The EDF-GEMI WaterMAPP

A Water Management Application Efficiency Toolkit

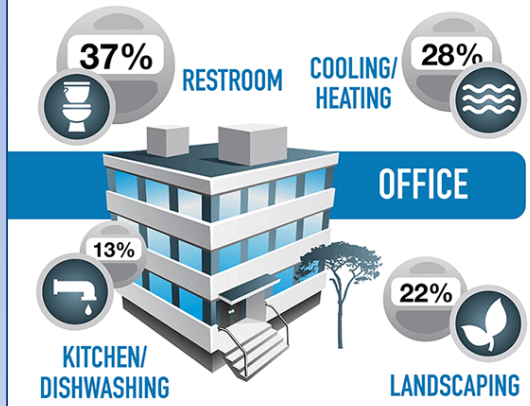
Steven Goldman, Environmental Defense Fund

Suppliers Partnership for the Environment Meeting
November 10, 2015

www.gemi.org/EDFGEMIwaterMAPP

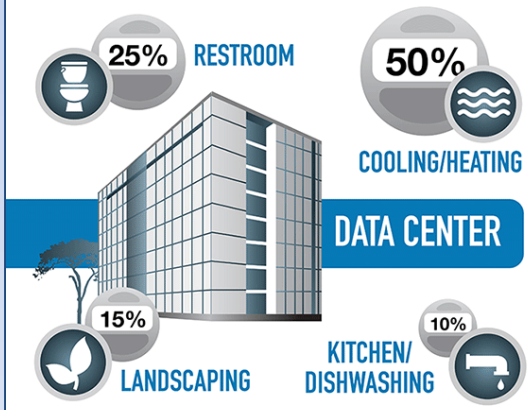
WHERE DO BUILDINGS use water?

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.

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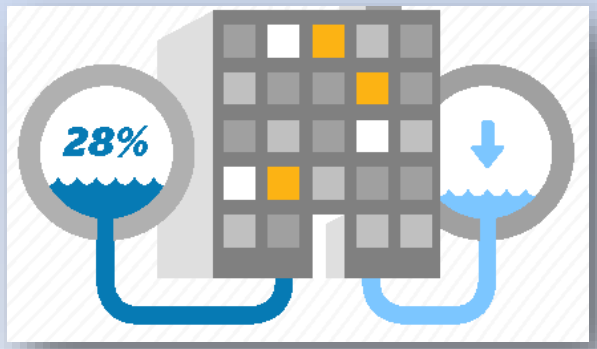
Background on the WaterMAPP

- 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

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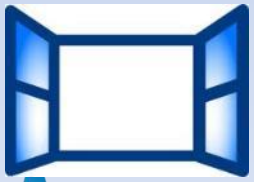
The EDF Pilot Project with AT&T

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

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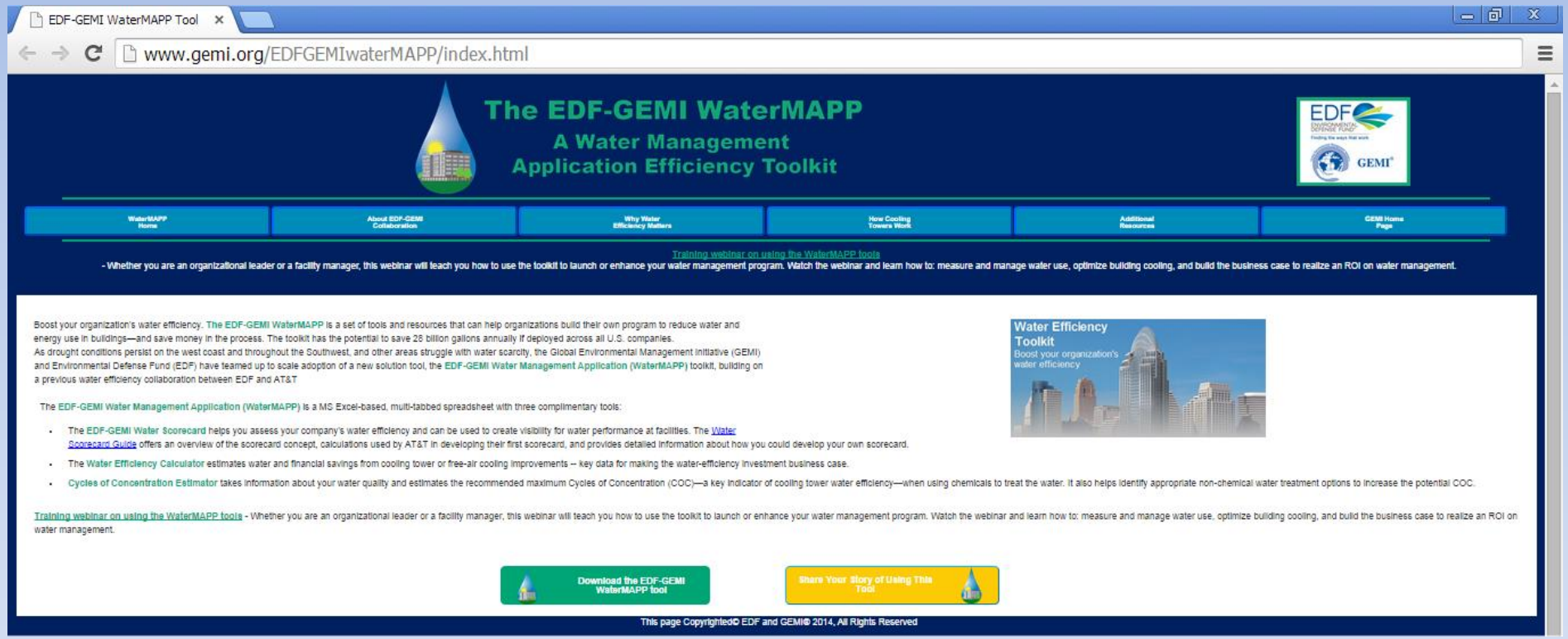
The EDF-GEMI WaterMAPP Toolkit



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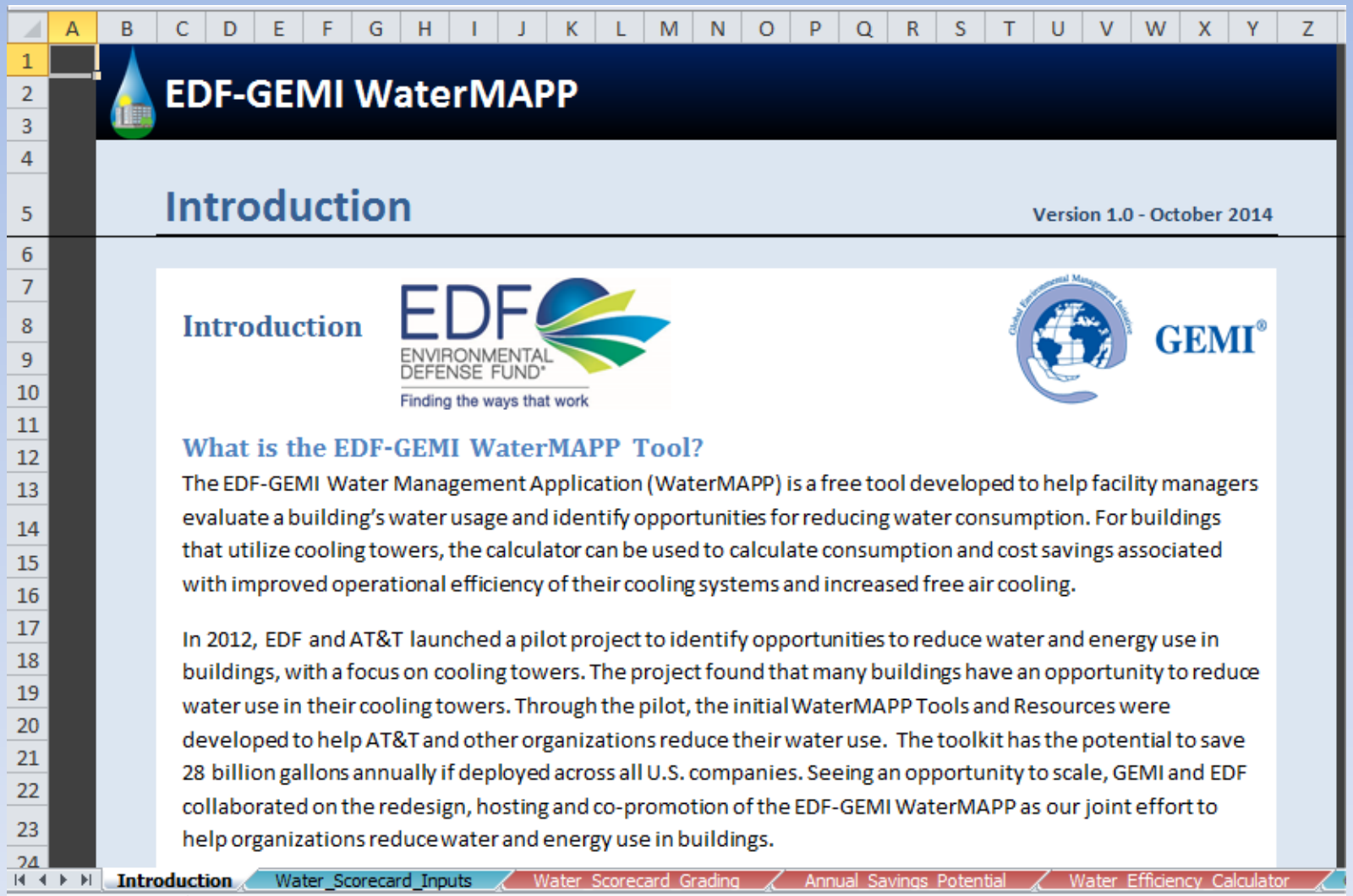
The Toolkit: Introduction



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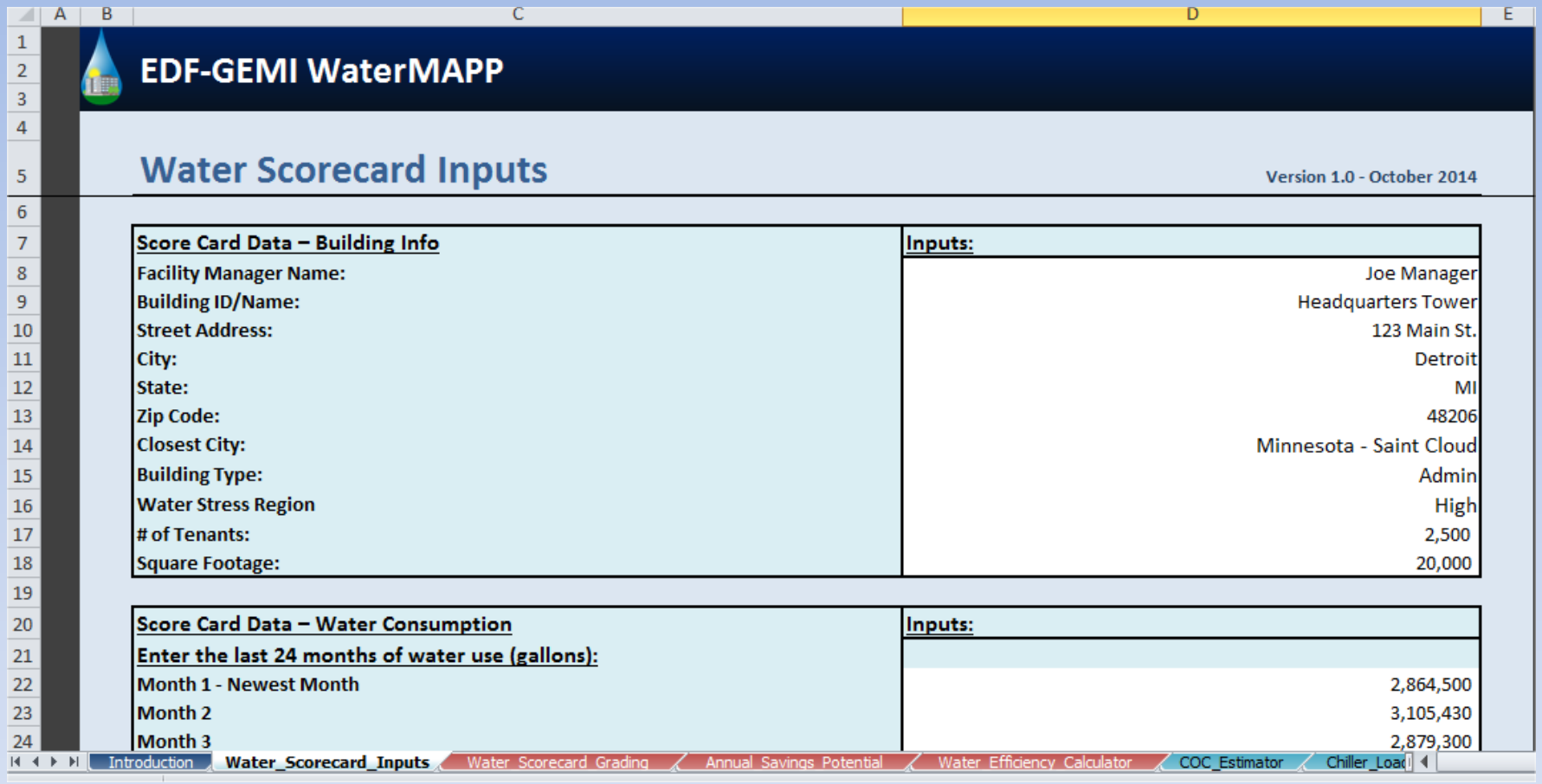
The Toolkit: Water Scorecard Inputs



EDF-GEMI WaterMAPP

Water Scorecard Inputs

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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

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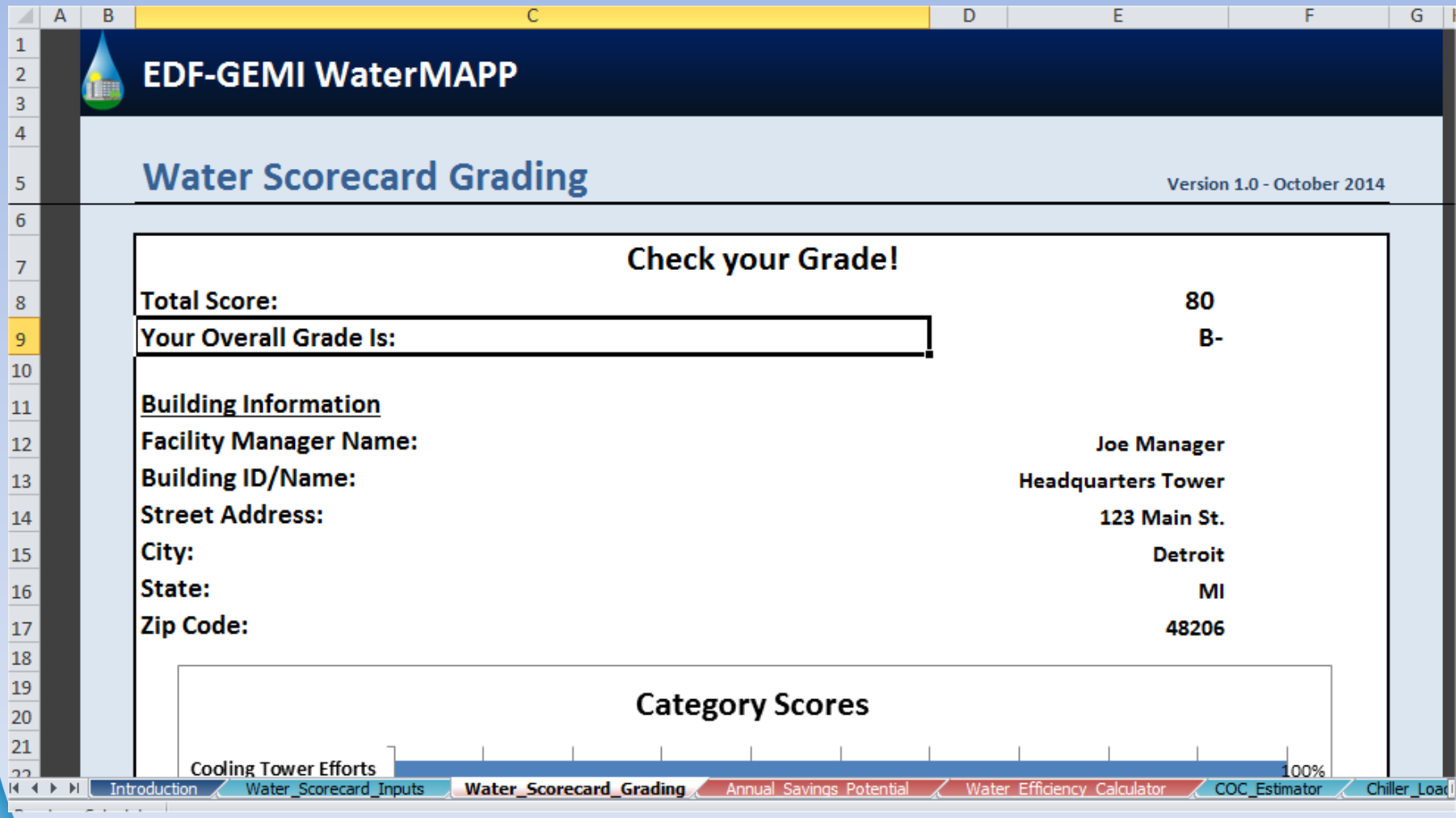
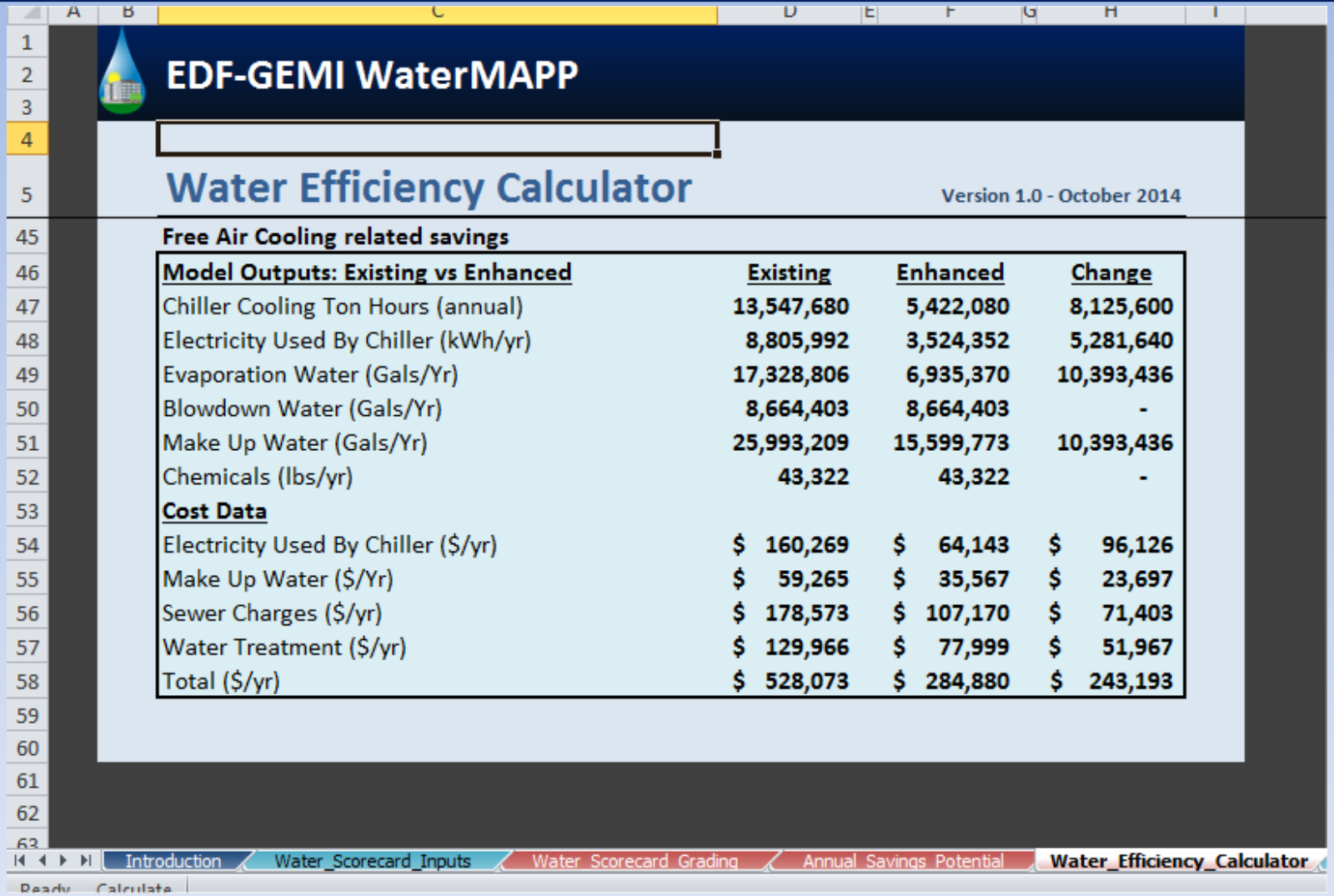
The Toolkit: Water Scorecard Grading



The Toolkit: Water Efficiency Calculator



EDF-GEMI WaterMAPP

Water Efficiency Calculator

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Free Air Cooling related savings

Model Outputs: Existing vs Enhanced	Existing	Enhanced	Change
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

Introduction | Water_Scorecard_Inputs | Water_Scorecard_Grading | Annual_Savings_Potential | Water_Efficiency_Calculator

Ready Calculate

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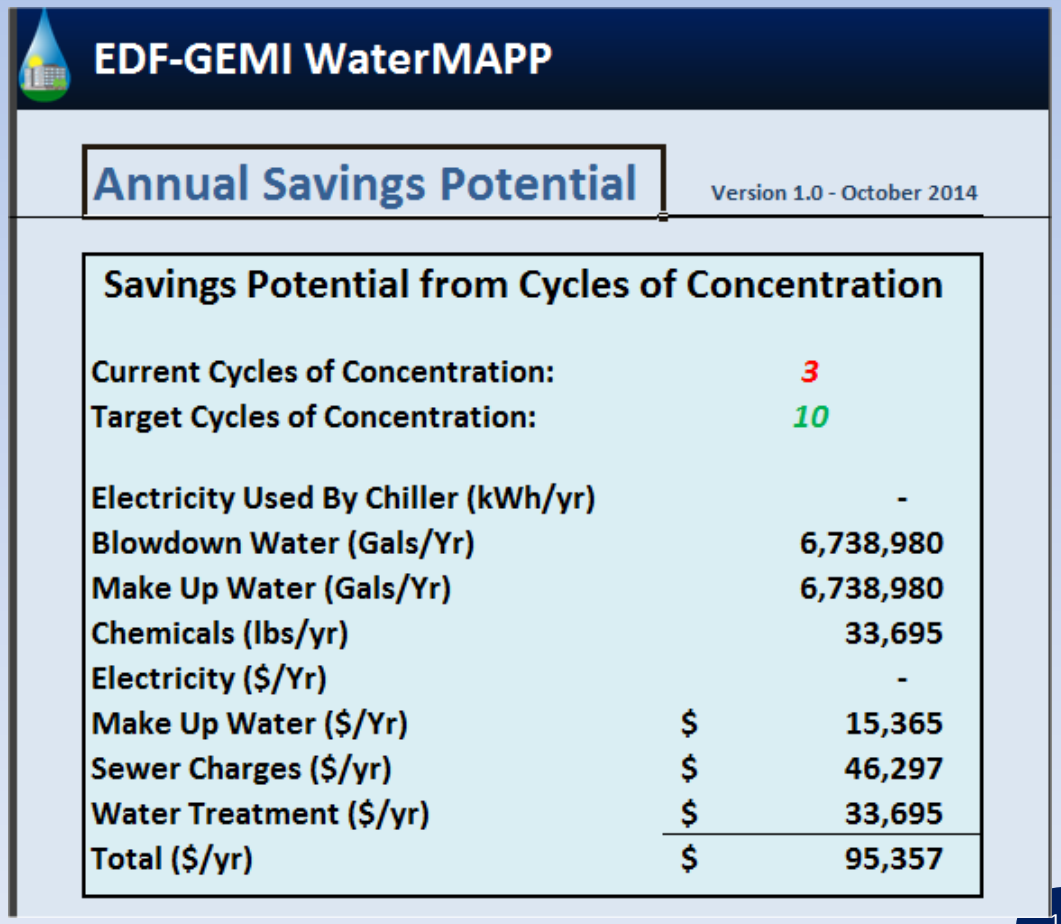
Business Case

- 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

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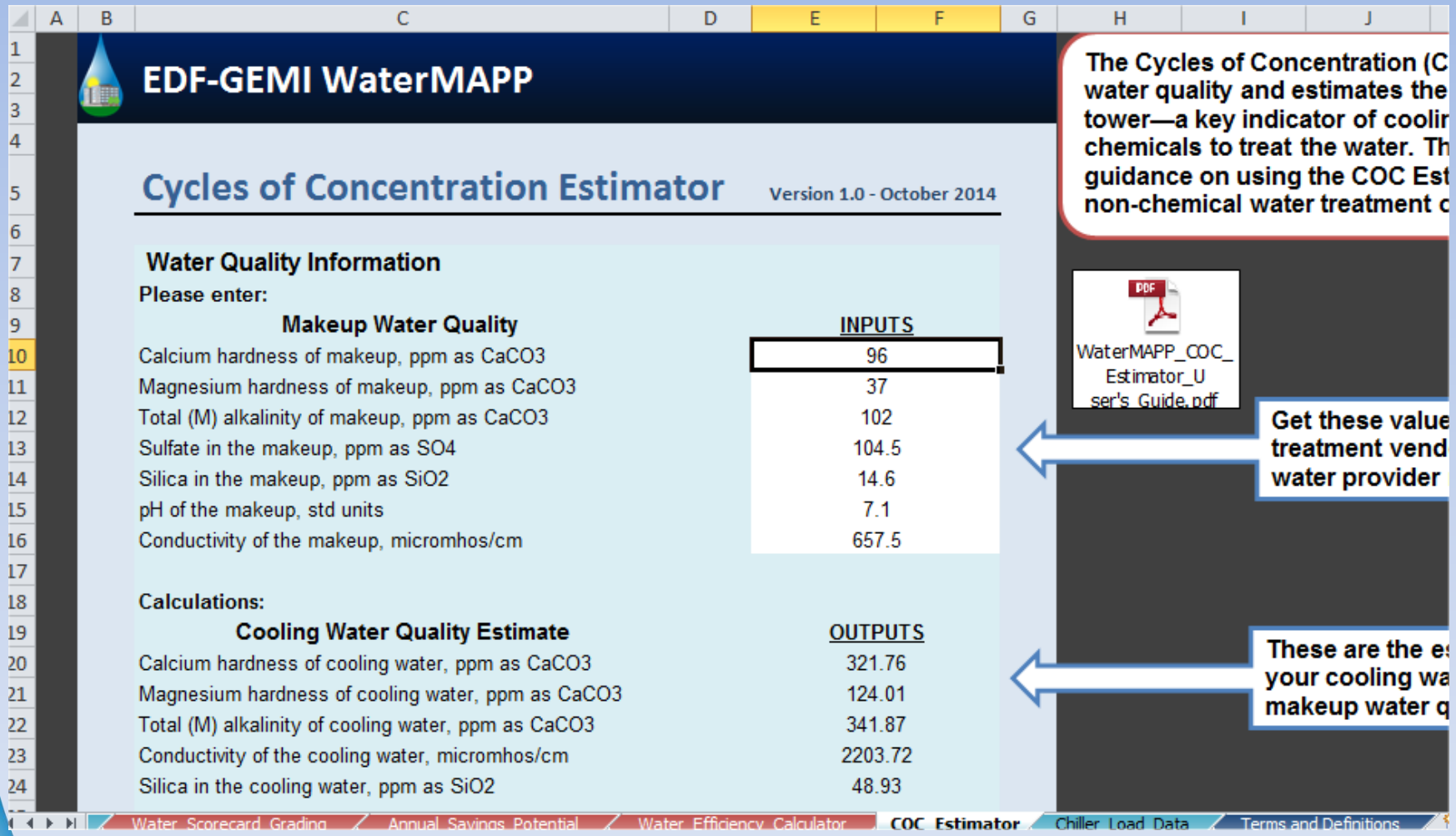
The Toolkit: Cycles of Concentration Estimator



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Cycles of Concentration Estimator

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Water Quality Information

Please enter:

Makeup Water Quality	INPUTS
Calcium hardness of makeup, ppm as CaCO3	96
Magnesium hardness of makeup, ppm as CaCO3	37
Total (M) alkalinity of makeup, ppm as CaCO3	102
Sulfate in the makeup, ppm as SO4	104.5
Silica in the makeup, ppm as SiO2	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 CaCO3	321.76
Magnesium hardness of cooling water, ppm as CaCO3	124.01
Total (M) alkalinity of cooling water, ppm as CaCO3	341.87
Conductivity of the cooling water, micromhos/cm	2203.72
Silica in the cooling water, ppm as SiO2	48.93

Water_Scorecard_Grading | Annual_Savings_Potential | Water_Efficiency_Calculator | COC_Estimator | Chiller_Load_Data | Terms and Definitions

The Cycles of Concentration (C
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guidance on using the COC Est
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WaterMAPP_COC_Estimator_User's_Guide.pdf

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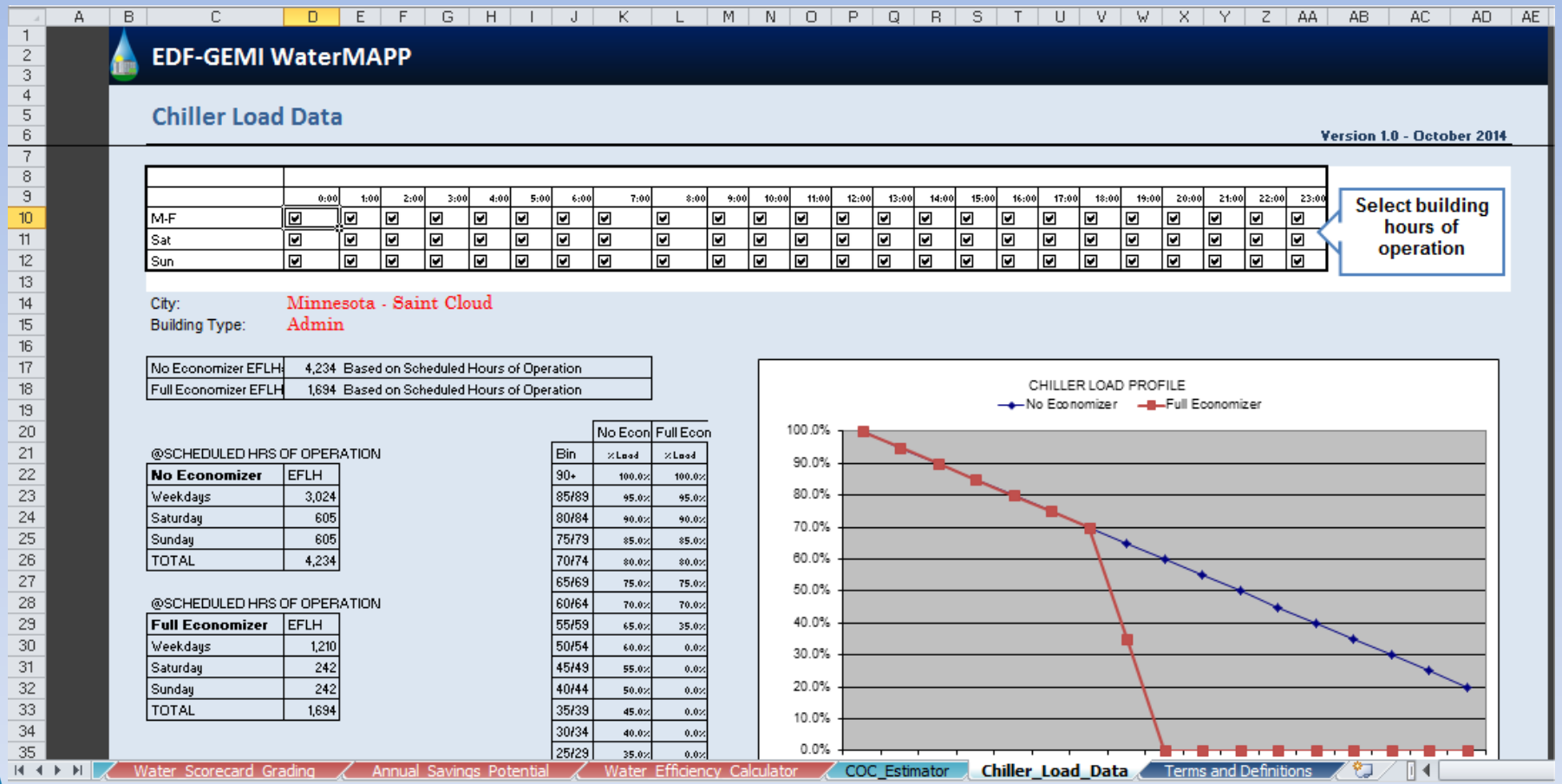
The Toolkit: Chiller Load Data



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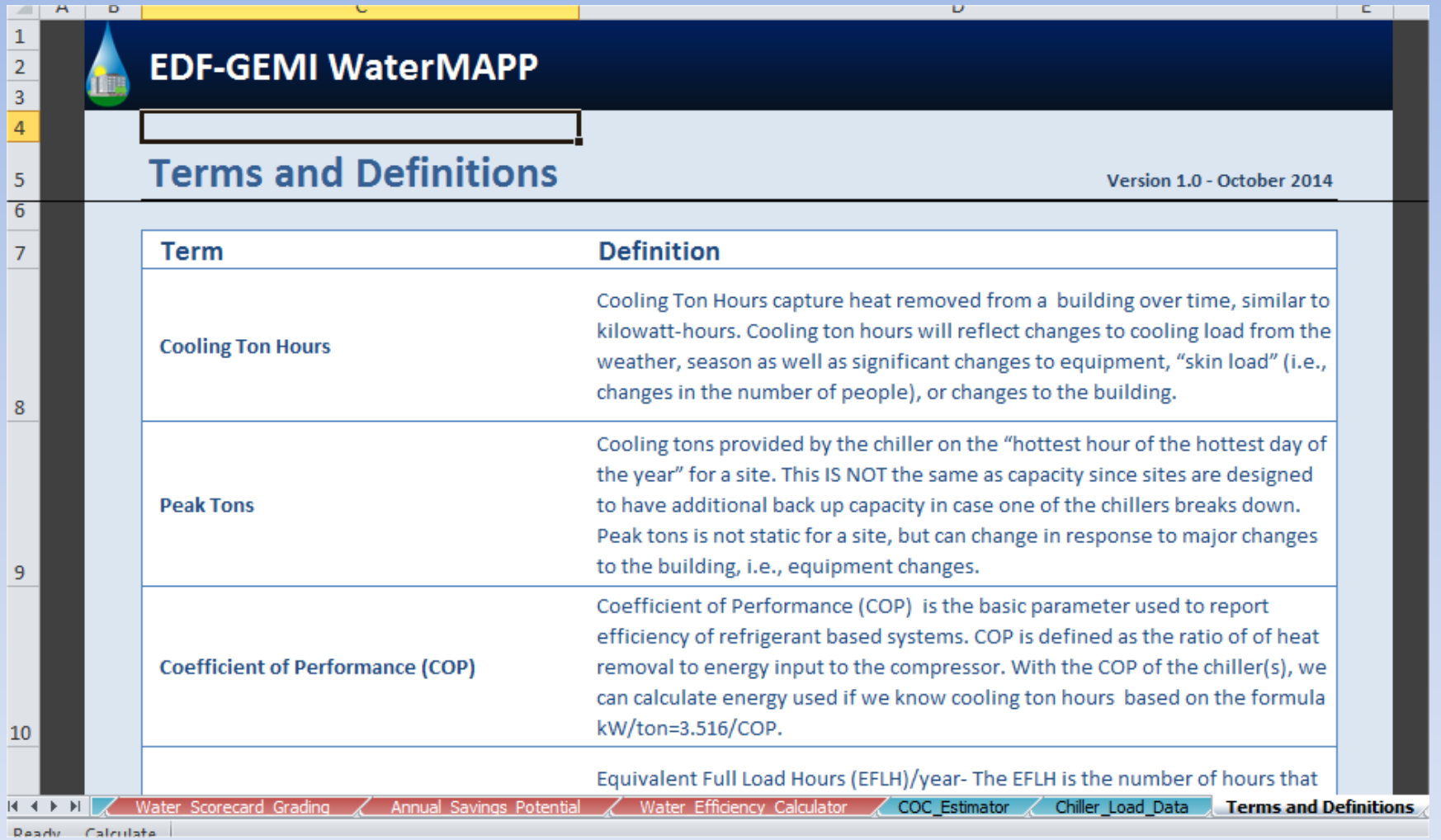
The Toolkit: Terms & Definitions



EDF-GEMI WaterMAPP

Terms and Definitions

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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 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 kW/ton=3.516/COP.
	Equivalent Full Load Hours (EFLH)/year- The EFLH is the number of hours that

Water_Scorecard_Grading | Annual_Savings_Potential | Water_Efficiency_Calculator | COC_Estimator | Chiller_Load_Data | Terms and Definitions

Ready Calculate

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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

Building Water Efficiency Webinar

October 2, 2013

www.gemi.org/EDFGEMIwaterMAPP

Using the Toolkit Overview

Facility Manager

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

Organizational Leader

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

www.gemi.org/EDFGEMIwaterMAPP

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

EDF ENVIRONMENTAL DEFENSE FUND
Finding the ways that work

Questions? Please Contact: GEMI or EDF…

- Where to access the EDF-GEMI WaterMAPP Toolkit
  - **www.gemi.org/EDFGEMIwaterMAPP**

- Corporate Partnerships Program, EDF
  - Email: **business@edf.org**
  - Website**:** **business.edf.org**

Additional slides

Cooling Water Systems

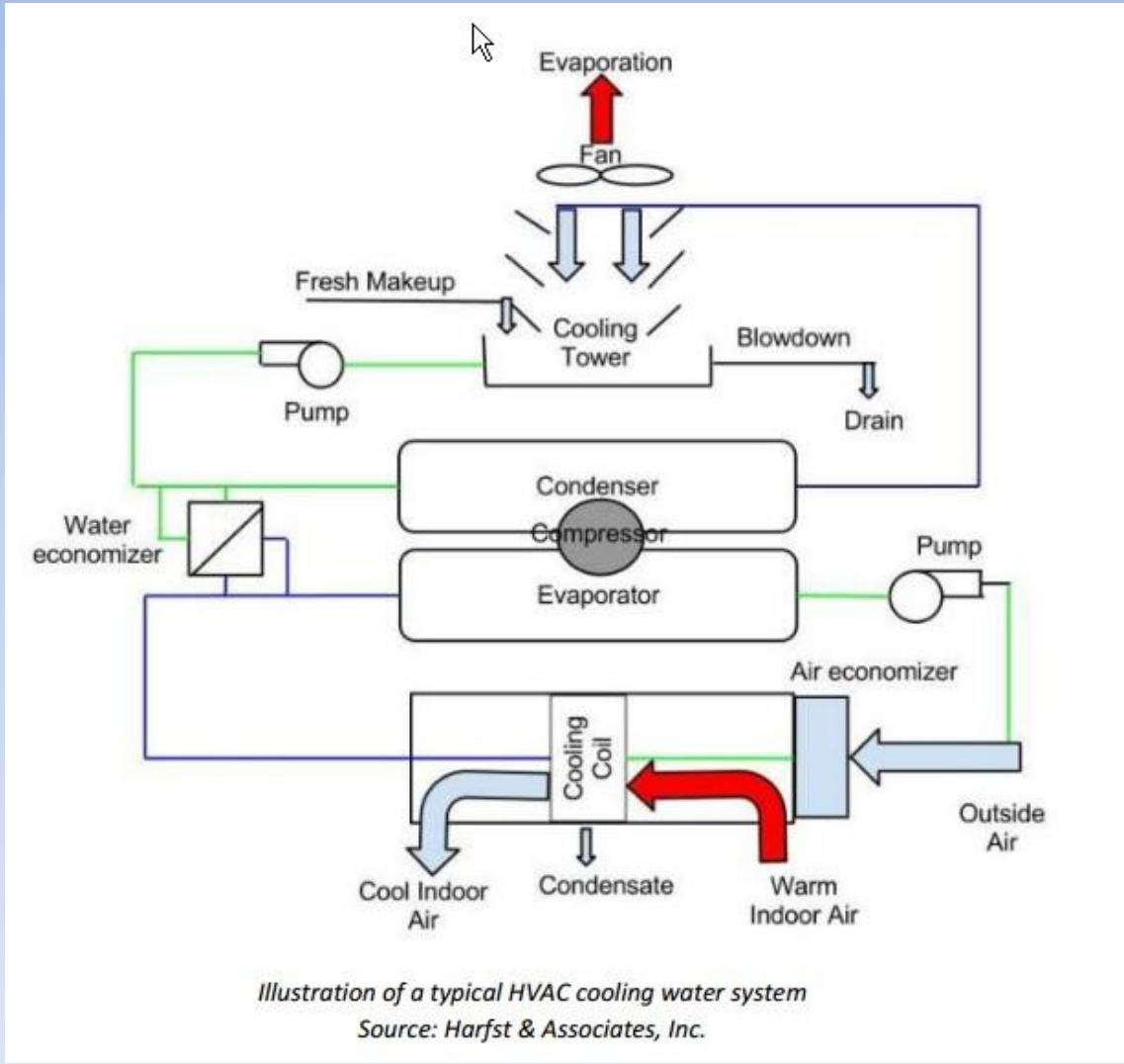
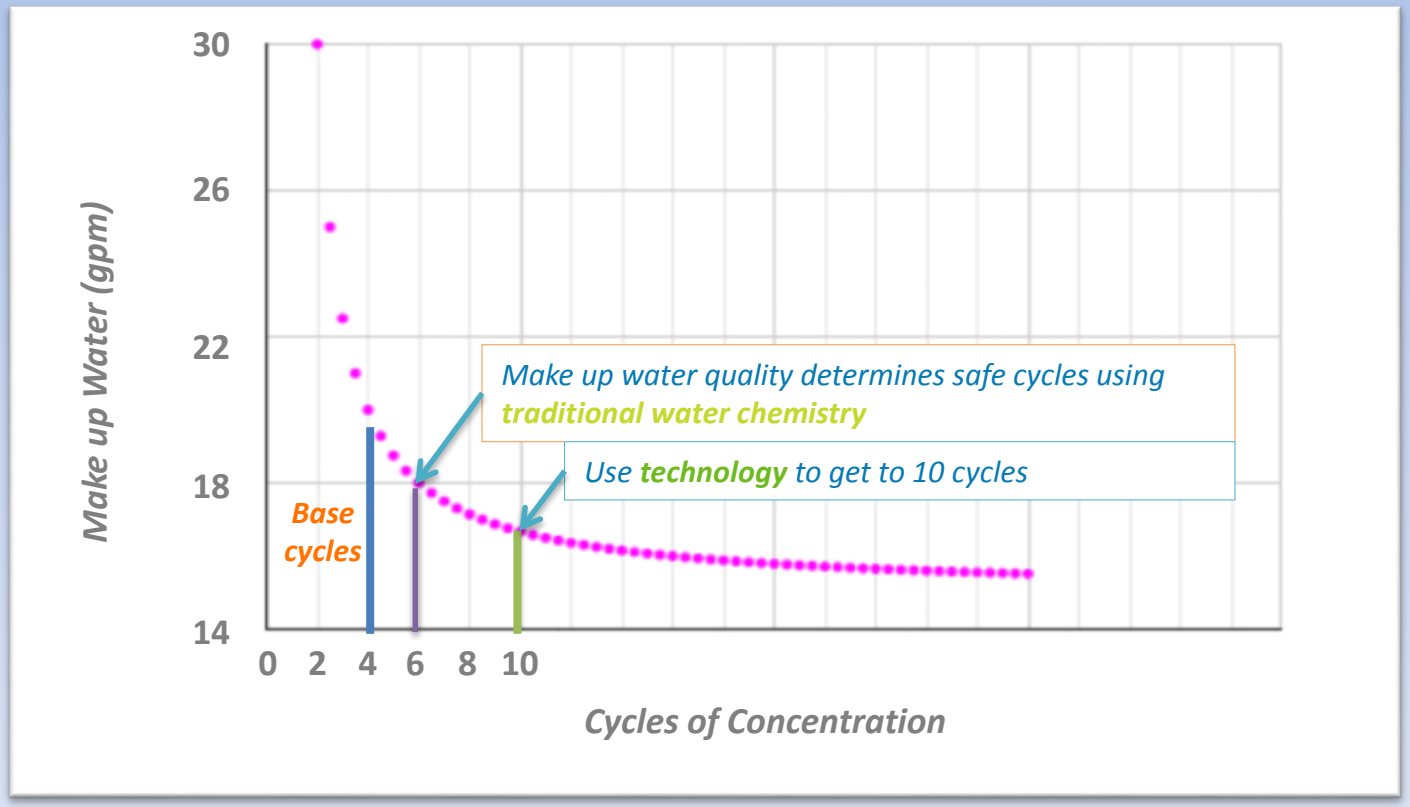


Illustration of a typical HVAC cooling water system
Source: Harfst & Associates, Inc.

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