

Date: October 8, 2009
To: Becky Eberle
From: Jamie Drakos and Meghan Lee
Re: Assessment of Washington Energy Education in Schools –
2008-2009 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 4,158 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 ²	700	436	62.3%
NCAC	1,600	1,758	110.0%
OIC	1,800	1,964	109.1%
<i>Total</i>	<i>4,100</i>	<i>4,158</i>	<i>101.4%</i>

Both OIC and NCAC exceeded their participation estimates, by about 9%. (OIC exceeded their target by 164 participants, or 9.1%, while NCAC exceeded their target by 158 participants, or 10%). The Program met 101.4% of its overall participation goal of 4,100 students, with 4,158 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:

- Increase awareness of electricity usage in the home and capture key household characteristics that impact electricity consumption

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.

² The actual participation for BMAC does not meet the target this year because they serve one school only every other year as the classrooms have a mixed 5th and 6th grade.

- 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

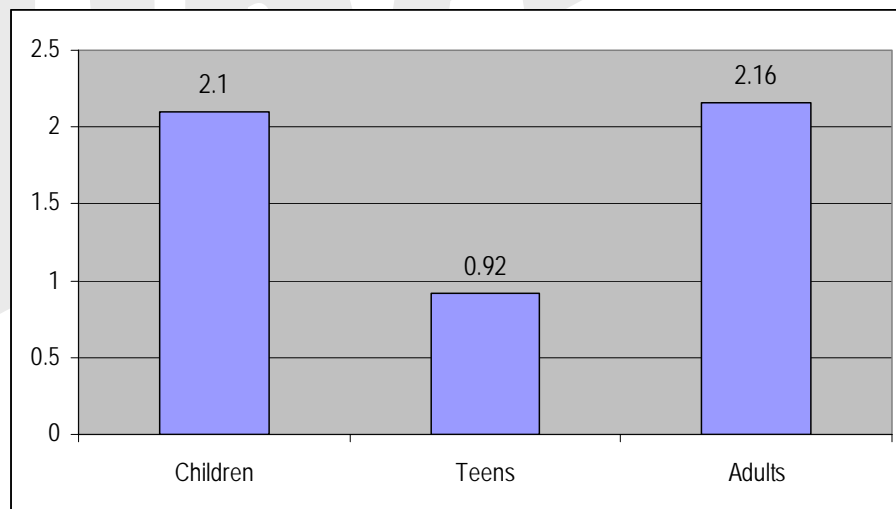
The data collected by students was entered into a database by Agency staff using a web-enabled interface. The data collection/survey instruments are refined on an annual basis to make them easier to use and more effective.

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 about 5 occupants as shown in Figure 1, below.

Figure 1. Average Household Occupancy by Age Group



Participants were asked to indicate the primary water heating, space heating and cooling sources in their home. Electricity is used by 80.4% of respondents for water heating, 18.0% use gas and 1.6% 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 Equipment³

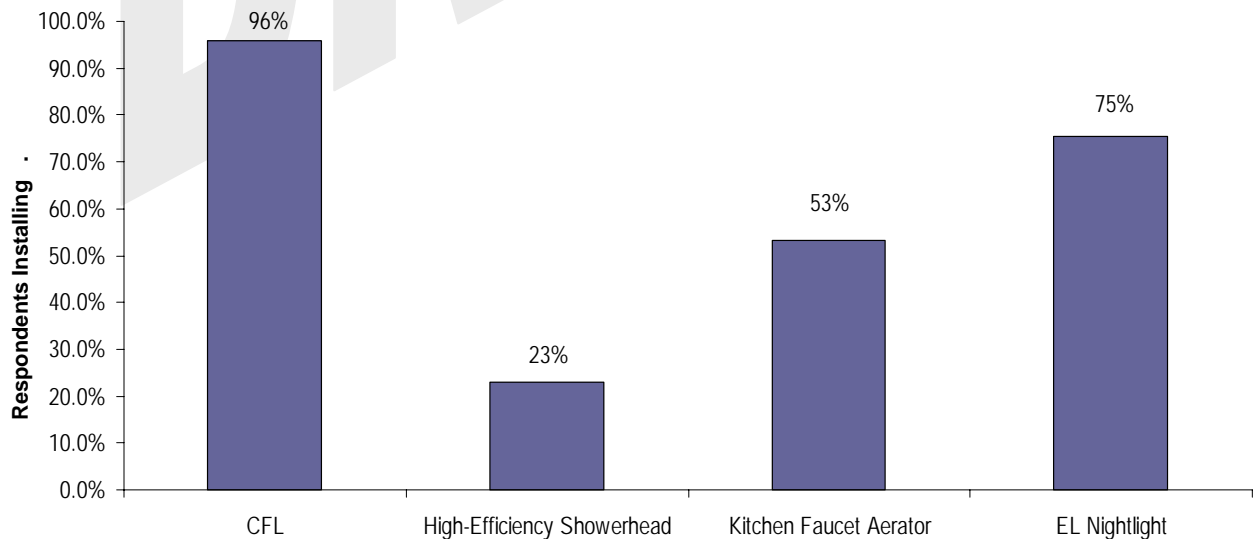
Electric Furnace	Gas Furnace	Other Electric	Oil Furnace	Heat Pump	Other
45.5%	22.7%	10.2%	2.0%	9.2%	10.4%
Central AC	Room Fan	Heat Pump	Window AC	Attic Fan	No Cooling
47.8%	20.0%	4.4%	22.5%	1.4%	3.9%

The majority of the students (95.5%) indicated that Pacific Power provided electric service to their home. The second most common electric provider was Benton REA (3.8%). Nearly thirty-five percent (34.7%) 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 2 shows the installation rates reported during the 2008-2009 school year.

Figure 2. Measure Installation Rates⁴



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:

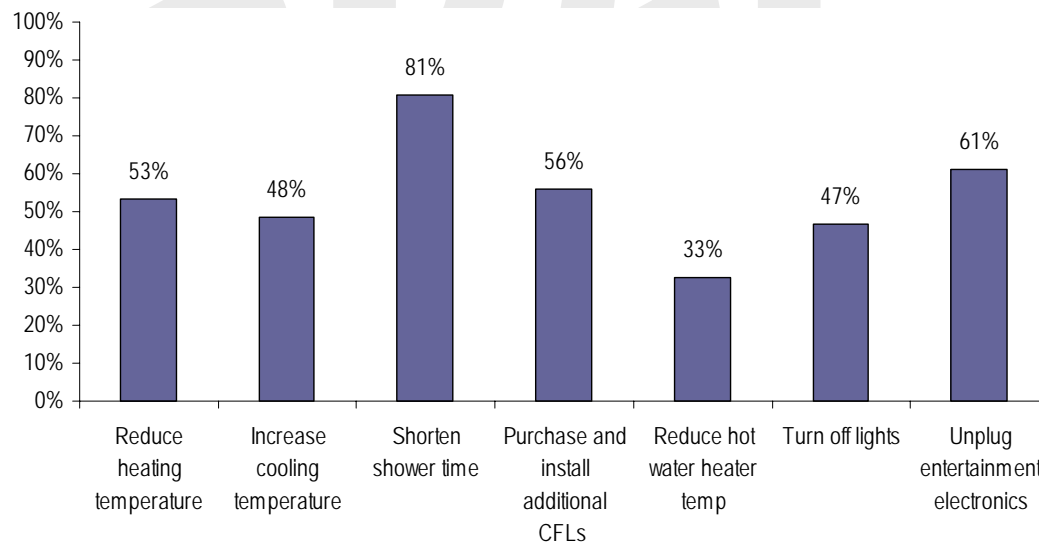
³ Percentages may not add to 100% due to rounding.

⁴ Showerheads are not distributed to all students. Based on results of flow testing, 28% of students received showerheads.

- 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 3.

Figure 3. 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

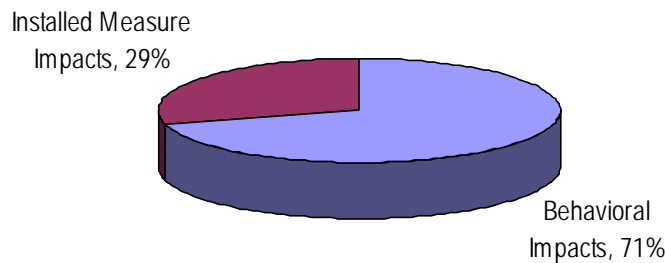
Measure	Average Annual Electric Savings (kWh)	Average Annual Gas Savings (Therms)	Average Annual Water Savings (Gallons)
Installation of Measures			
CFL	83		
Showerhead	284		2,532
EL Nightlight	16		
Kitchen Faucet Aerator	176	2.0	2,024
Install Additional CFLs	242		
Total Installation of Measures	801	2.0	4,556
Behavioral Impacts			
Shorten Shower Time	1,755	20.1	15,658
Adjust Heating Temp.	42	1.8	
Adjust Air Conditioning Temp.	26		
Reduce Hot Water Heater Temp.	21	0.4	
Turn off Lights	42		
Unplug Electronics	60		
Total Educational Impacts	1,946	22.3	15,658
Grand Total	2,747	24.3	20,214

Table 4. Total Program Savings by Measure

Measure	Annual Program Savings (kWh)	Annual Program Savings (Therms)	Annual Program Savings (Gallons)
Installation of Measures			
CFL	345,457		
Showerhead	1,179,581		10,525,034
EL Nightlight	68,335		
Kitchen Faucet Aerator	733,398	8,385	8,415,568
Install Additional CFLs	1,005,564		
Total Installation of Measures	3,332,335	8,385	18,940,602
Behavioral Impacts			
Shorten Shower Time	7,295,650	83,416	65,096,838
Adjust Heating Temp.	175,565	7,409	
Adjust Air Conditioning Temp.	108,683		
Reduce Hot Water Heater Temp.	85,749	1,503	
Turn off Lights	176,011		
Unplug electronics	250,998		
Total Educational Impacts	8,092,656	92,328	65,096,838
Grand Total	11,424,991	100,713	84,037,440

Of the per participant annual electricity savings, 801 kWh are attributed to the installation of measures, while 1,946 kWh are the result of behavioral changes. Figures 3 and 4 show the breakdown of savings between measures and behavioral changes.

Figure 4. Electric 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)	2,747	11,424,991	\$771,187
Natural Gas (Therms)	24.3	100,713	\$146,257
Water (Gallons)	20,214	84,037,440	\$129,867
Total			\$1,047,311

When the average participating household savings for electricity, natural gas and water are combined, the resulting first-year participant savings are \$251.91, as shown below in Table 6.

Table 6. Average Participant Savings

	Annual Savings	Value of Savings (\$)
Electricity (kWh)	2,747	\$ 185.49
Natural Gas (Therms)	24.3	\$ 35.18
Water (Gallons)	20,214	\$ 31.24
<i>Total</i>		\$251.91

Program Cost-Effectiveness

Using the calculated savings impacts and the program costs, we assessed the cost-effectiveness of the 2008-2009 Program. The costs to administer and deliver the Energy Education in Schools program during the 2008-2009 school year are shown below in Table 7.

Table 7. 2008-2009 Program Costs

Cost Category	Program Cost
PacifiCorp Administration	\$ 5,460.72
Agency Costs	\$ 309,045.92
Kits	\$ 73,719.66
Data Tracking and Evaluation	\$ 18,185.33
<i>Total</i>	\$ 406,411.63

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 2007-2008 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 scenario – that is, the cost to supply electricity that is avoided when it is saved through the Program. We use PacifiCorp's 2007 IRP decrement for the West with a 67% load factor in our analysis. The IRP decrement represents the marginal resource as considered in PacifiCorp's long-term resource plan.

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

Table 8. Cost-Effectiveness Assumptions

Assumption	Value
Discount Rate	7.10%
Line Losses	9.94%
Retail Rate	\$0.0675
Net Retail Rate	\$0.0672

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	\$0.0021	\$78,837	\$1,666,938	\$1,588,102	21.144
Total Resource Cost Test (TRC) no Adder	\$0.0021	\$78,837	\$1,515,399	\$1,436,562	19.222
Utility Cost Test	\$0.0107	\$406,412	\$1,515,399	\$1,108,987	3.729
Rate Impact Measure (RIM)		\$2,591,134	\$1,515,399	\$(1,075,735)	0.585
Participant (PCT)		\$(327,575)	\$2,201,835	\$2,529,409	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	\$0.0095	\$360,560	\$1,666,938	\$1,306,378	4.623
Total Resource Cost Test (TRC) no Adder	\$0.0095	\$360,560	\$1,515,399	\$1,154,839	4.203
Utility Cost Test	\$0.0107	\$406,412	\$1,515,399	\$1,108,987	3.729
Rate Impact Measure (RIM)		\$2,591,134	\$1,515,399	\$(1,075,735)	0.585
Participant (PCT)		\$(45,852)	\$2,201,835	\$2,247,686	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	\$0.0166	\$360,560	\$906,758	\$546,198	2.515
Total Resource Cost Test (TRC) no Adder	\$0.0166	\$360,560	\$824,326	\$463,766	2.286
Utility Cost Test	\$0.0187	\$406,412	\$824,326	\$417,914	2.028
Rate Impact Measure (RIM)		\$1,592,958	\$824,326	\$(768,632)	0.517
Participant (PCT)		\$(45,852)	\$1,208,095	\$1,253,947	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.