



The EDF-GEMI WaterMAPP

A Water Management Application Efficiency Toolkit

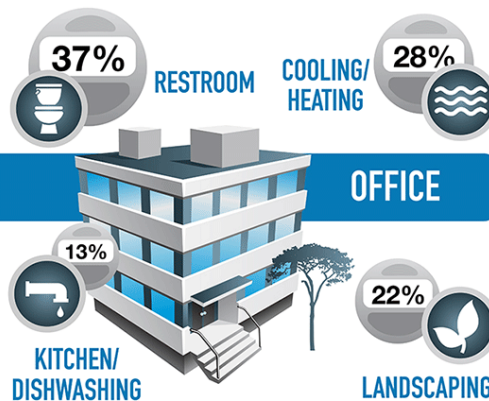
Steven Goldman, Environmental Defense Fund

Suppliers Partnership for the Environment Meeting
November 10, 2015



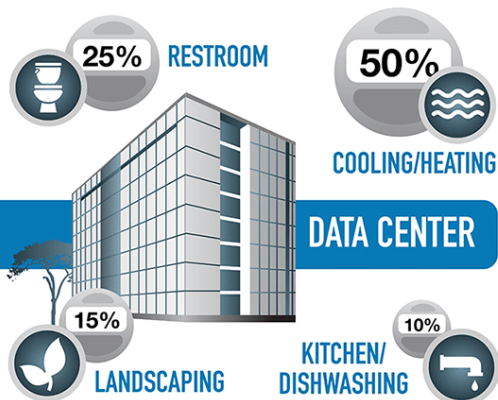
WHERE DO BUILDINGS use water?

Cooling is among the top consumers of water for large office buildings.



Source: <http://www.epa.gov/watersense/commercial/types.html#tabs-office>

...and because of the heat generated by computer equipment, data centers consume even more water for cooling.



The actual percentages will vary by data center, with some consuming a significantly higher percentage of water for cooling.

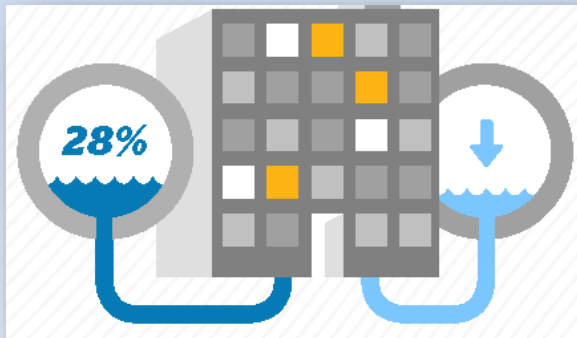


Background on the WaterMAPP



- AT&T water footprint: 3.3B gallons of water annually
- 2012 budget: Water expenditures 2% of energy expenditures
- AT&T internal water activities: Scorecard, training, pilots
- < 2 percent of portfolio (125 facilities) = 50 percent of total water use
- 31 in high or very high water stress regions

All had one thing in common: high evaporative cooling demands

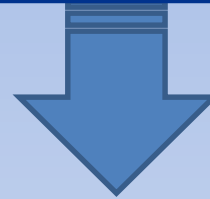


28%

*Amount of total water
in an office building
devoted to cooling*

The EDF Pilot Project with AT&T

Chemical Water Treatment, Technical, and Free Air Cooling



Technical and Free Air Cooling



- **Technical:** One cooling tower filtration system upgrade costs less than \$100,000 to install but promises more than \$60,000 in annual water and sewer savings—paying for itself in less than two years.
- **Free Air Cooling:** A minor \$4,000 equipment upgrade to expand free air cooling promises nearly \$40,000 in annual savings.



Water Savings

- AT&T's pilot projects achieved water reduction savings ranging between 14-40%
- **Potential scalability in the U.S:**
 - 28 billion gallons of water could be saved by U.S. companies per year.



Buildings Using Cooling Towers



The EDF-GEMI WaterMAPP Toolkit

EDF-GEMI WaterMAPP Tool x

www.gemi.org/EDFGEMIwaterMAPP/index.html

The EDF-GEMI WaterMAPP A Water Management Application Efficiency Toolkit

EDF
CHANGE YOUR
Thinking the smart way about
GEMI

WaterMAPP Home About EDF-GEMI Collaboration Why Water Efficiency Matters How Cooling Towers Work Additional Resources GEMI Home Page

[Training webinar on using the WaterMAPP tools](#)
- Whether you are an organizational leader or a facility manager, this webinar will teach you how to use the toolkit to launch or enhance your water management program. Watch the webinar and learn how to: measure and manage water use, optimize building cooling, and build the business case to realize an ROI on water management.

Boost your organization's water efficiency. The **EDF-GEMI WaterMAPP** is a set of tools and resources that can help organizations build their own program to reduce water and energy use in buildings—and save money in the process. The toolkit has the potential to save 26 billion gallons annually if deployed across all U.S. companies. As drought conditions persist on the west coast and throughout the Southwest, and other areas struggle with water scarcity, the Global Environmental Management Initiative (GEMI) and Environmental Defense Fund (EDF) have teamed up to scale adoption of a new solution tool, the **EDF-GEMI Water Management Application (WaterMAPP)** toolkit, building on a previous water efficiency collaboration between EDF and AT&T.

The **EDF-GEMI Water Management Application (WaterMAPP)** is a MS Excel-based, multi-tabbed spreadsheet with three complimentary tools:

- The **EDF-GEMI Water Scorecard** helps you assess your company's water efficiency and can be used to create visibility for water performance at facilities. The [Water Scorecard Guide](#) offers an overview of the scorecard concept, calculations used by AT&T in developing their first scorecard, and provides detailed information about how you could develop your own scorecard.
- The **Water Efficiency Calculator** estimates water and financial savings from cooling tower or free-air cooling improvements – key data for making the water-efficiency investment business case.
- **Cycles of Concentration Estimator** takes information about your water quality and estimates the recommended maximum Cycles of Concentration (COC)—a key indicator of cooling tower water efficiency—when using chemicals to treat the water. It also helps identify appropriate non-chemical water treatment options to increase the potential COC.

[Training webinar on using the WaterMAPP tools](#) - Whether you are an organizational leader or a facility manager, this webinar will teach you how to use the toolkit to launch or enhance your water management program. Watch the webinar and learn how to: measure and manage water use, optimize building cooling, and build the business case to realize an ROI on water management.

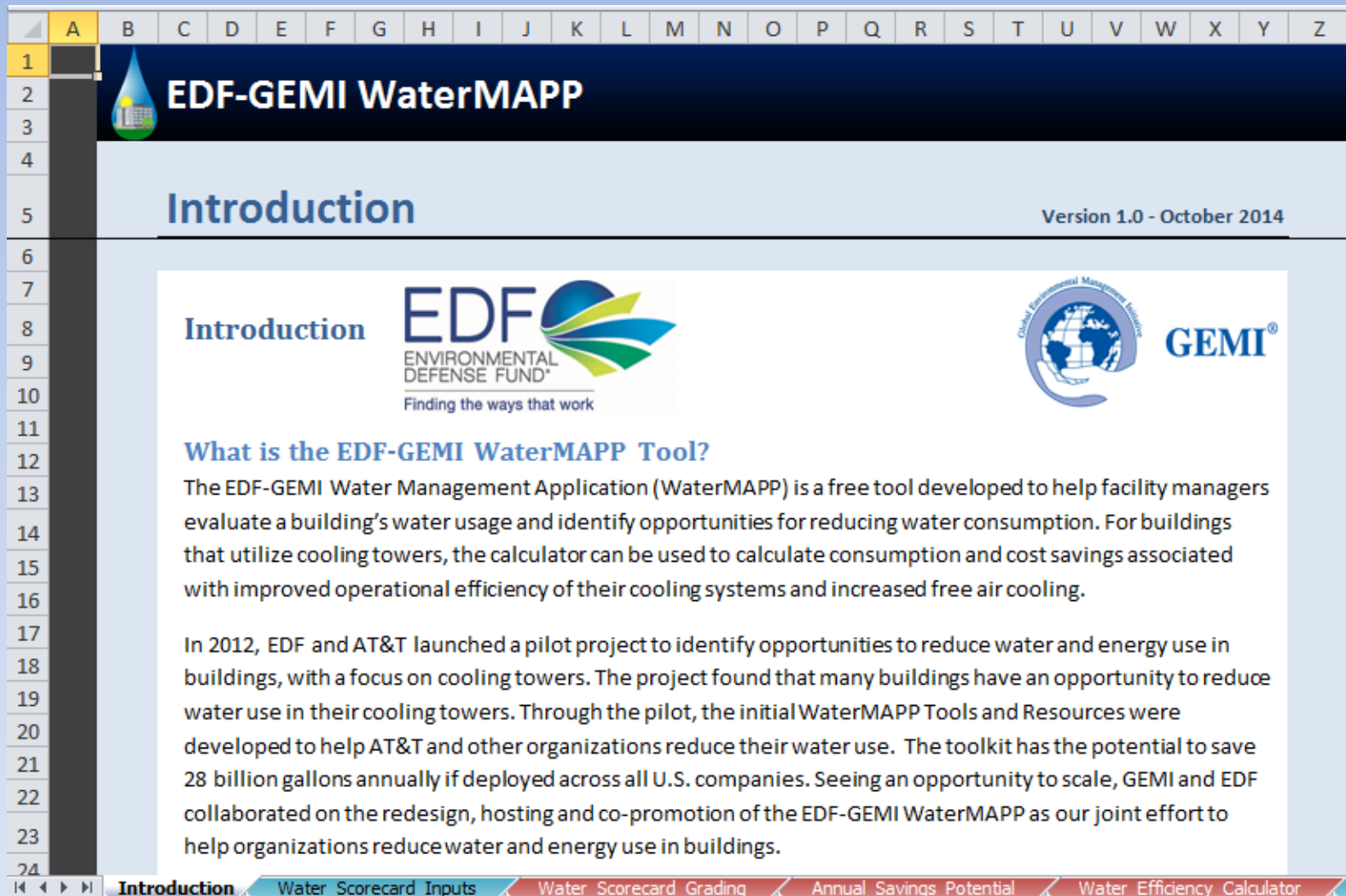
Download the EDF-GEMI WaterMAPP tool

Share Your Story of Using This Tool

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www.gemi.org/EDFGEMIwaterMAPP

The Toolkit: Introduction





The screenshot shows a spreadsheet interface with columns A through Z and rows 1 through 24. The main content area is titled "EDF-GEMI WaterMAPP" and "Introduction". It features logos for EDF (Environmental Defense Fund) and GEMI (Global Environmental Management Institute). The text describes the WaterMAPP tool and its development by EDF and AT&T.

EDF-GEMI WaterMAPP

Introduction

Version 1.0 - October 2014

Introduction



What is the EDF-GEMI WaterMAPP Tool?

The EDF-GEMI Water Management Application (WaterMAPP) is a free tool developed to help facility managers evaluate a building's water usage and identify opportunities for reducing water consumption. For buildings that utilize cooling towers, the calculator can be used to calculate consumption and cost savings associated with improved operational efficiency of their cooling systems and increased free air cooling.

In 2012, EDF and AT&T launched a pilot project to identify opportunities to reduce water and energy use in buildings, with a focus on cooling towers. The project found that many buildings have an opportunity to reduce water use in their cooling towers. Through the pilot, the initial WaterMAPP Tools and Resources were developed to help AT&T and other organizations reduce their water use. The toolkit has the potential to save 28 billion gallons annually if deployed across all U.S. companies. Seeing an opportunity to scale, GEMI and EDF collaborated on the redesign, hosting and co-promotion of the EDF-GEMI WaterMAPP as our joint effort to help organizations reduce water and energy use in buildings.

Navigation tabs: Introduction, Water_Scorecard_Inputs, Water_Scorecard_Grading, Annual_Savings_Potential, Water_Efficiency_Calculator




The Toolkit: Water Scorecard Inputs

EDF-GEMI WaterMAPP	
Version 1.0 - October 2014	
Water Scorecard Inputs	
Score Card Data – Building Info	Inputs:
Facility Manager Name:	Joe Manager
Building ID/Name:	Headquarters Tower
Street Address:	123 Main St.
City:	Detroit
State:	MI
Zip Code:	48206
Closest City:	Minnesota - Saint Cloud
Building Type:	Admin
Water Stress Region	High
# of Tenants:	2,500
Square Footage:	20,000
Score Card Data – Water Consumption	Inputs:
Enter the last 24 months of water use (gallons):	
Month 1 - Newest Month	2,864,500
Month 2	3,105,430
Month 3	2,879,300

Introduction | **Water_Scorecard_Inputs** | Water Scorecard Grading | Annual Savings Potential | Water Efficiency Calculator | COC_Estimator | Chiller_Load

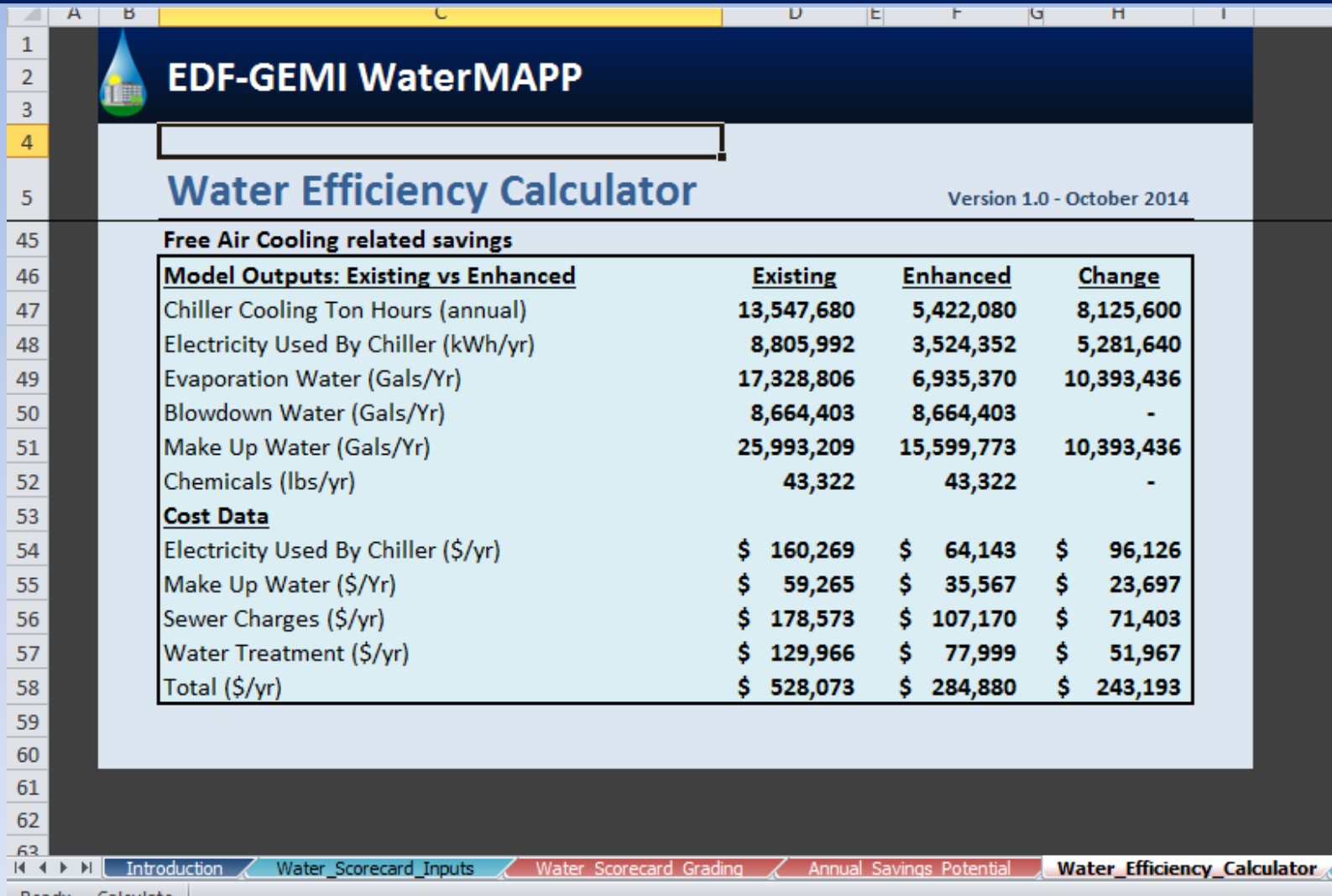


The Toolkit: Water Scorecard Grading

A	B	C	D	E	F	G
1						
2	EDF-GEMI WaterMAPP					
3						
4						
5	Water Scorecard Grading				Version 1.0 - October 2014	
6						
7	Check your Grade!					
8	Total Score:				80	
9	Your Overall Grade Is:				B-	
10						
11	<u>Building Information</u>					
12	Facility Manager Name:				Joe Manager	
13	Building ID/Name:				Headquarters Tower	
14	Street Address:				123 Main St.	
15	City:				Detroit	
16	State:				MI	
17	Zip Code:				48206	
18						
19	Category Scores					
20						
21						
22	Cooling Tower Efforts				100%	



The Toolkit: Water Efficiency Calculator



EDF-GEMI WaterMAPP

Water Efficiency Calculator Version 1.0 - October 2014

Free Air Cooling related savings


<u>Model Outputs: Existing vs Enhanced</u>	<u>Existing</u>	<u>Enhanced</u>	<u>Change</u>
Chiller Cooling Ton Hours (annual)	13,547,680	5,422,080	8,125,600
Electricity Used By Chiller (kWh/yr)	8,805,992	3,524,352	5,281,640
Evaporation Water (Gals/Yr)	17,328,806	6,935,370	10,393,436
Blowdown Water (Gals/Yr)	8,664,403	8,664,403	-
Make Up Water (Gals/Yr)	25,993,209	15,599,773	10,393,436
Chemicals (lbs/yr)	43,322	43,322	-
Cost Data			
Electricity Used By Chiller (\$/yr)	\$ 160,269	\$ 64,143	\$ 96,126
Make Up Water (\$/Yr)	\$ 59,265	\$ 35,567	\$ 23,697
Sewer Charges (\$/yr)	\$ 178,573	\$ 107,170	\$ 71,403
Water Treatment (\$/yr)	\$ 129,966	\$ 77,999	\$ 51,967
Total (\$/yr)	\$ 528,073	\$ 284,880	\$ 243,193

Navigation tabs: Introduction | Water_Scorecard_Inputs | Water Scorecard Grading | Annual Savings Potential | **Water_Efficiency_Calculator**



Business Case

- Key to scaling up potential savings is understanding all the areas in which you can save:
 - Water
 - Sewer
 - Chemicals
 - Energy



EDF-GEMI WaterMAPP

Annual Savings Potential Version 1.0 - October 2014

Savings Potential from Cycles of Concentration

Current Cycles of Concentration:	3
Target Cycles of Concentration:	10
Electricity Used By Chiller (kWh/yr)	-
Blowdown Water (Gals/Yr)	6,738,980
Make Up Water (Gals/Yr)	6,738,980
Chemicals (lbs/yr)	33,695
Electricity (\$/Yr)	-
Make Up Water (\$/Yr)	\$ 15,365
Sewer Charges (\$/yr)	\$ 46,297
Water Treatment (\$/yr)	\$ 33,695
Total (\$/yr)	\$ 95,357



The Toolkit: Cycles of Concentration Estimator

EDF-GEMI WaterMAPP

Cycles of Concentration Estimator

Version 1.0 - October 2014

Water Quality Information
Please enter:

Makeup Water Quality

	INPUTS
Calcium hardness of makeup, ppm as CaCO ₃	96
Magnesium hardness of makeup, ppm as CaCO ₃	37
Total (M) alkalinity of makeup, ppm as CaCO ₃	102
Sulfate in the makeup, ppm as SO ₄	104.5
Silica in the makeup, ppm as SiO ₂	14.6
pH of the makeup, std units	7.1
Conductivity of the makeup, micromhos/cm	657.5

Calculations:

Cooling Water Quality Estimate

	OUTPUTS
Calcium hardness of cooling water, ppm as CaCO ₃	321.76
Magnesium hardness of cooling water, ppm as CaCO ₃	124.01
Total (M) alkalinity of cooling water, ppm as CaCO ₃	341.87
Conductivity of the cooling water, micromhos/cm	2203.72
Silica in the cooling water, ppm as SiO ₂	48.93

WaterMAPP_COC_Estimator_User's_Guide.pdf

Get these values from your treatment vendor or water provider

These are the estimated values for your cooling water makeup water quality

Water Scorecard Grading | Annual Savings Potential | Water Efficiency Calculator | **COC Estimator** | Chiller Load Data | Terms and Definitions

The Cycles of Concentration (COC) is a key indicator of cooling tower water quality and estimates the amount of non-chemical water treatment chemicals to treat the water. The guidance on using the COC Estimator is available in the user's guide.

Get these values from your treatment vendor or water provider

These are the estimated values for your cooling water makeup water quality



The Toolkit: Chiller Load Data

EDF-GEMI WaterMAPP
Version 1.0 - October 2014

Chiller Load Data

	9:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
M-F	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sat	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Sun	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

City: Minnesota - Saint Cloud
 Building Type: Admin

No Economizer EFLH:	4,234	Based on Scheduled Hours of Operation
Full Economizer EFLH:	1,694	Based on Scheduled Hours of Operation

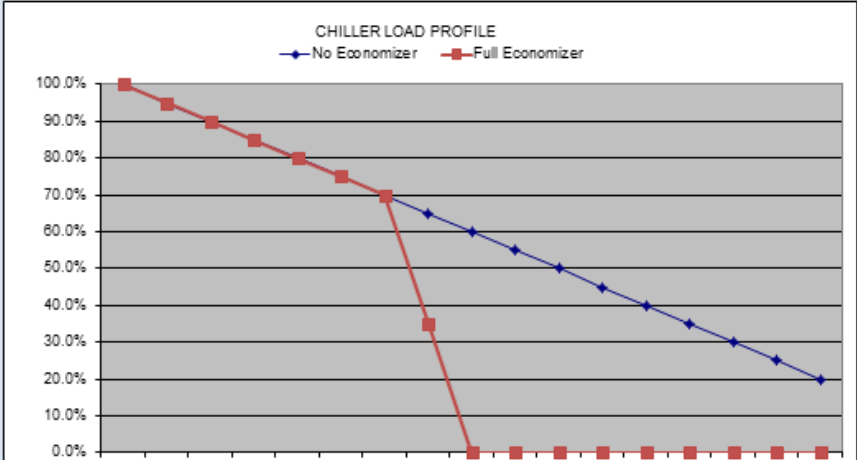
@SCHEDULED HRS OF OPERATION

No Economizer	EFLH
Weekdays	3,024
Saturday	605
Sunday	605
TOTAL	4,234

@SCHEDULED HRS OF OPERATION

Full Economizer	EFLH
Weekdays	1,210
Saturday	242
Sunday	242
TOTAL	1,694

	No Econ	Full Econ
Bin	% Load	% Load
90+	100.0%	100.0%
85/89	95.0%	95.0%
80/84	90.0%	90.0%
75/79	85.0%	85.0%
70/74	80.0%	80.0%
65/69	75.0%	75.0%
60/64	70.0%	70.0%
55/59	65.0%	35.0%
50/54	60.0%	0.0%
45/49	55.0%	0.0%
40/44	50.0%	0.0%
35/39	45.0%	0.0%
30/34	40.0%	0.0%
25/29	35.0%	0.0%



CHILLER LOAD PROFILE

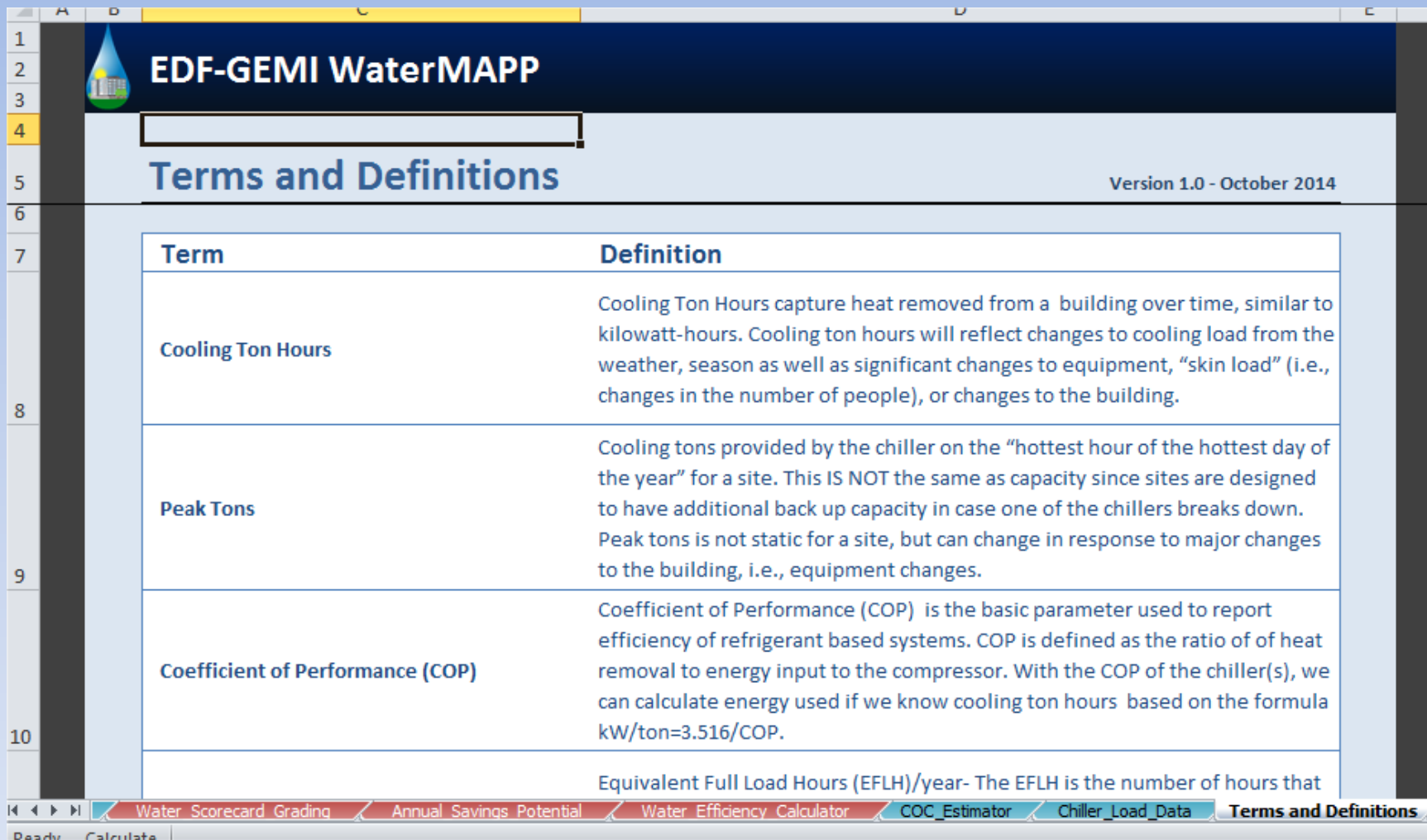
◆ No Economizer ■ Full Economizer

The graph shows the percentage of chiller load over a 24-hour period. The 'No Economizer' series (blue line with diamonds) starts at 100% at 9:00 and gradually decreases to approximately 20% by 23:00. The 'Full Economizer' series (red line with squares) follows the 'No Economizer' series until 17:00, then drops sharply to 0% by 18:00 and remains at 0% through 23:00.

Select building hours of operation



The Toolkit: Terms & Definitions



The screenshot shows the EDF-GEMI WaterMAPP software interface. At the top, there is a dark blue header with the logo (a water drop containing a building and sun) and the text "EDF-GEMI WaterMAPP". Below the header, the title "Terms and Definitions" is displayed in a light blue box, with "Version 1.0 - October 2014" to its right. The main content area contains a table with two columns: "Term" and "Definition". The table lists three terms: "Cooling Ton Hours", "Peak Tons", and "Coefficient of Performance (COP)". At the bottom of the table, the text "Equivalent Full Load Hours (EFLH)/year- The EFLH is the number of hours that" is partially visible. The software's navigation bar at the bottom includes buttons for "Water Scorecard Grading", "Annual Savings Potential", "Water Efficiency Calculator", "COC_Estimator", "Chiller_Load_Data", and "Terms and Definitions".

Term	Definition
Cooling Ton Hours	Cooling Ton Hours capture heat removed from a building over time, similar to kilowatt-hours. Cooling ton hours will reflect changes to cooling load from the weather, season as well as significant changes to equipment, "skin load" (i.e., changes in the number of people), or changes to the building.
Peak Tons	Cooling tons provided by the chiller on the "hottest hour of the hottest day of the year" for a site. This IS NOT the same as capacity since sites are designed to have additional back up capacity in case one of the chillers breaks down. Peak tons is not static for a site, but can change in response to major changes to the building, i.e., equipment changes.
Coefficient of Performance (COP)	Coefficient of Performance (COP) is the basic parameter used to report efficiency of refrigerant based systems. COP is defined as the ratio of heat removal to energy input to the compressor. With the COP of the chiller(s), we can calculate energy used if we know cooling ton hours based on the formula $\text{kW/ton} = 3.516/\text{COP}$.
	Equivalent Full Load Hours (EFLH)/year- The EFLH is the number of hours that



Additional Water Toolkit Resources

Additional EDF Resources

- The Cooling System Efficiency Guide and 12-video series on YouTube.
- Sample water audit templates

Additional GEMI® Resources

- The GEMI® Local Water Tool™ (LWT)
- GEMI's Connecting the Drops
- GEMI's Collecting the Drops: A Water Planner
- GEMI® Solutions Tool Matrix™

More Water Efficiency Tools & Resources

- CEO Water Mandate and Pacific Institute
- EPA WaterSense
- Ceres' Aqua Gauge
- WBCSD Global Water Tool (GWT)
- CDP's Water Program
- Alliance for Water Efficiency



Toolkit: Training Webinar

Water Efficiency Webinar with EDF and AT&T

AT&T and Environmental Defense Fund (EDF) developed a free suite of tools that U.S. commercial and industrial sector buildings can use to collectively save up to 28 billion gallons of water annually. Buildings with cooling towers typically use 28% of their daily water use for cooling, and they have the opportunity to reduce that water demand by 14-40% with the Building Water Efficiency toolkit.

Watch the webinar and learn how to:

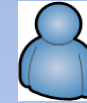
- Measure and manage water use
- Optimize building cooling
- Build the business case to realize an ROI on water management



Using the Toolkit Overview



Facility Manager



Organizational Leader

Learn

Training Resources



- Cooling Tower Efficiency Guide
- Cooling System Videos



Assess

Building Water Usage



- Water Audit Templates
- Scorecard Entry Data



Evaluate

WaterMAPP



- Cycles of Concentration Estimator
- Efficiency Calculator
- Scorecard Results



Implement

Solutions

- Technical
- Free Air Cooling

Awareness

Infographics

- Building Water Use
- Business Impacts



Performance

Portfolio Water Usage



- Water Scorecard Guide
- Facility Scorecard Results
- Leaderboard



Financials

WaterMAPP



- Potential Savings for Business Case



Results

WaterMAPP



- Fund solutions across portfolio



Help Your Organization Save Water

- Raise awareness
- Use the Water Score Card tool to identify savings opportunities at facilities
- Share training materials, including the Cooling Efficiency Guide, Training videos, and webinar
- Use the WaterMAPP's Water Efficiency Calculator to build the business case for identified efficiency opportunities



Questions? Please Contact: GEMI or EDF...

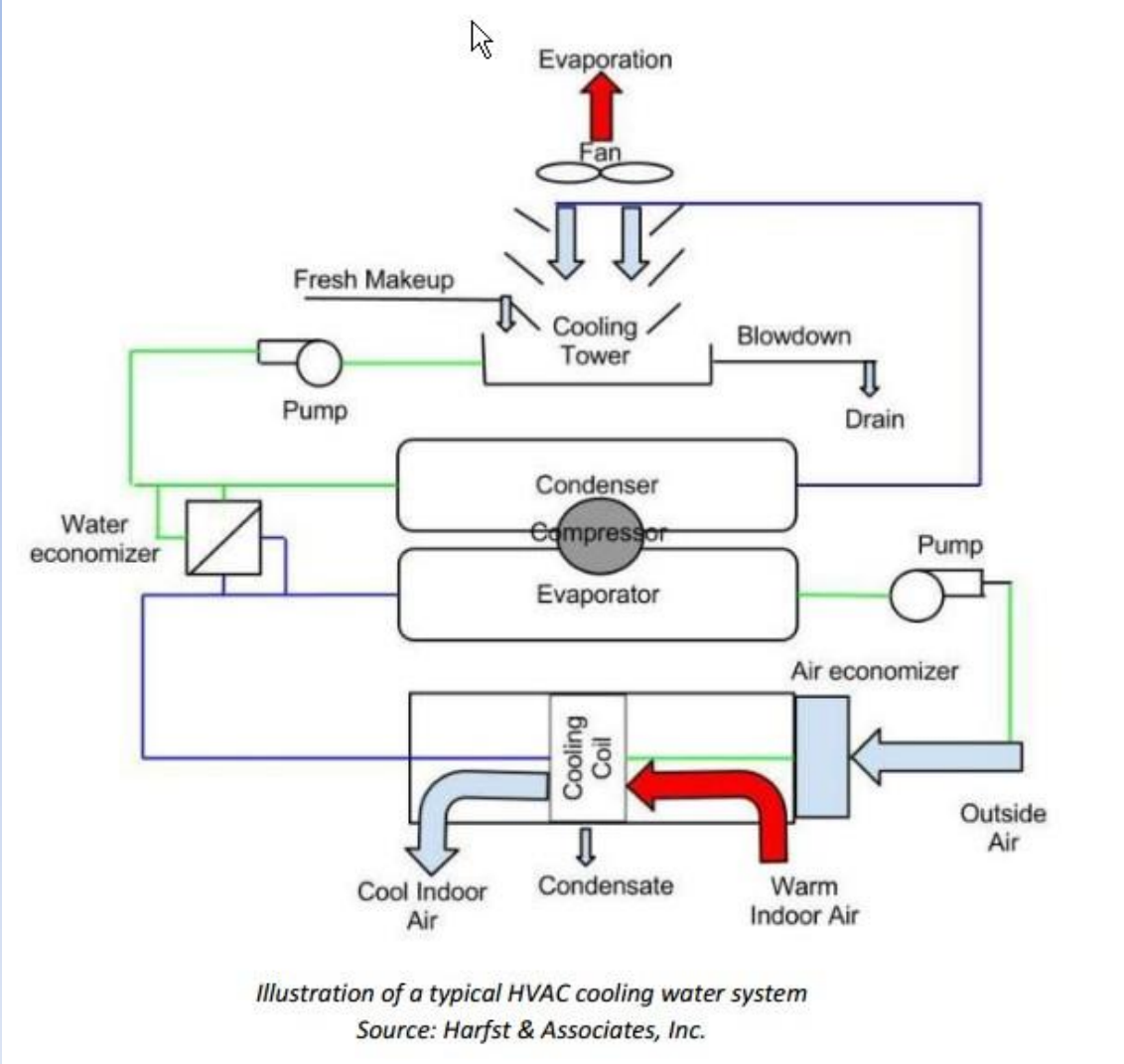
- Where to access the EDF-GEMI WaterMAPP Toolkit
 - www.gemi.org/EDFGEMlwaterMAPP
- Corporate Partnerships Program, EDF
 - Email: business@edf.org
 - Website: business.edf.org



Additional slides

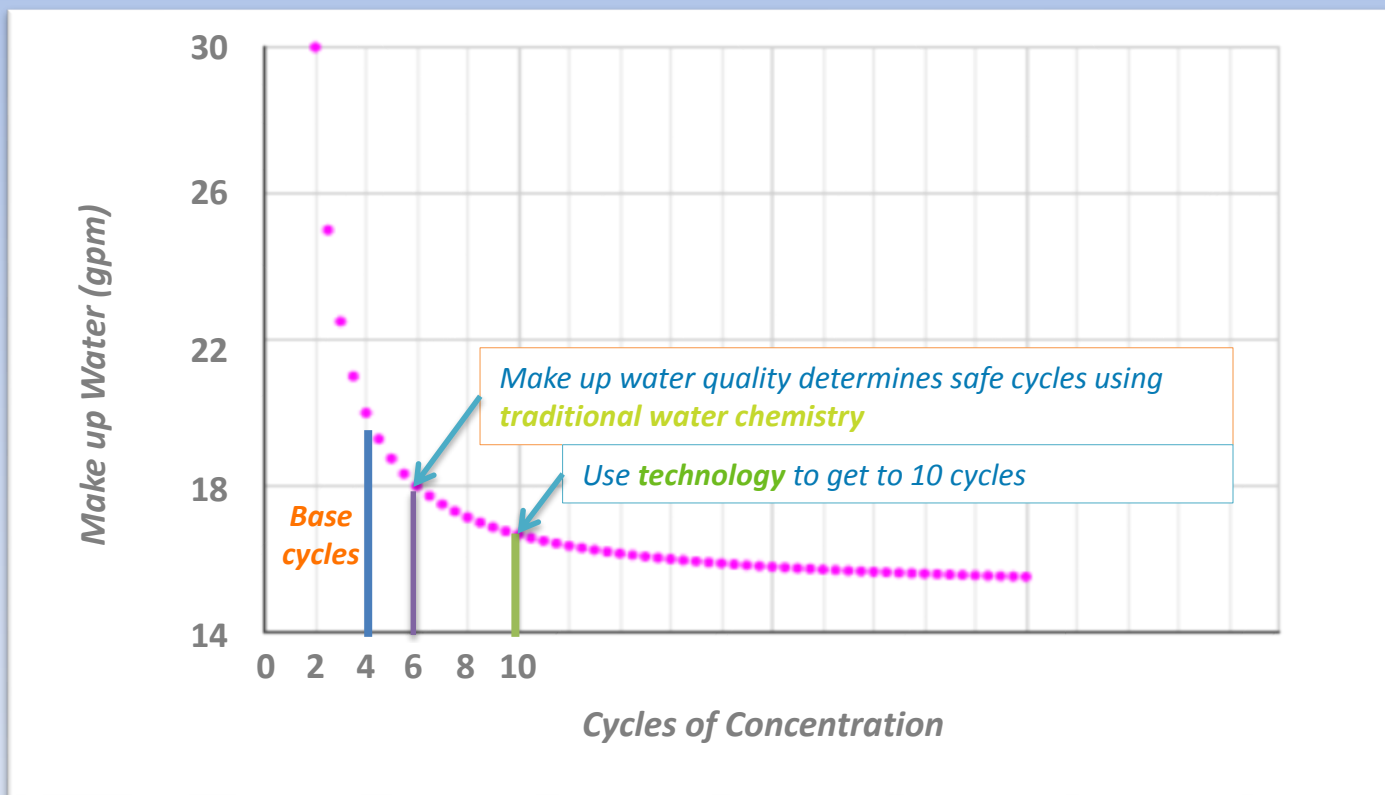


Cooling Water Systems



Operational vs. Technology Impacts to Cycles

- Increasing the Cycles of Concentration reduces cooling water requirements
- Free air cooling eliminates them



Source: "Improving Cooling Tower Efficiency" – Harfst and Associates



Opportunity For Free Air Cooling

