



Date: September 21, 2010
To: Becky Eberle
From: Jamie Drakos and Meghan Lee
Re: Assessment of Washington Energy Education in Schools –
2009-2010 Program Year

This memo provides an assessment of the Washington Energy Education in Schools Program, and includes the following:

- Program Structure
- Participation
- Data Collection Procedures
- Participant Characteristics
- Measure Installation and Adoption of Energy Savings Actions
- Program Impacts
- Program Cost Effectiveness

Program Structure

A total of 4,127 sixth-grade students received education through the local Community Action Agencies (Agencies) delivering the program. The following three agencies were responsible for Program delivery:

- Blue Mountain Action Council (BMAC), Walla Walla
- Northwest Community Action Center (NCAC), Toppenish
- Opportunities Industrialization Center of Washington (OIC), Yakima

Each of the agencies employs a certified teacher (or teachers) to promote the Program to school administrators and teachers in local school districts. The certified teacher serves as an Energy Instructor, delivering energy education in three classroom sessions. The energy education

curriculum covers the basics of energy production and consumption, creates awareness of resource use, and instructs students in ways that they and their families can reduce electricity use. Participating students receive a kit of low-cost efficiency measures to encourage them to put their new knowledge into practice. The kits contained the following efficiency measures:

- 14 watt compact fluorescent light bulb
- High efficiency kitchen faucet aerator
- Wall plate thermometer
- Electroluminescent (EL) nightlight
- Shower timer
- Various measurement devices to assess baseline energy consumption including refrigerator/freezer temperature card, water temperature card and water flow bag

Agencies also distribute a high-efficiency showerhead to students that have electric water heating and do not already have a high efficiency showerhead installed.¹

Participation

Participation across the three agencies and overall is shown in Table 1.

Table 1. Participation by Agency

	Student Participants		Percent of Estimate
	Estimate	Actual	
BMAC	775	520	67.1%
NCAC	1,800	1,573	87.4%
OIC	1,800	2,034	113.0%
<i>Total</i>	<i>4,375</i>	<i>4,127</i>	<i>94.3%</i>

The Program met 94.3% of its overall participation goal of 4,375 students, with 4,127 participants across the three Agencies.

Data Collection Procedures

The Program utilized three data collection tools this year: Home and Appliance Characteristics Survey, Installation Survey, and Follow-Up Survey. These data collection tools were designed to:

¹ Determined by pre-installation flow rates of 2.5 gallons per minute or higher. Students test flow rate with water flow bag included in kit.

- Increase awareness of electricity usage in the home and capture key household characteristics that impact electricity consumption
- Encourage and track the installation of energy efficiency measures and adoption of savings behaviors
- Document student learning and their efforts to share their new knowledge with other members of their household

This year, Program staff updated the data collection tool in order to automate the data entry process. Instead of written surveys, the students filled out scantron surveys that were designed by Cadmus and the Program's teachers to capture specific household, installation and follow-up data reported by the students. These scantron surveys included similar questions to previous years' survey questions and offered multiple choice answers to each question to clarify the students' responses. The data collection/scantron survey instruments will be refined on an annual basis to make them easier to use and more effective.

Key participant characteristics that define baseline consumption (type of appliances, occupancy, pre-installation usage factors), measure installation rates, and changes in electricity using behavior are analyzed in order to assess program impacts.

Participant Characteristics

The average participant's household had 5.2 occupants.

Participants were asked to indicate the primary water heating, space heating and cooling sources in their home. Electricity is used by 74.2% of respondents for water heating, 16.0% use gas and 9.8% use other fuels. Table 2 indicates the percentage of households with each type of heating and cooling equipment.

Table 2. Types of Heating and Cooling Equipment²

Electric Furnace	Gas Furnace	Other Electric	Oil Furnace	Heat Pump	Other
31.7%	20.4%	18.0%	1.6%	8.1%	20.1%
Central AC	Room Fan	Heat Pump	Window AC	Attic Fan	No Cooling
45.1%	14.6%	0.0%	24.6%	1.2%	0.0%

The majority of the students (84.5%) indicated that Pacific Power provided electric service to their home. The second most common electric provider was Benton REA (3.4%). About

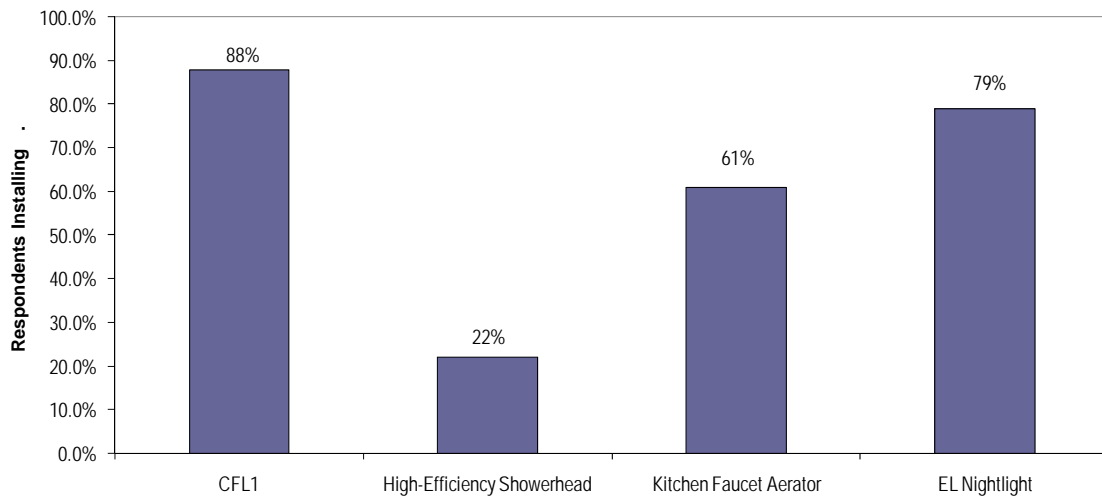
² Percentages may not add to 100% due to rounding.

thirty-one percent (31.3%) of the participants reported having natural gas service, with Cascade Natural Gas as the most common provider.

Measure Installation and Adoption of Energy Savings Actions

Students reported back on their installation of measures from the energy kits. The education sessions are intended to encourage high installation rates of kit measures. Figure 1 shows the installation rates reported during the 2009-2010 school year.

Figure 1. Measure Installation Rates³



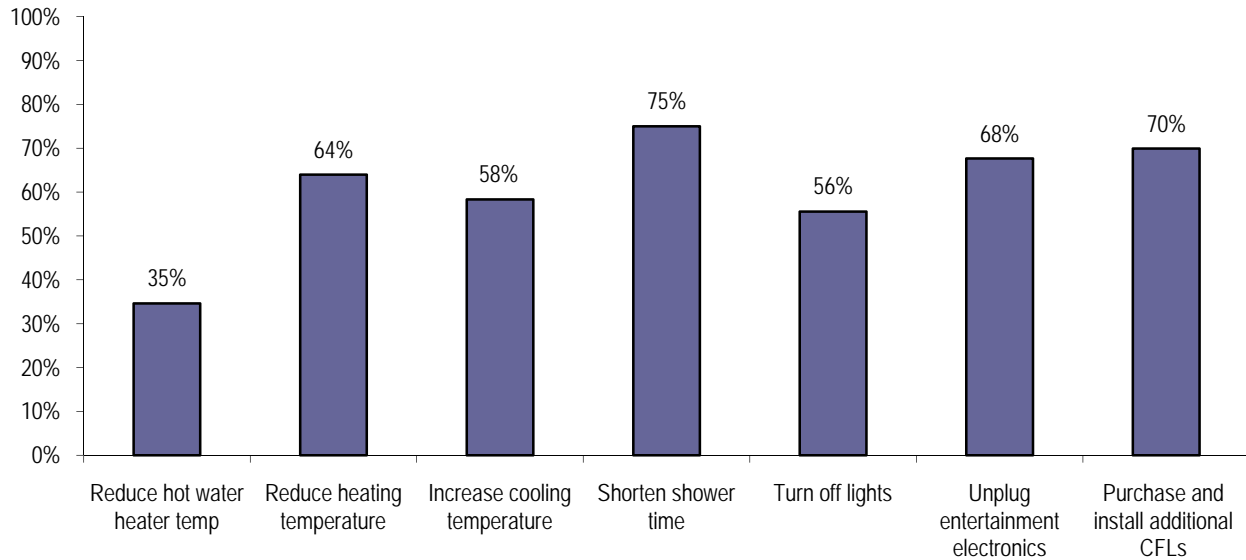
In addition, students also adopted several energy saving behaviors as encouraged by the energy education sessions. Key changes in energy using behaviors that were assessed included:

- Changing heating and cooling temperature settings (supported by the wall plate thermometer)
- Reducing shower length (using the shower timer)
- Purchasing and installing additional CFLs
- Reducing hot water temperature (based on temperature card)
- Turning off lights
- Unplugging entertainment electronics

The percentage of students adopting each of these energy savings behaviors is shown in Figure 2.

³ Showerheads are not distributed to all students. Based on results of flow testing, 28% of students received showerheads.

Figure 2. Adoption of Electricity Saving Behaviors



Program Impacts

We used the student completed surveys to determine baseline consumption characteristics, the installation of measures, and the adoption of energy saving behaviors. Based on their input, we then estimated the electric, natural gas and water savings of the program for the average participant and for the program overall. Table 3 shows the average annual savings per participant and Table 4 shows the total program savings.

Table 3. Average Participant Savings by Measure

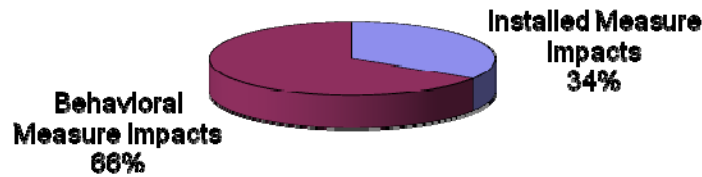
Measure	Average Annual Electric Savings (kWh)	Average Annual Gas Savings (Therms)	Average Annual Water Savings (Gallons)
Installation of Measures			
CFL	65		
Showerhead	134		1,423
EL Nightlight	12		
Kitchen Faucet Aerator	143	1.6	1,949
Install Additional CFLs	228		
Total Installation of Measures	582	1.6	3,372
Behavioral Impacts			
Shorten Shower Time	1,203	13.3	12,755
Adjust Heating Temp.	58	2.5	
Adjust Air Conditioning Temp.	44		
Reduce Hot Water Heater Temp.	19	0.3	
Turn off Lights	52		
Unplug Electronics	67		
Total Educational Impacts	1,443	16.1	12,755
<i>Grand Total</i>	2,025	17.7	16,127

Table 4. Total Program Savings by Measure

Measure	Annual Program Savings (kWh)	Annual Program Savings (Therms)	Annual Program Savings (Gallons)
Installation of Measures			
CFL	266,989		
Showerhead	554,050		5,872,754
EL Nightlight	47,890		
Kitchen Faucet Aerator	590,192	6,521	8,043,229
Install Additional CFLs	941,195		
Total Installation of Measures	2,400,316	6,521	13,915,983
Behavioral Impacts			
Shorten Shower Time	4,966,279	54,870	52,640,980
Adjust Heating Temp.	238,640	10,153	
Adjust Air Conditioning Temp.	181,896		
Reduce Hot Water Heater Temp.	79,947	1,355	
Turn off Lights	215,078		
Unplug electronics	275,962		
Total Educational Impacts	5,957,802	66,378	52,640,980
Grand Total	8,358,118	72,899	66,556,963

Of the per participant annual electricity savings, 582 kWh are attributed to the installation of measures, while 1,443 kWh are the result of behavioral changes. Figure 3, below, shows the breakdown of savings between measures and behavioral changes.

Figure 3. Savings Impacts



In addition to the electric savings, the Program also saves natural gas and water. Natural gas savings are attributed to adjustments in space heating thermostat settings, shower length and the installation of the faucet aerators. Water savings are attributed to shower length and the installation of faucet aerators and showerheads. The projected annual Program savings and dollar savings from installed measures and behavioral changes are shown below in Table 5.

Table 5. Annual Natural Gas and Water Savings

	Average Per Participant Savings	Total Program Savings	Total Dollar Savings
Electricity (kWh)	2,025	8,358,118	\$607,635
Natural Gas (Therms)	17.7	72,899	\$90,224
Water (Gallons)	16,127	66,556,963	\$102,856
Total			\$800,715

When the average participating household savings for electricity, natural gas and water are combined, the resulting first-year participant savings are \$194.01, as shown below in Table 6.

Table 6. Average Participant Savings

	Annual Savings	Value of Savings (\$)
Electricity (kWh)	2,025	\$ 147.23
Natural Gas (Therms)	17.7	\$ 21.86
Water (Gallons)	16,117	\$ 24.92
Total		\$ 194.01

Program Cost-Effectiveness

Using the calculated savings impacts and the program costs, we assessed the cost-effectiveness of the 2009-2010 Program. The costs to administer and deliver the Energy Education in Schools program during the 2009-2010 school year are shown below in Table 7.

Table 7. 2009-2010 Program Costs

Cost Category	Program Cost
PacifiCorp Administration	\$ 4,612
Agency Costs	\$ 367,679
Kits	\$ 66,006
Data Tracking and Evaluation	\$ 46,701
<i>Total</i>	<i>\$ 484,998</i>

We calculate program cost-effectiveness for multiple scenarios and perspectives. For consistency and ease of comparison, we use the same scenarios employed in the analysis of the 2008-2009 school year. Specifically, we consider three scenarios related to program costs and savings:

- **Scenario One** – Savings from both installation of measures and behavioral changes are considered under this scenario. The cost of additional CFLs purchased by the customer was considered a positive participant cost. Kit costs, water, and gas savings are treated as a program benefit.
- **Scenario Two** – Savings from both installation of measures and behavioral changes are considered, but natural gas and water savings are not considered. Kit costs are treated as a Program benefit.
- **Scenario Three** – Only electric savings from measure installation are considered. Kit costs are treated a Program benefit.

A number of analyses were conducted to evaluate the costs and benefits associated with the Program, particularly:

1. **Total Resource Cost Test (TRC)**: This test examines the Program benefits and costs from PacifiCorp's and PacifiCorp customers' perspectives. On the benefit side, it includes reduction in generation costs. On the cost side, it includes costs incurred by both the utility and the participants. A 10% conservation adder is applied to generation cost savings in Washington.
2. **Utility Cost Test (UCT)**: From the company's perspective, the benefits are in the form of reduced generation and line loss costs. The costs include any administrative or measure costs incurred by PacifiCorp.

3. **Ratepayer Impact Test (RIM):** All ratepayers (participants and non-participants) may experience an increase in rates to recover lost revenue. This test includes all PacifiCorp Program costs as well as lost revenues. On the benefits side, this test includes all avoided energy and capacity costs.
4. **Participant Cost Test (PCT):** This test examines the benefits from the Program participant perspective. Benefits include the participant utility bill reductions. Costs include any measure costs incurred by participants, net of any rebates received from the utility. For this Program, participants incurred no measure costs, and did not receive any direct rebates. They do realize energy savings from the various kit measures and the energy savings actions taken.

The results of this analysis are presented in multiple ways, including:

- **Levelized Cost/kWh** – Cost of achieving each kWh of savings levelized over time. The levelized cost/kWh can be compared to the cost of obtaining other resources to assess the cost-effectiveness of an efficiency investment. Energy efficiency resources that can be obtained for a levelized cost of \$.04/kWh or less are generally cost-effective.
- **Net Present Value (NPV)** – The difference between the discounted program benefits and discounted program costs. A net present value greater than zero would indicate benefits of the program exceed costs.
- **Benefit/Cost (B/C) Ratio** – The ratio of program benefits to program costs. The benefits and costs are determined over the life of the program impact and discounted to reflect the time value of money. A B/C ratio greater than 1.0 indicates benefits of the program exceed costs.

Finally, the value of savings is determined using PacifiCorp's avoided cost– that is, the cost to supply electricity that is avoided when it is saved through the Program. We use PacifiCorp's 35% 2008 IRP Westside Whole House decrement in our analysis⁴.

Other key assumptions used in the cost-effectiveness analysis are shown in Table 8.

⁴ PacifiCorp's avoided costs for DSM resources are developed through a decrement analysis in their integrated resource plan. For more details see:
http://www.pacificorp.com/content/dam/pacificorp/doc/Environment/Environmental_Concerns/Integrated_Resource_Planning_6.pdf

Table 8. Cost-Effectiveness Assumptions

Assumption	Value
Discount Rate	7.40%
Line Losses	11.03%
Retail Rate	\$0.0727
Net Retail Rate	\$0.0697

The results of the cost-effectiveness analysis for Scenario One are shown in Table 9.

Table 9. Scenario One: Cost-Effectiveness Results

	Levelized Cost \$/kWh	Total Discounted Costs	Total Discounted Benefits	Difference	Total Benefit/Cost Ratio
Total Resource Cost Test	\$0.010	\$256,722	\$1,483,321	\$1,226,599	5.78
Total Resource Cost Test (TRC) no Adder	\$0.010	\$256,722	\$1,348,474	\$1,091,752	5.25
Utility Cost Test	\$0.018	\$484,998	\$1,348,474	\$863,476	2.78
Rate Impact Measure (RIM)		\$2,138,521	\$1,348,474	\$(790,047)	0.63
Participant (PCT)		\$(228,276)	\$1,686,940	\$1,915,216	NA

Scenario One reflects savings from changes in household energy including behavioral changes. We also included the value of the kits as well as savings in natural gas and water costs as an additional benefit for the participants and the cost of additional CFLs purchased by the household is included as a participant cost. Non-electric and behavioral savings are not claimed by PacifiCorp.

The results of the cost-effectiveness analysis for Scenario Two are shown in Table 10.

Table 10. Scenario Two: Cost-Effectiveness Results

	Levelized Cost \$/kWh	Total Discounted Costs	Total Discounted Benefits	Difference	Total Benefit/Cost Ratio
Total Resource Cost Test	\$0.017	\$449,802	\$1,646,945	\$1,197,143	3.66
Total Resource Cost Test (TRC) no Adder	\$0.017	\$449,802	\$1,497,223	\$1,047,421	3.33
Utility Cost Test	\$0.018	\$484,998	\$1,497,223	\$1,012,225	3.09
Rate Impact Measure (RIM)		\$2,138,521	\$1,497,223	\$(641,298)	0.70
Participant (PCT)		\$(35,196)	\$1,686,940	\$1,722,136	NA

Scenario Two reflects savings from changes in household energy including behavioral changes but excluding natural gas and water savings. The value of the kit is included as a benefit to the participant and the cost of additional CFLs purchased by the household is included as a participant cost.

Finally, the results of the cost-effectiveness analysis for Scenario Three are shown in Table 11.

Table 11. Scenario Three: Cost-Effectiveness Results

	Levelized Cost \$/kWh	Total Discounted Costs	Total Discounted Benefits	Difference	Total Benefit/Cost Ratio
Total Resource Cost Test	\$0.030	\$452,896	\$990,281	\$537,385	2.19
Total Resource Cost Test (TRC) no Adder	\$0.030	\$452,896	\$900,255	\$447,360	1.99
Utility Cost Test	\$0.032	\$484,998	\$900,255	\$415,257	1.86
Rate Impact Measure (RIM)		\$1,350,343	\$900,255	\$(450,088)	0.67
Participant (PCT)		\$(32,102)	\$898,762	\$930,864	NA

Scenario Three does not reflect any savings from changes in household behaviors. Natural gas and water savings are also excluded from this scenario. The value of the kit is again included as a benefit to the participants and the cost of additional CFLs purchased by the household is included as a participant cost.

Conclusion

The attached presentation provides additional information on the performance of the program. In addition to providing cost-effective energy and cost savings, the Program also:

- Generated high levels of satisfaction amongst participating teachers
- Increased knowledge and awareness of the importance of energy efficiency among future energy consumers

The Washington Energy Education in Schools program continues to be a cost-effective initiative based on the standard cost-effectiveness analysis considered by the Washington Utilities and Transportation Commission and provides significant savings to participating families.