

DEEP CONSERVATION: GOING BEYOND BUILDING CODE

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BEYOND-CODE WATER EFFICIENCY

TECHNOLOGY & MEASURES

INDOOR TECHNOLOGY

courtesy of Ned Orrett, P.E. ned@resourceperform.com

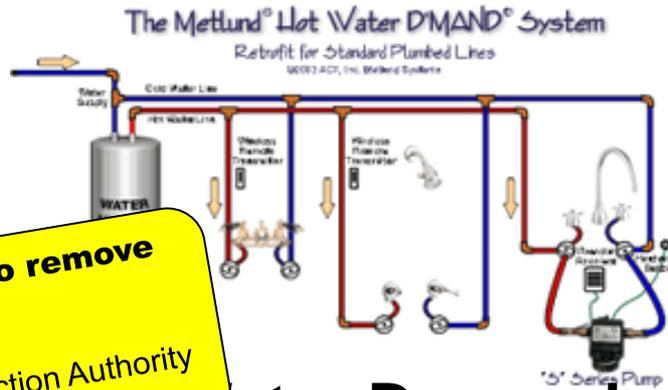


**~9 gal/full load
Premium
Clothes-washer**

~18 gal/full load
needs comprehensive program to remove market barriers
Windsor Efficiency PAYS
Sonoma County Regional Climate Protection Authority
www.windsorefficiencypays.com



**Ultra High Efficiency
Toilet 0.8 gpf
1.6 gpf**



**Water Demand
Recirculation System**

Aerators



**1.5 gpm 0.5 gpm
Kitchen Bathroom
1.8 gpm 1.5 gpm**



**1.5 gpm
High Performance
Showerhead
2.0 gpm**

MORE INDOOR TECHNOLOGY



\$75 (vs \$35)

B100MAX 1.0 gpm

UltraMax 0.6 gpm

2.0 gpm

- rated = max at 80psig
- installed <80 psig rated
- satisfaction \approx flow X pressure

KitchenAid



\$1,750 (vs \$500)

KDTE554C

EnergyStar

1.95 gal/cycle

5.0 gal/cycle

energy efficiency depends on piping layout and insulation

**Rheem
EcoSense**



water heating is 70-90% of water-related GHG

\$1,500 (vs 500)

ECORHE40S

**Condensing Water
Heater with Power
Vent**

0.82 Energy Factor

0.67 Energy Factor

OUTDOOR MEASURES

UC Verde Buffalograss Weather Controlled Irrigation

native grass with deep root system
1/4 inch of water per week

reduction: 75%

software and communications
irrigation system changes

reduction: 24% SFR; 29% MFR; CII 48%



Restricting use of *potable* water

Australian cities impose increasingly severe restrictions as reservoir levels decrease
Billing data analysis shows voluntary conservation reductions are small vs restrictions
Reduces peak supply/distribution capacity

Encourages turf removal, native plants, greywater, reclaimed w/w, rainwater tanks (43% in AU)

reduction: 66% SFR & MFR; CII 95%

TECHNOLOGY DEPLOYMENT

Widely available technologies perform far beyond code

Deep demand reductions require:

- High customer participation rates
- “Bundles” of technologies

- 
- a widely accepted vision for the future
 - a broad range of transparently developed scenarios
 - a comprehensive program to support implementation



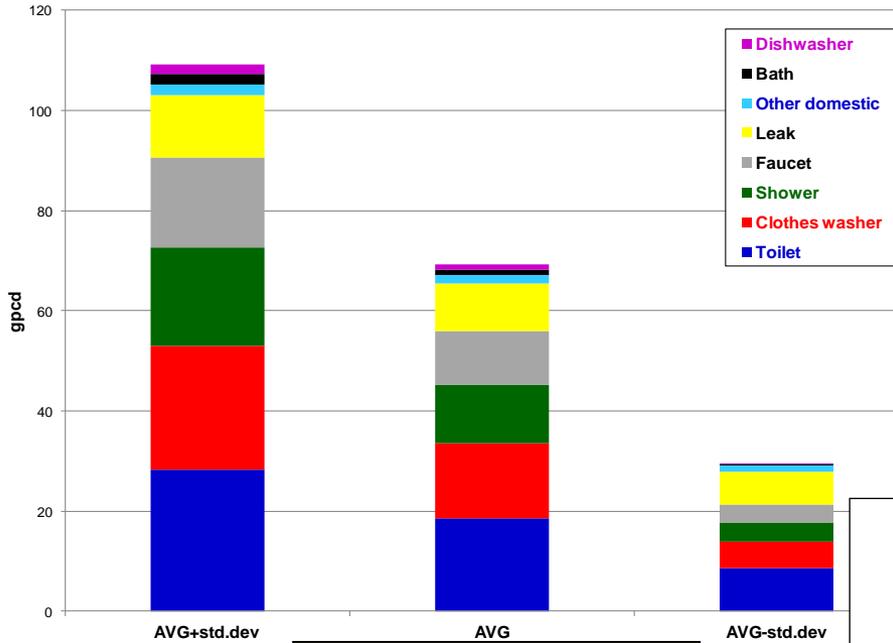
**finances, administration,
quality assurance, governance**

BEYOND-CODE WATER EFFICIENCY

SOME DATA INSIGHTS

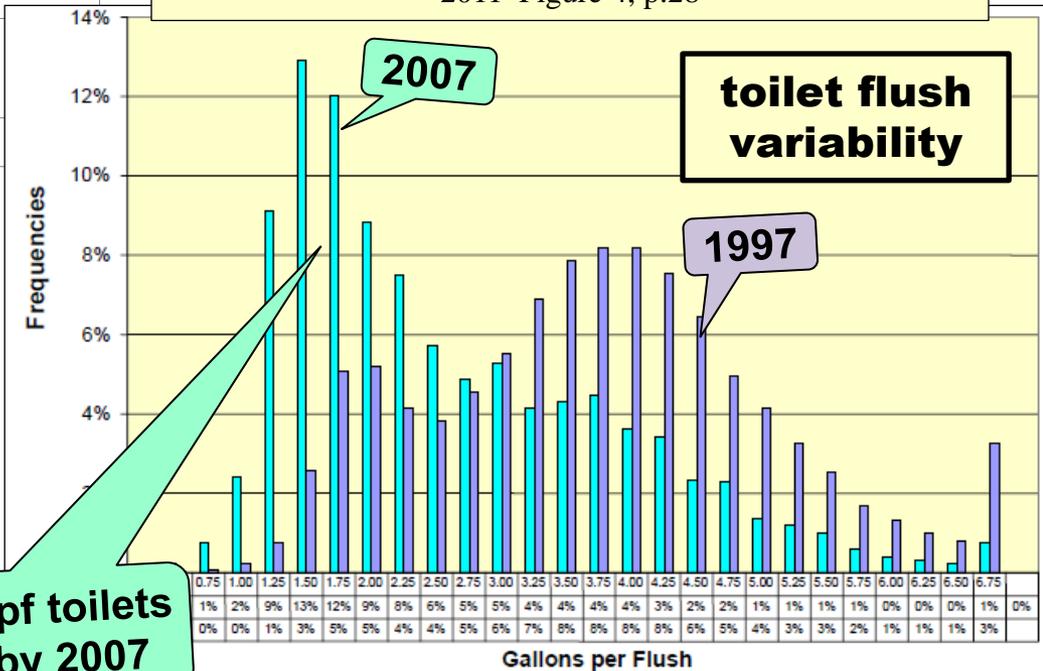
BEHAVIOR & VARIABILITY

Indoor Residential Water Demand: Monitored US Variability (1999)



most distributions are "fat tail"

CALIFORNIA SINGLE-FAMILY WATER USE EFFICIENCY STUDY, Aquacraft, Inc. Water Engineering and Management, July 20, 2011 Figure 4, p.28



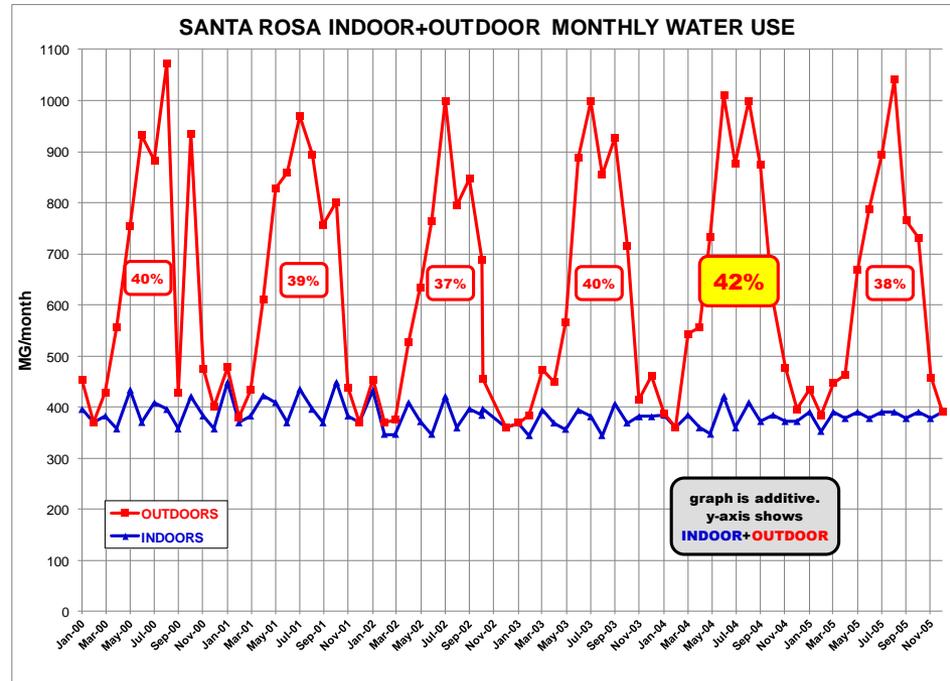
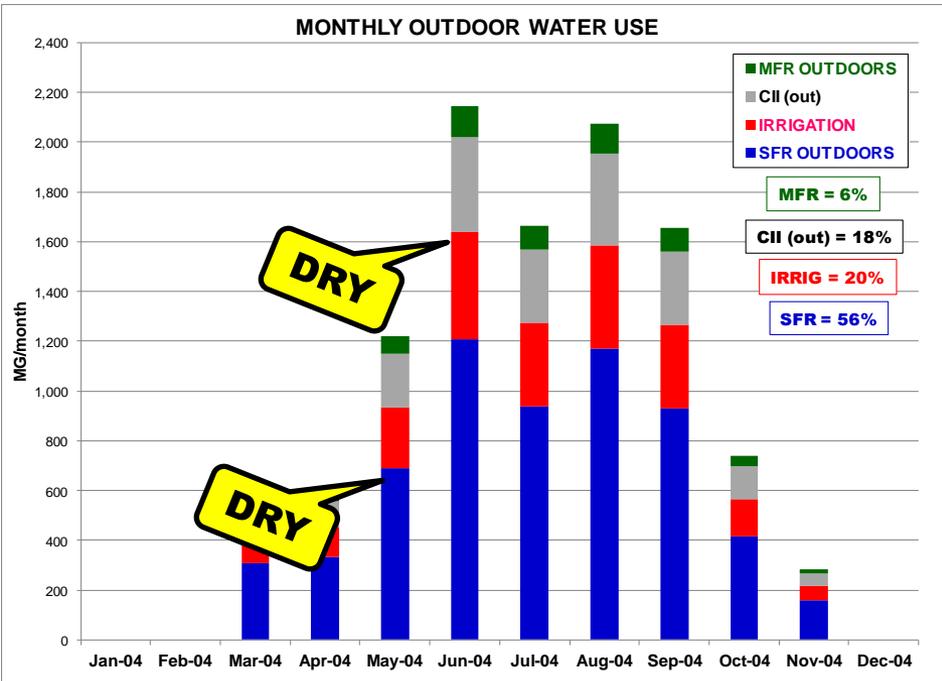
BEHAVIOR

- shorter showers
- shutting faucets
- less flushing

more 1.6 gpf toilets installed by 2007

OUTDOOR VARIABILITY

depends on timing of rains

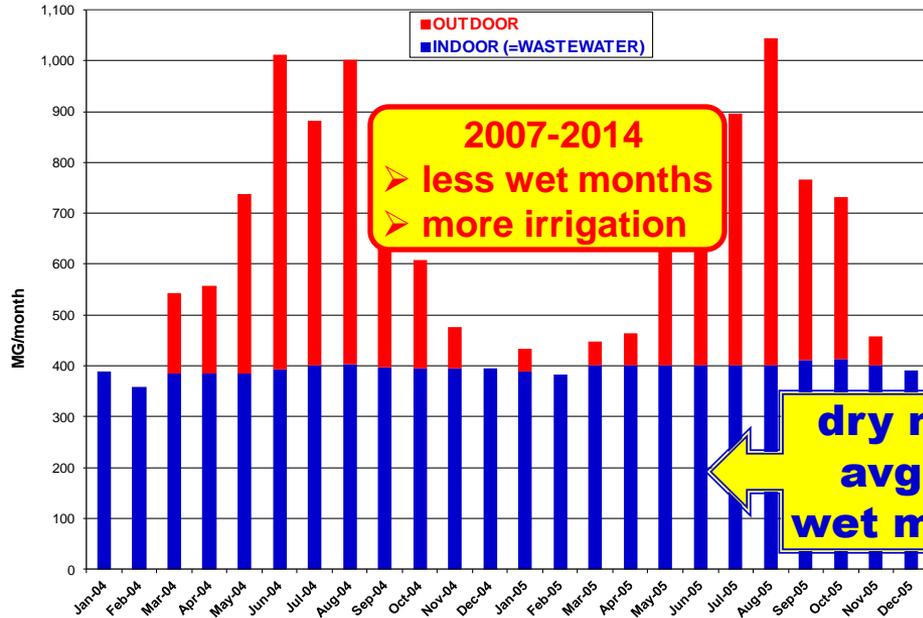


**need to reduce outdoor peaks
to reduce distribution system
capacity & cost**

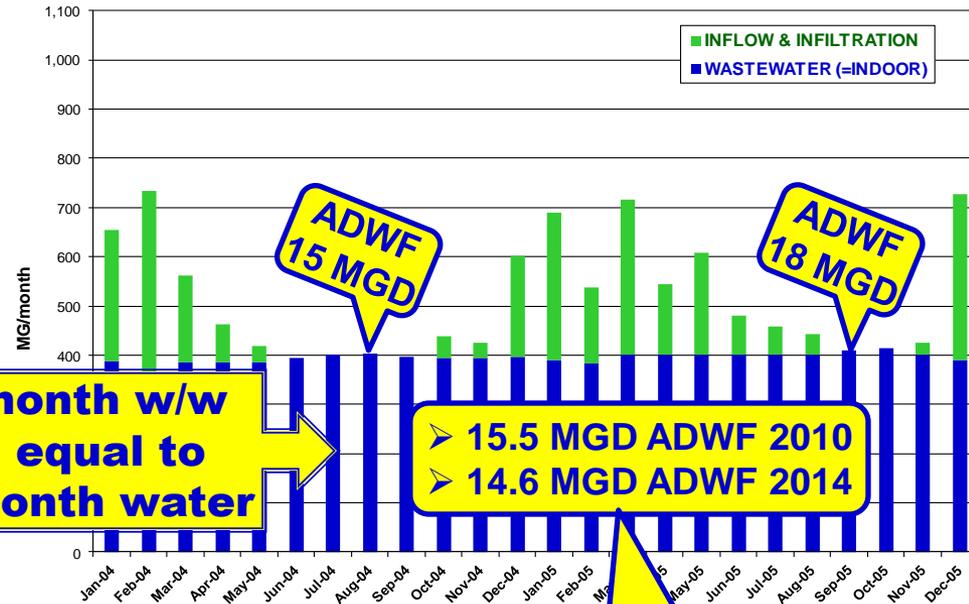
WATER ↔ WASTEWATER

impacted by changing climate and indoor conservation

SANTA ROSA WATER DEMANDS



SANTA ROSA WASTEWATER



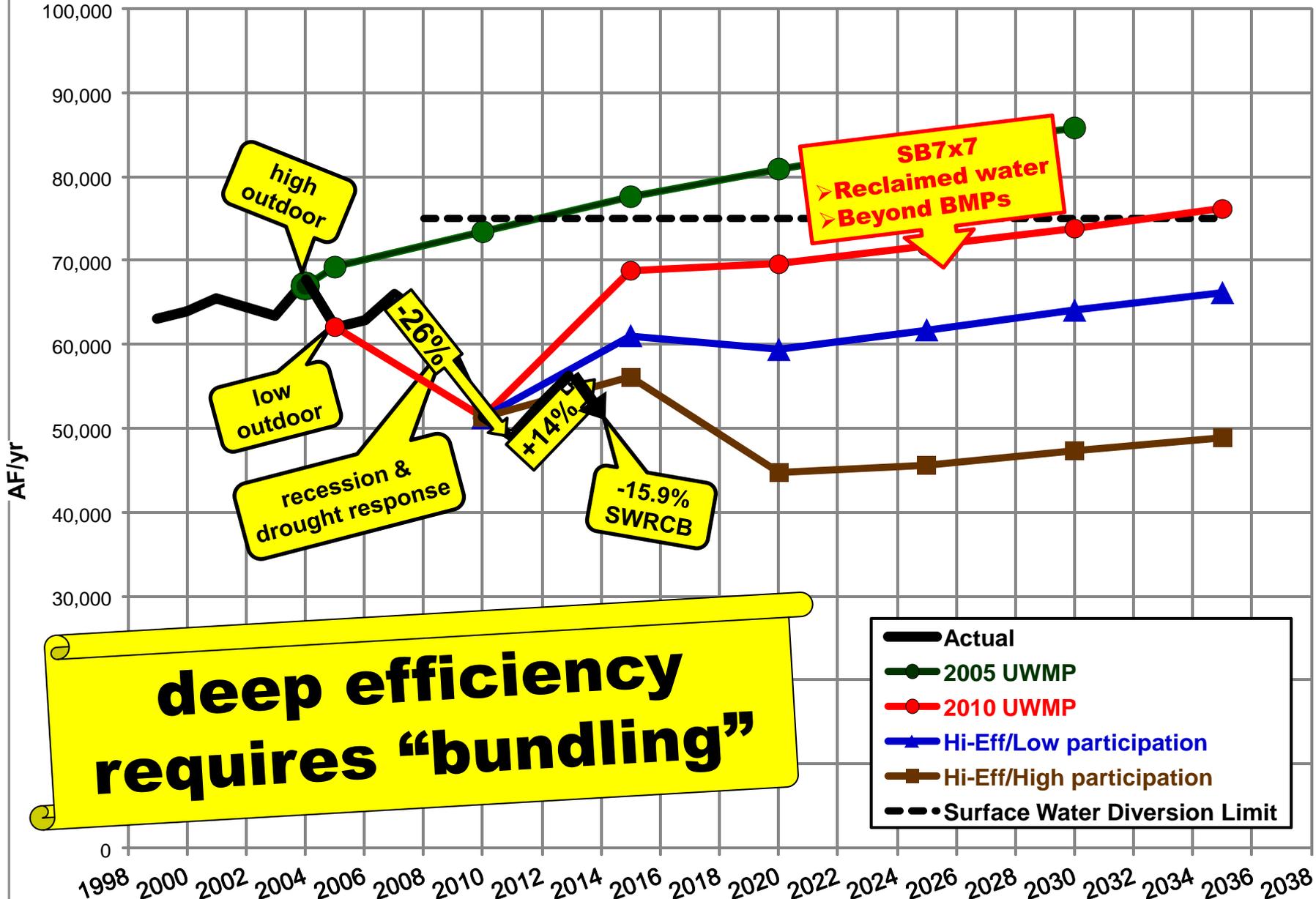
**water use
 impacts wastewater
 capacity & costs**

2007 report
 \$240-720 million for
 25.9 MGD ADWF

BEYOND-CODE WATER EFFICIENCY

INTEGRATING INTO DEMAND PROJECTIONS

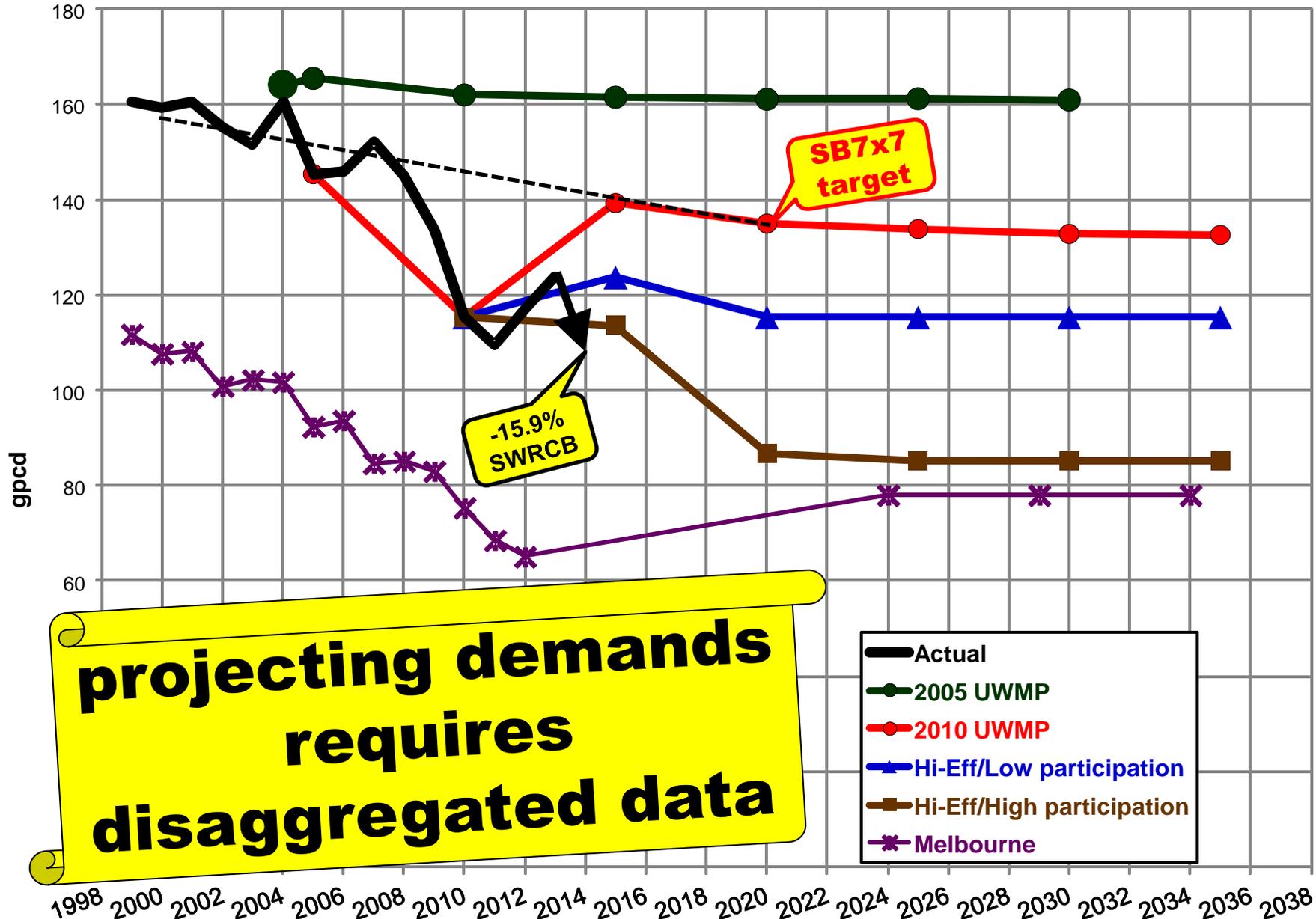
SONOMA COUNTY UWMP DEMAND PROJECTIONS



**deep efficiency
requires "bundling"**

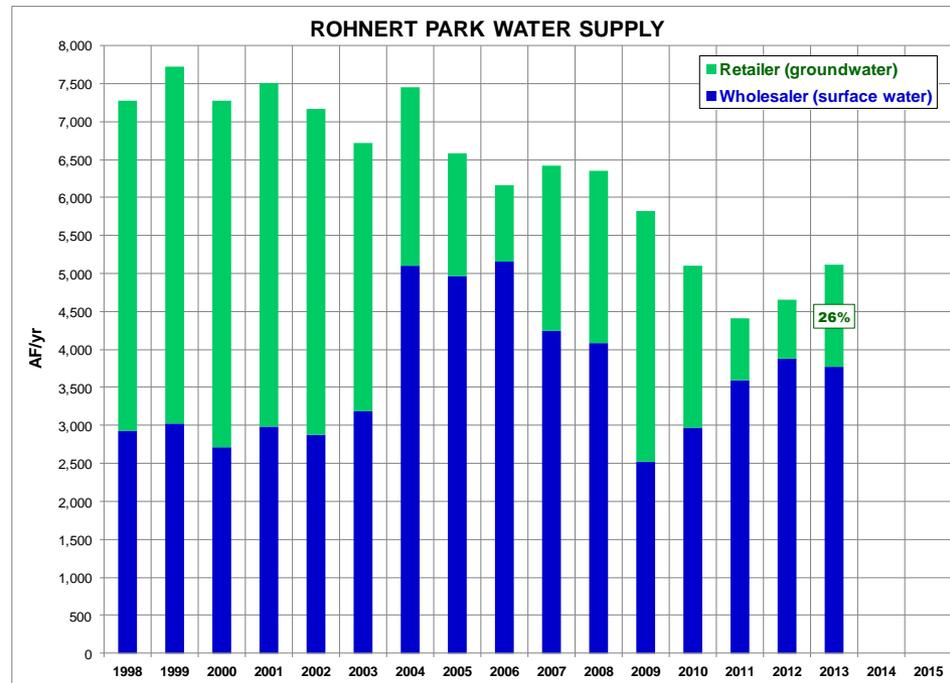
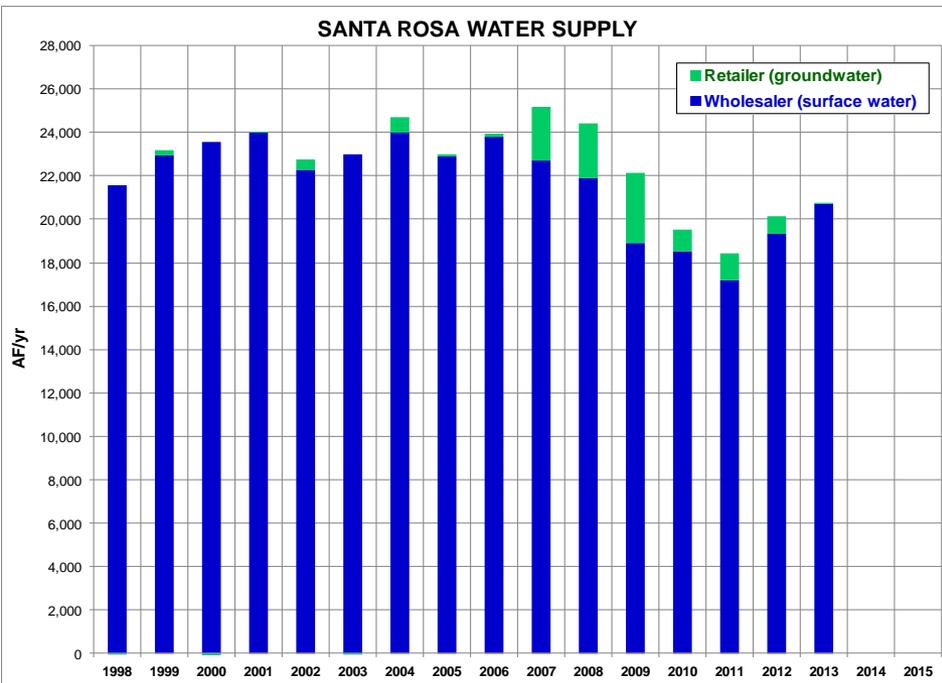
- Actual
- 2005 UWMP
- 2010 UWMP
- ▲— Hi-Eff/Low participation
- Hi-Eff/High participation
- - -●- - - Surface Water Diversion Limit

SONOMA COUNTY UWMP UNIT DEMAND PROJECTIONS



SOURCE WATER MIX

mix depends on regulation, price, and politics



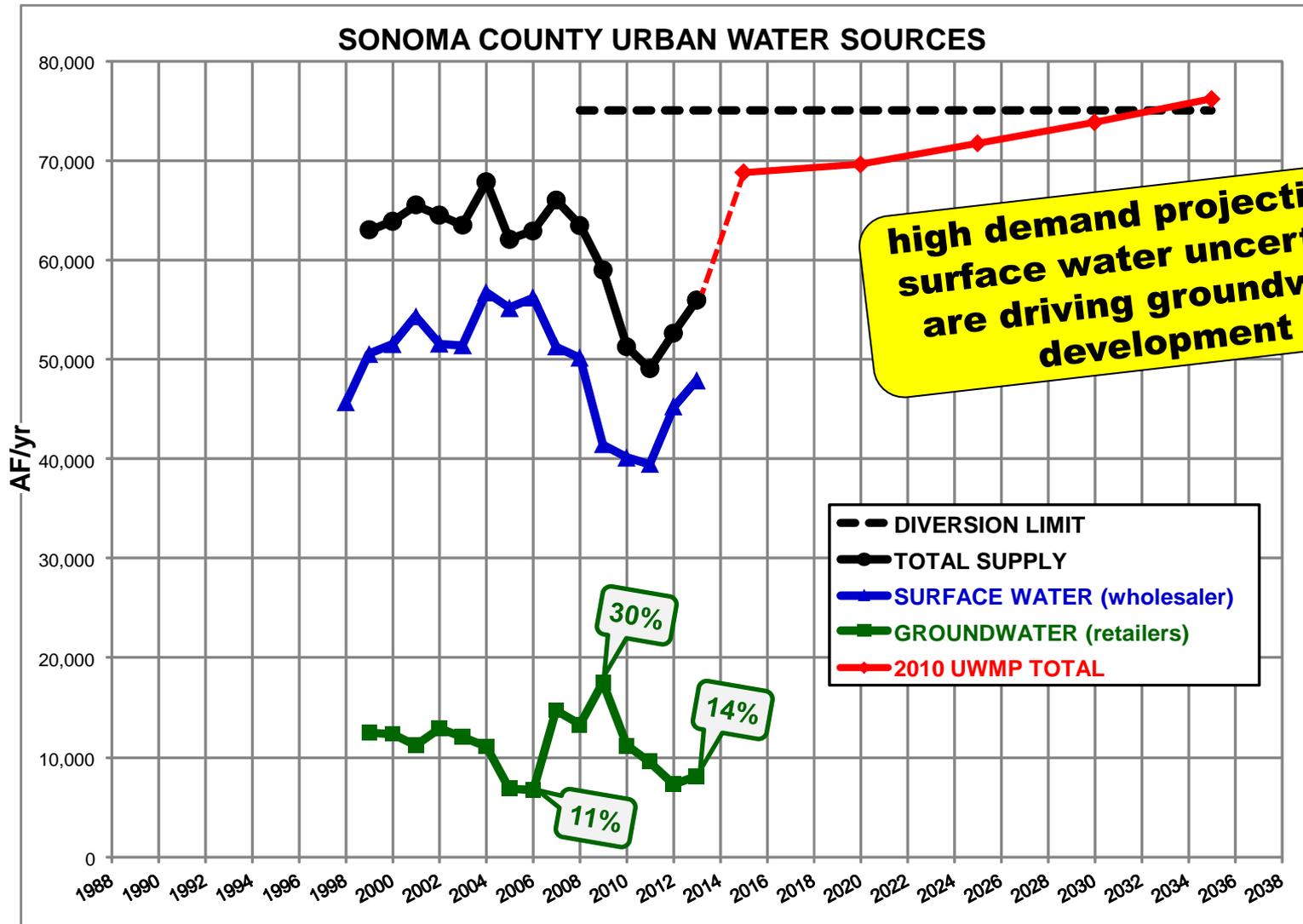
surface water from wholesaler (SCWA)

- climate change is already impacting river flows
- low energy and GHG per gallon

groundwater from retailers' wells

- groundwater availability heavily impacted by past pumping
- high energy and GHG per gallon

SOURCE WATER MIX



mix depends on regulation, price, and politics

future projections from past assumptions that do not reflect recent trends

INTEGRATION NEEDS

**to confirm the feasibility and effectiveness of
“beyond-code” efficiency scenarios:**

1. Billing data must be disaggregated:

- indoor from outdoor use
- customer type and location

2. Statistical trends must be validated for different periods:

- pre 2007 - slow decline
- 2007 to 2011 - steep decline
- 2011-2013 - rapid increase
- 2014 - rapid decline

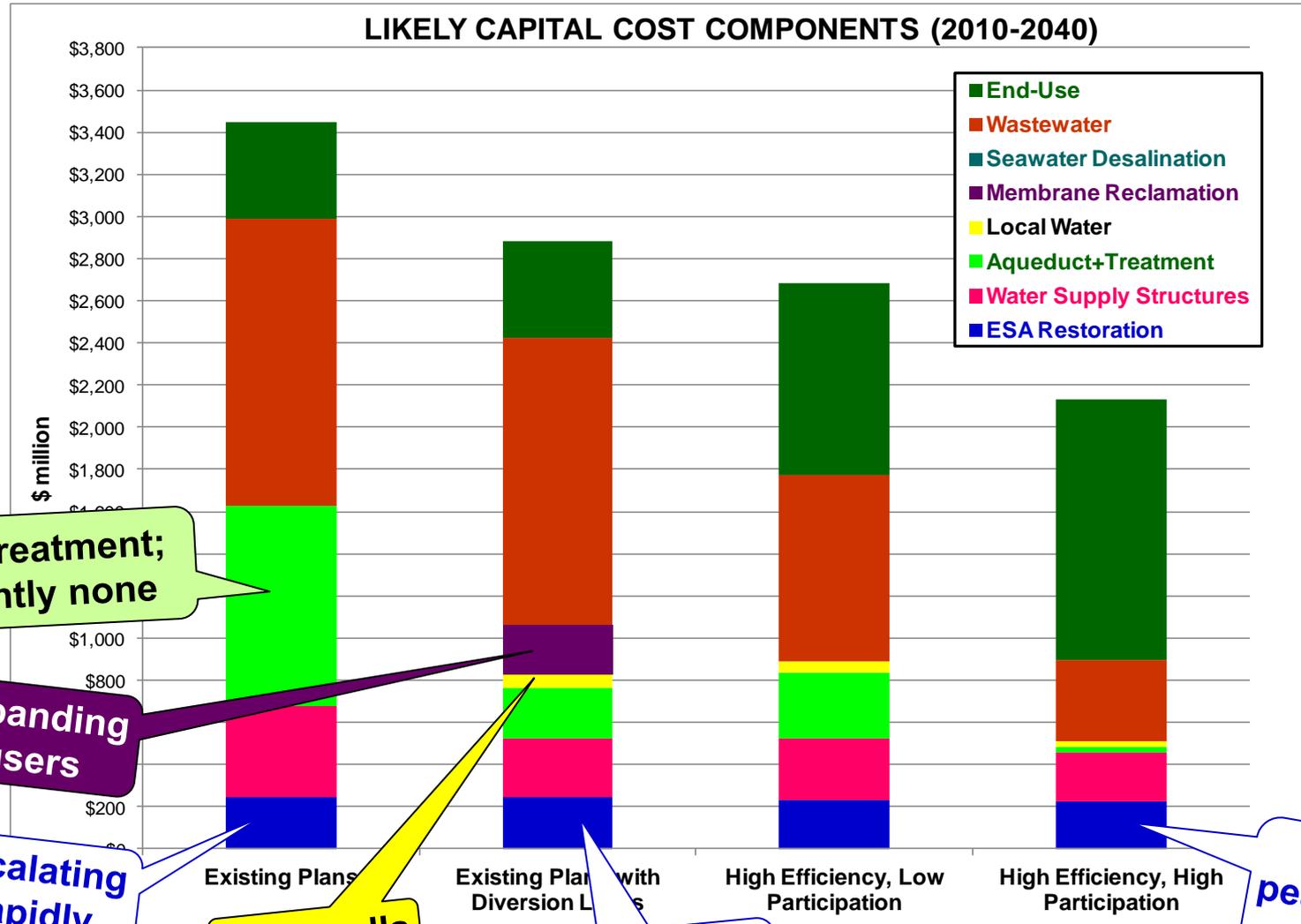
3. A range of scenarios must be examined to accommodate variability

BEYOND-CODE WATER EFFICIENCY SCENARIOS

ECONOMIC POTENTIAL

CAPITAL COST ELEMENTS

all water, wastewater, and watershed restoration projects



adds treatment;
currently none

expanding
users

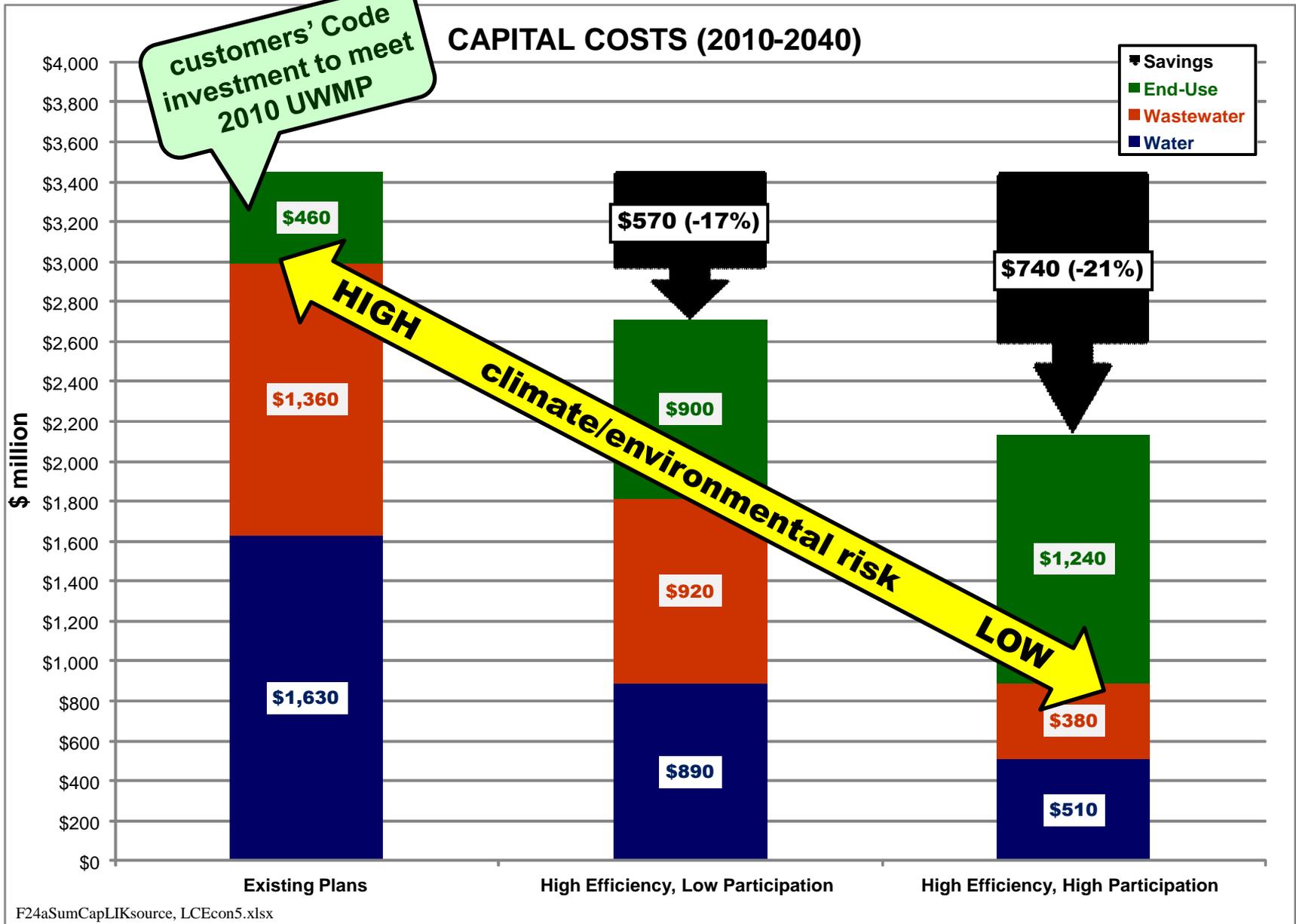
escalating
rapidly

adds wells

escalating
rapidly

lower if
peak outdoor
reduced

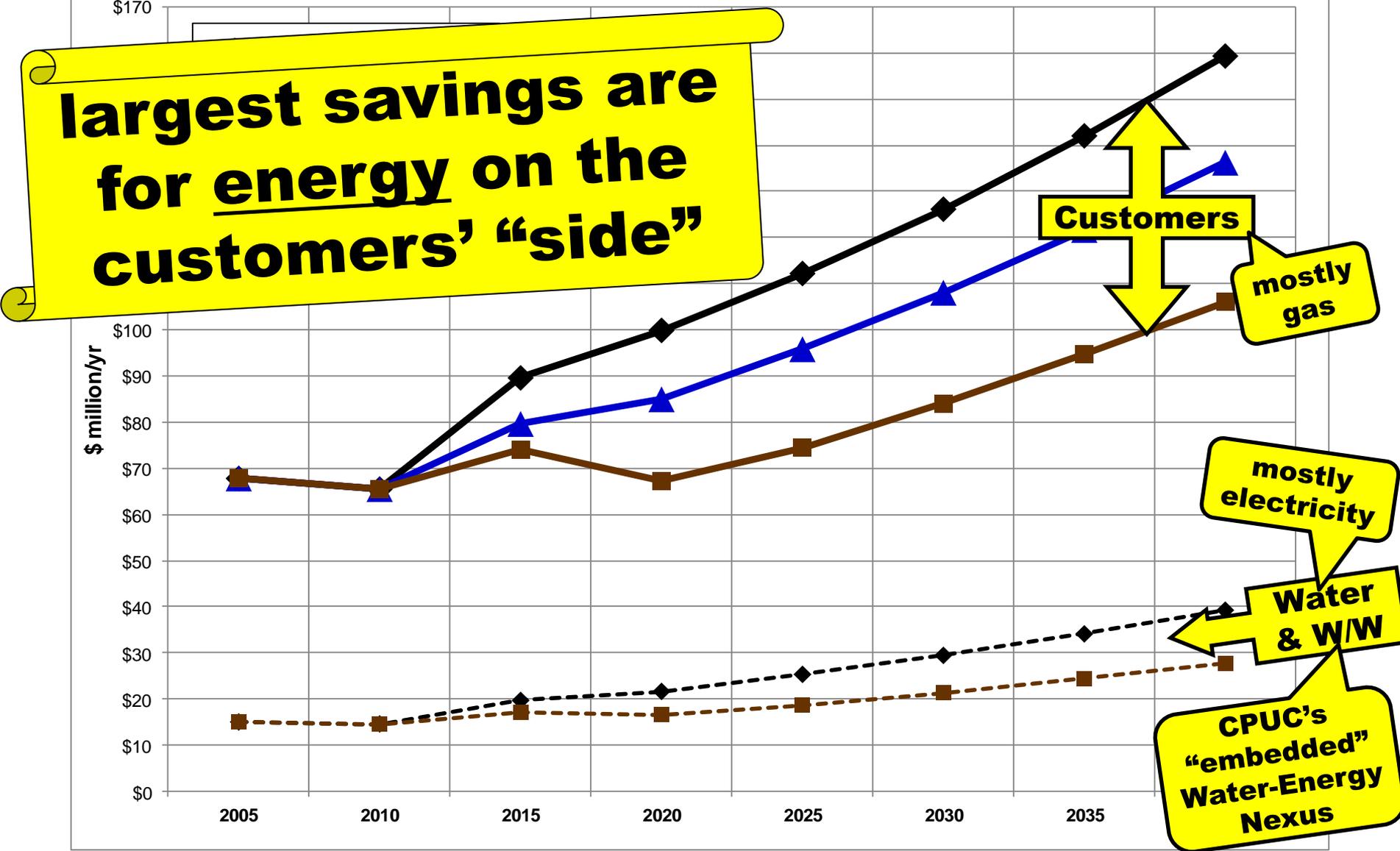
CAPITAL CATEGORIES



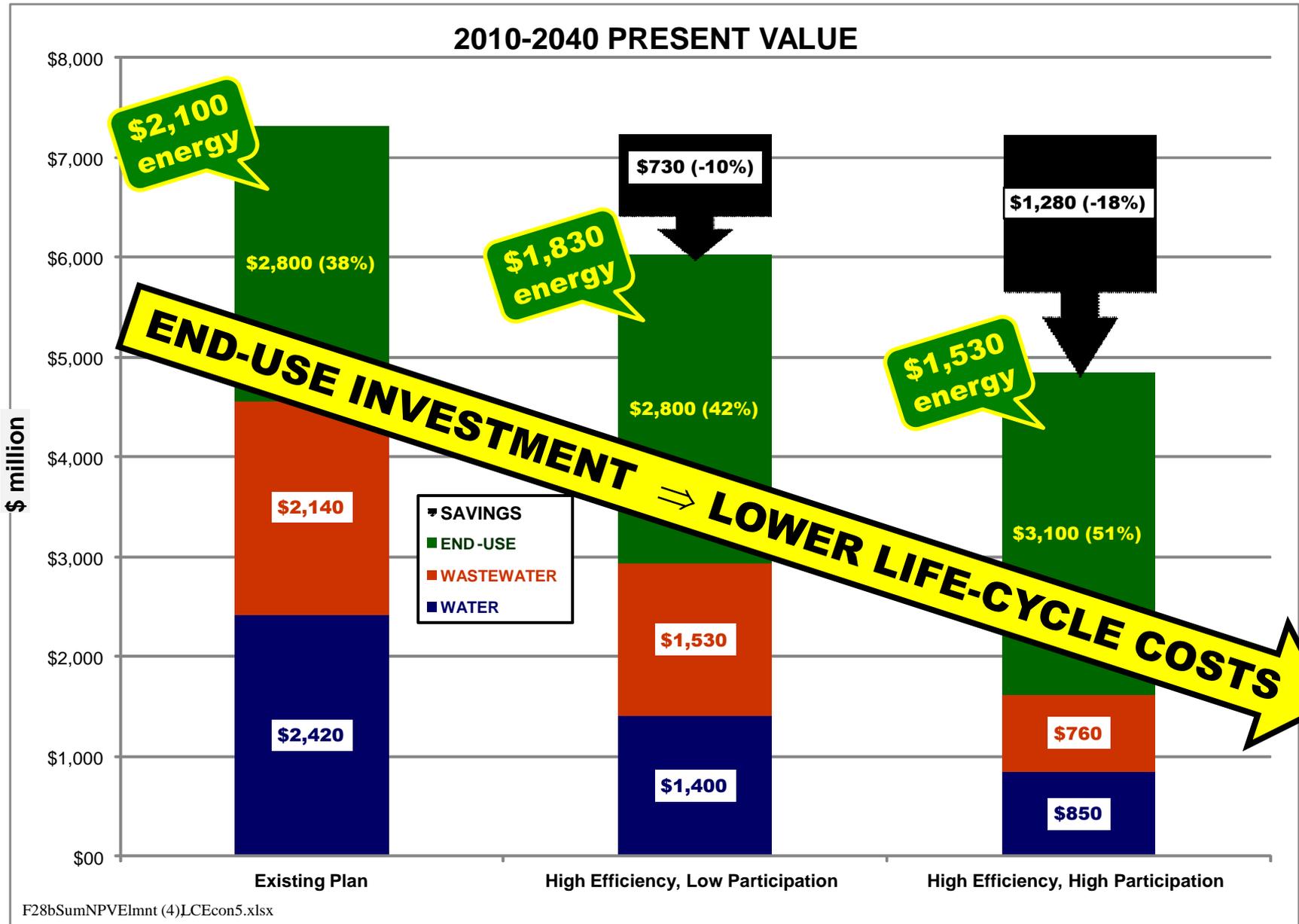
ENERGY COST CATEGORIES

F26SumOpCostEND, LCEcon5.xlsx

ANNUAL WATER-RELATED ENERGY COSTS



LIFE-CYCLE COSTS



ECONOMIC BENEFIT

- 1. Water and wastewater infrastructure investment (bonds) can be reduced**
- 2. Adding cost of customers' water efficiency can still be lower than bonds for existing plan**
- 3. Lower life-cycle cost implies lower - at least more stable - water-related bills**

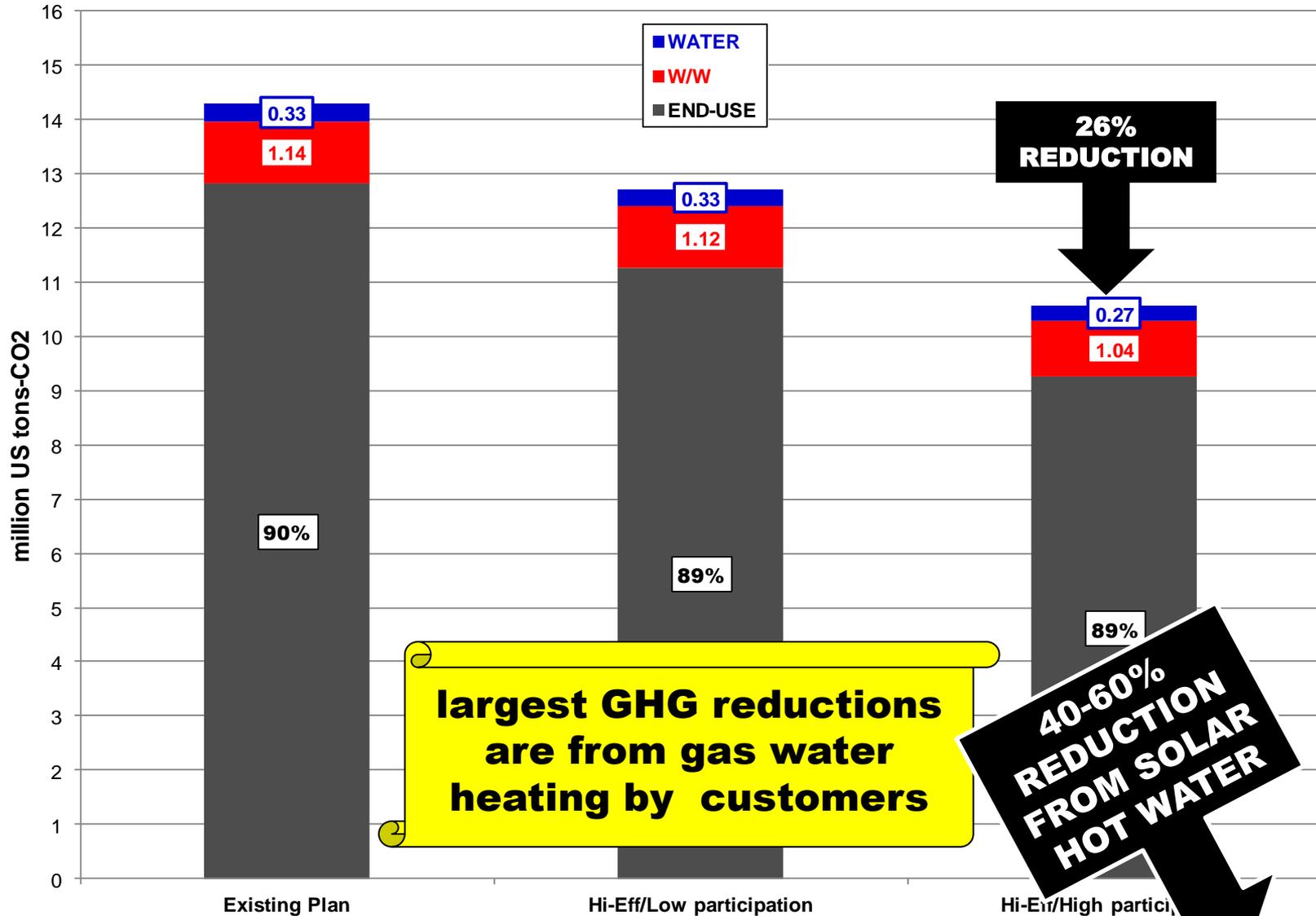
BEYOND-CODE WATER EFFICIENCY

GREENHOUSE GAS EMISSIONS

GHG EMISSIONS

F22SumLCghg, LCEcon5.xlsx

2010-2040 WATER-RELATED GHG EMISSIONS



ISRAEL: SOLAR HEATERS (85% of homes)

vertical tank, no pump, electric resistance backup



AUSTRALIA : SOLAR HEATERS

horizontal tank, no pump, electric resistance backup



BEYOND-CODE WATER EFFICIENCY

SHOULD WE PAY FOR IT?

Water & W/W agencies

- Lower infrastructure bonds & energy costs, with more reliability
- Reduces cost of environmental compliance & GHG reductions

Customers

- Lower/stabilized water, sewer, and water-related energy bills
- “Green building” upgrades

Community

- Sustainable water supply and GHG reductions, at lower cost
- Local “green” construction jobs

BEYOND-CODE WATER EFFICIENCY

HOW CAN WE PAY FOR IT?

Infrastructure bonds lower than for existing plans

Financing and repayment by customers

- PACE loans (property taxes) Sonoma County Energy Independence Program
- PAYS® program (elec/water/sewer bills) Windsor Efficiency PAYS
- CEC, SWRCB, DWR loans for water/energy efficiency projects
- JPA (special district)

Grants for evaluations and pilot projects

- CEC, SWRCB, DWR support for “Water-Energy Nexus”
- Federal water and energy agencies

BEYOND-CODE WATER EFFICIENCY

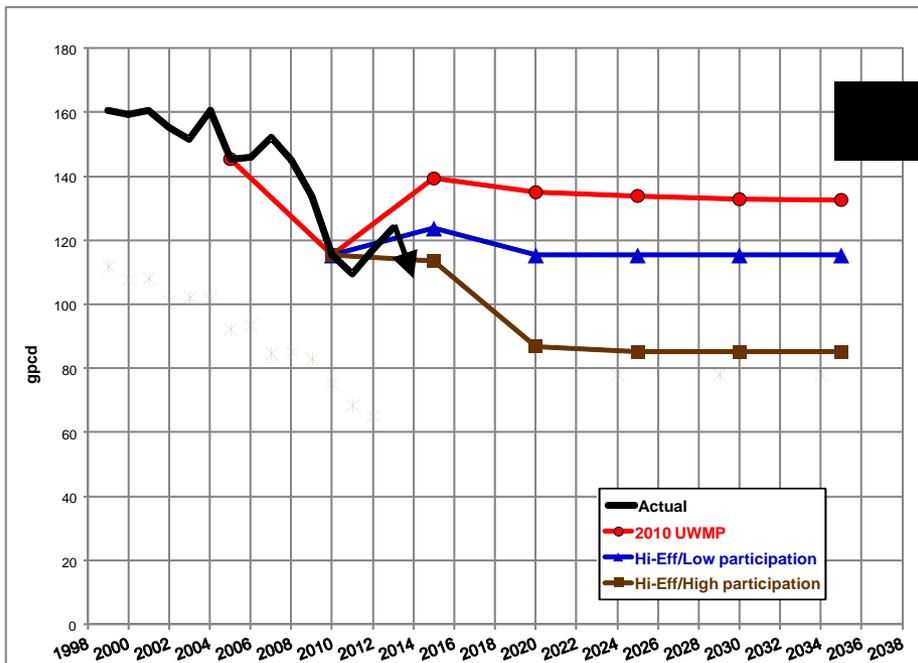
SUMMARY

- Technology widely available
- Integrate “bundles” into disaggregated demand categories
- Include all water, wastewater, and restoration capital costs
- Include water-related energy costs for agencies and customers
- Include water-related GHG reduction costs
- Develop comprehensive program to overcome market barriers

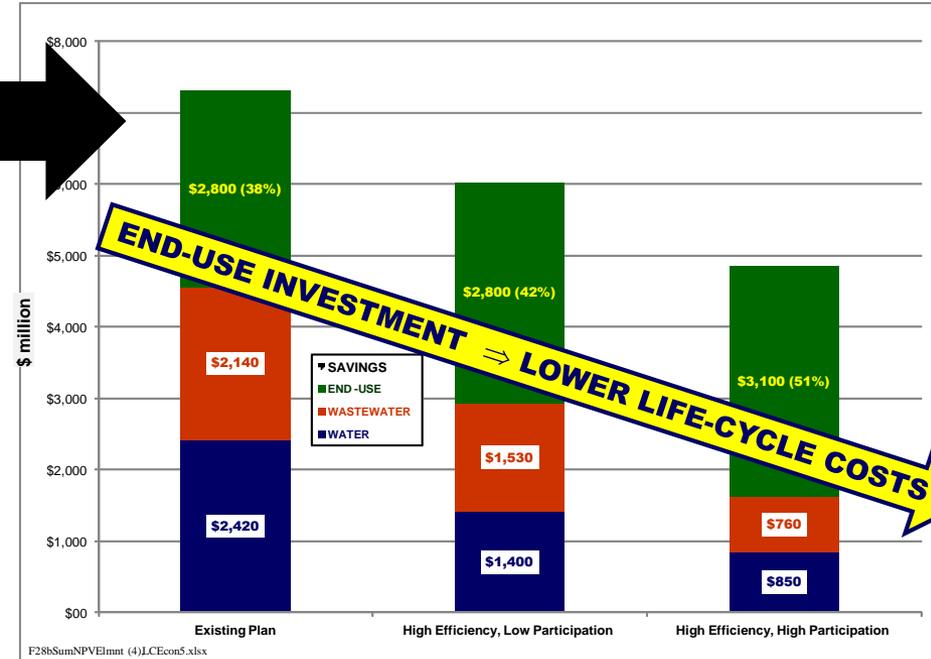
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unit water demand



life-cycle cost



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