# Cooling Tower Learning Cohort:

## Key Insights and Resources

Alliance for Water Efficiency

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## BACKGROUND ON AWE'S COOLING TOWER LEARNING COHORT

As the leading North American nonprofit dedicated to the efficient and sustainable use of water, the Alliance for Water Efficiency (AWE) and its utility and business members have a longstanding interest in cooling tower water use. Cooling towers use water to remove heat through evaporation and are primarily used for cooling, ventilation, air conditioning, refrigeration, and industrial cooling purposes in commercial, industrial, and institutional settings (CII). According to industry benchmarks for buildings with cooling towers, water used by cooling towers accounts for 40% of an average building's water demand, and in some buildings, they may account for far more.

Increasing cooling tower efficiency provides a prime opportunity for water savings in the CII sector. There are many opportunities to improve cooling tower water efficiency through better operations and maintenance and by monitoring usage to detect leaks, stuck valves, and other types of abnormal usage. As average temperatures increase due to climate change, cooling tower water savings opportunities are likely to increase in the future.

AWE, along with its members and partners, has developed a range of cooling technology research and resources:

- The Cooling Tower Estimating Model
- How-To Guide, Creating a Cooling Tower Water Efficiency Program
- The Cooling Tower Audit Tool and Simple Return on Investment Calculator
- Comparing Alternatives Tool
- Alternative Technologies Report
- Cooling Technologies Study Project Summary

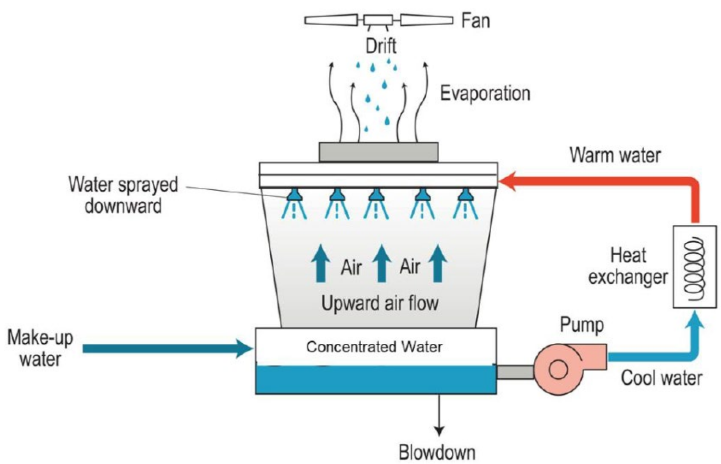
In January 2023 AWE launched its first learning cohort focused on cooling technology. The learning cohort consisted of utilities that met seven times from January 2023 through January 2024 to work through the cooling technology research and resources, share experiences and information, and learn from each other and from invited guests with relevant subject matter expertise. The purpose of this capstone report is to highlight the resources, key insights, and some utility examples of their programs and changes that resulted from participation in the learning cohort.

**THE LEARNING COHORT INCLUDED STAFF FROM THE FOLLOWING UTILITIES:**
AUSTIN WATER, COLORADO SPRINGS UTILITIES, EAST BAY MUNICIPAL UTILITY DISTRICT, CITY OF GOODYEAR WATER, JEA, LOS ANGELES DEPARTMENT OF WATER AND POWER, MUNICIPAL WATER DISTRICT OF ORANGE COUNTY, ORLANDO UTILITIES COMMISSION, CITY OF PHOENIX, CITY OF SAN LUIS OBISPO, CITY OF SCOTTSDALE, SOUTH FLORIDA WATER MANAGEMENT DISTRICT, SOUTHERN NEVADA WATER AUTHORITY, TAMP BAY WATER, AND SANTA CLARA VALLEY WATER DISTRICT (VALLEY WATER)

## UNDERSTANDING THE WATER SAVINGS POTENTIAL

For utilities evaluating the implementation or expansion of cooling tower efficiency programs, the threshold question is this – what potential is there for water savings?

At the outset, it is important to understand that the typical cooling tower efficiency program reduces the non-consumptive water use of a cooling tower. Essentially, cooling towers become more efficient by reducing the frequency with which they "blow down" wastewater into the drain.




The amount of water evaporated generally remains unchanged for a given amount of cooling, which means improving cooling tower efficiency does not significantly change consumptive water use.[1] For some utilities, like those focused on reuse or reducing consumptive water use, the value of the non-consumptive water savings may be limited. Learning cohort utilities and invited guests highlighted examples of where these water savings may be more or less valuable. For example, the Southern Nevada Water Authority presented its efforts to shift away from water-based cooling to air-cooled equipment because the Authority is primarily interested in reducing consumptive water use based on its indirect potable reuse arrangement with Lake Mead. For utilities with a greater interest in reducing consumptive water use, AWE in partnership with the Pacific Northwest National Laboratory developed "Water Savings Potential of Implementing Alternative Cooling Technologies" a guide looking at options beyond cooling tower efficiency programs.

[1] The United States Geological Survey defines consumptive use to include, among other things, evaporated water. Non-consumptive use, on the other hand, is when water is returned to its source such as to a river or reservoir or through aquifer recharge.

KEY INSIGHT: Cooling tower water efficiency improvements do not typically reduce consumptive water use. The water savings from cooling tower programs are similar to indoor water efficiency projects like toilet retrofits that reduce water use that would otherwise go down the drain and into the sewer. If your community is more focused on reducing consumptive water use through projects like landscape irrigation efficiency or landscape transformation, cooling tower programs may be a lower priority.

For most members of the learning cohort, the non-consumptive savings potential from cooling tower programs presents a valuable opportunity, and each member of the cohort worked on estimating the potential water savings using the Cooling Tower Estimating Model (CTEM) and related CTEM Guide titled “Taking Inventory: A Guide for Identifying Cooling Towers and Estimating Water Use”. AWE also hosted a webinar on CTEM and the CTEM guide in 2022 that provides foundational knowledge.

*IMPORTANT:* Make sure you are using version 3 of CTEM (the latest version as of the date of this report). If you do not have the latest version, members can request one from the AWE team.

By completing the required fields with just five base inputs (Country, State, County, Service Population, and System Water Quality), CTEM provides high-level estimates of water use and potential savings. See the example with screenshots on the following page.

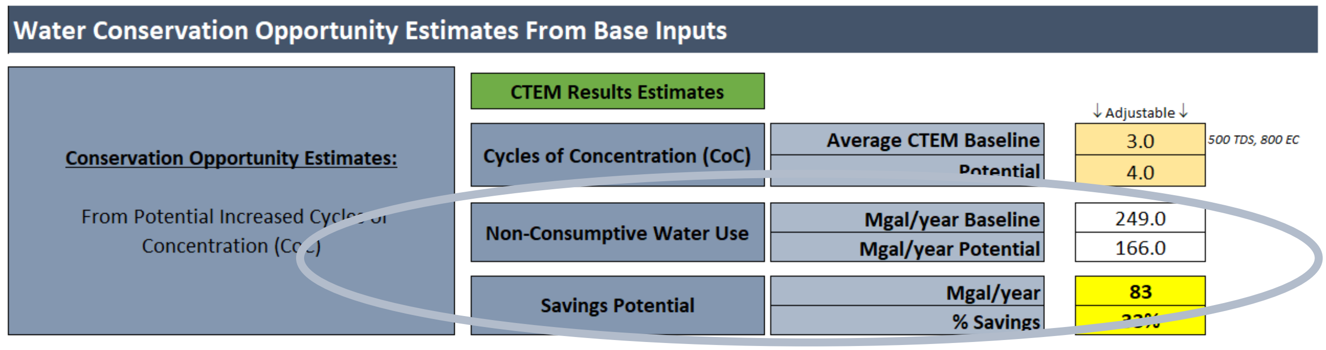
**CTEM Results Estimates**
**V3**

**Base Input Results Estimates**

| CTEM Results Estimates | Duty Factor: (% annual utilization) | 14.7% | Cycles of Concentration (CoC): | 3.0 | Re-Estimate Results (Re-Run Macro) | Clear Results (Cannot Undo) |
|---|---|---|---|---|---|---|

All results are estimates and based on North American dataset averages and statistical correlations.

| | Auto-Populated Inventory (Large-Scale) Facilities | Baseline Regression (Commercial) Facilities | Total Service Area (Auto-Populated + Baseline) Facilities | Range | Acre-feet/year ↓ |
|---|---|---|---|---|---|
| # of Facilities | 5 | 206 | **211** | | |
| # of Cooling Towers | 42 | 370 | **412** | | |
| Cooling Capacity, tons | 13,766 | 121,149 | **134,915** | | |
| Annual Cooling Load, tons/year | 17,705,398 | 155,822,789 | **173,528,187** | | |
| Consumptive (Evaporative) Water Use, Mgal/year | 30.0 | 268.3 | **298.3** | 285.3 - 312.4 | 916 |
| Non-Consumptive (Blow Down) Water Use, Mgal/year | 25.4 | 223.6 | **249.0** | 237.7 - 260.3 | 764 |
| Total Water Use, Mgal/year | 55.4 | 491.9 | **547.3** | 523.0 - 572.6 | 1,680 |



| Water Conservation Opportunity Estimates From Base Inputs | | | | |
|---|---|---|---|---|
| | CTEM Results Estimates | | ↓ Adjustable ↓ | |
| **Conservation Opportunity Estimates:** From Potential Increased Cycles of Concentration (CoC) | Cycles of Concentration (CoC) | Average CTEM Baseline | 3.0 | 500 TDS, 800 EC |
| | | Potential | 4.0 | |
| | Non-Consumptive Water Use | Mgal/year Baseline | 249.0 | |
| | | Mgal/year Potential | 166.0 | |
| | Savings Potential | Mgal/year | 83 | |
| | | % Savings | 33% | |

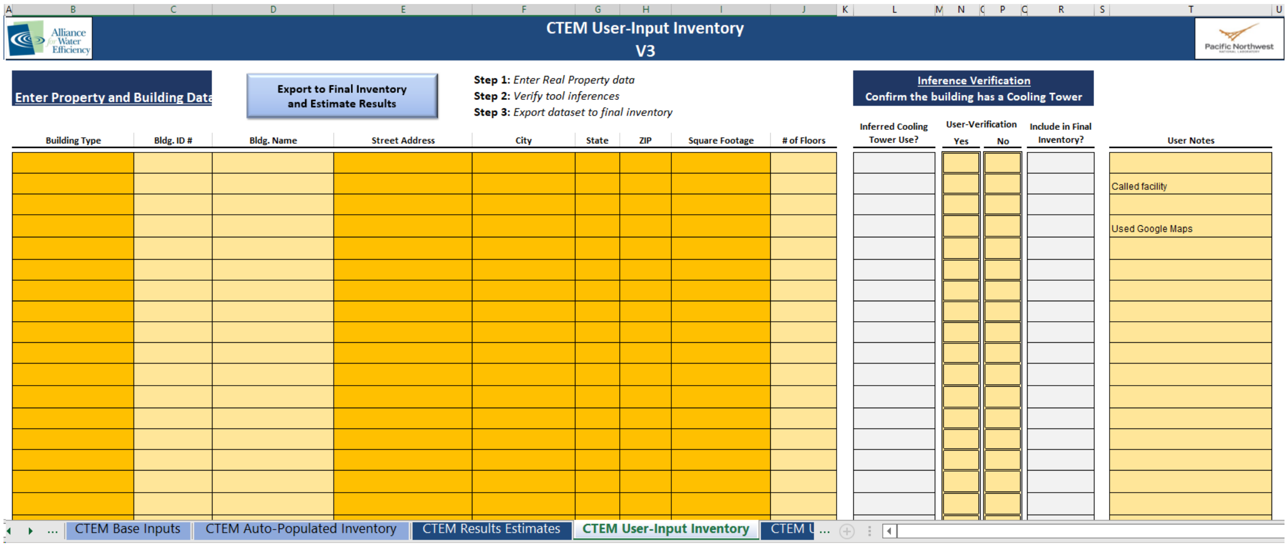
## GETTING STARTED WITH THE COOLING TOWER ESTIMATING MODEL

While the CTEM produces a comprehensive estimate of cooling tower savings potential and an auto-populated inventory of cooling towers, the auto-populated inventory only captures the expected cooling towers at large-scale facilities. Exploring this auto-populated inventory led the learning cohort to the following:

### KEY INSIGHTS:

- *MANY USERS INITIALLY EXPECTED THE AUTO-POPULATED INVENTORY TO BE* exhaustive (or close to it), but it is only a partial inventory. Looking at the CTEM Guide example above, there were 42 large-scale cooling towers from the auto-populated inventory and an estimated 370 cooling towers at commercial facilities not included in the inventory.
- *THE AUTO-POPULATED INVENTORY OFTEN INCLUDES AT LEAST SOME FALSE POSITIVES*, so utilities need to confirm the presence of cooling towers at large-scale facilities.
- *SOMETIMES, THE AUTO-POPULATED INVENTORY WAS BLANK AND SHOWED ZERO COOLING TOWERS,* which only means that there are no expected large-scale cooling towers based on data sets used by CTEM. *This does not mean there are no cooling towers in a given service area.*

Following the learning cohort's discussion of the auto-populated inventory, the group turned next to confirming the cooling towers in the auto-populated inventory and determining how to locate and identify all of the cooling towers in a given utility's service area. As cooling towers are confirmed and identified, they should be added to the CTEM user-input inventory:




## TOOLS AND DATASETS FOR IDENTIFYING COOLING TOWERS

As a starting point for identifying cooling towers, many learning cohort members found Appendix A to the CTEM Guide to be very helpful. It covers tips for identifying cooling towers, including basic visual characteristics of cooling towers, detailed building type examples, and many screenshots and pictures.

Metropolitan Water District of Orange County presented how to visually identify cooling towers during AWE's CTEM webinar starting at minute 45, which is another excellent resource.

Common free tools that can be used for visual identification include Google Maps, Google MyMaps, and Bing Maps. While they are not free, there are also other tools and services on the market such as Eagle Aerial.

While the CTEM guide focuses on manual, visual identification, there is a publicly available, free tool called TowerScout that can help automate the process of identifying cooling towers. The tool was originally developed to identify cooling towers for public health departments, but the inventory helps create can be readily used for the purposes of cooling tower water efficiency. Here are the related links needed to understand and use this tool:

- *BACKGROUND AND PROJECT CONTACTS* www.ischool.berkeley.edu/projects/2020/towerscout
- *FILES NECESSARY TO RUN THE TOOL* https://github.com/towerscout
- *TOOL DEMO VIDEO* https://youtu.be/k9zQgw4QEYs

KEY INSIGHT: The TowerScout tool provides significant potential time savings to create your first cooling tower inventory or as a tool for comparing existing inventory if one already exists.

To supplement visual identification or the use of automated tools like TowerScout, possible cooling tower locations can be cross-referenced against other data sets. While the availability and quality of datasets will vary from place to place, consider data sets like the following:

- State and county public health department records of cooling tower locations
- Utility backflow prevention records
- Water and sewer metering data, especially any records of sewer/evaporative loss credits, which are indicative of water not being returned to sewer because of cooling tower operation
- Building permit data and records
- Local government and private sector databases on commercial buildings and land use

## COOLING TOWER REGISTRIES AND PUBLIC HEALTH COLLABORATION

As a foundation for water efficiency or public health initiatives, some local governments and at least one state have decided to create cooling tower registries. In addition to the government efforts to identify cooling towers, registries typically impose a proactive obligation on the owners or operators of cooling towers to register their cooling towers with the relevant government. These registries can then serve as the foundation for a range of cooling tower regulations and programs, such as required maintenance, reporting, and certified contractor programs.

The learning cohort is aware of only one water efficiency-oriented registry program, and it was created by Austin Water in Texas. As summarized on their website for this registry: "All properties with cooling towers must register them with Austin Water. Registration information will help to identify potential water-saving upgrades and available rebates. All properties must also submit annual inspection forms. Inspections must be performed by an independent third-party Texas licensed mechanical or chemical engineer or a person holding a TDLR Texas Air Conditioning and Refrigeration License (Class A) with a combined endorsement for process cooling and refrigeration."

Public health-related cooling tower registries are somewhat more common. The purpose of these registries is typically to track potential sources of Legionnaires' disease, which can originate from bacteria that grow in, and are aerosolized by, poorly maintained cooling towers. Cooling tower registries allow public health officials to quickly identify the source of an outbreak and work to remediate the risk. For more information on this disease, see the Center for Disease Control's website. Representatives from the State of New York presented to the learning cohort on their public health-based cooling tower registry.

KEY INSIGHT: Based on information presented to and discussed by the learning cohort, registries can serve as a robust foundation for cooling tower programs and regulation, but significant resources must be secured to create, maintain, and enforce registration requirements. Some cooling tower owners and operators do not comply with registration requirements and identifying and remedying noncompliance also takes ongoing effort.

KEY INSIGHT: Water utilities and their state and local health departments should work to establish better lines of communication and collaborative working relationships. While there may be some apparent tensions between cooling tower water use and public health given concerns that increased efficiency may create conditions more favorable to Legionella bacterial growth, improving operations and maintenance is key both from a public health and water efficiency perspective. Through better operation and maintenance like the Center for Disease Control recommends, water quality and efficiency can both be pursued and balanced when needed. Based on the shared interest in identifying cooling towers and ensuring they are well maintained and properly operated, increased collaboration and communication should be mutually beneficial.

## COOLING TOWER WATER USE MEASUREMENT AND VERIFICATION

Throughout the learning cohort discussions, the importance of cooling tower water use measurement and verification came up regularly. Typically, there is no separate utility meter measuring cooling tower water use, and so water use data available to utilities includes all water use on a given site. While cooling tower owners and operators have sometimes installed private submeters, the use of submeters is far from universal.

The best practice is to install two submeters – one for makeup water and one for blow down water. The submeter for makeup water measures when water is added to the cooling tower. The submeter for blow down water measures when wastewater is periodically discharged into the building's drain lines and ultimately the sewer.

KEY INSIGHTS: Submeters on makeup and blow down water are important because they allow the cooling tower operators to:

1. *MEASURE THE AMOUNT OF WATER THAT IS EVAPORATED FOR COOLING* (i.e. consumptively used), which is the difference between the volume of water measured by the makeup submeter (water in from building water supply) and the blow down submeter (water out to the drain).
2. *CALCULATE THE CYCLES OF CONCENTRATION* (CoC), the essential metric to measure water efficiency. This is the number of times that water is recirculated in the cooling tower before being blown down (water out to the drain) and replaced with fresh water through makeup water (water in from building water supply). The higher the CoC, the greater the efficiency and the less water used for cooling.
3. *QUICKLY TROUBLESHOOT PERFORMANCE ISSUES* with cooling towers, such as valves that are stuck in the open position, overflows, leaks, issues meeting the target cycles of concentration, and more.

Historically, submeters had to be installed inline by cutting pipes, but the learning cohort explored the increasing range of more modern submetering options. Annikki Chamberlain of Mimir Water presented to the learning cohort on submetering options and approaches, and she also presented on December 6, 2023, on submetering for an EnergyStar webinar, which is available as a free recording. Avishai Moscovich of Wint also presented on water meter data management, analysis, and metering solutions for commercial buildings, including cooling towers. More information can be found at https://wint.ai/. There are other companies that provide submetering, data management, and analysis solutions, and these are two good examples to help orient yourself to these topics. There are various ways of monitoring and getting notifications related to water use, and monitoring and notification is a key component of an effective submetering approach.

Once water efficiency improvements are made to cooling tower operations and maintenance, measuring and verifying water savings is the next step. While it was developed for use in efficiency performance contracting, a protocol developed by the Pacific Northwest National Laboratory can be used for utility-based cooling tower audits and incentive programs. It's called the Cooling Tower (Evaporative Cooling System) Measurement and Verification Protocol. One key feature of this protocol is that it provides methodologies for accounting for changes in weather between the period when the water use baseline was established compared to the period after the water efficiency improvements have been made.

KEY INSIGHT: For an effective cooling tower water efficiency program, it is essential to submeter and monitor both the makeup and blowdown water and to establish a protocol that accounts for changes like weather in comparing water use across time.

## EFFICIENCY PROGRAMS FOR NEW COOLING TOWERS - STATE AND LOCAL CODES

The primary approach for improving the water efficiency of new cooling towers is through the adoption of state or local requirements through codes, statutes, rulemaking, or ordinances. Most commonly, this is done through state and local adoption of codes applicable to new and renovated buildings, but there are other approaches as well. Codes typically reference industry standards for efficiency. Some of the standards the learning cohort discussed included:

- IAPMO Water Efficiency and Sanitation Standard (WE·Stand)
- IgCC® — Powered by ANSI/ASHRAE/ICC/USGBC/IES Standard 189.1
- ASHRAE Standard 191 for the Efficient Use of Water in Building Mechanical Systems

These standards include a wide range of water efficiency provisions, including cooling tower efficiency, that could be adopted in code in their entirety. More specifically, just the provisions on cooling towers could be referenced or directly incorporated into the code.

As an example of how these standards, or variations thereof, can become codes, the learning cohort explored the following two different approaches:

1. *THE CALIFORNIA ENERGY COMMISSION* is considering requirements for energy and water efficiency improvements for cooling towers as part of its 2025 state energy code update process. These requirements focus on blowdown controls and increasing the cycles of concentration. If adopted, the code requirements would apply to "nonresidential and multifamily new construction, new systems serving additions, alterations (except for existing buildings), and both open-circuit and closed-circuit cooling towers 150 tons and larger."
2. *THE METROPOLITAN NORTH GEORGIA WATER PLANNING DISTRICT* is implementing a binding and enforceable plan to require all local governments in metro Atlanta to adopt local amendments to the plumbing code requiring the following water efficiency requirements for cooling towers, which are based on IAPMO's Water Efficiency and Sanitation Standard.

> "604.4.2 Cooling Tower Water Efficiency.
>
> > 604.4.2.1 Once-Through Cooling. Once-through cooling using potable water is prohibited.
> >
> > 604.4.2.2 Cooling Towers and Evaporative Coolers. Cooling towers and evaporative coolers shall be equipped with makeup water and blow down meters, conductivity controllers and overflow alarms. Cooling towers shall be equipped with efficiency drift eliminators that achieve drift reduction to 0.002 percent of the circulated water volume for counterflow towers and 0.005 percent for crossflow towers.
> >
> > 604.4.2.3 Cooling Tower Makeup Water. Water used for air conditioning, cooling towers shall not be discharged where the hardness of the basin water is less than 1500 mg/L. Exception: Where any of the following conditions of the basin water are present: total suspended solids exceed 25 ppm, $CaCO_3$ exceeds 600 ppm, chlorides exceed 250 ppm, sulfates exceed 250 ppm, or silica exceeds 150 ppm."

KEY INSIGHT: Code-based approaches apply to new cooling towers, whether being installed in new buildings or replaced in existing or renovated buildings. The codes-based approaches are gradual in that they don't proactively require retrofits for existing cooling towers, but the long-term water savings can be substantial making these approaches very attractive to utilities and policymakers. The greatest strength of code-based approaches is that they are generally the most cost effective, and the greatest weakness is the potential difficulty in ensuring the codes are being implemented and enforced.

## EFFICIENCY PROGRAMS FOR EXISTING COOLING TOWERS

Examples of cooling tower water efficiency programs from learning cohort participants can be found in Exhibit A.

*OBSERVATIONS ON CURRENT CHALLENGES.* The universal experience of learning cohort members is that there has been limited uptake of cooling tower water efficiency programs by building owners and operators. This has been true across a range of program structures, incentive structures, and resource investment levels by utilities. The root causes of this limited uptake remain uncertain. As detailed in AWE's *How-to-Guide: Creating a Cooling Tower Water Efficiency Program*, some known obstacles include:

- Customers' lack of knowledge about cooling tower operations and upgrade opportunities can make them hesitant to make changes.
- Customers may not track actual water usage in the cooling towers and do not understand the value of making upgrades.
- Customers often use water treatment vendors for standard maintenance and monitoring. Historically, the vendors have no incentive to manage water use.
- Customers may perceive there is a risk of adverse impacts to cooling equipment and system performance and/or reliability.

*AUDITS AND ASSESSMENTS.* Cooling tower audits and assessments are a foundational program offering for improving efficiency. AWE has developed a members-only tool that can be used for this purpose - The Cooling Tower Audit Tool and Simple Return on Investment Calculator. The purpose of an audit is to determine how the cooling tower is being operated and maintained, how much water it is using, and the approaches and measures that could be implemented to save water. These programs can be structured in several ways such as having utility staff perform the audit, having a designated contractor that the utility has hired to perform audits upon request, and offering a utility rebate for audits performed by contractors hired by building owners and operators.

*INCENTIVE APPROACHES FOR RETROFITS.* Utilities in the learning cohort offer a range of incentive programs for cooling tower water efficiency improvements and retrofits. Some utilities offer a fixed rebate amount for specific improvements like submetering, conductivity monitoring, overflow alarms, and drift eliminators. Another approach is to provide a cooling tower-specific performance incentive based on the actual water savings achieved. These incentive programs are typically structured as a dollar amount per gallon saved. And in some other programs cooling towers are included as a part of custom performance-based incentive programs that cover cooling towers along with a broader range of CII water efficiency improvements. These incentive programs are often structured so that an interested party can propose a water-saving project and the needed incentive, which the utility considers in light of other proposals and options it has to save water.

KEY INSIGHT: Based on the experience of the learning cohort members, natural participation rates are low in programs offering audits, assessments, and incentives. Utilities should expect that a proactive approach will be required to increase participation rates, and even with additional effort, meaningful participation rates are hard to achieve.

*REGULATORY APPROACHES.* An emerging approach is to require cooling tower owners to register with the state or local government and then take certain periodic actions aimed at improving water efficiency. For example, Austin Water's registration program, which is covered in more detail above, requires an annual inspection.

## CONCLUSION –TOOLS AND KEY INSIGHTS FROM THE LEARNING COHORT

The cooling tower learning cohort proved to be a valuable forum for utilities to regularly share and learn with their peers, and it allowed AWE members to gather together based on their interests and priorities. While it requires a meaningful investment of time, the benefits of the learning cohort model support its use on a broader range of water efficiency topic areas. AWE creates tools and provides guides and research for members, and as the above summary shows, many key insights can be gained from actively working through them as a group. By capturing the cohort's key insights in this short capstone report, other members can also benefit from these key insights.

## EXHIBIT A – EXAMPLE COOLING TOWER WATER EFFICIENCY PROGRAMS LEARNING COHORT PARTICIPANTS

1. *AUSTIN WATER - COOLING TOWER EFFICIENCY PROGRAM (CTEP)* Austin Water has two separate programs for cooling towers. There is the wastewater credit program called Evaporative Loss which started in 1995 and has roughly 120 participants. This program requires towers to have meters installed on the make-up and blow-down, and meter readings reported monthly. To participate in the Evap Loss program, customers must be compliant with the Cooling Tower Efficiency Program.

The Water Conservation Group operates the Cooling Tower Efficiency Program, which is a regulatory program that started in 2017. CTEP requires the registration and annual inspection of towers utilizing potable water as the make-up source. Code revisions went into effect on January 1, 2008, that required all newly installed towers to operate at 5 cycles of concentration and have the following efficiency components present: drift eliminator, conductivity controller, overflow alarm, and meters present on the make-up and blow down. Newer code revisions require towers installed on buildings constructed after September 5, 2017, to have 10% of make-up supplied by reclaim or on-site water reuse. CTEP has a small rebate component that is infrequently utilized. The rebates are for adding efficiency components to towers installed prior to the 2008 code revision and for removing the cooling tower and switching to air-cooled units.

CTEP currently has 316 registered properties and a reporting rate between 70-75%. Since 2017 CTEP has not had the ability to fine for non-compliance. 2024 will be the first year fines will be implemented, so the compliance rate is expected to rise.

Towers were located utilizing aerial imagery, and an internal utility database for backflow prevention. This database is utilized every year to ensure no property has been missed. Austin Water has also setup a line a communication with the Development Services division to be informed of any new applications indicating a cooling tower will be present. Austin Water mails out letters every year to all registered properties and properties we believe a tower may exist to inform of the upcoming inspection cycle. Inspections are due on March 1st of every year, with inspections beginning no earlier than December 1st of the previous year.

Lessons learned:

- The requirement that 10% of the makeup supplied must be reclaimed or on-site reuse water has been difficult to enforce.
- Five cycles of concentration are a yearly average since towers will operate less than five when maintenance is required.
- Recent weather events have dropped cycles due to equipment not being weatherized for hard freezes.
- Program still developing SOPs for variety of situations that have come up for inspection reports that are not compliant.
- Government entities make up large amount of program- city, county, state, local school district, state university. Austin Water is unable to enforce on these entities. Trying to gain compliance by participation in the Evaporative Loss program.

2. *CITY OF GOODYEAR, AZ.* Goodyear Water currently offers cooling tower evaluations and submeters at no cost to the customer. Active Phase 1 has been funded. Goodyear currently utilizes consultant assistance and in-house staff to work actively with customers who own or maintain cooling towers. The approach seeks to reach the asset owners, the facility maintenance staff, and the water treatment vendors to determine a holistic and realistic approach to optimization. Goodyear plans to expand the voluntary program to eventually minimally submeter all towers within the service area. As water in Arizona becomes more scrutinized, a compliance program focused on efficiency standards may be considered. Funding and staff time are the biggest obstacles to meeting this goal.

The next steps may include streamlining the accounting and tracking of cooling towers, and then there is potential to further improve efficiency based on cooling load management and finding ways to optimize the design of the refrigeration system as a whole to save both energy and water. There also may be opportunities here to partner more closely with power providers to leverage stacked incentives and gain access to appropriate contacts at these sites.

### *3. LOS ANGELES DEPARTMENT OF WATER AND POWER (LADWP)*

#### A. LADWP COOLING TOWER ASSESSMENT PROGRAM (COMPLETED)

LADWP implemented a Cooling Tower Assessment Program targeted at cataloging, measuring, and improving the operation of cooling towers in the LADWP service territory. Through this effort, LADWP was able to physically audit cooling towers, understand the operating efficiency of these cooling towers, and most importantly, inform the customer of opportunities available to improve the water use efficiency of their cooling towers.

Prior to program implementation, LADWP utilized AWE's Cooling Tower Estimating Model which provided a list of cooling tower customers available to engage in this program. LADWP then advertised the program by email, with a QR code leading to a survey asking for some basic information about the customer's facility, and arranged for onsite and virtual cooling tower assessments. This proved challenging as most customers thought the outreach was spam, and reaching the correct person in a commercial operation took time. Once onsite, a designated contractor assessed the critical components of the cooling towers and connected chillers and then inspected the efficiency of all other water fixtures on the property. Lastly, the contractor recommended rebate and incentive programs the customer is eligible to participate in to improve the water efficiency of the cooling tower as well as all other water fixtures.

The program successfully audited 125 LADWP customers after operating for approximately a year and a half. Results show that monitoring and ensuring proper cooling tower operation is the first and critical component in saving water in cooling towers. Proper and consistent operation should be established and confirmed before implementing efficiency measures such as advanced water treatment, which allows cooling towers tun operate more water efficiently at higher cycles of concentration. Most owners expressed a strong desire to improve operating efficiency and needed guidance to monitor proper cooling tower function. LADWP is now exploring advanced water management technology such as in-line submeters with data connectivity to enable cooling tower operators to manage better their cooling towers and to understand the proper functioning and water use of their cooling towers. Customers are also encouraged to implement advanced cooling tower water treatment where appropriate as well as other efficiency measures recommended by the auditing consultant.

Despite the challenges of the program, LADWP learned that connecting with our customers and seeing first-hand how the cooling tower is operated was a critical first step in saving water for cooling towers. As a result of the assessments, LADWP has a much better understanding of the issues facing cooling tower operators and hopes to use these results to greatly improve the water efficiency of cooling towers and the broader commercial industrial and Institutional (CII) sector.

### B. LADWP TECHNICAL ASSISTANCE PROGRAM (TAP) SUMMARY (ONGOING)

Industrial equipment such as cooling towers are often designed and sized for very specific commercial applications. As such, a one-size-fits-all rebate cannot cover the range or scale of efficiency improvements for all cooling towers found in Los Angeles. To incentivize water efficiency improvements in the cooling tower arena as well as other customized water saving installations in the CII sector, LADWP utilizes an incentive program which rewards customers for water saved, instead of a typical one-time rebate payment.

This program within LADWP is called the Technical Assistance Program (TAP) and offers a $7.00 rebate per 1,000 gallons of water saved up to a maximum amount of $2,000,000. New Equipment installations must be pre-approved, and typically, water meters are installed to measure water use well before, and after, the installation of the customized technology, in order to calculate the incentive amount.

The program does not incentivize the replacement of non-functioning cooling towers but rather incentivizes the operational improvement of the cooling tower via a water treatment installation, which allows cooling towers to run more water efficiently with higher cycles of concentration. Past installations have included items such as water softeners, reverse osmosis and acid water treatment. The TAP program also applies to non-cooling tower items such as laundry machines, water recycling installations, and other unique and novel technologies designed to save water in the CII sector.

4. *SANTA CLARA VALLEY WATER DISTRICT (VALLEY WATER) - WATER EFFICIENT TECHNOLOGIES (WET) PROGRAM* The WET program offers rebate funding to properties that upgrade their water-using equipment, including cooling towers. Commercial, industrial, institutional facilities, and multi-family residential complexes are eligible for WET. Rebate rates are the same across WET, despite the scale or type of project: $4/CCF saved annually, or up to 100% of the equipment costs, with a maximum rebate amount of $100,000.

Valley Water's first cooling tower rebate was issued in 1998, and there have been 10 completed projects as of 2023. These projects have averaged 2,241 CCF of annual savings. In the last few years, Valley Water has begun attempting to expand this program, by doubling the maximum rebate amount and temporarily doubling the rebate rate during the 2015 drought. As is common in working with the CII audience, these efforts alone have not led to a marked increase in cooling tower project applications, leading the conservation team to consider a larger overhaul of the program.

Rebates for cooling towers have historically represented a small amount of total commercial rebates, so projects have been handled on a case-by-case basis, rather than with a standardized set of procedures. Valley Water's conservation team is in the early steps of developing a procedure for processing cooling tower projects to ensure accurate water savings data, improve staff's knowledge about cooling towers, and harness the significant potential water savings from cooling tower upgrades in Santa Clara County. Staff's efforts so far have involved research into a basic county-wide cooling tower registry, clamp-on ultrasonic flow meters for measuring makeup and blowdown water, water savings and COC calculations, and more.

5. *SOUTHERN NEVADA WATER AUTHORITY (SNWA) COOLING TOWER INITIATIVES* Cooling towers are a priority area identified by SNWA (snwa.com) as a major source of consumptive water loss in its members' service areas. This is principally due to the process of evaporation integral to their operation to reject heat from buildings and other sources to the atmosphere. While SNWA has long worked with customers to reduce cooling tower use, more aggressive measures have now been undertaken to reduce cooling use in Southern Nevada.

A. MORATORIUM ON NEW EVAPORATIVE COOLING Southern Nevada jurisdictions and the Las Vegas Valley Water District have prohibited evaporative cooling (cooling towers, evaporative aka "swamp" coolers, evaporative condensers, etc.) in new commercial development. The policy is intended, with a suite of other measures, to assure protection against drought and sustainable community growth, and it's intended to help move the community to reach SNWA's gallons per capita per day target of 86. The moratorium implementation is graduated to avoid serious impacts on projects already planned with effective dates dependent on permit and certificate of occupancy dates. SNWA believes this is one of the strongest cooling-related water conservation policies ever applied to new development in a municipal area.

B. INCENTIVES SNWA has significantly enhanced its incentives for projects qualifying for its Water Efficient Technologies (WET) Program:

- Projects involving drift eliminators can receive up to $22.50 per ton.
- Projects that reduce, but do not eliminate evaporative cooling, like moving to hybrid cooling can receive a one-time payment of up to $70 per 1000 gallons conserved. This is slated for further enhancement.
- Projects converting evaporative cooling systems fully from wet to dry operation eliminate consumptive use and can qualify for a rebate of up to $1500 per ton.

Special funding is available from grants to the program and for research. Incentives are subject to limitations. To SNWA's knowledge these are the strongest incentives for conserving water from cooling towers and other evaporative cooling ever offered by a water utility.

C. PUBLIC-PRIVATE PARTNERSHIP Over the years of working with customers on WET projects, and long in advance of the moratorium, SNWA reached out and developed relationships with business leaders about cooling. Conservation professionals regularly attend industry meetings and participate in discussions about ideas, trials, programs, and standards related to cooling towers and evaporative coolers. SNWA also has a contract firm to assist in analyses supplemental with internal expertise. Learning more about the end uses and industries served by cooling systems strengthens relationships and leads to better policies and programs.

6. *TAMPA BAY WATER – WATERWISE FOR BUSINESSES AND ORGANIZATIONS: COOLING TOWER REBATE* Tampa Bay Water is actively accepting applications for their rebate program. The program includes a fixed rebate option of $1000 towards the installation of sub-meters and a conductivity controller and a variable option of $1 per thousand gallons saved over five years. As of February 2024, there have been a few inquiries and potential projects since launching in 2020, but no projects have been completed to date. The following are the obstacles that prevented projects from going through: 1) The cost to commission the towers instead of making major modifications was less expensive. 2) One project was part of a company's nation-wide effort to improve cooling tower operations, and they are working in other areas first. 3) One cooling tower needed major repairs which became the priority over changes that would impact the water usage. *Anticipated solutions*: The program would like to hire a dedicated outreach manager who is very knowledgeable about cooling towers.

**About the Alliance for Water Efficiency**

The Alliance for Water Efficiency is a nonprofit organization dedicated to the efficient and sustainable use of water. AWE supports water conservation practitioners from over 500 member organizations, including water utility agencies, businesses and corporations, governmental agencies, nonprofits, and researchers, to advance the adoption of water-efficient practices, appliances, and programs across North America.

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