Commercial SEM Final Report 2015

Portland Community College – Rock Creek Campus

Strategic Energy Group
1800 SW First Avenue, Suite 520
Portland, OR 97204

503.914.4178
a.griffin@strategicenergygroup.com

EnergyTrust of Oregon

Table of Contents

Engagement Overview

Kickoff Status/Goals

Portland Community College is a growing public education institution that serves the Portland metropolitan area. The Rock Creek Campus, opened in the Beaverton-Hillsboro area in 1976, educates over 23,000 students. The campus covers 260 acres and generates power with 35,000 square feet of solar arrays.

PCC Rock Creek is undertaking its Strategic Energy Management (SEM) initiative to continue to advance its energy management practices. The SEM initiative will help to ensure that PCC Rock Creek achieves its energy efficiency and sustainability goals and objectives. It will also contribute to improving its financial situation by reducing operating costs, reduce adverse impacts on the environment, and serve as an example to others.

Rock Creek Campus enrolled six sites all of which were included in the overall program scope and effort. The summary table below outlines all of the enrolled sites and inclusion in the program scope.

Site	Site Address	Included in Scope
Building 2	17705 NW Springville Rd, Portland	Y
Building 3	17705 NW Springville Rd, Portland	Y
Building 6	17705 NW Springville Rd, Portland	Y
Building 7	17705 NW Springville Rd, Portland	Y
Building 9	17705 NW Springville Rd, Portland	Y
Vet Tech Building	17705 NW Springville Rd, Portland	Y

EMA/Organizational Assessment Highlights

A major milestone in the Energy Trust SEM Program approach is conducting an organizational energy management assessment (EMA). The EMA session with Rock Creek was conducted on November 18, 2014 and depicts a snapshot of current PCC energy management business practices. Based on the EMA session with PCC Rock Creek participants, Strategic Energy Group recommends that initial efforts focus on the following areas to improve energy management business practices:

1. Organizational Commitment

Develop an energy management policy (connected to PCC Rock Creek's mission and overall sustainability efforts) with guiding principles that set expectations for how the organization will operate in carrying out its energy management initiative. The policy should contain specific long-term aims or goals that can be expressed as an energy reduction target or targets to be achieved within a particular timeframe. An effective policy clarifies expectations and will enable PCC Rock Creek's energy

management team to establish a strategic energy management plan and facility plans containing the activities, projects, and resources needed to meet expectations.

2. Facility Operations and Maintenance

Optimizing facility operations and maintenance (O&M) practices typically result in a 5-10% reduction in energy consumption, which can be a significant contribution to achieving an organization's energy management goals. Major energy-using equipment and systems need to be tuned up periodically for optimal performance. Building tune-ups help in creating check-lists that personnel can use to conduct specific actions required for managing energy consumption, with a focus on O&M protocol for large energy consuming systems and equipment. Using these checklists and other tools and techniques, staff can perform periodic building operational assessments to ensure operational improvements previously made are still in place, and to identify new opportunities to save energy and improve building operating performance.

3. Facility Upgrades

Organizations often view energy efficiency projects as a cost rather than an investment opportunity that generates revenue. PCC Rock Creek should systematically examine potential building or equipment upgrade and retrofit opportunities, and create an opportunity register. Working with finance, investment criteria can be established to screen projects, with financially viable projects considered in the capital budgeting process. Projects with attractive financial returns should depict how each project contributes to meeting specific reduction targets and PCC Rock Creek's overall goal.

4. Purchasing and Procurement

Based on the discussion at the EMA session, PCC Rock Creek has comprehensive efficiency standards to guide the routine purchase of energy using equipment. To ensure that the guidelines and standards are followed, those making routine purchases (organization-wide) will need to be educated on the standards, and monitoring put in place to ensure the standards are followed. Procedures for non-routine equipment purchases based on life cycle costs need to be developed to ensure lowest cost of ownership when these custom purchases are made.

5. New Construction

It is much more cost-effective to design a building to be energy efficient from the start than it is to retrofit it later in its life. PCC Rock Creek can continue to advance its new construction practices by setting aggressive, project-specific energy performance goals and by following an integrated design process to exam high performance building options. Including O&M staff in the design, construction, and commissioning processes helps to ensure that operational experience is taken into account and that staff gain exposure to new design and equipment options.

6. Occupant Engagement and Awareness

Raising energy efficiency awareness across the organization is a key ingredient to an effective energy management initiative. PCC Rock Creek should develop and initiate an energy awareness campaign. Employee and occupant (faculty and student) engagement activities can be fun and informative, involving contests, games, special events, and reminders on good habits and routines (signage, posters, etc.).

7. Tracking and Reporting

PCC Rock Creek can use available data and tools to create reports that communicate energy consumption and intensity to appropriate personnel at key sites on a regular basis. Building from baseline evaluations of overall consumption, energy intensity parameters and energy use reduction targets can be set for key sites that cascade up to an overall energy reduction goal. This should include regular reports to operating personnel for use in examining variances from established parameters and targets, with protocols for corrective action, and reporting to senior management.

Executive Sponsor & Energy Champion Meeting Highlights

Sandra Fowler-Hill is the Executive Sponsor for the SEM initiative and Laura Ward is the SEM Energy Champion. SEM Executive Sponsor check-ins involve discussing SEM activities completed or underway, and key next steps. Areas of focus include strategic leadership, setting the direction, mobilizing the organization, a focus on core practices, and continuous improvement.

Energy Team Meeting Highlights

PCC Rock Creek's Energy Team is led by Sandra Fowler-Hill and Laura Ward. Key members of the Energy Team include staff and faculty from the PCC Rock Creek Campus and PCC central staff. The team meets regularly and focuses on both technical and organizational energy management activities. Examples on the technical side include addressing economizer function from damper operation and sensor accuracy to programming. Building operations schedules were looked at, fan run times reduced, optimal start programs were reviewed, and boilers were tuned up. On the organizational side the team drafted and gained approval for a PCC Rock Creek Energy Policy, regularly uses the SEM MT&R tool to monitor building performance, and has begun employee/occupant engagement efforts.

Summary of progress with Energy Policy & SEMP

PCC Rock Creek developed and gained organizational approval and sign off for its Energy Policy with the Campus President in Sept. 2015. The Energy Team is focused on SEM Action Plan follow through, including specific actions associated with strengthening organizational commitment, improving facility operations, initiating employee engagement, and ongoing energy performance tracking and reporting.

Energy Awareness/Engagement Activities

PCC Rock Creek began its employee/occupant engagement efforts by conducting an employee survey to understand where staff and faculty were as far as understanding their energy impact at work. Night audits were conducted to identify both occupant

and operational improvements. A full scale employee and building occupant engagement effort began in September 2015. The Energy Team anticipates continued development and implementation of its employee engagement strategy, including additional occupant educational seminars for staff, faculty and students, over the course of the school year.

Building Opportunity Site Assessments

The table below lists the building opportunity assessments completed by site and date.

Site Name	Date Transitioned	Opportunity Workshop Date
Building 2 – Electric & Gas	12/17/15	2/20/2015
Building 3	5/18/15	
Building 6	3/31/15	
Building 7 – Electric & Gas	2/17/15	
Building 9	5/15/15	
Vet Tech Building	5/18/15	

Energy Savings and Incentives

Final Savings & Incentives by Site & Utility

After normalizing energy consumption for seasonal weather and other impacts, the four sites in the overall scope showed significant savings and qualify for Energy Trust of Oregon's SEM energy savings incentives. PCC also qualified for the bonus incentive of $0.005 per kWh and $0.05 per therm for savings achieved during the 2015 Program Year.

In addition to the energy savings incentives, a milestone incentive of $1000 is available for having drafted, approved and signed an Energy Policy by November 30, 2015. PCC Rock Creek qualifies for the bonus given organizational approval and sign off for its Energy Policy with the Campus President in Sept. 2015. The table below outlines the savings and incentives achieved by site and utility.

Site	PY 2015 SEM Savings					Energy Trust Incentives		
	PGE (kWh)	Pacific Power (kWh)	CNG (thms)	NWN Regular (thms)	NWN Rate 32 (thms)	Implement Bonus	Energy Incentive	Total Incentive
Building 2	0	0	0	0	8,384	$419.20	$1,676.80	$2,096.00
Building 3	0	0	0	0	0	$0.00	$0.00	$0.00
Building 6	0	0	0	0	0	$0.00	$0.00	$0.00
Building 7	258,973	0	0	17,945	0	$2,192.12	$8,768.46	$10,960.58
Building 9	144,342	0	0	8,555	0	$1,149.46	$4,597.84	$5,747.30
Vet Tech Building	0	0	0	0	0	$0.00	$0.00	$0.00
Savings Incentive	**403,315**	**0**	**0**	**26,500**	**8,384**	**$3,760.78**	**$15,043.10**	**$18,803.88**
Energy Policy Milestone Incentive								**$1,000.00**
Total Incentive								**$19,803.88**

Calculation Methodology

Regression models for Electricity and Natural Gas (where both fuels were present and enrolled at the site) were created and used to evaluate current operations versus the baseline operations and estimate the energy savings for the upcoming year. Typical coefficients include ambient weather, holidays, and event days. In some cases other variables may have been used. The variables used for each site are provided in the Appendix and the electronic MT&R models.

The performance tracking tools used to track building savings and performance are designed to measure actual savings (rather than project the upcoming year's estimated). To project savings that will occur in the upcoming year, average savings rates (graphically represented by the slope of the CuSum graph) are calculated based on the savings period and used for estimating the preceding 12 month period. Multiplying the calculated daily average savings rate by 365 equals the projected savings.

Capital projects implemented and incented by the Energy Trust that are included in the rate of savings period, are deducted from the total projected energy savings. As an example, total energy savings for a site is projected to be 1,000,000 kWh. A lighting project that was implemented and incented by Energy Trust of Oregon was completed after the baseline period, for which Energy Trust booked 500,000 kWh. In this scenario the net SEM program savings would equal 500,000 kWh subtracted from the total estimated savings of 1,000,000 kWh, resulting in SEM savings of 500,000 kWh.

Where applicable, the coefficients, regression statistics, and graphs can be found in the Appendix or the electronic MT&R model files. Due to interaction with capital projects or operational anomalies, in some cases the baseline period was taken prior to or sometimes after the start of the program period. In those cases, energy savings identified prior to the 'intervention period' were removed from the projected savings estimates.

The Rock Creek Campus enrolled six sites all of which were included in the overall program scope and effort. The primary variable used in all cases is ambient weather, with holidays, events, or other appropriate energy usage driver variables used on a case by case basis.

Site Savings Summary

Site	Baseline Annual Energy Consumption		Program Year 2015 Energy Savings				Notes Electricity	Notes Natural Gas
			Total Savings Achieved		SEM Savings Achieved			
	kWh	thms	kWh	thms	kWh	thms		
Building 2	2,847,200	56,951	(38,194)	8,384	0	8,384	Several SEM opportunities were implemented during program period but savings did not outperform tighter HVAC scheduling that occurred prior to SEM program. No claimed savings at this time. Multiple opportunities exist and are expected through continual SEM effort. Capital savings removed from lighting project that ended just prior to SEM program.	Boiler PM and tighter HVAC scheduling has provided savings during heating season. More opportunities exist and additional savings are expected through better control of OSA air use.
Building 3	1,502,600	0	(15,154)	0	0	0	No SEM events OR savings identified.	
Building 6	340,560	0	(944)	0	0	0	ETO incentive high bay lighting project completed 6/30/15. Project savings are subtracted and no SEM savings are identified. No other SEM events are recorded.	
Building 7	1,285,200	67,168	287,158	17,945	258,973	17,945	Tighter scheduling and PMs account for savings that begin 5/2015. It is expected that savings will continue and are not only seasonal.	From event log, savings begin after 1/2015 boiler PM and then increase after tighter scheduling in 5/2015. Most of the savings will be consistent with seasonality usage but will continue throughout the year.

Site	Baseline Annual Energy Consumption		Program Year 2015 Energy Savings				Notes Electricity	Notes Natural Gas
			Total Savings Achieved		SEM Savings Achieved			
	kWh	thms	kWh	thms	kWh	thms		
Building 9	963,238	25,068	144,342	8,555	144,342	8,555	2 chillers replaced 10/2014. AHU tune-up around beginning of SEM program account for savings. New chillers come on-line 4/2015.	New discussion ADDED 1-6-16. During the baseline period and subsequent year after, the boiler was allowed to operate during the summer months due to space overcooling. Though there was an air-handler tune-up & annual boiler PM that occurs at the beginning of the SEM program, the savings this period come from not allowing boiler to operate during summer months. The decision to eliminate summer boiler use was from continual SEM guidance and education that resulted in addressing the root cause of earlier overcooling by making multiple (albeit small) adjustments at the VAV and BMS level.

Site	Baseline Annual Energy Consumption		Program Year 2015 Energy Savings				Notes Electricity	Notes Natural Gas
			Total Savings Achieved		SEM Savings Achieved			
	kWh	thms	kWh	thms	kWh	thms		
Vet Tech Building	43,260	0	(42)	0	0	0	No SEM events OR savings identified during this period.	
0	0	0	0	0	0	0		
Totals	**6,982,058**	**149,187**	**377,166**	**34,884**	**403,315**	**34,884**		

Additional Capital Project Potential

Capital projects identified that may be eligible for Energy Trust of Oregon incentives through the Existing Buildings Program are outlined in the table below. Contact Lyn Schmidt with the Existing Buildings Program 503.351.1017 to discuss how these projects fit into your energy efficiency capital planning process.

Building	Capital Opportunity	Next Steps
Building 2	Investigate ways to shut off HW valves to HVAC in shops when high bay roll-up doors are open.	Once identified, install door switches and wire to local DDC controllers. Implement a DDC control strategy that shuts OFF HW valves and/or unit fans.
Building 2	Heating hot water boilers and pumps operate year around due to Victaulic fittings will leak when system is shut down and cools. If fittings were repaired (i.e. gasket replaced), significant savings in electric & gas would be realized.	Perform an energy audit for costs associated with running Heating System year around to also include simultaneous heating & cooling. Investigate costs associated with replacing bad gaskets.
Building 7	Verify if each boiler equipped with isolation valves to prevent convection heat going up flue stack	Through natural draft, the combustion burner inlet air may allow air to be drawn in and take boiler heat up the flue stack when boiler is not in use. Contact mechanical service provider for installing isolation valves and control strategy for each boiler.
Building 7	It was noted that multiple Terminal Unit reheat valves were incorrectly installed and leak hot water. Consequently, the discharge air setpoint for AHU-1 & AHU-2 has to be set down to 50° F.	Repair reheat valves and verify if hot water is still leaking by. Once completed, allow discharge air setpoint for air handlers reset again.

Appendices

Definitions

Average Savings Rate:	The rate of savings during the projected period (slope of CuSum graph), usually in units of (energy/day.) This quantity is used to project the current operating conditions over a 1 year period to determine the Projected Savings.
Baseline Period:	The time duration that is taken to be representative of the baseline operations. The time may be significantly earlier than the program period, in which case adjustments to energy savings need to be made to account for the differences.
Baseline Data Points:	The number of energy usage data points used to create the model, usually 12 or more.
Change-point Model:	These models are used to align the energy use to temperature based on cooling only, neutral (float) and heating only. The model is straight linear regression (non-polynomial) and has a balance point where heating or cooling no longer occurs. These models were used in place of the polynomial models, when the p-values for the square of the temperature were greater than 0.05. The model takes the form: **Energy=a+b*(Temp)+c*(other energy drivers) +…**
CuSum Savings:	Cumulative sum of energy savings (electricity or natural gas) usually presented in a time series graph with kWh or natural gas as the vertical axis.
Incented Capital Savings:	The total energy savings booked by the Energy Trust for providing incentives. These are usually capital projects completed during the program period, for which the program cannot claim savings (to avoid double counting.)
Measured Savings:	The total savings measured by the MT&R model over the program period. This number is usually different then the Projected Savings.
Net Savings:	The difference between the Projected Savings and any savings resulting from capital projects incented by the Energy Trust and implemented during the program period.
Net Incremental Savings:	The difference between the Year 1 Net Savings and the Year 2 Net Savings. Used to determine the participants energy incentive.
Polynomial Model:	These models take the form: **Energy=a+b*(Temp)+c*(Temp^2)+d*(other energy drivers) +…**
Savings Period:	The time period over which the Projected Savings Rate is calculated from the CuSum graph.
Projected Savings:	The product of Average Savings Rate and 365 days.
R2:	R squared, describes how well a regression line fits a set of data.
Standard Error:	The standard deviation of the data set, usually in units of (energy/day)

Site Performance and Savings Calculations