Savings Opportunities at Water and Power Utilities |
| 1:15 -2:00 pm | Agricultural Sector Water Use Efficiency |
| *2:00-2:30 pm* | *Break* |
| 2:30-3:15 pm | Funding & Financing |
| 3:15-4:00 pm | State Team Time |
| 4:00-4:20 pm | Report Out and Conclude Day 2 |

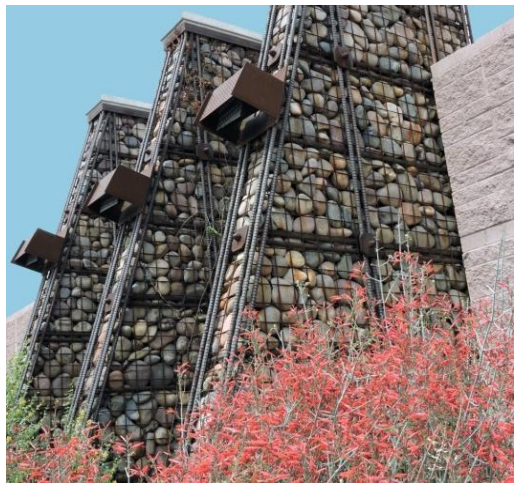
NATIONAL GOVERNORS ASSOCIATION

# Data Use and Benchmarking for Energy and Water Efficiencies

Brian Biesemeyer, Executive Director, Scottsdale Water

# SCOTTSDALE WATER



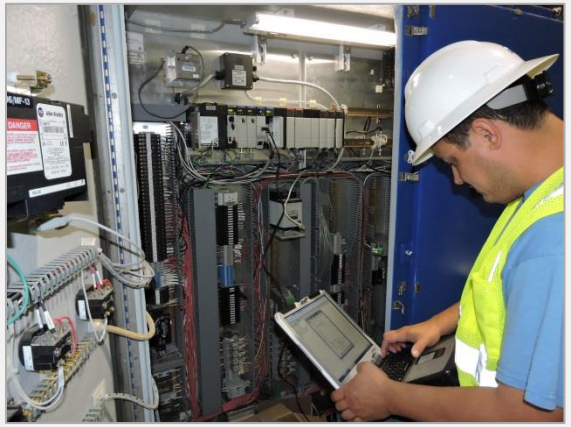




Balancing Energy and Water Efficiencies

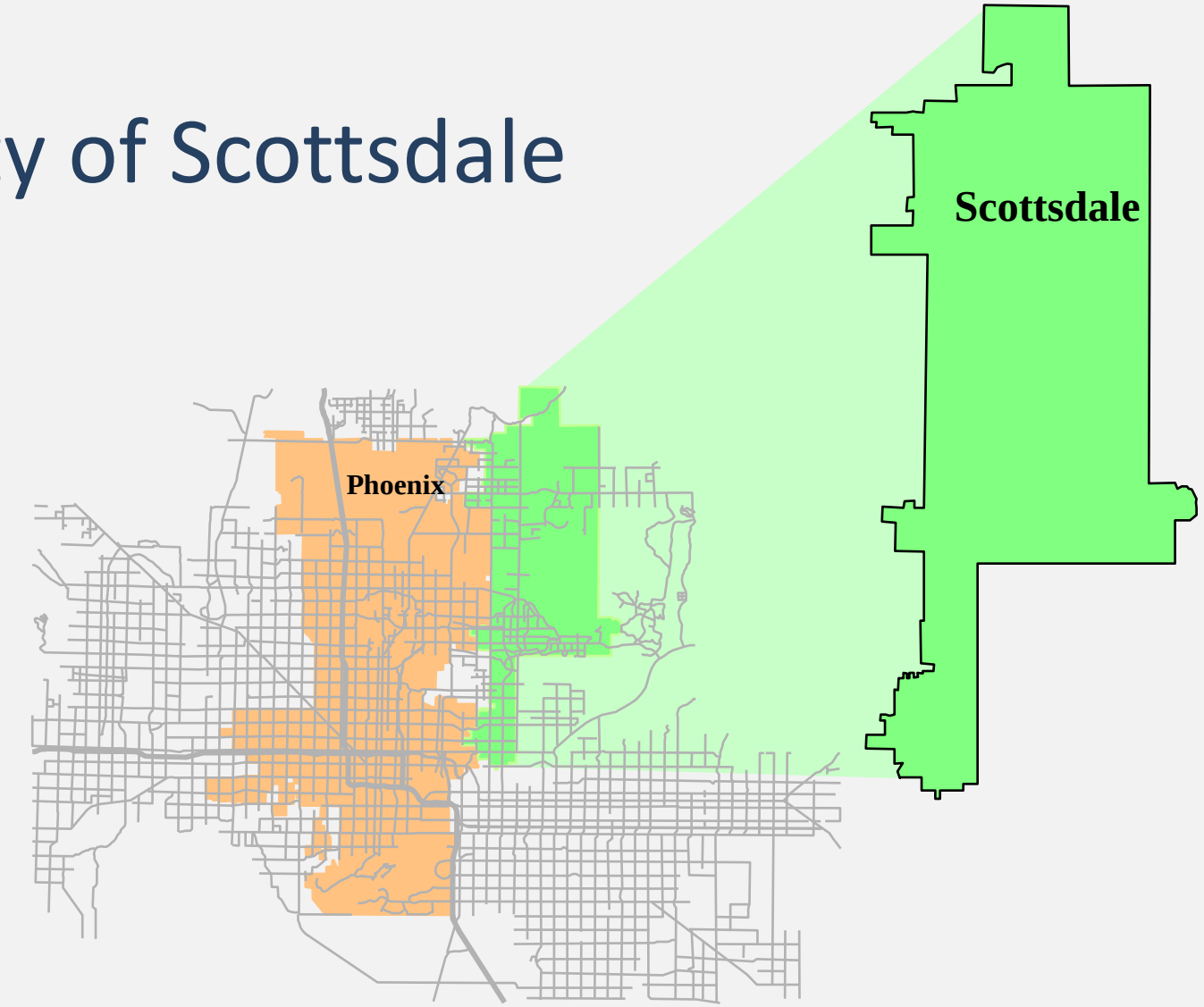
Brian K. Biesemeyer, P.E.

CITY OF SCOTTSDALE

# About Scottsdale Water

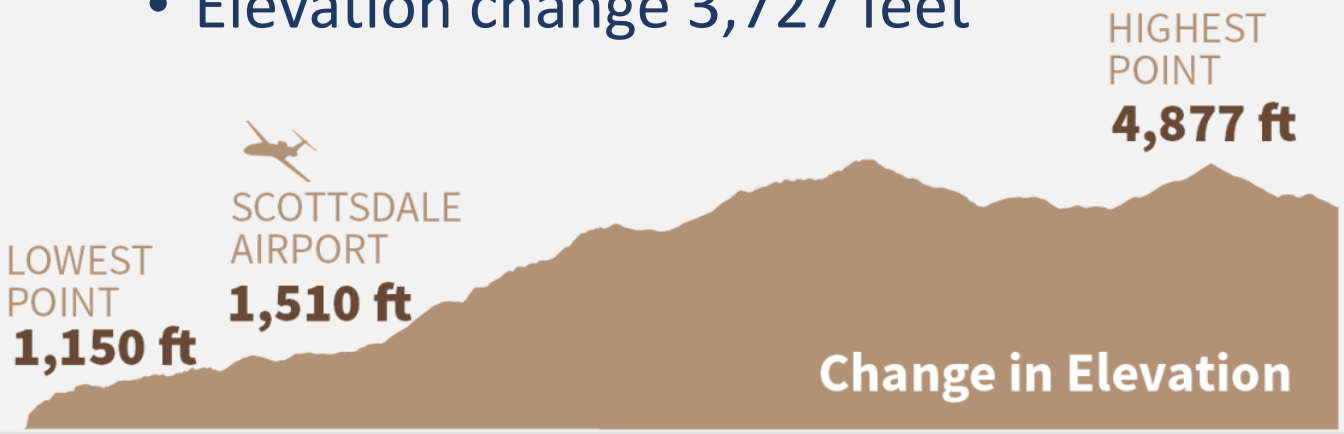


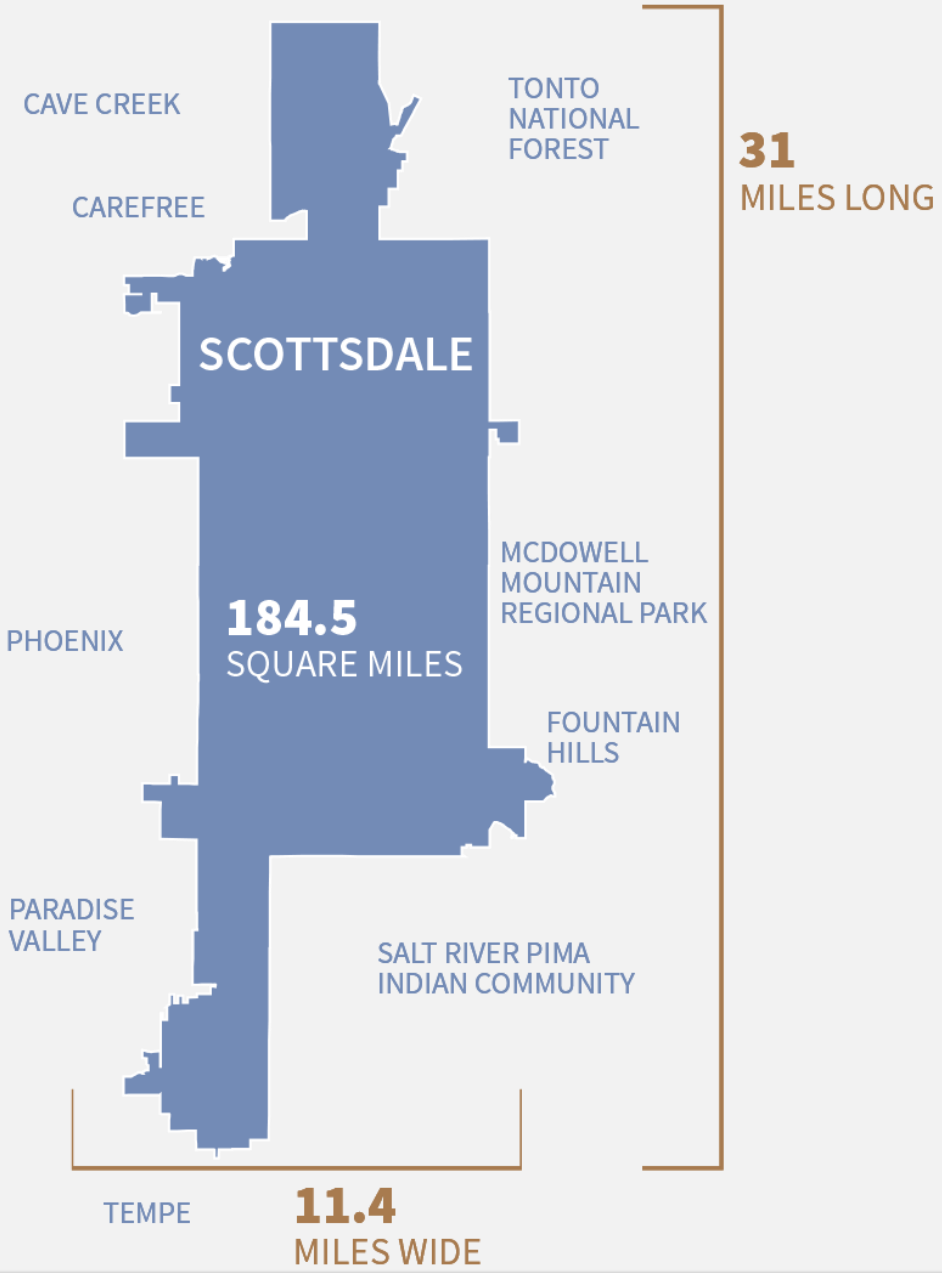
# City of Scottsdale



# About Scottsdale

- Population ~ 255,000
- Build Out ~ 300,000
- New Growth – North
- Redevelopment – South
- 184.5 square miles
- 31 miles long
- Elevation change 3,727 feet



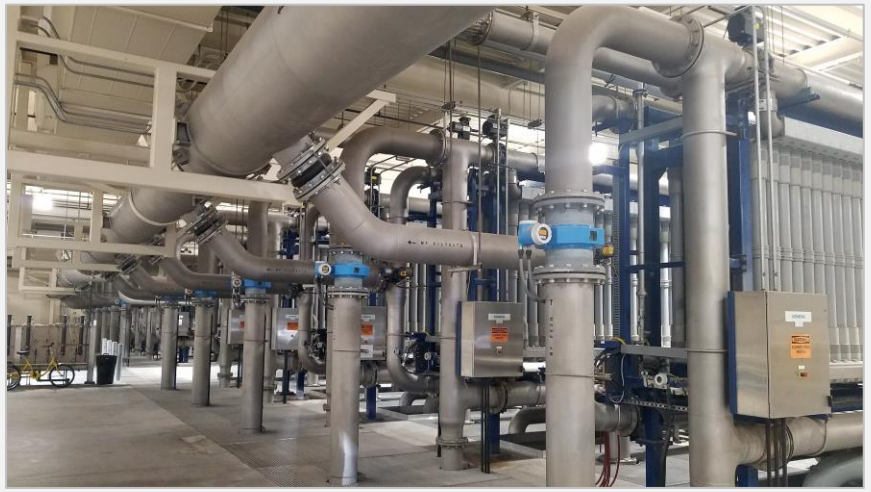
# Award-winning Utility

- 2019: Sustainability Champion, Arizona Forward Environmental Excellence Crescordia Award
- 2018: Sustainable Utility Management Award, American Association of Metropolitan Water Agencies
- 2017: Public Education Program of the Year (Scottsdale Water Citizen Academy), WateReuse Association
- 2016: Utility of the Future Today, EPA and national consortium of water organizations

1969 50 2019

ARIZONA FORWARD
ENVIRONMENTAL EXCELLENCE
CRESCORDIA AWARD
2019

Sustainable Utility Management Award
Association of Metropolitan Water Agencies



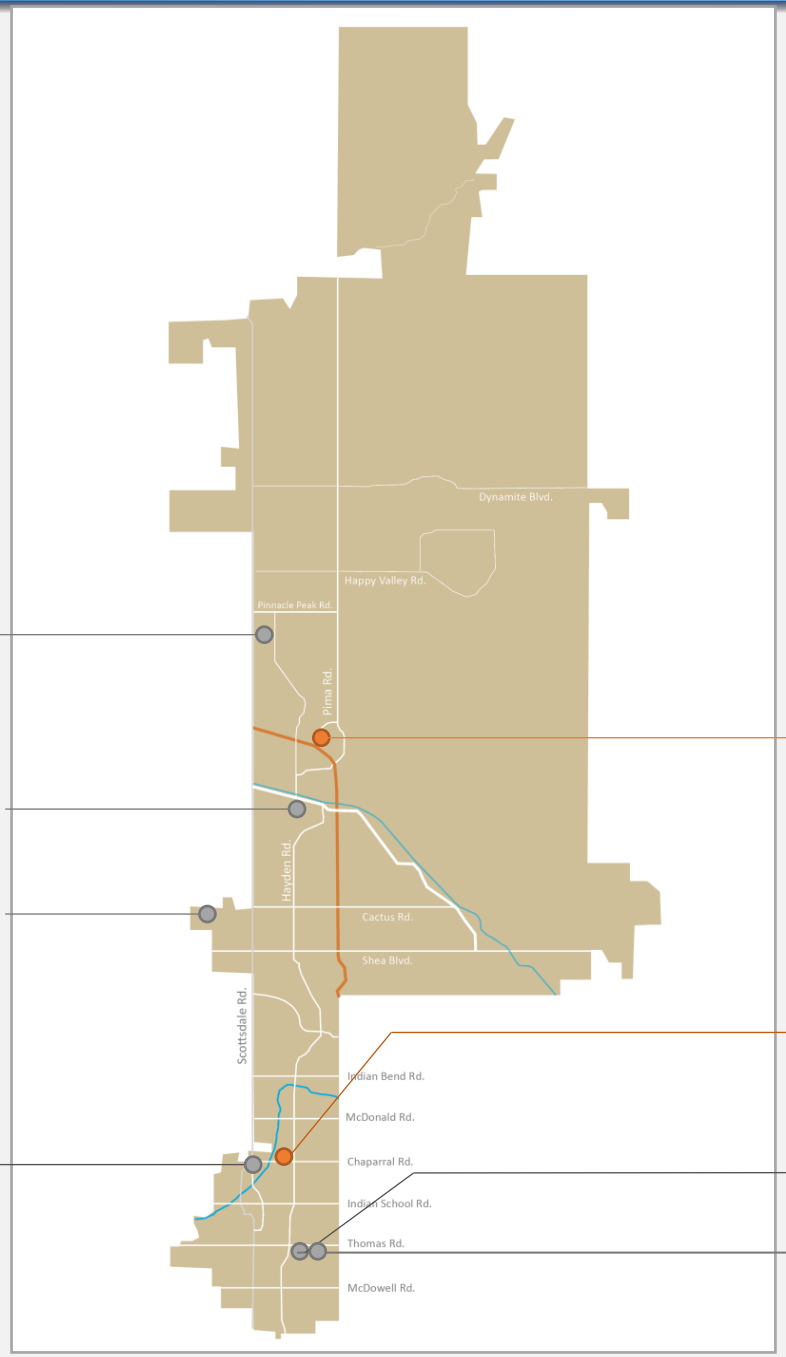
# Scottsdale Water's History of Sustainable Water Practices

- Gainey Ranch Water Reclamation Facility - 1981
- Water Campus – October 1998
  - CAP Water Treatment Facility
  - Water Reclamation Plant
  - Advanced Water Treatment Facility
    - Ozone/Ultrafiltration/Reverse Osmosis/Ultraviolet Photolysis
    - Two end uses: recharge, turf irrigation
- Safe Yield 2006
- First Facility DPR Permit – September 2019

# Operating Systems

- Drinking Water System:
  - CAP WTP (Water Campus)– 70 MGD (combined traditional treatment 50 mgd with membrane treatment 20 mgd and GAC)
  - Chaparral WTP (SRP Water) – 30 mgd (submerged membrane system)
  - 3 Arsenic Treatment Plants
  - 2 Superfund Treatment facilities (air stripping and GAC)
  - 1 Groundwater Treatment facility (under construction)
  - 16 wells
  - 21 booster station
  - 43 reservoirs

# Drinking Water Treatment Facilities




Arsenic Treatment Facility 115

Arsenic Treatment Facility 7

Arsenic Treatment Facility 32

North Groundwater Treatment Facility (4 mgd)

CAP Water Treatment Plant (70 MGD)

Chaparral Water Treatment Plant (27 MGD)

Central Groundwater Treatment Facility (12 MGD)

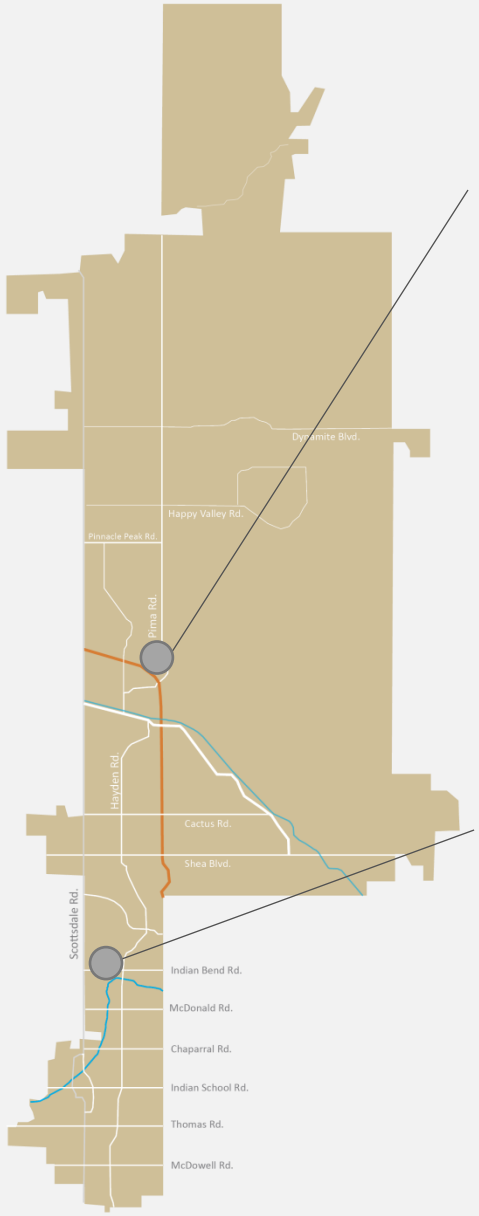
Thomas Groundwater Treatment Facility (online 2021)

SCOTTSDALE WATER

# Operating Systems (continued)

- Water Reclamation
  - SROG connection (20 mgd)
  - Water Campus Reclamation Facility (20 mgd)
  - Water Campus Advance Water Treatment Facility (20 mgd)
  - 5 Pump Back Stations
  - Gainey Ranch Water Reclamation Facility (1.8 mgd)
  - 33 Lift Stations

# Water Reclamation Facilities



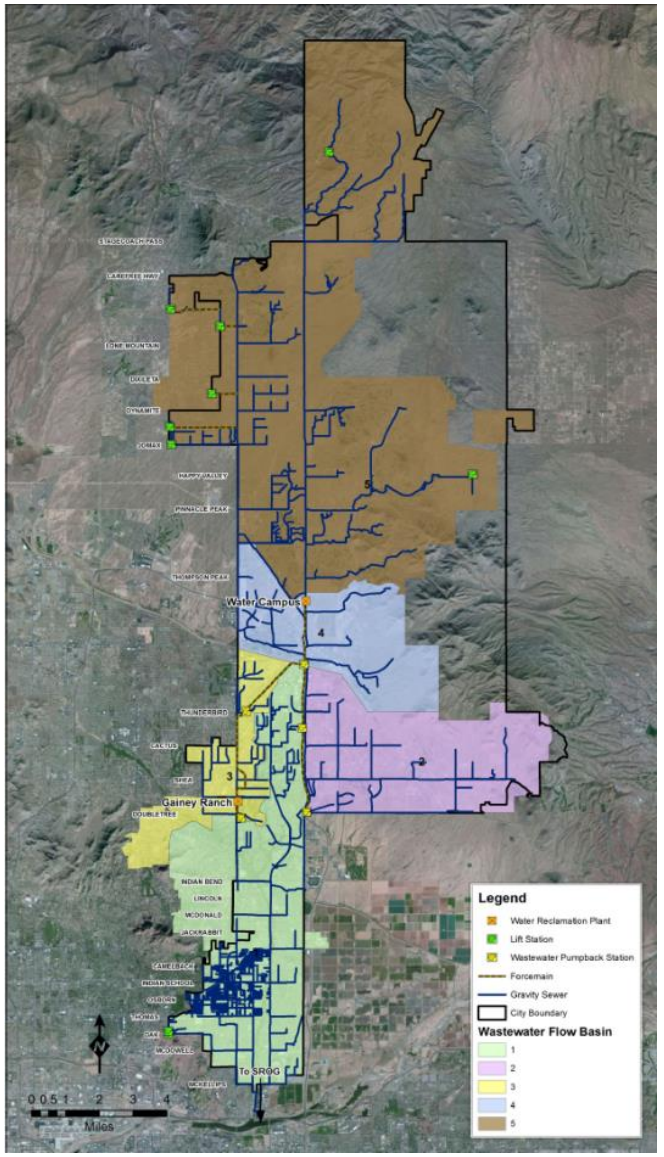

Water Campus

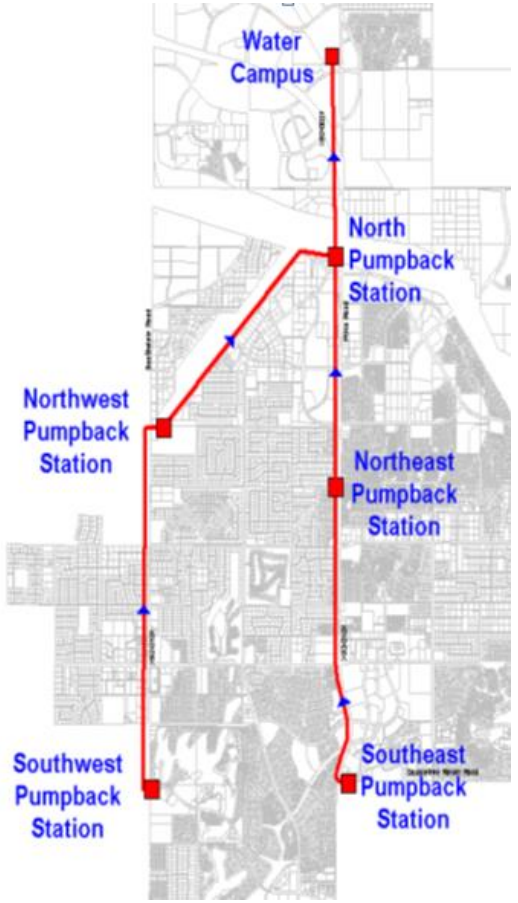
- Water Reclamation Plant – 20 mgd
- Advanced Water Treatment Plant – 20 mgd

Gainey Ranch WRP – 2 mgd

SCOTTSDALE WATER

# Pumpback System




SCOTTSDALE WATER

# Operating Systems (continued)

- Reclaimed Water Distribution System
  - 23 Golf Course
  - 14 miles of distribution system
  - 4 booster stations

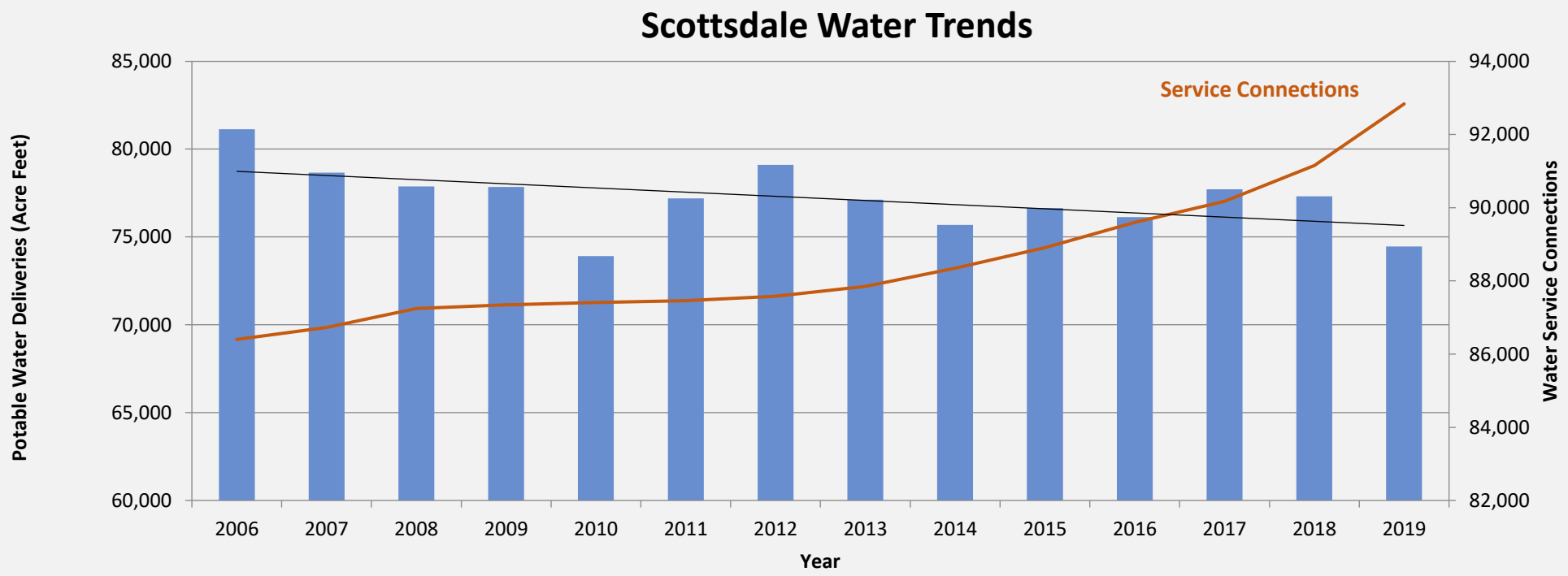
- Recharge Operations
  - 61 vadose zone wells (Water Campus)
  - 2 ASR wells
  - Westworld and Desert Mountain Recharge sites

# Scottsdale's Energy and Water Efficiency Efforts

- Optimization Control Room
  - Staffed 24-7-365 with experienced operators
  - Responsible for:
    - Water deliveries (including water balancing)
    - Optimizing Energy
    - Repair and maintenance scheduling
    - Communications hub

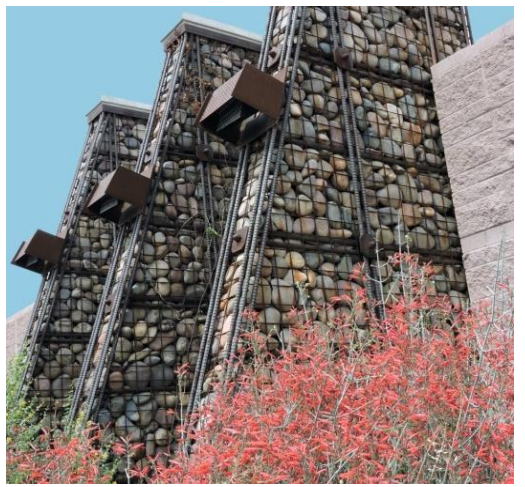
# Scottsdale's Energy and Water Efficiency Efforts

- Hoover Dam Power Allocation
  - 2.371 MW
  - 28% of our Water Campus energy requirements
- Peak Solutions Demand Response Program
  - In 2020 over 5 days saved over 16,000 kW at peak periods
  - Over the previous eight years of participating, received rebate checks of over $1.0 Million
- Non-Revenue Water/Water Conservation


Scottsdale Water Trends
Potable Water Deliveries (Acre Feet)
85,000
80,000
75,000
70,000
65,000
60,000
94,000
92,000
90,000
88,000
86,000
84,000
82,000
Water Service Connections
Service Connections
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year

# Questions?




SCOTTSDALE WATER

CITY OF SCOTTSDALE

NATIONAL GOVERNORS ASSOCIATION

# Cross Sector Savings Opportunities at Water and Power Utilities


Speakers:

Robert Woods, Operations Manager, O&M Baseload Generation, Salt River Project

Joseph Cantwell, Senior Energy Engineer, Focus on Energy

Facilitator:

Jessica Rackley, Program Director, NGA Center for Best Practices

# SRP Water & Energy Nexus

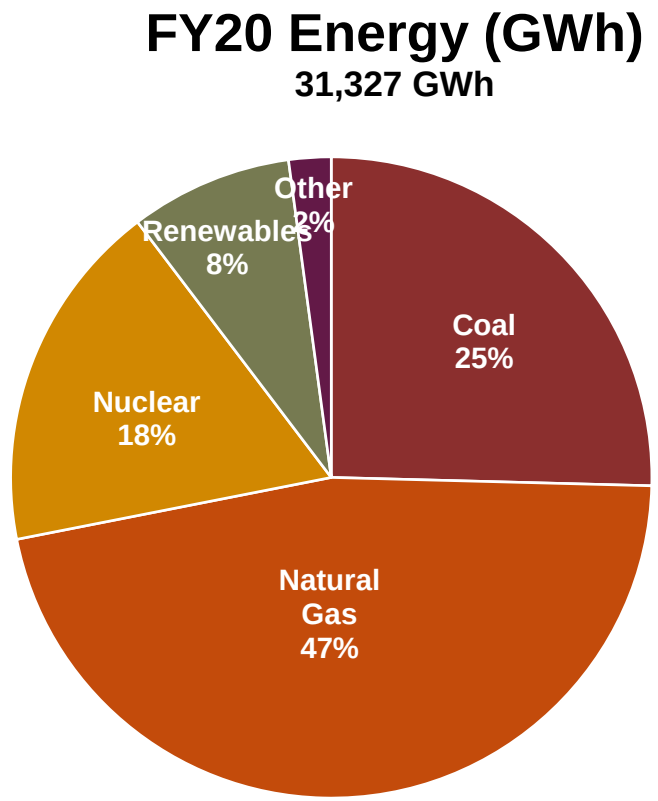
Delivering water and power™

# What is SRP?

- A community-based not-for-profit water and energy company.
- Provides reliable, affordable water and power to more than 2 million people living in central Arizona.
- SRP has provided these essential resources for more than a century to meet the needs of customers and help the region grow

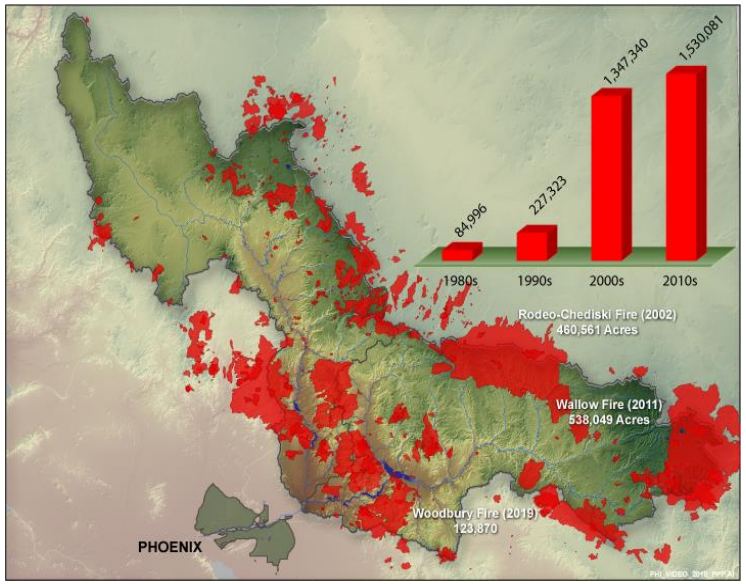
# Water Use and Power Production

- Resource Planning Considerations
- Facility Siting Considerations
- Customer Goals in the Water/Energy Nexus



# 2035 Sustainability Goals

- Reduce the amount of CO2 emitted (per MWH) by 62% from 2005 levels by 2035 and by 90% by fiscal year 2050.
- 20% reduction in generation related water use intensity across all water types.
- Eliminate or offset power generation groundwater use in AMAs
- Increase SRP's leadership role in forest restoration treatments through partnerships, influence, education and support for industry to thin 50,000 acres per year or 500,000 acres total



# Contact Information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SRP

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## Jason Baran

Manager, State & Local Government Relations

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Wisconsin Focus on Energy Program

# On-Site Energy Generation and Beneficial Utilization

Presented by: Joseph Cantwell

Date: September 2, 2020

focus on energy®

Partnering with Wisconsin utilities

# Introduction

focus on energy®
Partnering with Wisconsin utilities

- FOCUS ON ENERGY® is Wisconsin's statewide energy efficiency and renewable energy program.
- Focus on Energy provides technical and financial assistance to program participants to reduce their energy use and utilize renewable energy.
- I assist municipal and industrial water and wastewater systems to access Focus on Energy resources in order to become more energy efficient and beneficially utilize renewable energy resources.

WISCONSIN

# Implemented project

- **Community A** – The municipality wanted to further utilize the biogas it produced

- **Results**
  - Energy assessment identified several energy efficiency opportunities:
  - Aeration system, disinfection system and anaerobic digestion
  - Flexible membrane diffusers, new technology blowers, micro turbines for electric generation and additional heat for heating loop

# Implemented project

focus on energy®
Partnering with Wisconsin utilities

- **Community B** – The municipality wanted to become energy efficient and utilize renewable energy

- **Results**
  - Energy efficiency opportunities: aeration system, screw pump, direct convey industrial high strength waste to anaerobic digesters, high strength receiving station, auxiliary feed stock
  - Renewable energy opportunities: increase biogas production, generator to produce electricity, capture heat, install sludge dryer which reduced volume to dispose

WISCONSIN

# Implemented project

focus on energy®
Partnering with Wisconsin utilities

- **Industry C** – Rural industry had installed an anaerobic treatment system for pretreating waste load from product processing

- **Results**
  - The industry installed an anaerobic pretreatment system.
  - After confirming the production level of biogas they sought to identity the best way to beneficially utilize the biogas.
  - They decided to operate a 500 kW generator to offset the electric energy being used to power its aerobic treatment system.

WISCONSIN

# Implemented project

focus on energy®
Partnering with Wisconsin utilities

- **Industry D** – A rural (dairy) industry analyzed options to manage their high strength waste stream

- **Results**
  - Their consultant developed a report showing they could pretreat their waste load with anaerobic treatment then follow it with aerobic treatment to complete the treatment of their liquid waste.
  - The report projected their system could produce enough biogas to operate a generator to offset all of their treatment energy needs.
  - They could move from hauling waste to land disposal to a secondary treatment system without need of grid energy other than for backup.

WISCONSIN

# Additional benefits from projects

focus on energy®
Partnering with Wisconsin utilities

- Reduced cost of trucking high strength waste from industry to disposal sites
- Fewer heavy truck loads reduced damage to the roads
- Reduced amount of acreage required for land spreading
- Beneficially utilized a waste product (fuel)
- High strength waste actually becoming a sought after product

WISCONSIN

# Questions – Comments - Contact Information

Joseph Cantwell
Focus on Energy
Leidos Engineering, LLC
Telephone: 262-786 – 8221
Joe.Cantwell@focusonenergy.com

NATIONAL GOVERNORS ASSOCIATION

# Agricultural Sector Water Use Efficiency

Speakers:

Clint Chandler, Deputy Director, Arizona Department of Water Resources

Adrian Stocks, Water Quality Program Director, Wisconsin Department of Natural Resources

Facilitator:

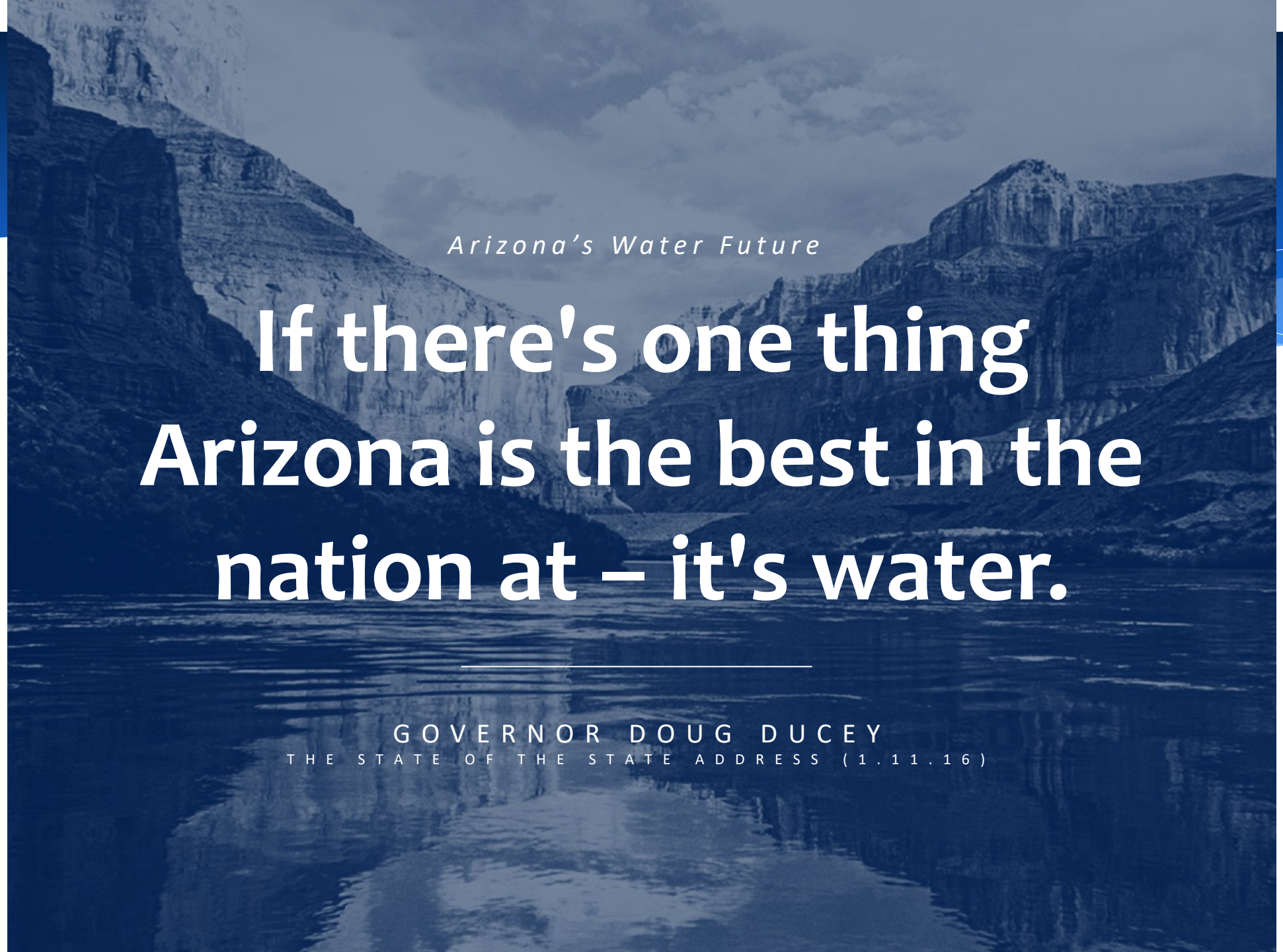
Timothy Schoonhoven, NGA Center for Best Practices

NGA Water-Energy Nexus Learning Lab

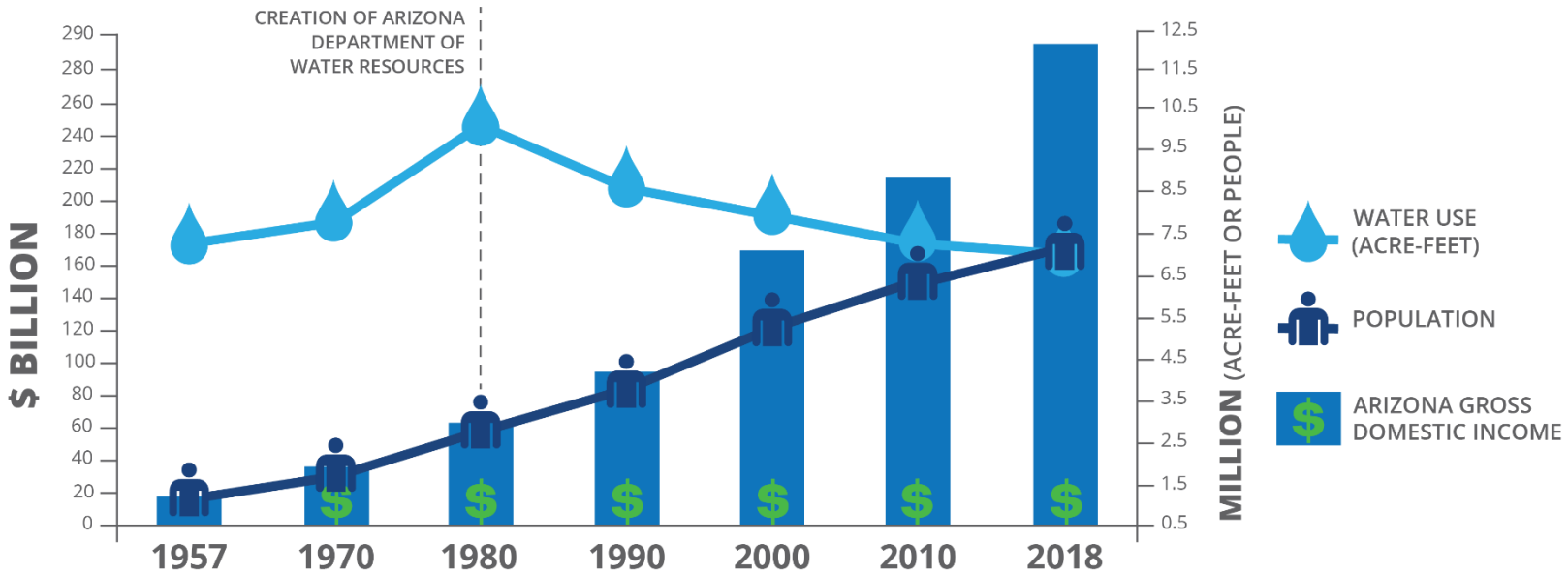
# Agricultural Sector Water Use Efficiency

Clint Chandler
Deputy Director
Arizona Department of Water Resources

September 2, 2020


*Arizona's Water Future*
If there's one thing Arizona is the best in the nation at – it's water.
GOVERNOR DOUG DUCEY
THE STATE OF THE STATE ADDRESS (1.11.16)

# ARIZONA'S WATER MANAGEMENT SUCCESS




## TOTAL WATER USE (IN MILLIONS ACRE/FEET)

1957 7.1 MAF
2018 7 MAF

-1% CHANGE FROM 1957-2018

## POPULATION (IN MILLIONS)

1957 1.1
2018 7.1

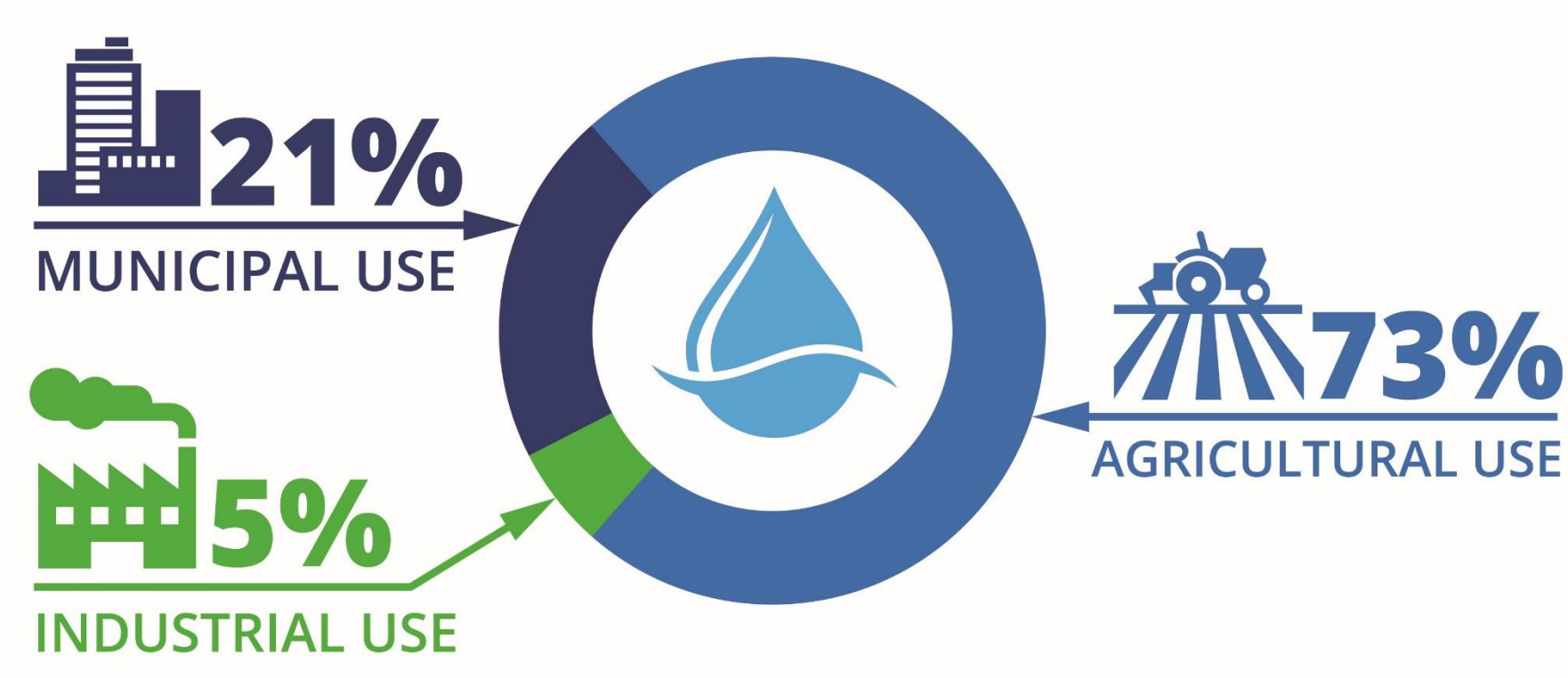
545% CHANGE FROM 1957-2018

## GROSS DOMESTIC INCOME (IN BILLIONS)

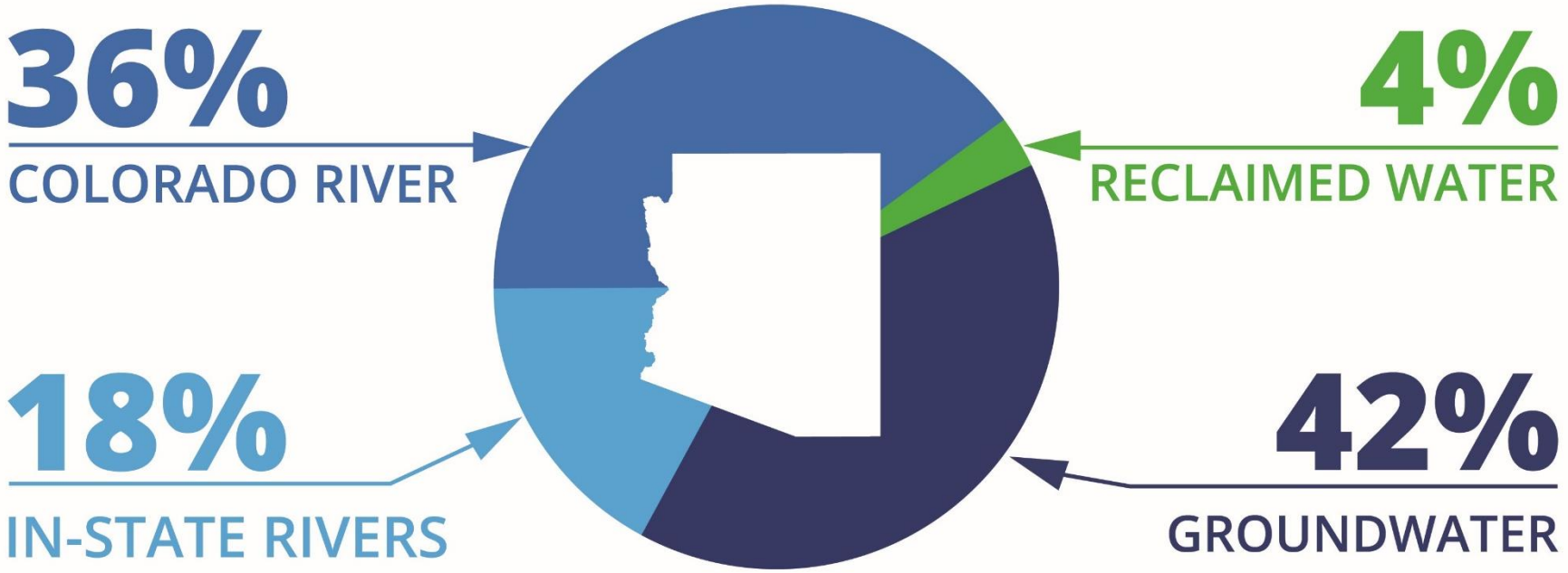
1957 $ 13.4
2018 $$$$$$$$$$$$$$$$$$$ 287.9

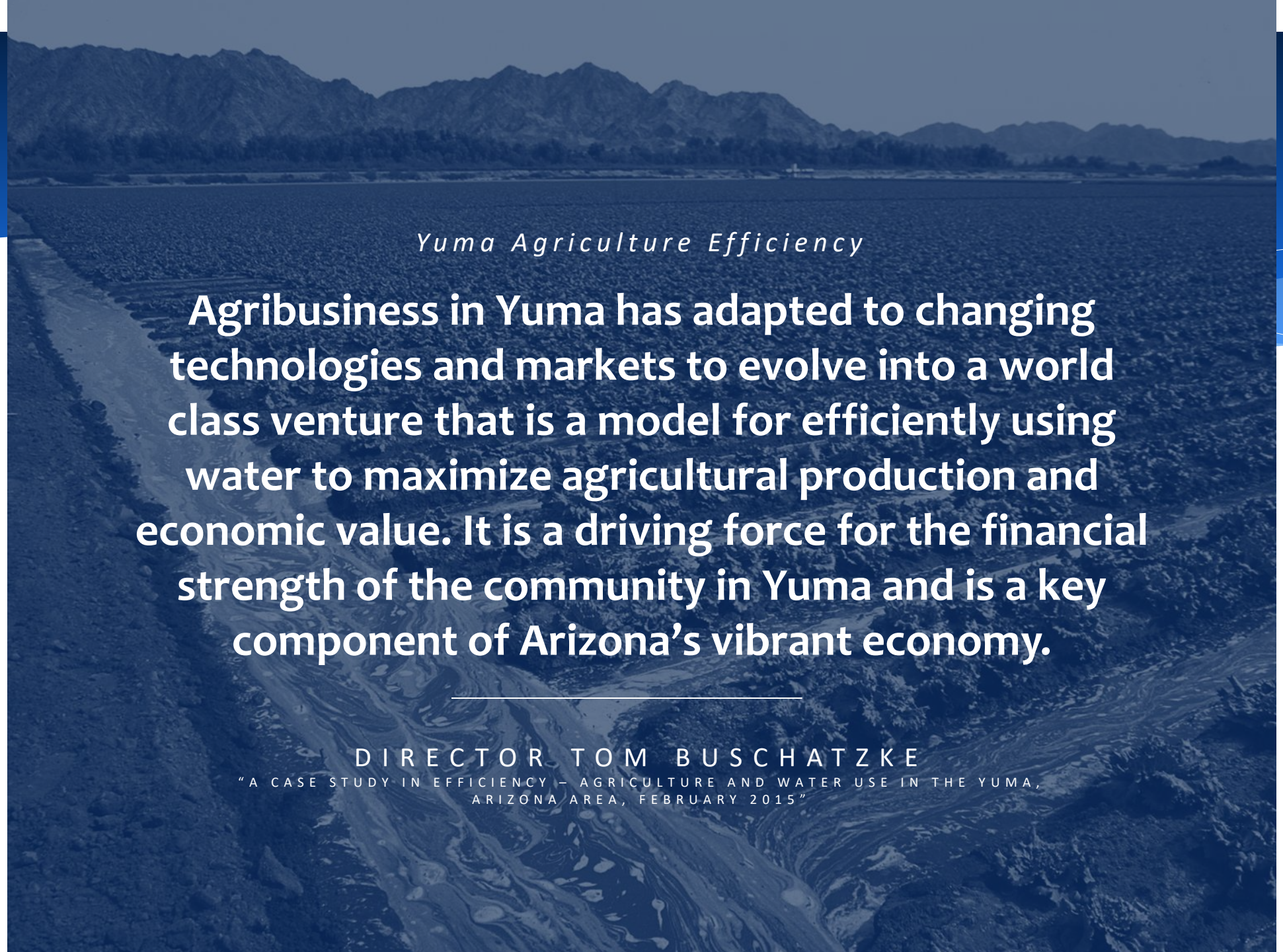
2,049% CHANGE FROM 1957-2018

# Water Use By Sector (2018)



# Arizona Water Use By Source (2018)





*Yuma Agriculture Efficiency*

**Agribusiness in Yuma has adapted to changing technologies and markets to evolve into a world class venture that is a model for efficiently using water to maximize agricultural production and economic value. It is a driving force for the financial strength of the community in Yuma and is a key component of Arizona's vibrant economy.**

---

DIRECTOR TOM BUSCHATZKE

"A CASE STUDY IN EFFICIENCY – AGRICULTURE AND WATER USE IN THE YUMA, ARIZONA AREA, FEBRUARY 2015"

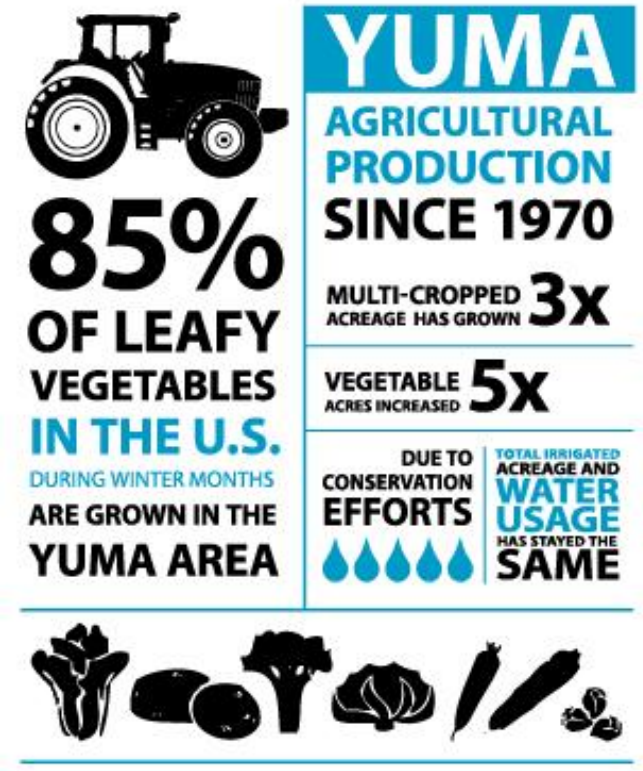
# Yuma Agriculture Efficiency

- **There have been numerous changes within the Yuma districts to improve water use efficiency. They include:**

  Modifications of conveyance systems and turnouts to allow high volume deliveries

  Implementation of improved scheduling

  Delivery practices including the use of Supervisory 12 Control and Data Acquisition (SCADA) systems for gate control and the use of electronic metering devices.




* "A Case Study in Efficiency – Agriculture and Water Use in the Yuma, Arizona Area, February 2015"

# 1980 Groundwater Management Code

**Issue:** Severe groundwater depletion

**Approach:** Collaborate among different sectors and stakeholders

**Goals:**

- Control severe groundwater depletion
- Improve groundwater supplies through conservation and development of additional water supplies
- Provide the means for allocating Arizona's limited groundwater resources

**Solution:** Groundwater Management Code

Former Arizona Governor and Interior Secretary Bruce Babbitt signing the GMA

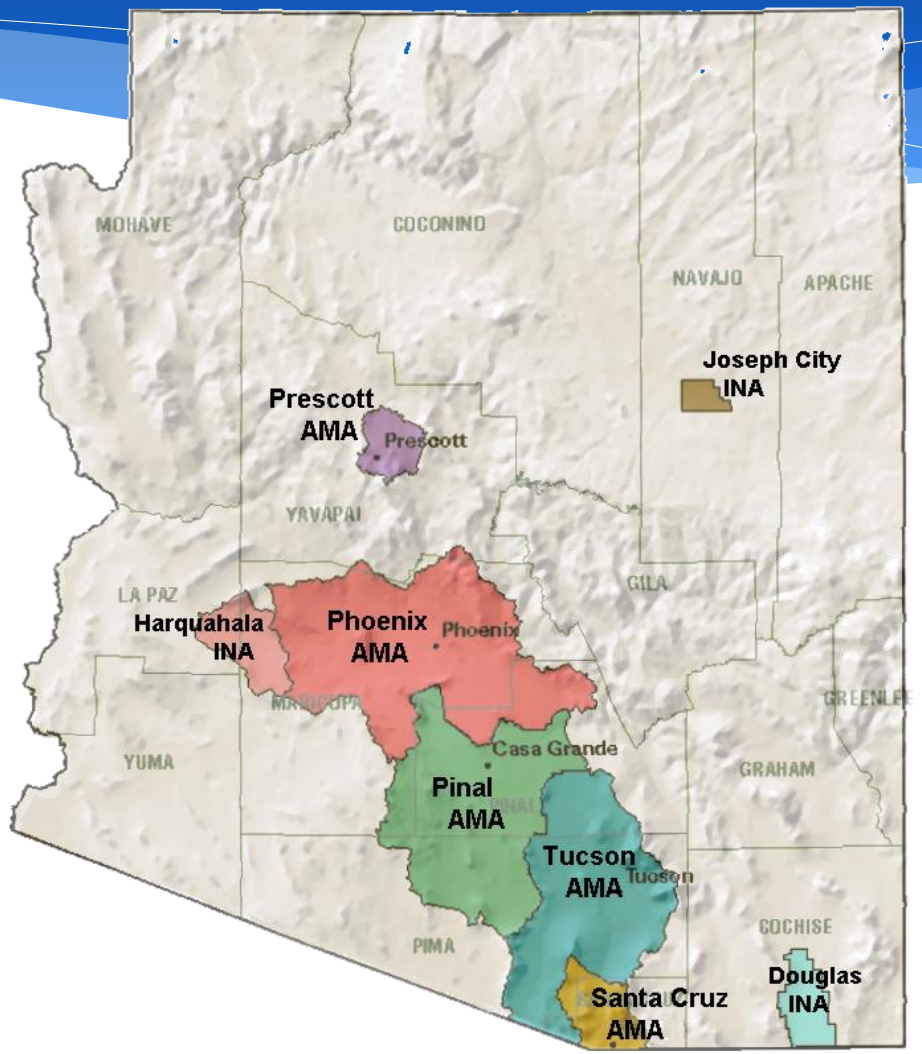
# Groundwater Management
# Active Management Areas

**Active Management Areas (AMAs)**

- Phoenix
- Pinal
- Prescott
- Santa Cruz
- Tucson

**Irrigation Non-Expansion Areas (INAs)**

- Joseph City INA
- Harquahala INA
- Douglas INA



# Active Management Area Goals

**Phoenix AMA**

- To achieve safe-yield by the year 2025

**Pinal AMA**

- To preserve agricultural economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses

**Prescott AMA**

- To achieve safe-yield by the year 2025

**Tucson AMA**

- To achieve safe-yield by the year 2025

**Santa Cruz AMA**

- To maintain a safe-yield condition in the active management area and to prevent local water tables from experiencing long term declines

# Groundwater Regulatory Structure

- Registration of all wells
- Adequate Water Supply
- Community Water Systems Documentation

**Statewide**

+

- Expansion of irrigated acres is prohibited
- Monitoring and Reporting

**INA**

+

- Assured Water Supply
- Groundwater Withdrawal Fees
- Management Goals, Plans & Conservation Programs

**AMA**


133

# Agricultural Base Program

**Each irrigation groundwater right is assigned a maximum annual groundwater allotment based on the water duty and water duty acres associated with the land, while allowing for some flexibility.**

## Components of the Base Program

- **Water Duty** – The amount of water that is reasonable to apply to irrigated land
- **Water duty acres** – The highest number of acres irrigated between 1975 – 1980
- **Flexibility account –** allows right holders to accrue credits or debits based on annual water use to accommodate for varying climatic and market conditions

# Best Management Practices Program

**A.R.S. § 45-568.02 (G)**

The BMP Program shall be designed to achieve conservation that is at least equivalent to that required under the Base Program

- Farm operator agrees to implement approved BMPs on their farm relating to water conveyance, irrigation systems, and efficient water & soil management practices.
- Must implement and report on practices annually, in addition to adhering to water use reporting requirements, under BMP farm unit number.
- No annual allotment to adhere to, therefore the water duty and flexibility account provisions are irrelevant to IGFRs while enrolled in the BMP Program.

# Agricultural BMP Program

**Category 1:**

**Water Conveyance System Improvements**

Participants may earn points based on the percentage of the farm's acreage that is served by an approved conveyance system.

- Concrete lined ditch
- Pipelines
- Drainback system

# Agricultural BMP Program

**Category 2:**

**Farm Irrigation Systems**

Participants may earn BMP points based on the types of irrigation systems used. More efficient types of irrigation systems are granted more points.

- Slope Systems
- Sprinkler Systems
- Drip Systems

# Agricultural BMP Program

**Category 3:**

**Irrigation Water Management Practices**

Participants may earn BMP points by implementing practices that will increase a farm's overall efficiency of water application in a growing season.

- Field management such as laser touch-up or furrow checks
- Irrigation management such as surge, temporary sprinklers, or scheduling services
- Continuing education

# Agricultural BMP Program

**Category 4:**

**Agronomic Management Practices**

Participants may earn BMP points by implementing combinations of plant and soil management practices to conserve water over the length of growing season.

- Crop management: rotation, use of transplants, residue management, etc.
- Other agronomic practices: surface conditioning, using plastic mulch, planting in the bottom of furrows, etc.

# Agricultural Data – Reporting Entities

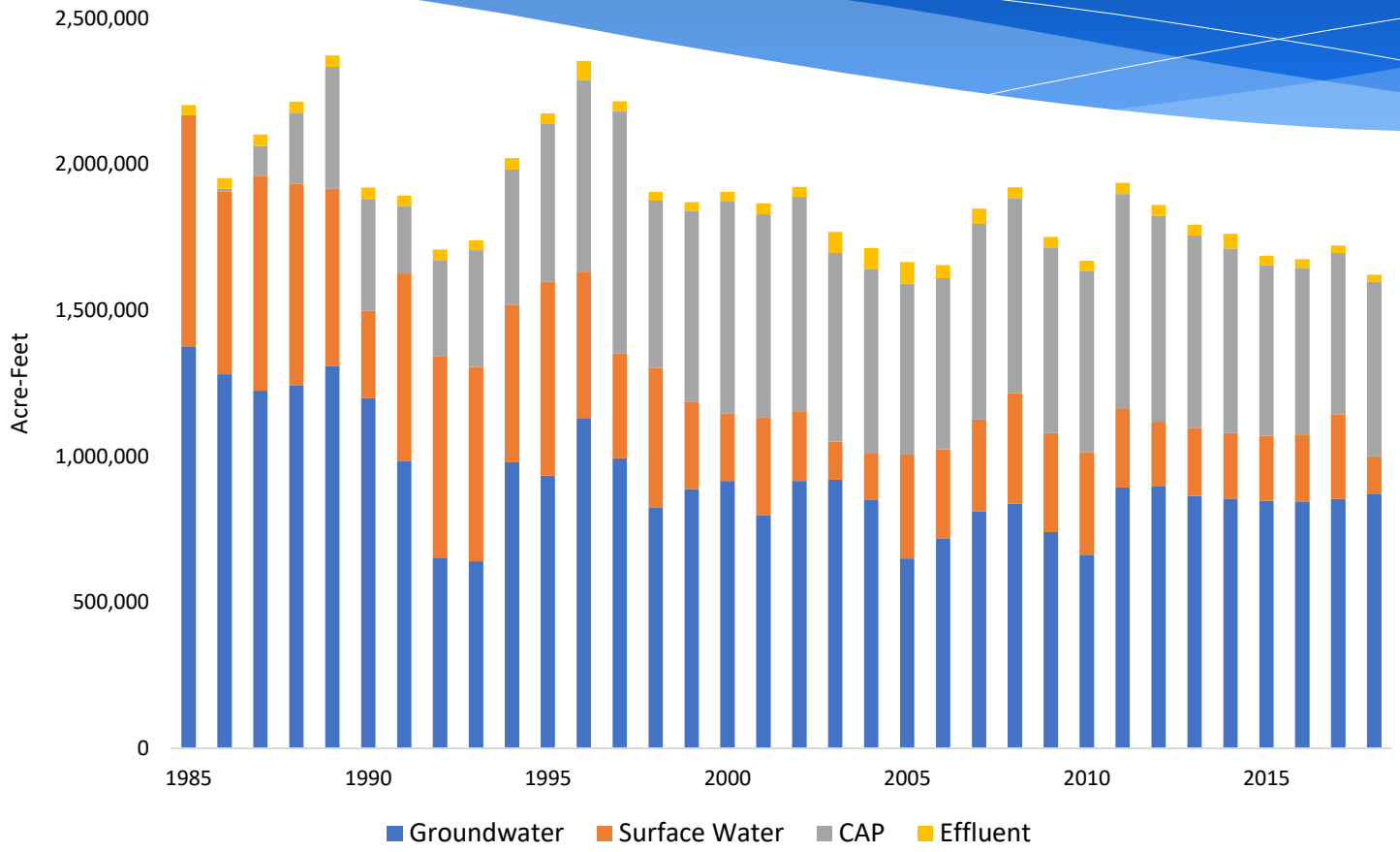
**Water use data reported to ADWR comes from:**

- Irrigation rights greater than 10 irrigation acres
- BMP Farm Units

  Can be made up of multiple Irrigation Rights, but only submit one report
- Irrigation Districts

  Some districts report on behalf of their right holders

# Agriculture Water-Use by Source




Agricultural groundwater use has declined ~37% since 1985 in response to the introduction of CAP water to the AMAs


*Arizona's Water Future*
As Arizona transitions to a drier future, we must continue to promote a culture of conservation - one that enables the unbeatable quality of life and boundless opportunity we enjoy.
GOVERNOR DOUG DUCEY
SIGNS ARIZONA DCP LEGISLATION (1.31.19)

# Questions?

**Clint Chandler**
Deputy Director

Phone: 602.771.8659
Email: cchandler@azwater.gov

Website: www.azwater.gov
Twitter: @azwater

PROTECTING
ARIZONA'S WATER SUPPLIES
*for* ITS NEXT CENTURY

# Reducing Energy Consumption through Manure Treatment Technologies

Adrian Stocks

Wisconsin DNR Water Quality Bureau Director

# Why Consider Manure Treatment?

- Reduction in hauling costs
  - Remove water from material being hauled to fields
  - Increases distance that drier materials can be hauled
- Reduction in liquid storage needs/increased cattle numbers for same sized storage
- Create segregated nutrient streams
  - Solids: P
  - Liquids: N
- Create products (e.g., bedding)
- Reduced odors?
- Water reuse
  - Water for cattle
  - Water for reuse on site

# Potential Issues

- How does the cost of hauling manure compare to the cost of treatment?
  - What level of treatment do you need to accomplish your desired goals?
    - Irrigation
    - Seepage Cells
    - Recurring Surface Water Discharge
    - On-site reuse
    - Cattle watering
- Maintenance of treatment equipment


BALZER
6000

# Landspreading "Math" Example

How many tankers does it take?

50 acre field

5,000 gallon tankers

15,000 gallons liquid manure/acre

15,000 gallons per acre / 5,000 gallon tankers = 3 tankers per acre

3 tankers x 50 acres = **150 tankers!**

# Permitted Wisconsin Manure Treatment Systems

Son Bow (CAFO)

Majestic Meadows (CAFO)

BC Organics (proposed)

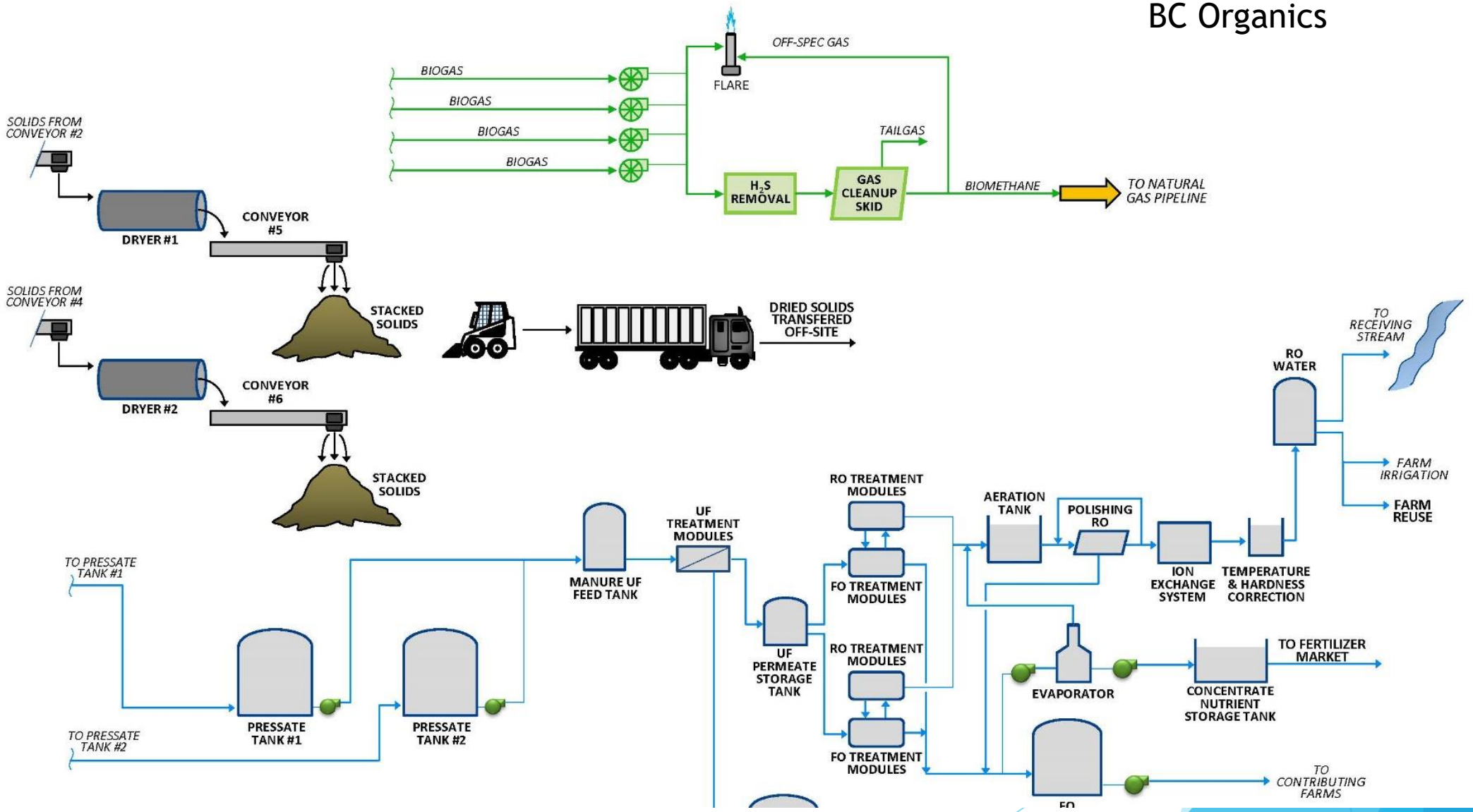
Emerald Dairy (inactive) (CAFO)

Springfield Clean Water

# Treatment Train

- Anaerobic Digestion (optional)
  - Product stabilization
  - Energy production/GHG offset
- Solids separation
- Ultrafiltration
- Reverse osmosis
- Air stripping (optional)
- Activated carbon (optional)
- Disinfection

# BC Organics


BIOGAS
BIOGAS
BIOGAS
BIOGAS
FLARE
OFF-SPEC GAS
TAILGAS
H2S REMOVAL
GAS CLEANUP SKID
BIOMETHANE
TO NATURAL GAS PIPELINE
SOLIDS FROM CONVEYOR #2
DRYER #1
CONVEYOR #5
STACKED SOLIDS
SOLIDS FROM CONVEYOR #4
DRYER #2
CONVEYOR #6
STACKED SOLIDS
DRIED SOLIDS TRANSFERED OFF-SITE
TO PRESSATE TANK #1
TO PRESSATE TANK #2
PRESSATE TANK #1
PRESSATE TANK #2
MANURE UF FEED TANK
UF TREATMENT MODULES
UF PERMEATE STORAGE TANK
RO TREATMENT MODULES
FO TREATMENT MODULES
RO TREATMENT MODULES
FO TREATMENT MODULES
AERATION TANK
POLISHING RO
ION EXCHANGE SYSTEM
TEMPERATURE & HARDNESS CORRECTION
RO WATER
TO RECEIVING STREAM
FARM IRRIGATION
FARM REUSE
EVAPORATOR
CONCENTRATE NUTRIENT STORAGE TANK
TO FERTILIZER MARKET
TO CONTRIBUTING FARMS

# Common Problems

- Consultant inexperience with NPDES/WPDES permit requirements
  - Permitting process
  - CAFO TBELs vs. WQBEL
- Ammonia, the small molecule
  - Requires acidification to increase its size and get caught by membranes
- Temperature
- Discharge locations
  - Wetland issues
  - Low flow receiving waters
  - High quality/low quality streams
  - Available WLA in TMDL areas?
- WET Testing Anion/Cation deficiency toxicity associated with RO discharges

# Questions?

NATIONAL GOVERNORS ASSOCIATION

# Break Until 2:40

NATIONAL GOVERNORS ASSOCIATION

# Funding & Financing

Speakers:

Adrian Stocks, Water Quality Program Director, Wisconsin Department of Natural Resources

Alice Dasek, Energy Efficiency & Renewable Energy, US Department of Energy

Facilitator:

Bevin Buchheister, Senior Policy Analyst, NGA Center for Best Practices

# Supporting Innovations through CWF Loan Program

Adrian Stocks

Wisconsin DNR Water Quality Program Director

# Innovations

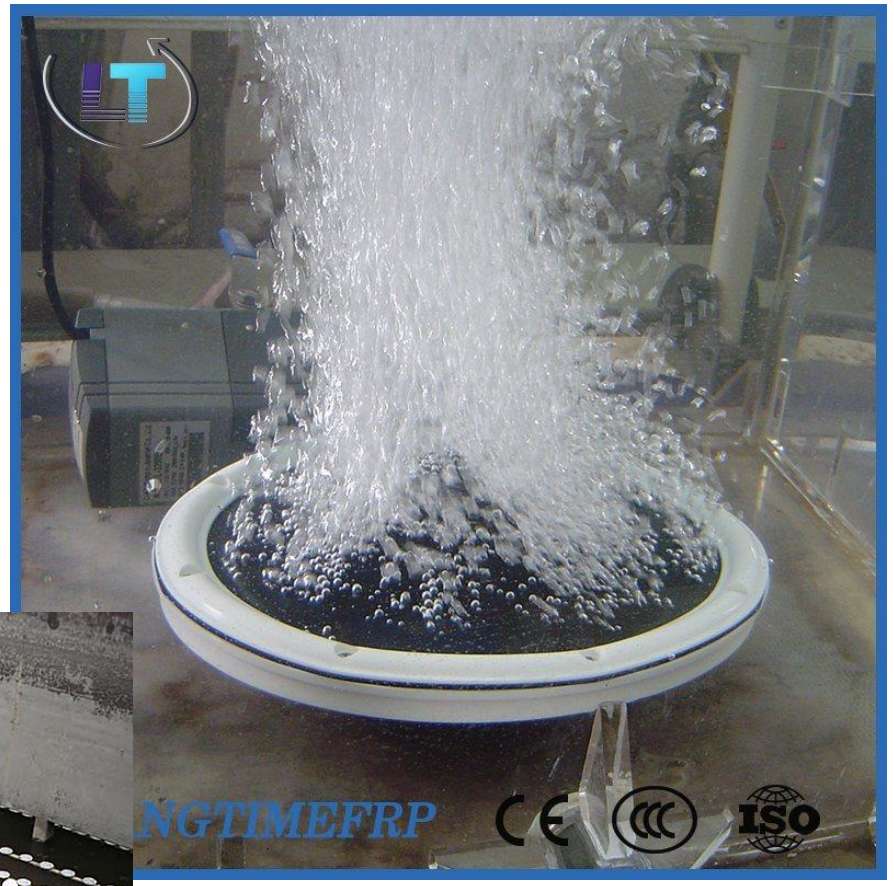
Regionalization-

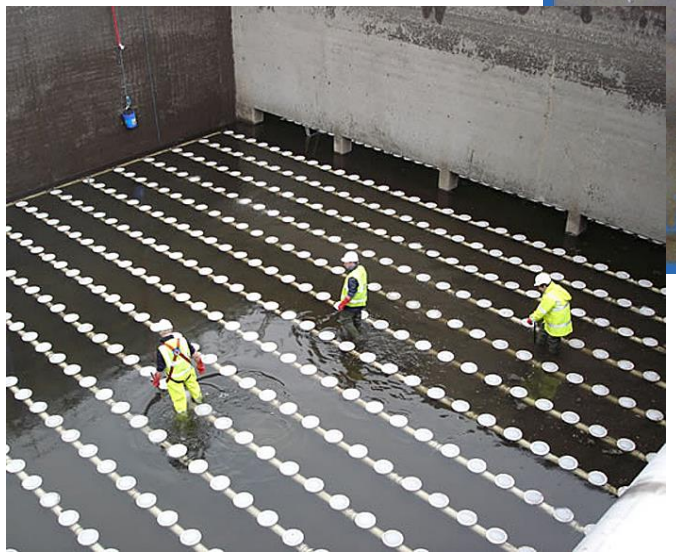
# Innovations

## Phosphorus Reduction

# Innovations

## Energy Efficiency

# Questions?

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy


# Funding and Financing for Improvement Projects in the Wastewater Sector

**Alice G. Dasek**
U.S. Department of Energy

NGA Water-Energy Nexus Learning Lab
Virtual Format
September 2, 2020

# DOE's Wastewater Energy Management Toolkit

## Building Blocks of Energy Management & Planning

- Energy Data Management
- Measure Evaluation
- Financing
- Improvement Planning

SWIFt



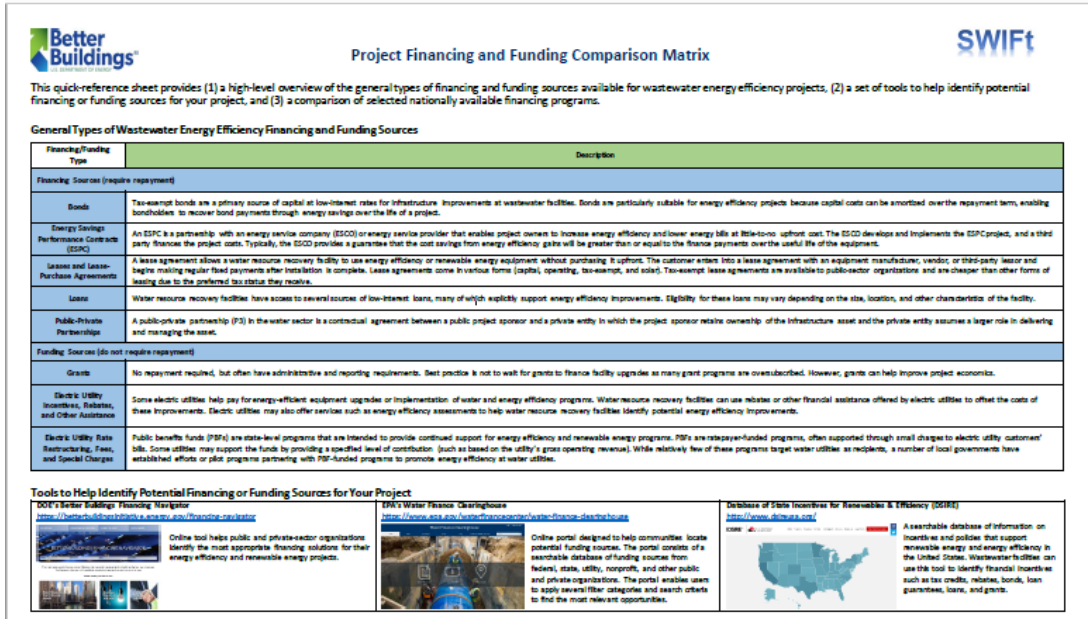
Better Buildings U.S. DEPARTMENT OF ENERGY

https://betterbuildingssolutioncenter.energy.gov/accelerators/wastewater-infrastructure

U.S. DEPARTMENT OF ENERGY

# Project Financing & Funding Comparison Matrix

## Search Tools



Better Buildings

SWIFt

Project Financing and Funding Comparison Matrix

This quick-reference sheet provides (1) a high-level overview of the general types of financing and funding sources available for wastewater energy efficiency projects, (2) a set of tools to help identify potential financing or funding sources for your project, and (3) a comparison of selected nationally available financing programs.

General Types of Wastewater Energy Efficiency Financing and Funding Sources

| Financing/Funding Type | Description |
|---|---|
| Financing Sources (require repayment) | |
| Bonds | Tax-exempt bonds are a primary source of capital at low-interest rates for infrastructure improvements at wastewater facilities. Bonds are particularly suitable for energy efficiency projects because capital costs can be amortized over the repayment term, enabling bondholders to recover bond payments through energy savings over the life of a project. |
| Energy Savings Performance Contracts (ESPC) | An ESPC is a partnership with an energy service company (ESCO) or energy service provider that enables project owners to increase energy efficiency and lower energy bills at little-to-no upfront cost. The ESCO develops and implements the ESPC project, and a third party finances the project costs. Typically, the ESCO provides a guarantee that the cost savings from energy efficiency gains will be greater than or equal to the finance payments over the useful life of the equipment. |
| Leases and Lease-Purchase Agreements | A lease agreement allows a water resource recovery facility to use energy efficiency or renewable energy equipment without purchasing it upfront. The customer enters into a lease agreement with an equipment manufacturer, vendor, or third-party lessor and begins making regular fixed payments after installation is complete. Lease agreements come in various forms (capital, operating, tax-exempt, and solar). Tax-exempt lease agreements are available to public-sector organizations and are cheaper than other forms of leasing due to the preferred tax status they receive. |
| Loans | Water resource recovery facilities have access to several sources of low-interest loans, many of which explicitly support energy efficiency improvements. Eligibility for these loans may vary depending on the size, location, and other characteristics of the facility. |
| Public-Private Partnerships | A public-private partnership (P3) in the water sector is a contractual agreement between a public project sponsor and a private entity in which the project sponsor retains ownership of the infrastructure asset and the private entity assumes a larger role in delivering and managing the asset. |
| Funding Sources (do not require repayment) | |
| Grants | No repayment required, but often have administrative and reporting requirements. Best practice is not to wait for grants to finance facility upgrades as many grant programs are oversubscribed. However, grants can help improve project economics. |
| Electric Utility Incentives, Rebates, and Other Assistance | Some electric utilities help pay for energy-efficient equipment upgrades or implementation of water and energy efficiency programs. Water resource recovery facilities can use rebates or other financial assistance offered by electric utilities to offset the costs of these improvements. Electric utilities may also offer services such as energy efficiency assessments to help water resource recovery facilities identify potential energy efficiency improvements. |
| Electric Utility Rate Restructuring, Fees, and Special Charges | Public benefits funds (PBFs) are state-level programs that are intended to provide continued support for energy efficiency and renewable energy programs. PBFs are ratepayer-funded programs, often supported through small charges to electric utility customers' bills. Some utilities may support the funds by providing a specified level of contribution (such as based on the utility's gross operating revenue). While relatively few of these programs target water utilities as recipients, a number of local governments have established efforts or pilot programs partnering with PBF-funded programs to promote energy efficiency at water utilities. |

Tools to Help Identify Potential Financing or Funding Sources for Your Project

DOE's Better Buildings Financing Navigator

https://betterbuildingsinitiative.energy.gov/financing-navigator

Online tool helps public and private-sector organizations identify the most appropriate financing solutions for their energy efficiency and renewable energy projects.

EPA's Water Finance Clearinghouse

https://www.epa.gov/waterfinancecenter/water-finance-clearinghouse

Online portal designed to help communities locate potential funding sources. The portal consists of a searchable database of funding sources from federal, state, utility, nonprofit, and other public and private organizations. The portal enables users to apply several filter categories and search criteria to find the most relevant opportunities.

Database of State Incentives for Renewables & Efficiency (DSIRE)

http://www.dsireusa.org/

A searchable database of information on incentives and policies that support renewable energy and energy efficiency in the United States. Wastewater facilities can use this tool to identify financial incentives such as tax credits, rebates, bonds, loan guarantees, loans, and grants.

### DOE's Better Buildings Financing Navigator

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# Project Financing & Funding Comparison Matrix

## Comparison Matrix

Project Financing and Funding Comparison Matrix

| Financing Source (website) | Financing Details (size, terms, interest, etc.) | Eligible Recipients | Eligible Activities | Application/ Execution Timeline | Application Requirements | Technical Assistance Available | Combine w/other funding? Leverage incentives? |
|---|---|---|---|---|---|---|---|
| Clean Water State Revolving Fund (CWSRF) https://www.epa.gov/cwsrf | Loan Size: Project requirements determined by individual states<br>Loan Term (length): 30 years or the useful life of the project<br>Interest rate/Fees: Vary by loan and state (national weighted average interest rate in 2018 was 1.510%)<br>Grants: States may use up to 30% of their CWSRF funding to provide grants (in the form of principal forgiveness, negative interest rate loans, or grants)<br>Other: Other types of assistance are also available | Municipalities, tribes, or inter-municipal, interstate, and state agencies; non-profit organizations and National Estuary Programs | Energy efficiency is one of the 11 eligible project types | Apply through state programs; states may accept applications on a rolling basis or according to an annual cycle | The project must be on the state's priority list to be eligible to receive assistance; Federal requirements and cross-cutter provisions apply | Yes | Yes |
| Energy Savings Performance Contracting (ESPC) | Financing option in which a third party finances the total cost of the energy improvements based on guaranteed annual savings<br>Interest Rate: Varies, low enough for cost savings to cover finance payments<br>Financing Term: The useful life of equipment, typically 15 to 25 years | Large facilities and groups of facilities are good candidates for ESPC, including wastewater facilities | Energy efficiency improvements and facility upgrades | Timeline by agreement between project owner and energy service company | State statutes set requirements for government sectors | Yes | Yes |
| Lease-Purchase Agreements | Flexible financing option that allows a facility to lease energy efficiency or renewable energy equipment from an equipment manufacturer, vendor, or third-party lessor without purchasing it upfront. Customer makes regular fixed payments after installation is complete and may have the option to purchase or return equipment at the end of the contract<br>Interest Rate: Varies, tax-exempt leases result in lower interest rates<br>Financing Term: Typically shorter than 12 years but can extend to 20 years | Public-sector organizations and 501(c)(3) organizations such as non-profit water and wastewater organizations | Real or personal property, including energy equipment | No specified timeline | Terms and conditions are state-specific | No | Yes |
| U.S. EPA Water Infrastructure Finance and Innovation Act (WIFIA) Program https://www.epa.gov/wifia | Loan Size: Min. project size $20 M for large communities and $5 M for small communities (population of 25,000 or less)<br>Interest rate / Fees: Interest rate pegged to U.S. Treasury securities (currently 2.85% on 30-year maturity). Application fee ($20k-$100k) and a credit processing fee ($250k-$500k) apply<br>Loan Term (length): Maximum 35 years<br>Other: WIFIA can fund ≤49% of eligible project costs. Total federal assistance is ≤80% of a project's eligible costs | Local/state/tribal and federal government entities; partnerships and joint ventures; corporations and trusts; Clean Water and Drinking Water State Revolving Fund (CWSRF and DWSRF) programs | Development phase activities; construction, reconstruction, rehabilitation, and replacement activities; acquisition of real property or an interest in real property, environmental mitigation, construction contingencies, and acquisition of equipment | (1) Issuance of a Notice of Funding Availability; (2) Applicants submit letters of interest; (3) Selected projects invited to apply; timeline is approximately 6 months | Creditworthiness and dedicated source of revenue; Federal requirements and cross-cutter provisions apply | No | Yes |
| U.S. HUD Community Development Block Grant (CDBG) Program https://www.hud.gov/program_offices/comm_planning/communitydevelopment/programs | Grant Size: Varies<br>Loan Size: No size limits (typically $500,000 to $140 M)<br>Interest rate / Fees: Interest rate pegged to LIBO + markup (currently 2.79%); fee is a percentage of the principal amount of the guaranteed loan (2.23% for FY2019)<br>Loan Term (length): Maximum 20 years | Entitlement Grant Program: Entitlement cities; other metropolitan cities ≥ 50k people; qualified urban counties ≥ 200k people<br>State Grant Program: Non-entitlement communities and governments<br>Loan: Eligible recipients of the grant programs | Activities that meet one of the national objectives for the program: (1) benefit low- and moderate-income persons, (2) prevent or eliminate slums or blight, or (3) address community development needs having a particular urgency; eligible activities include energy conservation | Grant: Determined by Entitlement Cities and States<br>Loan: Determined by HUD Community Planning and Development field offices | Federal requirements and cross-cutter provisions apply | Yes | Yes |
| USDA Rural Development Water & Waste Disposal Loan & Grant Program https://www.rd.usda.gov/programs-services/water-waste-disposal-loan-grant-program | Grant Size: Up to 75% or 45% of eligible project costs<br>Loan Size: Based on repayment ability<br>Interest rate / Fees: Three interest rates (2.5%, 3.375%, and 4.25% until June 30, 2019); no upfront fees for direct loan program<br>Loan Term (length): The useful life of the facility or 40 years | Grant: Limited to low-income communities, prioritizing smallest, most needy communities and those with health and compliance issues<br>Loan: Not-for-profit entities, federally recognized tribes, cities, towns, and rural areas under 10,000 population | Eligible activities include, but are not limited to, acquisition, construction, or improvement of drinking water sourcing, treatment, storage, and distribution; sewer collection, transmission, treatment, and disposal; stormwater collection, transmission, and disposal | Rolling application cycle but the best time to apply is October-December | All federal financing must be used for a public purpose; Projects must be financially sustainable | Yes | Yes |

## Comparison Criteria

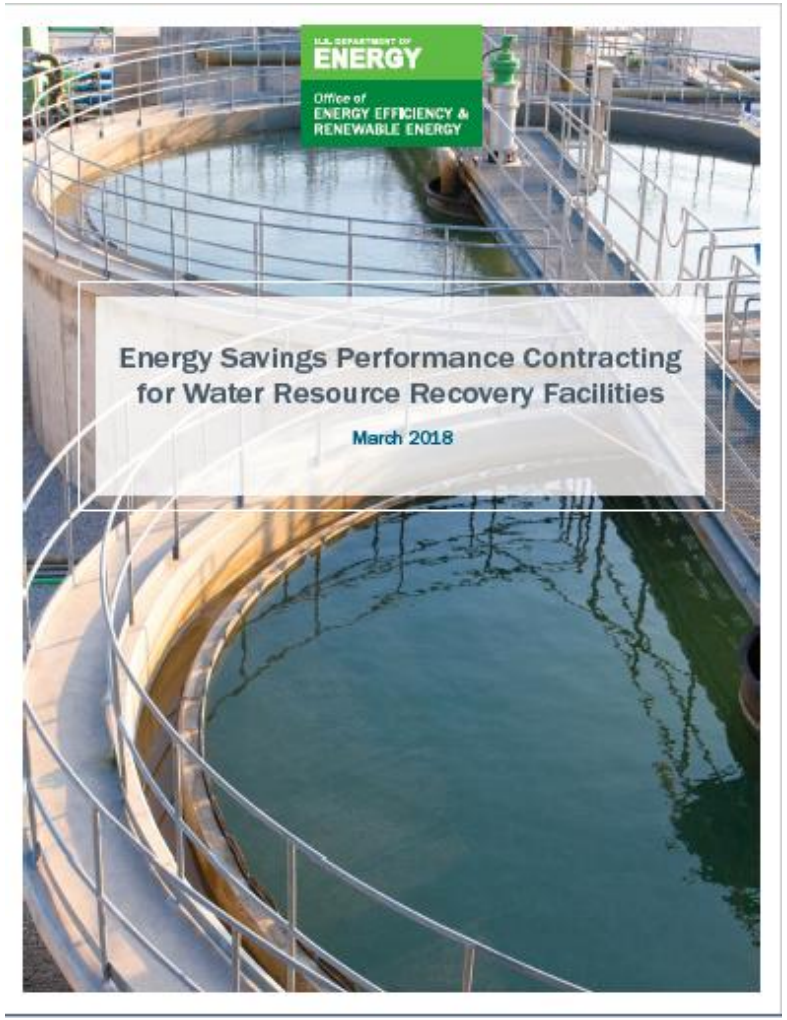
1. Description
2. Eligibility
3. Activities
4. Deadlines
5. Application Requirements
6. Technical Assistance
7. Compatibility Options

# Financing Funds & Programs

- **Clean Water State Revolving Fund (CWSRF)**
- **EPA Water Infrastructure Finance & Innovation Act (WIFIA) Program**
- **HUD Community Development Block Grant (CDBG) Program**
- **USDA Rural Development Water & Waste Disposal Loan & Grant Program**

# Financing Mechanisms

- **Lease-Purchase Agreements**
- **Energy Savings Performance Contracting (ESPC)**



# Thank You!

**For more information:**

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NATIONAL GOVERNORS ASSOCIATION

# State Team Time

NATIONAL GOVERNORS ASSOCIATION

# Report Out and Conclude Day 2

NATIONAL GOVERNORS ASSOCIATION

# Welcome Day 3

# Water Energy Nexus Learning Lab Agenda

| Day 3 – Thursday | |
|---|---|
| 12:00-12:30 pm | Virtual Site Visit – 91st Ave WWTP |
| 12:30-1:30 pm | Facilitated State Team Time and Action Planning |
| 1:30-2:00 pm | State Final Report Out |

PHX WATER SMART

City of Phoenix
WATER SERVICES DEPARTMENT

# The Heat is On:
## Sustainability in a Desert City

Nazario Prieto | Assistant Director, Wastewater

Cynthia Campbell | Water Resources Management Advisor

National Governors Association
September 3, 2020

# PHX Water: One of the Nation's Leading Utilities

- Largest potable water provider in Arizona
- 8 treatment plants
- 12,000 miles of water and sewer mains (540 sq. miles)
- Serve 1.7 million water and 2.5 million wastewater custo
- Produce 95 billion gallons of water annually
- Treat 63 billion gallons of wastewater annually
- 1,452 employees
- $3.22B 5-yr Capital Improvement Program

PHX WATER SMART

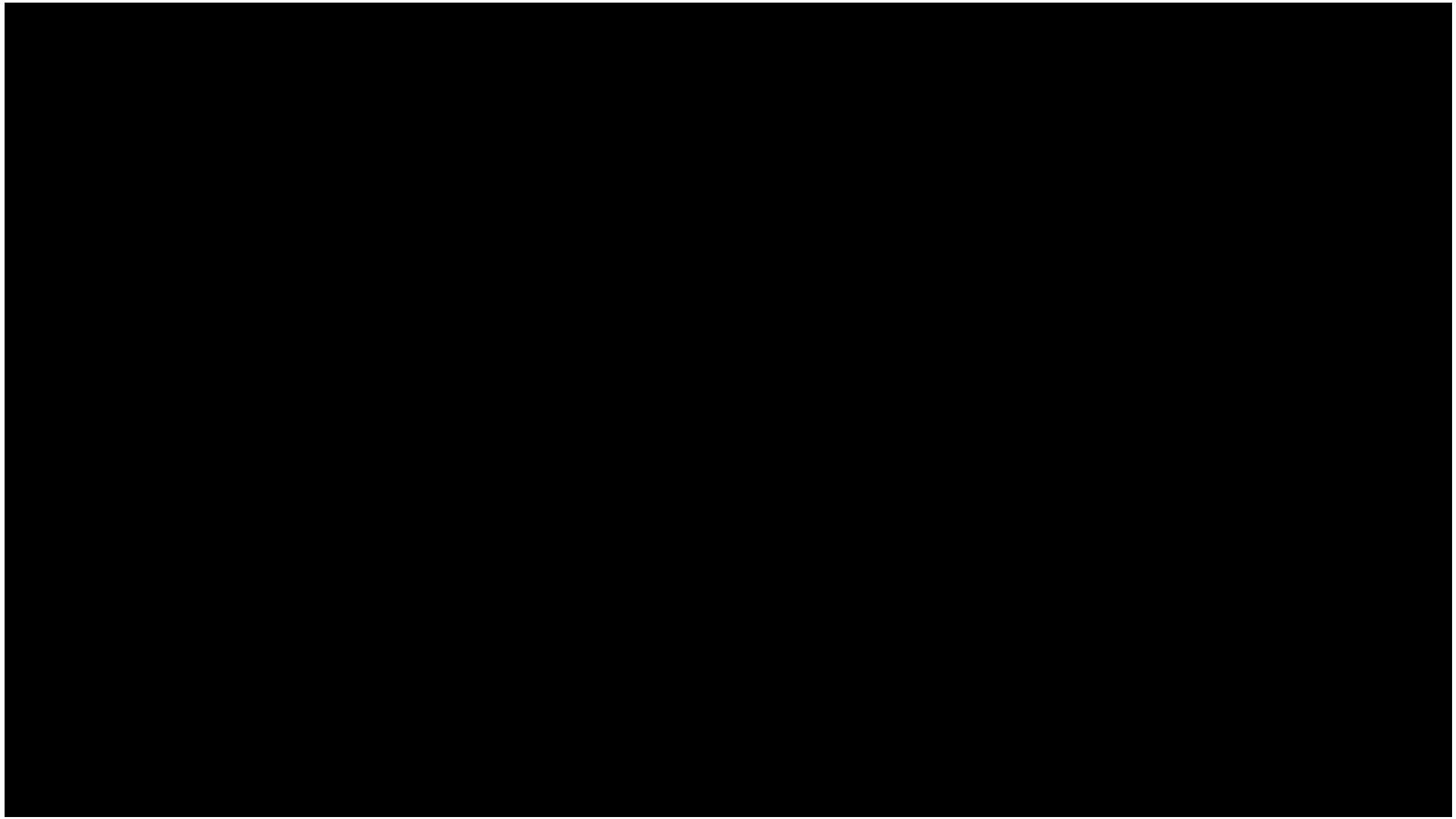
# 91st Avenue Wastewater Treatment Plant


# 91st Avenue Renewable Biogas Project

# 100%

## Reuse of Biosolids as a soil amendment for non-edible crops

# Water Reuse and Why it Matters



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# Thank You

**For More Information:**
**phoenix.gov/water**

/PHXWATER

NATIONAL GOVERNORS ASSOCIATION

# State Team Time

NATIONAL GOVERNORS ASSOCIATION

# Report Out and Conclude Day 3