Product: School Education Kit

A package of home energy efficiency measures in a kit that can be distributed to 6th grade students. Each participant receives a kit containing six compact fluorescent bulbs, a low flow shower head, a kitchen faucet aerator, and a bathroom faucet aerator. In addition, other items are included such as a thermometer, filter alarm, leak detection tablet, night light and tape measure.

Algorithms:

CFL/LED Electric Energy Savings (Customer kWh)	= (kW_Base-kW_Eff) x Hr use
CFL/LED Electric Demand Savings (Customer kW)	= (kW_Base - kW_Eff)
Showerhead Electric Savings (Customer kWh)	= (GPY_Saved_Showerhead x Delta_T x 8.33) / HE_Electric /3412 = 421 kWh
Showerhead Demand Savings (Customer kW)	= 0.000 kW
Showerhead Electric Savings (Modified Customer kWh)	= (GPY_Saved_Showerhead x Delta_T x 8.33) / HE_Electric /3412 x % Elec HW = 46 kWh
Showerhead Demand Savings (Modified Customer kW)	= 0.000 kW

Aerator Electric Savings (Customer kWh)	= (GPY_Saved_Aerator x Delta_T x 8.33) / HE_Electric /3412 = 52 kWh for 1.5gpm aerator, 89 kWh for 1.0gpm aerator
Aerator Demand Savings (Customer kW)	= 0.000 kW
Aerator Electric Savings (Modified Customer kWh)	= (GPY_Saved_Aerator x Delta_T x 8.33) / HE_Electric /3412 x %Elec HW = 6 kWh for 1.5gpm aerator, 10 kWh for 1.0gpm aerator
Aerator Demand Savings (Modified Customer kW)	= 0.000 kW

Showerhead Gas Savings (Dth)	= (GPY_Saved_Showerhead x Delta_T x 8.33) / HE_Gas/1,000,000 = 1.65 Dth
Showerhead Gas Savings (Modified Dth)	= (GPY_Saved_Showerhead x Delta_T x 8.33) / HE_Gas x % G HW/1,000,000 = 1.46 Dth

Aerator Gas Savings (Dth)	= (GPY_Saved_Aerator x Delta_T x 8.33) / HE_Gas/1,000,000 = 0.20 Dth for 1.5gpm aerator, .0.35 Dth for 1.0gpm aerator.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Aerator Gas Savings (Modified Dth)	= (GPY_Saved_Aerator x Delta_T x 8.33) / HE_Gas x % G HW/1,000,000 = 0.18 Dth for 1.5gpm aerator, .0.31 Dth for 1.0gpm aerator.
Electrical Energy Savings (Gross Generator kWh)	= (Customer kWh * number of kits) / (1-TLDF)
Electrical Demand Savings (Gross Generator kW)	= (Customer kW * number of kits)*CF / (1-TLDF)
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG x Install Rate
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG x Install Rate

Variables:

Hrs	= Annual operational hours per year of the fixture. 694 hrs will be used for 2014. Reference 3
CF	= Coincidence Factor, the probability that peak demand of the lights will coincide with peak utility system demand. 0.08 will be used for CFLs and LEDs (Ref 2)
kW_EE	= Bulb wattage per supplied CFLs; = 2 x 13W and 3 x 18W. = Bulb wattage per supplied LEDs; = 1 x 11 W
kW_Base	= Bulb wattage replaced by supplied CFLs or LEDs; = weighted average existing EISA federal minimum and incandescent (Ref 10) See Table 4 to look up CFL and LED baseline watts from efficient watts.
Incremental Costs	= costs provided by vendor.
Transmission Distribution Loss Factor (TDLF)	Transmission Distribution Loss Factor = 7.70%, the percentage loss of electricity as it flows from the power plant to the customer.
Net-to-Gross Factor (NTG)	= We will use 100% for school education kits as these kits would not be available without the product.
Install Rate	= Actual Installation Rates will be collected as part of the M&V exercise. For these assumptions, an install rate of 60% for CFLs and 40% for showerheads and aerators has been assumed.
O&M savings	= Operation and Maintenance savings. For school kits O&M savings come from using less water with the install of low flower showerheads and faucet aerators.
GPY_Saved_Showerhead_Total Water	= Gallons per year of total water saved with 1.5 gpm showerhead. 3,292 gal/yr.
GPY_Saved_Showerhead	= Gallons per year of hot water saved with 1.5 gpm showerhead. 2,469 gal/yr of Hot Water.
GPY_Saved_Aerator_Total water	= Gallons per year of total water saved with 1.5 gpm aerator: 378 gal/yr, with 1.0 gpm aerator: 649 gal/yr
GPY_Saved_Aerator	= Gallons per year of hot water saved with 1.5 gpm aerator: 306 gal/yr, with 1.0 gpm aerator: 524 galyr
Delta_T	= Change in temperature of water from incoming water temperature to water heater temperature setting. Delta_T = 64 F. (Reference 4)
HE_Electric	= Heat generation efficiency for electric water heater based on steady-state water heater efficiency. HE_Electric = 0.9172
HE_Gas	= Heat generation efficiency for gas water heater based on steady-state water heater efficiency. HE_Gas = 0.80

Hr Operation_Shower	=Annual water heater "on" time to meet hot water demand. For baseline showerhead: 238 hours. For 1.5 gpm Showerhead: 140 Hours.
Hr Operation_Aerator	=Annual water heater "on" time to meet hot water demand. For baseline showerhead: 36 hours. For 1.5 gpm aerator: 25 hours, for 1.0 gpm aerator: 17 hours.
Measure Life	Measure lives are shown in Table 1.
O&M savings - Showerhead	Showerhead total water savings of gallons/yr and Inc O&M Savings = $
O&M savings - Aerator	Aerator total water savings of gallons/yr and Inc. O&M Savings = $
% Electric Hot Water Heating (% Elec HW)	% Customers that use electricity for domestic water heating = 11%
% Gas Hot Water Heating (% Gas HW)	% Customers that use gas for domestic water heating = 89%

Tables:

Table 1. Operational Hours / Coincidence Factor / Measure Life

Measure	Operational Hours	Coincidence Factor	Measure Life	Source
School Education Kit-Showerhead	See Variables	0%	10	Reference 9
School Education Kit-Faucet Aerator	See Variables	0%	10	Reference 9
CFLs (5 bulbs) in 2014	694.0	8%	14.42	
LEDs (1 bulb) in 2014	694.0	8%	20	

	Material Costs					
Table 2 Measure Cost	**Total**	**Electric**	**Gas**			
School Education Kit						
School Education Kit- 13 W CFLs	$2.98	$2.98	$0.00			
School Education Kit - 11 Watt LED	$9.80	$9.80	$0.00			
School Education Kit- 18 W CFLs	$5.64	$5.64	$0.00			
Shower head	$2.95	$0.32	$2.63			
Faucet aerator (Kitchen)	$1.11	$0.12	$0.99			
Faucet aerator (Bath)	$0.44	$0.05	$0.39			
Electric Total = $18.92		$18.92				
Gas Total = $4.01			$4.01			
School Kit Total = $22.92	$22.92					

~~**Table 3 - Existing lighting wattage for residential lights (Reference 8)**~~

~~CFL Wattage Range~~	~~Replaced Incandescent Bulb Wattage (2014)~~
~~9 - 12~~	~~29.0~~
~~13 - 16~~	~~43.0~~
~~17 - 22~~	~~53.0~~

~~23 - 30~~	~~72.0~~
~~31 - 52~~	~~150.0~~

Table 4 - Existing lighting wattage for residential lights

Bulb Wattage Table					
Eff Watts	Baseline Watt CFL	Baseline Watts LED	Eff Watts	Baseline Watt CFL	Baseline Watts LED
4		33.00	19	57.50	76.00
5		33.00	20	57.50	76.00
6		33.00	21	57.50	76.00
7	33.00	48.50	22	57.50	76.00
8	33.00	48.50	23	76.00	76.00
9	33.00	48.50	24	76.00	76.00
10	33.00	48.50	25	76.00	150.00
11	33.00	57.50	26	76.00	150.00
12	33.00	57.50	27	76.00	150.00
13	48.50	57.50	28	76.00	150.00
14	48.50	57.50	29	76.00	150.00
15	48.50	57.50	30	76.00	150.00
16	48.50	76.00	31	150.00	150.00
17	57.50	76.00	32	150.00	150.00
18	57.50	76.00	>=32	150.00	150.00

Assumptions:

Provided by Customer:	**Verified during M&V:**
Number of kits distributed	Yes
Was CFL #1 installed	Yes
Was CFL #2 installed	Yes
Was CFL #3 installed	Yes
Was CFL #4 installed	Yes
Was CFL #5 installed	Yes
Was LED #1 installed	Yes
Was showerhead installed	Yes
Was Kitchen aerator installed	Yes

Was Bath aerator installed	Yes

Changes From 2012:

Hrs of operation dropped

Wattage of the baseline bulb dropped

References

1. US DOE US Lighting Market Characterization Stı 2002
2. Composite Wattages, Operating Hours and Coincidence from CFL METERING STUDY FINAL REPORT, Prepared for: Pacific Gas & Electric Company, San Diego Gas & Electric Company, Southern California Edison Company, 2005
3. Xcel Energy Home Lighting and Recycling Program Assumptions
4. "The effects of variation in body temperature on the preferred water temperature and flow rate during showering" Authors: Tadakatsu Ohnaka, Yutaka Tochihara, Yumiko Watanabe. Affiliations: a) Department of Physiological Hygiene, The Institute of Public Health, Minato-ku, Tokyo, Japan; b) Faculty of Home Economics, Jissen Women's University, Hino, Tokyo, Japan.
5. Handbook of Water Use and Conservation, Denver Water Conservation
6. California Measurement Advisory Committee (CALMAC) Protocols, Appendix F (www.calmac.org/events/APX_F.pdf).
7. DOE HW Appliance calculator
8. Lighting Baseline Watts per Agreement with Minnesota Division of Energy Resources. Based on a DOE report table
9. DEER Database for Energy Efficient Resources 2011 update to EUL data
10. US EPA Next Generation Lighting Program Report on Opportunities to Advance Efficient Lighting - Table 3