Oregon Can Save Energy, Money, and Mitigate the Effects of Climate Change through Building Energy Codes

Buildings built to the latest energy codes represent a significant opportunity to save energy, lower utility bills, and reduce the environmental impact of the built environment. Building energy codes and standards establish minimum efficiency and performance requirements for new and renovated buildings, assuring reductions in energy use and emissions over the life of the building. Buildings built in accordance with modern building standards are not only more efficient, but are healthier, more comfortable, and more resilient to extreme weather, natural disasters, and other adverse events. Nationally, building energy codes represent an opportunity to reduce utility bills by $138 billion and avoid 900 MMT of CO_2 emissions in residential and commercial buildings[1], benefiting states, local governments, households and businesses alike.

Building Energy Codes Provide Lasting Impacts

Buildings last a long time, typically from 50 to 100 years, and many for even longer. As a building's environmental impact is largely determined by upfront decisions, energy codes present a unique opportunity to assure savings through efficient building design, technologies, and construction practices. Once a building is constructed, it is significantly more expensive to retrofit to achieve higher efficiency levels. Energy codes ensure that a building's energy use is included as a fundamental part of the design and construction process—and making this early investment in energy efficiency pay dividends to owners and occupants for years to come.

The average new homeowner in Oregon can expect to save 5.1% which equates to $81 annually on their utility bills

[1] *Tyler M et al.. 2021. Impacts of Model Building Energy Codes - Preliminary Update, Pacific Northwest National Laboratory, Richland, Washington. Available at http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-31437.pdf*

Residential Buildings

New homes built to the 2021 IECC will save homeowners energy which translates into lower operating costs and utility bill savings. While investments in energy efficiency can increase the incremental "first costs" of construction, the resulting savings outweigh any increases in costs, as shown in the table below. Life-cycle cost (LCC)[2] is the best metric for assessing the cost-benefit and economic impacts of building energy codes, and it best balances first costs against longer term savings, and accounts for maintenance, repairs, replacements, and other operational costs which can have a significant impact on the overall cost of ownership[3].

When net LCC savings are positive, the updated code edition is cost effective for homeowners. **Net LCC savings in Oregon are $3,543, with most households seeing positive cashflow in as little as Immediate years.**

The results shown below are weighted averages for common home configurations, including foundation and fuel types, across all climate zones in Oregon. Learn more about how the U.S. Department of Energy assesses the energy and cost impacts of building energy codes at energycodes.gov[4].

Metric	Residential Buildings
Down payment increase	$(52)
Annual mortgage increase	$(3)
Annual reduction in energy bill	$81
Years to positive net savings	Immediate years
Net annual consumer cash flow in year 1	$102
Net present value of LCC savings	$3,543
Simple payback	Immediate years

Commercial Buildings

New commercial buildings built to ASHRAE Standard 90.1-2019 save energy and experience lower operational costs, which results in lower utility bills for building owners and businesses. Life-cycle costing (LCC) methods are used to assess the savings and economic impact of commercial building energy codes, through separate cost scenarios representing both publicly- and privately-owned buildings.

Net LCC savings is calculated based on the present value of energy savings for a building built under the updated code compared to the previous code, less the incremental costs of construction, and other costs such as replacement and residual costs, over a 30-year analysis period. When net LCC savings is positive, the updated code edition is cost-effective for commercial building owners.

Net LCC savings, public buildings, $3,595/ksf | Net LCC savings, private buildings, $3,144/ksf

Adopting the latest model codes in Oregon is estimated to reduce greenhouse gas emissions (CO_2e) by 12,158,089 metric tons (MT) (over 30 years).

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[2] LCC savings is the present value of energy savings for a building built under an upgraded code compared to an exisiting code, less the incremental construction cost difference, less the present value of the replacement and residual cost difference

[3] Further details available in DOE's Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes

[4] Additional details about the residential state level analysis are available at https://www.energycodes.gov/national-and-state-analysis

[5] Further details available in DOE's Methodology for Evaluating Cost-Effectiveness of Commercial Energy Code Changes

The results shown below are weighted averages for prominent commercial building types across all climate zones in Oregon. Learn more about how the U.S. Department of Energy assesses the energy and cost impacts of building energy codes at energycodes.gov[5].

Metric	Commercial Buildings[6]	
	Public Buildings	Private Buildings
Annual reduction in energy bills ($/ft^2)	$0.04	$0.04
Added construction cost ($/ft^2)	$(1.01)	$(1.01)
Present value of replacement costs ($/ft2)	$(1.93)	$(1.84)
Net present value of LCC savings ($/ft2)	$3.59	$3.14
Simple payback	Immediate	Immediate

Additional Economic and Environmental Benefits

Adopting the latest model codes in Oregon is estimated to reduce statewide greenhouse gas emissions (CO^2e) by 12,158,089 metric tons (MT) (over 30 years). For perspective, this is the equivalent to 2.6 million passenger vehicles, 3.1 coal power plants, or 1.5 million homes.

Greenhouse gas emission equivalencies are calculated based on estimated energy savings. The avoided greenhouse gas emissions and corresponding impacts are presented in the tables below.[7]

Metric	Residential Buildings*	Commercial Buildings**
First year statewide CO_2e reduction	18,664 MT	4,233 MT
Cumulative statewide CO_2e reductions (over 30 years)	9,111,207 MT	3,046,882 MT

Metric	Quantity
CO_2	12,116,896 MT
CH_4	651 MT
N_2O	87 MT
TOTAL (CO_2e)	12,158,089 MT

**As compared to the current residential state code*
***As compared to Standard 90.1-2016*

[6] *In some cases, the added construction and replacement costs are negative. This occurs, for example, when there are net decreases in costs either from reductions in HVAC capacity or reductions in installed lighting due to lower LPDs.*
Additional details about the commercial state level analysis are available at https://www.energycodes.gov/national-and-state-analysis

[7] *Emission factor sources are a combination of EPA AVert (https://www.epa.gov/avert) and Egrid (https://www.epa.gov/egrid) tools for electric energy and the EPA AP-42 Report (5th edition) for natural gas and oil combustion on site (https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors). Factors for converting CH_4 and N_2O to CO_2 equivalents from the IPCC 5th Assessment Report at https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_all_final.pdf.*

In addition, buildings built to the latest codes yield several additional benefits which are not directly assessed in the current analysis. This includes lowering peak demand on the utility grid, and allowing for better energy planning and forecasting for utilities. As buildings are the largest consuming sector of energy in the U.S.—accounting for 40 percent of total energy consumption and over 70% of electricity use[8]—they play an important role in ensuring a reliable and resilient utility grid. Beyond benefits to the grid, the latest building codes also have enhanced ability to maintain safe and comfortable indoor temperatures in the event of a power outage, which can be particularly important during extreme temperature events. Building energy codes represent a dependable and readily available solution for states and local governments to incorporate into their resilience planning, reducing total energy demand and associated greenhouse gas emissions, but also providing constituents with everyday benefits in the form of buildings that are more comfortable, more resilient, and at a lower cost to own and operate.

Impacts on Jobs and the Economy

When a home or building is built to the latest building codes, home or building owners benefit through lower utility bills. Energy-efficient building codes not only put money in consumers' pockets, they help stimulate the economy and create jobs. Lower bills leave American families with more discretionary income, which when returned to local economies drives job creation. Jobs are also created through construction-related activities that result from the incremental costs of building more energy-efficient buildings. State and local economies benefit from increased discretionary spending, as well as the associated construction activity. Energy efficient building codes save energy, save money and create jobs, making them a foundational building block of a resilient, sustainable, clean energy economy.

Value Stream	Number of Jobs (Over 30 Years)
Lower utility bills	4,959
Construction-related activities	4,691
TOTAL	9,650

About the Building Energy Codes Program

The U.S. Department of Energy (DOE) supports the advancement of building energy codes. Modern building codes and standards offer cost-effective solutions, contributing to lower utility bills, and providing everyday benefits to homes and businesses through buildings that are healthier, more comfortable, and more resilient. Building energy codes also help mitigate the impacts of climate change, and are a foundational component in the transition to a clean energy economy.

Learn more at energycodes.gov.

[8] *Energy Information Administration (EIA). Monthly Energy Review April 2021. Washington, DC: U.S. Department of Energy, 2021. Available at: https://www.eia.gov/totalenergy/data/monthly/*

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