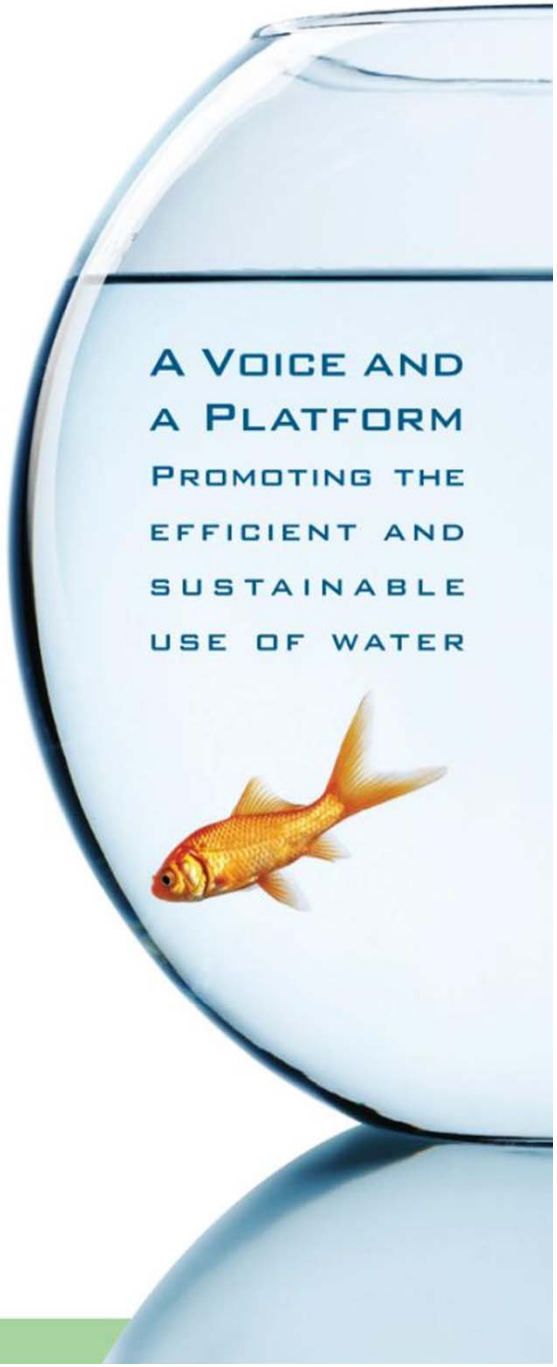
Planning and Evaluating Water Conservation Programs and Better Planning for Rates

Mary Ann Dickinson & Thomas Chesnutt

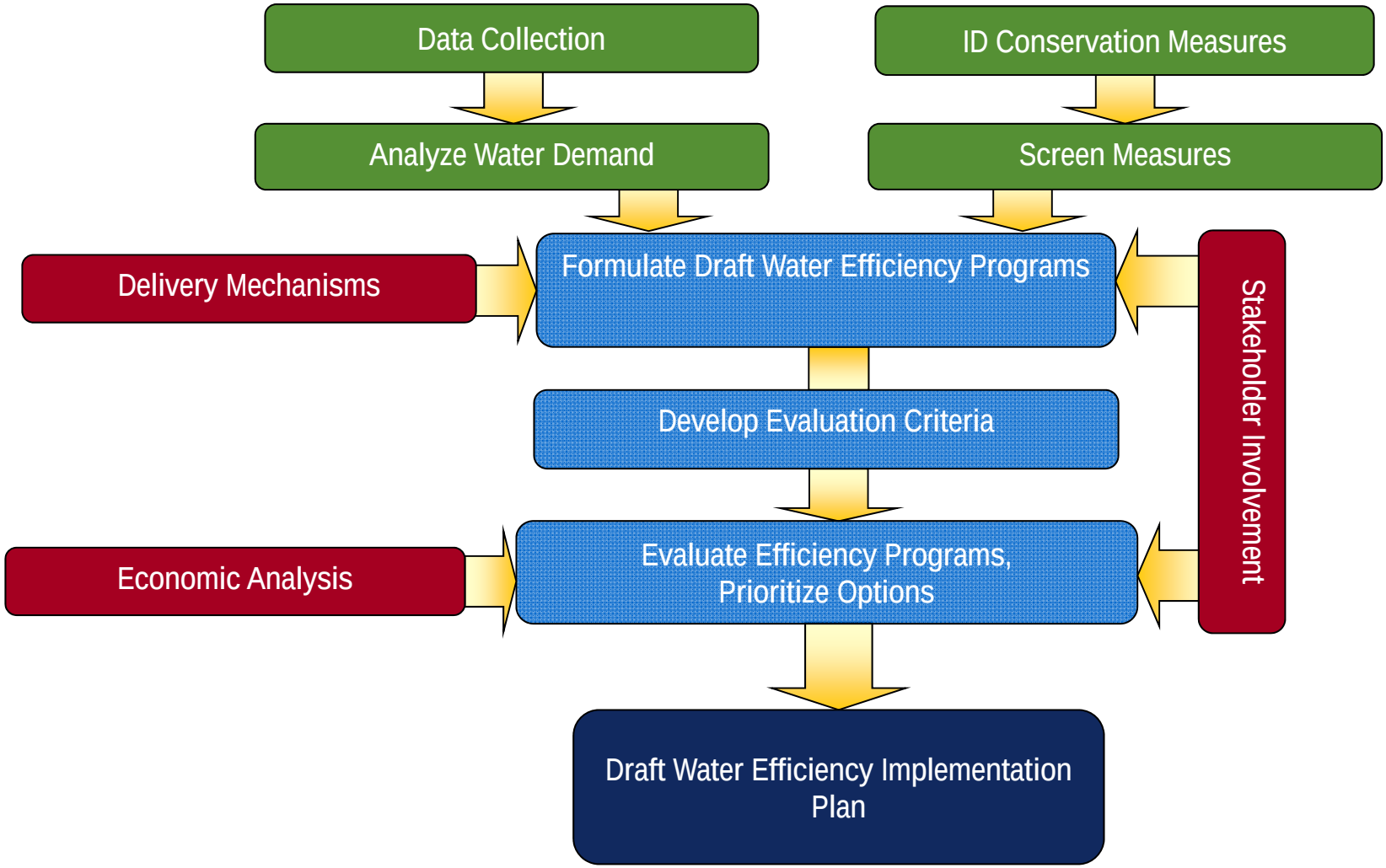
WETCAT Meeting

November 18, 2013



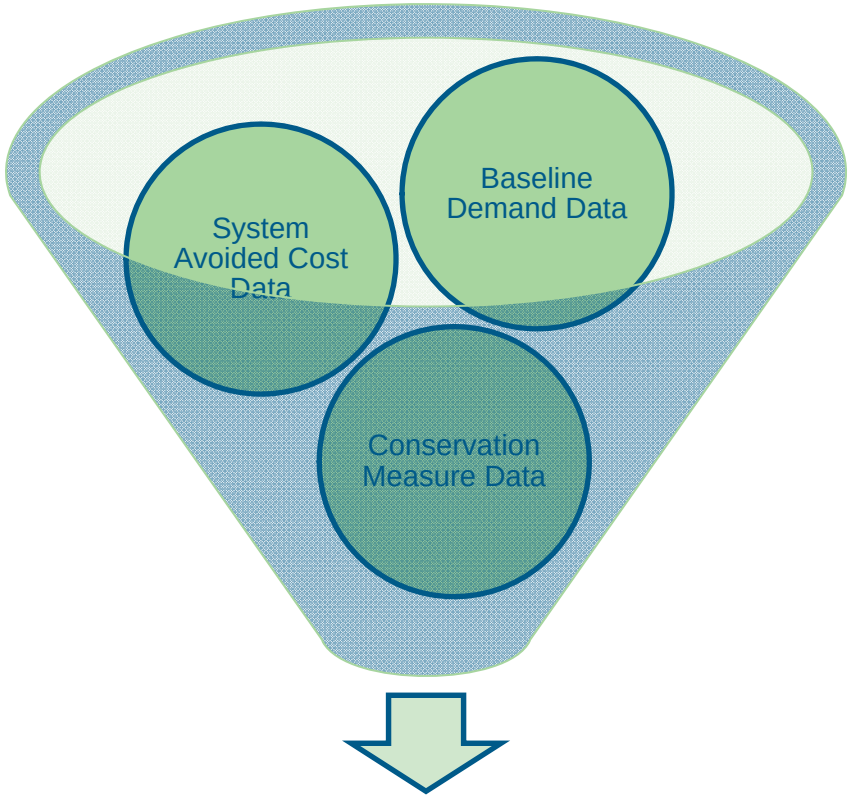
Alliance *for* Water Efficiency

Constructing a Water Efficiency Plan



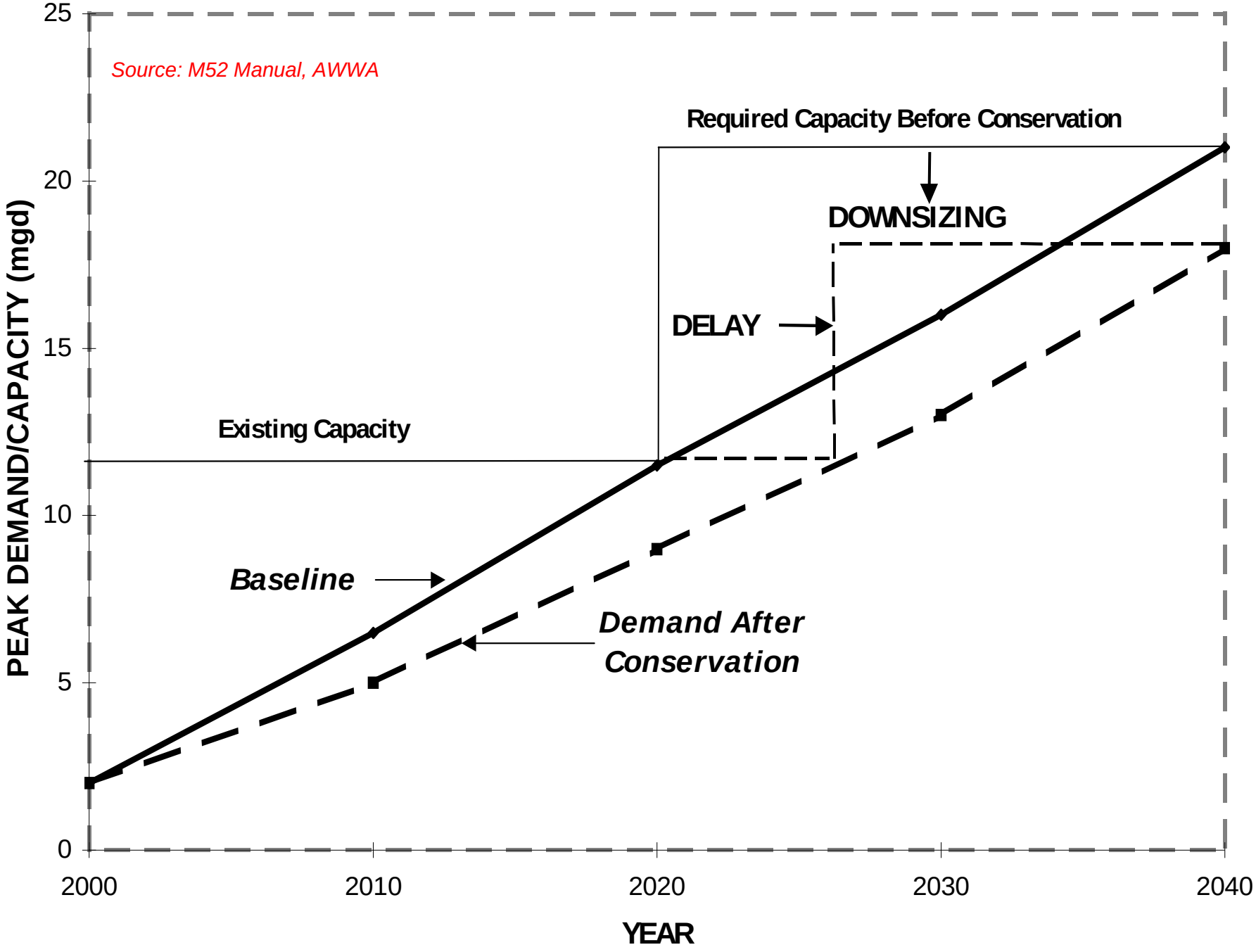
Source: A & N Technical Services, Inc.
AWWARF Project 2935: Water Efficiency Programs for Integrated Water Management

Tracking Tool Inputs and Outputs



Model Outputs

Savings Analysis Benefit-Cost Analysis Revenue/Rate Impacts Energy Savings


Source: M52 Manual, AWWA
Required Capacity Before Conservation
DOWNSIZING
DELAY
Existing Capacity
Baseline
Demand After Conservation
PEAK DEMAND/CAPACITY (mgd)
0
5
10
15
20
25
2000
2010
2020
2030
2040
YEAR

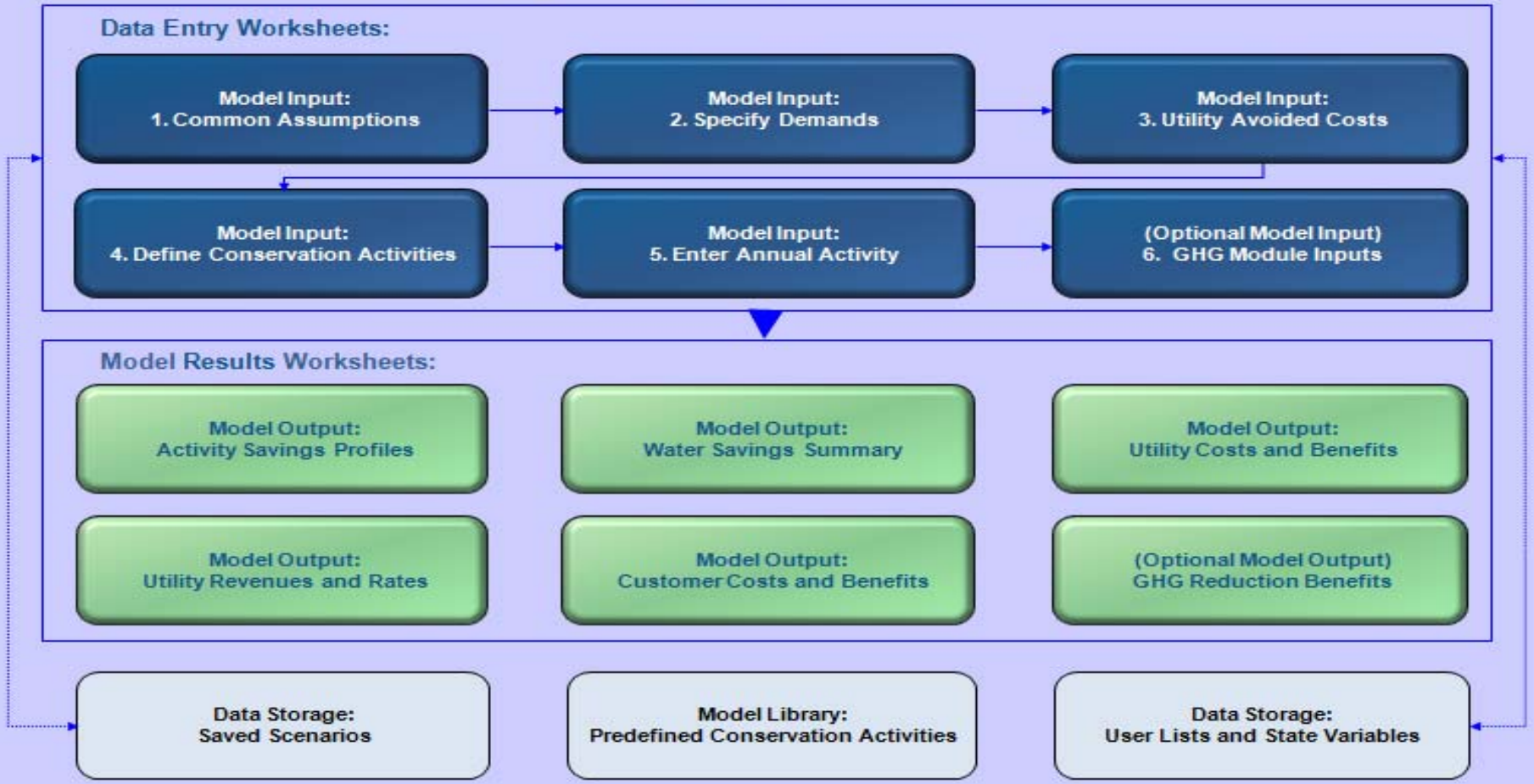
AWE CONSERVATION TRACKING TOOL

Version 2.0, Standard North American Edition

About Tracking Tool

Getting Started:

1. The model uses a simple worksheet tab color code:
   - Blue Tabs = User Data Entry
   - Green Tabs = Model Outputs/Results
   - Grey Tabs = Data Storage and Library
2. First provide informaton about your system, customers, and water demands. This is done on data entry worksheets 1 thru 3.
3. Next define or import conservation activities and set their annual activity levels. This is done on data entry worksheets 4 and 5.
4. You can save conservation activity scenarios at any time. You access the scenario manager on the Common Assumptions worksheet.
6. You can navigate to model worksheets by clicking on the model schematic below or by clicking on the worksheet tabs at the bottom of the screen.
7. Data entry cells on input worksheets look like this: xx,xxx Only enter data in cells with this color coding.



AWE CONSERVATION TRACKING TOOL: COMMON ASSUMPTIONS WORKSHEET

ENTER COMMON ASSUMPTIONS:

Manage Scenarios

Last Loaded Scenario:
"Sample Scenario (English Units)" loaded on 10/25/2013 10:14:50 AM

Last Saved Scenario:
"Sample Scenario (English Units)" saved on 10/25/2013 12:46:27 PM

Analysis Start Year	2012	**2020**	**2030**	**2040**	**2050**
Service Area Population	350,000	355,000	365,000	380,000	395,000
Service Area Population in 1990	300,000				
Peak-Season Start Date ('month/day')	31-May				
Peak-Season End Date ('month/day')	31-Oct				
Nominal Interest Rate	6.00%				
Inflation Rate	3.00%				
Year in which to Denominate Costs & Benefits	2013				
Persons Per Household - SF	2.25				
Persons Per Household - MF	1.50				
Full Bathrooms Per Household - SF	1.75				
Half Bathrooms Per Household - SF	0.75				
Full Bathrooms Per Household - MF	1.00				
Half Bathrooms Per Household - MF	0.25				
SF Housing Units Built *before 1992*	100,000				
MF Housing Units Built *before 1992*	50,000				
Reference ET (inches/yr)	57.33				
Avg. Annual Rainfall (inches/yr)	7.67				

Show Bathroom Lookup Table

CHOOSE VOLUME UNITS:

Water Volume Units
- ○ Million Gallons (MG)
- ◉ Acre-Feet (AF)
- ○ Million Cubic Meters (MCM)

Flow Units Will Be: MGD

Return to Navigation Sheet

Report Error

Select Water User Classes

Class Names: Single Family, Multi Family, Residential, CII, Commercial, Industrial, Institutional, Irrigation, Other

Add >

Selected Classes: Single Family, Multi Family, CII, Irrigation

Move Up | Move Down | Delete | OK | Cancel

SELECT REGION:

US-West

Show U.S. Regional Map

Show Canada Map

SELECT CUSTOMER CLASSES:

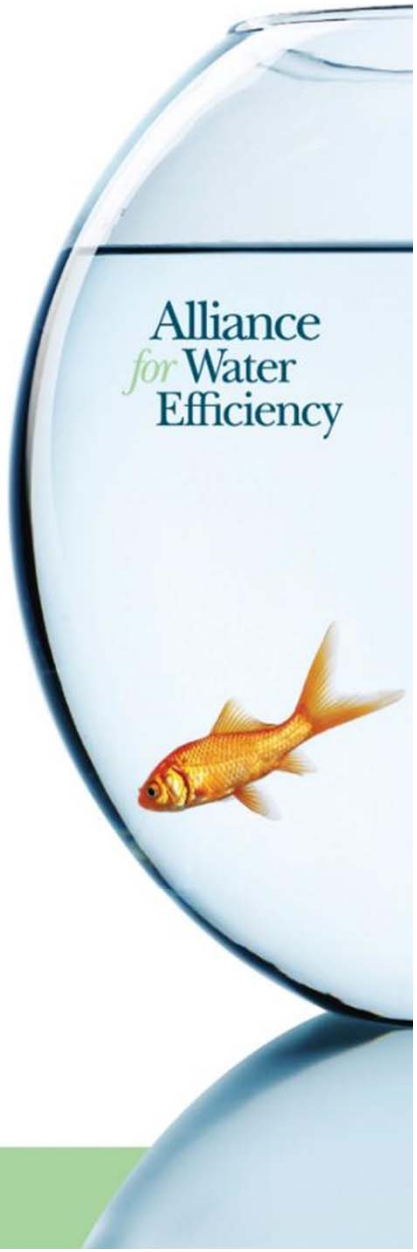
Select Water User Classes

ENTER UTILITY RATE INFORMATION:

	Customer Utility Rates (2013 Dollars)				Nominal Rate of Increase			
Water User Classes in Model	Water Rates ($/Thou Gal)	Sewer Rates ($/Thou Gal)	Electric Rates ($/KWh)	Gas Rates ($/Therm)	Water Rates (%/Yr)	Sewer Rates (%/Yr)	Electric Rates (%/Yr)	Gas Rates (%/Yr)
Single Family	$2.50	$0.70	$0.15	$1.50	3.0%	3.0%	3.3%	3.3%
Multi Family	$2.30	$0.70	$0.15	$1.50	3.0%	3.0%	3.3%	3.3%
CII	$2.00	$0.70	$0.15	$1.50	3.0%	3.0%	3.3%	3.3%
Irrigation	$2.30	$0.70	$0.15	$1.50	3.0%	3.0%	3.3%	3.3%

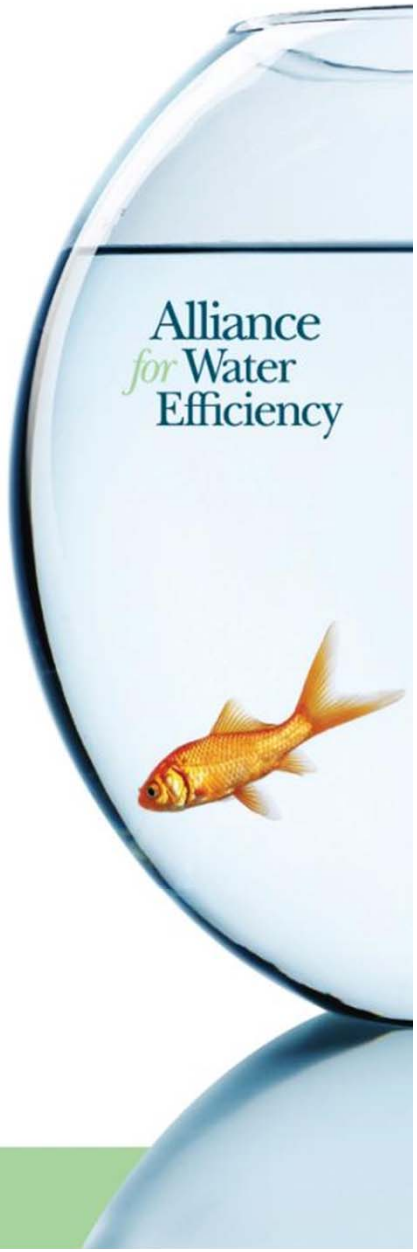
Baseline Demands

- Two Data Entry Options
  - *Enter or link to an existing demand forecast*
  - *Use model to grow current demand by population*
- Plumbing/Energy Code Adjustment
  - *Model can adjust for impact of existing plumbing/energy codes as necessary*
- Demand Disaggregation
  - *Peak/Off Peak Seasonal Demands*
  - *Customer Class Disaggregation*



Avoided Costs

- Two Data Entry Options
  - *Enter or link to an existing avoided cost forecast*
  - *Use model's avoided cost calculator*
- Model's Avoided Cost Calculator
  - Short-run avoided O&M
    - *Water Supply*
    - *Wastewater Treatment*
  - Long-run avoided or deferred capacity
    - *Calculates present value of delaying and/or downsizing peak season capacity expansion*



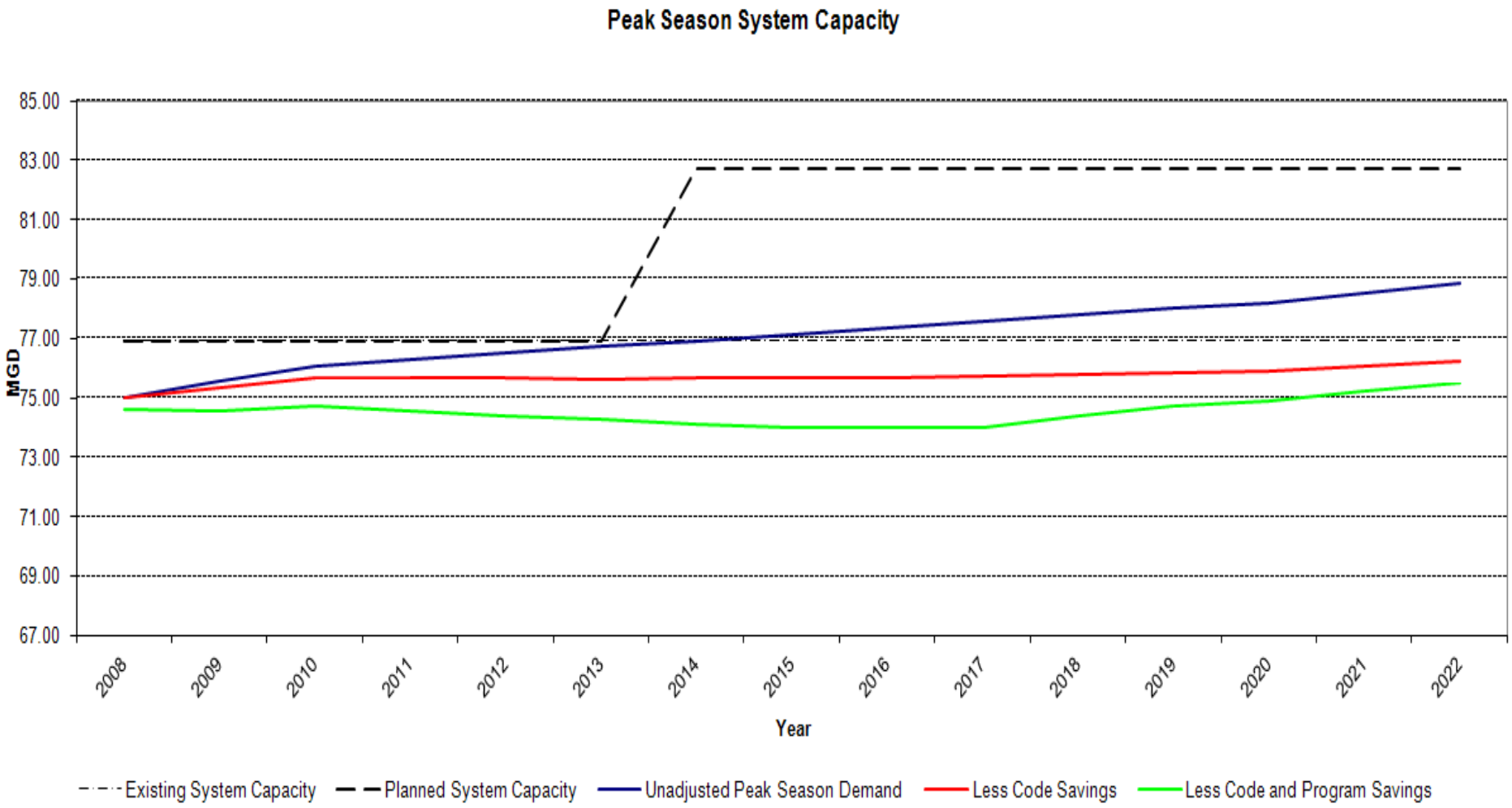
Year forecasted peak season demand equals existing peak season delivery capacity		Deferred Expansion (Years)	Deferred Capacity (MGD)	Benefit of Deferred Expansion ($)	Avoided Capacity (MGD)	Benefit of Avoided Expansion ($)
Baseline Demands	2014	N/A	N/A	N/A	N/A	N/A
Baseline - Code Savings	2025	11	5.8	$9,764,491	0.0	$0
Baseline - Code Savings - Program Savings	2027	13	5.8	$11,231,717	0.0	$0

Select Chart to View

Peak Season Capacity

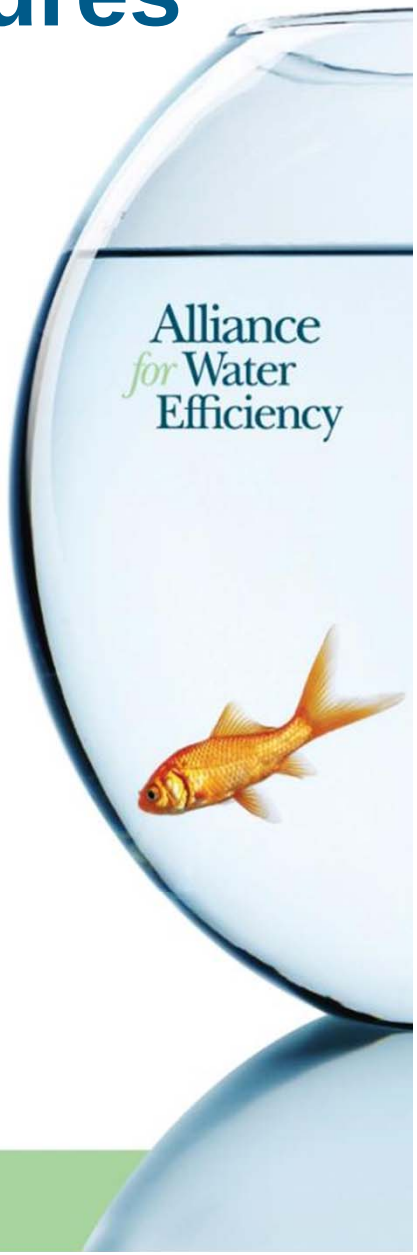
No. of Years to Display 15 yrs

Chart Explanations



Setting Up Conservation Measures

- Two Specification Options
  - *Build from scratch*
  - *Import pre-defined measures from library*
  - *Pre-defined measures can be customized*
- Library currently includes 25 measures
  - *13 residential measures*
  - *8 CII measures*
  - *4 large landscape measures*



AWE CONSERVATION TRACKING TOOL: DEFINE CONSERVATION ACTIVITIES WORKSHEET

Last Loaded Scenario: "Sample Scenario (English Units)" loaded on 9/16/2011 11:58:00 AM

Return to Navigation Sheet Report Error

Define Conservation Program Activities

Define/Edit/Delete Conservation Activities Hide Table of Activities in Model

Warning: Only use the form to edit or delete activities. Editing/deleting activities directly in the table may result in model errors!

Activity ID	Activity Name	Class	Savings, Per Unit (gpy)	Savings, Annual Rate of Decay (%)	Savings, Peak Period (% of Annual Savings)	Savings, Useful Life (yrs)	Savings, Participant Free Riders (% of Participants)	Utility Costs, Year Denominated	Utility Costs, Initial Fixed ($)	Utility Costs, Initial Variable ($/unit)	Utility Costs, Years of Follow-up (yrs)	Utility C Follow Fixed (
1	Residential Surveys, SF	Single Family	12373	20%	68%	5	0%	2011	$2,000.00	$95.00		
2	Residential HE Toilets, SF											
3	CII Tank-Type HE Toilet											
4	Residential Irrigation Controller, SF											
5	Large Land. Irrigation Controller											
6	Residential LF Showerhead, SF											
7	Residential LF Showerhead, MF											
8	Residential HE Washer, SF											
9	Residential HE Washer, MF											
10	CII Spray Rinse Valve											
11												
12												
13												
14												
15												
16												
17												
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												

Define Conservation Activities

Activity Name: Residential HE Toilets, SF

Affected Customer Class: Single Family

Unit Water Savings | Utility Costs | Participant Costs | Participant Non Water Benefits | Plumbing Code

Unit Water Savings (Gal/Yr): 9,072.0

Annual Rate of Savings Decay (%/Year): 0.00%

Peak Period Savings (% of Annual): 41.92% Peak days = 42% of days in a year.

Useful Life (Years):

Participant Freeriders (% of Participants): 0.00%

Import an Activity from the Library

Close Form

Previous Activity

Next Activity

New Activity

Delete Activity

2 of 10

AWE CONSERVATION TRACKING TOOL: GHG MODULE INPUTS WORKSHEET

Last Loaded Scenario: "Sample Scenario (English Units)" loaded on 10/25/2013 10:14:50 AM

Return to Navigation Sheet Report Error

Select eGRID Region or Enter Your Own Emission Factors:

Note: Model will use eGRID factors if User Entered Factors left blank.

In which eGRID Region are you located? (See map)	CAMX

Average Generation Emission Factors	eGRID Factors (lb/MWhr)	User Entered Factors (lb/MWhr)
CO_2	724	
CH_4	0.03024	
SO_2	0.5310	
NO_x	0.6177	
N_2O	0.00808	
Hg	0.0000041	

Model will use eGRID factor if User Entered Factor is blank.

eGRID Subregion Representational Map

Energy Used for Water Supply and Wastewater Treatment:

Enter the average rate ($/KWh) your utility pays for electricity:	$0.15/KWh

○ User Entered Energy Intensity Values ◉ AWE Energy Intensity Calculator Values

1.Click the first radio button if you already know the energy intensity of your water and wastewater services.

2. Click the second radio button if you want to use the **AWE Energy Intensity Calculator** to estimate these values.

AWE Water and Wastewater Energy Intensity Calculator

Water Supply, Treatment, and Distribution Energy Intensity Default Values

Local Water Supply Sources	KWh/AF	% of Local Supply
Local Surface Water	222	40%
Groundwater	624	40%
Brackish Desalination	528	0%
Recycled Water	730	10%
Seawater Desalination	4,497	10%
	Total:	100%

Average Energy Intensity of Local Water Supply	861	KWh/AF

Imported Water Supply Sources	KWh/AF	Default Value
Select the imported water energy intensity level	High	
Average Energy Intensity of Imported Water Supply		2,473 KWh/AF

Imported Water Energy Intensity Key

Low - Transmission mostly via gravity with limited pumping. More likely raw than treated water.

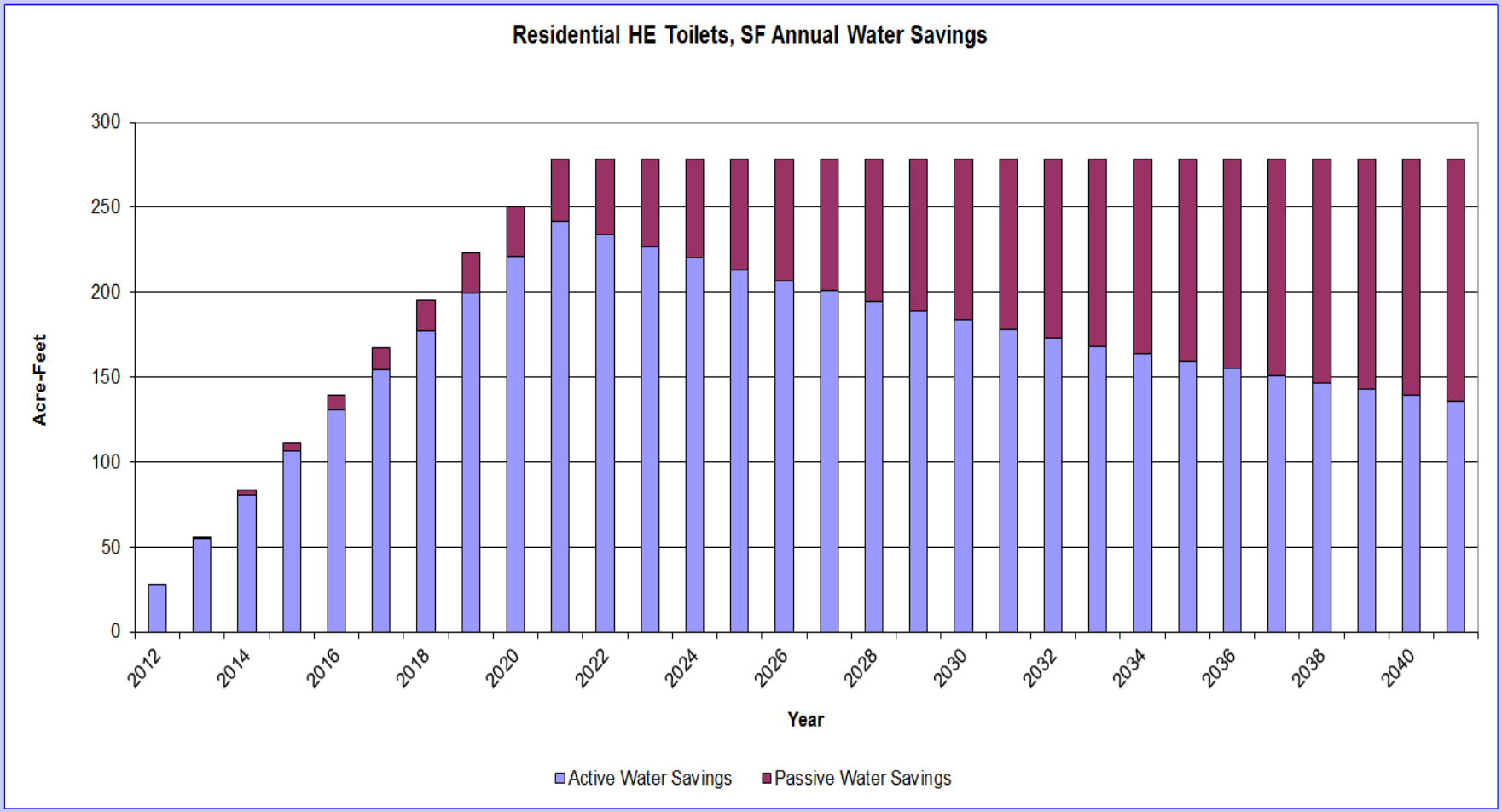
Moderate - Some transmission pumping required. Source may be groundwater. Delivered water may be raw or treated water.

High - Transmission involves significant pumping. Source may be groundwater. Delivered water more likely treated than raw water

Last Loaded Scenario: "Sample Scenario (English Units)" loaded on 10/25/2013 10:14:50 AM

Return to Navigation Sheet Report Error

Activity Name	Residential HE Toilets, SF



Residential HE Toilets, SF	**Gross**	**Active**	**Passive**
Lifetime Water Savings (AF)	**15,452**	7,957	7,495
Average Annual Water Savings (AF)	**258**	133	125

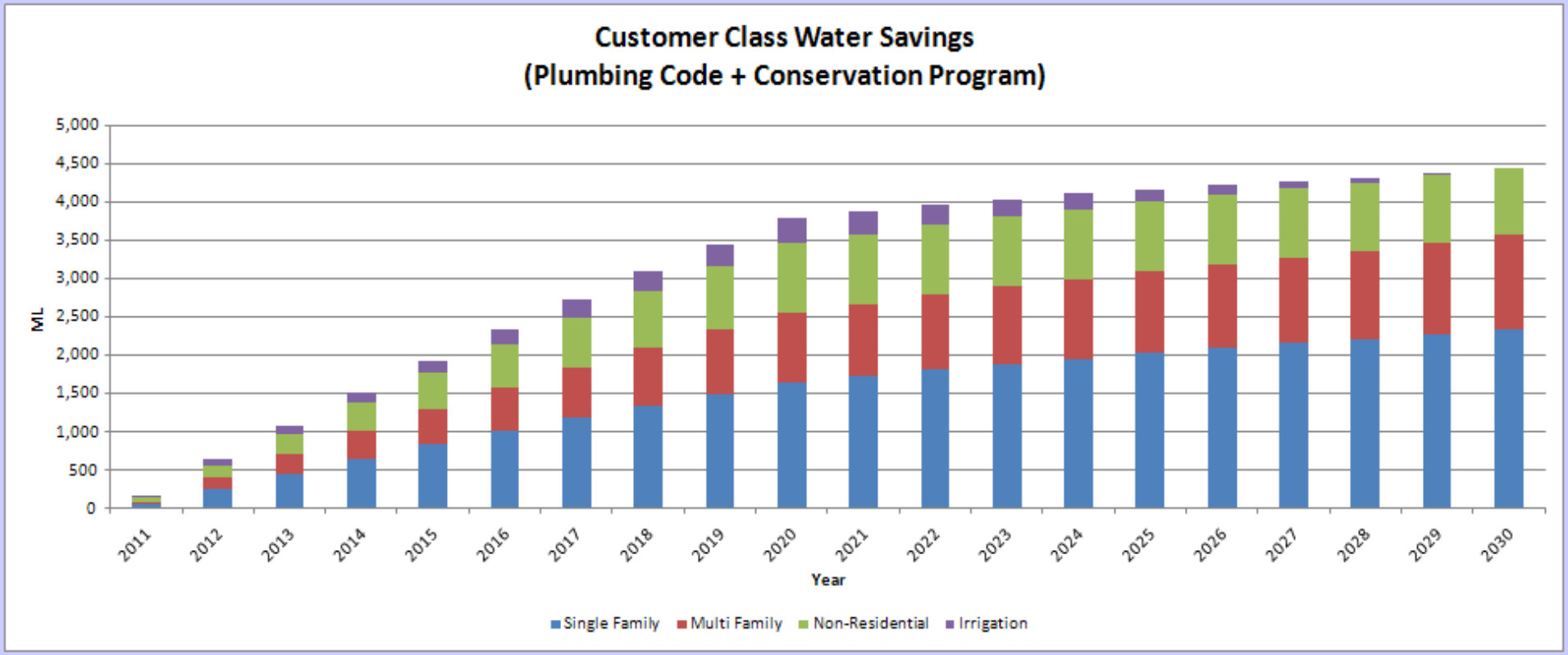
Year forecasted peak season demand equals existing peak season delivery capacity		Deferred Expansion (Years)	Deferred Capacity (kL/D)	Benefit of Deferred Expansion ($)	Avoided Capacity (kL/D)	Benefit of Avoided Expansion ($)
Unadjusted Baseline Demand	**2020**	N/A	N/A	N/A	N/A	N/A
Less Conservation Program Savings	**2025**	**5**	15,421	$2,944,923	0.0	$0

Select Chart to View

Total Class Savings

No. of Years to Display 20 yrs

Chart Explanations



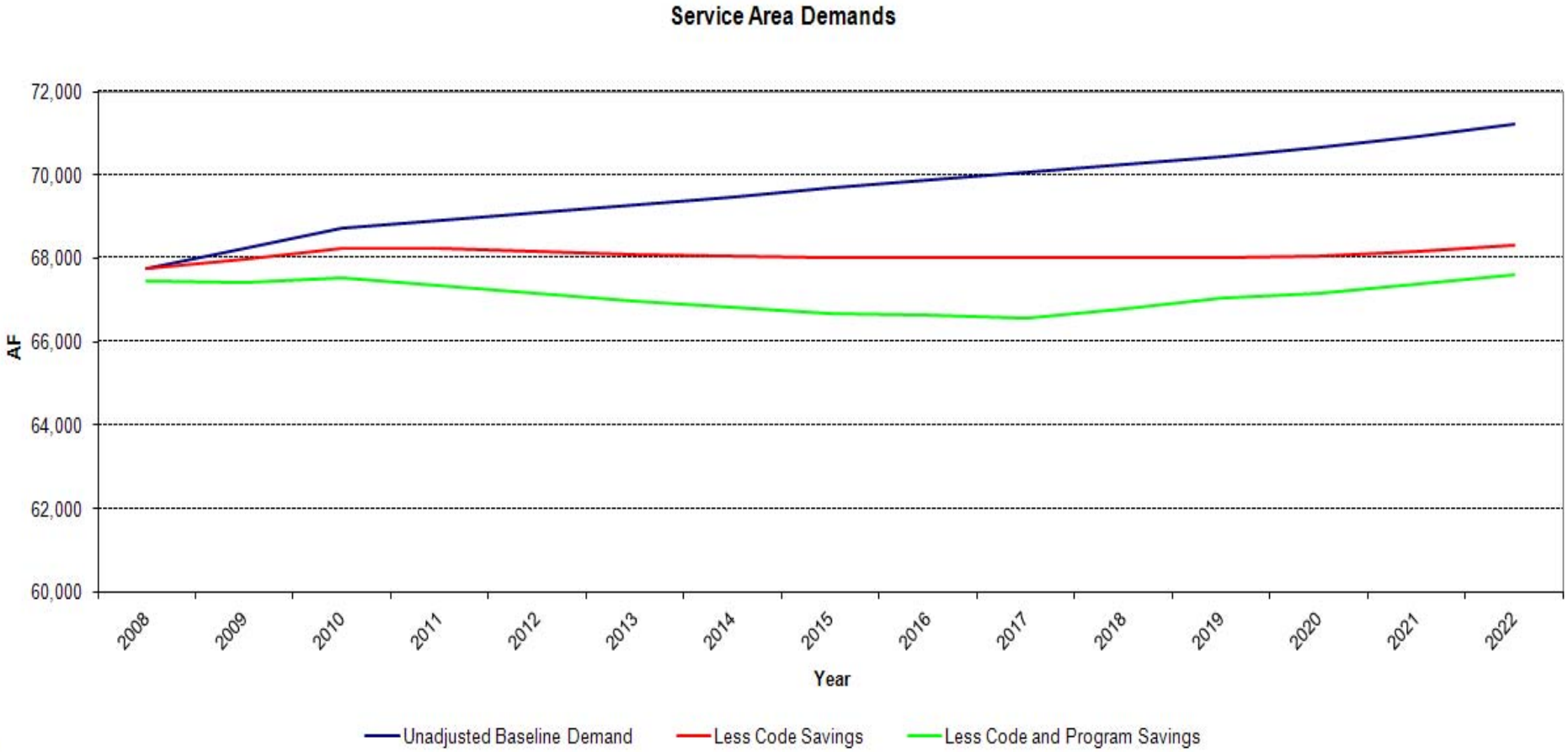
Year forecasted peak season demand equals existing peak season delivery capacity		Deferred Expansion (Years)	Deferred Capacity (MGD)	Benefit of Deferred Expansion ($)	Avoided Capacity (MGD)	Benefit of Avoided Expansion ($)
Baseline Demands	2014	N/A	N/A	N/A	N/A	N/A
Baseline - Code Savings	2025	11	5.8	$9,764,491	0.0	$0
Baseline - Code Savings - Program Savings	2027	13	5.8	$11,231,717	0.0	$0

Select Chart to View

Service Area Demands

No. of Years to Display 15 yrs

Chart Explanations



6. GHG Module Inputs | Activity Savings Profiles | **Water Savings Summary** | Utility Costs and Benefits | Utility Revenues and Rates | Customer C

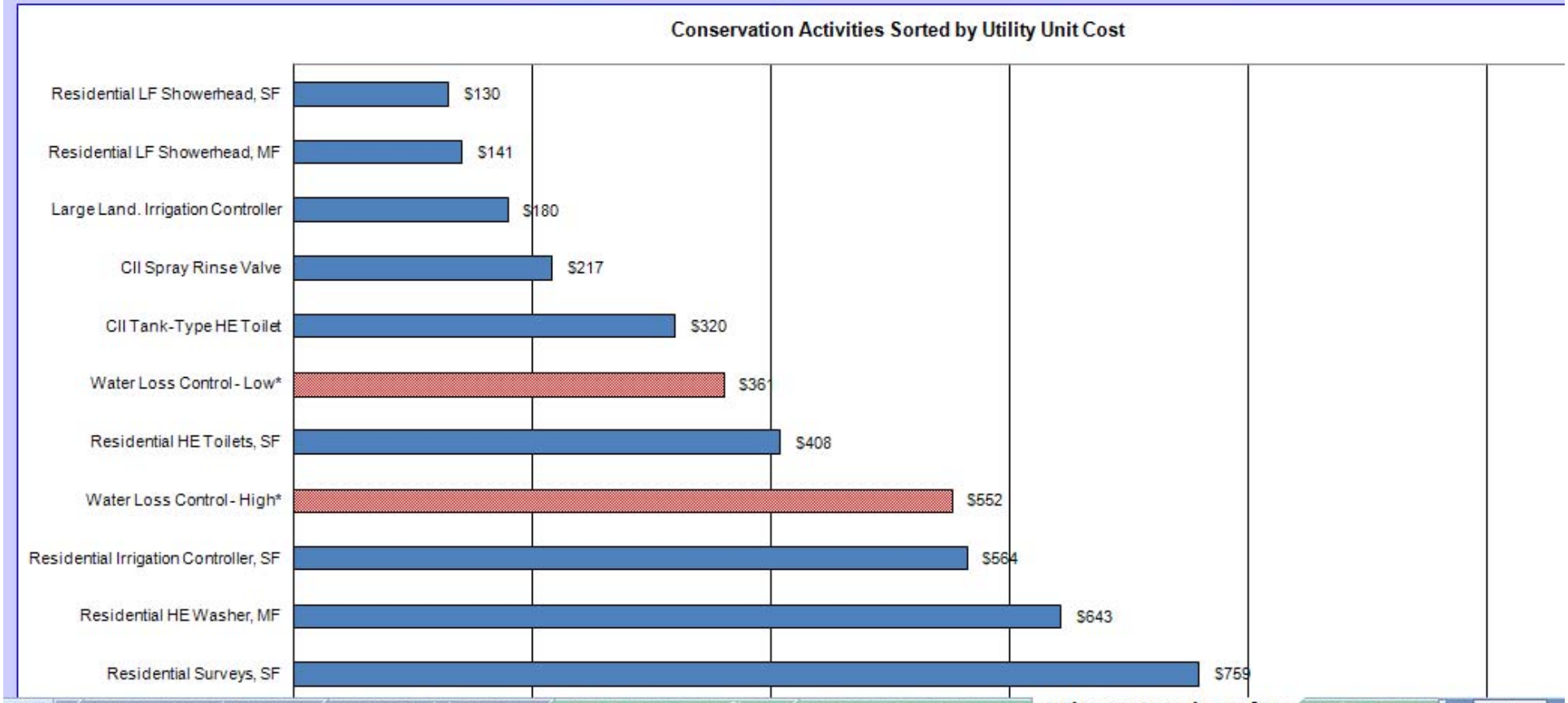
Utility Conservation Program NPV and B/C Ratio (2010 Dollars)

Class	Activity Name	NPV ($)	B/C Ratio
Single Family	Residential Surveys, SF	$ (36,168)	0.90
Single Family	Residential HE Toilets, SF	$ 1,344,835	1.78
CII	CII Tank-Type HE Toilet	$ 2,187,962	2.28
Single Family	Residential Irrigation Controller, SF	$ 417,318	1.20
Irrigation	Large Land. Irrigation Controller	$ 1,081,885	3.72
Single Family	Residential LF Showerhead, SF	$ 54,101	5.40
Multi Family	Residential LF Showerhead, MF	$ 48,813	4.97
Single Family	Residential HE Washer, SF	$ (45,846)	0.73
Multi Family	Residential HE Washer, MF	$ 25,293	1.08
CII	CII Spray Rinse Valve	$ 146,203	3.25
Subtotal Conservation Activities		**$ 5,224,396**	**1.76**
Total With Overhead & Public Information		**$ 5,224,396**	**1.76**

Select Chart to View

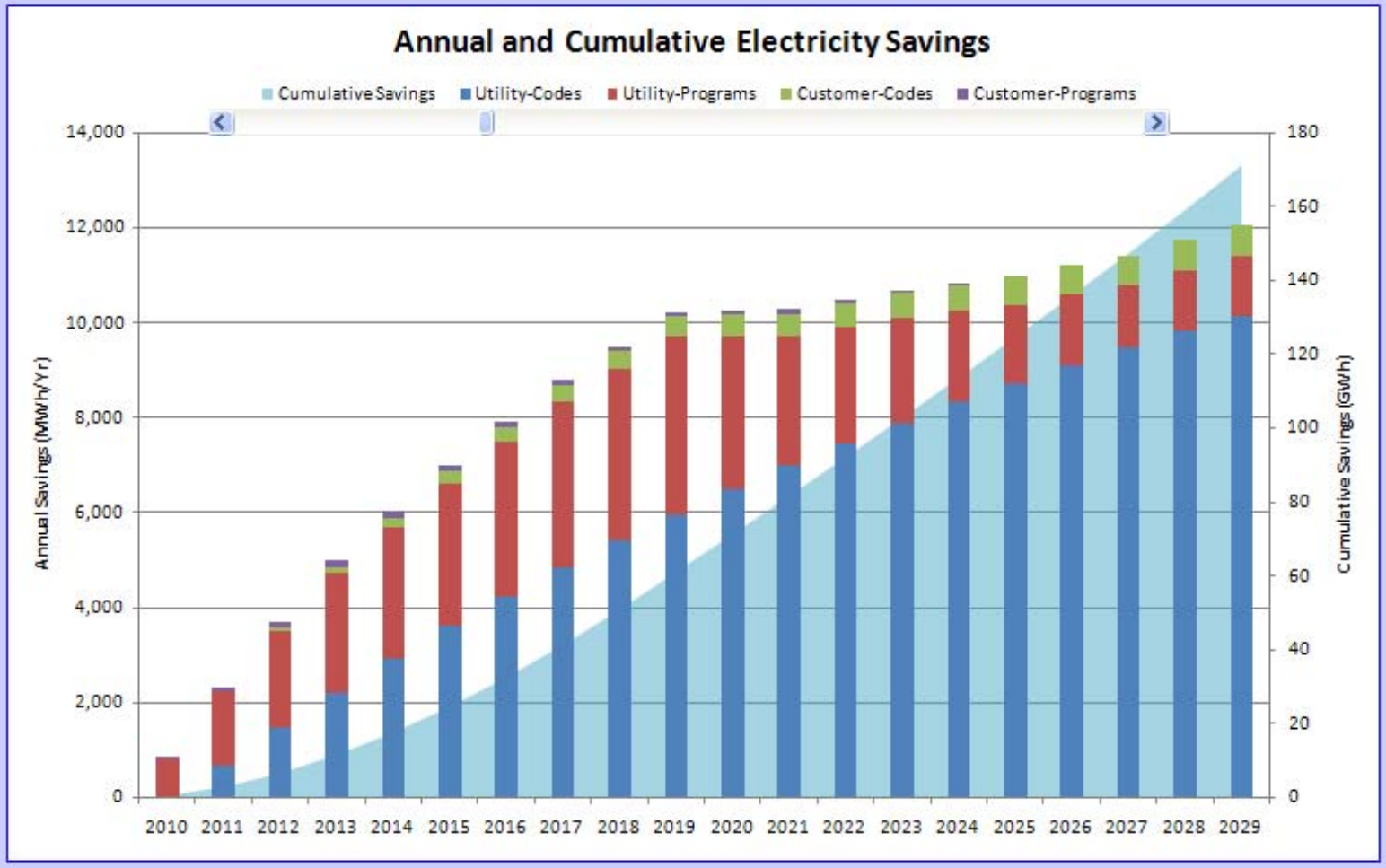
Unit Costs Sorted

Chart Explanations



5. Enter Annual Activity | 6. GHG Module Inputs | Activity Savings Profiles | Water Savings Summary | Utility Costs and Benefits | Utility Revenue

O P Q R S T U V W X Y Z AA AB AC AD AE AF

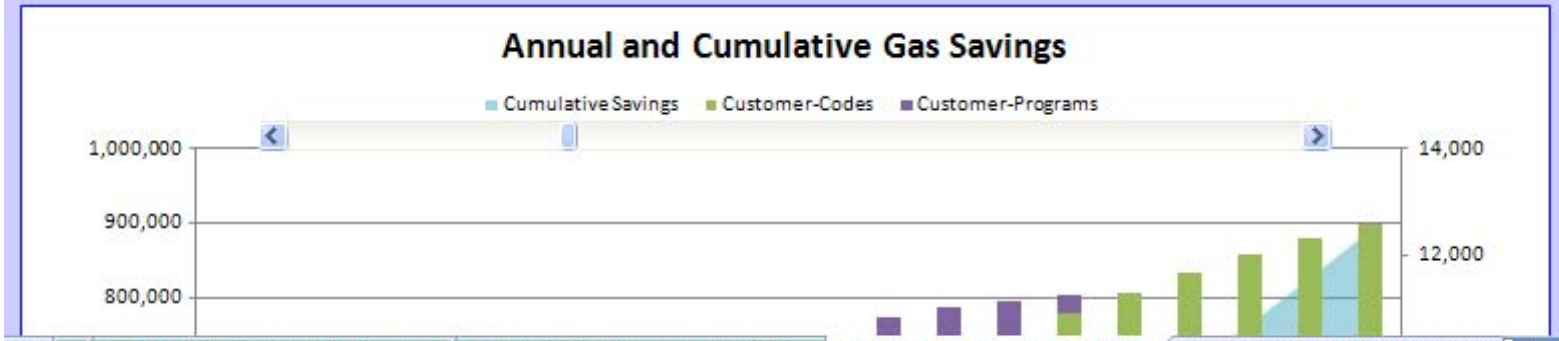


Show Series

- ☑ Utility-Codes
- ☑ Utility-Programs
- ☑ Customer-Codes
- ☑ Customer-Program
- ☑ Cumulative Savings-All

Years to Display: 20

Use the slider in the chart to set the number of years to display. Or enter a whole number between 5 a 60 in the box above.

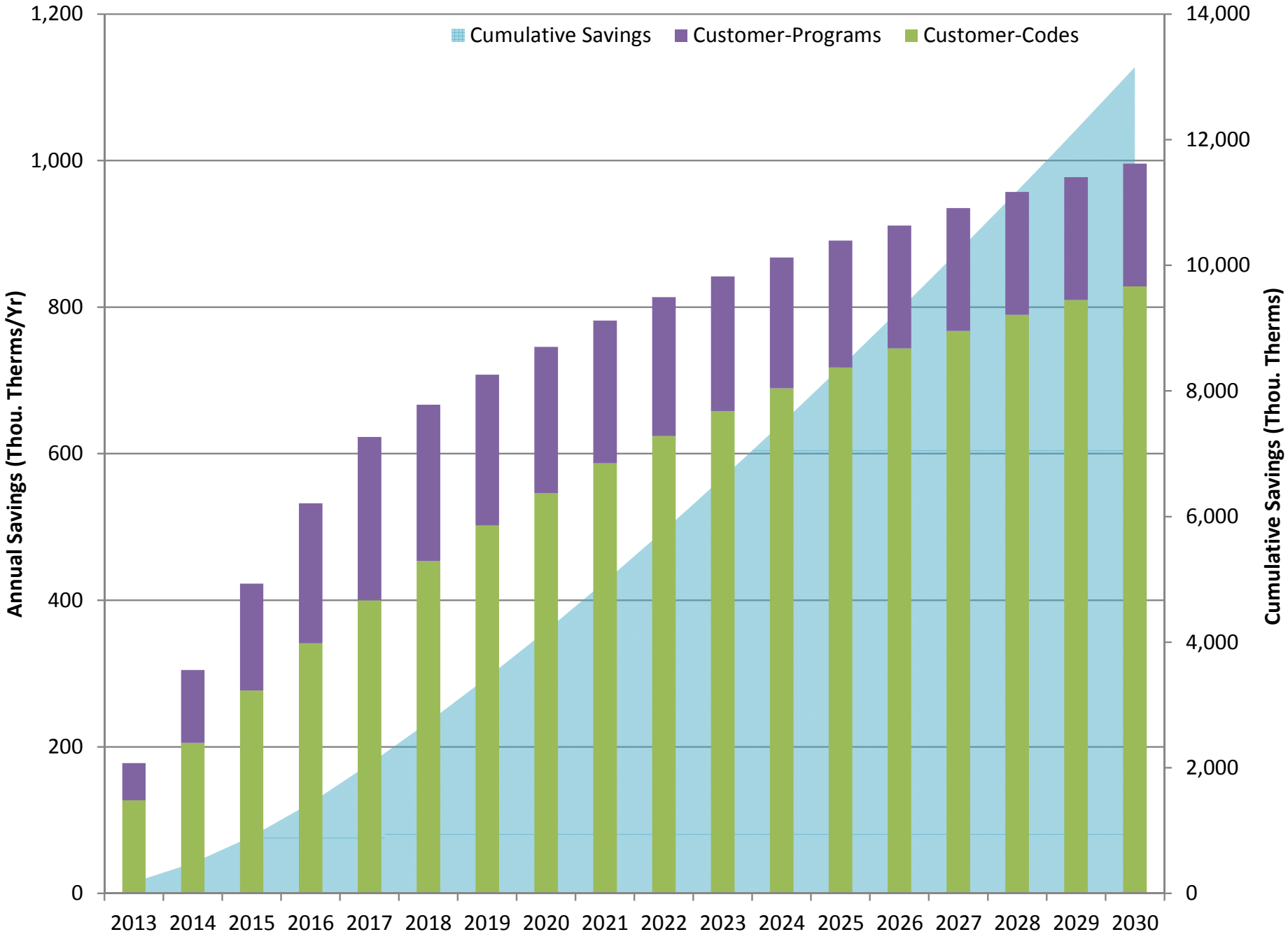


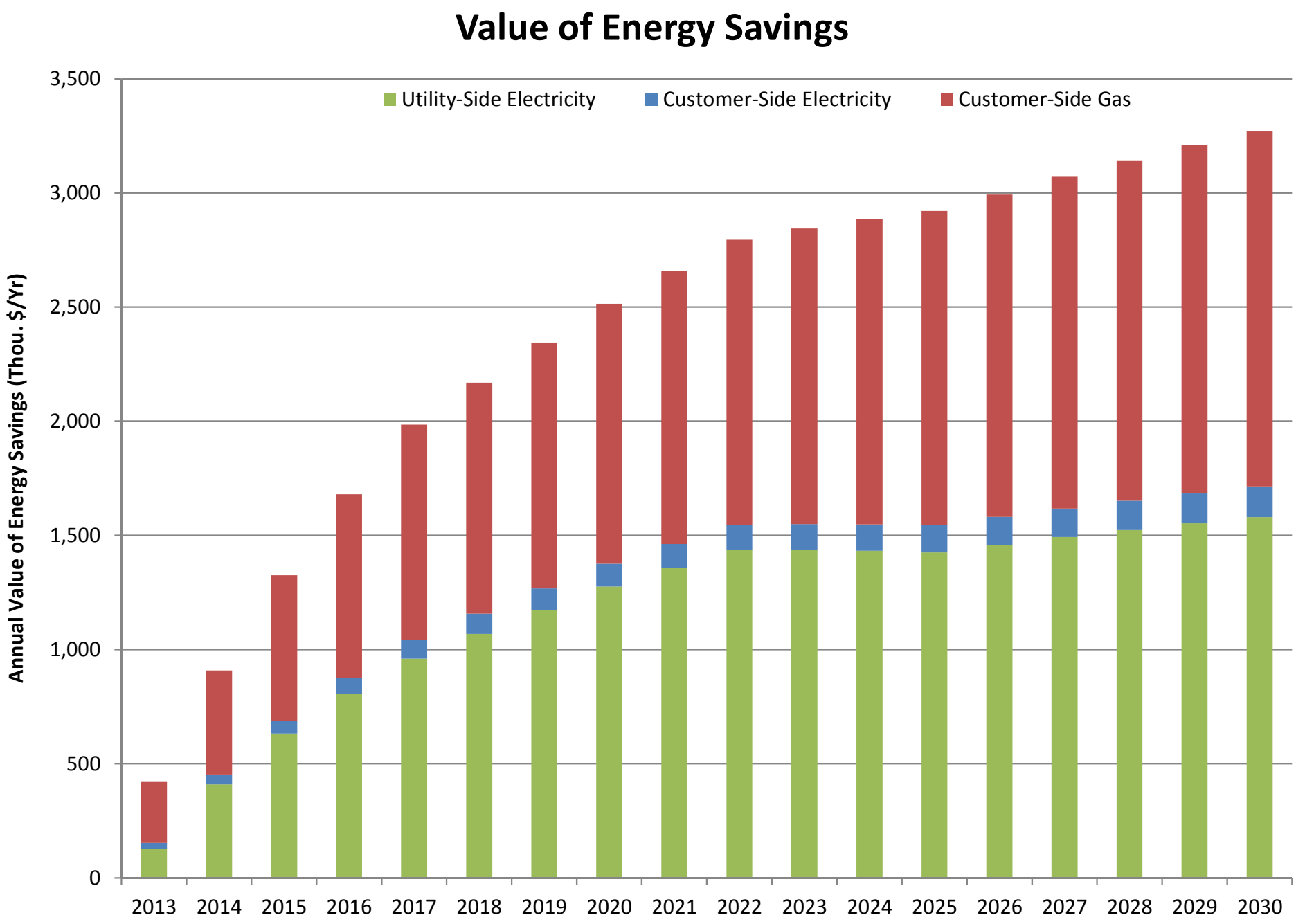
Show Series

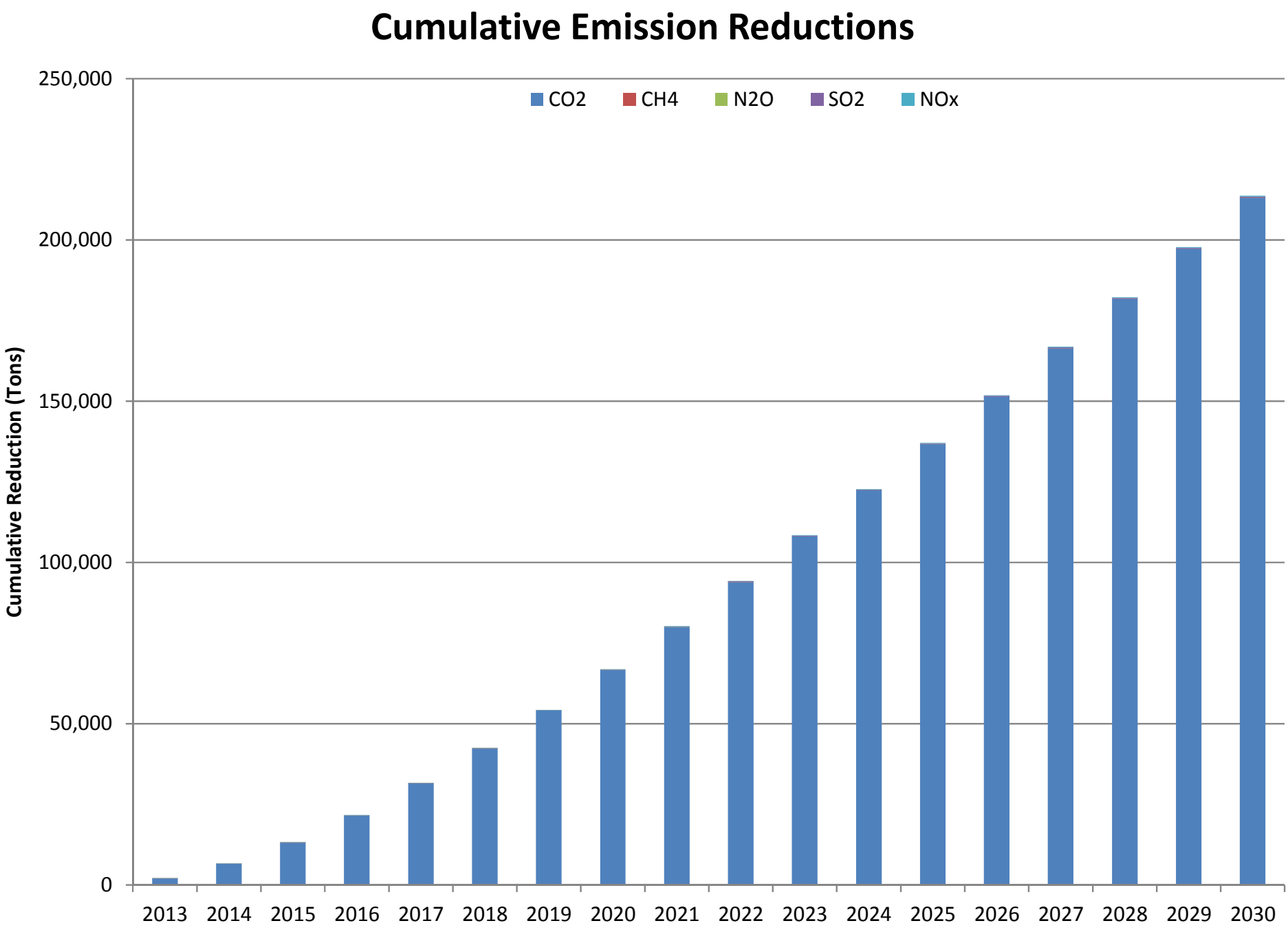
- ☑ Customer-Codes
- ☑ Customer-Program
- ☑ Cumulative Savings-All

Utility Revenues and Rates | Customer Costs and Benefits | **GHG Reduction Benefits** | User Lists and State Variable

Annual and Cumulative Gas Savings




Value of Energy Savings
Utility-Side Electricity
Customer-Side Electricity
Customer-Side Gas
Annual Value of Energy Savings (Thou. $/Yr)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030


Cumulative Emission Reductions
CO2
CH4
N2O
SO2
NOx
Cumulative Reduction (Tons)
250,000
200,000
150,000
100,000
50,000
0
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030

AWE CONSERVATION TRACKING TOOL: UTILITY REVENUES & RATES WORKSHEET

Last Loaded Scenario: "Sample Scenario (English Units)" loaded on 9/16/2011 11:58:00 AM

Return to Navigation Sheet Report Error

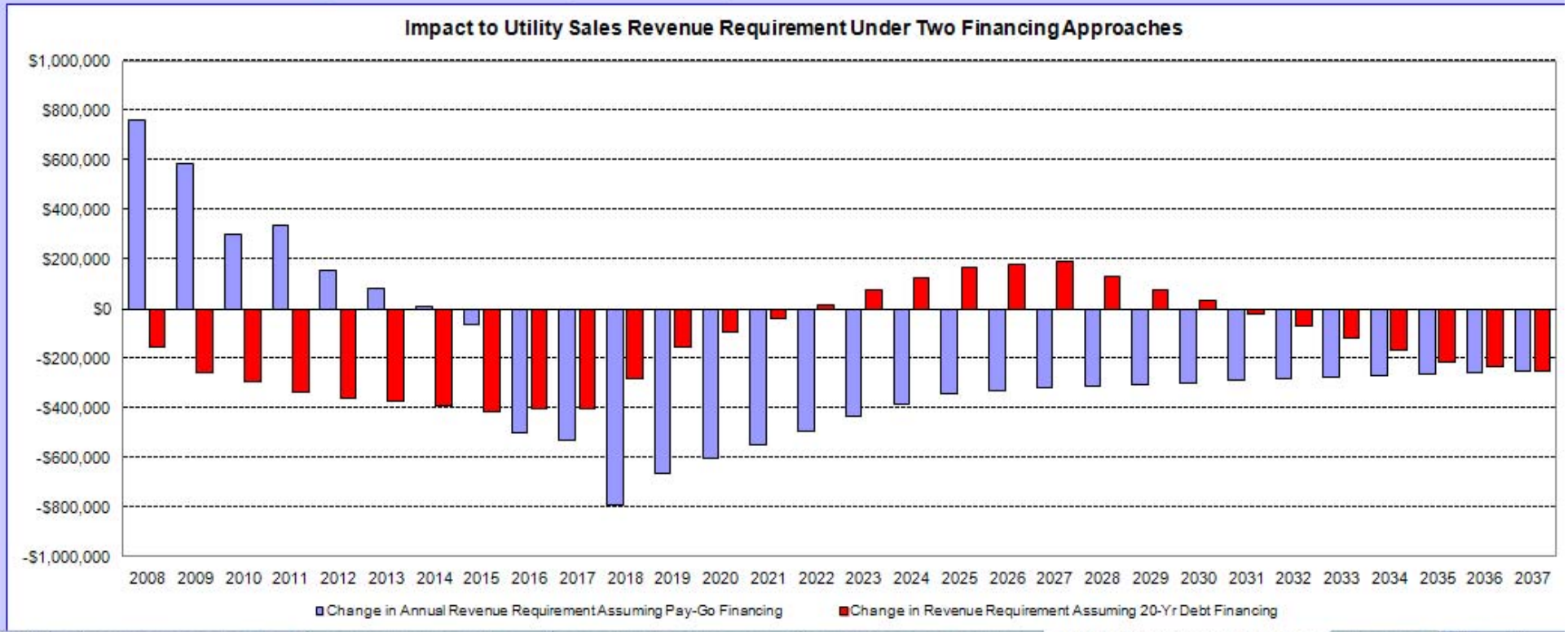
Utility Revenue Requirement and Rate Impacts

Program Impact on...	Baseline	With Conserv.	Change to Baseline
Water Utility Annual Sales Revenue Requirement	49,742,591	$49,562,581	($180,010)
		% change from baseline	-0.36%
Avg. Water Rate ($/Thou Gal)	$2.17	$2.29	$0.13
		% change from baseline	5.86%
Annualized Bill Impact ($/Mo.)	46.86	$46.69	($0.16)
		% change from baseline	-0.35%

Select Impact Chart to View

Revenue Requirement

Chart Explanations



6. GHG Module Inputs | Activity Savings Profiles | Water Savings Summary | Utility Costs and Benefits | **Utility Revenues and Rates** | Customer Cl

AWE CONSERVATION TRACKING TOOL: UTILITY REVENUES & RATES WORKSHEET

Last Loaded Scenario: "Sample Scenario (English Units)" loaded on 9/16/2011 11:58:00 AM

Return to Navigation Sheet Report Error

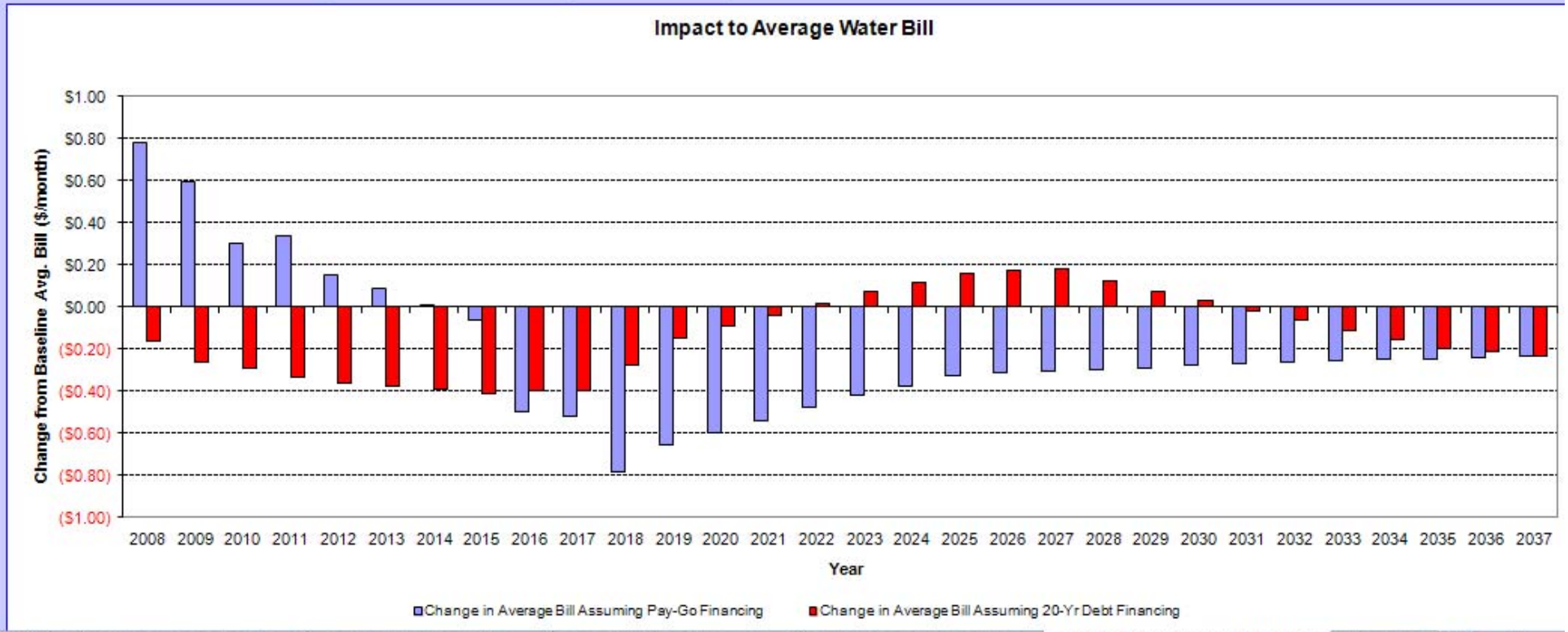
Utility Revenue Requirement and Rate Impacts

Program Impact on...	Baseline	With Conserv.	Change to Baseline
Water Utility Annual Sales Revenue Requirement	49,742,591	$49,562,581	($180,010)
		% change from baseline	-0.36%
Avg. Water Rate ($/Thou Gal)	$2.17	$2.29	$0.13
		% change from baseline	5.86%
Annualized Bill Impact ($/Mo.)	46.86	$46.69	($0.16)
		% change from baseline	-0.35%

Select Impact Chart to View

Avg. Water Bill

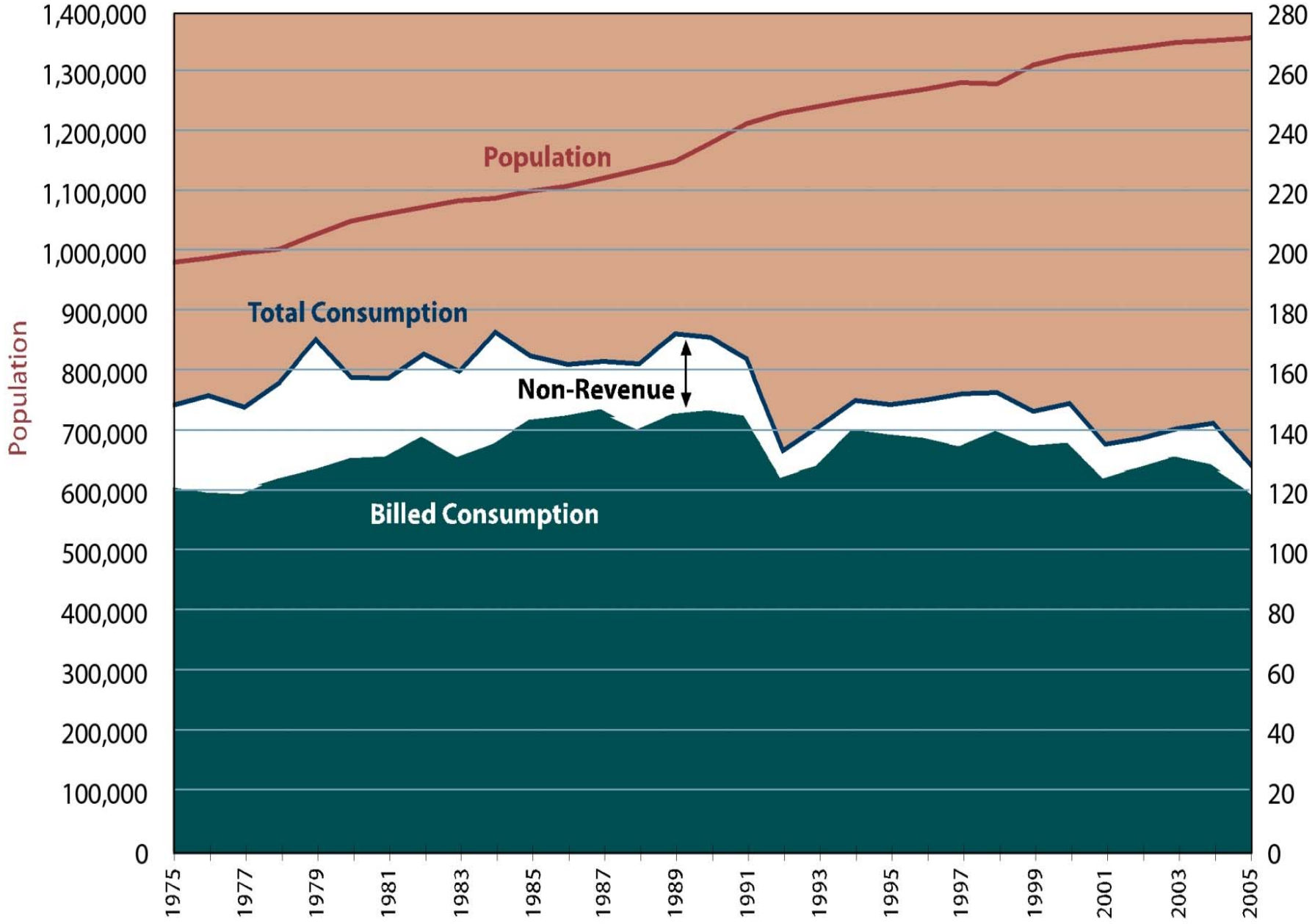
Chart Explanations



6. GHG Module Inputs | Activity Savings Profiles | Water Savings Summary | Utility Costs and Benefits | **Utility Revenues and Rates** | Customer C

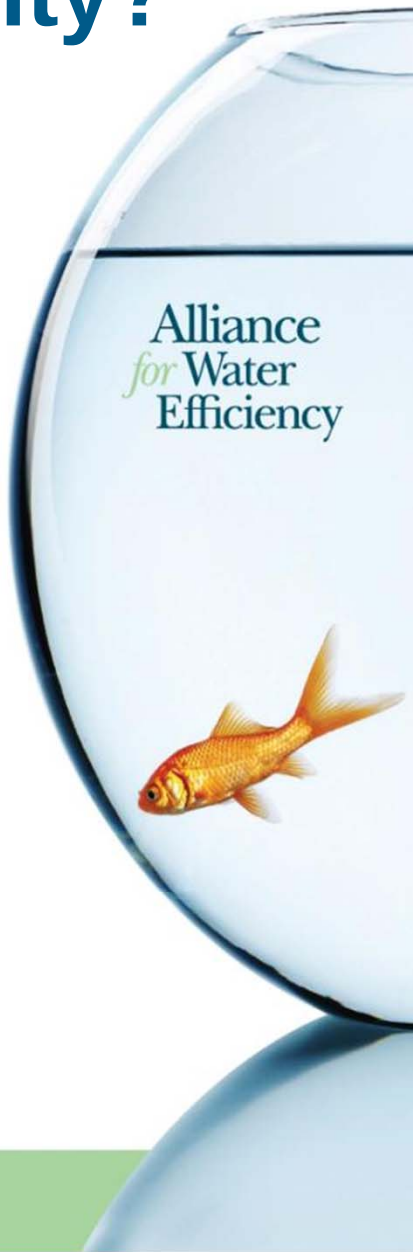
Growth in Population and Water Consumption

Seattle Regional Water System: 1975-2005



What Causes Revenue Instability?

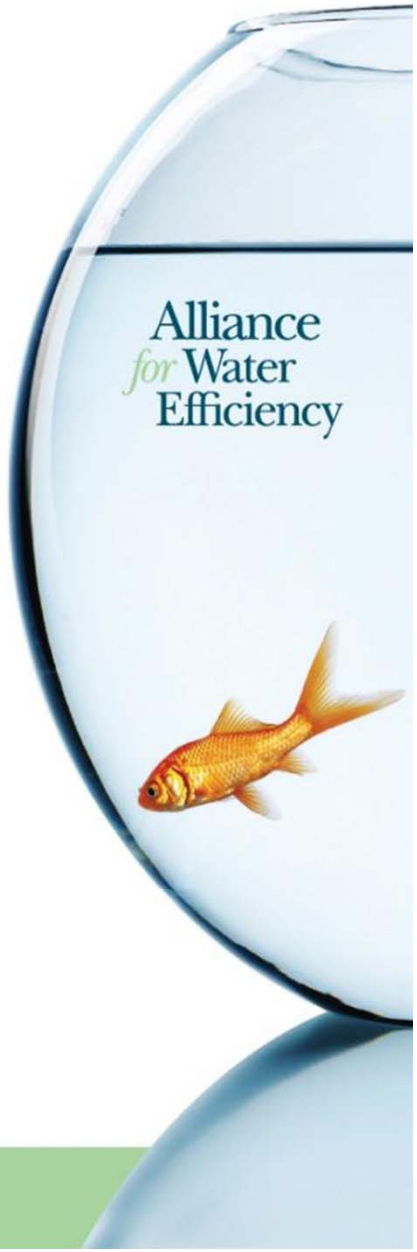
- Reduced demand from:
  - ✓ efficient fixture replacement under the plumbing and appliance codes
  - ✓ active conservation programs
  - ✓ the recession: industrial shift layoffs, home foreclosures
- Reduced peak demand in wet years
- Increased infrastructure costs
- Rise in other fixed costs
- Continuing Inflation



And Conservation?

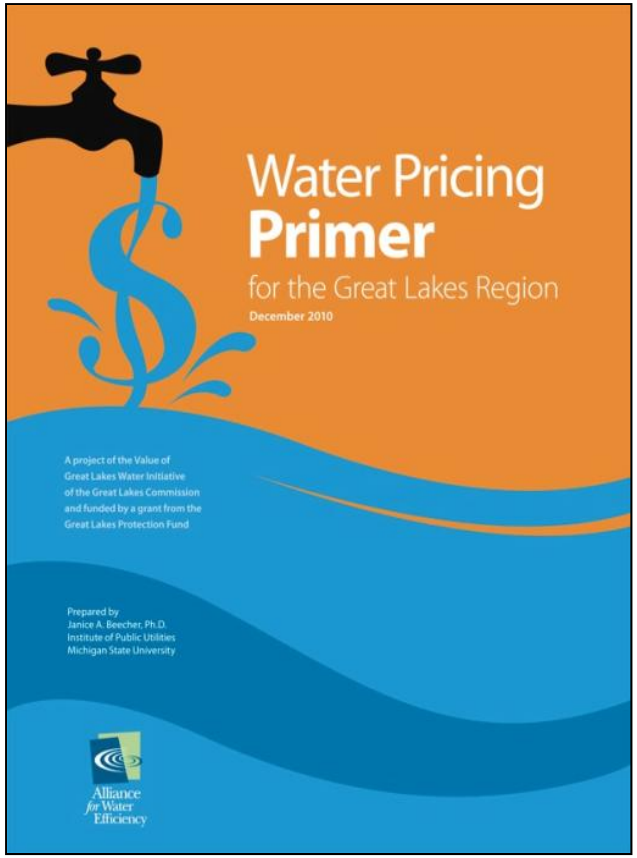
Conservation is still part of the solution

- It is a long-term cost reducer to the utility
- Revenue loss is often due to other drivers
- Every gallon saved is water that does not have to be pumped, treated and delivered
- Reduced utility costs generally mean reduced customer rates in the long-term due to avoided infrastructure
- Conservation is an investment and short-term effects must be planned for



AWE's First Foray into Rates

- Rates and Water Pricing Project in the Great Lakes Region
- Workshops held in 2010
- Primer published 2011 and posted at www.a4we.org
- Author: Dr. Janice Beecher, Institute for Public Utilities, Michigan State University
- Practical advice for water board elected officials, managers, and consumers

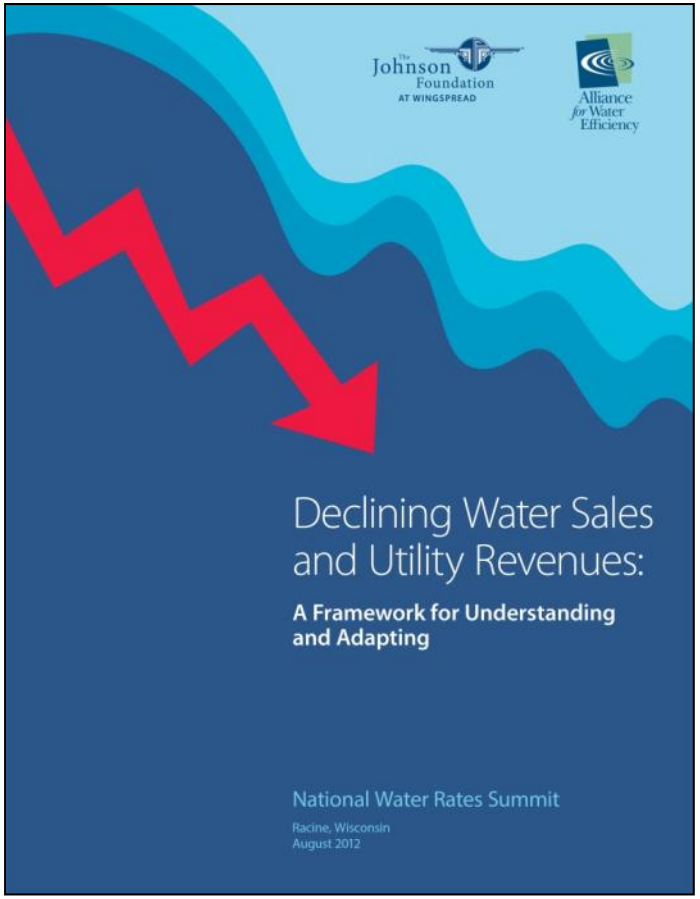


Declining Water Sales Summit

- Held August, 2012
- Hosted by AWE & the Johnson Foundation at Wingspread
- Funded by Walton Family Foundation
- 30 Attendees including utility CEO's, CFO's, regulators, rates experts, economists, non-profit advocates

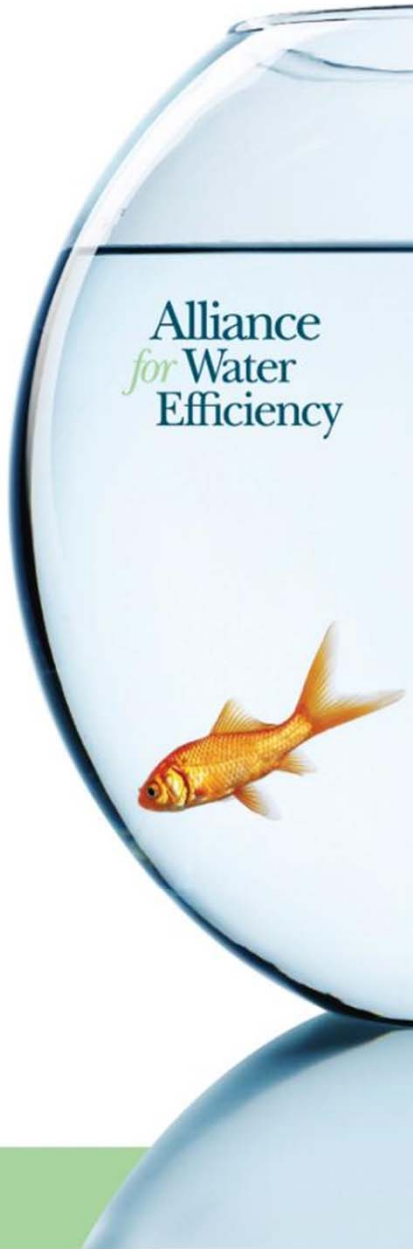
Summit Summary

- Results of August, 2012 Rates Summit
- Detailed Summary and background Framing Paper
- Copies in your packets
- Available free of charge and posted at **www.a4we.org**



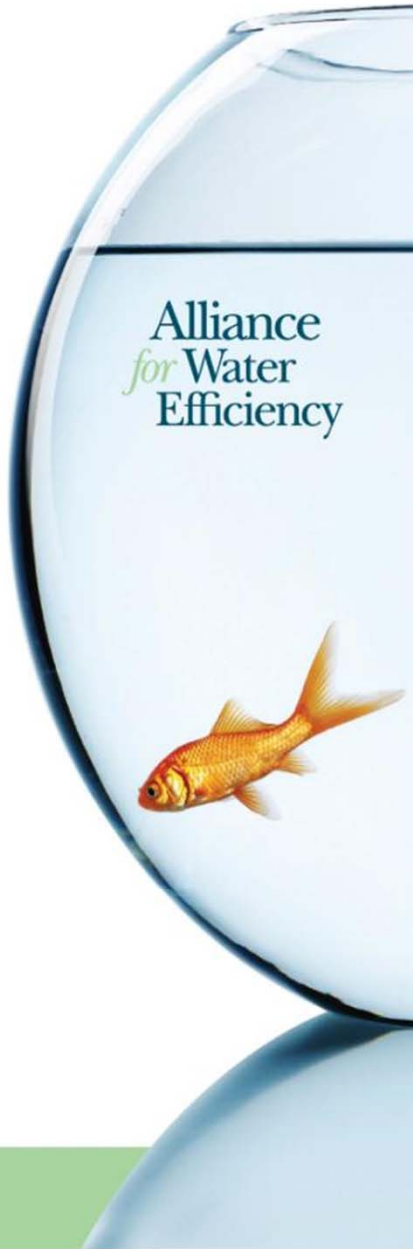
Summit Discussion Areas

1. How and why are water sales declining?
2. Are water utility revenues falling short of revenue requirements?
3. Do water utilities and the conservation community have a messaging problem?
4. What methods are available to repair revenues and improve fiscal stability?
5. What role do industry standards, practices, and policy reforms play?



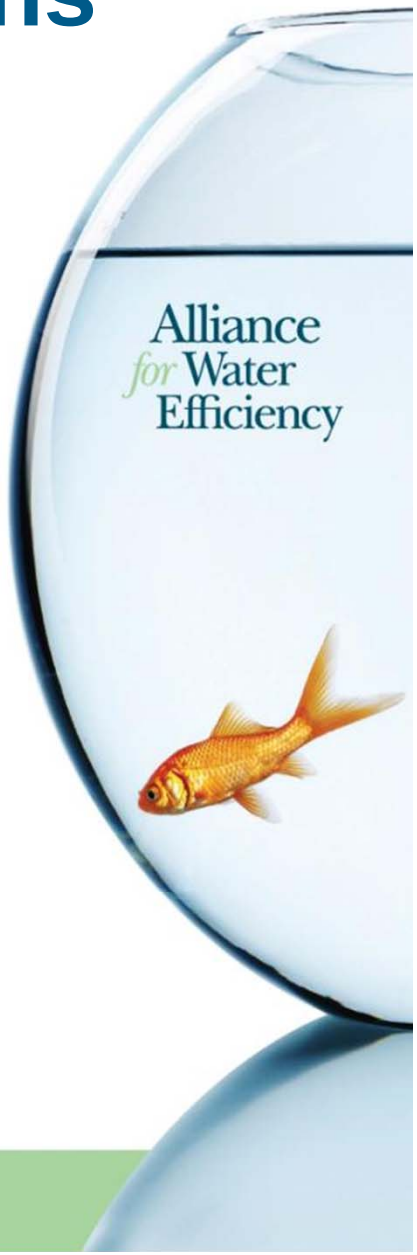
Address the revenue shortfall

- Rate adjustments
- Improved cost forecasting
- Improved demand forecasting
- Weather normalization
- Cost-adjustment mechanisms
- Cost indexed rates
- Demand-repression adjustment
- Revenue-stable rate design
- Property-based fire-protection charge



Improvement Recommendations

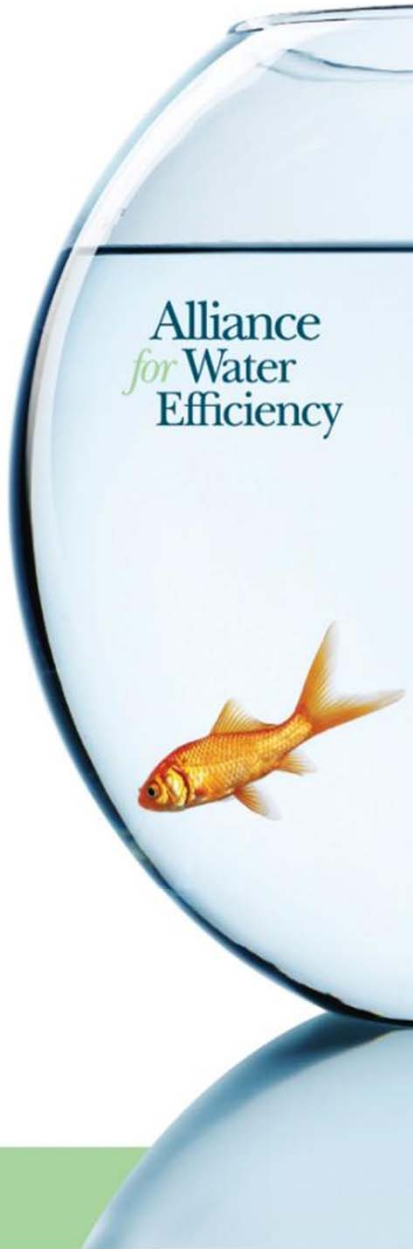
- Forecast demand to assess water use reductions from codes and standards
- Compensate for the uncertainty of future sales with a risk compensation strategy
- Quantify the response of water demand to changes in rates and other external factors
- Adjust revenue collection annually
- Account for the water savings actually achieved by conservation programs
- Estimate future cost-effective potential
- Educate the consumer



What's Next at AWE?

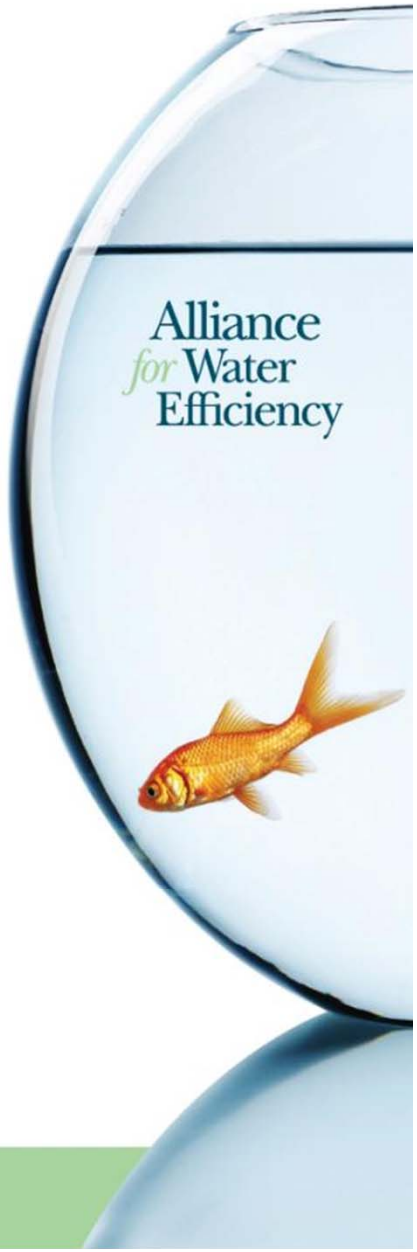
AWE is developing solutions to assist water suppliers to set water rates that help:

- Provide clean drinking water at rates that are fair and affordable for customers today and in the future
- Support long-term financial sustainability of water systems and utilities
- Stretch and protect water supplies to fuel growing, urbanizing and industrializing communities



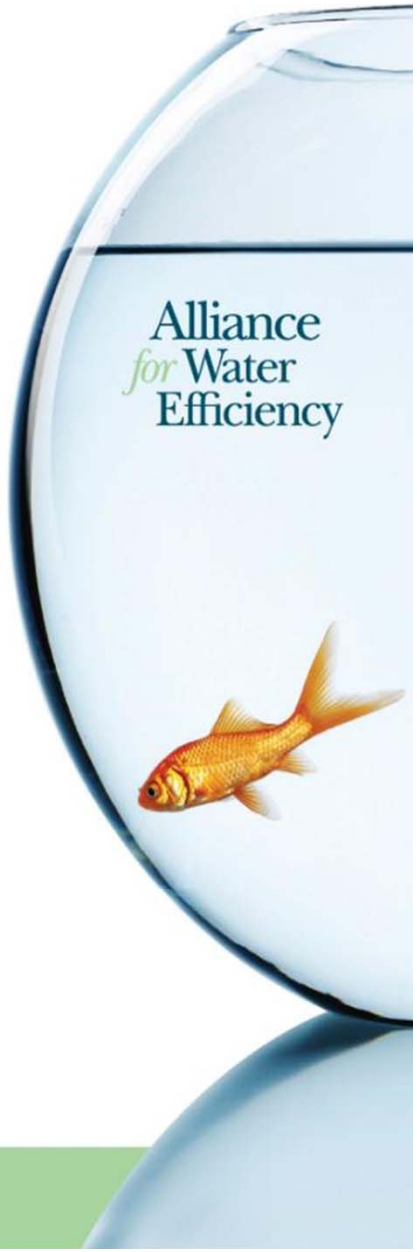
AWE Rates Project

- Handbook for Efficiency-Oriented Rates to balance sustainability and financial goals
- User-friendly rate model spreadsheets
- Second “Solutions Summit” at Wingspread
- Online Resource Hub with new case studies and tools to design, implement and communicate rate changes
- Training and education opportunities for utility staff



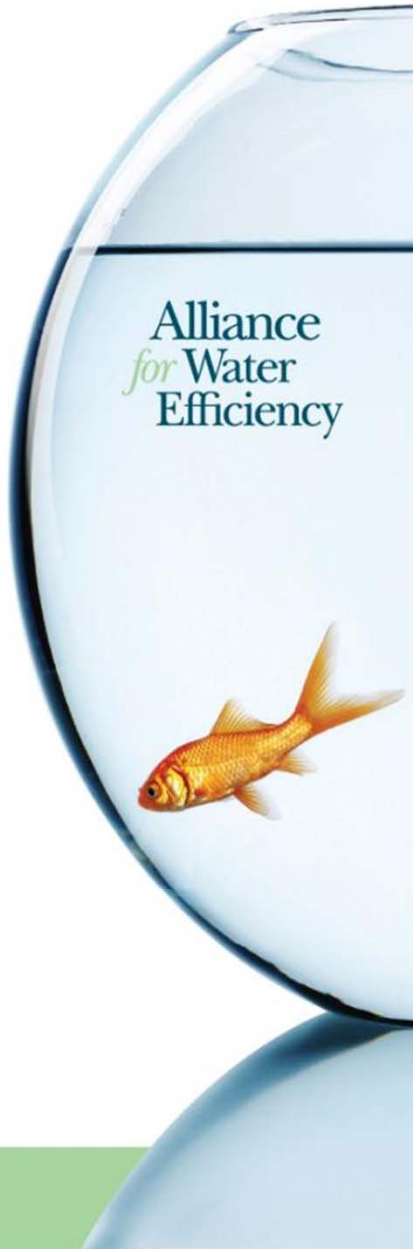
Rates Handbook

- **Working Title:** Handbook for Achieving Efficiency-Oriented Water Rate Structures: Balancing Revenue Management, Resource Efficiency, and Fiscal Sustainability
- **Introduction Sections:**
  - ✓ Overview of Water Rates, Efficiency, and Revenue
  - ✓ Overview of Rate-Setting
  - ✓ Deciding on a Rate Structure and Balancing Rate Objectives



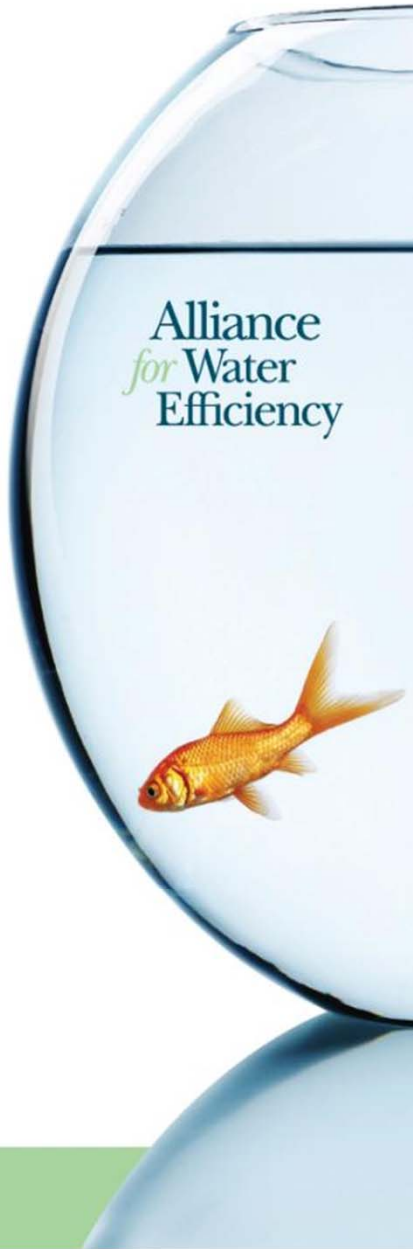
Rates Handbook

- **Building a Better Rate Structure**
  - ✓ Revenue Requirements
  - ✓ Cost of Service
  - ✓ Rate Design
  - ✓ Revenue Management and Fiscal Sustainability



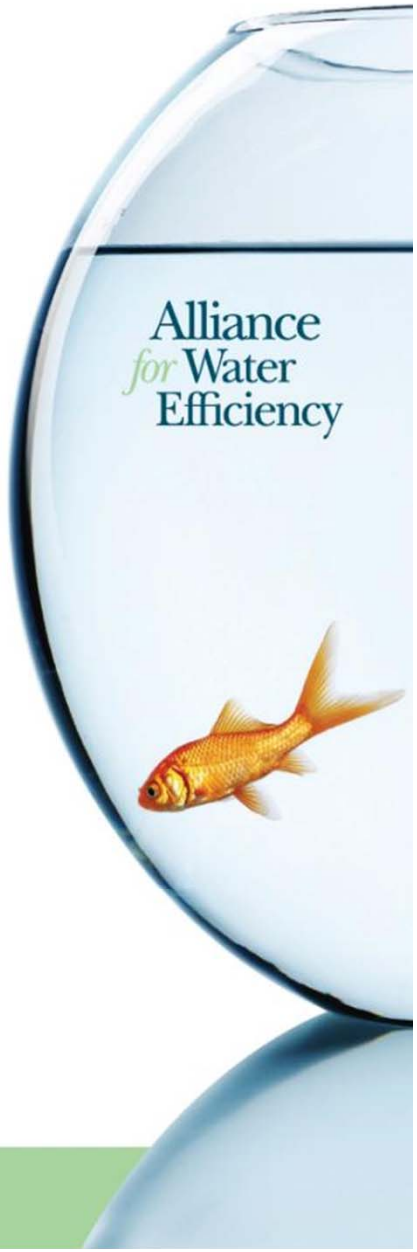
Rates Handbook

- **A Tool Box for Efficient Rates**
  - ✓ Self assessment matrix
  - ✓ Modeling Short Term Water Demand Variability
  - ✓ Modeling Water Revenue Variability
  - ✓ Depicting Customer Bill Impacts
  - ✓ How Cost-effective WUE programs lower customer bills



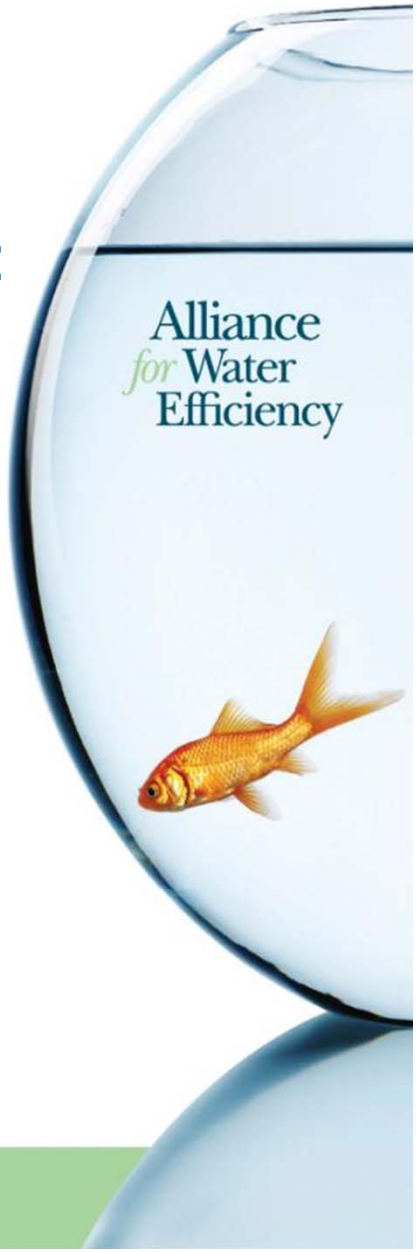
Rates Handbook

- **Implementing Efficient Rates**
  - ✓ Provide recommendations for ensuring the smooth implementation of an efficient rate structure.
  - ✓ Provide communication guidance for different audiences: management within the agency; the general public; and any approval process.
  - ✓ Provide suggestions for designing customer bills to communicate a clear price signal and provide messaging for steps toward more efficient water use.



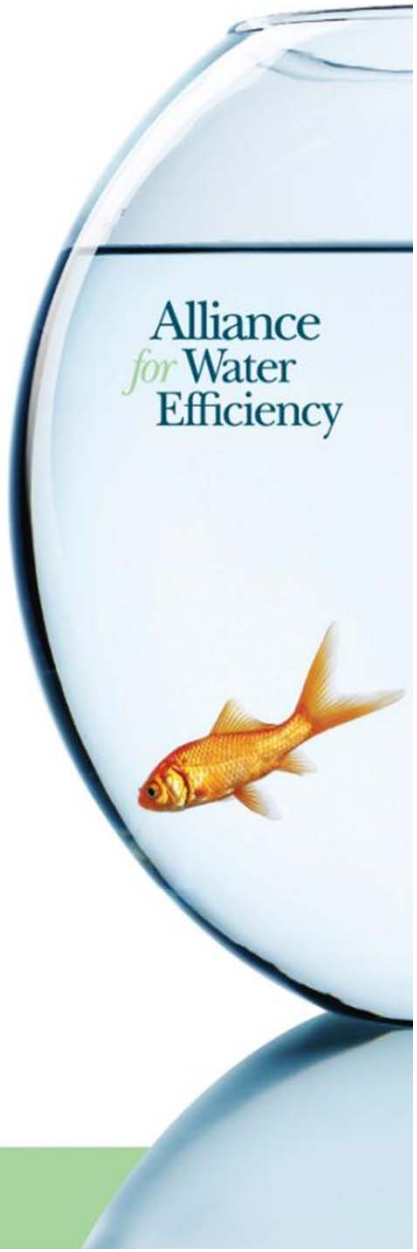
Rates Handbook Case Studies

- 4-5 case studies to illustrate the principles of efficient rate design and illustrate the following:
  - ✓ Seasonal Rates, Seasonal Costs
  - ✓ Empirical Sales Forecasting
  - ✓ Drought Pricing
  - ✓ Water Budgets, Coping with Water Shortage
  - ✓ Consumption-Based Fixed
  - ✓ Fiscal Policies—Reserves, Pass-Through Provisions, Decoupling



Rates Handbook Appendices

- Appendix A – California Legal, regulatory, & statutory issues (Prop 218, CUWCC BMP 1.4)
- Appendix B - Marginal/Incremental/Avoided Costing Methods
- Appendix C - User Guide to the AWE Sales Forecasting and Rate Model:
  - ✓ Predicting future block sales (volume and revenue)—price elasticity within consumption distributions
  - ✓ Customer Consumption Variability—weather, the economic cycle, and conservation
  - ✓ Drought Pricing—Contingency planning for net revenue neutrality

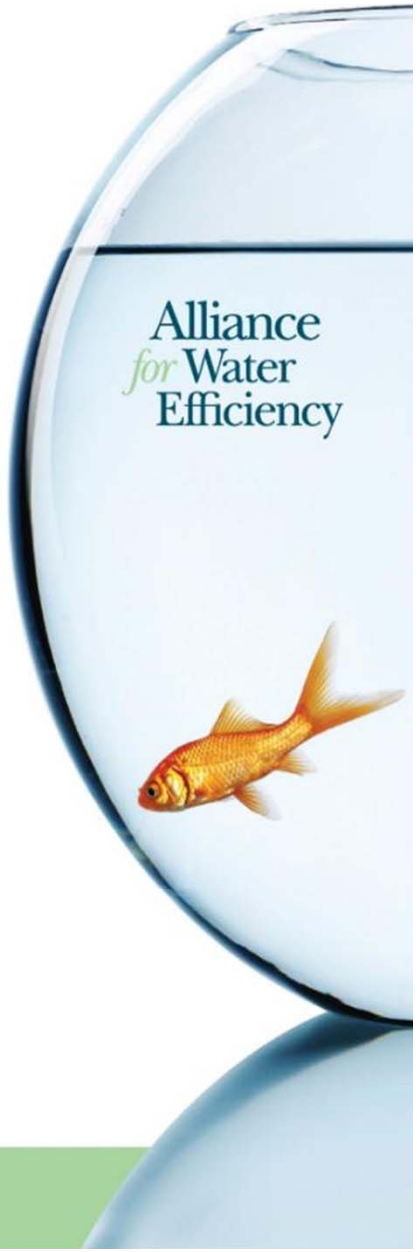


Rate Model Background

Most water rate models assume:

- Future sales are certain
- Future sales are known with certainty
- Future sales do not respond to price, weather, the economy, or supply shortages

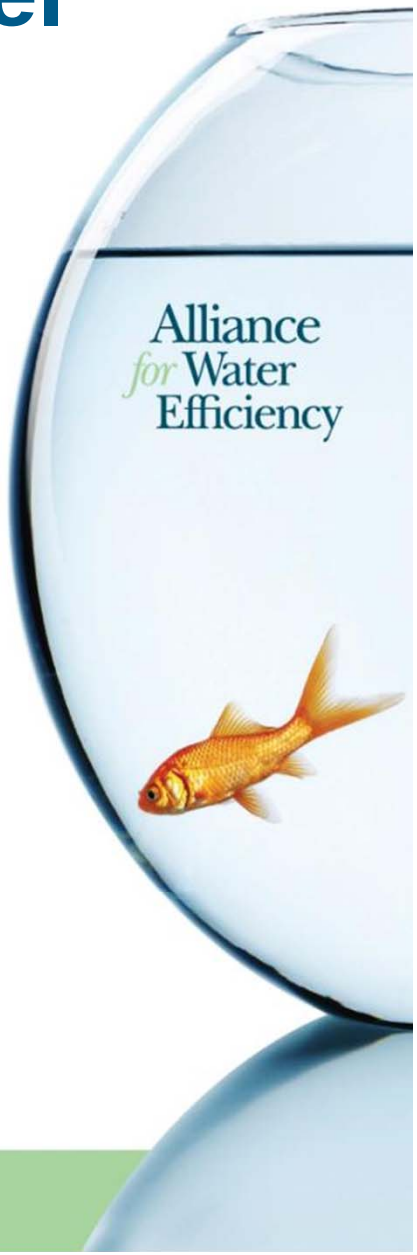
This is not the world we live in!



Sales Forecasting & Rate Model

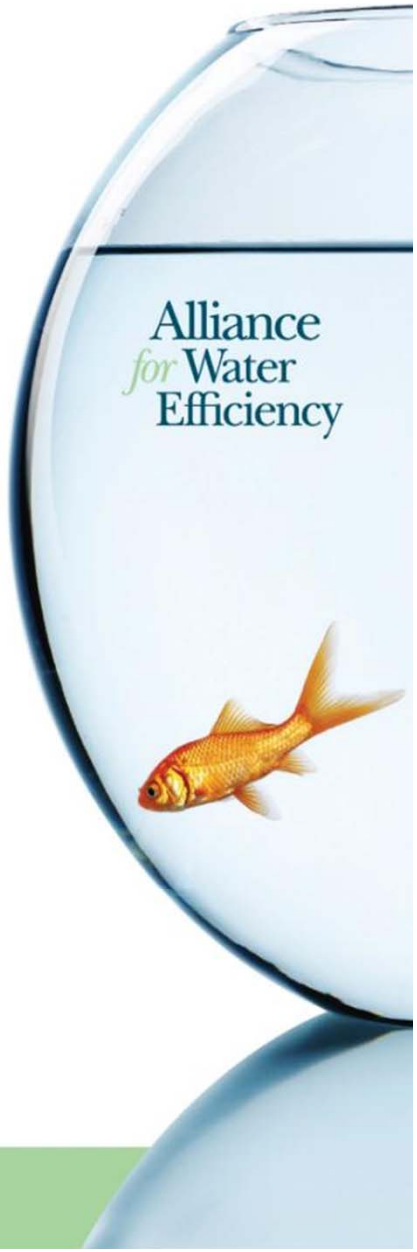
AWE wants to address this deficiency and provide the following:

- Predicting future block sales (volume and revenue)—price elasticity within consumption distributions
- Analyzing Customer Consumption Variability—weather, the economic cycle, and conservation
- Configuring Drought Pricing—Contingency planning for net revenue neutrality



Rate Model Features

- Up to 5 predefined Customer Classes
- Seasonal differentiation of Water Sales
- Predefined water rate alternatives:
  - ✓ Increasing block rates
  - ✓ Uniform Volumetric Rates
  - ✓ Seasonal rates
  - ✓ Water budget based rates
  - ✓ Hybrids
- Focus on Net Revenue
  - ✓ Tracks expenditures during shortages
  - ✓ Net revenue neutrality



Frequency Distribution of Summer and Winter Bills
Residential 1

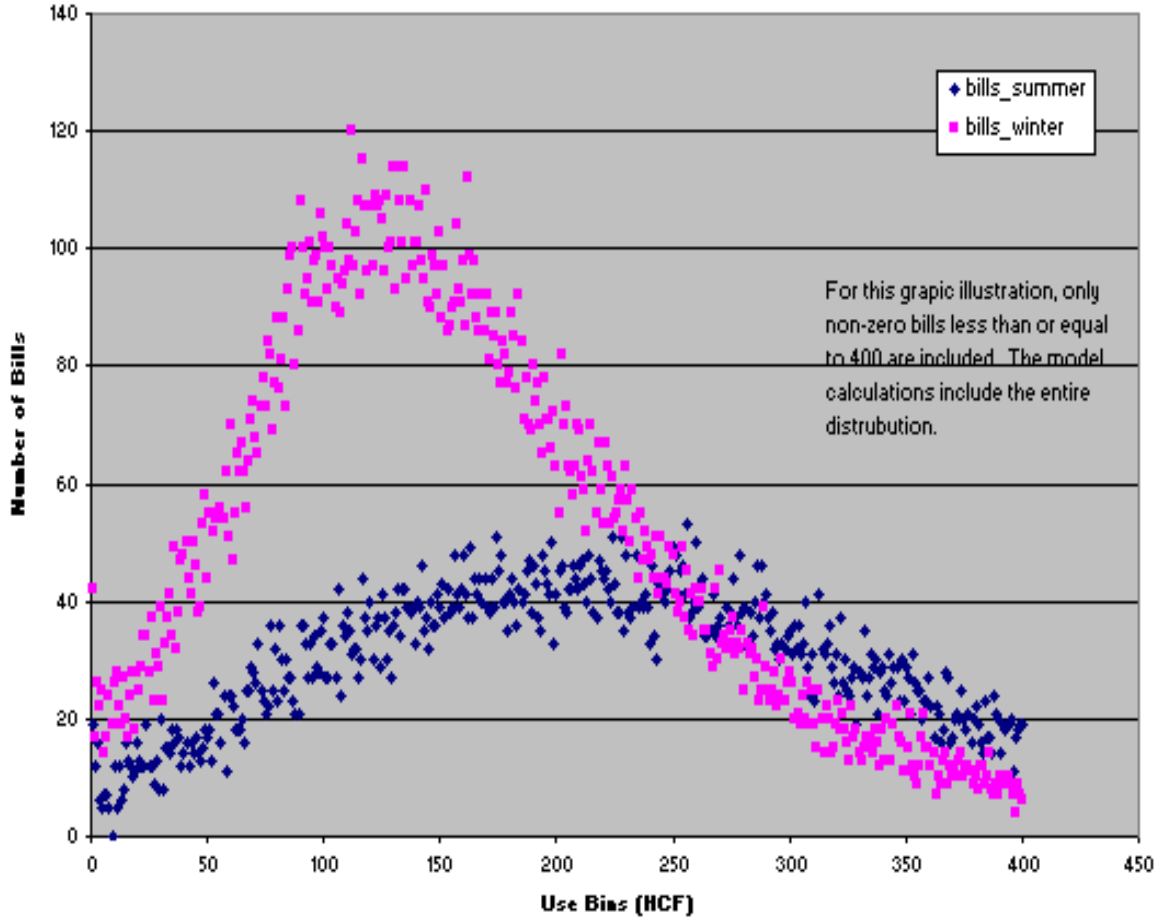


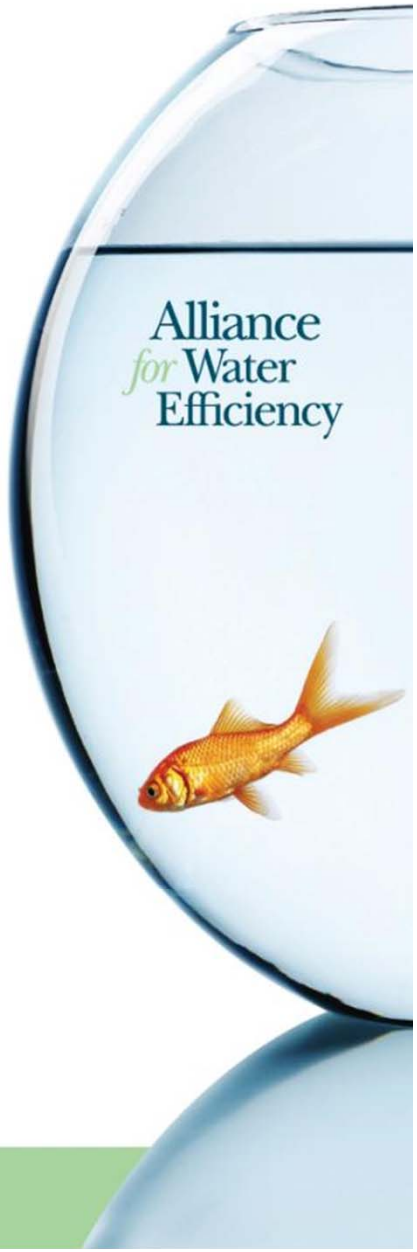
Chart Area

Timetable

Second Summit at Wingspread:
April 30-May 2, 2014

Handbook completion: June 2014

AWE Web Site Digital Resource Hub:
December, 2014



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A Voice and
a Platform
Promoting the
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