

The Effect of Energy Efficiency Measures on K12 Educational Performance

Background

The Broad Overview

SB 1149

- ▶ SB 1149 (1999) was Oregon's deregulation bill.
 - ▶ It was part of the implementation of FERC 888.
 - ▶ Established a public purpose charge that funds things like The Energy Trust of Oregon.
- ▶ The 3% Public Purpose Charge was collected by *almost* all the IOUs.
 - ▶ PacifiCorp and PGE collect, but Idaho Power in Eastern Oregon does not.
 - ▶ Used for Energy Efficiency
 - ▶ 10% must be used in schools.

Schools Program

Schools using SB 1149 public purpose funds:

- ▶ Complete energy audits of *buildings*, not districts, served by Pacificorp or PGE (with limitations);
- ▶ Audits must be completed by an approved audit company;
- ▶ Implement the approved Energy Efficiency Measures identified in the audits;
- ▶ Report Energy Use Index data in the Schools Interactive Database each year;

Details are later . . .

Key Points

- ▶ Not all districts are eligible.
- ▶ Not all schools within districts are eligible.

Makes it easier to establish a natural control group for any treated school by using others in the district.

Educational Funding in Oregon

Oregon Educational Funding has key provisions that makes using schools in other district more attractive than other states.

- ▶ 1991 Oregon establishes an Equalization Formula:
 - ▶ The legislature establishes a biennial K12 State School Fund Budget
 - ▶ The State School Fund budget is distributed equally by student across the state, but adjusted for property tax collections.
 - ▶ \$1 increase in property tax collected results in \$1 less in State School Fund support.
- ▶ Result, equal, per-student funding across the state with a few exceptions:
 - ▶ Short-term, 3 year, property tax operating levies.
 - ▶ Capital bonds
 - ▶ A few, depends on year, school districts with few students but lots of taxable property.

Much smaller inter-district funding differences than other states.

School District Size

- ▶ Oregon has 197 school districts for ~500K students.
 - ▶ Washington has 296 for ~1M students
- ▶ The three largest school districts, Portland Public, Salem-Keizer, and Beaverton are about 40K each.
 - ▶ Washington has 9 over 20K
- ▶ The remainder are small.

Less opportunity for intra-district funding differences but need to watch the big three.

Key Points

- ▶ Management and salary levels may be different across districts
- ▶ There are fewer haves and have nots within and between districts than other states.

We can feel more comfortable using schools out of district for controls given equal funding.

The Energy Efficiency Measures (EEMs)

Mostly what you would expect

- ▶ Building Envelope, including windows and insulation.
- ▶ HVAC Components
- ▶ HVAC Controls
- ▶ Pumps, Motors and Drives
- ▶ Domestic Hot Water
- ▶ Lighting
- ▶ Kitchen Equipment
- ▶ Other (Pool Covers . . .)

What Should Strike you About the List

- ▶ Most of the items you would never notice unless you were an expert looking or listening for them.
- ▶ There are a few that could have an impact on the educational environment.
 - ▶ Double or Triple Glazed Windows (Sound, Moisture Control)
 - ▶ Cavity Insulation (Sound, Moisture Control)
 - ▶ Lighting Quality Improvements (Daylighting)

Key Points

- ▶ Treated schools may or may not have educationally impactful EEMs.
- ▶ Treated schools could have a mix.

The non-impactful EEMs can provide a placebo effect robustness check on the effects of the impactful EEMs on educational performance.

How to Measure Educational Impact

- ▶ Some of the measures produce environmental improvements, less moisture, mold, we can look at the effect on attendance.
 - ▶ Recorded annually for each school.
 - ▶ Intermediate indicator. The more often you go to school the better you do.
- ▶ Environmental Improvements can reduce teacher absenteeism.
 - ▶ Counts not recorded but expenditures on substitutes are a budget item that can be observed.
- ▶ Some produce better learning environments, less distraction. We can use the annual standardized testing results.
 - ▶ Everyone in the same grade takes the same test, but the test, and the levels can be different from year-to-year.

Key Points

- ▶ Test scores are the main indicator but for some EEMs, absenteeism and attendance may be good predictors.
- ▶ We have some candidates for instruments if we wish to take that route.

Data Details

Schools Program Audit Requirements

- ▶ Non-educational buildings and those that are rented or will close in 5 years are ineligible.
- ▶ Energy Audits are required
 - ▶ Whole Building audits, similar to ASHRAE Level 2. Identify EEMs with 50 year payback or less.
 - ▶ Multi-component payback is
 - ▶ Targeted Audits are acceptable for limited scope.
 - ▶ Target is 47/48 kBTU/SF/Year for elementary and 61/62 kBTU/SF/Year for High Schools
- ▶ Multi-component payback calculations are allowed.

School Program Implementation

- ▶ The maximum amount of PPC funds reimbursed will be capped at the total annual savings multiplied by the Measure Life capped at cost.
- ▶ Common for some cost to not be funded.
- ▶ Commissioning is required for:
 - ▶ All boiler or chiller measures exceeding \$100,000
 - ▶ All other HVAC measures and all HVAC controls measures exceeding \$50,000
 - ▶ All lighting control measures exceeding \$100,000
 - ▶ Other measures in which commissioning is critical for successful implementation and operation of the measure, as deemed appropriate by the auditor.

Required Annual Reporting

- ▶ Annual energy expenses by fuel type
- ▶ Square footage
- ▶ Hours of operation

Summary of Measures

Year	Installations
2010	189
2011	92
2012	119
2013	91
2014	81
2015	33
2016	17

Note spikes in installation.

Types of Installed Measures

EEM	Installations
Boiler Equipment	121
Chiller/AC Equipment	3
Controls	44
Distribution System	44
Doors	19
Fixture Modification	100
Flow Issues	2
Heat Recovery Options	3
Insulation	38
Lamp Modification	146
Maintenance	18
Other	47
Windows	37

Comments

- ▶ Controls are frequently occupancy sensors and daylighting controls
- ▶ Fixtures are described in detail later as gym, exterior, etc.

Electric Utilities

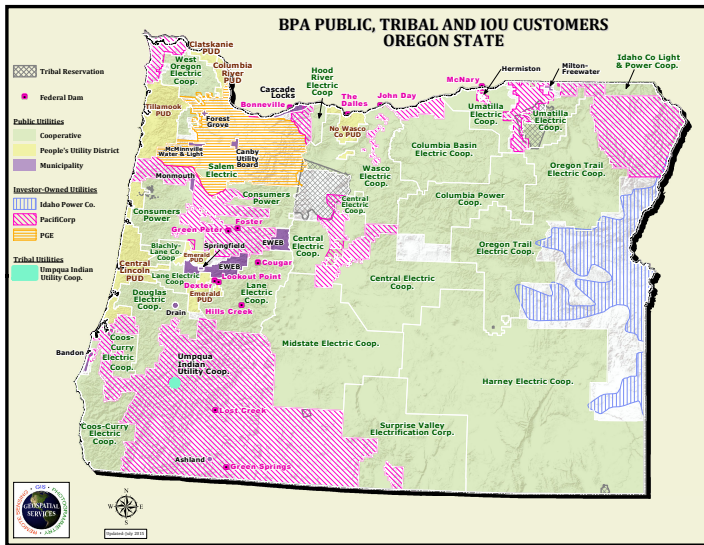
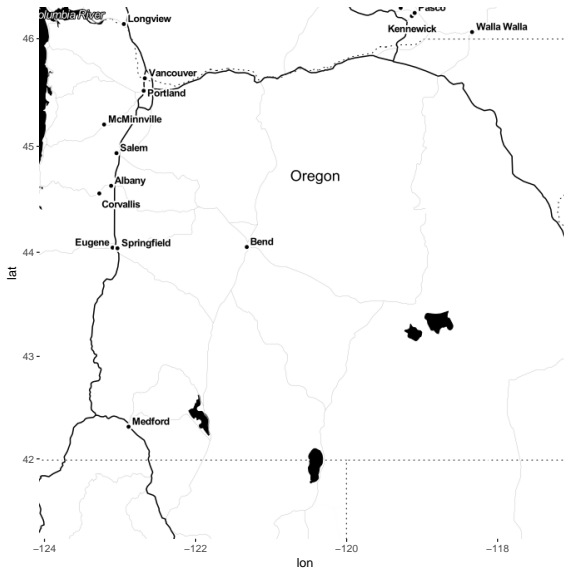


Figure 1: BPA 2015

Oregon is a mix

- ▶ Most of population is served by IOUs
- ▶ Large tracts of COUs
- ▶ Only PacifiCorp and PGE schools are eligible.

Districts with Eligible Schools



Identification Strategy One

- ▶ Treatment schools, have had EEMs
- ▶ Control schools:
 - ▶ Same district
 - ▶ Same level, e.g., elementary.
 - ▶ Synthetic control based on student population characteristics
- ▶ No charter, immersion, shared campuses, or magnet schools

How Many District? Schools?

- ▶ Eligible
 - ▶ Districts: 108
 - ▶ Schools: 778
- ▶ Districts with both eligible and ineligible schools (Border Districts): 86
 - ▶ With treated schools: 48
- ▶ Schools in Border Districts : 934