

Policy Brief: Energy Efficiency Policy Opportunities in Existing Buildings

- Existing buildings hold **the greatest potential** for reducing energy consumption and associated greenhouse gas emissions in the building sector.
- Successful existing voluntary energy efficiency programs have **made Oregon a leader** in energy efficiency and greenhouse gas (GHG) reductions, but more is required to access the large pool of potential energy efficiency and GHG reductions in the existing building stock.
- There are multiple strategies and programs that can **support higher adoption** of energy efficiency technologies for existing buildings.
- Policy design should be informed by robust data and new programs should establish specific targets and goals to **ensure programs are efficient and effective**.

This policy brief will explore policy and program options for reducing energy use and greenhouse gas emissions in the existing buildings sector. Energy consumption in buildings is responsible for approximately 22.4 million metric tons, or nearly 35 percent of annual Oregon greenhouse gas emissions.¹ Reducing greenhouse gas emissions in the built environment is a priority for Oregon and a focus of recent executive orders and legislation. While building energy codes are a successful policy for addressing energy efficiency in *new* construction, there are few regulations that focus on existing buildings – which represent most emissions in the building sector.

Energy efficiency reduces both energy use and GHG emissions. It is now the second largest resource in the Pacific Northwest, behind hydropower.² The Northwest Power and Conservation Council reports that from 1978 through 2020, the region acquired 7,530 average megawatts (aMW) in energy efficiency, including about 2,200 aMW in Oregon alone.³ These accomplishments save ratepayers more than \$4 billion per year on their electricity bills and have reduced emissions by over 24 million metric tons of carbon dioxide.⁴ Building efficiency is a big part of these overall energy savings.

Building Codes for New Buildings

Oregon’s building energy codes apply to newly constructed buildings; application to existing buildings is limited to only renovations. Building codes cover many aspects of construction, including: insulation, windows, and heating and cooling options that affect the building’s overall energy consumption. Once occupied, updates to existing equipment and building elements are not required; and building energy performance is not regulated once construction is complete. Newly installed equipment, however, is required to meet the current code.



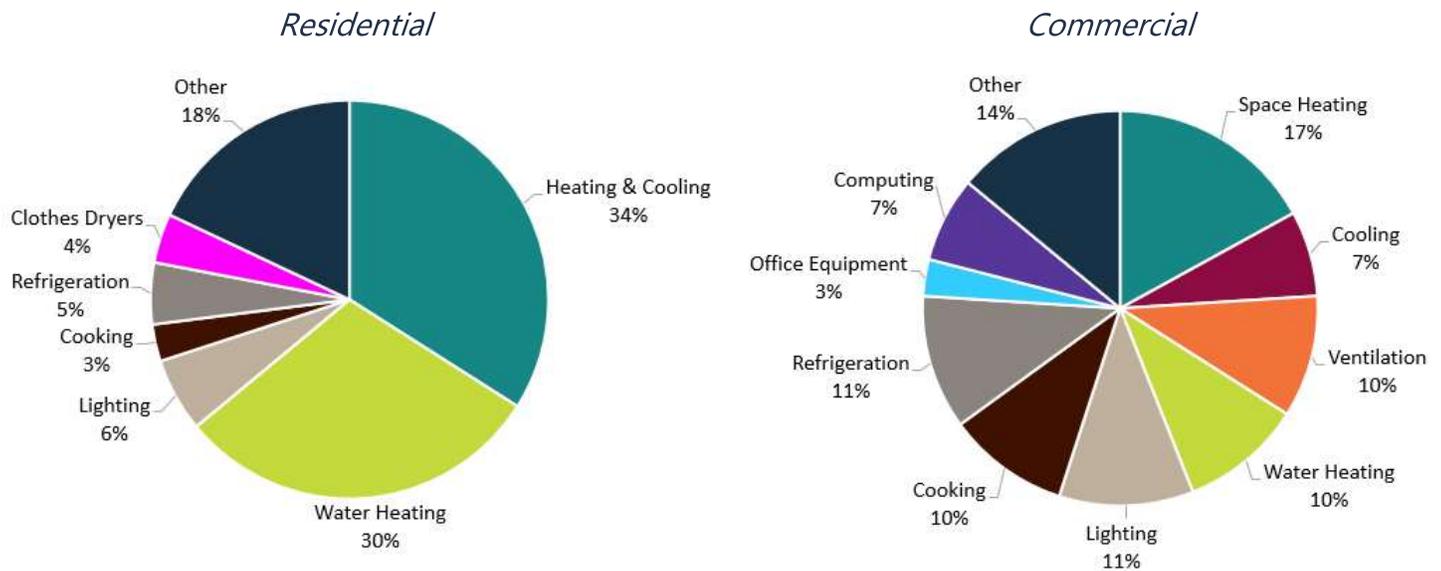
Oregon’s commercial and residential building codes are some of the most energy efficient codes in the country.⁵ Governor Brown’s Executive Order 20-04 included a directive to update building codes to reduce building energy consumption by 60 percent by 2030, compared to a 2006 baseline.⁶ Existing code reduces residential energy use by about 35 percent⁷ and the commercial code by about

ⁱ The Northwest Power and Conservation Council previously reported about 7,200 aMW in energy efficiency; the Council updated its estimate to 7,530 in September 2022.

45 percent⁸ from this baseline, and future code increases will be introduced incrementally. Oregon also established voluntary residential and commercial reach codes which are optional energy construction standards that exceed existing energy codes. Reach codes are designed to allow the energy efficiency and construction industries to prepare for future code requirements. By introducing new technologies and practices through a reach code, industry learns and modifies its approach, paving the way for future adoption into the next code iteration.

As shown in Figure 1, about 70 percent of residential sector energy end-uses (heating & cooling, lighting, and water heating) are directly affected by building codes. In the commercial sector, the primary end-uses that are directly affected by energy codes (space heating, cooling, ventilation, water heating, and lighting) account for approximately 55 percent of total energy usage. Other end-uses not directly covered, such as refrigeration, cooking, and computing, can be influenced by the building code through efficiency and control requirements for the equipment that serves these uses.

Figure 1: Energy End-Uses in the Residential and Commercial Building Sectors^{9 10}



Appliance Efficiency Standards

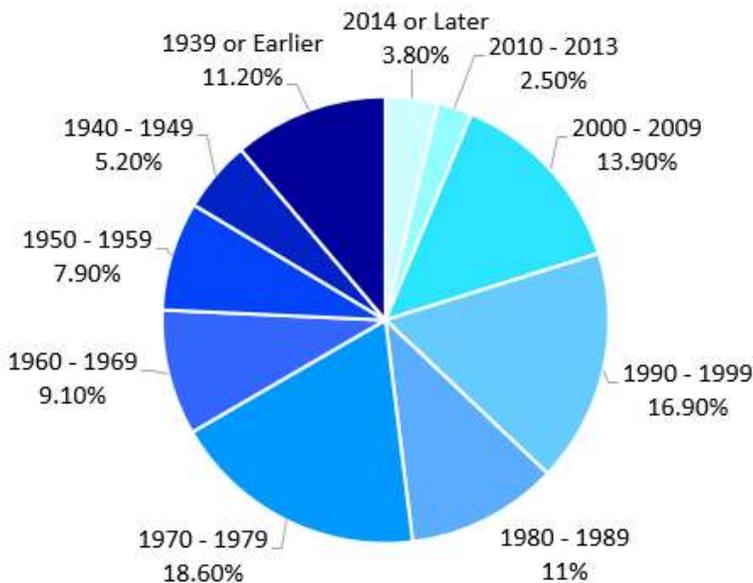
New consumer products such as water heaters, commercial dishwashers, and televisions are required to meet Oregon’s product efficiency standards when they are installed in new or existing buildings.

These standards ensure improvements in energy savings for consumers. Governor Brown’s Executive Order 20-04 directed Oregon to update and improve its appliance efficiency standards.⁶ An ODOE public rulemaking and legislative passage of HB 2062 in 2021 created nine new and two updated product efficiency standards,^{11 12} which match the highest standards in the country. Savings and reductions will continue into the future as long as the standards remain in place. By 2025, implementation of the standards will result in an estimated 111 gigawatt-hours of electricity savings, 414 billion Btus of natural gas savings, and will reduce approximately 49,500 metric tons of CO₂.¹³ ODOE will continue to evaluate opportunities for new efficiency standards. Regular updates help maintain consistency and alignment with comparable standards, eliminate marketplace confusion, and achieve cost-effective energy conservation for Oregon consumers.

Existing Building Energy Use

There is potential for significant energy savings in existing residential and commercial buildings. About 25 percent of all energy use in Oregon supports existing residential buildings.¹⁴ In 2018, there were 1.8 million existing residential housing units in Oregon, compared to about 17,600 new residential building permits issued per year (representing about 1 percent of that total number of existing residential units).⁹ Most existing residential buildings are also relatively old; 63 percent were built before 1990, when building energy codes were substantially lower than today.¹⁵ Comparatively speaking, the opportunity for energy saving and greenhouse gas reduction in existing buildings far exceeds the opportunity in new buildings.

Figure 2: Oregon Homes by Vintage



Commercial buildings account for 19 percent of Oregon’s energy consumption.¹⁴ There are 3.4 billion square feet of commercial buildings in the Pacific Northwest,¹⁶ and approximately 60 percent of that square footage was built before 1990.

Current Oregon Programs Supporting Energy Efficiency in Existing Buildings

In 1999, the State of Oregon created the Oregon Public Purpose Charge as part of Senate Bill 1149, which requires the state’s two largest investor-owned electric utilities to provide funding to support cost-effective energy efficiency improvements.¹⁷ Most funds are administered by Energy Trust of Oregon through incentive programs that help utility customers offset the cost of energy efficiency upgrades. These programs, and the individual measures they support, must pass Oregon Public Utility Commission required cost-effectiveness tests to ensure energy efficiency investments are in the best interests of ratepayers. Consumer-owned utilities also offer energy efficiency incentive programs, supported by the Bonneville Power Administration.

The Northwest Power and Conservation Council collects information each year about the progress the region makes toward its energy efficiency targets, and with every new plan, forecasts future cost-effective energy savings. NWPCC reported that the region missed the 7th Power Plan targets

significantly, and is projecting a substantial decrease in overall available cost-effective energy efficiency.¹⁸ While voluntary energy efficiency incentive programs are effective, the current pace of savings acquisition is slowing and will take a very long time to capture all the potential available savings in existing buildings.

Examples of programs promoting energy efficiency in the existing buildings include:

Audits and Weatherization

Energy audits can help identify the best options for energy efficiency improvements in a building. Energy audits vary in complexity from in-person, in-depth data collection performed by a trained expert – including building energy leakage measurements – to a more self-directed audit that allows owners or occupants to enter home characteristics using an online entry system. This information can be used to prioritize upgrades to the building, such as addressing the building envelope through air-sealing, increasing insulation, and replacing windows. These types of envelope upgrades are supported by incentives made available through utility programs and Energy Trust of Oregon to encourage building improvements.

Space Heating and Water Heating Upgrade Incentives

Space and water heating make up 64 percent of an average residential building’s energy use.¹⁵ Utility programs provide incentives for space and water heating upgrades. Many programs also offer incentives, rebates, and/or low-interest loans for new heat pump installations that are particularly effective at reducing building energy consumption. Heat pumps use energy to transfer heat, rather than using energy to create heat, and are up to three times more efficient than electric resistance space heat. Heat pumps also come in many configurations, sizes and options that help keep installation costs down. For more information about heat pumps, see the *Energy Efficient Building Technologies* Resource and Technology Review.



New Program Options for Existing Buildings

New energy efficiency programs are needed to increase the adoption rate of energy efficiency technology in existing buildings. There are four main programmatic strategies that help drive energy efficiency in existing buildings.

-  **Education and Awareness**
-  **Incentives**
-  **Mandatory Requirements**
-  **Decarbonization of Fuels**

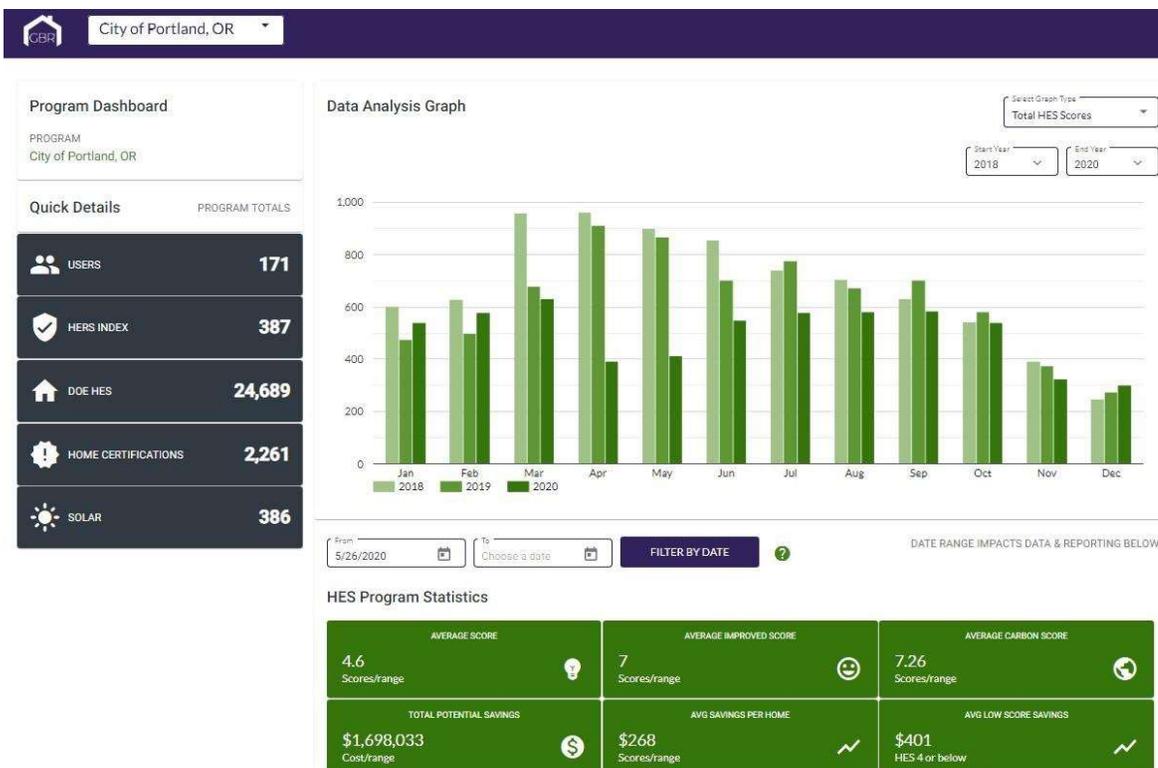
Education and Awareness

Programs that provide information about building energy consumption and options to reduce that consumption help building owners and occupants make informed decisions about improving their building’s energy performance. These programs are informational, and do not set requirements for adoption or provide monetary incentives, are more effective when used in conjunction with other strategies.

Home Energy Scoring

Home Energy Scoring increases the awareness of the home’s energy consumption and identifies specific energy efficiency improvements that could improve a home’s overall score. The Home Energy Score captures 40 characteristics within each home, calculates the estimated annual energy use, and describes the overall efficiency of the home using a 1-10 scale.¹⁹ A scorecard is produced, and also includes a graphic that describes the carbon footprint of the home, and like the energy score, assigns a 1-10 rating. Each scorecard calculates what cost-effective measures can be used to improve performance and reduce greenhouse gas emissions. The scorecard also shows the total potential savings in dollars if the recommended efficiency upgrades were added to the home. Oregon has three cities that have adopted mandatory Home Energy Scoring – Portland, Milwaukie, and Hillsboro, which represent 18 percent of Oregon’s population²⁰ – and numerous other cities considering adoption. Overall, the three cities have done over 35,000 scorecards,¹³ with the City of Portland’s Home Energy Score program producing more than 32,000 home energy scores. The average score in Portland is 4.6 and the average score with improvements is 7.²¹ Figure 3 below from the City of Portland’s HES program dashboard, shows the number of home energy scores done by month from 2018 through 2020.

Figure 3: City of Portland Home Energy Score Program Dashboard



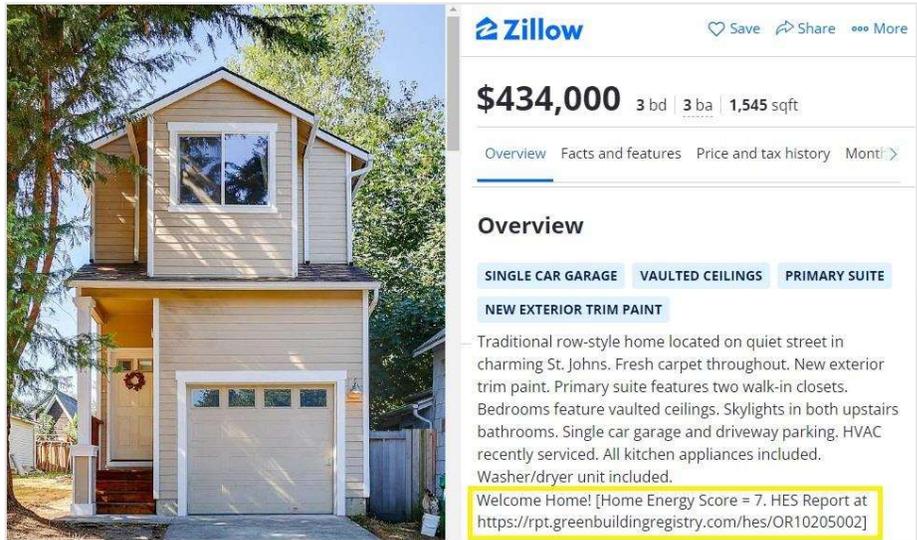
One major gap in the HES programs is data on rental units, which are estimated to be 38 percent of all homes in Oregon.²² Most HES programs require scores only when a home is listed for sale, and there are currently no programs in place that require a score when a rental unit turns over. In 2023, ODOE is planning on developing a HES program design to create energy scores for single family and multi-family home rentals.

Commercial Building Benchmarking

Benchmarking programs increase visibility and awareness of energy performance and motivate investment in efficiency improvements through market competition, transparency, and comparison. They allow commercial building owners to track, compare, and measure energy performance relative to similar buildings, and provide local and state governments with information and data to inform the development of energy efficiency policies and programs. There are many types of commercial buildings, such as retail, office, medical, and educational occupancies. Tracking building energy efficiency is often performed using the U.S. Environmental Protection Agency's ENERGY STAR® software, and there are many examples of commercial building benchmarking in place nationwide.²³ Locally, the City of Portland has required commercial buildings larger than 20,000 square feet to report energy consumption since 2016.²⁴

Educational Campaigns

Educational marketing can inform broad or targeted audiences about energy efficiency options and benefits. Utility and government websites, real estate advertising, professional and social networking platforms, and the mainstream media all have examples of energy information available to the general public. For example, the Home Energy Score is widely incorporated into popular real estate-oriented mobile apps like



Zillow and Redfin because the data is required as part of the listing in some cities. These apps use HES data to target consumers interested in energy efficient homes and allow users to search for homes within a specific energy score range.

Energy-related training is also available to realtors, lenders, and appraisers to help them understand various topics and benefits of energy efficiency. Many realtors are finding value in a "Green Designation" credential,²⁵ which provides them with knowledge on home energy efficiency options and benefits that they can use to inform home buyers and sellers. Fannie Mae and Freddie Mac provide attractive loan rates through HomeStyle Energy Mortgages²⁶ that give qualifying buyers lower interest rates by purchasing more energy efficient homes, and they share this information with lenders and realtors.

Incentives

While many energy efficiency measures are cost-effective, the up-front cost of purchasing and installing many technologies can be a barrier to adoption. Incentive programs such as tax credits and rebates can help reduce some of the up-front costs that will allow for more widespread adoption of energy efficiency technologies. Examples of incentive programs include: the Oregon Department of Energy’s Residential Energy Tax Credit program (which provided tax credits to more than 600,000 Oregonians from 1977 to 2017²⁷); the Energy Trust of Oregon’s rebates to residential, commercial, industrial, and agricultural buildings in Portland General Electric and Pacific Power territories; and similar programs offered by Oregon’s consumer-owned utilities.²⁸ In addition to reducing up-front costs, incentive programs have encouraged market acceptance of new energy efficient products like LED lighting, heat pumps, and ductless heat pumps.

Incentive programs have encouraged market acceptance of new energy efficient products.

In 2022, Senate Bill 1536 directed the Oregon Department of Energy to develop two heat pump programs to provide relief to Oregonians during extreme heat events by using high efficiency heating and cooling equipment.²⁹ A \$10 million Community Heat Pump Deployment Program will offer eligible entities funding to provide incentives for the purchase and installation of heat pumps. A \$15 million Oregon Rental Home Heat Pump Program will offer incentives for the installation of heat pumps to landlords for rental properties, as well as certain owners of manufactured homes and recreational vehicles.ⁱⁱ Utilities and Energy Trust of Oregon also offer direct consumer incentives for installation of heat pumps through their energy efficiency programs.

Oregon may also receive federal dollars from the 2022 Inflation Reduction Act to support heat pump installations in Oregon homes, but details are not yet available as of the date of this report.

Mandatory Requirements

Mandatory requirements programs require audits, performance standards, retrofit, and decarbonization of fuels to save energy and reduce greenhouse gas emission from existing buildings. These are most frequently applied when buildings undergo major remodels, when a building is sold, or when tenants’ turnover. Mandatory requirements can be coupled with incentive programs to offset the cost of compliance. There is a good deal of potential for savings. In 2020, the American Council for an Energy Efficient Economy estimated that among buildings at least four years old in the U.S., 14 to 39 percent have had an efficiency-related renovation over the preceding 18 years,³⁰ but the Northwest, including Oregon, is likely to be higher than the national average. However, most buildings only receive upgrades for one or a few systems instead of all the cost-effective measures.

Auditing

Many jurisdictions require whole building energy audits prior to a sale or remodel. Several cities, including Austin, TX; Piedmont, CA; and San Francisco, CA require an energy audit that identifies all cost-effective energy efficiency improvements as part of the issuance of a residential permit.

ⁱⁱ Learn more about ODOE incentive programs: <https://www.oregon.gov/energy/Incentives>

Building Performance Standards

Building Performance Standards use energy benchmarking data and compare that to regional and national data from similar building types to establish an efficiency performance target for a building. These programs are separate and distinct from building code requirements because they focus only on reducing the building energy consumption of existing buildings. Building Performance Standards can be an important tool to drive improvements throughout an existing building’s life by requiring a building to meet outcome-based energy performance targets.³¹ Building Performance Standards can also reduce both total and peak building energy demand, which coupled with on-site energy storage can help electric utilities better manage peak load.

These programs typically follow best-practice guidelines for building energy management of existing buildings, outlined in industry standards such as ASHRAE Standard 100 – Energy Efficiency in Existing Buildings, or similar frameworks. Such programs generally include:

- Establishing appropriate energy performance targets for building types and locations.
- Performing energy surveys and audits to identify projects to achieve targets.
- Developing operations and management programs to maintain energy efficiency projects and ensure continued savings.
- Periodic re-analysis or evaluation of actual building performance to confirm achievement savings estimates or adjust building management to get back on track.

Programs start out by prioritizing larger commercial buildings and then gradually phase-in other smaller buildings. Building equipment replacements, retro-commissioning (a building tune-up that helps heating and cooling equipment operate as efficiently and effectively as possible), and operational improvements are often components to help a building meet its targets under a Building Performance Standard.

In recent years, multiple jurisdictions at the city, county, and state levels have adopted some form of building performance standards.³² Washington State and New York City led the way with BPS programs adopted in 2019. Washington’s program tracks energy consumption per square foot of building area, was originally applied to only commercial buildings with 50,000 square feet or more, and was expanded to include all commercial and multi-family buildings with 20,000 square feet or more. New York City’s BPS program applies to commercial and multi-family properties greater than 25,000 square feet and uses a performance metric based on annual greenhouse gas emissions. Colorado, Maryland, and the cities of Chula Vista, CA; Boston, MA; and St. Louis, MO also recently adopted building performance standards.³³

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Building Performance Standards can be established so they are triggered on a specified timeline, rather than by a specific event such as a property sale or major renovation. These programs require achieving a level of performance by a certain date. They typically do not prescribe specific measures to be installed implemented, but rather allow flexible for building owners to evaluate and choose which measures they will install to achieve the target.

Decarbonization of Fuels

Energy efficiency programs complement and support overall decarbonization policies and goals. For example, Oregon’s 100 percent clean electricity by 2040 law (HB 2021) will significantly reduce the emissions of buildings using electricity in IOU service territories.¹² Similarly, the Oregon Department of Environmental Quality’s Climate Protection Program will reduce the greenhouse gas emission from natural gas use in buildings by 50 percent by 2035 and 90 percent by 2045.³⁴

Building Performance Standards Supporting Decarbonization



Building Performance Standards can prescribe targets for greenhouse gas emission reductions that are based on corresponding energy use reductions. Reduction targets are normalized for building square feet for different types of buildings so they can be applied to other similar buildings. Building owners are required to assess their building’s performance relative to the target standard, determine the gap in performance, conduct a comprehensive building energy audit to identify energy efficiency measures to address the gap in performance, and implement those measures by a certain date. For example, Boston, MA and New York City set building performance standard greenhouse gas emission reduction targets – usually in metric tons of CO₂ per square foot – for offices, multi-family buildings, retail buildings, and schools.³² Each specific building type has its own standard and target. Many building performance standard programs offer exceptions for financial hardship and cost-effectiveness considerations. Buildings owners and jurisdictions can also support decarbonization by electrifying end-uses that currently use fossil fuels and by installing on-site distributed energy systems, like rooftop solar and battery storage.

Implementation Issues/Considerations

As described above, achieving energy efficiency in existing buildings is critical for reducing emissions in the buildings sector, and while there are many benefits, there are also barriers and challenges. This section provides an overview of some potential challenges and questions to consider when designing a new program.

Voluntary vs Mandatory Participation

Voluntary programs encourage investment in energy efficiency through incentives and allow the market to drive adoption. While this potentially allows for more innovation in pathways that encourage efficiency technology adoption, it usually results in a more gradual market change that may not be fast enough to achieve energy or greenhouse gas reduction goals. Mandatory programs drive faster adoption toward achieving goals, but it may be met with opposition because of unmitigated potential costs and the fact that they are regulatory directives. Both approaches have benefits and drawbacks that should be weighed when considering a program design. Many jurisdictions have successfully run voluntary residential and commercial building energy efficiency programs for decades, often funded by utilities. However, the urgency of the need to reduce greenhouse gas emissions may lead more jurisdictions to pursue mandatory programs.

Legal Authority

Regulating existing buildings sometimes requires new legal authority to administer and enforce a new program. This authority can flow from a state or local jurisdiction.^{35 36} In Oregon, there is no state agency with authority to regulate existing building energy performance on a statewide basis. The Oregon Department of Consumer and Business Services' Building Codes Division regulates the energy efficiency measures in new construction and renovations through the building energy code, but this regulation does not extend to operational building performance once the building is occupied. New legislative direction and authority may be required for an Oregon state agency to administer a regulatory energy efficiency program for existing buildings.

Cost and Incentives

The initial cost of energy efficiency projects may be a significant financial barrier to building owners, especially those with low-to-moderate incomes. The American Council for an Energy-Efficient Economy estimates deep energy retrofit project costs for residential homes range from \$50,000 to well over \$100,000. Commercial deep energy retrofits of average office buildings range from \$25 per square foot to over \$150 per square foot.^{37 38}

Mandatory energy efficiency programs can be designed to reduce negative financial impacts on building owners.

Mandatory energy efficiency programs can be designed to reduce negative financial impacts on building owners. For example, rules can require only cost-effective energy efficiency measures. Cost caps or building exceptions can be included to limit the investments required by building owners. Other economic hardship exemptions can also be incorporated in program rules to protect home or building owners who may have financial difficulty in meeting the energy performance targets. Programs can set aside or require a certain percentage of the incentive budget for low-to-moderate income owners and for buildings located in environmental justice communities. Penalties collected by jurisdictions for non-compliance to program rules can be used to offset some of the costs in low-income communities.

Local energy efficiency programs to offset the high up-front costs for building owners can remove some financial barriers, but costs to build and implement energy efficiency programs are also significant for state and local governments.

It is important to develop program budgets that account for the many costs associated with developing and operating a program. It is important to include adequate funds for incentives or financing; staffing to support program design, administration, and enforcement; training; education to building owners and trade allies; and outreach to historically underserved communities, including communities of color, rural communities, veterans, and people with disabilities.

The Federal Inflation Reduction Act includes more than \$9 billion for states to help overcome these financial barriers for consumers, states, and local governments. The Home Energy Performance-Based, Whole House Rebates (HOMES) program and the High-Efficiency Electric Home Rebate Program (HEERA) are two programs that are targeted specifically at helping consumers with low or moderate incomes achieve energy savings through retrofits and by installing new efficient appliances. Oregon will likely see over \$100 million from these programs come to the state over the next few years. In

addition to direct assistance, the law also expands and extends tax credits for numerous energy efficiency measures and appliances, including insulation, windows, heat pumps, battery storage, and energy audits. Funding from the Inflation Reduction Act has the potential to help the state make significant progress addressing in reducing energy use in existing buildings.ⁱⁱⁱ

Types of Buildings and Customers

During program development, jurisdictions need to determine the types and characteristics of buildings they intend to include. This could be determined through inventory surveys or benchmarking efforts that help identify the building types. Building type consideration could include: commercial, residential, or both; floor area limits; occupancy types; building age; and baseline energy consumption. Program participant consideration could include: income level, owner/renter, and disadvantaged or underserved community members.

Programs should design evaluation metrics that track performance in relation to the identified objective for improved performance, including based on energy costs, greenhouse gas emission reductions, and program timeline, among others.

Specific Measures

Programs should be designed to be flexible and work with the needs of individual building owners. Energy audits can be effective in identifying cost-effective measures in individual homes and buildings. Potential energy efficiency measures cover a wide range of heating, cooling, ventilation, lighting, envelope, and other building improvements. Identifying cost-effective measures while improving the comfort of the building can be a challenge. There is no “one size fits all” set of measures, although there are certain classes of measures that may apply across many building types.

Monitoring and Verification of Savings

Many energy efficiency programs require achievement of performance targets and reporting of building performance data over time to verify compliance. Sometimes more advanced submetering may be required to track the performance of installed equipment, rather than just relying on whole-building level measurements. It is also important to ensure there is adequate resources to do the monitoring and verification of energy or greenhouse gas reductions by participant buildings.

Conclusion

Reducing energy use and greenhouse gas emissions from existing commercial and residential buildings is essential to achieve Oregon’s state energy efficiency and climate goals. Most potential building energy savings – and their associated greenhouse gas emissions – are in existing building stock. While advancing building energy codes prepares new buildings for the future, codes have limited effect on existing buildings. Successful voluntary energy efficiency programs have provided significant energy

Reducing energy use and greenhouse gas emissions from existing commercial and residential buildings is essential to achieve Oregon’s state energy efficiency and climate goals.

ⁱⁱⁱ Track ODOE’s work with federal funds online: <https://www.oregon.gov/energy/energy-oregon/Pages/IIJA.aspx>

savings for many years, but to dramatically reduce energy consumption in buildings would require new state or local existing building programs that may include mandatory program features.

There are many different strategies to achieve significant reductions in building energy consumption. A combination of strategies is likely to be necessary to fully capture the reduction potential in existing buildings, with education and awareness programs, incentive programs, mandatory requirement programs, and enhancement of our existing decarbonization of fuels programs among these potential strategies.

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