

This presentation premiered at WaterSmart Innovations

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The Water-Energy Nexus: Contribution of the San Francisco Public Utilities Commission's Retail Water Conservation Programs to Climate Mitigation

Presented by Kimberly Stern Liddell

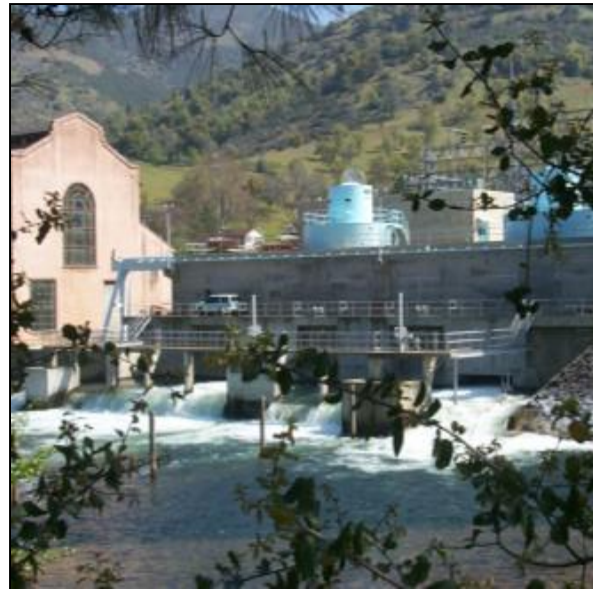
WaterSmart Innovations 2016



Who We Are



Water: delivering high quality water every day



Power: generating clean energy for vital City services



Wastewater: protecting public health and the environment



Agenda

- Climate change effects on hydrology and water supply
- Water-energy nexus overview
- Greenhouse gas (GHG) emissions avoided by water conservation
- Connecting the dots, implications for water conservation practitioners

Climate Change Effects on California

Agriculture



Ecosystems



Public Health

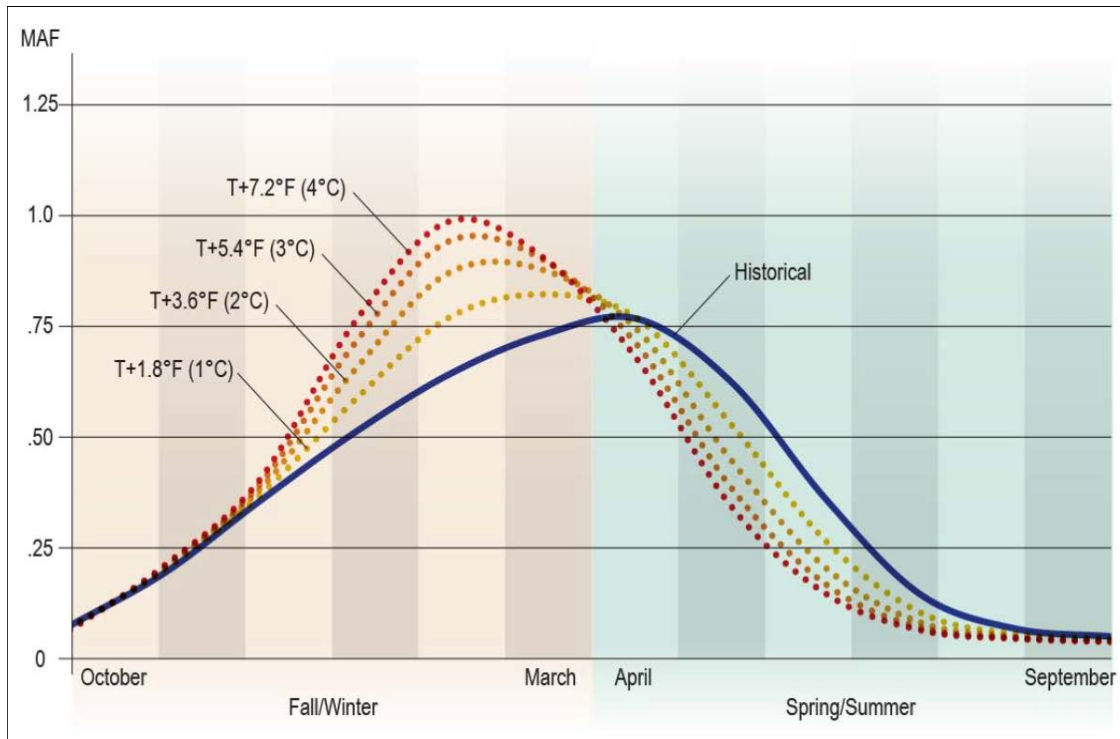


Water Supply



Major Effects on California Hydrology

- More precipitation as rain instead of snow
- Snowpack decline
- Earlier snowmelt and surface water runoff



Implications for Water Supply

- Maximum supply occurs in winter/spring instead of spring/summer
- Water supply reliability decreases
 - greater impact to agricultural than urban customers
 - variable effects throughout the state
 - increased competition between people and the environment
- Diversification
 - wet weather storage, including conjunctive groundwater management, must increase

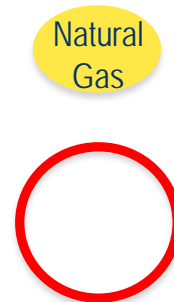


Any Good News?

- Future level of emissions influences severity of longer-term effects



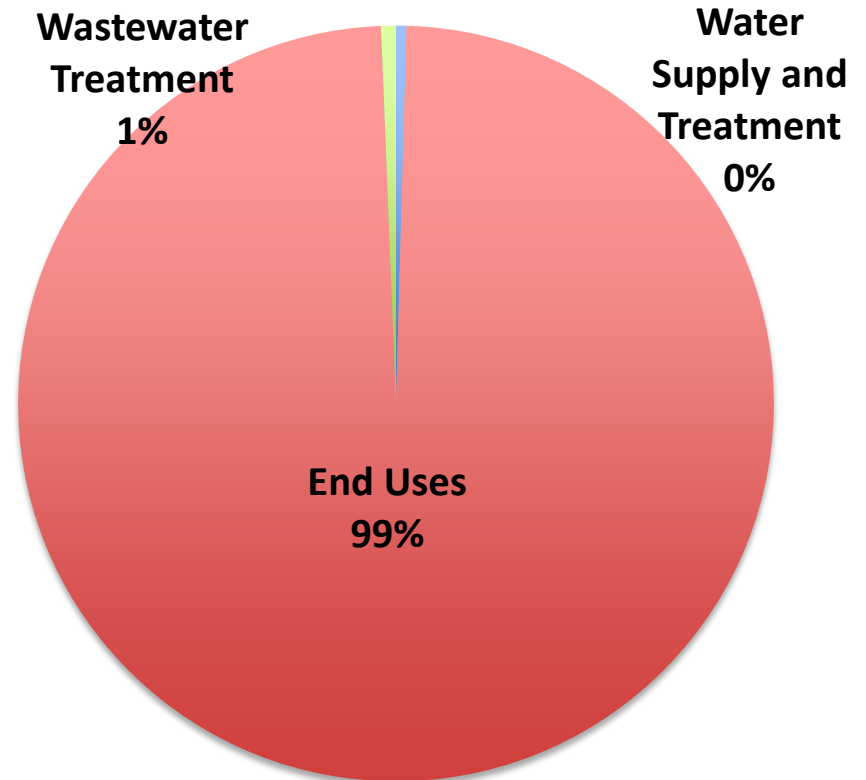
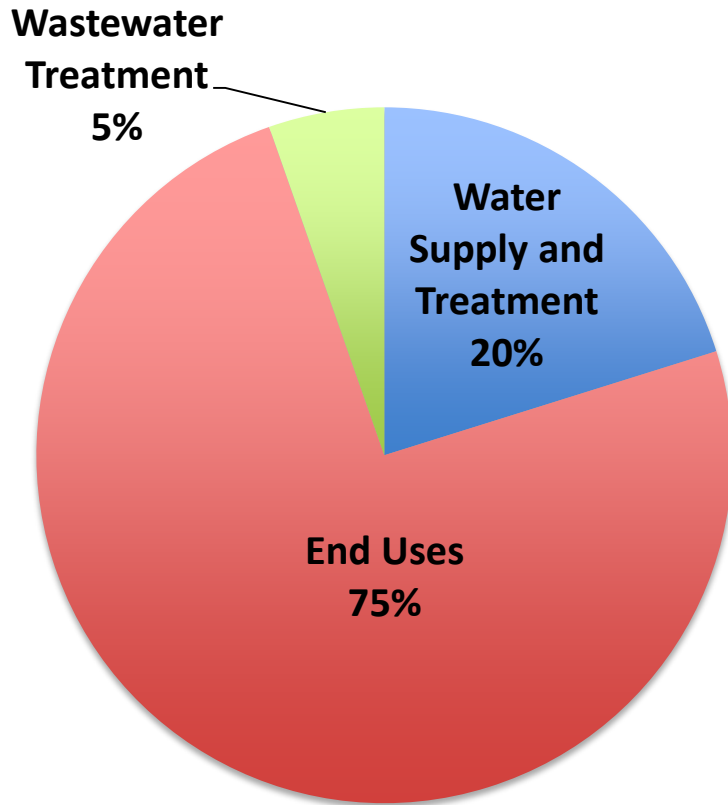
Water-Energy-Climate Nexus



California Water-Related Energy Use

15% of electricity

30 % of natural gas





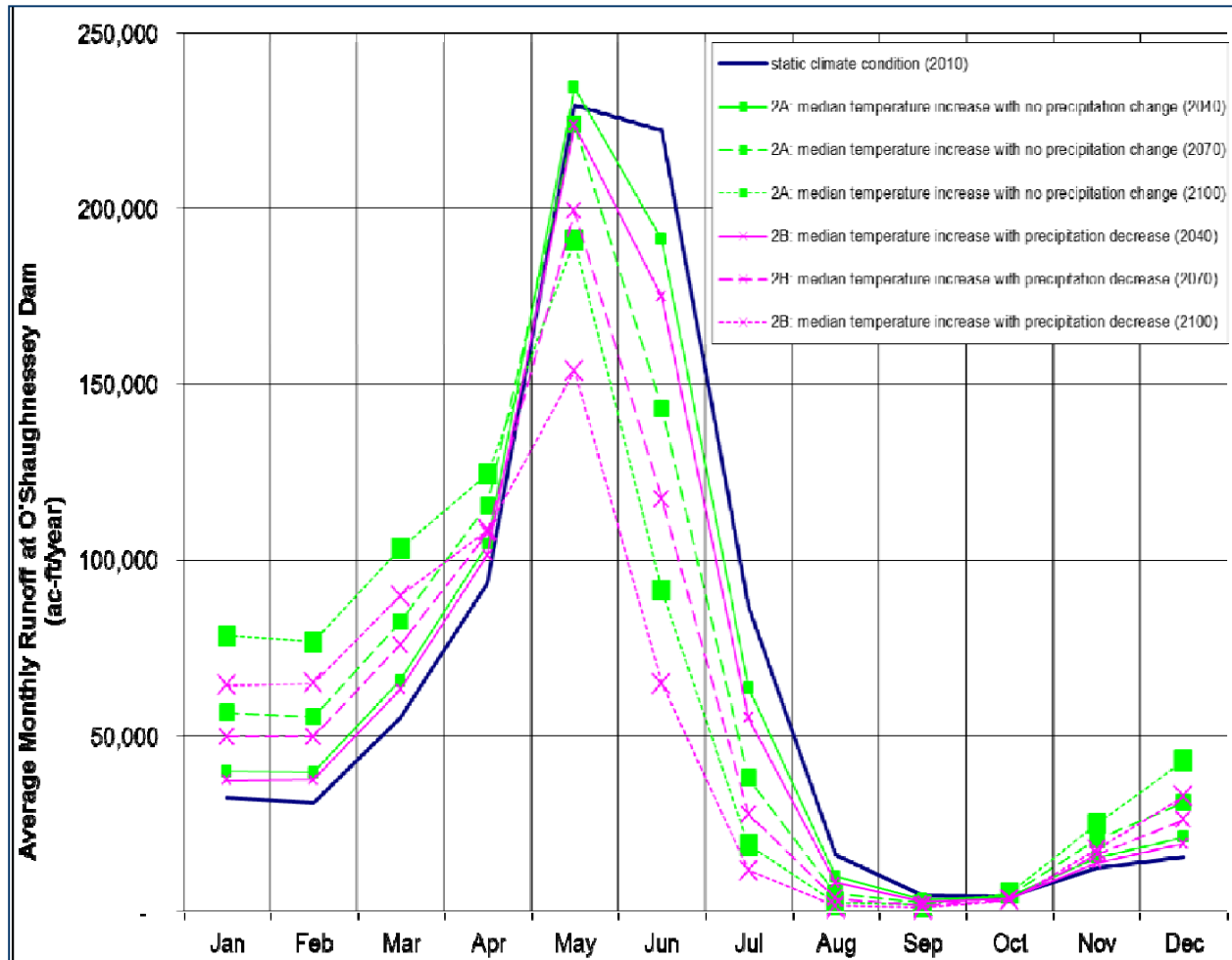
Residential End Uses of Water

Hot water = 33.2% of Total Indoor Water Use

SFPUC Regional Water System



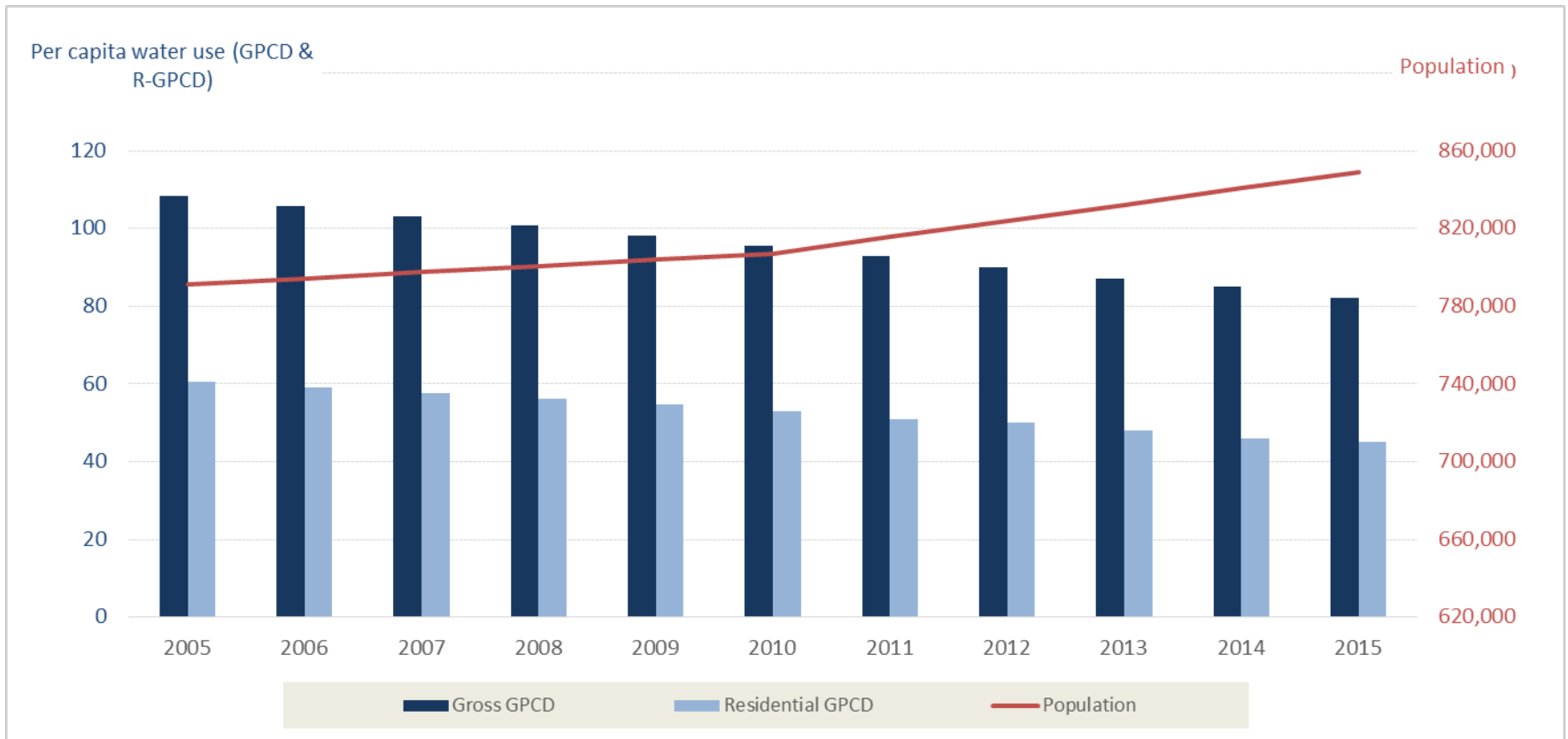
Climate Change Effects on SFPUC Regional Water System





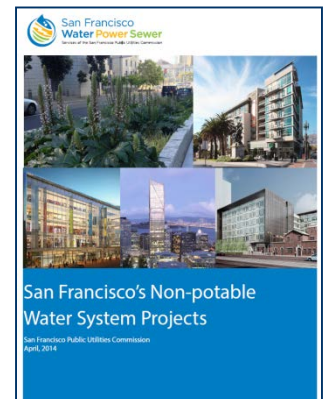
Comprehensive Conservation Program

- Extensive assistance since 1990s has significantly reduced water use despite population growth. Over last 10 years, per capita water use decreased 25+ percent.



Current Conservation Services

- Online portal for viewing daily water use and leak alerts
- Free indoor/outdoor conservation evaluations
- Free water-efficient devices and materials
 - Showerheads, aerators, pre-rinse spray valves, toilet leak detection tablets and flappers, spray nozzles, plumbing and gardening handbooks, signage
- Fixture rebates and incentives
 - Tank and flushometer toilet and urinal rebates and direct install
 - Residential and commercial clothes washer rebates
 - Large commercial equipment rebates and grants
- Large landscape and community garden grants
- Non-potable system installation grants
- Residential graywater and rain barrel incentives
- Free gardening classes and school programs
- Educational guides and materials





Conservation Programs Included

Programs ¹	Sector		
	Single Family	Multi-Family	Commercial Institutional, Industrial
Cold Water Savings (Embedded Energy)			
High efficiency toilets	X	X	X
High efficiency urinals	X	*	*
Surveys/audits	X	X	*
Landscaping	X	X	X
Hot Water Savings (Embedded and Direct Energy)			
High efficiency clothes washer	X	X	X
Low-flow showerheads	X	X	X
Faucet aerators ²	X	X	X
Low flow sprayers-restaurants			X

Source: SFPUC

* = program exists but not included

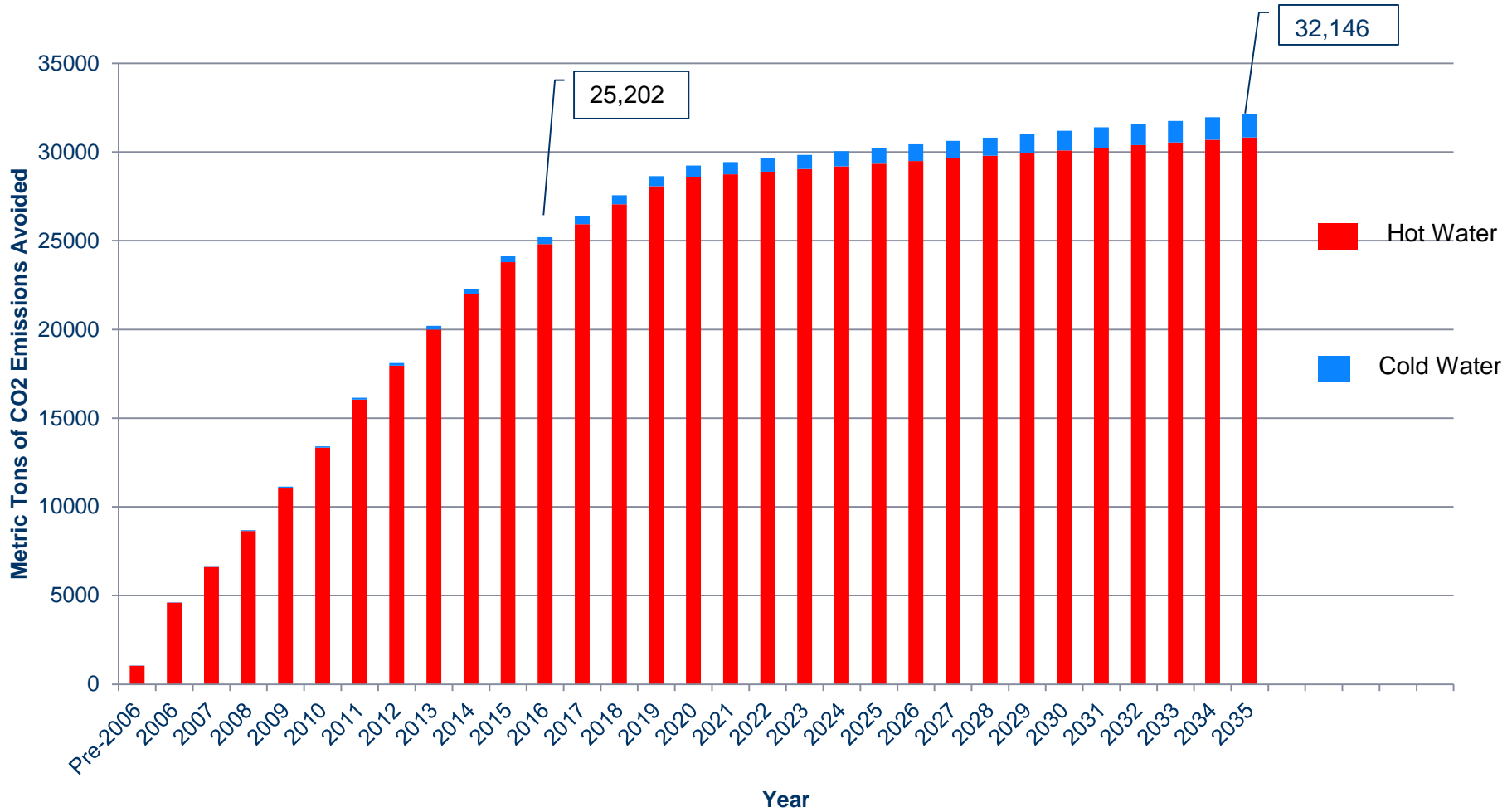
¹This is a simplification of the measures. In actuality there are a number of mechanisms for implementing these programs, such as rebates or direct installation and for some measures, there is a tier structure to incentivize more efficient fixtures and appliances over time.

² SFPUC distributes faucet aerators but does not include water savings from them in the demand model because the total savings are uncertain. However, they save energy and are thus included in this research.

- 235.9 kWh/AF factor for water delivery and treatment (GEI Consultants/Navigant Consulting, Inc., 2010)
- PG&E emissions factors for electricity and natural gas (PG&E, 2013a)
- Pacific Institute factors for energy saved per device (Cooley et al., 2010)
- California Public Utilities Commission percentages for natural gas used for water heating in buildings (CPUC, 2008)
- San Francisco Department of the Environment GHG emissions reports (SFE 2010, 2013)
- Environmental Protection Agency relative GHG emissions (USEPA 2013a)

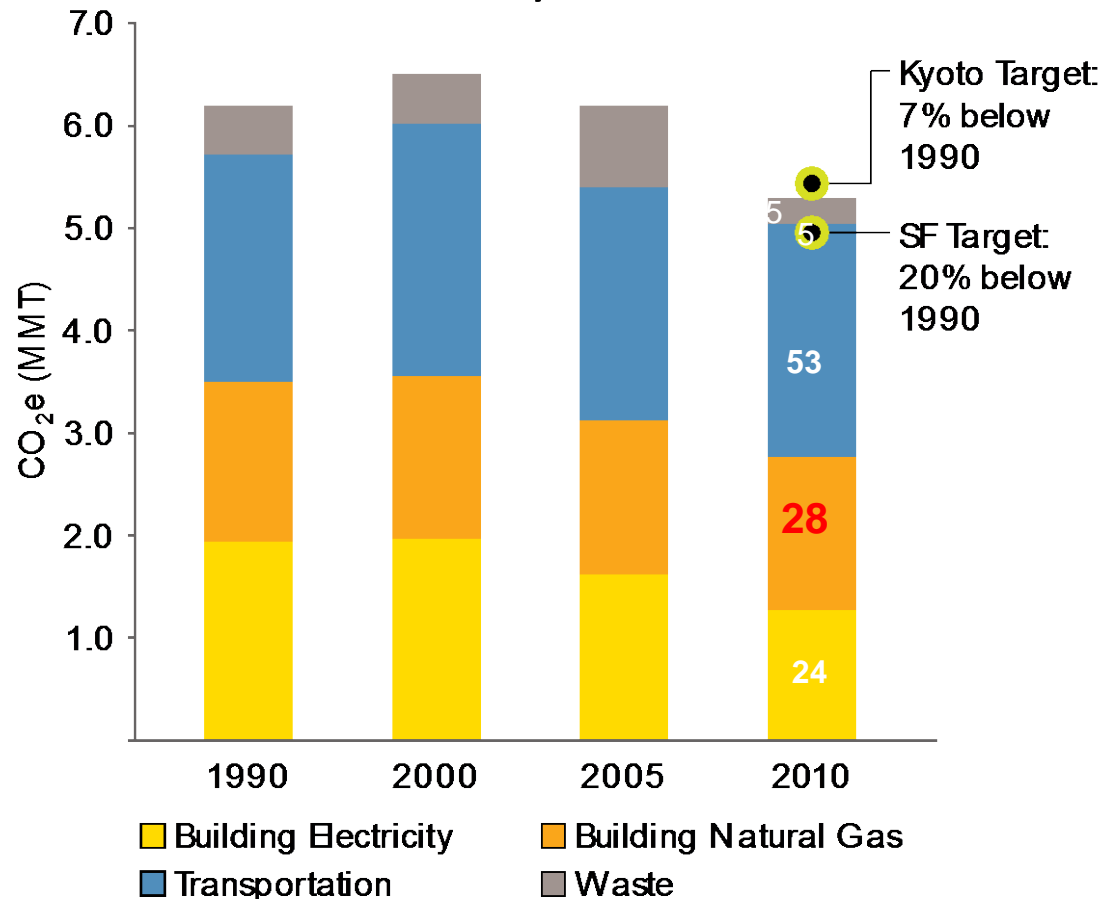
Device	Annual Hot Waters Savings (Therms/Year)
Showerhead (1.5 gpm)	30
Faucet aerator (1.5 gpm)	2
Residential clothes washer (5.0 WF)	37
Commercial pre-rinse spray valve (1.0 gpm)	330
Commercial clothes washer (5.0 WF)	138

Results

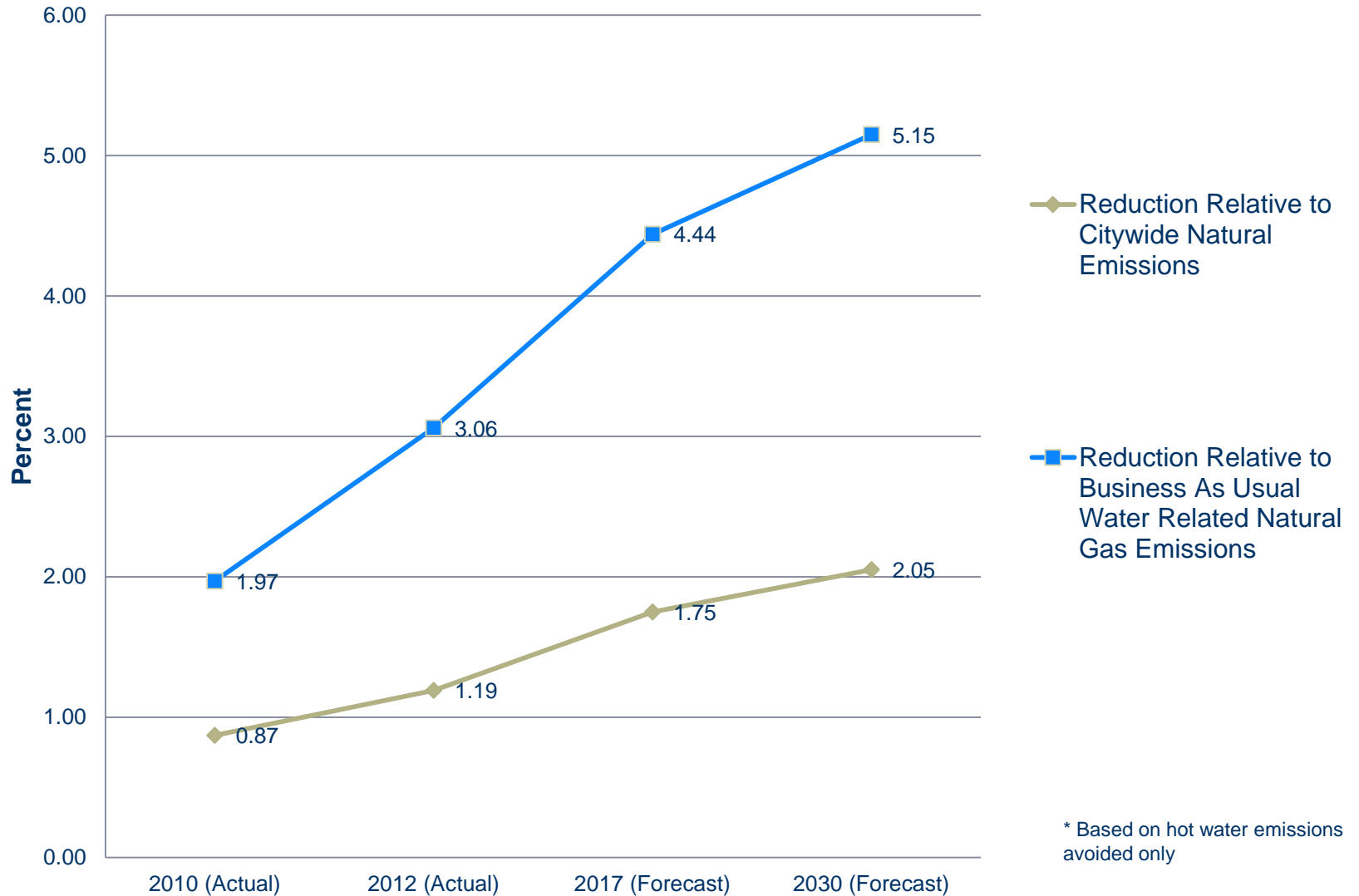


San Francisco Climate Action Goals

- Reduce annual GHG emissions to:
 - 25% below 1990 level by 2017
 - 40% below 1990 level by 2025



Results



2016 (Actual)



2,791,606 gallons of gasoline consumed



2,620 homes' energy use for one year



23,484 acres of U.S. forests in one year

2035 (Forecast)



3,469,450 gallons of gasoline consumed



3,256 homes' energy use for one year



29,187 acres of U.S. forests in one year

So What?

- **Climate change adversely impacts water supply**
 - Conservation mitigates climate change and allows time for other supplies to develop and be as energy efficient as possible
- **Achieving long term climate action goals will be challenging**
 - Conservation is “low-hanging” fruit that mitigates climate change without requiring behavioral changes and should be maximized
- **Significant opportunity exists**
 - Per capita use of 58.6 gpcd expected to reduce to 36.7 gpcd (nationally)
 - Off-the-shelf conservation technologies could save water for 3 to 15 million homes annually and avoid associated GHG emissions

Connecting the Dots

- Water conservation important for
 - Water supply
 - Drought resilience
 - Climate change adaptation
 - **Climate change mitigation**
- Replicable methodology to quantify GHG emissions avoided
- Energy, climate mitigation, and financial **co-benefits** amplify importance



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[WaterSense](#) [Our Water](#) [Shower Better](#)



A SHOWER OF SAVINGS
Installing WaterSense labeled showerheads just adds up!

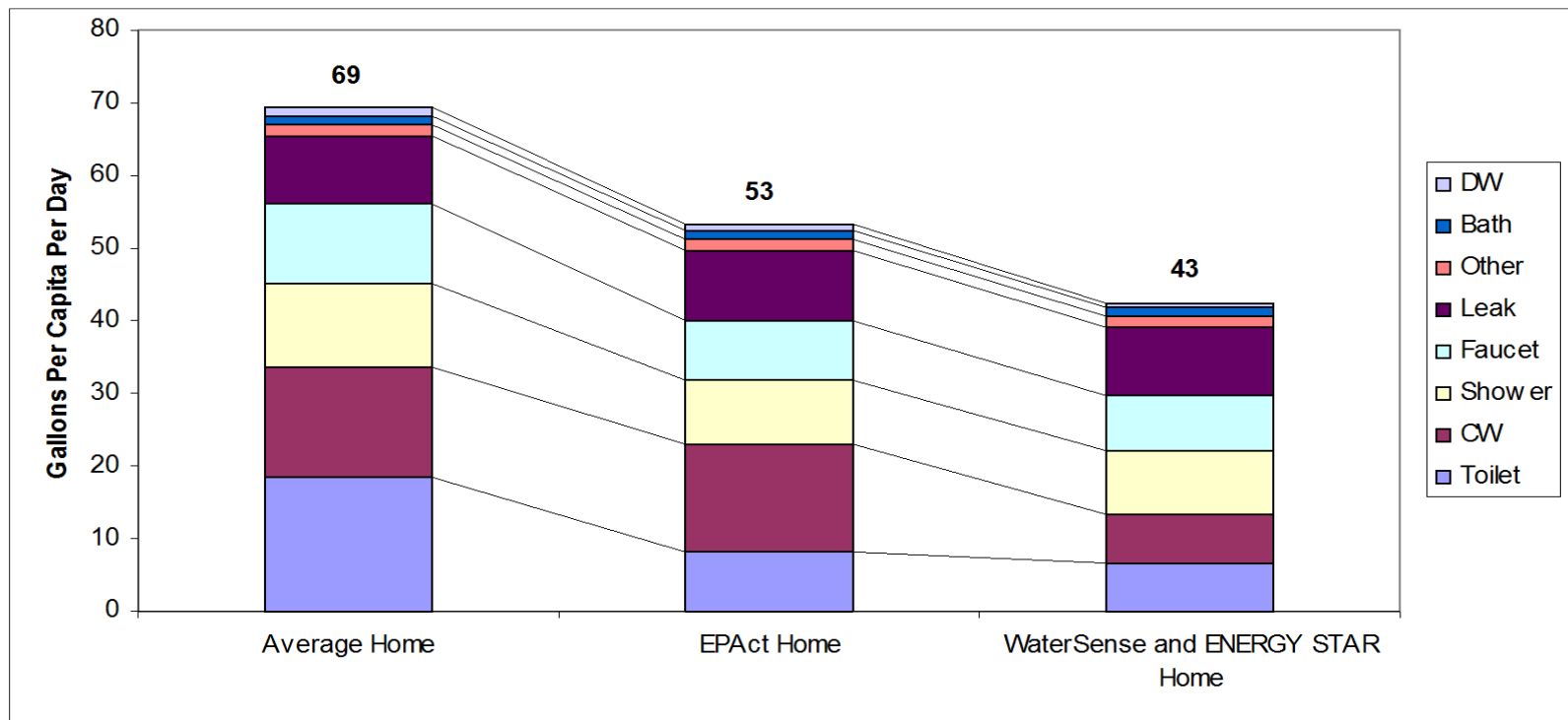
Why waste...

2,900 GALLONS of water + **13 DAYS of energy to power your home** + **\$70 per YEAR** + **GHG Emissions Avoided**



ShowerBetter

Integrate energy and water efficiency programs



Address the Existing Housing Stock





Connecting the Dots

- **Develop a Water-Energy Nexus Strategic Plan**
 - Interdepartmental coordination opportunities
 - Integrated public outreach efforts
 - Reporting of co-benefits in publications
 - Pursue grants for projects that save water and energy

Just Add Water!

Questions?

“GHG emissions reduction is a critical responsibility of water managers... efficiency in water and energy use should be pursued at every opportunity.”

Source: CDWR, 2013

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-this used to be CEC 2005



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