

OPPORTUNITY

How much water do cooling towers routinely flush from the system?

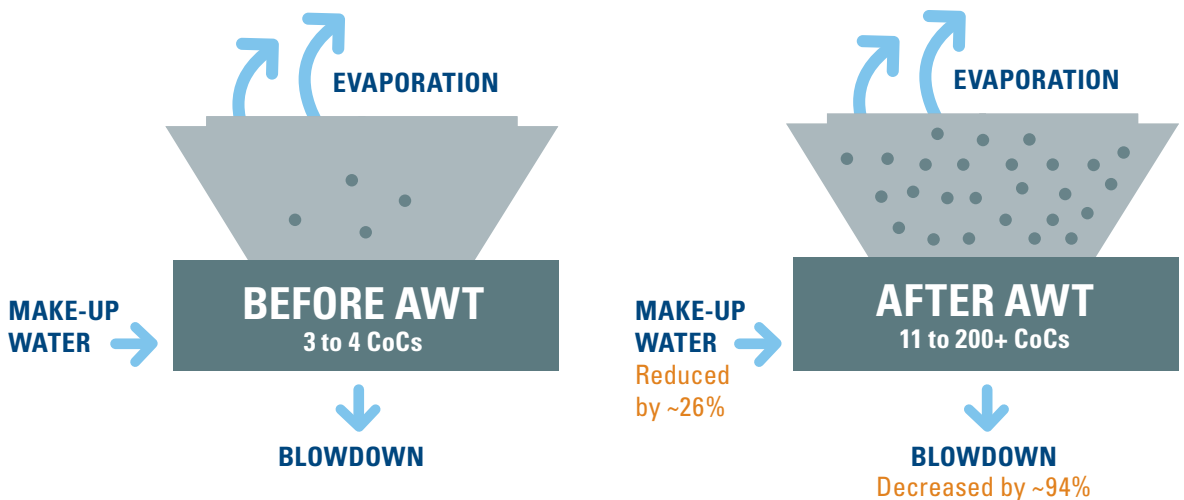
UP TO **50%** COOLING WATER IS "BLOWDOWN" TO MINIMIZE SCALE BUILD-UP¹

TECHNOLOGY

How do Alternative Water Treatment (AWT) systems work?

INCREASE CoC (CYCLES OF CONCENTRATION) WHILE CONTROLLING SCALE & CORROSION

AWT systems hold minerals in suspension at increased CoCs



M&V

Where did Measurement and Verification (M&V) occur?

NATIONAL RENEWABLE ENERGY LABORATORY (NREL) has assessed four AWT systems, three at the Denver Federal Center and one in Savannah, Georgia. Two more assessments are underway with results due by 2021.

RESULTS

How did the four AWT systems perform in M&V?

26%

AVG. WATER SAVINGS

Savings ranged from 23% to 32%; blowdown reduced 94% to 99%²

50%

REDUCTION IN TOWER CLEANING

due to less scale and corrosion³

MET

GSA WATER STANDARDS

including controlling for legionella⁴

2-3

YEAR PAYBACK

@ 2017 GSA avg. water/sewer \$16.76/kgal⁵

Positive Return on Investment for all Systems

@ 2017 GSA average water/sewer cost of \$16.76/kgal

| | Electrochemical | Advanced Oxidation | Salt-Based | Chemical-Scale |
|---|-----------------|--------------------|-----------------|-----------------|
| Cooling Tower Size (tons) | 300 (2 x 150) | 500 (2 x 250) | 1,500 (3 x 500) | 1,200 (2 x 600) |
| Installed Cost | \$45,340 | \$23,425 | \$29,600 | \$32,511 |
| Installed Cost Per Ton | \$151 | \$47 | \$20 | \$27 |
| Annual Maintenance Change | +\$720 | -\$2,522 | -\$6,445 | +\$1,883 |
| Annual Electricity Increase (@\$0.11/kWh) | \$3,049 | \$582 | | |
| Water Savings Per Ton-Hour of Cooling | 0.64 | not measured | 0.58 | 0.42 |
| Annual Water Savings (@\$16.76 kgal/yr) | \$19,003 | \$8,846 | \$6,724 | \$13,818 |
| Payback (yrs) | 3.0 | 2.2 | 2.2 | 2.7 |
| Savings-to-Investment Ratio | 5.0 | 6.9 | 6.7 | 5.5 |

DEPLOYMENT

Where do the assessments recommend deploying AWT systems?

ALL COOLING TOWERS

Anticipate changes needed to O&M contracts to transition from traditional chemical treatment to alternative water treatment systems.

¹Demonstration and Evaluation of an Advanced Oxidation Technology for Cooling Tower Water Treatment, Jesse Dean, Dylan Cutler, Gregg Tomberlin, James Elsworth (NREL), December 2018, p.1 ²GSA Guidance—Alternative Water Treatment Systems for Cooling Towers, Jesse Dean (NREL), Gregg Tomberlin (NREL), Andrea Silvestri (Tenfold Information Design), January 2020, p.6

³Ibid, p.9 ⁴Ibid, p.7 ⁵Ibid, p.11