Notes from the Trail: Checking in on the Path to Net Zero

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ABSTRACT

Clean energy proponents across the country proclaim net-zero energy buildings are a critical step toward dramatically lowering carbon and energy footprints within the next decade. While many government and private entities are promoting net-zero energy goals, the number of net-zero commercial buildings remains small. To spur wide-spread development of net-zero buildings, the industry needs more actual project experience.

Energy Trust of Oregon is leading 13 projects through the Path to Net Zero pilot. Launched in 2009, the pilot is one of the first programs in the country to offer structured incentives to net-zero buildings to push innovative design and offset costs. The pilot sparked overwhelming interest in professional design support and funding for technical studies, energy-efficient designs and technologies, and monitoring systems. Thus far, pilot projects have reduced their energy loads significantly, putting net-zero energy goals within reach.

Six Path to Net Zero projects have completed construction and two have one year of 15-minute-interval, whole-building monitored data. Using information from the buildings' energy simulation models and monitored data, this paper will summarize system-level energy usage and the overall performance of the buildings compared to modeled assumptions. It will also highlight building components, identify designs and technologies that worked and didn't work, and explore lessons learned about post-occupancy. Insights from these projects will distinguish strategies, measures, and technologies that are ready for wider market adoption from those that need further study.

Introduction

Energy Trust is an independent nonprofit that offers energy-efficiency and renewable energy incentive programs for electric and gas customers of Pacific Power, Portland General Electric, NW Natural, and Cascade Natural Gas. Energy Trust's New Buildings program (New Buildings) provides incentives and technical support to new construction, major renovation, and tenant improvement projects. Since 2003, New Buildings has offered a range of financial incentives and technical support to help project owners achieve energy efficiency beyond the increasingly stringent Oregon code requirements. PECI has served as the Program Management Contractor for New Buildings since 2009 and manages the Path to Net Zero pilot.

Over the past decade, a number of initiatives, including the Architecture 2030 Challenge, Cascadia Region Green Building Council's Living Building Challenge, and the U.S. Department of Energy's Commercial Building Initiative and Commercial Building Partnership Program have inspired select developers, nonprofit organizations, schools, and governments to pursue construction of net-zero buildings in Oregon. In 2009, New Buildings created the Path to Net Zero pilot to inspire and support these ground-breaking projects by providing financial incentives and technical assistance for projects achieving energy use reduction targets.

Path to Net Zero Pilot

Energy Trust launched the Path to Net Zero pilot in May of 2009 to support new construction and major renovation projects that utilize integrated, energy-efficient designs and technologies to achieve deep energy savings and are thus considered to be moving the market further along the path to net zero. For the purposes of this pilot, a net-zero building was defined as a building that uses no more energy than it produces throughout the year on average[1].

The key goal in designing net-zero buildings is to reduce the energy needs of the building as much as possible, so that the energy load can be met with onsite renewable energy—usually solar photovoltaics (PV). Because solar PV can only be installed in limited places (ideally roof or awning surfaces that have unobstructed southern exposure), and because the technology is relatively expensive[2], deep reduction of energy loads is the first goal of net-zero designers. According to stakeholders consulted during the development of the pilot, fifty to 80 percent reductions in energy use beyond current practices are needed for most buildings to achieve net zero.

To be eligible for the Path to Net Zero pilot, project owners had to commit to designing and constructing a building that is at least 50 percent better than Oregon's 2007 energy code through energy-efficient design and energy conservation measures, and at least 60 percent better than code through any combination of energy efficiency and on-site renewable energy generation. Energy Trust did not require projects to design for net zero because the program wanted to engage a range of building types and sizes to make significant energy reductions through technologies and design strategies that are cost-effective, market ready, and may gain wide market adoption quickly.

For projects that meet the energy savings requirements, the pilot provided financial support for energy-focused integrated design charrettes, energy modeling, supplemental technical analysis, installation of energy-efficient technologies, and equipment for monitoring and tracking building performance. In addition, program engineering staff provided secondary engineering support throughout the process by participating in early design and scoping meetings, assisting with the quantification of energy savings, providing a Monitoring and Reporting Guide, and advising project teams about monitoring system selection. Table 1 details the incentives offered through the pilot.[3]

Pilot Projects

Within six months of launch, fifteen projects had enrolled and the pilot was closed to further applications. Since then, six projects have completed construction, three will be constructed by the end of 2013, three are on hold due to funding issues, and three have left the pilot. The program has reviewed and approved energy models for eight buildings, which make up the data-set for this paper. Each of these models used 2007 Oregon Structural Specialty Code

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[1] The National Renewable Energy Laboratory defines net-zero goals in four ways: net-zero site energy, net-zero source energy, net-zero energy costs, and net-zero energy emissions (Torcellini et al. 2006). For the purposes of the pilot, Energy Trust encourages net-zero site energy buildings, defined as buildings that generate all of the energy that they consume on site on an annual basis.

[2] Average installed cost for solar PV systems has substantially declined recently, with a 17% drop from 2009 to 2010 and an 11% drop in the first half of 2011 (Barbose et al. 2011).

[3] Further details on the pilot offerings can be found in *Energy Trust of Oregon Path to Net Zero Pilot: Pushing the Limits in the Oregon New Construction Market* (Moersfelder et al. 2010)

(2007 code) as a baseline, except for XVI Vernon, which uses the 2010 Oregon Energy Efficiency Specialty Code (2010 code) as a baseline.

Table 1. Path to Net Zero Offerings

Design Phase	Path to Net Zero Incentives
Early Design	$10,000 for integrated design charrette
Design	$0.10/kWh and $0.80/therm, up to $50,000 for energy modeling and energy-related technical studies
Construction	$0.20/kWh and $1.60/therm, up to $500,000; commissioning required
Post-Occupancy	$5,000 for whole-building monitoring and additional $0.20/sq. ft. for subsystem monitoring, up to $30,000

Table 2. Pilot Projects with Approved Energy Models

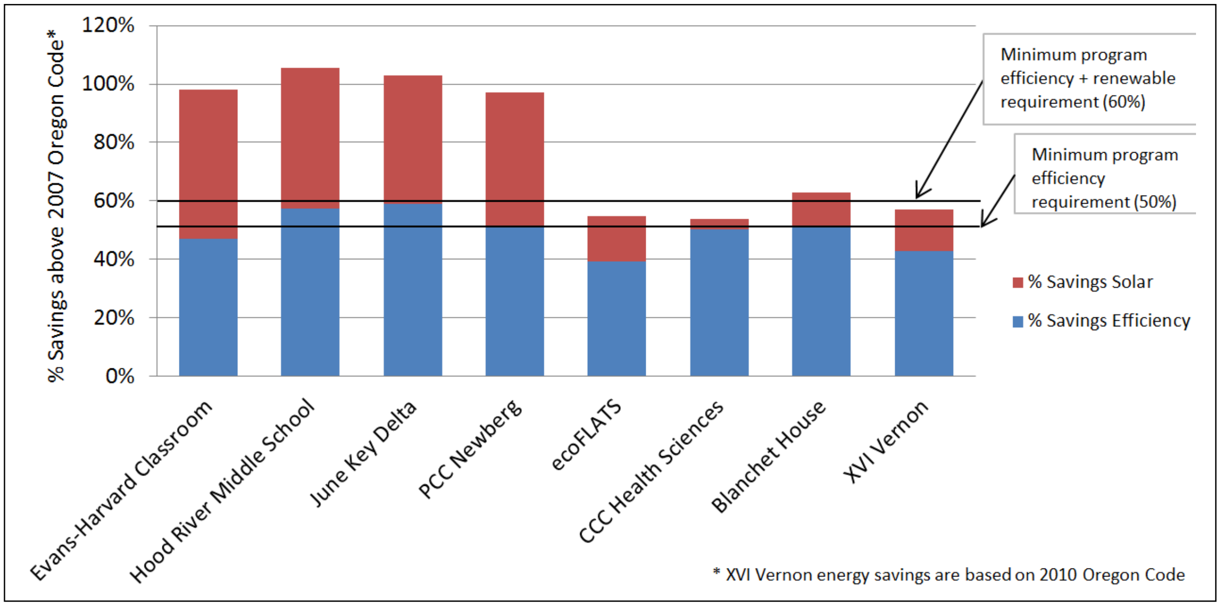
Project Name	Size (sq. ft.)	Building Type	Location	Description
Evans-Harvard High Performance Classroom	1,500	School	Portland	Free-standing music classroom at a middle school; construction complete and one year of monitored data available
Hood River Middle School Science/ Music Building	5,600	School	Hood River	Free-standing building with music and science classrooms at a middle school; construction complete
June Key Delta Community Center	2,700	Community Center	Portland	Major remodel from existing gas station to community center; construction complete
Portland Community College Newberg Campus	13,500	College/University	Newberg	Single story; first building on new community college campus; construction complete
ecoFLATS	17,000	Apartments and Retail	Portland	16 apartment units on three floors over two ground-floor retail spaces; construction complete
Chemeketa Community College Health Sciences Complex	70,000	College/University	Salem	2-story wing addition on community college campus; construction complete
Blanchet House of Hospitality	35,000	Dormitory Housing	Portland	Temporary housing with a commercial kitchen and dining space; under construction
XVI Vernon	62,000	Apartments and Retail	Portland	Three floors of apartment units and live/work units over retail space and a clubhouse; modeled to 2010 Oregon code; in design

Results from Modeling and Monitored Data

Percent Energy Savings

Energy savings were quantified for each project through whole-building energy modeling studies utilizing software capable of hourly simulations (e.g. DOE-2). Half of the eight projects achieved 95 percent savings or more beyond code, based on the approved energy models. The average was 50 percent energy savings from energy efficiency measures alone and 79 percent when combined with renewable energy. Figure 1 shows the percent energy savings beyond Oregon energy code for each project.

Figure 1. Percent Savings Beyond Oregon Energy Code, Based on Energy Models



Two projects with efficiency savings lower than 50 percent warrant further explanation. As one of his energy savings strategies, the ecoFLATs project developer Jean Pierre Veillet—who also designed the building through his company Siteworks Design-Build—created an exterior exposed hallway connecting the apartments, thus reducing the total conditioned space; this decision was motivated entirely by energy load reduction. As a result, there were no energy savings calculated for this feature because the program requires the same building layout be used for both the baseline and proposed models. In addition, Siteworks is utilizing occupant engagement strategies to try to further reduce the building's energy use; however, to be conservative, these strategies were not accounted for in the energy model. The project was allowed to remain in the pilot though the modeled savings were 39 percent because the exterior hallway and occupant strategies will contribute to the overall lower EUI of the building.

XVI Vernon is the only project of the eight to be permitted under the 2010 Oregon Efficiency Specialty Code, which strives to reduce energy use by 15 percent over the 2007 code and is one of the most stringent efficiency codes in the nation. The project was therefore invited to join the pilot by committing to at least 35 percent beyond the 2010 code through energy efficiency—a goal they have surpassed in their energy model, which shows 43 percent savings over the 2010 code baseline.

In addition to the percent savings shown in the energy model, some projects—notably Blanchet House and ecoFLATs—expect to realize further load reductions due to occupant behavior, which was not captured in the energy model.

Energy Use Index

Figure 2 shows the energy use index (EUI) in kBtu/sq. ft./year for each building at various stages. It compares the typical EUI, code baseline EUI, proposed EUI from the model, and actual EUI as monitored where available. The first data point for each project is the NW Commercial Building Stock Assessment (CBSA), which is the average EUI of existing buildings in the Northwest by building type (The Cadmus Group 2009). In most cases, the CBSA EUI is higher than the Oregon code baseline because the CBSA data set contains buildings that are not in compliance with the most current versions of the Oregon energy codes. In particular, the Oregon code baselines for PCC Newberg and CCC Health Sciences are much lower than CBSA, mainly because they are compared to "college / university" building types in the CBSA data set, which includes high-energy using facilities (e.g. science laboratories or aquatic centers) along with classroom-only buildings like PCC Newberg and CCC Health Sciences. Conversely, the Oregon code EUI for Blanchet House is higher than the CBSA EUI, because the project is not a typical multifamily building; it is a continuously occupied men's dormitory with a commercial kitchen (soup kitchen), office space, dining area, and common rooms on the first floor.

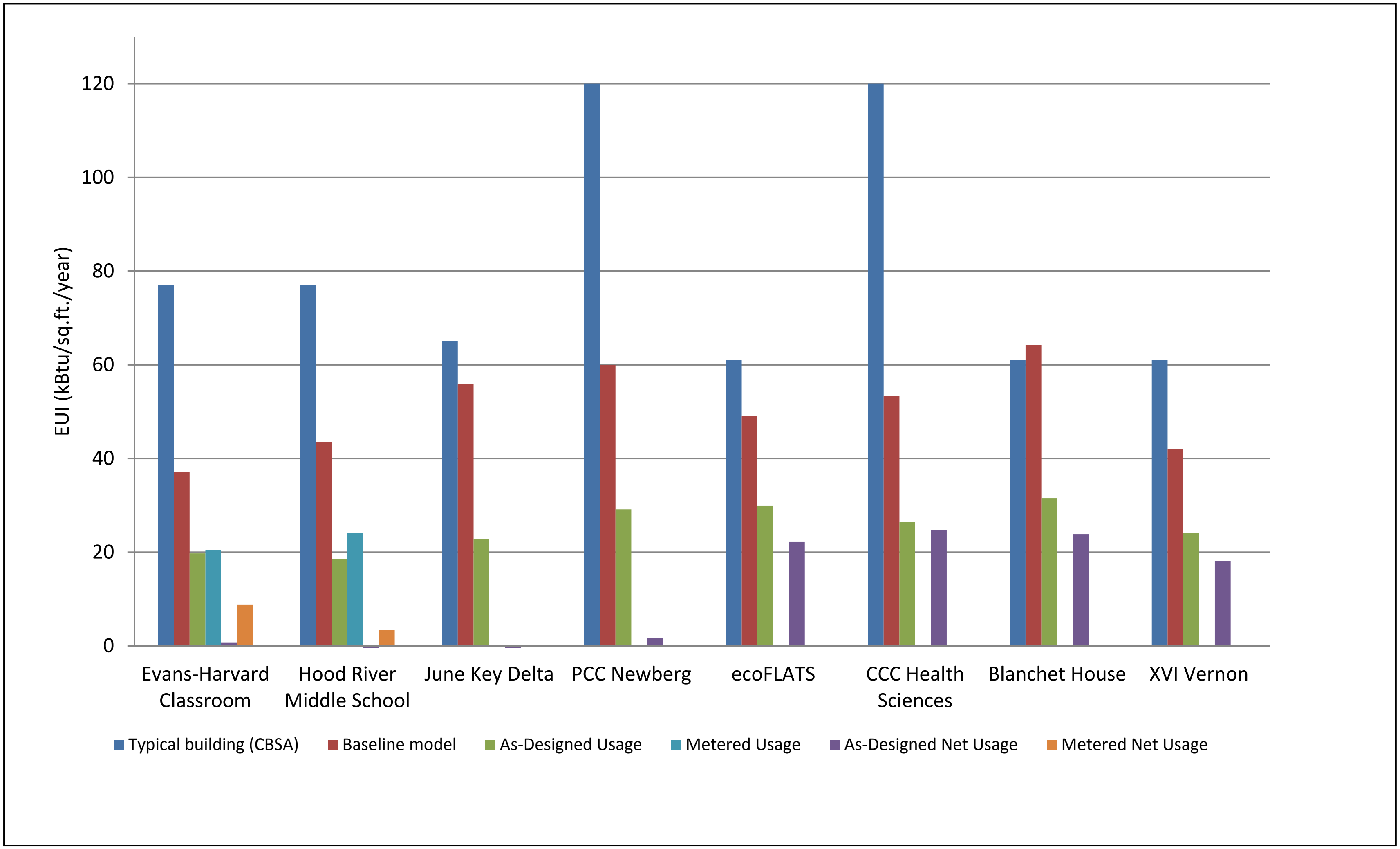
The second data point is the baseline EUI as modeled for 2007 Oregon energy code; an exception is XVI Vernon, which was modeled against a 2010 code baseline. For energy uses that are not governed by code, or where standard practice exceeds code requirements, standard practices are used as the baseline. New Buildings maintains detailed Technical Guidelines that provide baseline requirements for all energy models it uses.

The third column shows the EUI predicted by the proposed building energy model, excluding any expected renewable energy generation. The fifth shows the net EUI proposed, including predicted renewable energy generation.

The fourth and sixth data points are metered EUI and net metered EUI for two projects: the Evans-Harvard High-Performance Classroom and Hood River Middle School Science/Music Classroom. For these two projects, the program has received at least one year of monitored energy use data. For the Evans-Harvard Classroom, actual energy use is close to what was predicted by the model (20.44 kBtu/sf/yr was measured compared to 19.75 kBtu/sf/yr predicted by the energy model). Unfortunately, the energy production contributed by the solar PV system over the course of the year was lower than expected due to the integrated roof tile PVs being recalled by the manufacturer. The school is not able to immediately replace the panels, so the monitored net energy use of the building is currently 8.76 kBtu/sf/yr.

For Hood River Middle School Science/Music Classroom, monitored data demonstrates the building has been using more energy than expected (24.10 kBtu/sf/yr compared to 18.52 kBtu/sf/yr that was predicted in the model). This is likely due to an outside air damper that was stuck open for several months during the monitoring period and a winter that was colder than average. The PV system is performing as expected, so the building's net EUI is currently 3.44 kBtu/sf/yr. Now that the damper is fixed and a classroom monitoring display provides actionable energy use information to the occupants, the teacher and students who use the building are committed to hitting the net-zero target in the coming year.

Figure 2. EUIs for Eight Path to Net Zero Projects



Energy End Uses

To achieve a net zero building, project teams and owners need to strategically reduce energy use wherever it occurs, including heating, cooling, ventilation, lighting, water heating, and appliances and equipment plugged into outlets (plug loads). Energy Trust found that the relative amount of savings from each end use varies widely from project to project. What is common across the projects, however, is that plug loads represent a smaller proportion of the savings and become a more significant energy end use in the proposed buildings.

For example, XVI Vernon is predicted to attain significant energy savings in domestic hot water heating by installing high-efficiency heat pump water heaters, solar thermal collectors and conserving water use through low-flow fixtures. This, combined with heating, lighting, and fan energy savings, is expected to lower the EUI of the building to 24.08 kBtu/sf/yr, but the percent of energy use from plug loads increases from 27% in the baseline to 46% in the design. The project designers are lowering energy use caused by plug loads by installing ENERGY STAR® refrigerators, dishwashers, and washing machines, but the plug load as a percent of overall energy use increases significantly from the baseline to the proposed.

Energy Savings Strategies and Building Features

Because of the range in building uses and sizes of the pilot projects, the energy saving strategies varied from project to project; however, several strategies, design features, and technologies were commonly explored. Table 2 lists the common features and strategies and the number of projects that utilized them.

Table 2. Common Energy-Efficient Features

Design Strategies or Technologies	Number of Pilot Projects	Design Strategies or Technologies	Number of Pilot Projects
Increased insulation, high performance glazing, other envelope improvements	8	Plug Loads	3
Heat Recovery	6	Geothermal	2
Daylighting	6	LED Lighting	2
Efficient Hot Water Heaters	6	Monitoring Display	2
Solar PV	5	Solar Water Heating	2
Low Flow Fixtures	5	Variable Refrigerant Flow	1
Hydronic Heating and/or Cooling	4	Displacement Ventilation	1
Passive Cooling	4	Transpired Solar Collectors	1
Natural Ventilation	4	Irrigation Water Heat Exchanger	1
Demand Controlled Ventilation	3		

Strategies for reducing load. Pilot project building teams investigated a number of strategies to reduce the need for energy in the building. Since most of the projects are located in Oregon's mild-climate Willamette Valley, minimizing or eliminating mechanical cooling was commonly explored as an option. Some project owners specified a broader range of allowable maximum and minimum set-point temperatures in the building and prepared building occupants to expect that the building may be slightly cooler or warmer than a typical building, especially during extreme weather.

The scheduling and zoning of several buildings was influenced to be able to meet ventilation requirements while minimizing the use of conditioning equipment for as long as possible. Light level requirements were lowered from conventional lighting designs and substituted with low-contrast daylighting and task lighting as needed.

In addition, building owners are seeking to influence participant behavior through a variety of strategies, such as providing energy information, setting rewards, restricting behavior, and creating obstacles. For example, ecoFLATS, an apartment building that has no mechanical cooling is designed with tall, narrow operable windows that maximize ventilation and prevent the installation of window-unit air conditioners.

Design techniques. To support the energy load reduction strategies, pilot project design teams are implementing a number of common design elements. To reduce cooling load, buildings are shaded on southern exposures. Increased thermal mass—overall and in key locations of the building—allows for more stable temperatures when outside temperatures spike in the summer and winter. Different design strategies compete for exterior wall and roof space. These exterior spaces must be optimized to include glazing to provide daylighting, louvers or turbines for ventilation, thermal mass for energy storage, and solar PV or hot water collectors.

Energy-related studies can help project teams optimize design strategies and determine if the building design will function as intended, helping to minimize risk. For example, a daylighting analysis conducted by University of Oregon's Energy Studies in Buildings Laboratory for PCC Newberg informed the shape and size of skylights and skylight reflectors, and identified opportunities for a horizontal mullion, interior light shelves, and an exterior overhang. Expected skylight shading from turbine ventilators, used to increase the ventilation in the space, was taken into account in the analysis.

Several pilot projects also conducted computational fluid dynamics (CFD) analyses. CFD analysis predicts how air will flow through a space and helps to predict the resulting temperatures. The results of a CFD analysis led the design team for CCC Health Sciences Building to adjust the thermal massing and ventilation space openings in the building. The analysis had the added benefit of helping to assure the project manager for the college that the building will maintain a comfortable temperature without mechanical cooling throughout most of the building, thus allowing the elimination of the majority of the cooling equipment. Early monitored data suggests the building is maintaining temperatures predicted by the CFD analysis and staying within the owner's required comfort range.

Technologies. Many of the project teams commonly utilized—or at least considered—a few specific technologies. All projects in the pilot focused on envelope measures to reduce the heating and cooling load of the building. Envelope strategies included low-e glass, insulating concrete form, and high levels of wall (up to R-39) and roof insulation. Installed roof insulation had R values as high as 60.

Four projects installed hydronic heating and cooling systems, which offer many benefits over air-based heating and cooling systems. Water provides a more effective means of heat transfer than air, resulting in reduced energy consumption and increased energy efficiency. In addition, two of these buildings also used geothermal heat pumps to cool and heat the hydronic systems. In addition to heating and cooling with a horizontal ground loop heat pump, Hood River Middle School Science/Music Classroom also exchanges heat with irrigation water for a nearby field through a plate and frame heat exchanger, providing free supplemental cooling to the radiant slabs in the summer.

Six of the eight projects utilized some form of heat recovery, including heat recovery ventilators that exchange heat between exhaust air and supply air. One project, Hood River Middle School Science/Music Classroom, installed a transpired solar collector that uses warm air collected under the rooftop solar PV panels to preheat outside air. This has the added benefit of lowering the temperature of the PV panels and increasing their efficiency. Three projects also use demand controlled ventilation to ensure spaces are not over-ventilated when not occupied. Of the four projects that utilized the principle of natural ventilation for space conditioning, two installed turbine ventilators. Turbine ventilators perform better than stack ventilators, which can only take advantage of upward-driving wind.

For domestic water heating, most projects used both efficient hot water heaters, both tank and tankless, in combination with low-flow fixtures and water-saving appliances. Both multi-family projects use solar thermal panels to pre-heat water. Early monitored data from ecoFLATS shows that this offsets the gas load by approximately 180 therms per month.

Five of the projects installed solar PV panels. Portland Public Schools received a donation of 4.96 kW of solar PV roof tiles integrated with the roof for the Evans-Harvard Classroom building. Unfortunately the tiles were later recalled and removed from the building for safety reasons, and the school has not received additional funding or donations to replace the tiles. PCC Newberg installed 25.95 kW of bi-facial PV panels that collect solar energy from both the top and bottoms of a canopy. The school is also planning to install 75.25 kW of standard solar PV panels on the roof to reach net zero.

Automated controls (daylighting, occupancy controlled lights and plugs, HVAC, etc.) are used throughout the pilot projects in varying degrees, but there is generally some debate during design about what level of control should be automated and what should be left for the occupants. On the one hand, automating as many systems as possible can finely tune the building to operate efficiently under a wide variety of circumstances, with little occupant training needed. Conversely, buildings that are more complex may be a black box to the occupants, who then may override the systems to attain a desired outcome. This in turn can lead to the systems counteracting themselves, instead of optimizing energy performance.

High levels of control are more typically best fitted to larger, more complex buildings with dedicated management staff and to buildings with shifting occupant populations with little knowledge of the building. Lower levels of control may be more appropriate for smaller buildings, buildings with long-term occupants, and buildings designed to engage the occupants, such as schools and demonstration projects. For example, ecoFLATs is designed to leave more control in the hands of the occupants. Ventilation and cooling is provided by residents opening the windows or keeping the shades drawn at the hot part of the day. Occupants are made aware of strategies for keeping the space cool, but ultimately are left to operate their apartments as needed. Likewise, the residents are responsible for unplugging chargers and turning off lights when not needed to help the building as a whole drive toward net zero. Monitoring data are provided to the residents through a real-time display in the lobby that shows energy use compared to past performance and other residents, and shows how the building is operating compared to the net-zero goal.

Building monitoring. For projects in the Path to Net Zero pilot, Energy Trust provides assistance and financial support for the installation of monitoring and reporting systems. This assistance aims to help owners and operators get actionable information about their buildings' energy use so they can diagnose operational issues and make any needed adjustments to optimize energy performance.

Projects in the pilot were required to install a monitoring system capable of at least whole-building, 15-minute interval data for electric consumption and solar PV production and one-hour interval data for natural gas consumption. Additional incentives are provided to projects that further monitor energy use with system or subsystem level meters, which separate energy end uses such as lighting, heating, cooling, plug loads, etc. Participants in the pilot are asked to report monitored data electronically to the program for 18 months following occupancy and meet quarterly with program staff to discuss findings.

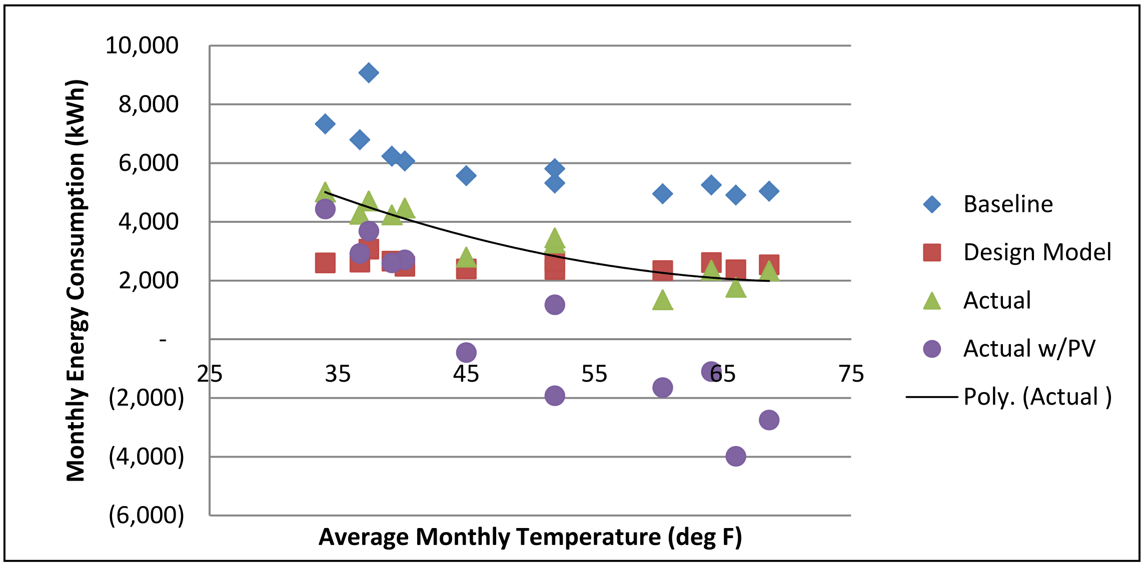
For each project in the pilot, deciding what to monitor and how to display the information was challenging. An increasing number of metering devices and data display systems are available in the market and the benefits and costs must be weighed carefully. Selection can depend on building type/complexity and anticipated use of the data. For example, one pilot participant installed a simple dashboard, whole building monitoring system, while another chose to install a more complex monitoring system that tracked energy consumption by end use. Circuits and electrical panels were intentionally separated, during design so that this could be achieved. Three projects —two educational facilities and one multifamily building— installed monitoring displays that provide information about building features and share real-time energy use and solar energy production data. In several cases, the building operators' schedules prevent them from utilizing the monitoring system as an ongoing energy-optimization tool.

To help raise owners' awareness of the value and applicability of the monitoring systems, Energy Trust meets quarterly with building operators to review data results. In preparation for the quarterly check-ins, a program engineer reviews the latest metered data and creates a summary of findings. The interval meter data is typically rolled up to monthly data so that it can be easily compared to modeled performance. If any anomalies or unusual data points are noticed, the program engineer will go to the raw data to find the affected system. During the quarterly check-in, the program engineer helps the owner troubleshoot those issues along with any comfort or energy issues reported by the owner.

The graph shown in Figure 3 is an example of output from the data analysis completed for Hood River Middle School Science/Music Classroom. It shows the monthly energy consumption plotted against the average monthly temperature with points for baseline, proposed, and actual energy consumption. Based on this graph, it was found that actual building energy consumption varied from modeled consumption by as much as 30 to 50 percent, particularly in the winter months. A deeper look into the data uncovered that over-ventilation was likely the culprit, which was confirmed at the quarterly check-in as it was revealed that an outside air damper had been stuck open for several months. It was also observed that weather data in Hood River in 2011 was 8 percent colder, on average, than the historical weather data used in the energy model, further explaining discrepancies between actual and modeled energy consumption.

Even with these discrepancies from the model, the building is performing within expectations with a first year net EUI of 3.412 kBtu/sf/yr, which is approximately 92 percent more efficient than Oregon code.

Figure 3. Hood River Middle School Science/Music Classroom Monthly Energy Consumption vs. Temperature



Design feature costs. Energy Trust requires all energy-saving measures to pass a utility and societal benefit-cost ratio test in order to qualify for incentives. Because of the interrelated nature of many of the features in the pilot projects, Energy Trust allowed measures to be bundled together for cost-effectiveness screening if they were interdependent from a design, energy, and cost standpoint. In addition, the program accepted measures on the margin of cost-effectiveness if there were significant and well-defined—although difficult-to-quantify—non-energy benefits, or if the measure was part of a market transformation effort that forecasted decreases in measure cost over time.

Based on these criteria, pilot projects were able to receive incentives for most measures. In some cases, envelope measures were bundled with heating and cooling measures, and in other cases daylighting controls were bundled with high-efficiency glazing. Measures that did not pass cost-effectiveness included low-flow fixtures and a tankless water heater (both in spaces with low hot water use), triple pane windows, and increased wall and roof insulation. Solar thermal and geothermal systems are considered part of Energy Trust market transformation efforts and are therefore not required to pass the same cost-effectiveness tests.

Conclusions

Projects in this pilot program have demonstrated what is being discovered across the nation: that net zero is within reach for a variety of building types, particularly for small buildings (NBI 2012). Eight buildings in this pilot are predicting or demonstrating energy reductions of 50 to 60 percent beyond the 2007 Oregon code (according to the Oregon Buildings Code Division, this is comparable to ASHRAE 90.1 2007) and attaining EUIs of 20 to 30 kBtu/sf/yr—and four of these are within five percent of achieving net zero. To achieve these results, these projects:

- Established energy goals early and remained committed to those goals throughout design and construction;
- Identified and successfully implemented design strategies that are not common in typical building designs in the United States by using an integrated design approach;
- Found deeper savings by altering the requirements for space use, scheduling, temperature ranges, and occupant interaction; and
- Installed technologies that are, for the most part, cost-effective and market ready.

Costs will continue to decline for efficient technologies and contractors and designers will gain more experience with efficient systems, such as radiant heating and cooling, bringing the success of these projects within reach for an even wider array of buildings. At the same time, cutting-edge projects will continue to test emerging technologies and inventive occupant engagement strategies to reach net-zero and even net-positive energy use. Utilities and other entities should continue to encourage net zero and net-zero ready design aspirations through incentives, awards, design support, and information sharing.

Lessons learned from the Path to Net Zero pilot have informed the ongoing implementation of the New Buildings program. Based on findings from the pilot, early design and technical assistance has been expanded to encourage integrated design, iterative modeling, and additional energy-related studies. The program is exploring ways to integrate solar further into efficiency projects and promote solar-readiness. Program staff has gained experience with the development, modeling, and installation of innovative design ideas, such as radiant heating systems that are supplemented by solar thermal or geothermal preheating. In the coming months, Energy Trust is interested in developing offerings to encourage post-occupancy monitoring and building optimization, as well as supporting burgeoning net-zero and net-zero-ready initiatives in the market.

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