



WATER & ENERGY NEXUS

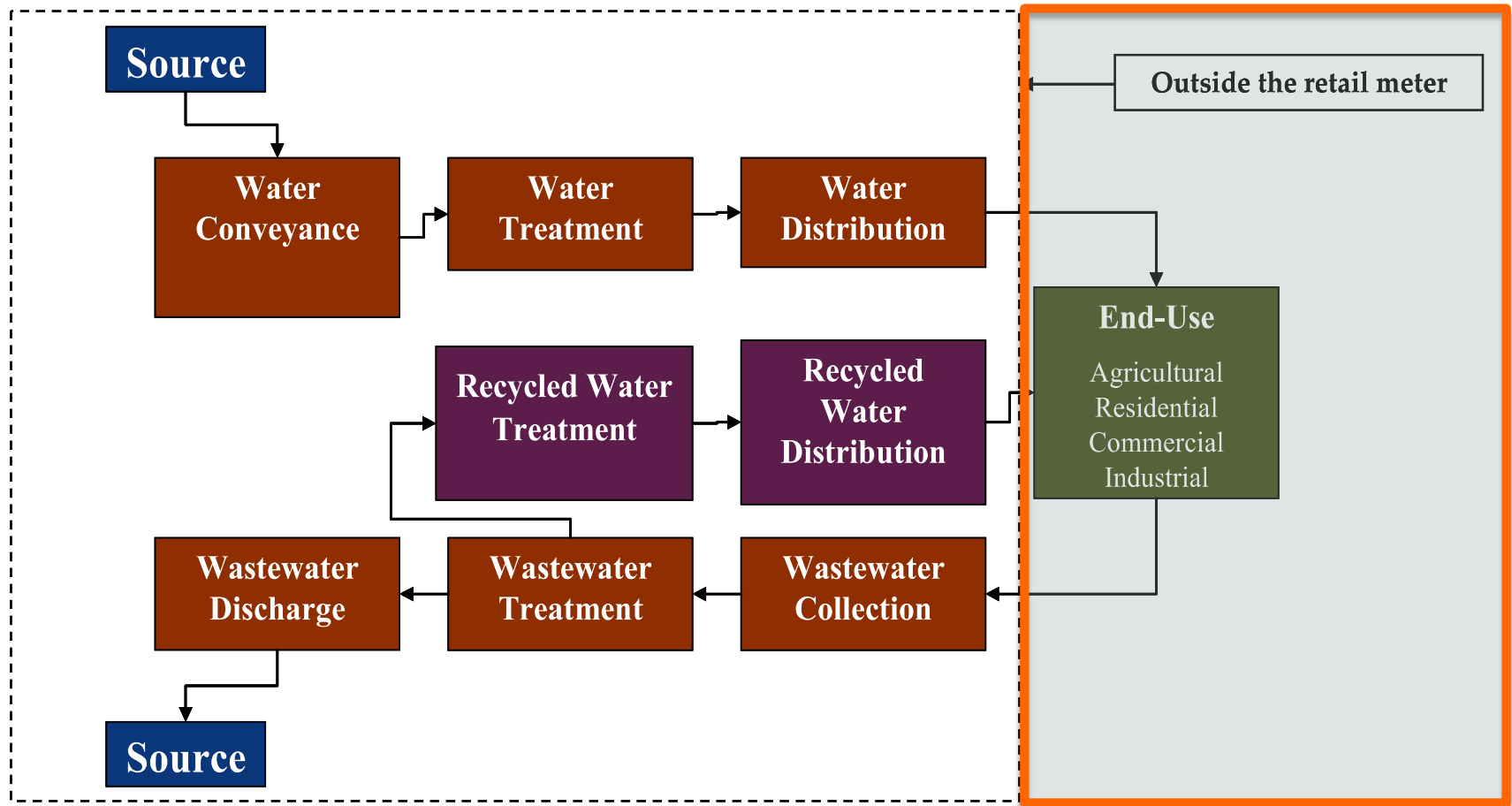
2016 Business of Local Energy Symposium

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Water-Energy Nexus

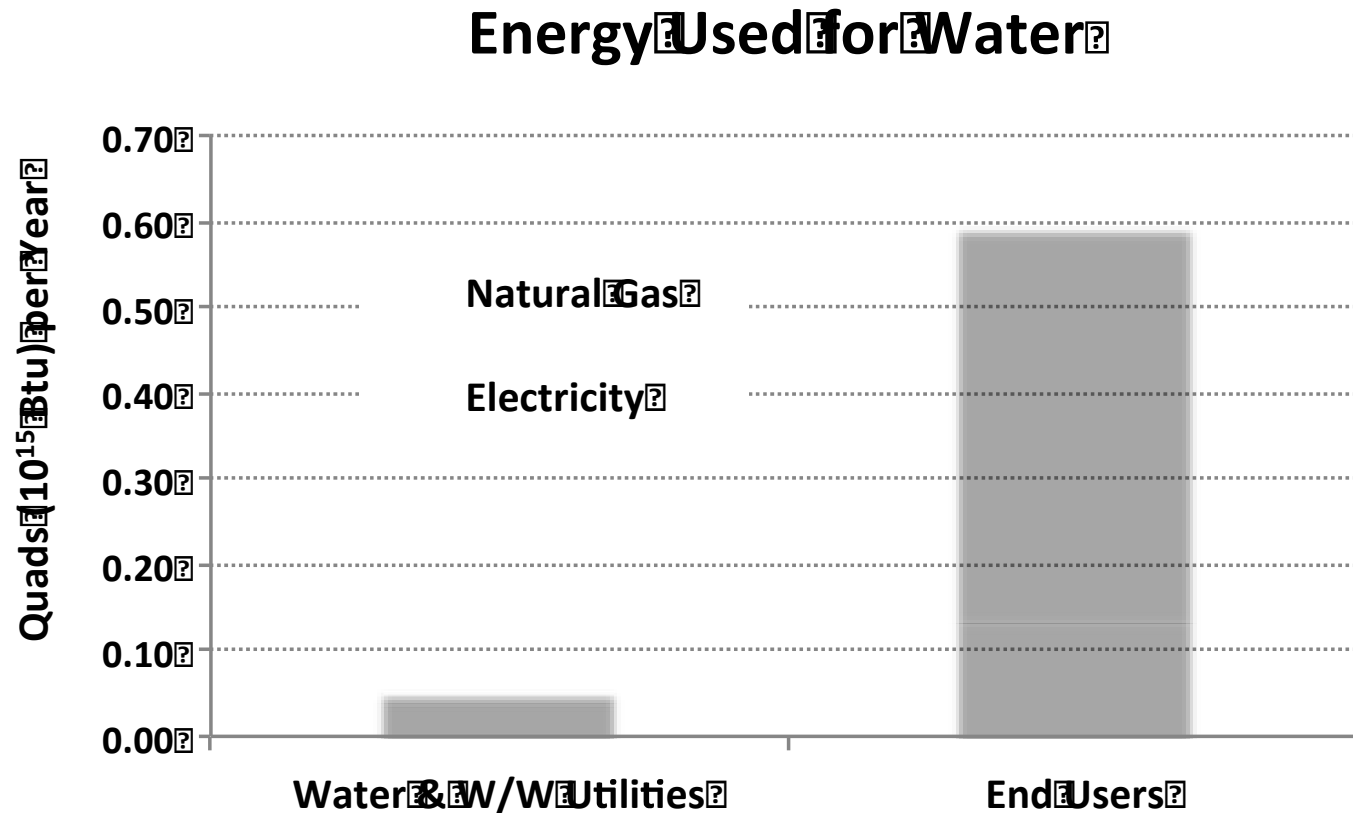
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Figure 1. The water-use cycle



Energy Used for Water (California)

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~92% of energy use (and GHG emissions) occur on the customer's side of the meter (subject of this presentation)

Indoor Water Efficiency

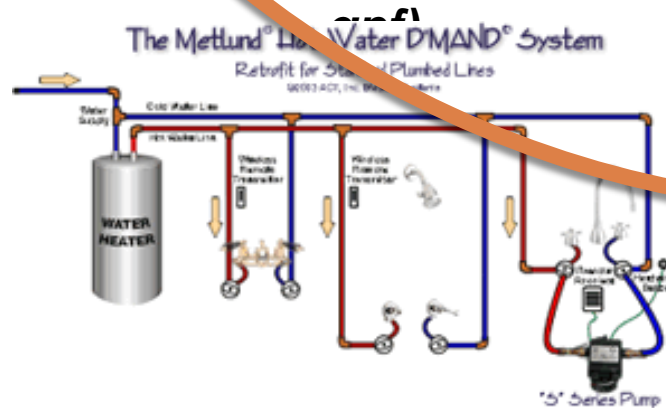
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Premium Clothes washer
(~9 gal per full load)



Ultra High Efficiency Toilet (0.8



Hot Water Demand Recirculation System



Aerators

1.5 gpm Kitchen



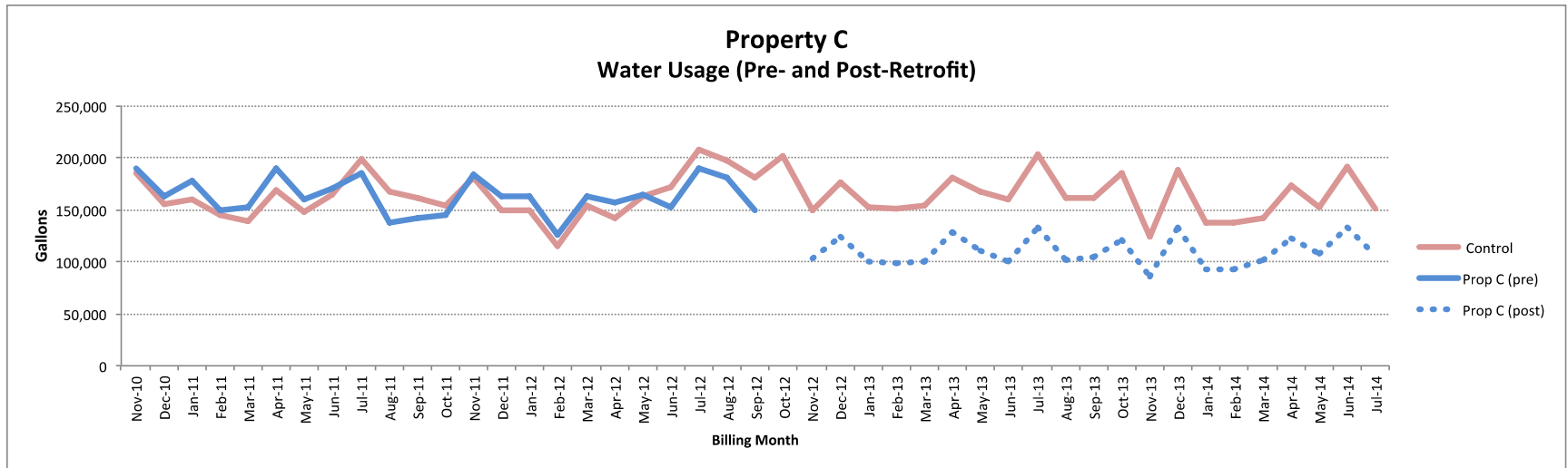
0.5 gpm Bath



High Performance 1.5 gpm Showerhead

Example Multi-Family Savings Analysis

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Savings Analysis							
Group	Pre	Post	Savings		Pre and Post Sample		
	Avg gl/mo	Avg gl/mo	gl/mo	% reduction	Variances Equivalent?	Probability; Finding	Difference of Pre- and Post- Mean Values
Control (N=36)	163,374	161,903	1,470	0.9%	0.80	Yes	0.41 The Null Hypothesis (Pre Retrofit mean usage = Post Retrofit mean usage) cannot be rejected
Property C	163,374	109,608	53,766	32.9%	0.34	Yes	4.61E-14 The Null Hypothesis (Pre Retrofit mean usage = Post Retrofit mean usage) may be easily rejected
Net Savings:			52,296	32.0%			

Notes

The Control Group includes all Windsor multifamily water customers not participating in Windsor Efficiency PAYS nor having billing records with a unit pre-retrofit standard deviation (standard deviation of annual usage for 2009 - 2012 / total usage for 2009-2012) that exceeds the maximum among all participants. The latter condition excludes properties with incomplete records and those with exceptional incidental irrigation usage. Control Group usage is adjusted by an appropriate ratio (same for all periods) to match pre retrofit average usage for the retrofitted property. The pattern of this indexed version of the control group, however, remains identical to that of the full Control Group.

Pre Retrofit Period used for this specific Savings Analysis: Nov 2010 - Sep 2012

Post Retrofit Period used for this specific Savings Analysis: Nov 2012 - Jul 2014

The F-Test, available within Excel, was employed to determine if variance of pre-and post samples are equivalent (in the above case, they are, for both groups)

The T-Test, available within Microsoft Excel, was used to understand if the mean values of pre- and post- samples are equivalent or not. The specific test used above is 1 tail, two-sample equal variance.

The difference between pre- and post-means is significant for the retrofitted property but not the control group.

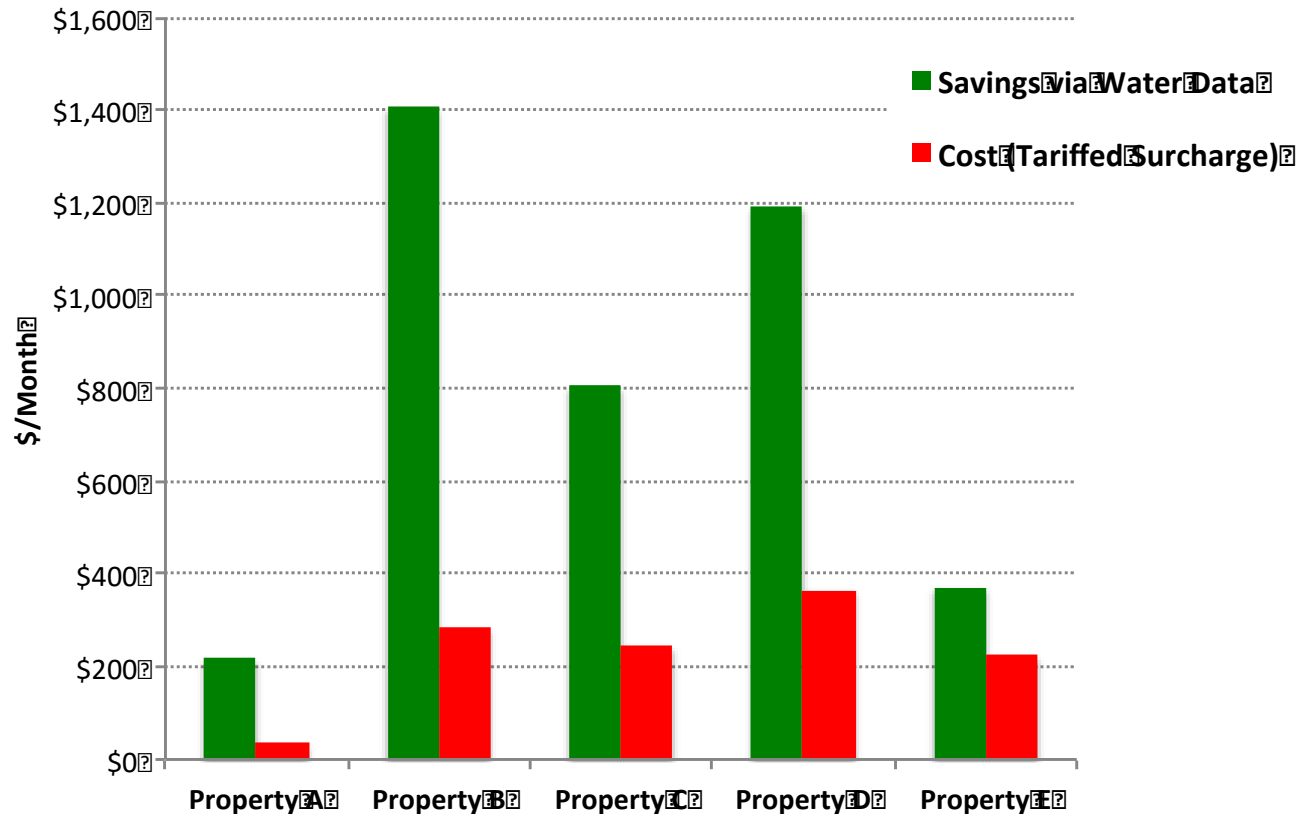
Example Multi-Family Savings Analysis

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Multi-family properties served by Windsor Efficiency PAYS®

Indoor water savings for these post-1995 bldgs averaged 33% via new toilets, showerheads, and aerators.

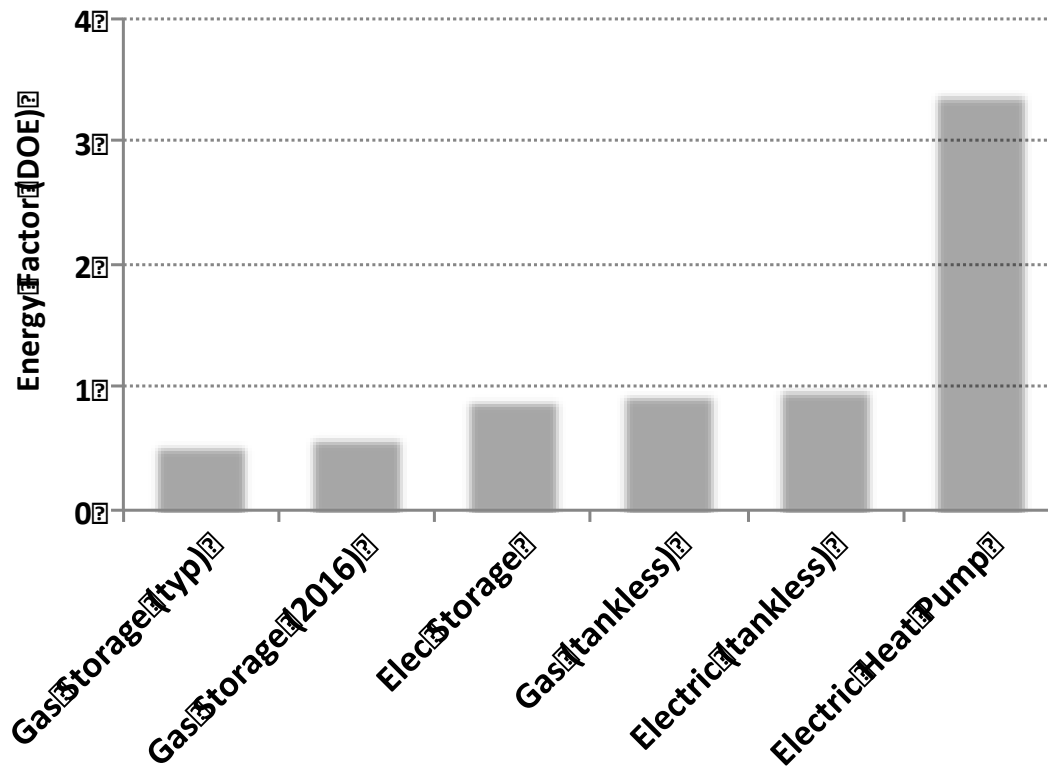
Financial Performance for Property Owner



Water-Energy Game-Changer

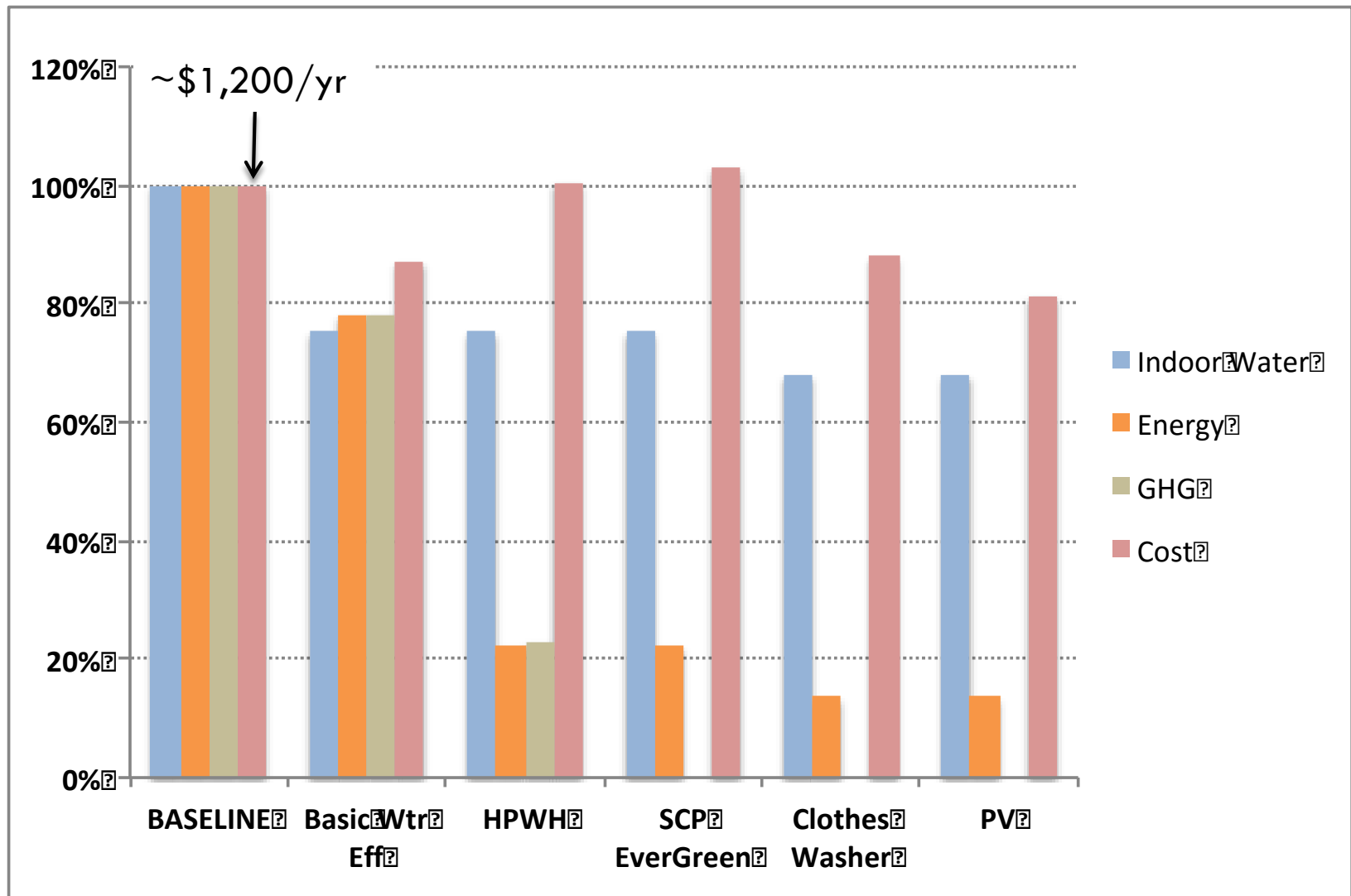
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Residential Water Heater Efficiency



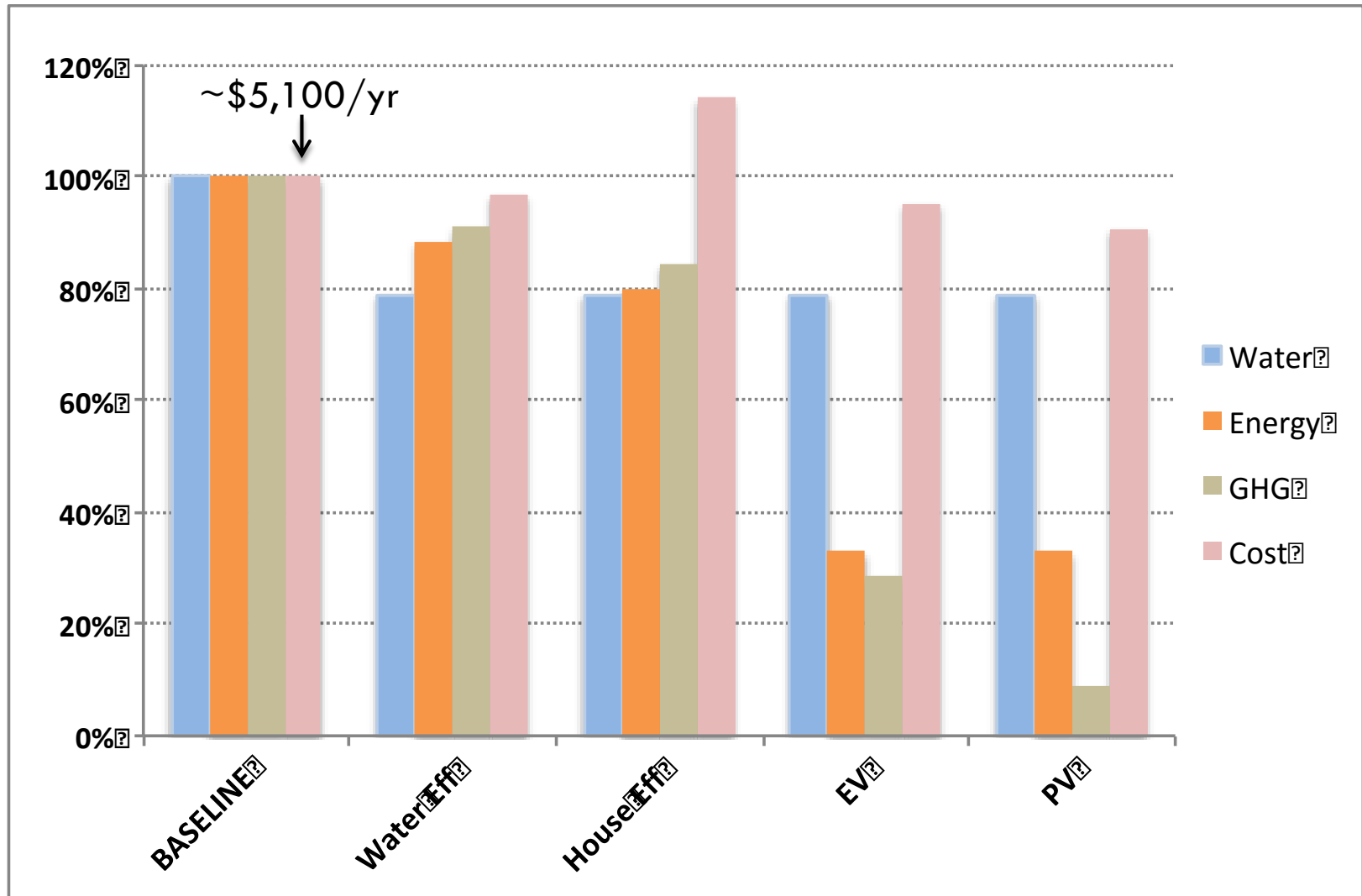
Water-Energy Nexus: SFD Indoor Water

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Resource Nexus: Whole House

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Let's Innovate!

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Dutch Astronaut/physicist Wubbo Ockles with 155 mph, 23 passenger electric Superbus

Notes

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Most energy use and GHG emissions associated with water use in California occur on the customer's side of the meter. Water heating is the key issue for municipal water use. This presentation suggests utilities – especially new CCEs – may soon enable their customers to virtually eliminate GHGs associated not just with water heating, but also space heating and cars. The effect of the PAYS[®] implementation system, designed to eliminate most market barriers to cost-effective efficiency measures, is outlined above when used to deploy just simple indoor water efficiency measures (see <http://www.townofwindsor.com/index.aspx?nid=819>).

One slide shows how this may be extended to remove all GHG associated with water heating by installing an 80 gl electric heat pump water heater (sized to support grid integration); this also indicates on-site PV may be the smartest source of GHG-free electricity for the end user. Given the public interest value, 3% public bond financing is assumed, with a 10-yr term for all except PV (20 yr). Pro forma resource use and total annual cost to the customer for successively deeper levels of effort are estimated relative to Baseline. Direct support cost will be reduced if appliances are replaced immediately upon burnout instead of earlier (finance less than the total cost new).

The scenario is extended to include electric heat pump space heating and enough PV to cover an EV for 16,000 mi/yr. Conservative estimates used; no Net Metering advantage assumed.

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