

State Energy Efficient Design 2009-11 Biennial Report



OREGON
DEPARTMENT OF
ENERGY

State Energy Efficient Design

Biennial Report

2009-11

It is my pleasure to submit this report to the 76th Oregon Legislative Assembly on the State Energy Efficient Design Program (SEED). The SEED program was established in 1991 during a time of increasing national awareness of the environmental impacts of energy consumption, the importance of energy efficiency, and of sustainability issues in general. The Oregon legislature recognized that state government should be a leader in conserving energy and that state facilities should be constructed to serve as models of energy efficiency. The adopted legislation that created the program stated:

“It is the policy of the State of Oregon that facilities to be constructed or purchased by authorized state agencies be designed, constructed, renovated and operated so as to minimize the use of energy resources and to serve as models of energy efficiency.”

This goal is accomplished through a unique partnership between the Oregon Department of Energy, state agencies, the Oregon University System and the Department of Administrative Services. The program establishes a high level of energy performance for state buildings that results in substantial savings in energy use for the state.

For a building to operate at a high degree of energy efficiency, it is important to incorporate all cost effective energy conservation technologies into its design. Therefore, SEED program staff gets involved with state agencies at the very beginning of a building project to assist them in analyzing available energy efficiency technologies for the project. SEED program staff are skilled in mechanical engineering, energy modeling analysis and the latest technologies in energy efficiency. This report provides a summary of the program’s activities and the buildings built and renovated over the past biennium.

In 2001, the SEED statute was revised to include the requirement that state buildings exceed Oregon’s energy code requirements by at least 20 percent and that the Department of Energy work with state agencies to periodically define “highly efficient buildings” to modify this requirement as energy efficiency best practices progress. A lot has changed since 2001. The trend toward “green” building practices has quickened. Oregon’s energy codes have increased building energy efficiency requirements by about 30 percent, Oregon is adopting its first ever voluntary “Reach Code” this year to encourage above-code energy efficiency estimated to be an additional 15 percent, DAS has implemented sustainability policies for many state operations, and national code bodies are aggressively pursuing significant increases in energy efficiency. In light of these developments, I have instructed my staff to work with state agencies to revise SEED rules to include updated goals and increased flexibility for state agencies in meeting those goals.

Oregon has become recognized as a national leader in energy efficiency. Through the ongoing work of the SEED program, the Oregon Department of Energy, in partnership with other state agencies, is continuing to strive to make state buildings as energy efficient as possible, and to use the latest technologies to pursue even greater levels of energy efficiency. SEED buildings are a source of public pride and provide an opportunity for all citizens of Oregon to see first-hand how a high level of energy efficiency can be achieved and maintained.

This report covers building projects completed during the 2009-11 biennium through the end of 2010. Thanks to the many state agency representatives and partners who contribute to make the SEED program successful.



Bob Repine, Director
Oregon Department of Energy

INTRODUCTION

In the United States, buildings account for 25-50 percent of national energy use and over 70 percent of electricity consumption. Buildings are exceptionally costly investments. Buildings constructed to perform efficiently pay dividends for many years in the form of lower energy costs. The SEED program seeks to reduce energy use in state buildings, making them models of energy efficiency. By constructing and renovating buildings with energy efficiency in mind, state agencies can significantly reduce long-term operating costs. In some cases, initial capital costs may also be reduced. Those savings can be redirected to fund essential services. In addition, the benefits of energy efficiency help reduce adverse environmental impacts and improve comfort for building occupants.

The SEED process calls for state agencies to involve the department in the initial design of their building projects so that energy efficiency issues are addressed and cost-effective energy efficiency technologies are incorporated into building designs. Depending upon the size and complexity of the project, SEED program staff provides technical consulting services to the state agency throughout the course of a project. SEED staff works closely with state agencies and their building design teams to develop a list of energy conservation measures for consideration for each project. Each energy conservation measure (ECM) is analyzed for cost-effectiveness and an “optimum ECM” package is developed for each building project. To keep costs down for smaller building projects, Class 2 projects (less than 10,000 square feet) are self-administered by each agency. Although the agency is responsible for ensuring all cost-effective energy conservation measures are incorporated into Class 2 projects, SEED staff provide assistance and monitor these buildings occasionally.

Working together, SEED program staff and agency design teams ensure that all cost-effective energy conservation measures are included in each building’s design and that the building will exceed the energy conservation provisions of the Oregon state building code by 20 percent or more. In some cases, department involvement has also enabled the agency to save capital costs.

SEED AUTHORITY

The SEED program is governed by ORS 276.900 - ORS 276.915. In January 2001, the Energy Conservation Initiative was added to the statute and requires all state facilities constructed or substantially remodeled to exceed the energy conservation provisions of the Oregon state building code by a minimum of 20 percent. Since then, much has changed in the world of energy efficient building construction. Oregon’s energy codes have been upgraded by approximately 30 percent, Oregon is developing its first ever Reach Code to encourage “above code” building energy efficiency, and some agencies seek to build LEED¹ certified buildings. The SEED rules advisory group is currently working on a revised definition of “highly efficient buildings” and LEED and Reach Code options for state agency building projects.

Also added to the statute was the requirement for state agencies to reduce energy consumption in existing buildings by 20 percent from 2000 levels by the end of the 2013-15 biennium. Interim energy reduction goals were set by rule: 10 percent reduction December 31, 2010; 15 percent reduction by December 31, 2012. Agencies enter energy data directly into a web-based database overseen by the department. State agency building energy use data is provided in this report.

¹ “Leadership in Energy Efficient Design (LEED)” is an internationally recognized green building certification system, providing third-party verification that a building or community was designed and built using strategies intended to improve performance in metrics such as energy savings, water efficiency, greenhouse gas emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

SECTION 1 - STATE ENERGY EFFICIENT DESIGN PROGRAM

Buildings Covered in This Report

The SEED program divides buildings into two classes depending upon their size. Class 1 buildings are 10,000 or more square feet and Class 2 buildings are less than 10,000 square feet. Regardless of building class, state agencies are responsible for ensuring that ECMs are incorporated into the building. For Class 1 buildings, SEED staff works closely with state agencies and their design teams to develop an “optimum ECM” package for each building project. Class 2 building projects are self-administered. Although the agency is responsible for ensuring all cost-effective ECMs are implemented, SEED staff provides a list of ECMs for consideration and assist agencies with technical advice. This report covers Class 1 buildings for which post-occupancy energy use data has been collected as of December 31, 2010.

Program Savings to Date

Over the course of the SEED program, 155 state building projects have been completed. Twenty nine projects were completed during the 2009-10 biennium. Since SEED’s inception, the total cost for completed construction projects exceeds \$1.79 billion and over \$43 million has been invested in energy efficiency, resulting in over \$5.7 million of energy savings per year. While most projects are for individual buildings, several large infrastructure projects were undertaken by three universities (Portland State University, Oregon State University, and the University of Oregon) which affect energy savings campus-wide. These accomplishments are listed separately to more accurately portray SEED program costs and benefits.

With energy costs increasing, the energy saved becomes more valuable each year. Annual savings from SEED projects completed to date are more than \$5.7 million of energy savings per year.

Current Activity Level

The department is currently working with ten SEED projects in the active design phase. Four additional projects are on hold at the design level for budgetary reasons. These projects have the potential of being reactivated if funding becomes available.

After SEED projects are completed, post-occupancy energy use is tracked for a period of 18 months to determine if the project is meeting its energy use targets. Currently, 34 SEED projects are in this 18 month post- occupancy energy metering phase. Another 29 projects are pending final inspection and 18 additional projects are in the construction phase. All of these projects will require post-occupancy energy metering as well. The table on the next page provides data for projects where enough data collection has occurred to begin comparing predicted to actual energy use.

Post-Occupancy Metering Results

Post-occupancy energy metering is done to verify predicted savings are being achieved. The projects that have not met the predicted goals are required to investigate the reason that the building is not meeting its goal and develop a corrective plan. Post-occupancy metering data is provided in the following table for which sufficient data is available:

Project Name	Predicted Energy Use % Better Than Code	Actual Energy Use % Better Than Code
UO Health and Counseling Center	26.7	-0.6
UO Living Learning Center	29.1	32.2
Justice Bldg Renovation	10.0	-19.4
DEQ Quality & Public Health Lab	38.4	12.8
OSU Apperson Hall Renovation	23.8	44.6
OIT Center for Health Professions Phase 1	22.4	38.1
Oregon Military Department Lane County AFRC-Phase 2	38.8	57.0
SOU/RCC Higher Education Center	37.0	35.8
UO College of Education- New Building	32.3	44.0
OIT Center for Health Prof. Phase 2	47.3	65.0
PSU Shattuck Hall	22.7	19.1
Oregon Military Department Lane AFRC BLM Warehouse	20.8	35.0
Eugene State Office Bldg	19.8	15.5
PSU FAB HVAC Improvements	N/A	13.2*
OMD Lane AFRC Warehouse Expansion	26.0	32.8
Average Overall Energy Use Better Than Code	26.3	28.3

Negative numbers denote performance below modeled (or simulated/predicted) results.

* Compared existing energy use to post-project energy use.

When a building's performance does not meet the projected energy use, an energy conservation plan is developed to outline modifications to be made until monitoring shows that the building meets the projected energy use, or all reasonable attempts to reduce the energy use have been made. Overall SEED program projects completed this biennium achieved an average energy performance of 28 percent better than code.

Current Biennium Highlights

ROGUE COMMUNITY COLLEGE/SOUTHERN OREGON UNIVERSITY

Higher Education Center

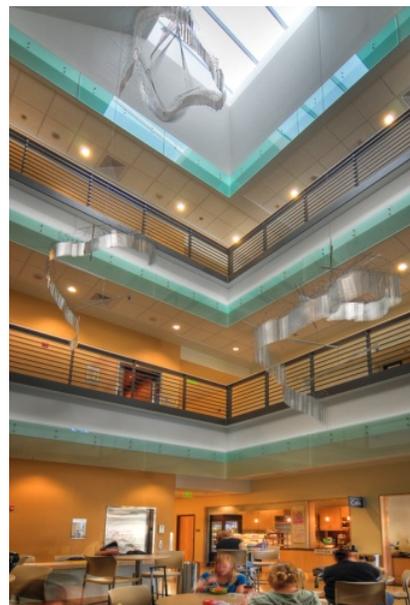
The Higher Education Center was one of the first buildings in the Oregon University System to receive the LEED certification and one of only a handful of LEED Platinum certified university buildings in the western United States. The building incorporates a large number of green building and sustainable strategies.

Key features include:

- Total energy use is 37 percent better than Oregon Energy Code resulting in savings of about \$37,330 annually.



- Strategic window placement utilizes day lighting which in turn decreases lighting energy use.
- Occupancy sensors control lighting and temperature adjustments and shut off HVAC to unoccupied spaces.
- Occupancy sensor in labs reduce minimum outside air from 10 air-changes-per-hour (ACH) when occupied, to 4 ACH when unoccupied.
- Water-efficient landscaping reduces water use by 50 percent; annual domestic water use is 53 percent less than code.
- Building is located adjacent to public transit and provides showers for bike commuters.
- A 56-kilowatt solar array on the roof produces 6 percent of the building's electricity supply.



PORTLAND STATE UNIVERSITY Shattuck Hall

Shattuck Hall is a fully renovated beautiful 1915 red brick building, originally used as an elementary school and is now the home for PSU's architecture department. With a \$13 million budget the building has been transformed into a dynamic facility which includes a multi-level open plan, naturally-lit



studios, a roof-top gallery, digital lab, and an extensive materials lab encompassing model-making, woodworking, metalworking, foundry and digital fabrication. The American Institute of Architects recognized the design and awarded the project one of two top Honor Awards plus an Award for Sustainability. In January 2010, Shattuck Hall received the top award of Building of the Year from the Oregon chapter of the American Council of Engineering Companies.

Key features include:

- Refurbished eight foot tall operable windows retain the building's character and beauty while supplying abundant daylight and outside air.
- An integrated ceiling system of white perforated metal panels provide radiant heating and cooling, acoustical absorption and reflection of indirect lighting.
- Refurbished light wells serve as skylights for the basement foundry and shop, providing daylight to formerly dark interior spaces.
- Daylight and occupancy sensors ensure lighting is only used when needed.
- Dedicated outside air supply provides for ventilation which significantly reduces heating and cooling energy and required fan power.



- Serves to demonstrate that preserving existing buildings can be a cost-effective way to achieve SEED objectives.

UNIVERSITY OF OREGON – College of Education



The \$50.5 million project, the first construction for the college since 1980, included renovation of all the buildings within the complex. It provides the college's 1,295 students, 325 faculty and 119 staff members with the most advanced technology for teaching and learning at the university. The building is projected to be 30 percent more energy efficient than state code requires with a variety of environmentally friendly features including photovoltaic systems and on-site storm water treatment.

Key features include:

- Solar assisted hot water heater.
- Increased insulation in roof and walls.
- Architectural shading on west and south facing courtyard windows.
- Reduced fan energy use due to ductwork sizing, routing and selection of fittings.
- Heat recovery for makeup air and restroom exhaust.
- Natural ventilation in stairwells.



UNIVERSITY OF OREGON – Living Learning Center



The Living Learning Center (LLC) is the first residence hall built at UO since 1963. The Living Learning Center was designed using U. S. Green Building Council's LEED rating system along with the University's sustainability guidelines. While not officially registered under the USGBC's LEED rating system, the project targeted the 'Silver' level when evaluating choices of materials, and system's design. ECMs were analyzed against a full building energy model under the Oregon SEED program. The energy model verified that the LLC is projected to be 30 percent more efficient than required by the Oregon Energy Code.

Key features include:

- Shower waste water heat recovery.
- External sunshades.
- Corridor lighting setback between 1 AM and 7 AM.
- Air to air heat recovery.
- Solar hot water for peak summer loads.



Evaluation and Adaptation

When buildings do not meet the target energy use, the department and agency work together to identify why performance is not achieved and consider alternatives to improve energy efficiency. The following projects are undergoing this evaluation and modification process:

- University of Oregon Health and Counseling Center – The project has had problems with the calibration of meters and has only recently been able to take accurate readings of utility use. At this time, UO is investigating why energy use is higher than expected. They start by verifying that all systems are operating at peak performance and all ECMs are performing as designed.
- Justice Building Renovation – It is more of a challenge to find cost-effective ECMs for renovation projects than for new construction. This project was predicted to have a 10 percent savings over a code baseline building. The Department of Administrative Services has requested an extended post-occupancy measurement period to make refinements to building operations to bring the energy use down and meet the energy use target.
- Eugene State Office Building – This is another example of a renovation which faces challenges that new construction does not. The project had a very tight budget which did not allow for extensive changes to the building shell. While the project is not quite meeting its goal, the reported use is very close to the margin of error expected from energy simulation modeling and is performing close to the 20 percent better than code requirement. The design team has worked closely with the building operators during the post-occupancy phase to assure that the HVAC systems are performing as designed.
- Department of Environmental Quality’s Quality and Public Health Lab – During the SEED staff post-occupancy inspection, this project was noted to have some control issues with laboratory hoods and air systems. SEED staff, DEQ and DAS are working to identify and implement possible changes to reduce energy use.

Biennium Summary

The following table summarizes SEED projects that were completed in the 2009-2010 calendar years. These projects have not yet collected sufficient post-occupancy energy use data, therefore the energy savings are predicted amounts. Most data reflect costs and benefits of one building. Shaded rows in the table below indicate projects which affect more than one building such as central plant upgrades resulting in savings in multiple buildings which use the central plant heating and cooling system.

Project	Construction Budget	Project Sq Ft	SEED added ECM cost	Annual Savings		
				Total MMBtu	Annual (\$) Savings	% above code
OMD Lane County AFRC-Phase 2	\$31,000,000.00	155,000	\$138,030	4,316.6	\$ 57,930	38.8
UO College of Education	\$38,000,000.00	80,173	\$119,600	2,095.3	\$ 26,836	30.2
Eugene State Office Bldg	\$ 4,100,000.00	29,316	\$31,556	139.8	\$ 1,804	19.8
EOU Zabel Hall	\$ 550,000.00	43,613	NA	1,121.2	\$ 10,287	23.5
EOU Combined projects	\$ 875,000.00	600,000	\$335,095	6,476.5	\$ 90,901	N/A
OSU Education Hall	\$ 5,262,157.00	40,032	\$11,800	155.2	\$ 2,240*	N/A
PSU FAB HVAC Improvements	\$ 1,800,000.00	199,564	\$980,815	6,671.0	\$195,851	13.2
OMD Lane AFRC Warehouse Expansion	\$ 1,479,145.00	12,140	\$0	148.0	\$ 2,048	26.0
OSU Heckart Lodge	\$ 2,000,000.00	12,443	\$30,900	122.9	\$ 1,771	25.2
OMD, Ontario Readiness Center	\$12,407,170.00	35,380	\$498,136	2,361.0	\$ 29,616	59.8
OSU Energy Center Building (Phase 2)	included in #32A	21,452	\$7,700	460.0	\$ 7,413	50.7
OMD Salem Flight Operations Facility	\$10,300,000.00	38,000	0	601.8	\$10,344	26.0
OIT Center for Health Prof. Phase 2	\$15,000,000.00	53,022	\$4,200	1,917.0	\$ 3,025	47.3
PSU ASRC	\$61,000,000.00	185,125	\$245,964	7,326.8	\$114,373	30.7
OMD Lane AFRC BLM Warehouse	\$ 1,850,000.00	12,637	\$0	246.7	\$ 3,322	20.8
UO Jaqua Academic Learning Center	\$20,000,000.00	36,108	\$25,425	164.9	\$ 2,733	7.7
OSU ONAMI Lab Facility	\$ 7,000,000.00	59,950	\$ 9,000	273.0	\$ 3,465	43.9
DOC Santiam Boiler Replacement	\$ 1,800,000.00	96,663	\$1,039,802	6.2	\$10,252*	0.0
OMD St. Helen's Armory	\$ 2,300,000.00	12,192	\$25,457	274.5	\$ 3,959	36.3
PSU Lincoln Hall	\$20,000,000.00	139,972	\$170,145	2,938.0	\$41,341	30.4
OIT Owens Hall	\$ 5,000,000.00	36,240	\$ 13,844	1610.0	\$ 14,134	51.5
WOU Live/Learn Residence Hall	\$ 14,000,000.00	82,095	\$15,120	2308.0	\$ 19,113	36.0
EOU Inlow Hall	\$4,650,000.00	43,613	\$144,000	1415.0	\$15,273	28.0
OSU Reed Lodge	\$2,200,000.00	12,443	\$30,900	122.9	\$ 2,186*	25.2
UO PK Park Phase 2	\$10,840,000.00	14,838	\$0	406.3	\$ 8,016	38.4
OIT Geothermal	\$882,000.00	1,000	\$ 20,000	2682.6	\$47,160	72.0
PSU Steam & Chilled Water Loop	\$ 13,500,000.00	NA	\$10,319,520	7,604.0	\$92,382	8.0
UO Central Plant	\$ 13,000,000.00	2,500	\$1,164,800	13,467.0	\$154,724	38.8
EOU Central Plant	\$ 1,400,000.00	NA	\$1,065,540	5,257.1	\$14,466	8.1
OSU Energy Center Phase 1	\$39,000,000.00	NA	\$4,018,839	349,012.0	\$1,425,298	33.0
PSU Central Loop and Plant	\$ 5,500,000.00	NA	\$2,660,248	938.0	\$29,604	1.0

*Savings are estimated.

SECTION 2 - ENERGY CONSERVATION IN EXISTING STATE BUILDINGS

In addition to ensuring that buildings built by state agencies are designed to operate in an energy efficient manner, it is also the priority of state government for existing buildings to reduce their energy use. Added to the statute in 2001 was the requirement for state agencies to reduce energy consumption in existing buildings by 10 percent. In 2008 the statute was amended to require 20 percent energy reduction from 2000 levels by the end of 2015. Interim energy reduction goals were set by rule: 10 percent reduction by December 31, 2010; 15 percent reduction by December 31, 2012. Agencies enter energy data directly into a web-based database overseen by the department.

Agencies which do not achieve the 2010 interim energy reduction goal must notify the department by June 30, 2011. Within 90 days of notification, the agency must submit to the department a corrective plan to reduce energy use by the required percent. The plan must outline modifications, procedures, and changes that need to be introduced until the target is met. The agency may request technical assistance from the department in developing their corrective plan. The agency then has six months to implement the plan. The agency will monitor progress, report to the department, and modify the plan as necessary, until the target reduction is achieved.

Eleven agencies have met the interim goal of saving 10 percent of energy over the year 2000 baseline. The Department of Public Safety Standards and Training is not referenced because their facility was completed in 2006 and was subject to SEED program requirements that the design be 20 percent more efficient than the building code applicable at that time. The Department of Energy, while not required to report data (the department occupies a leased building), showed 14 percent savings.

Agency	2000 Energy Use, MMBtu	2010 Energy Use, MMBtu	Percentage change	Is the Agency meeting goals?
Dept. of Administrative Services	213,921	201,911	18	Yes
Dept. of Agriculture	985	712	37	Yes
Dept. of Aviation	237	250	-5	No
Dept. of Corrections	743,343	--	--	--
Dept. of Education	42,238	18,854	39	Yes
Dept. of Employment	7,664	11,894	-65	No
Dept. of Energy	1,155	996	14	Yes
Dept. of Fish & Wildlife	13,357	55,258	-314*	No
Dept. of Forestry	18,084	20,651	-14*	No
Legislative Administration	19,697	15,291	22	Yes
Lottery	12,259	9,698	21	Yes
Military Department	256,295	459,924	-56	No
Dept. of Transportation	87,668	171,635	-96*	No
Liquor Control Commission	12,932	17,250	19	Yes
Oregon Youth Authority	110,015	89,006	21	Yes
Oregon University System	1,463,144	2,203,709	-31	No
Dept. of Parks & Recreation	51,275	59,952	-17*	No
PERS	3,748	4,580	-22	No
State Hospital	123,224	103,146	16	Yes
Dept. of State Lands	6,437	4,428	32	Yes
Dept. of Veterans Affairs	26,511	21,009	21	Yes

*Results for these agencies are skewed because complete data for 2000 baseline was not available. Data were not available for the Dept. of Corrections.