ECOnorthwest

DATE:	January 27, 2025
TO:	Vinh Mason and Andria Jacob, City of Portland Bureau of Planning Sustainability (BPS)
FROM:	Becky Steckler and James Kim, ECOnorthwest
SUBJECT:	Cost Analysis of Cooling Temperature Standard in Portland

Executive Summary

Heat waves and extreme heat events have become hallmarks of climate change globally. Residents of Portland are very much affected by the increasing frequency and intensity of extreme heat events. The 2021 Heat Dome set a record high temperature of 116 degrees Fahrenheit, exceeded the previous high of 107 degrees Fahrenheit for three consecutive days, and left 62 people dead in Multnomah County alone.

A maximum temperature standard may be one path to mitigating the effect of heat waves and extreme heat events in Portland. A local code amendment that requires landlords to provide cooling options can not only save lives but also improve the health and comfort of renters who often lack control over improvements to their living spaces. Based on other jurisdictions' experience with maximum temperature standards ranging from 78 to 88 degrees Fahrenheit, this analysis assumed a maximum temperature standard of 80 or 82 degrees Fahrenheit to estimate compliance costs.

Two potential options to comply with such a requirement are installing window air-conditioning (A/C) and hiring a contractor to install ductless mini-split heat pumps along with necessary upgrades to electrical panels. An ENERGY STAR certified window A/C costs about $330, though up to three times higher with professional installation. On the other hand, a professionally installed mini-split heat pump could cost about $6,100, and, if needed, upgrading the electrical panel could increase the costs by about $3,900.

In Portland, there are more than 153,000 rental units. About 75 percent of renters already have some form of air conditioning. Portland Clean Energy Community Benefits Fund (PCEF) Cooling Portland Program is providing 15,000 households with portable cooling options. For the residents of about 25,400 units that are not likely to have air conditioning, property owners complying with a potential maximum temperature standard would need to determine the best way to provide cooling options for these units. About half of the renters without air conditioning live in older, smaller multifamily properties, but many are also in larger multifamily properties, regulated affordable properties, and single-family units.

City-wide compliance costs will depend on specific code amendments. If the requirement is for a cooled common space to be available for a building's residents to take shelter in but

does not apply a maximum temperature standard to the whole building, the compliance cost would be lower: about $1.4 million with window A/Cs and about $39 million with ductless mini-split heat pumps. On the other hand, if the requirement is for each private unit to be cooled to the maximum temperature, the compliance cost would be higher: about $7.9 million with window A/Cs and about $50 million with ductless mini-split heat pumps. These estimates account for existing funding opportunities through Energy Trust of Oregon, Oregon Housing and Community Services (OHCS), PCEF Cooling Portland Program, PCEF Community Investment Plan (CIP), and federal Inflation Reduction Act.

Depending on the requirements and property-specific needs, the possible range of compliance costs could vary widely. Cost estimates for window A/Cs do not include installation labor costs; they could be three times higher with contractor labor. The costs for ductless mini-split heat pumps are high, but they could also complement carbon emissions performance standards for buildings.

Exhibit 1. Summary of Cooling Temperature Standard Compliance Costs, After Incentives

Cooling Requirement	Window A/C, No Contractor	Mini-Split Heat Pump
Option A: Common Space	$1.4 million	$39 million
Option B: In-Unit	$7.9 million	$50 million

Source: ECOnorthwest

Although the heat pump option will be much more costly for landlords and potentially the public sector, they can benefit renters by lowering their utility costs. While A/Cs could moderately increase energy use and electricity bills in hotter months for renter who choose to use it, heat pumps could decrease annual energy use and annual cost of using electricity by reducing energy consumed for heating in cooler months. Because rents could potentially increase by the amount utility costs decrease, this means there could be an increase in monthly rents in units with new heat pumps due to increased amenity factors and capitalization of utility cost savings: about $18 per month for multifamily and about $35 per month for single-family. If both property owners and tenants expect the same savings, it is possible the rents of units with heat pumps could increase by a similar amount.

However, rent increases are not likely to be larger amounts that might be sought by property owners trying to recoup the costs of cooling measures. Market conditions will dictate the ability of property owners to pass through the additional costs of new heat pumps to tenants in the form of higher rents. Lack of coordination between rental property owners, a long compliance period, and renters' options across the rental market are likely barriers to passing through the costs of cooling measures. If local regulations require cooling measures, renters may perceive the associated costs for property owners as a compliance requirement, making it harder to justify rent increases solely based on the cooling measures.

Introduction

Purpose and Context

Heat waves and extreme heat events have become hallmarks of climate change globally. Over the last decade, communities across the U.S. have experienced and continue experiencing record-breaking temperatures in the summer. Residents of Portland are very much affected by the increasing frequency and intensity of extreme heat events. The 2021 Heat Dome set a record high temperature of 116 degrees Fahrenheit, exceeded the previous high of 107 degrees Fahrenheit for three consecutive days, and left 62 people dead in Multnomah County alone.[1]

Moreover, the consequences of extreme heat event are often amplified for communities that have been made vulnerable by historically discriminatory systems and policies. Researchers at Portland State University and Virginia Commonwealth University found that across 108 U.S. cities, "heat islands"—neighborhoods that are susceptible to excessive heat—tend to be disproportionately occupied by low-income communities and people of color and that they are inextricably linked to historical housing policies. Nationally, land surface temperatures in historically redlined areas are approximately 4.7 degrees Fahrenheit warmer than in other areas.[2]

Safety of residents in their own living spaces is a key concern, especially among renters. In the Portland metropolitan area, about 25 percent of renters do not have air conditioning in their dwelling units.[3] This is more likely to be the case for renters who are cost-burdened—spending 30 or more percent of income in housing costs—and for renters who are Asian, Black, and Hispanic.[4] In addition, renters also have less control over improvements to their living spaces. Their ability to prepare for emergency situations are sometimes restricted by the responsiveness of landlords. Meanwhile, landlords are financially incentivized to minimize their costs. Therefore, regulations and incentives that result in more landlords providing air conditioning will benefit renters in Portland.

Establishing a cooling, maximum temperature standard will complement the existing minimum temperature standard (City Code Section 29.30.180). Renter protection laws across the country require landlords to provide heating systems. The Oregon Residential

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[1] Paul Loikith, "The 2021 Pacific Northwest Heatwave (Heat Dome)," Oregon Encyclopedia, April 20, 2023, accessed August 5, 2024, https://www.oregonencyclopedia.org/articles/heat-dome-2021/.
[2] Jeremy S. Hoffman, Vivek Shandas, and Nicholas Pendleton, "The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas," *Climate* 8, no. 1 (January 2020), https://doi.org/10.3390/cli8010012.
[3] U.S. Census Bureau, 2019 American Housing Survey (AHS) data indicate about 34% of renters in Portland lacked air conditioning. Based on 2023 AHS data for Seattle—data for Portland is not available—ECOnorthwest estimated 25% of renters in Portland lack air conditioning.
[4] 2019 AHS data

Landlord and Tenant Act states that landlords must ensure habitability of residential rental properties with one component of habitability measured as adequate heating facilities.[5] While minimum temperature standards are common across the country, maximum temperature requirements are slowly gaining traction nationwide.

From 2019 through 2023, BPS collaborated with Black, Indigenous, and People of Color (BIPOC) community members to develop an equitable building decarbonization policy concept called the HEART Standards. This proposal would establish minimum requirements for existing apartments intended to achieve community objectives: reduce carbon emissions, advance healthy housing and energy affordability, consider anti-displacement in policy design, and enhance climate resilience. One of the standards is a maximum indoor temperature for heat wave resilience.

Maximum Temperature Laws

Cooling laws vary significantly from state to state and often between cities in the same state.[6,7,8] Some states such as Arizona, California, and Nevada require landlords to fix the air conditioning if the rental unit was leased with an air conditioner (A/C) installed.[9,10,11] Importantly, these laws do not require cooling technologies to be provided, only that they be maintained should the landlord choose to provide the amenity. In the legal landscape, several local jurisdictions have chosen to enact their own maximum temperature requirements or cooling standards to mitigate heat-related illnesses and deaths.

Arizona (Phoenix, Tucson, Tempe & Glendale)

Under current Arizona law, landlords are required to provide rental units with fully operating appliances that are safe to occupy, including "running water, gas or electrical service, or both if applicable, and reasonable amounts of hot water or heat, air conditioning or cooling, where such units are installed or offered."[12] Additionally, Arizona law (Title 33-1363)

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[5] Oregon State Legislature, "Title 10-ORS 90.320," Oregon Revised Statutes (ORS) 2023 Edition.
[6] Li Zhou, "The US is failing renters during extreme heat waves," Vox Media, July 12, 2024, accessed August 5, 2024, https://www.vox.com/climate/360019/climate-extreme-heat-ac-cooling-policy.
[7] Sam Whillans, "Toward a Renter's Right to Heat-Safe Housing," National Resources Defense Council, June 9, 2022, accessed August 5, 2024, https://www.nrdc.org/bio/sam-whillans/toward-renters-right-heat-safe-housing.
[8] Rachel Kurzius, "Do landlords have to provide AC? Here's what renters should know," The Washington Post, July 10, 2024, accessed August 5, 2024, https://www.washingtonpost.com/home/2024/07/10/do-landlords-have-to-provide-ac/.
[9] Arizona Supreme Court, "Questions about Air Conditioning (A/C) Issues," accessed August 5, 2024, https://www.azcourts.gov/legalinfohub/Legal-Info-FAQs/Air-Conditioning-A-C-Issues.
[10] California Department of Real Estate, *California Tenants: A Guide to Residential Tenants' and Landlords' Rights and Responsibilities* (February 1, 2022), https://www.courts.ca.gov/documents/California-Tenants-Guide.pdf.
[11] Nevada Legal Services, *Habitability & Essential Services* (May 2021), https://nevadalegalservices.org/wp-content/uploads/2022/01/Habitability-Fact-Sheet.pdf.
[12] Arizona State Legislature, "Sect 33-1364(A). Title 33 Chapter 10 – Arizona Residential Landlord and Tenant Act," Arizona Revised Statutes 2024.

requires landlords to fix a broken A/C within ten days of written notice. Otherwise, renters can repair it themselves and deduct the cost from their rent.[13]

Phoenix and Tucson, Arizona's two largest cities, are both considered "heat islands" where average summer temperatures reach well above 100 degrees Fahrenheit. To mitigate these temperatures, the City of Phoenix and the City of Tucson passed ordinances to set specific cooling standards.[14,15] These policies issue temperature maximums of at least 20 degrees less than outside or 82 degrees Fahrenheit for rental units with A/Cs and 86 degrees Fahrenheit for rental units with evaporative coolers. This means that if an air conditioning unit is installed in a Phoenix or Tucson apartment and it is 105 degrees Fahrenheit outside, the landlord must ensure that the unit can cool to 85 degrees Fahrenheit or below. Phoenix's satellite cities Tempe and Glendale have similar cooling requirements.[16,17]

California (County of Los Angeles)

The County of Los Angeles Board of Supervisors is currently deliberating laws that would establish a countywide maximum temperature threshold for rental units. While not currently a law, this would be a first of its kind requirement in California should it pass.[18]

Maryland (Montgomery County)

In February 2020, Montgomery County in Maryland enacted a countywide cooling mandate requiring all landlords to provide cooling technology to tenants between June 1st and September 30th of each year such that the maximum temperature permissible in the unit is 80 degrees Fahrenheit. However, the law excludes detached single-family rental units from the requirements, allows landlords to charge tenants for the cooling services, and allows tenants to decline air conditioning services provided that such agreements are explicitly documented in the lease.[19]

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[13] The Arizona Legal Center, "A/C Is An Essential Need: Arizona Tenant Rights With Air Conditioning," May 15, 2020, accessed August 5, 2024, https://arizonalegalcenter.org/arizona-tenant-rights-with-air-conditioning/.
[14] City of Phoenix, "Article II Section 39-5(B)(1)(b)," City of Phoenix Code, accessed August 5, 2024, https://phoenix.municipal.codes/CC/39-5.
[15] City of Tucson, "Article 16. Section 16-11(b)(2)," Charter and General Ordinances, accessed August 5, 2024, https://codelibrary.amlegal.com/codes/tucson/latest/tucson_az/0-0-0-11113.
[16] City of Tempe, "Article 2. Section 21-34(c)," City Code, accessed August 5, 2024, https://library.municode.com/az/tempe/codes/city_code?nodeId=CH21NUPREN_ARTIIREHOCO_DIV2REHOST_S21-34THEN.
[17] City of Glendale, "Section 29.1-15(a)," Code of Ordinances, accessed August 5, 2024, https://library.municode.com/az/glendale/codes/code_of_ordinances?nodeId=PTIICOOR_CH29.1REREPR_ARTIIST.
[18] County of Los Angeles Board of Supervisors, "Additions and/or revisions to the agenda for the Board meeting of Tuesday, January 23, 2024," January 19, 2024. https://assets-us-01.kc-usercontent.com/0234f496-d2b7-00b6-17a4-b43e949b70a2/4342d969-5ab1-453c-8a8a-b47efefcf6f7/01232024.pdf.
[19] Montgomery County Maryland, "Air Conditioning Requirements in Rental Townhome or Multi-Family Dwelling Unit", accessed August 5, 2024, https://www3.montgomerycountymd.gov/311/Solutions.aspx?SolutionId=1-6VX9W2.

Texas (Dallas & Houston)

The State of Texas does not require cooling standards in rental units, neither does it explicitly require landlords to fix air conditioning if provided. Responsibility of repair can be set on a lease-by-lease basis.[20]

The City Council of Dallas enacted stricter cooling standards into their City Code in 2016. While an earlier version of the code already required rental units to be cooled to either 85 degrees Fahrenheit or 20 degrees Fahrenheit cooler that the external temperature, the amendment made 85 degrees Fahrenheit the maximum allowable temperature in rental units.[21] This ordinance came in light of increasing extreme heat events in Dallas where outdoor ambient temperatures would hit 110 degrees Fahrenheit.[22]

The City of Houston only requires landlords to provide air conditioning if window or door screens are not provided. Landlords must maintain the air conditioning unit so that the internal temperature is no greater than 80 degrees Fahrenheit or 20 degrees Fahrenheit lower than the outside temperature, whichever is greater.[23]

Washington, D.C.

Like Montgomery County in Maryland, there is a cooling mandate in Washington, D.C. Landlords must provide air conditioning between May 15th and September 15th of each year so that the maximum temperature is either 78 degrees Fahrenheit or 15 degrees Fahrenheit cooler that the external temperature, whichever is greater.[24]

Exhibit 2. Examples of Maximum Temperature Standards

State	Jurisdiction	Requirement
Arizona	City of Glendale City of Phoenix City of Tempe City of Tucson	♦ Temperature no greater than 82 degrees Fahrenheit, if cooled by air conditioning ♦ Temperature no greater than 86 degrees Fahrenheit, if cooled by evaporative cooling (88 degrees Fahrenheit for Tempe)

[20] Texas State Law Library, "Does my landlord have to provide air conditioning or heating?," accessed August 5, 2024, https://www.sll.texas.gov/faqs/tenants-rights-ac-heating/.
[21] City of Dallas, "Section 21-17(e)(1)," The Dallas City Code, accessed August 5, 2024, https://codelibrary.amlegal.com/codes/dallas/latest/dallas_tx/0-0-0-111216.
[22] Tristan Hallman, "Dallas makes rules tougher on landlords with new housing standards," The Dallas Morning News, September 28, 2016, accessed August 5, 2024, https://www.dallasnews.com/news/2016/09/28/dallas-makes-rules-tougher-on-landlords-with-new-housing-standards/.
[23] City of Houston, "Chapter 10. Article IX. Division 4. Sec. 10-363 (d)(8)," Code of Ordinances, accessed August 5, 2024, https://library.municode.com/tx/houston/codes/code_of_ordinances?nodeId=COOR_CH10BUNEPR_ARTIXBUST_DIV4MIST_S10-363REOW.
[24] District of Columbia Department of Buildings, "DC Housing Code Standards," accessed October 7, 2024, https://dob.dc.gov/service/dc-housing-code-standards.

State	Jurisdiction	Requirement
Maryland	Montgomery County	♦ Temperature no greater than 80 degrees Fahrenheit ♦ Between June 1st and September 30th ♦ Excludes detached single-family rental units ♦ Permit costs can be passed to tenants ♦ Tenants can reject A/C
Texas	City of Dallas	♦ Temperature no greater than 85 degrees Fahrenheit
Texas	City of Houston	♦ Temperature no greater than 80 degrees Fahrenheit or 20 degrees Fahrenheit lower than the outside temperature, whichever is greater ♦ Only for units that do not have window or door screens
District of Columbia	District of Columbia	♦ Temperature no greater than 78 degrees Fahrenheit or 15 degrees Fahrenheit lower than the outside temperature, whichever is greater ♦ Between May 15th and September 15th

Oregon

Currently, neither the State of Oregon nor the City of Portland have a cooling or maximum temperature standard that require all landlords or property managers to provide cooling systems in rental units. Senate Bill 1536 (2022) directs the State to enhance the availability and support of cooling facilities in residential properties by limiting restrictions imposed by landlords, home-owners associations, condominium associations, and local governments on the use of portable cooling devices.[25] Importantly, while the Act requires adequate cooling facilities for all buildings permitted on or after April 1, 2024, it does not mandate similar cooling systems in existing residential rental properties.[26] The bill also requires Oregon Housing and Community Services (OHCS) to list dates of extreme heat events on its website and include information about programs and services for landlords providing cooling facilities. Under this bill, Oregon Health Authority (OHA) can distribute standalone portable cooling devices to its clients via Oregon's newly established Air Conditioner Deployment Program.[27]

Senate Bill 1536 also requires rented spaces in facilities to provide sufficient electrical service for tenants' heating and cooling needs, particularly for new manufactured dwellings and floating homes. The State Department of Energy is authorized to offer grants for rental

[25] Oregon State Legislature, "SB1536 81st Oregon Legislative Assembly·2022 Regular Session," accessed August 5, 2024, https://olis.oregonlegislature.gov/liz/2022R1/Downloads/MeasureDocument/SB1536/A-Engrossed.

[26] The act additionally requires that air conditioning be maintained in good repair when its provision is locally required and prohibits landlords from stopping or restricting tenant's from installing or using their own portable cooling devices.

[27] Oregon Health Authority, "Tenants Have the Right to Install Portable Cooling Devices," July 27, 2022, accessed August 5, 2024, https://www.oregon.gov/oha/HSD/OHP/Tools/Tenant-Rights-Cooling-Devices.pdf.

housing upgrades and provide rebates for heat pump purchases and installations, supported by the newly established Residential Heat Pump Rebate Fund. The bill also expands the Department of Human Services' grant program for clean air shelters to include warming and cooling shelters and facilities. It appropriates funds to support these initiatives and declares an emergency, making the bill effective immediately upon passage.

Overview of Policy Analysis

To comply with a maximum temperature standard, property owners are likely to consider installing window A/Cs or ductless mini-split heat pumps that limit installation work mostly to each unit. Retrofitting new central A/Cs or ducted heat pump systems are unlikely to be achievable, especially for older buildings without adequate ducts and vents. While portable A/Cs or other more convenient options could meet the cooling temperature standard, property owners might prefer other options that are fixed to the property and not as easily movable by the tenants. For these reasons, **ECOnorthwest analyzed window A/Cs and ductless mini-split heat pumps along with costs to upgrade electrical panels**, although some property owners could opt for other measures to reach the maximum temperature. Data collection and analysis were completed in October 2024. Information on utility rates were updated in January 2025.

Passive Cooling

Window coverings are other ways to help reduce the amount of energy spent on cooling. An experiment of operable exterior shades in Richland, Washington, showed about 10 percent energy savings and 2 to 3 degrees Fahrenheit reduction in indoor temperature compared to having only interior shades.[28] A simulation of Portland's 2021 extreme heat event showed even greater energy savings with interior or exterior shades that increased to 70 percent with fan-assisted ventilation (i.e., opening windows at night with window fans).[29] However, these measures require active monitoring and operation, which most people may forget to do.[30] In fact, the failure to operate shades throughout a hot day could result in higher indoor temperatures.

On the other hand, passive cooling measures do not require a daily operation, but their benefits are not clear. Cool roofs, awnings, and applied window films can reduce how much heat enters a building and improve energy efficiency, but their effectiveness can depend on the region. For example, cool roofs (and cool walls) can generate energy saving benefits in warmer climates—International Energy Conservation Code (IECC) climate zones 1A to 4B. The effect on indoor temperatures can be between 2.2 to 5.9 degrees Fahrenheit. [31] But the energy benefits are generally small in cooler climates.[32] Portland is in climate zone 4C.

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[28] W.E. Hunt and K.A. Cort, *Evaluation of Exterior Shades at PNNL Lab Homes and Occupied Field Sites: Final Report*, Pacific Northwest National Laboratory (PNNL), October 2020.
[29] Alexandria R. Rempel, Jackson Danis, Alan W. Rempel, Michael Fowler, and Sandipan Mishra, "Improving the passive survivability of residential buildings during extreme heat events in the Pacific Northwest," *Applied Energy* 321 (May 2022), https://doi.org/10.1016/j.apenergy.2022.119323.
[30] U.S. Department of Energy, "Energy Efficient Window Coverings," accessed August 12, 2024, https://www.energy.gov/energysaver/energy-efficient-window-coverings.
[31] U.S. Environmental Protection Agency, "Using Cool Roofs to Reduce Heat Islands," accessed August 7, 2024, https://www.epa.gov/heatislands/using-cool-roofs-reduce-heat-islands.
[32] Pablo Rosado and Ronnen Levinson, *Potential benefits of cool walls on residential and commercial buildings across California and the United States: Conserving energy, saving money, and reducing emission of greenhouse gases and air pollutants*, Lawrence Berkeley National Laboratory (LBNL), February 2019.

Moreover, while passive cooling measures can have benefits in the summer months, there could also be a "heating penalty" in the winter months because the passive cooling measures reduce heat gain and require greater heating energy use.[33] In fact, awnings and films can increase total energy use in northern and central climates, like Portland, where more energy is typically used for heating than cooling.[34] While past studies may not be perfectly applicable to climates like Portland's and units could still be cooler with awnings and films, especially during a heat wave, the increase in total annual energy use is worth considering.

Passive cooling measures are not further considered in this analysis for two reasons. First, their total effect on energy use and utility cost might be detrimental to renters in Portland because of the potential for heating penalty. Second, the benefits of passive cooling measures during heat waves are not likely to be sufficient for lowering indoor temperatures below dangerous levels. Property owners complying with a potential cooling temperature standard would be interested in active air conditioning options.

Still, passive cooling measures would complement active air conditioning options and help reduce the energy load. They allow property owners to potentially consider smaller, less expensive air conditioning options and tenants to use air conditioning less frequently. The resulting energy savings and improved indoor air quality are also a key factor in decisions about passive cooling measures.

While some generalizations are made for passive cooling, property owners and tenants should conduct their own assessments to determine appropriate measures. After all, cool roofs can reduce peak energy demand[35] and awnings and window films can significantly reduce solar heat gain.[36] The U.S. Department of Energy provides many resources for further consideration of passive cooling measures:

- Passive and Low-Energy Cooling: https://basc.pnnl.gov/resource-guides/passive-and-low-energy-cooling
- Pre-Retrofit Assessment of Existing HVAC Systems: https://basc.pnnl.gov/information/pre-retrofit-assessment-existing-hvac-systems

[33] U.S. Environmental Protection Agency.
[34] D. Charlie Curcija, Mehry Yazdanian, Christian Kohler, Robert Hart, Robin Mitchell, and Simon Vidanovic, *Energy Savings from Window Attachments*, Lawrence Berkeley National Laboratory (LBNL), October 2013.
[35] U.S. Environmental Protection Agency.
[36] Mary H.J. Farrell, "Block the Sund and Lower Your Energy Costs With Window Coverings," Consumer Reports, June 12, 2023, accessed August 12, 2024, https://www.consumerreports.org/home-garden/energy-efficiency/beat-the-heat-with-window-coverings-a9364047186/.

Building Prototypes

ECOnorthwest developed **3 rental housing prototypes** to analyze the financial implications of a cooling temperature standard on landlords and tenants. Although they cannot completely capture various types and conditions of rental housing in Portland, the 3 prototypes are useful for modeling typical energy use and cooling costs.

- **Single-Family** is a single-dwelling unit with an individual garage or a parking alley. Some may share a wall with another single-dwelling unit, though most are detached. A majority of such rental units in Portland were built before 1940, and a three-quarters of such units were built before 1980. Single-family rentals make up about 20 percent of single-family units in Portland.
- **Small Multifamily** is a property with multiple units in each building. Each property may have multiple buildings. Typical buildings have 1 to 3 floors. Many of such rental properties in Portland were built in the 1960s and the 1970s. Small Multifamily buildings are more likely to have units that rent at lower levels and in worse conditions (less energy-efficient with older systems). Such properties are sometimes referred to as unregulated affordable rental housing or naturally occurring affordable housing (NOAH), which may have different building performance characteristics than newer multifamily buildings. NOAH properties represent about 75 percent of multifamily properties, excluding regulated affordable housing.
- **Large Multifamily** is a property with multiple units in each building. Each property may have multiple buildings. Typical buildings have more than 3 floors. About half of such buildings in Portland were built in the 2010s. These properties are more likely to be in better conditions and could be considered "market-rate" properties. These properties represent about 25 percent of multifamily properties, excluding regulated affordable housing.

Although the physical characteristics of the Small Multifamily and the Large Multifamily prototypes do not always delineate NOAH and market-rate properties, the simplification is assumed for this analysis.

Exhibit 3. Prototypes for Temperature Standard Analysis

	Single-Family	Small Multifamily	Large Multifamily
Building Area	1,600 ft^2	15,800 ft^2	64,400 ft^2
Unit Count	1 unit	18 units	70 units
Average Gross Unit Size	1,600 ft^2	878 ft^2	920 ft^2
Building Height	2 stories	2 stories	7 stories
Typical Built Decade	Before 1940	1960s and 1970s	2010s

Source: ECOnorthwest using CoStar and U.S. Census Bureau data

To estimate the potential effects of cooling measures on energy use and utility bills, ECOnorthwest used the Building Energy Optimization Tool (BEopt™) developed by the National Renewable Energy Laboratory (NREL). Assumed building characteristics summarized in Exhibit 4 are informed by the default characteristics and assumptions in the BEopt™ tool. Estimates from the American Housing Survey (AHS) suggest about 75 percent of renter households already have some form of air conditioning. Therefore, this analysis focuses on the 25 percent of renter households without air conditioning.

Exhibit 4. Building Characteristics of Prototypes

	Single-Family	Small Multifamily	Large Multifamily
Construction Type	Wood	Wood	Steel
Wall Insulation	R-11 fiberglass	R-7 fiberglass	R-11 fiberglass
Roof	Asphalt shingles	Asphalt shingles	Asphalt shingles
Foundation	Vented crawlspace	Slab, uninsulated	Slab, R-5 perimeter
Windows	Double-pane, non-metal, U-0.49, SHGC-0.56	Double-pane, metal, U-0.76, SHGC-0.67	Double-pane, non-metal, U-0.49, SHGC-0.56
Air Leakage	10 ACH50	10 ACH50	7 ACH50
Space Heating	Gas Furnace, 80% AFUE	Electric baseboard	Electric baseboard
Space Cooling	Window A/C or heat pump (80%) None (20%)	Window A/C or heat pump (70%) None (30%)	Window A/C or heat pump (80%) None (20%)
Water Heating	Gas, 0.83 UEF	Electric, 0.92 UEF	Electric, 0.92 UEF
Lighting	60% LED	60% LED	60% LED

Source: ECOnorthwest using U.S. Census Bureau, 2019 and 2023 AHS; and NREL's BEopt™ tool

Naturally Occurring Affordable Housing (NOAH)

The key distinction between the Small Multifamily prototype and the Large Multifamily prototype is the concept of NOAH. Although NOAH does not have a precise definition, the National League of Cities and the American Planning Association (APA) define NOAH as residences that are affordable to low- or moderate-income households without federal subsidies.[37,38] Rents in NOAH units are usually affordable because the building condition is relatively poor and people are not willing to pay higher rents for them. In contrast, rents in regulated affordable housing are limited by their sources of subsidy, and the limitations and

[37] Mia Chapman. "What is Affordable Housing?" *National League of Cities*. January 8, 2024. https://www.nlc.org/article/2024/01/08/what-is-affordable-housing.
[38] Donald Elliott. "Preserving Naturally Occurring Affordable Housing." *Zoning Practice* 40, no. 12 (December 2023). American Planning Association.

definition of affordability are usually related to standards set by the U.S. Department of Housing (HUD). Neither HUD nor CoStar—a key database of building characteristics in this analysis—define or categorize NOAH properties.

To understand the number of properties that could be considered NOAH and market-rate (i.e., not NOAH), ECOnorthwest developed a methodology for classifying NOAH properties. The basis for multifamily rent information is CoStar, a comprehensive dataset of multifamily (and commercial) building characteristics. However, rent information is not available for all properties. For example, one-bedroom asking rent is available for about half of all rental multifamily properties in Portland. For properties without rent information, ECOnorthwest estimated their rents using a regression model. Based on property characteristics available in the CoStar data and other spatial information available in U.S. Census[39], ECOnorthwest estimated rents with a 60-percent explanatory power. Properties with average rents that would be affordable to a household earning less than 80 percent of the Area Median Income (AMI)[40] are classified as NOAH, while properties with higher average rents are classified as market-rate. Rents (including utilities) affordable to a household earning 80 percent of the AMI are $1,770 for one-bedroom units and $2,124 for two-bedroom units.[41]

ECOnorthwest used this NOAH classification to create the two multifamily prototypes. The average year of construction (i.e., built year) is 1969 for NOAH properties and 2005 for market-rate properties, but built years of NOAH and market-rate properties can vary widely.

There are other ways of classifying NOAH properties. One option is to use star ratings that CoStar assigns to all properties. Properties with higher ratings are generally considered higher quality properties. If star ratings 1, 2, and 3 are assumed to represent NOAH properties and star rating 4 and 5 are assumed to represent market-rate properties, then about three-fourths of properties and about half of units and building area would be in the NOAH category. Another option is to use data from the U.S. Census to identify share of rental units that have affordable levels of rents. This data could be further filtered for units occupied by households earning less than 80 percent of the AMI.

BEopt™

This analysis relies on NREL's BEopt™ (Version 3.0.1 Beta, released March 16, 2023) for modeling energy use. BEopt™ is a software developed by NREL to help researchers "evaluate residential building designs and identify cost-optimal efficiency packages at various levels of whole-house energy savings along the path to zero net energy. "BEopt can

[39] Variables included in the regression model with statistical significance were star rating, number of building amenities, year built, building area, and distance to downtown.
[40] HUD uses AMI to determine affordable levels of rents in regulated affordable housing. HUD publishes annually AMI levels for various geographies. 2024 AMI for the Portland-Vancouver-Hillsboro metropolitan area is $116,900.
[41] Portland Housing Bureau, 2024 Income and Rent Limits. Affordable rents calculated are based on HUD definition that no more than 30 percent of AMI are spent on rent costs. Affordable rents are also adjusted for bedroom count. https://www.portland.gov/phb/documents/2024-income-and-rent-limits-phb/download.

be used to analyze both new construction and existing home retrofits."[42] Users can create their own designs and compare them to another user-defined design or select 'Parametric Mode' or 'Optimization Mode' to run an analysis of multiple designs. It provides detailed simulations of energy use based on user inputs on building features such as size, dimension, age, envelope, appliances, construction material, and other factors. It generates estimates of energy use, utility costs, and equipment costs. Although the tool is designed primarily for single-family and small multifamily buildings, ECOnorthwest adapted its application to analyze larger multifamily properties in the Pacific Northwest. Because ECOnorthwest used BEopt™ for energy use estimates and initial cost estimates, building characteristics of analyzed prototypes are informed by the features available in the tool.

[42] NREL. "BEopt: Building Energy Optimization Tool." https://www.nrel.gov/buildings/beopt.html.

Cooling Measure Cost Scenarios

ECOnorthwest worked with DCW Cost Management to determine the total cost of complying with a cooling temperature standard in Portland. The cost estimates include equipment costs, installation material and labor, shipping, and contractor markups for expenses such as overhead, insurance, profit margin, and contingency. Separate estimates were produced for:

- ENERGY STAR certified, 8,300 BTU 115V window A/C
- 12,000 BTU ductless, mini-split heat pump
- 200-amp electrical panel upgrades

Depending on property condition and needs, property owners could choose to install window A/Cs or mini-split heat pumps and upgrade their electrical panels as needed. A summary of cost estimates is shown in Exhibit 5. The actual costs to property owners could be lower if they choose to install the measures without a contractor, which could be a likely possibility for window A/Cs. The equipment cost alone is assumed to be about a third of the total cost for window A/Cs.

Exhibit 5. Estimated Unit Cost of Cooling Measures

Measure	Estimated Cost per Cooling Unit
Window A/C, No Contractor	$ 328
Window A/C	$ 983
Mini-Split Heat Pump	$ 6,073
Electrical Panel	$ 3,887

Source: ECOnorthwest analysis of data from DCW Cost Management
Note: Contractor costs include installation material and labor, shipping, and contractor markups. For multiple installations, there may be economies of scale that are not accounted for in the estimates.

The compliance cost for each analyzed prototype could vary based on requirements. On the one hand, if the requirements result in a common space available for a building's residents to take shelter in but does not require the whole building to reach the maximum temperature, the compliance cost would be much lower. For the Single-Family prototype, this might be satisfied with one cooling unit. For the Small Multifamily prototype with 18 units (about 30 to 50 residents), 4 cooling units might be sufficient to cool the common space(s). For the Large Multifamily prototype with 70 units (about 100 to 200 residents), up to 7 cooling might be needed to cool multiple common spaces. The costs to upgrade electrical panel is applied to the Single-Family and Small Multifamily prototypes only and scaled by the number of cooling units (see Option A in Exhibit 6).

On the other hand, if the requirement is for each private unit to be cooled to the maximum temperature, the compliance cost would be much higher for multifamily buildings. For the Small Multifamily prototype and the Large Multifamily prototype, there would be a cooling

unit and potentially an electrical panel upgrade associated with each unit (see Option B in Exhibit 6). For the Single-Family prototype, a single cooling unit would still be sufficient.

Exhibit 6. Prototype Costs for Cooling Measures, Before Financial Incentives

Measure	Single-Family	Small Multifamily	Large Multifamily
Option A: Common Space	1 cooling unit	4 cooling units for common space(s)	7 cooling units for common space(s)
Window A/C, No Contractor	$ 328	$ 1,312	$ 2,296
Window A/C	$ 983	$ 3,932	$ 6,881
Mini-Split Heat Pump	$ 6,073	$ 24,292	$ 42,511
Electrical Panel	$ 3,887	$ 15,548	N/A
Mini-Split Heat Pump + Electrical Panel	$ 9,960	$ 39,840	N/A
Option B: In-Unit	1 cooling unit	1 cooling unit per unit (18 units)	1 cooling unit per unit (70 units)
Window A/C, No Contractor	$ 328	$ 5,904	$ 22,960
Window A/C	$ 983	$ 17,694	$ 68,810
Mini-Split Heat Pump	$ 6,073	$ 109,314	$ 425,110
Electrical Panel	$ 3,887	$ 69,966	N/A
Mini-Split Heat Pump + Electrical Panel	$ 9,960	$ 179,280	N/A

Source: ECOnorthwest analysis of data from DCW Cost Management

Note: Contractor costs include installation material and labor, shipping, and contractor markups. For multiple installations, there may be economies of scale that are not accounted for in the estimates.

There is a wide range of possible compliance costs. At the lowest end, if (a) property owners install window A/Cs without hiring contractors, (b) the property does not need upgrades to electrical panels, and (c) cooling is provided for common spaces only, the compliance costs could be as low as $328 for the Single-Family prototype, $1,312 for the Small Multifamily prototype, and $2,296 for the Large Multifamily prototype. At the highest end, if property owners need to install mini-split heat pumps for all units and upgrade their electrical panels, the compliance costs could be as high as $9,960 for the Single-Family prototype, $179,280 for the Small Multifamily prototype, and $425,110 for the Large Multifamily prototype, which is assumed to not require electrical panel upgrades. **Depending on the requirements and property-specific needs, the possible range of compliance costs could vary widely.**

Citywide Compliance Cost Estimates

About 25,400 rental units in Portland lack in-unit air conditioning. As shown in Exhibit 7, there are about 33,900 rental single-family units in Portland and about 20 percent lack air conditioning. Based on the Small Multifamily and Large Multifamily prototypes defined in this analysis, there are about 19,500 NOAH units without air conditioning and about 4,300 market-rate multifamily units without air conditioning.[43]

There also are regulated, affordable, rental housing that may lack air conditioning.[44] The latest data from OHCS indicates there are 622 regulated affordable properties in Portland with about 29,400 units.[45] CoStar data shows 34 additional regulated affordable properties built in 2022, 2023, and 2024 with about 3,200 units. In total there are 656 regulated affordable properties in Portland with about 32,600 units, for an average of 50 units per property. Thirty percent of regulated affordable units are assumed to lack in-unit cooling, resulting in an estimate of about 9,780 units without air conditioning.

Finally, the Cooling Portland Program has already provided 7,180 portable cooling units in 2022 and 2023.[46] Conversations with Earth Advantage suggest the program is likely to achieve its goal of 15,000 units in 2025, ahead of schedule. While the program mainly benefits households earning below 60 percent of the AMI, there also are other target populations. Most households who benefit do not live in regulated affordable units. Removing 15,000 units potentially served by the Cooling Portland program by the end of 2025, about 25,360 rental units in Portland may lack air conditioning.

Exhibit 7. Estimated Rental Units Lacking Cooling in Portland

Property Type	Estimated Units	Share Lacking Cooling	Estimated Units Lacking Cooling	Estimated Units Lacking Cooling with Cooling Portland Program
Single-Family	33,900	20%	6,780	3,030
Small Multifamily	65,000	30%	19,500	12,000
Large Multifamily	21,500	20%	4,300	4,300
Regulated Affordable	32,600	30%	9,780	6,030
TOTAL	153,000		40,360	25,360

Source: U.S. Census Bureau, 2022 American Community Survey (ACS), Public Use Micro Samples (PUMS), 1-Year Estimates; CoStar; OHCS, 2022 Oregon Affordable Housing Inventory; U.S. Census

[43] Estimates of units without air conditioning is based on ECOnorthwest's analysis of AHS data.
[44] Some housing types such as rental townhouses and manufactured housing are not covered in this analysis.
[45] Oregon Housing and Community Services (OHCS), 2022 Oregon Affordable Housing Inventory.
[46] Earth Advantage, "Cooling Portland Annual Report 2023," https://www.portland.gov/bps/cleanenergy/documents/cooling-portland-report-year-2-2023/download.

Bureau, 2023 AHS; Earth Advantage, 2023 Cooling Portland Annual Report
Note: Distribution of Cooling Portland Program across property types are based on assumptions.

There is a wide range of potential citywide compliance costs due to multiple unknown factors. First is the potential requirement: common space cooling vs. whole unit cooling (this is the distinction between Exhibit 8 and Exhibit 9). Second is various compliance measures: window A/C with or without a contractor, mini-split heat pump, and/or electrical panel upgrade. Third is applicability for various types of rental housing covered in this analysis. The full range of potential citywide compliance costs are summarized in Exhibit 8 and Exhibit 9.

The minimum citywide compliance cost is about $4.8 million, with window A/Cs in common spaces (only) across the analyzed housing types (see Exhibit 8). The minimum compliance cost could be greater when considering other housing types, such as rental townhouses and manufactured housing, that are not the focus of this analysis. **If property owners are required to install a window A/C in each unit instead, the citywide compliance cost would be about $8.3 million** (see Exhibit 9). With contractor installation, the compliance costs could triple.

The citywide compliance cost with ductless mini-split heat pumps is between $142 million and $236 million. The low estimate ($142 million) is for a scenario where the regulatory requirement is for common space cooling (only). The high estimate ($236 million) is for a scenario where a cooling unit is required in each rental unit. For both estimates, electrical panel upgrades are assumed to be needed for single-family, NOAH, and regulated affordable units.

Exhibit 8. Estimated Citywide Compliance Costs for Cooling Measures with Option A ($ Million)

Property Type	Window A/C, No Contractor	Window A/C	Mini-Split Heat Pump	Electrical Panel	Mini-Split Heat Pump + Electrical Panel
Single-Family	$1.0	$3.0	$18	$12	$30
Small Multifamily	$2.8	$8.4	$52	$33	$85
Large Multifamily	$0.4	$1.3	$8	$0	$8
Regulated Affordable	$0.6	$1.8	$11	$7	$18
TOTAL	$4.8	$14.5	$89	$53	$142

Source: ECOnorthwest analysis of data from various sources

Exhibit 9. Estimated Citywide Compliance Costs for Cooling Measures with Option B ($ Million)

Property Type	Window A/C, No Contractor	Window A/C	Mini-Split Heat Pump	Electrical Panel	Mini-Split Heat Pump + Electrical Panel
Single-Family	$1.0	$3.0	$18	$12	$30
Small Multifamily	$3.9	$12	$73	$47	$120
Large Multifamily	$1.4	$4.2	$26	$0	$26
Regulated Affordable	$2.0	$5.9	$37	$23	$60
TOTAL	$8.3	$24.9	$154	$82	$236

Source: ECOnorthwest analysis of data from various sources

Funding Gap for Multifamily

Window A/Cs

There is limited funding available for window A/Cs in rental units. For common space cooling, Energy Trust of Oregon's Landlord Provided Cooling Space Initiative provides up to 100 percent equipment rebates for landlords providing an on-site or a nearby location that is maintained at 80 degrees Fahrenheit or lower and can accommodate 5 or more residents during extreme heat events.[47] Assuming this program can cover all NOAH and regulated affordable housing properties but none of the rental single-family or rental market-rate multifamily properties, about 3,200 properties would still lack funding for common space cooling. Based on assumptions above for common space cooling (see Exhibit 6), **the funding gap for self-installed window A/Cs is about $1.4 million** ($1.0 million for rental single-family and $0.4 million for rental market-rate multifamily). With contractor installation, the gap could be about three times higher.

For in-unit cooling, there is a $60 incentive for ENERGY STAR window A/Cs in regulated affordable housing through the OHCS Multifamily Energy Program (OR-MEP).[48] Based on assumptions above for in-unit cooling (see Exhibit 6), **the funding gap for self-installed window A/Cs is about $7.9 million** ($1.0 million for rental single-family, $3.9 million for NOAH, $1.4 million for rental market-rate multifamily, and $1.6 million for regulated affordable). With contractors, the gap could be about three times higher.

Mini-Split Heat Pumps

There are many funding sources available for mini-split heat pumps. For common space cooling, Energy Trust of Oregon's Landlord Provided Cooling Space Initiative could still be applicable, saving up to $7,000 per heat pump. Energy Trust also provides $1,800 cash incentive for single-family and multifamily structures replacing electric heating with ductless heat pumps.[49,50] OR-MEP provides a $1,500 incentive for regulated affordable properties. Finally, Portland Clean Energy Community Benefits Fund (PCEF) Climate Investment Plan (CIP) allocated $250 million for residential clean energy projects—strategic programs 1, 2,

[47] Energy Trust of Oregon, "Landlord Provided Cooling Space Initiative," accessed August 19, 2024, https://www.energytrust.org/communities/landlord-provided-cooling-space-initiative/.
[48] Oregon Housing and Community Services (OHCS) Multifamily Energy Program, "Incentives at a Glance," July 2023, https://oregonmultifamilyenergy.com/wp-content/uploads/2023/07/OR-MEP_IncentiveBooklet_Online-Format.pdf.
[49] Energy Trust of Oregon, "Landlords & Property Managers of Single-Family Homes," accessed July 26, 2024, https://www.energytrust.org/incentives/landlords-property-managers-single-family-homes/.
[50] Energy Trust of Oregon, "Existing Multifamily Cash Incentives," accessed July 26, 2024, https://www.energytrust.org/commercial/multifamily-cash-incentives/.

and 3.[51] Their purposes suggest common space cooling might not be in the initial plans. But, assuming one heat pump in each property would be funded through the PCEF, there could be about $32 million available for funding common space cooling. Altogether, these funding sources would **reduce the citywide compliance cost for mini-split heat pumps in common spaces to about $39 million**, assuming there are no limits to the total available funding.

For in-unit cooling, after accounting for Energy Trust's $1,800 cash incentive for electric heated units, OR-MEP, and PCEF, the citywide compliance cost for mini-split heat pumps in units would be approximately $54 million. Also available is federal funding through the Inflation Reduction Act. Oregon was allocated $56,714,400 for Fiscal Years 2022 to 2026 to provide rebates for high-efficiency electric appliances such as heat pumps. Up to $8,000 is available for households earning 80 percent of the AMI or below (i.e., NOAH units). For households earning more than 80 percent of the AMI (i.e., market-rate units), the rebate is capped at 50 percent of the cost.[52] Assuming linear allocation across 5 years, one year's funding amount would be about $11.3 million. Assuming about $4 million will be spent in Portland, **the citywide compliance cost for installing mini-split heat pumps in each unit that lacks cooling could be reduced to approximately $50 million**, assuming there are no limits to the total available funding. There also is Oregon Department of Energy's Oregon Rental Home Heat Pump Program, but it is not considered as a potential funding source because it is no longer accepting applications due to high demand.[53]

The estimates above—$1.4 million to $7.9 million for window A/Cs and $39 million to $50 million for mini-split heat pumps—are based on many generalizations and high-level assumptions about funding availability, application demand, and awarding process. ECOnorthwest assumed multifamily property owners and managers would apply for the funding source above whenever possible so that they may be recipients of more than one funding source. ECOnorthwest also assumed that the considered funding sources would be used exclusively for one of the cooling measures. In reality, there likely will be competing applications and uses of the funding between cooling measures as well as competition with energy-efficiency or emissions reduction measures.

[51] City of Portland, Bureau of Planning and Sustainability, *Portland Clean Energy Community Benefits Fund (PCEF) Climate Investment Plan*, August 2023, https://www.portland.gov/bps/cleanenergy/climate-investment/documents/pcef-climate-investment-plan/download.
[52] U.S. Department of Energy, "Biden-Harris Administration Announces State And Tribe Allocations For Home Energy Rebate Program," November 2, 2022, accessed July 26, 2024, https://www.energy.gov/articles/biden-harris-administration-announces-state-and-tribe-allocations-home-energy-rebate.
[53] Oregon Department of Energy, "Oregon Rental Home Heat Pump Program," accessed July 26, 2024, https://www.oregon.gov/energy/Incentives/Pages/ORHHPP.aspx.

Potential Implications for the Rental Housing Market

A maximum temperature standard could cost about $330 per unit for an ENERGY STAR certified window A/C unit, three time higher with professional installation, or $6,100 per unit for installing a mini-split heat pump. If needed, upgrading electrical panel would increase the costs by about $3,900 per unit. While a careful use of rebates and incentives could eliminate nearly all expenses for some property owners, many would still incur some expenses. Past conversations with stakeholders and some academic literature suggest that property owners may seek to pass the costs of cooling measures onto renters by increasing rents. This pass-through depends on how sensitive demand and supply for rental housing are to price changes. If cooling measures are implemented across the rental housing market in a short period of time, property owners may have more flexibility to increase rents in a market like Portland's where there is relatively limited housing supply and high demand.[54] This perspective would be further supported if there is one or only a few property owners in the market or if many property owners can coordinate their decisions.

However, individual property owners may find it difficult to increase rents without losing tenants for several reasons:

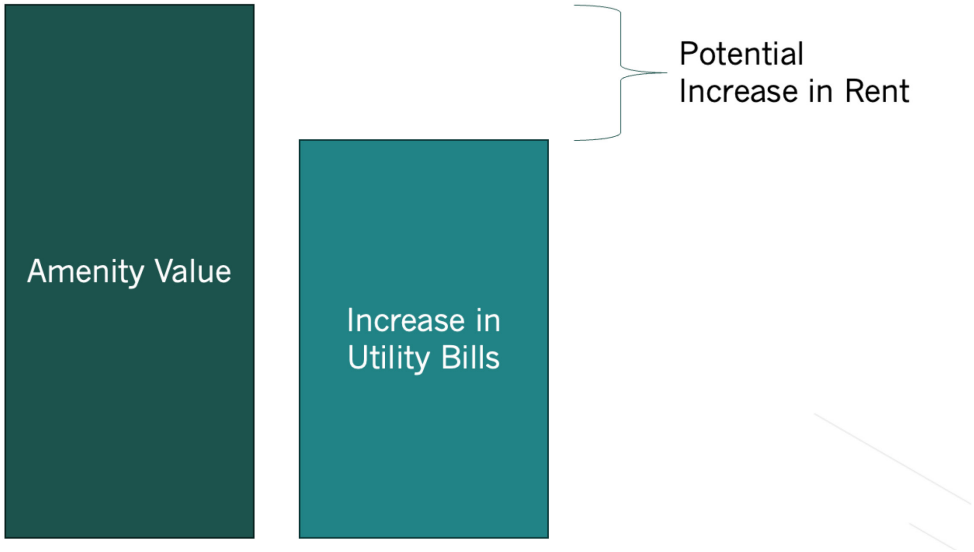
- The (unregulated affordable) rental housing market is usually made up of many unrelated property owners who make discrete, uncoordinated decisions based on their perceptions about what renters are paying in their properties and in other properties. Although they will want to recoup their costs whenever possible, they may not be able to simply pass through the costs unless the tenants think there are additional benefits associated with the higher rents.
- If cooling measures are implemented for a subset of rental units and there is a long compliance period (5 or more years), renters will have greater ability to choose among rental units. Because it is reasonable to expect that property owners are competing for renters to some degree, the possibility of losing tenants to other properties—that either have not yet adopted cooling measures or are not passing through the costs—could keep individual property owners from increasing their rents.
- If local regulations require cooling measures, renters may perceive the associated costs for property owners as a compliance requirement, making it harder to justify rent increases solely based on the cooling measures.
- Economic cycles also matter. In a weak economy with declining real incomes, renters are less able to absorb rent increases.

[54] But annual increases would be limited to 10 percent for older properties due to a statewide restriction on rent increases (Senate Bill 611, 2023 Regular Session).

For units with new window A/Cs, increasing rents would be even more difficult because A/C use would increase electric utility bills for the tenants in hotter months, thus increasing the total housing cost as a share of tenants' budgets. Although there could be some amenity value associated with having a cooling option that the tenants are willing to pay more for, that value would be partially offset by the increased utility costs, as illustrated in Exhibit 10. Unfortunately, there is no consistent evidence of renters' perceived values of A/C as an amenity, so this analysis is not able to quantify the rent implications.

Even when conceptualizing the A/C units as leases that tenants could hypothetically sign up for, the monthly lease cost would be less than $10 per month for a renter who is thinking out to 3 years ($330 is about $9.17 for 36 months, without any time-value discounting or interest). The estimate would be smaller for a longer time horizon. Instead of paying additional $10 or more in monthly rent for a unit with a window A/C, it is not unreasonable for a renter to invest in an A/C unit for $330 or less, assuming the landlord allows the renter to install their own window unit. Additionally, though portable cooling devices cost slightly more, Senate Bill 1536 protects tenants' right to install them. Therefore, new window A/Cs are unlikely to impact rents across the market.

Exhibit 10. Illustration of A/C Amenity Value, Utility Costs, and Potential Rent Increases



Source: ECOnorthwest

On the other hand, installation of mini-split heat pumps (in housing where tenants pay utility bills) could result in rent increases because of the perceived benefit of energy cost savings. While heat pump use for cooling would increase energy usage (compared to no cooling), it would also replace other means of heating and potentially decrease the total annual energy use and cost of using electricity. If heat pumps lower utility costs and improve living conditions for renters, property owners may be able to monetize the increased amenity factor.

In other words, rents could potentially increase by the amount utility costs decrease. Higher rents could be offset by lower utility bills for some, but there are likely to be exceptions.

Based on ECOnorthwest's energy modeling results using BEopt™, mini-split heat pumps could save each rental unit about $220 per year for multifamily and about $415 per year for single-family compared to window A/Cs, or a monthly average of $18 for multifamily and $35 for single-family.[55] If both property owners and tenants expect these savings, it is possible the rents of units with new heat pumps could increase by a similar amount. The benefits could be perceived to be more tangible if property owners can provide verifiable information or a national certification like the federal government's Energy Star program or regional and local certifications like Portland's Earth Advantage.[56] If such information is not available or property owners and tenants do not expect these savings, there may not be notable increases in rents.

The potential increase in utility costs can be mitigated with passive cooling solutions. Awnings (outdoors) and applied window films (indoors) can be cost-effective options for reducing heat gain. For properties that need to replace their roofs, cool roofs could also be an alternative, though it will be more costly. However, landlords tend to not allow such changes to be made by rental tenants, who would benefit from passive cooling measures.

The potential implications of emissions reduction measures could include moderate increases in rents of unregulated rental housing with heat pumps due to increased amenity factors and capitalization of utility cost savings. Rent increases from heat pumps will likely add to displacement pressures. Displacement risk could be exacerbated during the early years of implementing regulations for the maximum temperature standard as property owners try to raise their rents in anticipation of upcoming expenses for cooling measures. However, similar effects on displacement would not be likely if property owners can install window A/Cs instead to comply with the maximum temperature standard.

There is a high level of uncertainty about utility rates in the future. For a long time, residential utility rates grew at about 3.1 percent per year in Oregon.[57] But they have

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[55] Utility cost estimates are based on residential electricity cost of $0.177/kWh and natural gas cost of $1.426/therm. ECOnorthwest referenced various PGE, Pacific Power, and NW Natural rate schedules for the electricity and natural gas costs. The rates reflect the proposed rate increases for 2025 (5.5% for PGE, 9.8% for Pacific Power, and 4.5% for NW Natural). Fixed fees such as public purpose charges are not relevant for the analysis of marginal costs; the switch to heat pumps does not necessarily eliminate use of natural gas.

[56] A study of certification programs in Portland, Austin, TX, and the Research Triangle region in North Carolina showed housing prices were higher possibly because the certifications signaled better energy efficiency and lower utility costs for future buyers. Margaret Walls, Karen Palmer, Todd Gerarden, and Xian Bak, "Is Energy Efficiency Capitalized into Home Prices?: Evidence from Three US Cities," *Resources for the Future*, Discussion Paper (July 2013, revised February 2016), https://media.rff.org/documents/RFF-DP-13-18-REV.pdf.

[57] ECOnorthwest calculated annual growth rates of residential electricity and natural gas prices in Oregon. Electricity rate data is available through U.S. Energy and Information Administration (EIA) Form EIA-861, Annual Electric Power Industry Report. Natural gas rate data is available through Form EUA-857, Monthly Report of Natural Gas Purchases and Deliveries to Customers. Although natural gas prices have been more volatile, long-term price trend matches that of electricity prices. Both sets of data are available only at state and national levels.

increased by about 30 to 50 percent in the past three years.[58] And, the transition to renewable energy in the electricity grid could result in greater rate increases in the future. The influence of wildfires and changes in insurance costs are also uncertain and could affect future utility rates. The distributional consequences of the higher rates would be more burdensome for lower-income households. Moreover, adoption of time-of-use or peak pricing along with behavioral changes in response to price changes could result in different utility costs for various households. These factors have not been accounted for in this analysis.

To understand the potential influence of greater utility rate increases, ECOnorthwest performed a sensitivity test. In a hypothetical scenario in which the utility rates increase by 10 percent a year from 2025 to 2030 instead of 3.1 percent a year, the lifetime value of utility costs—a net present value[59] over 15 years—would be about 30 percent larger. For this analysis, the hypothetical scenario would result in 30 percent greater savings in utility costs for heat pumps because they would generate annual energy savings. This also means the change in rent could be about 30 percent greater—about $24 per month for multifamily to $45 per month for single-family.

[58] Portland General Electric raised residential electricity rates by 12% in 2023, 18% in 2024, and 5.5% in 2025. Pacific Power raised its residential rates by 21% in 2023, 12.9% in 2024, and 9.8% in 2025. NW Natural increased its rates by 25% in the winter of 2022 and the spring of 2023 and 4.5% for 2025.

[59] Present value is today's value of future stream of costs. Future costs are discounted by between 4.4% and 4.7% to reflect preference for having a dollar earlier rather than later. The discount rate is based on the latest guidance on benefit-cost analysis provided by the U.S. Office of Management and Budget (OMB) Circular No. A-94, Appendix C, Revised December 28, 2023.

Conclusion

A maximum temperature standard through local code amendment is a way of protecting renters in Portland from future heat waves. To cover about 25,400 renters without access to cooling, there will be significant expenses for most landlords and the City of Portland, even after accounting for the most likely financial incentives. However, the range of compliance costs varies by potential requirements. The City of Portland will need to determine whether the new standard could be satisfied with common spaces that are cooled or each unit would need access to private cooling equipment.

The least expensive—and the most likely—scenario is property owners purchasing window A/C units and installing them without hiring a contractor. The compliance costs after accounting for likely funding opportunities could be between $1.4 million and $7.9 million depending on the requirements. It is unlikely that there would be changes to rents or displacement.

On the other hand, heat pumps that require professional installation would result in compliance costs between $39 million and $50 million, after accounting for likely funding opportunities. It would reduce renters' utility costs, but rents could rise by a similar amount and create some displacement pressures.

This analysis is focused on financial considerations and built on many assumptions. However, there are many other factors that the City of Portland could weigh when creating a maximum temperature standard.

- There are important implications for carbon emissions. Window A/Cs in units that would otherwise not have them will increase citywide energy consumption and carbon emissions. In contrast, heat pumps that replace an existing heating appliance and create new option to cool a unit would reduce the total energy consumption and carbon emissions on net.
- Other potential actions to study include tree canopies to reduce neighborhood-level temperature and heat island effect, locating emergency cooling shelters where there is a concentration of older housing stock and more vulnerable households, and implications for resiliency during a potential power outage.
- The analysis does not discuss other housing types with renters such as townhouses and manufactured housing. In fact, the analysis is based on prototypes that cannot represent the diverse ways in which renters live. Therefore, a nuanced interpretation of the analysis results is encouraged.
- The analysis of heat pumps does not account for replacement costs. Property owners will have to replace their heating equipment at some point. The cost incurred to install heat pumps should be balanced with the cost property owners will incur anyway for replacement of old equipment.