
IDEA2021
Powering the Future: District Energy/CHP/Microgrids
Sept. 27-29 | Austin Convention Center | Austin, Texas

Impact of Water Treatment on University Sustainability Initiatives

Marc Lind – Nalco Water

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NALCO Water
An Ecolab Company

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

Purpose

Provide an overview on water treatment’s impact on sustainability

Process

Walk through this PowerPoint and identify key water treatment parameters and why they are so important

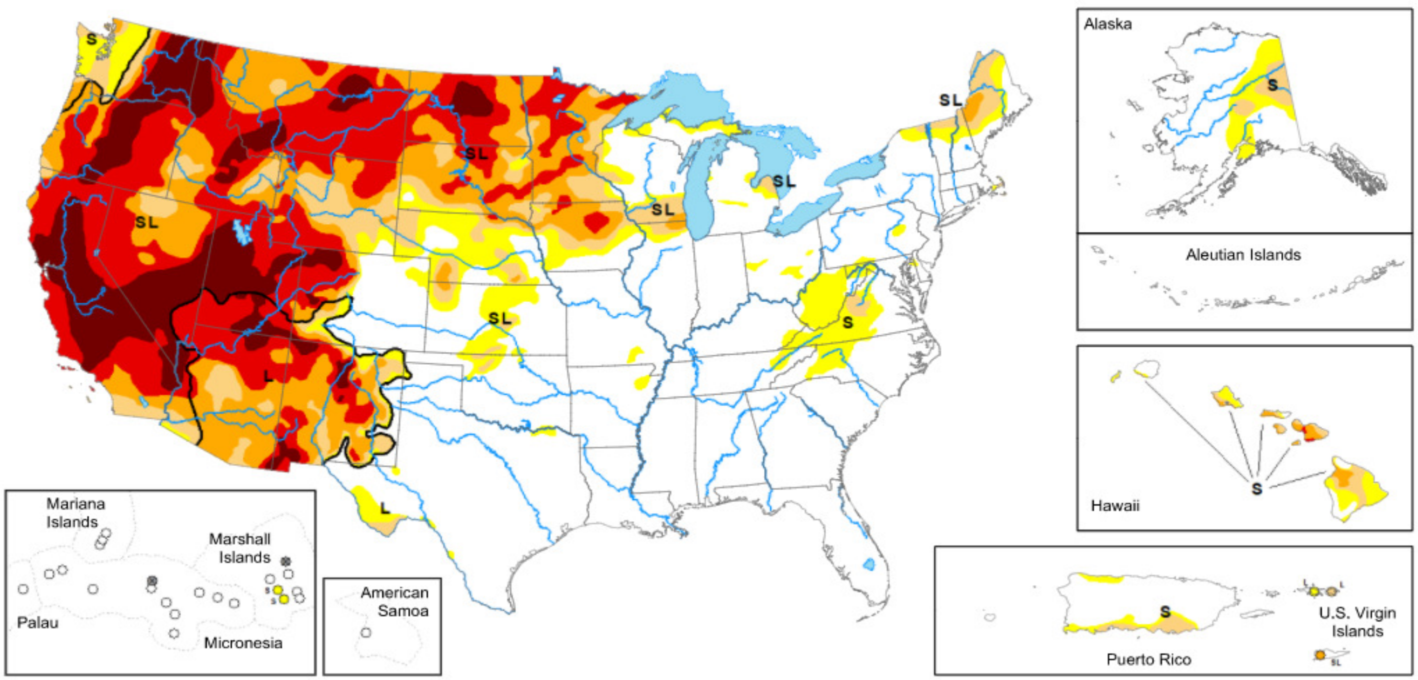
Pay-off

Identify the benefits of an efficient water treatment program and have a better understanding of water treatment

Drought Conditions Historic High

Map released: August 5, 2021

Data valid: August 3, 2021



Intensity and Impacts

- None
- D0 (Abnormally Dry)
- D1 (Moderate Drought)
- D2 (Severe Drought)
- D3 (Extreme Drought)
- D4 (Exceptional Drought)
- No Data

~ - Delineates dominant impacts

S - Short-term impacts, typically less than 6 months (agriculture, grasslands)

L - Long-term impacts, typically greater than 6 months (hydrology, ecology)

SL - Short- and long-term impacts

Source: https://droughtmonitor.unl.edu/

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The World's Water Challenges

Source: UN Sustainable Development Goals and the World Resources Institute (WRI)

71%
of the world's surface is covered in water

0.3%
is accessible for human consumption

3 in 10
people lack access to basic drinking water

>40%
of the global population is affected by water stress

By 2030
if nothing changes, global water demand will outpace supply by 56 percent

Nearly 1/2
of the world's people will live in water-stressed areas

75%
of companies have water goals

85%
lack the tools to achieve them

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Understanding the True Cost of Water

Water is often far more expensive than your municipal water bill suggests, due to costs associated with:

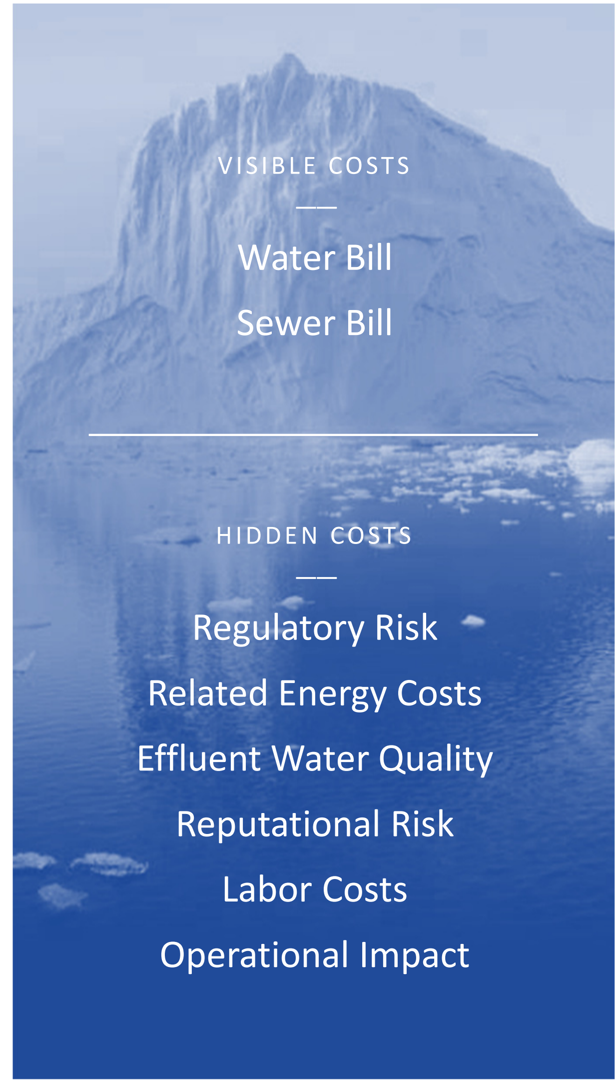
INCOMING WATER RISKS: The impacts of water use on human health and ecosystems and the future costs of incoming water treatment

OUTGOING WATER RISKS: The impacts of outgoing water pollution on human health and ecosystems, regulatory restrictions, and the future costs of wastewater treatment

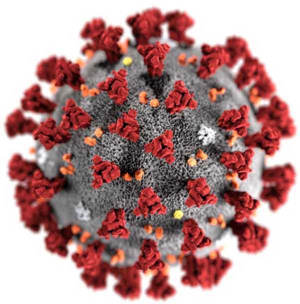
OPERATIONAL COSTS: The energy required to pump, cool, heat, treat, filter and move water to meet operational needs

POTENTIAL REVENUE RISKS: The impacts of water use versus availability, based on water required to do business

ENTERPRISE RISKS: Facility risks regarding projected business growth and location-specific water stress, plus impact to brand reputation

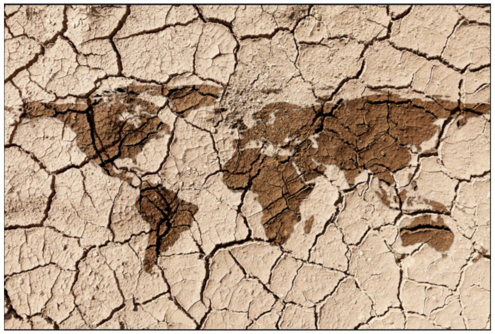


Push for Solutions



Global Pandemic

Remote Work



Global Water Crisis

Water Sustainability

Where are we today

- Sustainability and water risk management is more relevant today than ever
- Solving critical water problems requires understanding full value of water and **development of an action plan** to meet water reduction targets
- **Business and environmental goals** can be achieved in parallel
- There is a **tool to help: Ecolab's Smart Water Navigator**

INCREASING Pressure on business to reduce water demand

43%

of the global population may experience water scarcity by 2025*

56%

shortfall in freshwater for business use by 2030*

38%

of companies say water is a strategic corporate initiative**

As businesses rely on water to operate and grow, water issues present a growing risk to organizations

*World Resources Institute
**Greenbiz

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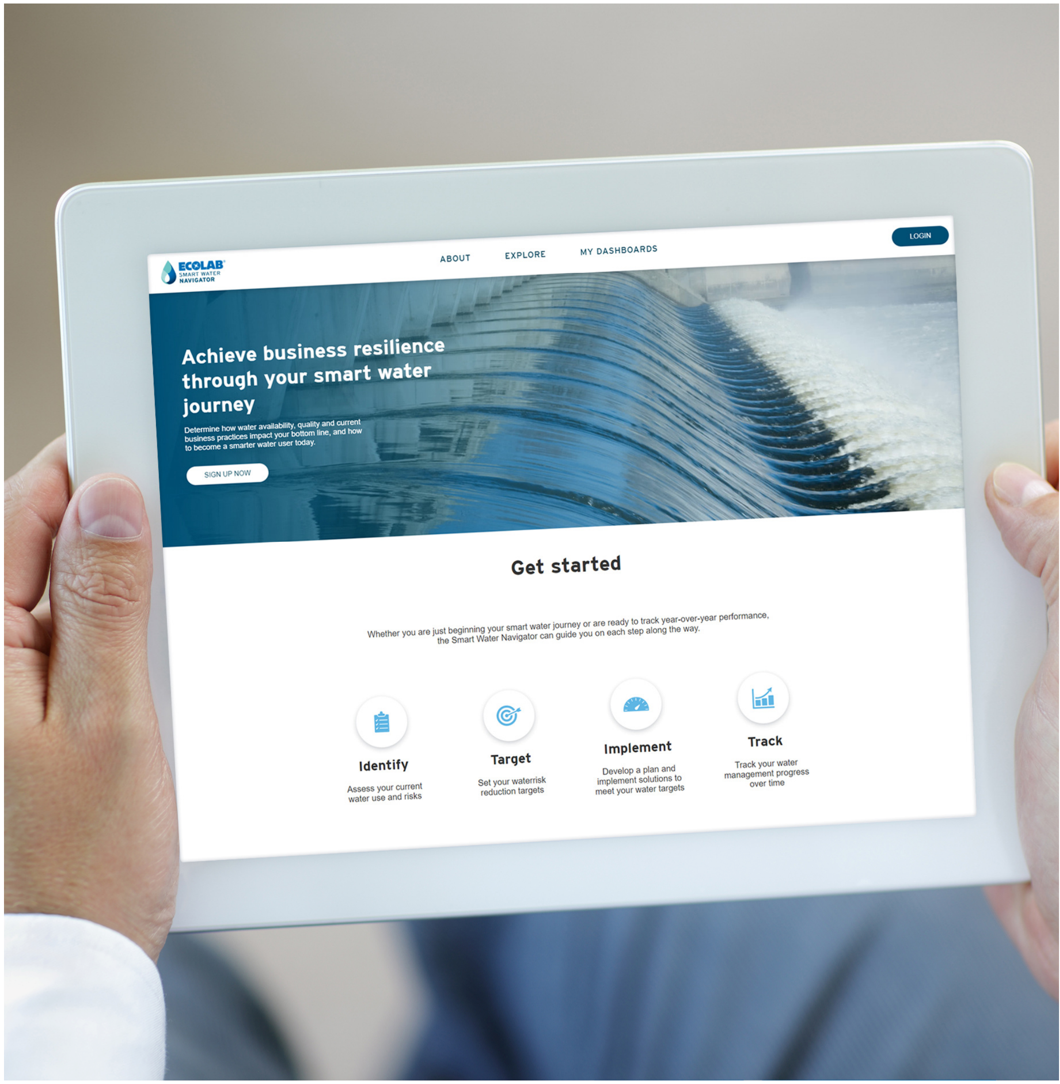
ECOLAB®
SMART WATER NAVIGATOR

Ecolab's enhanced Smart Water Navigator is a publicly available, online water management platform with additional new features to help you:

1. Set local water reduction targets and drive internal accountability to help reach them
2. Optimize water use leading to more resilient operations
3. Build trust and credibility with stakeholders to drive collective action on water issues



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Available at SmartWaterNavigator.com

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WHERE DO WE GO FROM HERE?

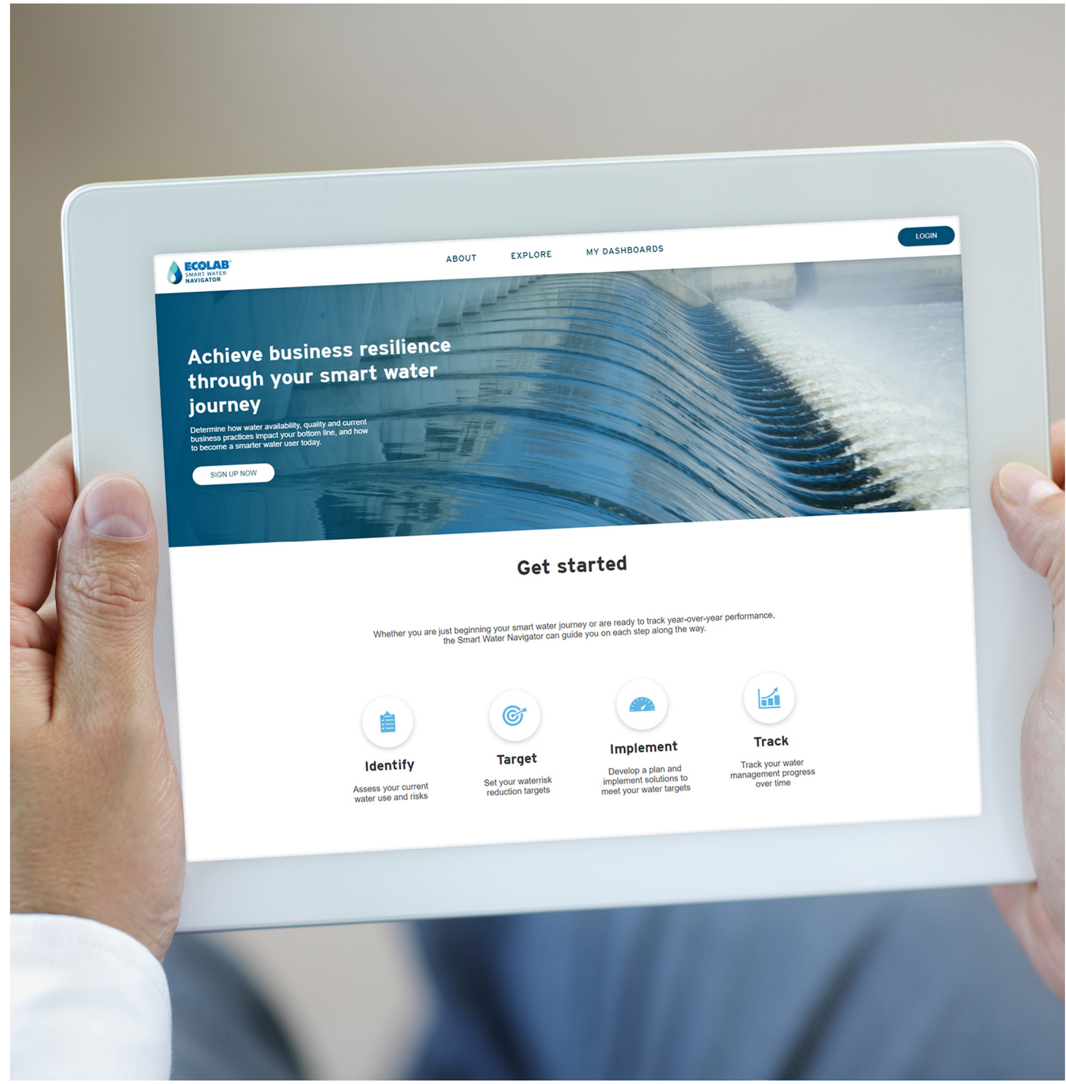
1. Assess where you would like to start: identifying risks, target-setting, implementing action plans, or tracking performance over time

2. **Register** user(s) on SmartWaterNavigator.com

3. Collect data from facilities around incoming water use and prices, outgoing water use and prices, growth projections and/or existing water management practices

   Data can be entered for one facility at a time, or using a templated spreadsheet for batch upload of multiple facilities

4. **Review findings** and integrate them into your broader water management strategy



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Universities Challenged with Sustainability:

- Either landlocked based on consumption
- Local water restrictions
- Because it's the right thing to do
- Stay Ahead of the curve

Common Attempts include

- Saving water on landscaping
- Reducing electrical costs through automation/VFDs
- Heating through solar, ground heating, ect
- Water Treatment is often overlooked!
  - Impacts TCO of plant

Total Cost of operation Summary

- Graph depicts an example of the annual expenditures for a Refrigeration Utility system
- Water Treatment small piece of the pie
- Issues that affect these costs are:
  - Low Cycles of Concentration
  - Poor Microbio control
  - High corrosion rates
  - Increased Time demand (labor)
  - Equipment issues/failure
- Large impact on sustainability initiatives

Energy:	$178,704
Water:	$258,754
Labor:	$48,000
Treatment:	$42,097
Maintenance:	$21,140
Other:	$15,000
Total:	$563,695

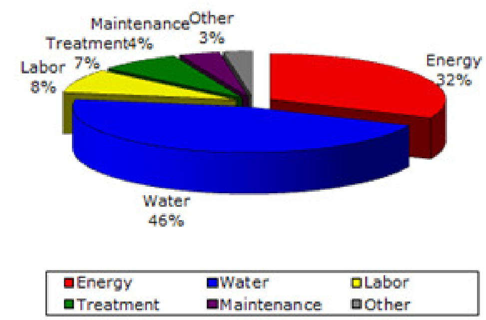


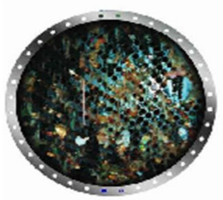
Figure 1: Estimated 2000 ton chiller annual expenditure

First Suggestion: Ensure Water Treatment Program is working properly

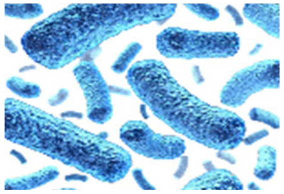
Analytical testing of water is required for all water treatment programs.

Failure to maintain systems leads to:

Fouling



Microbiological activity



Corrosion

Scaling

- Increase in energy usage
- Damage of assets
- Increase in downtime
- Decrease in product quality

Impact of Scale and Fouling on Water Treatment

- **Scale:** Scale formation occurs when minerals come out of solution and form hard, dense crystals
- 0.01 inch scale increases electricity costs by $24,500 (for 500-ton chiller operated 5,000 hours per year).

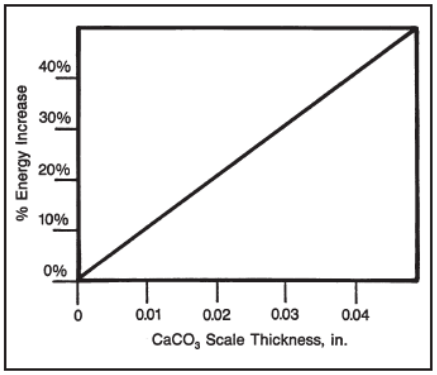


Figure 3.7.36 - Effect of condenser scale on energy efficiency

- **Fouling:** is the accumulation of solids material, other than scale, that hampers the operation of equipment or contributes to its deterioration.
- 0.01 inch biofilm (Foulant) increases electricity costs by **$98,000** (for 500-ton chiller operated 5,000 hours per year).

Table 3.15.1 - Excessive energy cost from condenser scale (per 1000 tons cooling). Assumes chiller runs 24 hr/d, 365 d/y with the indicated level of deposition at 75% calcium carbonate. Costs are U.S. dollars per year.

Electricity Cost $/kWh	10 mils (0.25 mm) Thickness	50 mils (1.3 mm) Thickness	100 mils (2.5 mm) Thickness	200 mils (5.1 mm) Thickness
$0.04	$8800	$42200	$80400	$156700
$0.05	$10700	$51100	$98300	$186600
$0.06	$12600	$62000	$116200	$216500
$0.07	$14500	$71900	$134100	$246400
$0.08	$16400	$81800	$152000	$276300

What Can I Do To Prevent Scale?

1. Limit the concentration of the scale forming minerals

Two methods:

- Pre-treating the makeup water
- Increasing the blowdown from the system to limit the concentration of the troublesome minerals

3 Make mechanical changes to the system design

Changes to avoid mineral scale are:

- Increase water velocity
- Avoid too high surface temperatures

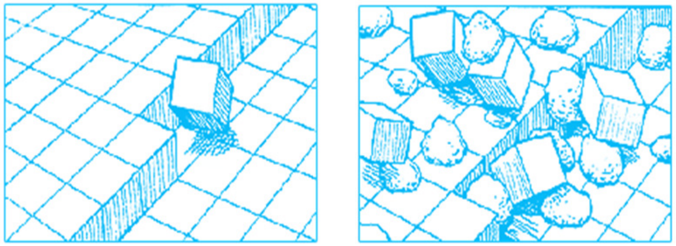
2. Feed acid to reduce pH and alkalinity

This will **reduce** the tendency for scale formation.

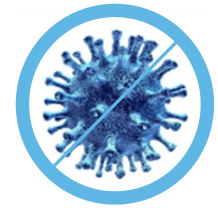
This will **increase** the potential for corrosion.

4. Apply chemical scale inhibitors

Antiscalants are chemicals that prevent the build-up of mineral scale .



What Can I Do To Prevent Fouling?



1. Water quality

The survival of the microorganisms depends on the availability of a proper food source.

Steps should be taken to minimize the nutrient source present in the organic contaminants.

If there is no food there will be no microorganisms!

2. System design considerations

Considerations in the system design that determine the growth of microorganisms are:

- Using plastic fill and mist eliminators to reduce problems with fungi
- Covering tower decks to inhibit growth of algae
- Avoid using materials that harbor bacteria and other organisms, or provide nutrients for microbial growth

3. Chemical treatment

A. Oxidizing Biocides

a. "Burn up" microorganisms they come in contact with

b. Include chlorine, bromine, chlorine dioxide, ozone, and sodium hypochlorite

c. Dosage needs to be adjusted to obtain a free oxidant residual

B. Non-Oxidizing Biocides

a. Are toxic to microorganisms when applied at moderate to high dosages

b. Require a minimum amount of contact time to kill

C. Bio-dispersants

a. Help oxidizing/non-oxidizing biocides work more effectively

Case Study: 8 Million Gallons of Water Saved Annually

- Problem: Local well system was becoming dry and a natural low flow condition impacted surrounding river area
- EPA and Department of Heath contacted and encouraged the school to take action to reduce water consumption

Case Study: 8 Million Gallons of Water Saved Annually

- Solution: Cooling Tower Cycles were increased from 4.5 cycles to 8 cycles of concentration
- Biocide program was improved to reduce electrical spend

Customer Impact	eROI	Economic Results
8 million gallons annual water reduction	WATER	$34,400 savings per year or water and energy
281,967 kWh reduction	ENERGY	
169,180 pounds of CO_2 reduced	AIR	$1,366/year in voluntary CO_2 credits

Q&A

Thank You!

Marc Lind
District Representative
Nalco Water

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