

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Comprehensive Water Management Strategies

Training brought to you by the Federal Energy Management Program

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FEMP Water Management Program

- FEMP aims to train energy managers to be water managers by providing them tools and resources to develop a comprehensive water management program.
- FEMP strives to help agencies establish priorities based on a thorough evaluation of current water consumption, efficiency measures, and alternative water opportunities.

Instructors





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Training Objectives

Objectives:

- Provide an overview of Federal water-related laws and statutes
- Describe steps in a comprehensive water management program
- Link these steps to meeting Federal requirements

At the end of this lesson, we hope that you can:

- Identify important Federal water-related laws and requirements
- Describe the major elements of a comprehensive water management program
- Identify useful water strategies to help inform your water management program

Throughout this training look for questions in blue boxes that you'll answer in the Webex Q&A feature

Basic Water Terms

Water Supply Types



Freshwater: Sources from surface or groundwater

Water Treatment Levels



Potable water: classified, permitted, and approved for human consumption



Alternative water: Sustainable sources not from freshwater (e.g., harvested rainwater)



Non-potable water: not classified, permitted, nor approved for human consumption

Water Treatment Levels: <u>https://www.energy.gov/eere/femp/alternative-water-treatment-levels</u>

Key Federal Facility Water Management Legislation Overview

- Energy Act of 2005
 - Comprehensive Energy and Water Evaluations
 - Procurement
 - Water efficiency measure implementation
- Energy Independence and Security Act 2007
 - Measurement and verification
 - Sustainable design
 - Stormwater management
- Energy Act of 2020
 - Water metering
 - Water efficiency measure implementation and use of performance contracts
 - Energy manager responsibilities that include water management
 - Commissioning of water equipment
- National Defense Authorization Act Department of Defense only (not covered in this course)

Question: Put your answer in the Q&A feature Who do you work for and what is your primary role such as:

- Head quarter or regional manager
- Water manager at a site
- Water system evaluator

Eight Key Agency Actions to Meet Legislative Statutes



• Construct new buildings that meet the Guiding Principles

Look for green boxes through the training that indicate how these Federal requirements can be met.

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Federal Water-Related Laws and Statutes Breakdown

Title	Legal Authority	Originating Legislation	Summary				
Comprehensive Energy and Water Evaluations	42 U.S.C. § 8253(f)(3)(A)	Energy Independence and Security Act (EISA) 2007 § 432 and Energy Act of 2020 § 1002	Agency energy managers are required to complete an annual comprehensive energy and water evaluation for approximately 25% of agency covered facilities in a manner that ensures that an evaluation of such facility is completed at least once every 4 years.				
Implementation Water Efficiency Measures & Performance Contracting	42 U.S.C. § 8253(f)(4) And 42 U.S.C. § 8253(b)(1)	EISA 2007 § 432 and Energy Act of 2020 § 1002	Each agency shall implement any water-saving measure that was identified as life cycle cost (LCC) effective in the water evaluations and bundle individual measures of varying paybacks together into combined projects. And Each federal agency shall use performance contracting to address at least 50 percent of the measures identified in comprehensive evaluations.				
Commissioning and Measurement and Verification	42 U.S.C. § 8253(f)(5)	EISA 2007 § 432 and Energy Act 2020	For each measure implemented under 42 U.S.C. § 8253(f)(4), agencies are required to ensure that equipment is fully commissioned at acceptance to be operating at design specifications; equipment and system performance is measured during its entire life to ensure proper operations, maintenance, and repair; and energy and water savings are measured and verified.				
Building Water Metering	42 U.S.C. § 8253(e)	Energy Act of 2020 § 1002	All Federal Buildings shall be metered for water by October 1, 2022 and to the maximum extent practicable, shall be metered with advanced meters that provide data at least daily and measure data at least hourly (in accordance with guidance submitted by FEMP).				
Energy Manager Responsibilities	42 U.S.C. § 8253(f)(2)	Energy Act of 2020 § 1002	Agencies are required to designate an energy manager that is responsible for reducing energy and water at each facility; energy managers shall take into consideration the use of a system to manage energy and water at the facility.				
Sustainable Design Principles	42 U.S.C. § 6834(a)(3)(D)(i)(III)	EISA 2007 § 433	Sustainable design principles shall be applied to siting, design, and construction of all new and replacement buildings.				
Water-Efficient Product Procurement	42 U.S.C. § 8259b(b)	EPAct 2005 § 104	Federal agencies are required to procure ENERGY STAR and FEMP designated products.				

Executive Order 14057

Agency Water Efficiency Requirement:

- Potable Water Use Intensity (WUI) Target: Each agency shall establish an FY2030 agency-wide potable WUI target
 - Agencies shall consider performance benchmarks for categories of building types (e.g., hospitals, office buildings) and the composition of the agency's building portfolio
 - CEQ is providing a tool to assist in developing the agency potable WUI target

Other Requirements:

- Sustainable Procurement: Purchase sustainable products identified by the Environmental Protection Agency
- *Net zero water:* Agencies must ensure all new construction over 25,000 sqft are designed to meet net zero water where feasible
- *Performance Contracting:* Agencies are to use performance contracting to audit buildings and implement energy and water efficiency measures

Implementing Instructions:

https://www.sustainability.gov/pdfs/E0_14057_Implementing_Instructions.pdf

Comprehensive Water Management Process



Comprehensive Water Management Process



Understand the Facility Water Cycle



Understand the Current Conditions

- Identify existing plans and strategies that have been developed or are underway that can impact your efforts
- Review any past water evaluations to determine what projects were identified and if they have been implemented
- Define water sources and treatment levels
- Cybersecurity needs

Federal Water Management Planning Manual: https://www.osti.gov/biblio/1826651

Develop Program Goals

- Develop goals that provide overarching objectives for the water management program
- Develop a strategic plan with specific targets
- To track performance over time, ensure your goals are measurable and have a specific timeline associated to them
- Consider framing agency goals around the concepts of efficiency, resilience, and sustainability. This framework can help drive a multi-faceted program that achieves crosscutting benefits for your agency

Assign Energy Manager Roles

- Responsible for managing and reducing both energy and water use at their facility
- Play a crucial role in the development of a comprehensive water management program and most likely lead the effort
- Required to complete comprehensive energy and water evaluations
- Recommended water training on water management

Question: What other personnel can support water management?

Requirement: Energy Act of 2020 § 1002 42 U.S.C. § 8253(f)(2)

Water Management Training: https://www.osti.gov/biblio/1826651

Steps for water metering prioritization:

- Verify the existence/type of currently installed building-level meters
- Identify buildings appropriate for metering
- Prioritize based on covered facility and water-intensive building types/applications
 - Chiller and steam plants, industrial/manufacturing buildings, data centers, hospitals and laboratories, and commercial kitchens

Requirement: Energy

Act of 2020 § 1002

42 U.S.C. § 8253(e)

- Irrigated landscape greater than 25,000 square feet
- Mission-critical buildings with large water-consuming processes (e.g., cooling towers, steam boilers, and water purification)

Energy Exchange 2022: Energy and Water Metering (Track Number 7 Session 6) 2:00 PM to 3:30 PM October 26, 2022

Comprehensive Water Management Process



Conduct a Comprehensive Water Evaluation

- Before you start conducting comprehensive evaluations:
 - Prioritize locations for water audits such as sites with high water use intensity
 - Develop a 4-year plan with 75% of covered facilities audited
- Required elements of a comprehensive evaluation:
 - Walk-through audit
 - Water balance
 - Assessment of water efficiency and alternative water projects
 - Life cycle cost analysis
 - List of identified projects

Requirements: EISA 2007 § 432 and Energy Act of 2020 § 1002 42 U.S.C. § 8253(f)(3)(A)

Question: Do you currently have a prioritized list of sites for comprehensive evaluations?

Establish a Baseline and Water Balance

- Identify all water sources
- Collect facility and utility data
- Determine facility water use baseline
- Identify all water using equipment
- Conduct a walk-through survey
- Estimate water end-use consumption
- Develop a water balance

FEMP Water Evaluation and Water Balance Tool: https://www.energy.gov/eere/femp/articles/waterevaluation-tools#water-balance-tool



Assess Water Efficiency Solutions

Investigate ways to optimize water use and increase water efficiency to reduce water use

- Consider water awareness and education
- Investigate water efficiency options
 - O&M changes
 - Retrofit
 - Replacement
- Investigate leak detection and repair

FEMP Best Management Practices for Water Efficiency:

https://www.energy.gov/eere/femp/best-management-practices-water-efficiency

Did you know a commercial toilet with a flush longer than 6 seconds is likely wasting water due to an old gasket?

Investigate Underutilized Water-Efficient Technologies

- Hot water temperature maintenance technologies
- Advanced irrigation controls
- Multi-stream rotational sprinklers
- Side stream filtration for cooling towers
- Advanced cooling tower controls
- Leak detection technologies
- Connectionless food steamers
- Steam sterilizer condensate retrofit kits

FEMP Water Efficient Technology Opportunities: <u>https://www.energy.gov/eere/femp/water-efficient-technology-opportunities</u>

Question: What water-efficient technologies have you implemented?

Assess Alternative Water Projects

- Alternative water sources are from sustainable supplies that offset the demand for freshwater
- Assess alternative water projects in the comprehensive evaluation. Consider the following:
 - Identify applications that could use alternative water
 - Size systems based on water demand
 - Determine if water treatment is needed for each application
 - Consider water resilience as a main driver
 - Plan early for required permitting
 - Integrate an O&M program into the project
- Determine the cost of each project and the amount of freshwater use that will be offset by alternative water

Alternative Water Sources: <u>https://www.energy.gov/eere/femp/alternative-water-sources</u> Rainwater Harvesting Systems: https://www.energy.gov/eere/femp/water-efficient-technology-opportunity-rainwater-harvesting-systems

Alternative Water Examples



Conduct Life Cycle Cost Analysis

- Perform a life cycle cost analysis (LCCA) that assesses the economic viability of projects identified in the comprehensive evaluation
 - Helps decision makers prioritize the projects that are most appropriate and cost-effective for the facility.
- Determine costs and savings
 - For each water efficiency and alternative water solution identified, determine the cost of the measure, water savings, and other associated savings such as energy and total cost savings.

Resources:

- Water Rate Escalation Study: https://www.energy.gov/eere/femp/downloads/water-and-wastewaterannual-price-escalation-rates-selected-cities-across-united
- National Institute of Standard and Technology Handbook 135 Life Cycle Costing Manual for the FEMP: https://www.wbdg.org/ffc/nist/criteria/nist-handbook-135

Develop List of Solutions

- Document the results of the water evaluation, detailing the results of the assessments and LCCA
- Compile a list of all the solutions: O&M measures, retrofits, and replacement projects and alternative water projects
- Consider bundling solutions

Question: Have you've bundled energy and water measures together?

Note: Federal agencies are required to report data on water measures as part of the EISA requirement for comprehensive water evaluations.

> A comprehensive water evaluation that produces a list of solutions with LCCA results meets the requirement: EISA 2007 § 432 and Energy Act of 2020 § 1002 42 U.S.C. § 8253(f)(3)(A)

Solution Description	Water Savings (gal/yr)	Energy Savings (kWh/yr)	Capital Cost	Water Cost Savings (\$/yr)	Energy Cost Savings (\$/yr)	Simple Payback (yr)	Savings to Investment Ratio
Plumbing fixture retrofit – high- efficiency fixtures	228,000	3,370	\$17,833	\$2,657	\$479	5.7	2.6
Cooling tower – conductivity controller	52,800	0	\$1,849	\$615	\$0	3.0	5.0
Irrigation – weather-based controller	233,800	0	\$498	\$2,725	\$0	0.2	81.4
Distribution system – leak detection and repair	170,000	0	\$3,480	\$1,981	\$0	1.8	8.5
Alternative water – rainwater harvesting	161,800	0	\$95,700	\$1,886	\$0	50.7	0.3
Total	846,400	3,370	\$119,360	\$9,865	\$479	11.5	1.3

Comprehensive Water Management Process



Prioritize Solutions

After completing the comprehensive evaluation – prioritize solutions:

- Assess the potential benefits and costs and rank them in order of priority to obtain the biggest impact
- Consider the following ranking criteria to prioritize solutions
 - Life cycle cost results
 - Water reduction that helps to meet targets
 - Increased resilience (e.g., redundant water source)
 - Level of effort
- Develop a schedule of implementation
 - Implement life cycle cost effective projects within 2 years

Requirements: Energy Act of 2020 42 U.S.C. § 8253(f)(4)(B)

Identify Funding



Procure Energy Star Commercial Kitchen Equipment



Air Cooled Ice Machines

Connectionless Steam Cookers

Energy Star Commercial Kitchen Equipment Website:

https://www.energystar.gov/products/commercial_food_service_equipment

Requirements: Energy Act

of 2005 § 104

42 U.S.C. § 8259b(b)

Procure WaterSense Labeled Equipment



"WaterSense labeled products are backed by independent, third–party certification and meet EPA's specifications for water efficiency and performance." High Efficiency Tank Toilets

High Efficiency Commercial Toilets

High Efficiency Private Lavatory Faucets

High Efficiency Flushing Urinals

High Efficiency Showerheads

Advanced Landscape Controllers

Irrigation Spray Sprinkler Bodies

Just say no to *low flow*! Use the term *high efficiency* instead!

WaterSense Website: <u>http://www.epa.gov/watersense/</u>

Develop an Implementation Plan

- Develop an implementation plan that:
 - Includes roles and responsibilities
 - Specifies a date of implementation for each viable solution identified in the comprehensive evaluation
 - Prioritizes LCC effective projects *within two years of comprehensive evaluation*
 - Has a mechanism to track progress on implementation overtime
 - Includes commissioning and M&V protocols

Requirements: Energy Act 2020 42 U.S.C. § 8253(f)(5)

- To maximize the opportunity for success, throughout the life of the project
 - Review progress toward goals
 - Closely monitor your projects
 - Follow up regularly with O&M personnel
 - Create incentives

Reevaluate Program

- Continually examine ways to improve the program
- Reevaluate key items that may influence the direction of the program
 - Changes in Federal water requirements
 - New agency goals and objectives
 - Emerging water technologies
 - Changes in water risk and availability
- Evaluate facilities every four years
- Thoroughly document the program improvements that can be used to inform leadership for continued success



Construct New Buildings Using Guiding Principles

• Stormwater Management:

- Use low impact development (LID) strategies to maintain or restore the natural, pre-developed ability of a site to manage rainfall
- Protect and Conserve Water:
 - Indoor water use: Install LCC effective water-efficient equipment
 - Water metering: Install building level advanced water metering
 - Outdoor water use: Use best practices and management strategies for water efficient landscaping
 - Alternative water: Maximize the use of alternative sources of water to the extent practicable

Requirement: EISA 2007 § 433 and 42 U.S.C. § 6834(a)(3)(D)(i)(III)

FEMP Resources

- *Water Efficiency in Federal Buildings and Campuses* main FEMP webpage that provides guidance on how to increase water efficiency and reduce water use
- <u>Federal Water Management Planning Manual</u> provides direction to Federal agencies on how optimize water use at Federal facilities, use water balance analysis methods, identify design elements and procurement best practices, and expand use of alternative water
- <u>Water Metering Resources</u> provides water metering best practices and water metering prioritization strategies
- <u>Water Evaluation and Water Balance Tool</u> comprehensive water evaluation tool that provides a
 detailed handbook on how to conduct a walk-through survey with printable forms and a water
 balance tool that estimated end-use water consumption
- <u>Best Management Practices for Water Efficiency</u> water efficiency best management practices to help agencies increase water efficiency and meet federal requirements.
- <u>Water-Efficient Technology Opportunities</u> information on deploying innovative products and systems that may otherwise be overlooked
- Alternative Water Sources technical information on alternative water & project implementation

FEMP Resources

- <u>Best Management Practice on Leak Detection and Repair</u> best practices for conducting a leak detection and repair program
- <u>Detection System Leak Detection Guide</u> description of technology options to detect leaks in distribution systems
- <u>Water Rate Escalation Study</u> provides a sample set of water and wastewater annual price escalation rates from utilities throughout the United States to facilitate the appropriate integration of such factors in life cycle cost analyses of water efficiency projects
- <u>Energy and Project Procurement Development Services</u> resources for establishing performance contracts to help agencies implement energy and water efficiency projects
- <u>Water Project Screening Tool</u> Excel-based tool to enable federal agencies to quickly screen sites for water-efficiency opportunities when planning ESPCs and UESCs.
- <u>Template for a Comprehensive Water Assessment Statement of Work</u> outlines the major elements of a comprehensive statement of work for a facility-level water assessment.
- *Water-Efficient Products* acquisition guidance for FEMP-designated water-efficient products.
- <u>Water Management Training</u> training in various topics related to water management, including strategic planning, water assessments, alternative water, and best management practices.

Closing

- Final Q&A
- Thank You!

Question: What information did you find most useful in this training?

This will help us inform future trainings!

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