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

U.S DOE Resources for Sustainable Low-Energy Water Utilities

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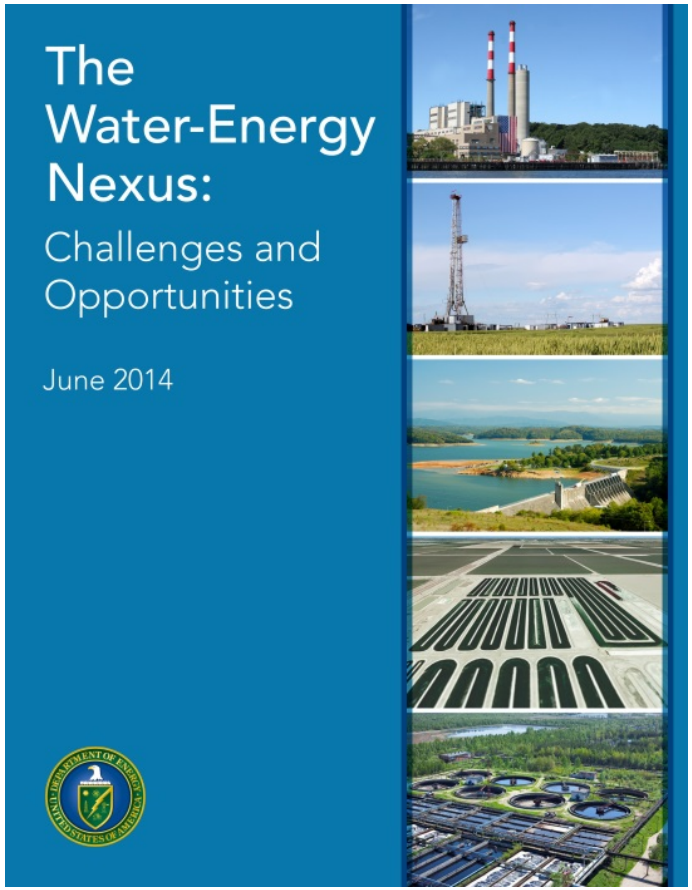
Overview

- **DOE and the Water-Energy Nexus**
- **Water-Energy Flows: Sankey Diagrams**
- **DOE Technical Assistance and Related Activities**

DOE and the Water-Energy Nexus

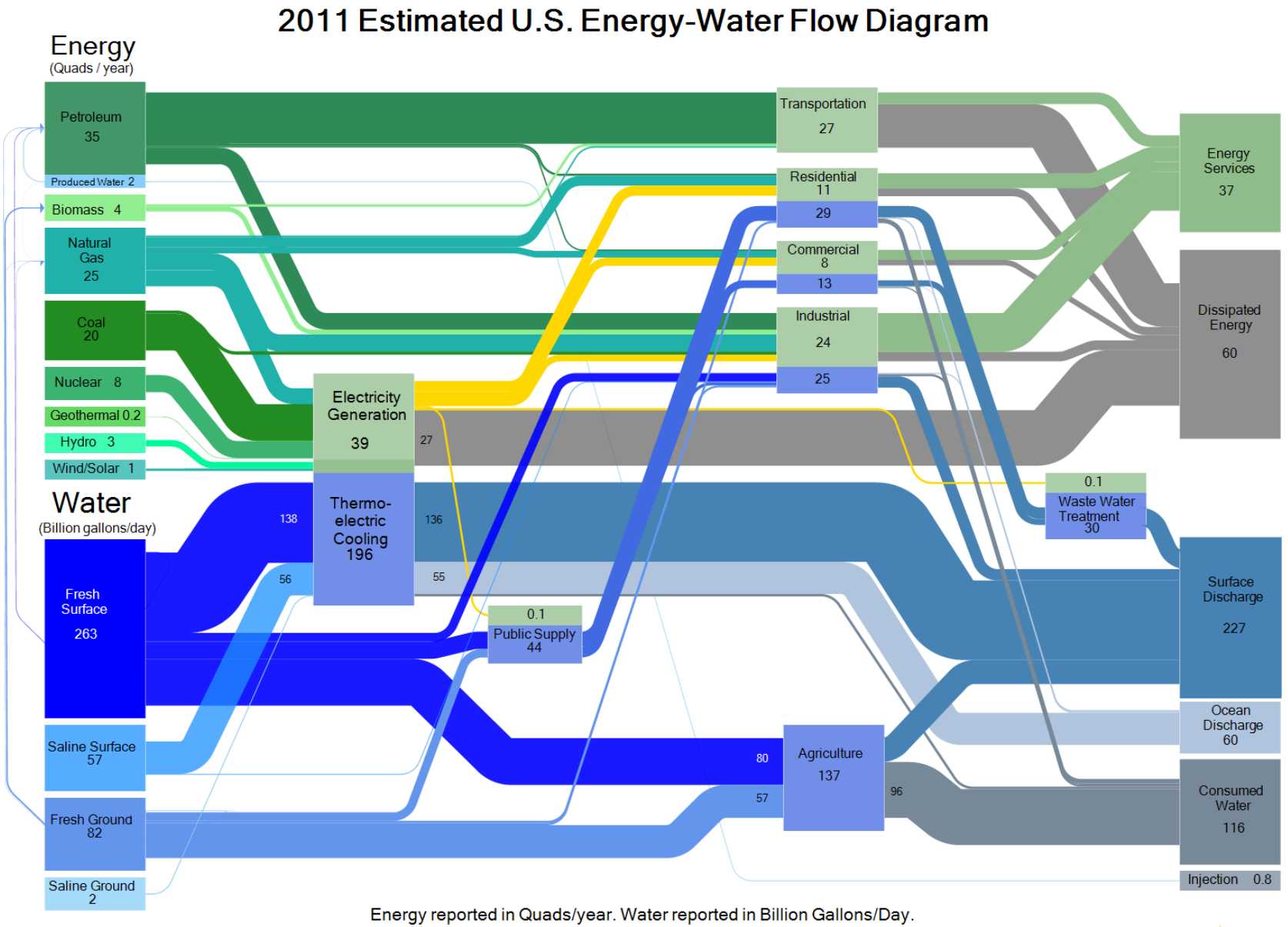
- DOE has strong expertise in technology, modeling, analysis, and data
- DOE's work has broad and deep implications
  - User-driven analytic tools for national decision-making supporting energy resilience
  - Technology RDD&D, policy analysis, and stakeholder engagement
- DOE approach focuses on energy:
  - Focus on technical strengths and mission
  - Leverage strategic interagency connections
- Energy Policy Act of 2005 directs DOE to carry out programs on energy for water and water for energy

Search: DOE WETT



Download the full Report

Interconnected Energy and Water Systems



DOE's Six Strategic Pillars for the Water-Energy Nexus

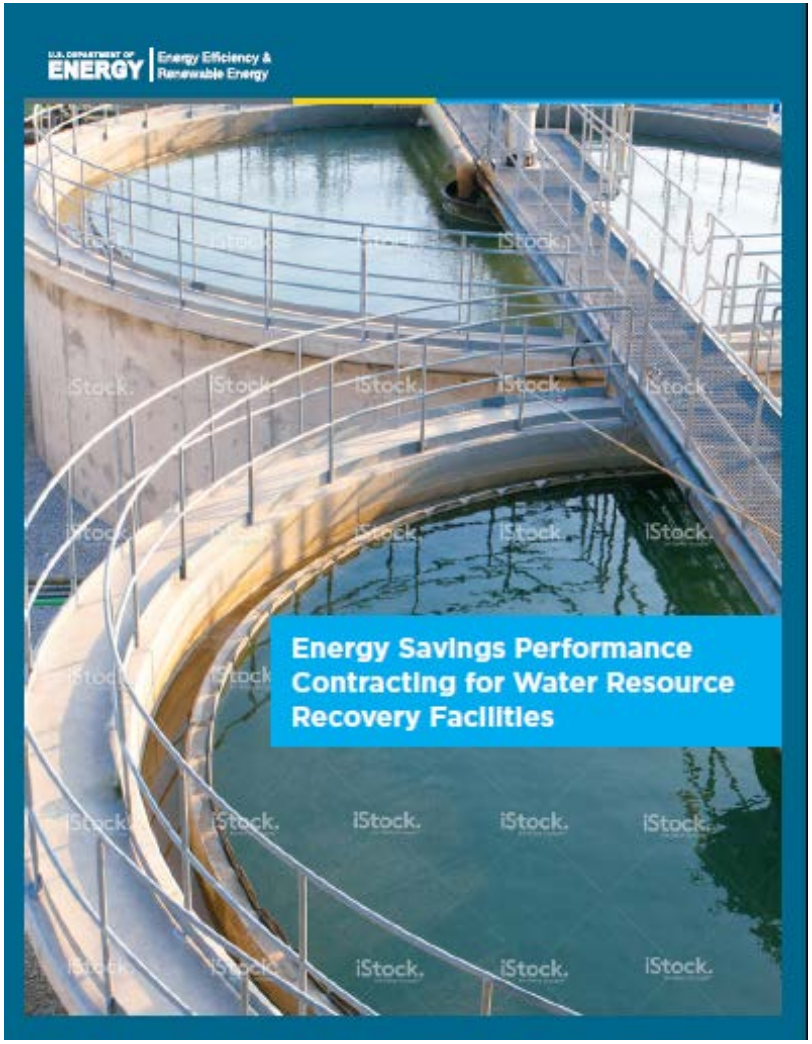
- Optimize the freshwater efficiency of energy production, electricity generation, and end use systems.
- Optimize the energy efficiency of water management, treatment, distribution, and end use systems.
- Enhance the reliability and resilience of energy and water systems.
- Increase safe and productive use of nontraditional water sources.
- Promote responsible energy operations with respect to water quality, ecosystem, and seismic impacts.
- Exploit productive synergies among water and energy systems.

Pillars discussed today

Topic discussed today	Connected Pillar
• Wastewater Infrastructure Accelerator • Better Buildings, Better Plants • Superior Energy Performance • Industrial Assessment Centers (IACs) • CHP Technical Assistance Program • Tools	Energy efficiency of water management, treatment, distribution, and end uses
• Better Buildings Water Savings Initiative • IACs	Freshwater efficiency in energy production, electricity generation, and end uses
• CHP Resiliency Accelerator	Reliability and resilience of energy and water systems
• Energy Positive Resource Recovery	Synergies among water and energy systems
• Energy-Water Bandwidth Study for Desalination Systems	Use of nontraditional water sources

Wastewater Infrastructure Accelerator

Purpose: To accelerate a pathway toward a sustainable infrastructure



Snapshot

- Launched May 2016
- 22 partners, representing 80+ facilities
- Three-year commitment

Areas of Activity

- ✓ Establish energy data management
- ✓ Assess technical, management, process, and resource recovery options
- ✓ Consider financing options
- ✓ Demonstrate energy conservation measures

Outcomes

- Model infrastructure improvement plans
- Assessment & decision tools
- Road-tested examples of facility upgrades

Better Plants – Water and Wastewater Utilities

- **Better Plants is the industrial component of the Better Buildings Initiative**
- **Through Better Plants:**
  - Organizations set long-term efficiency goals (25% energy intensity reduction over 10 years)
  - Receive technical assistance and national recognition for their leadership
- **Better Plants is now open to water and wastewater treatment agencies:**
  - 22 Utilities have joined, 9 at the Challenge Level, including some of the nation's largest and most complex systems (NY, LA, Boston)
  - DOE provides quarterly webinars to understand key challenges, refine metrics, and share solutions
  - energy.gov/betterplants

Better Plants – Partner Benefits

- Technical Assistance
- Peer-to-Peer Networking Opportunities
- National Recognition

DOE official poses with Volvo NRV employees

DOE will assign an expert Technical Account Manager, who will help you navigate the program and tap into our energy-saving resources

Better Plants – In-Plant Training

- Teach participants how to conduct assessments, use DOE tools, and implement projects
- Open to employees from host plant, peer companies, suppliers
- ~60 INPLTs covering steam, compressed air, process heating, pumps, and fans since 2011
- ~850 participants
- Identified > 3 TBTU and $14 million in energy savings
- Pre-INPLT webinars available on program website
- New topic: Water/Wastewater Treatment Plant Energy Efficiency
  - Applications due out Oct ‘16
  - First trainings Jan ‘17

Process heating INPLT at an ArcelorMittal plant in Nov. 2013. Photo courtesy ArcelorMittal and ORNL.

TAM Support / Improved Resources for Data Analysis

- Guidance on energy baselines and data tracking / reporting
- Guidance aligned with DOE's EnPI 4.0 tool, updated recently to include GHG and cost savings calculations
- DOE Technical Account Managers help companies compile and continuously improve metrics and methodology

Superior Energy Performance (SEP)

Superior Energy Performance
U.S. DEPARTMENT OF ENERGY

- Certification program – meet the ISO 50001 energy management standard
- SEP verifies the energy savings they achieve
- 33 plants have been certified so far
- Average energy performance improvement of 11% in 18 months
- Savings over $500,000 per year
- **New Water Utility Members:**

Des Moines Water Works
Water You Can Trust for Life

Kent County, Delaware
Levy Court
SERVING KENT COUNTY WITH PRIDE

Delta Diablo
TRANSFORMING WASTEWATER TO RESOURCES

ALEXANDRIA renew ENTERPRISES

Utilities, Inc.

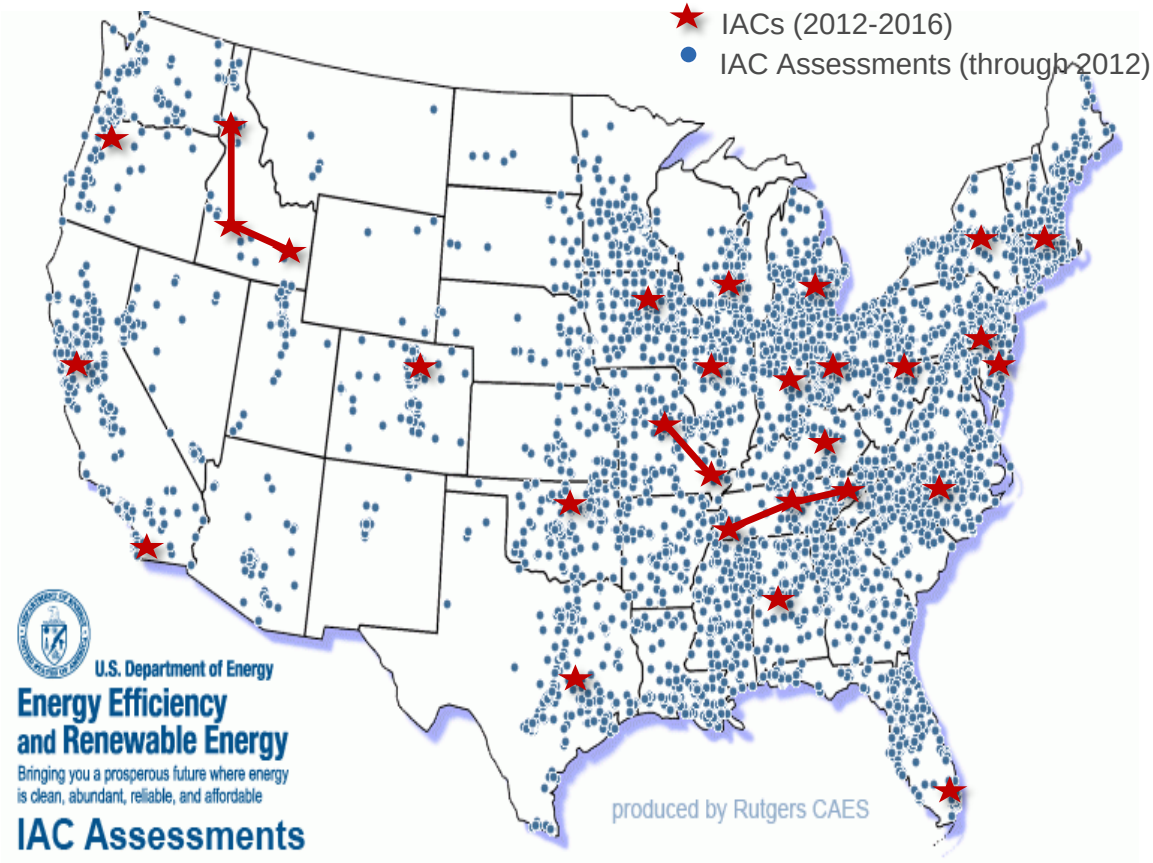
SBCSA • Apple Valley • Hesperia • Victorville
VVWRA
Taking the Waste Out of Wastewater

Industrial Assessment Centers (IACs)

24 University-based Centers that support the industrial sector and train energy engineers

FREE assessment for small and medium sized manufacturers, including **water and wastewater plants**

- Energy expenses between $250k - $2.5M/year
- Water >5 MGD
- Wastewater >2 MGD
- Recommendations to reduce energy and water/waste and increase productivity
- On average, IAC clients report $46,000 in 1st year energy and process improvements savings



CHP Deployment Program

Program activities include:

- **Market Analysis and Tracking**
  - CHP Market Study – Technical Potential
  - DOE/ICF CHP Installation Searchable Database
- **Fact sheets, reports, project profiles:**
  - Waste Heat to Power Market Assessment
  - CHP Project Profile Database
- **CHP Technical Assistance Partnerships**
  - 7 CHP TAPs for National Coverage
  - Provided support to over 780 projects in FY2009-2014, with more than 220 under development or online: estimated installed capacity of 1.7 GW.

➢ **New Initiatives…**

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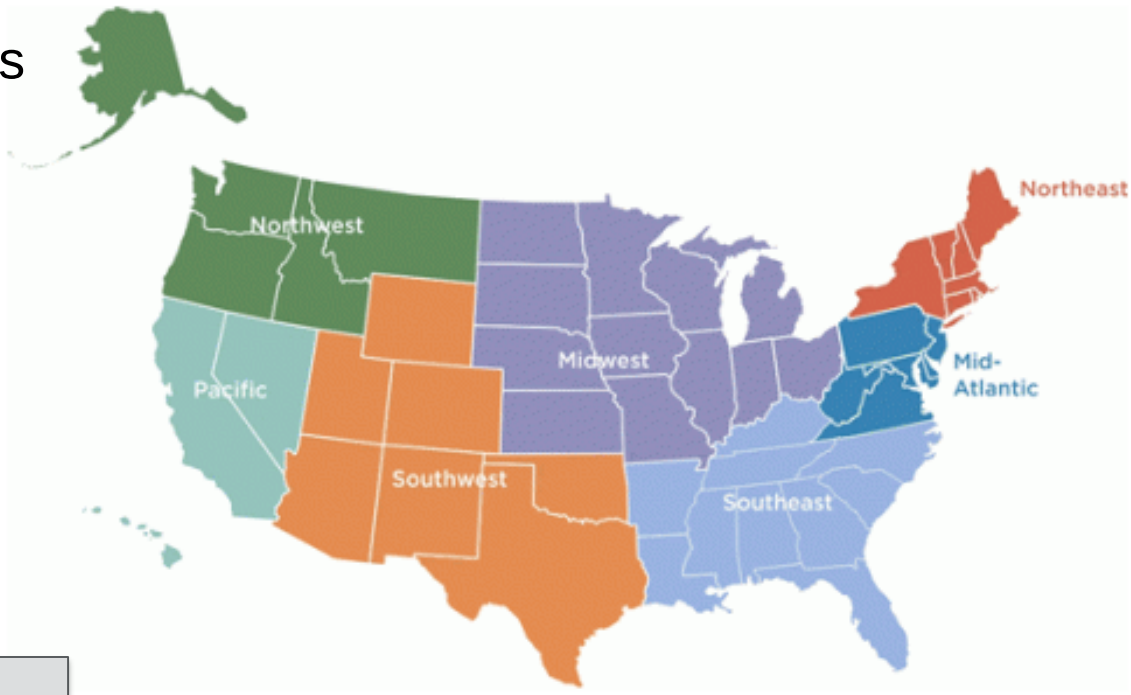
CHP Technical Assistance Partnerships (TAP)

CHP TAPs Provide:

- Market Opportunity Analysis
- Education and Outreach
- Technical Assistance
- See "Project Profiles" for wastewater:
  - 14 Projects = 100 MW
  - 150 kW – 60 MW



Free CHP screenings and engineering assistance

www.energy.gov/CHP

Better Buildings Water Savings Initiative

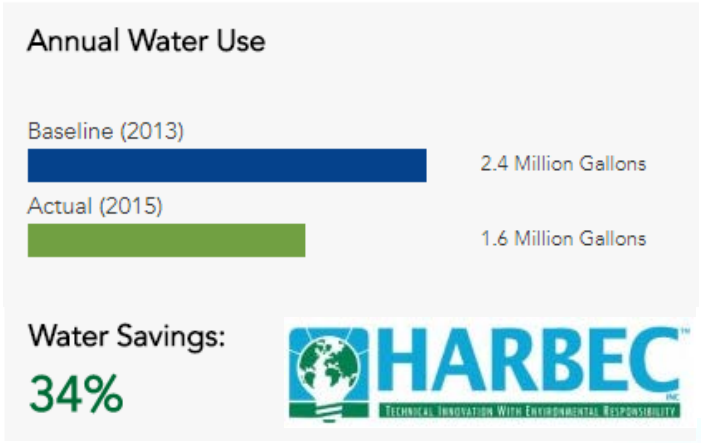
- Partners sign up with DOE to:
  - Set water savings goals
  - Track progress towards the goal
  - Publicly share success
- 35 partners across 5 sectors have signed up for the Water Savings Initiative
- Solutions shared include:
  - Implementation Models
  - Showcase Projects
  - Water Management Strategies
  - Visit: https://betterbuildingssolutioncenter.energy.gov/challenge/water-savings

Partners with Greatest Water Savings (since baseline year)	
HARBEC, Inc.	49%
Cummins, Inc.	***45%***
Ford Motor Corporation	44%
United Technologies Corp.	***43%***
Shari's Café and Pies	30%
Poudre School District (CO)	***29%***
Atlanta, GA	***20%***
State of North Carolina	19%
Hillsboro, OR	15%

Denotes goal achiever

Saving Water in Industry

Rainwater pond cuts water bill by 1/3



Best practice list drives corporate-wide water savings

United Technologies

REQUIRED ACTIONS

Water reduction initiatives should be scalable to match local conditions. Sites will review the best practices listed below for applicability and will develop an implementation plan for the water management best practices that are considered practical. Project details will be tracked in the EH&S Project Tracking Module.

Water Management Best Practice Tracking

Best Practice for Existing Sites	Project Complete	Developing - Implementing	Not Started	Considered Not Recommended
Water Balance				
Leak management program				
Eliminate once-through cooling				
Implement cooling tower management program				
Install flow meters				
Install low flow fixtures				
Reduce or eliminate rinse tank overflow				
Reduce or eliminate landscape irrigation				
Recycle process wastewater				
Rain water harvesting				

Better Buildings Solution Center

200+ showcase projects

- Large and small buildings
- All sectors
- Specific building types such as schools, hospitals, hotels, grocery stores, universities, civic centers, libraries, offices and labs

100+ implementation models (playbooks)

- Overcome barriers: finance, data, energy management, staff training, community and customer outreach, partnering with utilities, and more
- Multi-faceted and applicable across sectors

1,000 case studies, reports, tools, calculators and more

https://betterbuildingssolutioncenter.energy.gov/

CHP for Resiliency Accelerator

Purpose: Elevate role & opportunity of CHP in Critical Infrastructure Planning

Long Island, NY 2012

Offerings

- ✓ Establish resiliency action plans
- ✓ Utilize CHP TAPs
- ✓ Promote “Packaged CHP Challenge”
- ✓ National recognition and visibility

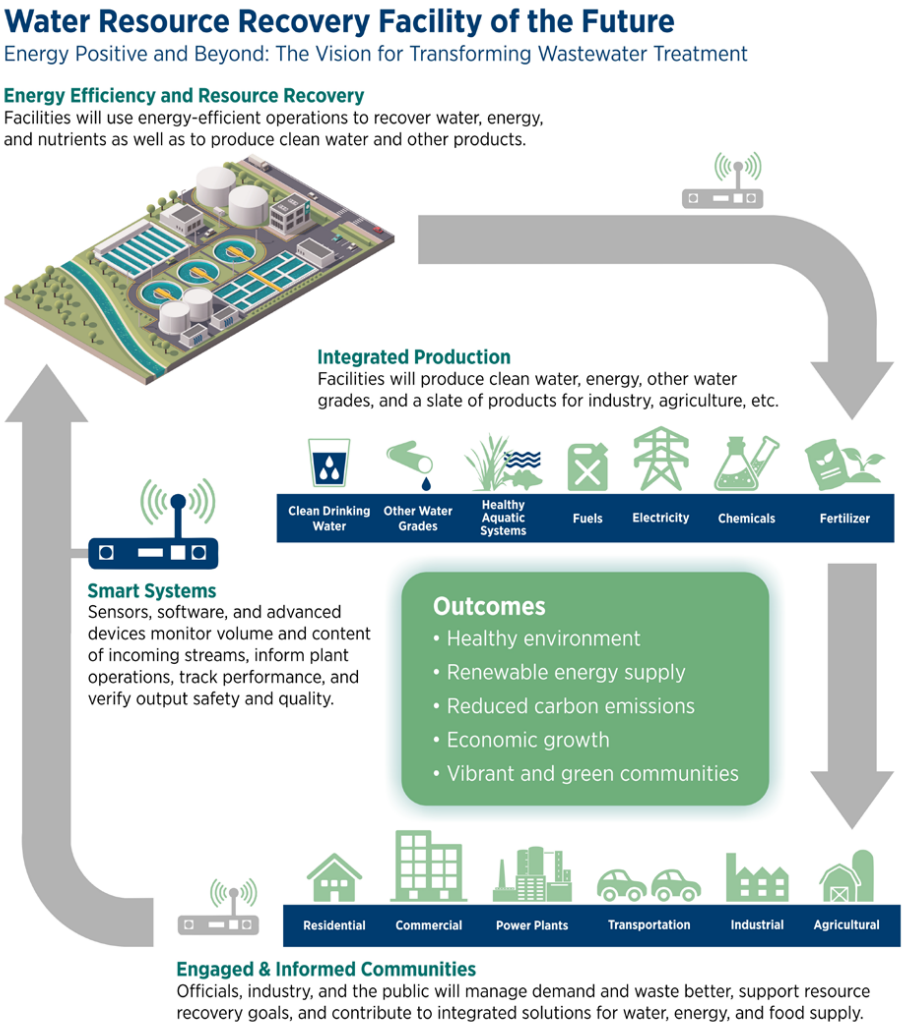
Outcomes

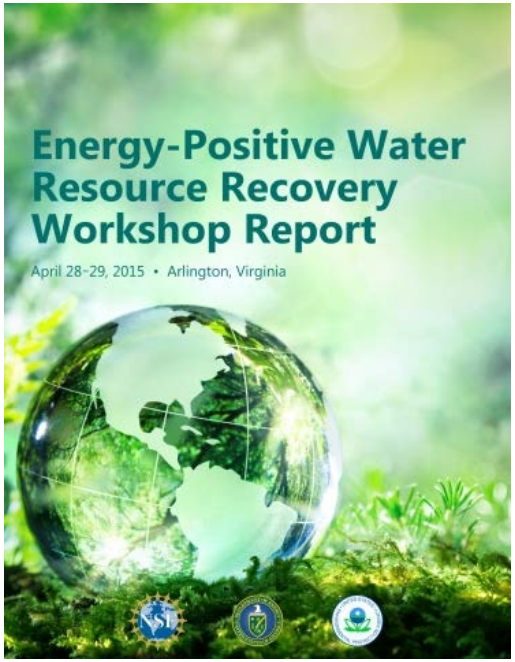
- Integrated resiliency plans (local, state, utility)
- Collective lessons learned for replicability
- Increased CHP installations

Timeline

- Launched May 2016
- Two-year commitment

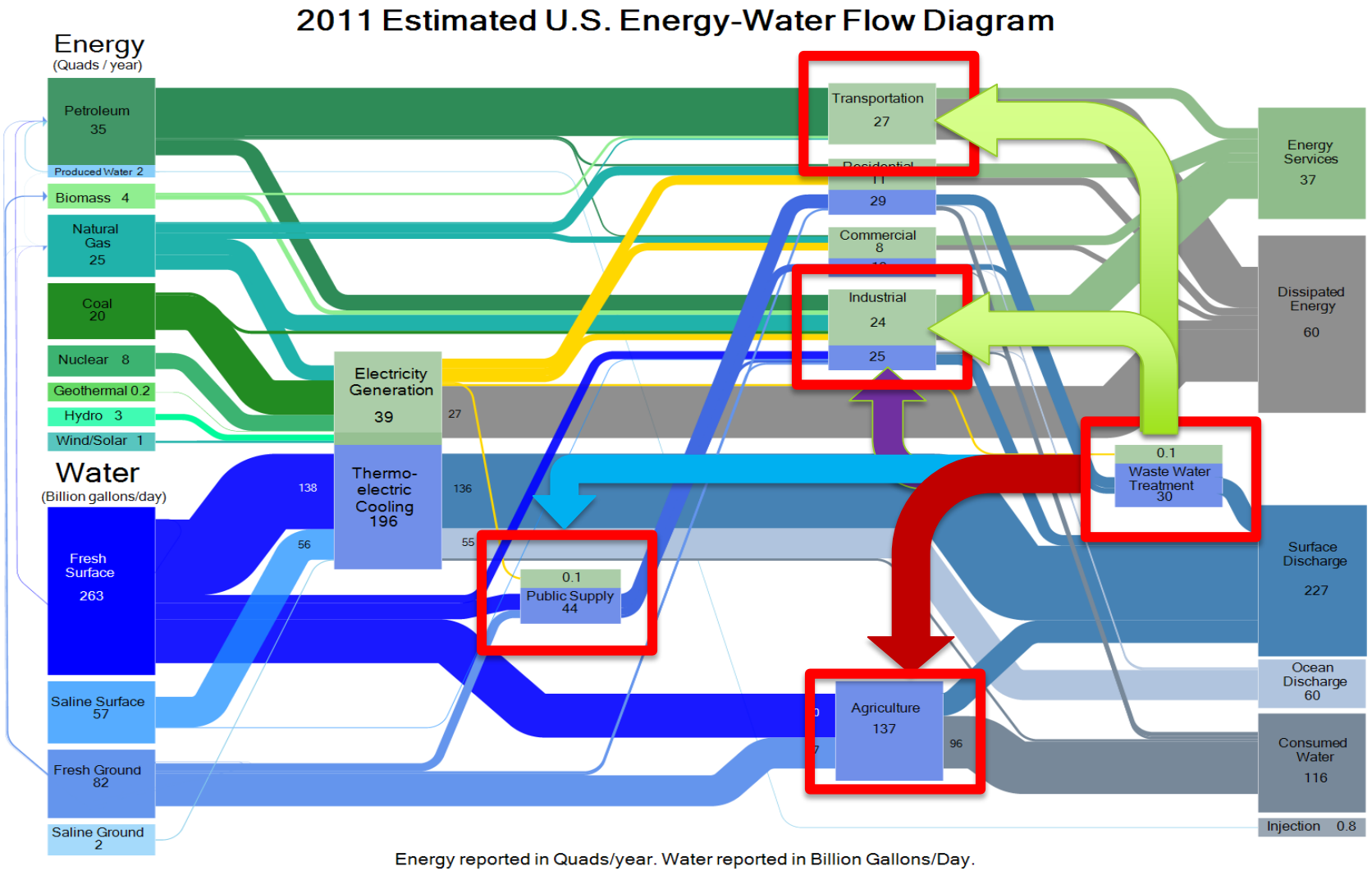
Energy Positive Water Resource Recovery





Water Resource Recovery Facilities are a Target Market for CHP TAPs

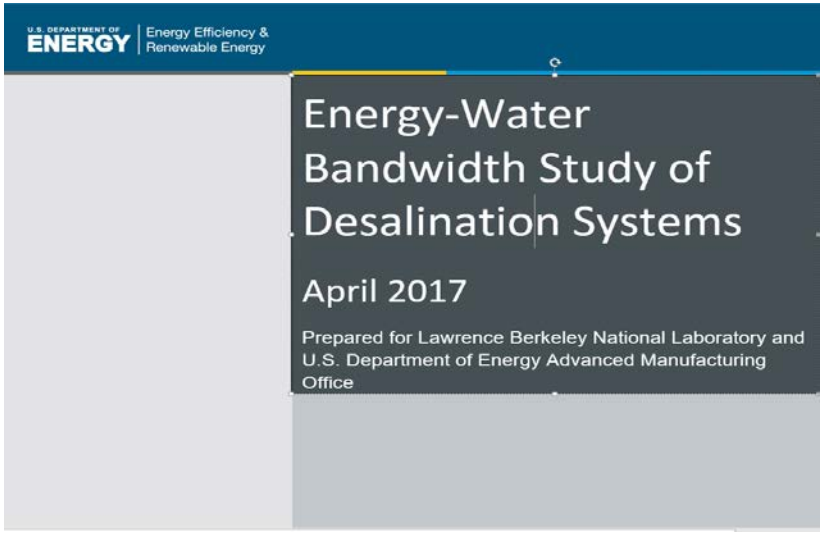
WRRF connects back upstream

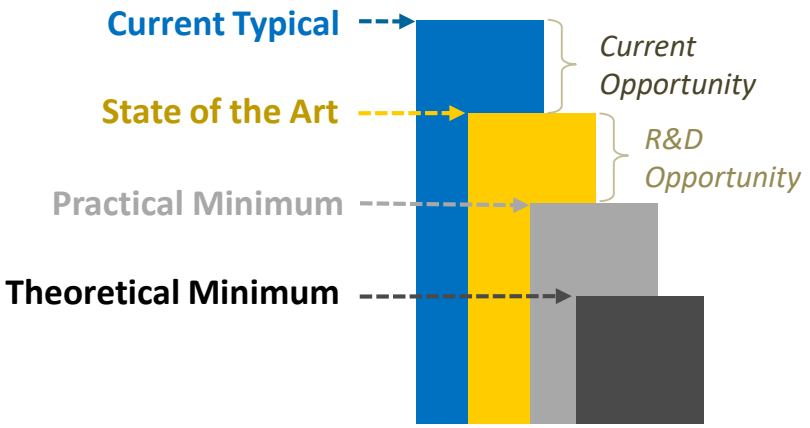


Energy | Recycled Water | Nutrients | Potable Water

Energy–Water Bandwidth Study for Desalination Systems

Study will frame the current and R&D opportunity for reducing the energy consumption, CO_2 emissions, and costs of seawater desalination for U.S. public water supply under various uptake scenarios



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Thank You

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HARBEC: Rainwater harvesting

- 900,000 gallon rainwater retention pond offsetting cooling loads and tower make-up water
- 145,000 gallons/month reduction in purchased water
- Project aligns with company target to be water-neutral
- 17,000 kWh/month in energy savings from reduction in cooling pump and fan loads from 50 hp to 6 hp
- Motivated by increasing fire insurance premiums
- Simple financials:
  - Saved $3,000 in water cost
  - Saved $50,000 in avoided insurance costs
  - Energy cost savings
  - $250,000 implementation cost

Nissan - Water Reuse at Smyrna, TN plant

- Phosphate removal using once through rinsing
  - Water treated onsite (consumes energy) and discharged to sewer
  - Water replaced with municipal and RO water (consumes energy)
- Water filtration system installed
- Saved 50 million gallons of water in 2015 compared to 2014
- Simple financials:
  - $320,000 water cost savings
  - $640,000 implementation cost

Responding to Challenges in the Energy-Water System

Energy Technology Pathways

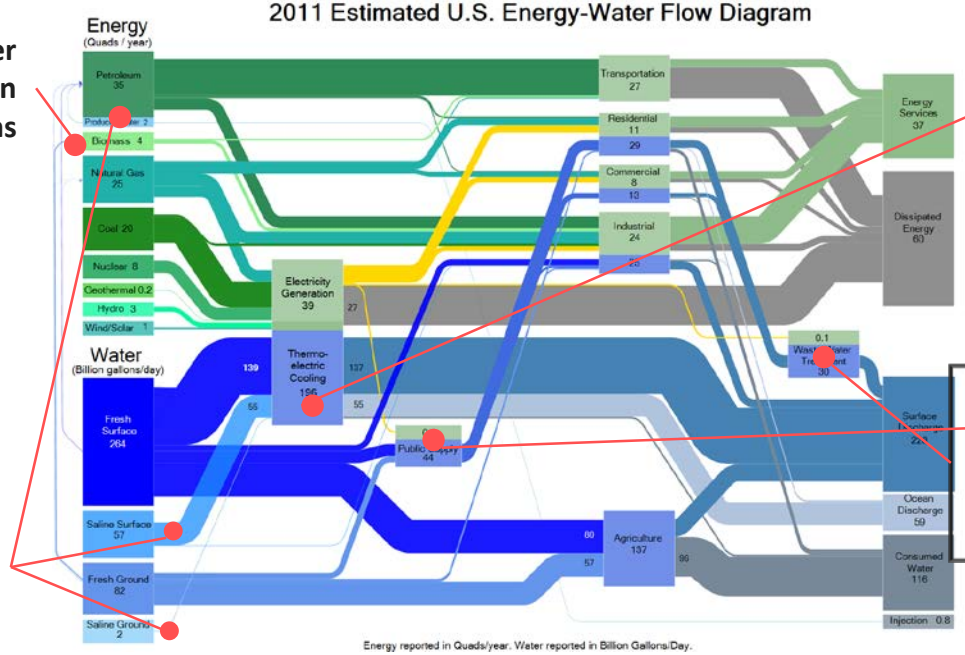
Forces on System

Climate Change (Mitigation and Adaptation)

Technology Solutions

Improved Water Efficiency in Bioenergy Systems

Water-Efficient Cooling



Sustainable Water Utilities

Treatment, Management, and Beneficial Use of Nontraditional Waters

Policy and Institutional Changes

Land Use & Land Cover Change

Stakeholder and Consumer Preferences

Population/ Migration

Urbanization & Infrastructure Dynamics

Regional Economic Development