KING COUNTY

BUILDING DECARBONIZATION STRATEGY

King County

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EXECUTIVE SUMMARY

The King County Building Decarbonization Strategy (Strategy) assesses potential priority actions and activities to reduce building greenhouse gas (GHG) emissions countywide while also exploring their potential to address equity impacts in policy and program development.

Existing buildings are the second-largest contributor to GHG emissions in King County, representing 43 percent of King County's GHG emissions in 2023. Although Washington state and local building codes are helping us develop greener new buildings, we will not meet our climate goals without reducing emissions in existing buildings. Stronger policies, targeted programs, appliance and building standards, incentives, and assistance programs can reduce barriers and accelerate retrofits. These actions can improve comfort, lower utility costs, reduce local air pollution, and improve health outcomes for all people, especially our frontline communities most impacted by climate change.

The foundation of this Strategy is the King County 2025 Strategic Climate Action Plan (SCAP), which identifies priority actions to reduce GHG emissions, advance equity, and help communities prepare for the impacts of climate change. The 2025 SCAP includes several actions to reduce GHG emissions from the building sector in King County. The purpose of this Strategy is to provide more in-depth analysis of 2025 SCAP building-related actions that are estimated to have high GHG reduction potential and require establishing new programs and activities, while also exploring new actions with strong GHG reduction potential or those that might aid action implementation. Several of these actions also align with, and are informed by, the Puget Sound Clean Air Agency (PSCAA) Comprehensive Climate Action Plan (CCAP).

Several state regulations have yielded strong GHG emission reductions from buildings—and set the stage for stronger GHG reductions in the years to come. Retaining and strengthening these regulations is critical to achieving King County GHG reduction goals. Several Strategy actions rely on, connect to, and build upon these, including the following state regulations:

CLEAN ENERGY TRANSFORMATION ACT (CETA): Requires electricity to be coal-free by 2025; GHG-neutral by 2030, through offsets if necessary; and GHG-free by 2045.

CLIMATE COMMITMENT ACT (CCA): Creates a cap-and-trade system to reduce GHGs from entities emitting 25,000 metric tons or more of GHGs per year starting in 2023.

CLEAN BUILDINGS PERFORMANCE STANDARD (CBPS): Requires energy reporting and improvements in buildings with low energy-efficiency performance for structures over 20,000 sq. ft.

As informed by the King County 2025 SCAP and state regulations, this Strategy explores the following actions, with the most impactful actions listed first by building sector. Impact evaluation is based on their GHG reduction potential as well as community and co-benefits. These are:

Residential

1. **Energize Expansion Analysis**
2. **HES: Home Energy Scores**
3. **Appliance Loan Programs**

Residential/Commercial

4. **Zero Emissions Appliance Standards**
5. **BEPS: Building Emissions**

Performance Standards

6. **Rooftop Units (RTUs) Initiative**
7. **Building Decarbonization Accelerator**

Commercial/Industrial

8. **Advance Industrial Retrofits**
9. **Embodied Carbon Emissions Reductions**

Residential/Commercial/Industrial

10. **TENs: Thermal Energy Networks**

The Strategy reviews each of these actions in detail, however some of their unique and comparative GHG reduction potential and co-benefits are summarized below.

ZERO EMISSIONS APPLIANCE STANDARDS: The action with the greatest GHG reduction potential for both the residential and commercial sector would be a Zero Emissions Appliance Standard. It is also one of the harder items to achieve, as it relies on adoption by entities external to King County, such as an air agency or the state. Such standards are not without precedent, however.

- Texas and Utah have had water heater emissions limits since 2000 and 2015 respectively.
- Colorado will be limiting emissions from space and water heaters in 2026.
- Maryland is planning to enact an ultra-low NOx limit, followed by a zero emissions heating equipment standard.
- Nine California air districts regulate space and water heater emissions, with California considering a statewide zero emissions space and water heater regulation.

The exceptional GHG reduction potential of this action warrants its strong consideration.

BEPS, RTUS AND ACCELERATORS: After Zero Emissions Appliance Standards, actions identified with the greatest GHG reduction potentials are countywide (or statewide) Building Emissions Performance Standards (BEPS) and the implementation of an initiative to electrify gas-fired Rooftop Units (RTUs). Similar to Appliance Standards, BEPS are more challenging as they require achieving statewide implementation or working with multiple local cities to adopt a coordinated program with notable complexity and staffing support needs. On the other side of the spectrum, the main challenge to RTU implementation is that it requires extensive one-on-one interactions with building owners. This contrasts the ability of BEPS to rely on broad regulatory action, which requires and helps motivate GHG reduction activity among building owners independent of requiring staff assistance—though staff support can also be vital, such as that provided by Accelerators.

TENS: A still-nascent option that has strong potential to reduce GHG emissions is supporting broad scaling of Thermal Energy Networks (TENs). TENs are viable for all building sectors, though their newer framework may contribute to market hesitancy, slowing development adoption. The TENs action explores activities King County may take to support its advancement.

EXPANDING ENERGIZE: A final strong GHG reduction action is the potential expansion of Energize, the King County direct installation program that works primarily in single-family buildings, with plans to expand to some multifamily and community buildings. Energize expansion is also beneficial in that it provides strong equity benefits, including restoring heat, adding cooling, and reducing energy bills for frontline communities. The primary challenge for this action is that it is cost-intensive, and it has historically relied on grant funding; long-term program support or program expansion would likely require additional County funding.

HES AND LOANER PROGRAMS: Requiring Home Energy Scores (HES) advances energy efficiency more than it likely advances GHG reductions, but reducing electricity demand is critical for grid stability and ensuring that future electricity sources can be renewable. Efficiency gains of this action are achieved through independent homeowner decisions to improve home efficiency rather than requiring improvements to the home, though some programs in other jurisdictions are paired with improvement requirements. Beyond these benefits, HES also supports consumer protection by providing advance disclosure of potential energy bill costs for homes, helping prospective homeowners understand the full costs of home purchase in terms of mortgage and monthly utility bills. Loaner programs are another option to help single-family households gain familiarity with new technological solutions that can help facilitate independent decarbonization activities.

INDUSTRIAL RETROFITS AND EMBODIED CARBON: Just as there are limited options to address GHG emissions from existing single-family homes, there are likewise limited options to address emissions from the industrial sector. This sector faces challenges in part due to the nature of industrial process emissions which directly result from chemical or physical changes in manufacturing as well as high energy demand and technological retrofit costs. There are ten primary industrial emitter sites within King County, though there are options to engage smaller-emitting operators under this action as well. GHG reductions in this sector can either advance through supporting retrofits via one-on-one engagement with industrial entities, or through broad regulatory action that incentivizes increased purchasing of low-emitting materials (i.e., reducing embodied carbon). Both have the potential to support the local economy and contribute positive equity impacts through reducing emissions sources located closer to frontline communities.

To achieve our climate emission reduction goals, we must all work together: government, businesses, community organizations, and King County residents. Overall, this Strategy explores some of the most prominent GHG reduction options available, while also assessing positive and negative equity impacts and potential mitigations; action co-benefits; as well as potential costs and best practices to support County implementation. It is also the intent of the County that all actions contemplated in this Strategy undergo additional, robust community engagement and equity evaluation prior to and throughout implementation.

King County has a long history of leading on climate and equity through innovative policy, programming and dedication to wholistic action, consistently demonstrating that bold, forward-thinking policy can deliver both environmental and economic benefits. Today, as the built environment emerges as the next critical frontier in the fight against climate change, King County has a historic opportunity—and responsibility—to once again lead by example. This Strategy does not contain everything that must be done, but it outlines the primary actions the County can take to progress on this important journey. It is the next chapter in King County's proud legacy of turning ambition into action and proving that local leadership can bend the global arc toward a safer, more equitable, and more sustainable future. By committing to building decarbonization that reduces fossil fuel use in our homes, workplaces, and institutions, King County can cut emissions deeply, improve public health, create thousands of clean energy jobs, and position our County as a national model for an equitable, sustainable and resilient community.

King County Jumpstart workforce participants in action.

INTRODUCTION

INTRODUCTION

The King County Building Decarbonization Strategy (Strategy) assesses potential priority actions and activities to reduce building greenhouse gas (GHG) emissions countywide while also exploring their potential to address equity impacts in policy and program development.

The foundation of this Strategy is the King County 2025 Strategic Climate Action Plan (SCAP), which identifies priority actions to reduce GHG emissions, advance equity, and help communities prepare for the impacts of climate change. The 2025 SCAP Building Energy and Green Building focus area includes several actions and performance measures to reduce GHG emissions from the building sector in King County.[1] The purpose of this Strategy is to provide more in-depth analysis of 2025 SCAP building-related actions estimated to have high GHG reduction potential and that would require the establishment of new programs and activities. This Strategy also reviews additional programs not included in the SCAP, including appliance loan programs, a rooftop unit (RTUs) initiative, and additional industrial decarbonization efforts. Several of these actions also align with, and are informed by, the Puget Sound Clean Air Agency (PSCAA) Comprehensive Climate Action Plan (CCAP).

This Strategy is not a comprehensive evaluation of all possible activities that can be pursued to reduce building emissions. Instead, it identifies the potential pathways to reduce building emissions, and it provides details on key attributes of those actions, namely emissions impacts, equity, and costs. This Strategy is not the final activity planned for these potential programs. Future efforts will need to build on this work and develop the infrastructure necessary to support SCAP implementation.

In addition to the above review of Strategy context, this introductory section reviews Strategy organization and the actions it contemplates, summarizes the existing building stock in King County, and provides a brief overview of the current GHG emissions from existing buildings in King County.

STRATEGY ORGANIZATION

The Strategy first reviews cross-cutting barriers and solutions that span across building decarbonization actions. These barriers must frequently be addressed or solutions integrated where feasible, regardless of whether an initiative is a policy or program. Given their broad applicability to multiple programs, barriers

1. Note that this Strategy does not review all building-related actions in the 2025 SCAP, some of which relate to ongoing efforts or approaches to green building programming that should be developed throughout multiple enterprise actions. Please refer to the 2025 SCAP for the full list of recommended Building Energy and Green Building focus area actions.

are discussed prior to reviewing specific actions.

This Strategy then dives into ten possible actions King County, community groups, and partners could pursue to reduce GHG emissions from existing buildings, organized by building sector. Potential action items are organized with the most impactful actions listed first by building sector, as evaluated based on their GHG reduction potential as well as their community and co-benefits. These are:

Residential

1. Energize Expansion Analysis
2. HES: Home Energy Scores
3. Appliance Loan Programs

Residential/Commercial

4. Zero Emissions Appliance Standards
5. BEPS: Building Emissions

Performance Standards

6. Rooftop Units (RTUs) Initiative
7. Building Decarbonization Accelerator

Commercial/Industrial

8. Advance Industrial Retrofits
9. Embodied Carbon Emissions Reductions

Residential/Commercial/Industrial

10. TENs: Thermal Energy Networks

Each action is described using the following framework:

- Background information relevant to the action, as well as its intersection with the SCAP.
- Overview of that action, including overall action goals.
- Initial cost estimates for County implementation.
- Potential GHG reductions and other co-benefits to action implementation.
- Equity considerations for that action, including positive and negative equity impacts to community health and vitality, as well as potential strategies to address negative impacts. Note that all actions contemplated in this Strategy would benefit from additional, robust community engagement and equity evaluation prior to and throughout its implementation.

EXISTING BUILDING STOCK

Across King County, in both incorporated and unincorporated areas, there are approximately 727,000 properties, though not all of these are "improved" or developed with a building.[2]

As part of this Strategy, approximately 537,000 buildings representing an excess of 2 billion sq. ft. are sorted as residential buildings as well as properties subject to the state Clean Buildings Performance Standard (CBPS), though counts for the commercial building stock evaluations outside of CBPS are harder to provide.[3] Overall, there is tremendous variety across the building stock in size, occupancy, and GHG emissions.

RESIDENTIAL

Most buildings in King County are residential, making up over 1.1 billion sq. ft. of property. King County has approximately 1,060,800 housing units as of 2025, including the following:[4]

- 525,645 single-family homes.
- 17,875 mobile homes and special units including houseboats and floating homes.[5]
- 350,000 – 517,000 multifamily housing units, depending how data analysts classify a multifamily project.
  - » There are 350,000 residential units housed in 9,425 apartment projects, with a "project" ranging from a "stand-alone 4-plex to a multi-building, multi-parcel complex." These counts are only for buildings with four or more units per building.[6]
  - » The state lists more units in multi-unit buildings, though the state's estimate also includes duplexes and 3-unit housing. The state's projection is that there are 517,250 housing units among duplexes, fourplexes and apartment units.[7]
  - » There are also 3,120 multifamily buildings that are over 20,000 sq. ft. in size and hence subject to the CBPS.[8]

2. King County Department of Assessors (King County Assessor Office), "Floating Homes & Houseboats: Area 15-10 & 730," 2024 Assessment Year. Accessed 12/2/25. Pg. 3.
3. CBPS is discussed more under the Building Emissions Performance Standard section. The 537,000 were identified through internal analysis of Assessor Geographic Information System (GIS) Data; see Appendix 2 for more information on this process.
4. Numbers will not add precisely due to rounding. See Washington State Office of Financial Management, (WA OFM), "Housing Units," April 1, 2025. Accessed 11/9/25.
5. There are approximately 600 parcels for floating homes etc., including 500 con do and lease parcels which may host multiple structures. For more information on floating homes, see King County Assessor Office, "Floating Homes ...," ibid. Pg. 5. General information pulled from WA OFM "Census Tabulation Manual;". Census Sheet A – Field Enumeration. Pg. 4. Accessed 12/2/25.
6. King County Assessor Office, "Apartments: Specialty 100...," ibid. Accessed 12/2/25. Pg. 4.
7. WA OFM, "Housing Units," April 1, 2025. Accessed 11/9/25.
8. Pulled from King County Assessor data; for details on how numbers were derived, please see Appendix 2. Building Stock Analysis Using Geographic Information System (GIS) Data..

In Washington state, approximately 40 percent of single-family homes are heated by natural gas, with another five percent using furnaces heated by other fossil fuels (i.e., propane, oil).[9] The use of natural gas is less prevalent in multifamily properties, though data on its prevalence is less certain. For instance, between 8 – 10 percent of multifamily units are heated by in-unit furnaces and, while more likely to be natural gas, these could also be propane, oil, or electric furnaces.[10] Similarly for water heating fuel types, almost 40 percent of single-family homes use natural gas for water heating, though usage is less clear for multifamily buildings.[11] Where multifamily buildings do have in-unit water heaters, though, approximately 15 percent use fossil fuel, 71 percent are electric resistance, and 15 percent have an unknown fuel type.[12]

Regardless of housing type, there is a strong need to achieve rapid decarbonization of the residential sector to achieve County and state GHG reductions goals. The Operation 2030 Report analyzed and proposed goals for the annual "zero carbon" retrofits that would be needed to meet Washington 2021 State Energy Strategy (SES) goals, estimating that residential retrofits would be needed at a rate of 42,000/year by 2025 and 110,000/year by 2030 in the state.[13] As King County contains 30 percent of the state's population and housing units alike, the County's proportionate residential retrofit goal would be 12,500/year by 2025 and 33,000/year by 2030.[14] Most retrofits would not be conducted by King County, and instead would have to be achieved through independent actors, market influences, and the impacts of policies and programs within the County.

For more information on the residential sector, see the Existing Emissions from Buildings subsection below or the Residential Decarbonization Actions section.

COMMERCIAL

There is no definitive count of commercial buildings in King County, though there is data on the number of buildings subject to state CBPS, categories of businesses in the County, and general patterns on fuel usage in commercial buildings.

Based on internal analysis of King County Assessor data, it is estimated that there are 9,211 buildings in King County subject to CBPS, representing over 867 million sq. ft. as shown in Table A-1.

9. Northwest Energy Efficiency Alliance (NEEA), "2022 Residential Building Stock Assessment," April 2024. Accessed 12/2/25. Pg 16.
10. NEEA, "2022 Residential Building Stock Assessment," April 2024. Accessed 12/2/25. Pg 22.
11. NEEA, "2022 Residential Building Stock Assessment," April 2024. Accessed 12/2/25. Pg 26.
12. NEEA, "2022 Residential Building Stock Assessment," April 2024. Accessed 12/2/25. Pg 29.
13. Storm, Poppy and Quigley, Eileen. "Operation 2030: Scaling Building Decarbonization in Washington State," Clean Energy Transition Institute (CETI), 2050 Institute, January 2022. Accessed 12/2/25. Pg. v, 19.
14. Population: 2,269,675 King/7,706,310 state total. All housing units: 1,060,799 King/ 3,441,914 state total. See WA OFM, "Housing Units," April 1, 2025; and "April 1, 2025, population of cities, towns, and counties used for the allocation of selected state revenues." Accessed 12/2/25.

Table A-1: *Buildings and Square Footage by CBPS Tier in King County*

Building Tier	Number of Buildings	Total sq. ft.
CBPS Tier 1: Over 220,000 sq. ft.	531	228,110,000
CBPS Tier 1: Over 90,000 sq. ft., less than 220,001 sq. ft.	1,123	152,272,000
CBPS Tier 1: Over 50,000 sq. ft., less than 90,001 sq. ft.	1,325	87,281,000
CBPS Tier 2: Over 20,000 sq. ft., less than 50,001 sq. ft.	3,112	98,091,000
CBPS Tier 2: Multifamily residential, over 20,000 sq. ft.	3,120	301,770,000
CBA Tier 1 Subtotal	**2,979**	
CBA Tier 2 Subtotal	**6,232**	
Total (Excluding Mixed-Use Residential)	**9,211**	**867,526,000**

In addition to strictly commercial land uses, there are also approximately 155 residential/commercial mixed-use buildings that are also subject to CBPS requirements representing 15,430,000 sq. ft. For more information on assumptions supporting the above summary, see Appendix 2. Building Stock Analysis Using Geographic Information System (GIS) Data.

The King County Assessor Office also releases reports for different types of commercial land uses, providing additional insight on groups of enterprises in King County, which includes:

- 12,500 permitted food establishments.[15]
- 375 hotels and temporary lodging facilities.[16]
- 500 major retail facilities.[17]
- 282 business parks parcels, though some of these parcels may be concentrated together to comprise one perceived "park."[18]
- 575 major office buildings over 90,000 sq. ft.[19]
- 215 hi-tech/flex properties, with multiple buildings on one parcel in some cases.[20]
- 55 biotech parcels with buildings.[21]

In the Northwest overall, approximately 80 percent of commercial floor space is heated by natural gas; two notable exceptions where natural gas is used less are the grocery and lodging sectors, where natural gas heats around 40 percent of the commercial floor areas.[22] Furnaces also serve a majority of commercial use types, though hospitals and schools use a higher proportion of boilers, and lodging

15. Note: this number includes food trucks. See King County, "About the inspection reporting system," 2025. Accessed 12/2/25.
16. King County Assessor Office, "Temporary Lodging: Area 160," 2024 Assessment Year. Accessed 12/2/25. Pg 15.
17. Includes, "regional malls, single-tenant discount retailers, big box stores, large neighborhood/community retail centers, and stand-alone grocery stores." See King County Assessor Office, "Major Retail: Area 250," 2024 Assessment Year. Accessed 12/2/25. Pg 5, 6.
18. King County Assessor Office, "Business Parks: Area 520," 2024 Assessment Year. Accessed 12/2/25. Pg 11.
19. King County Assessor Office, "Major Office Buildings: Area 280," 2024 Assessment Year. Accessed 12/2/25. Pg. 6
20. King County Assessor Office, "Hi-Tech/Flex Properties: Area 510," 2024 Assessment Year. Accessed 12/2/25. Pg 9, 13.
21. King County Assessor Office, "Biotech: Area 800," 2024 Assessment Year. Accessed 12/2/25. Pg. 5.
22. NEEA, "Commercial Building Stock Assessment 4 (2019) Final Report," May 21, 2020. Accessed 12/2/25. Pg 49, 52.

uses a much higher proportion of electric resistance heating systems.[23] Almost all building types primarily use natural gas for service water heating save for retail/service establishments and warehouses, which typically use electric fuel.[24]

Similar to the residential sector, there is a strong need to achieve rapid decarbonization of commercial buildings to achieve County and state GHG reductions goals. The Operation 2030 Report analyzed and proposed goals for the annual "zero carbon" retrofits that would be needed annually to meet Washington 2021 State Energy Strategy (SES) goals, estimating that commercial building retrofits would be needed at a rate of 1,400/year by 2025 and 2,400/year by 2030 in the state.[25] As approximately 40 percent of the labor force of the state is employed in commercial and community buildings in King County, the County's proportionate commercial retrofit goal would be 560/year by 2025 and 960/year by 2030.[26] Most retrofits would not be conducted by King County, and instead would have to be achieved through independent actors, market influences, and the impacts of policies and programs within the County.

For more information on the commercial sector, see the Existing Emissions from Buildings subsection below or the Commercial Decarbonization Actions section.

INDUSTRIAL

Emissions in the industrial sector are primarily from the 10 entities that emit over 10,000 metric tons of carbon dioxide equivalent ($MTCO_2e$) annually in King County.[27] However, this sector is represented by a larger stock of properties, with the County Assessor office identifying 108 parcels which meet its industrial specialty designation, though it remains unclear if all of these properties include buildings.[28] Beyond large emitters, there are also smaller enterprises that may fall into an industrial designation per the County Assessor office, which states the industrial designation is composed of the following parcel or land-use type:

> *Ideally, a combination of land, improvements, and machinery which has been integrated into a functioning unit intended for the assembling, processing, and manufacturing of finished or partially finished products from raw materials or fabricated parts, such as factories; or a similar combination intended for rendering service, such as laundries, dry cleaners, storage; or for the production of natural resources, such as oil wells.*[29]

A majority of industrial properties in King County are in the Duwamish Manufacturing Industrial Center – often referred to as SODO.[30] For more information on the industrial sector, see the Existing Emissions from Buildings on the following page or the Industrial Decarbonization Actions section.

23. NEEA, "Commercial Building Stock...," ibid. Accessed 12/2/25. Pg 53.
24. NEEA, "Commercial Building Stock...," ibid. Accessed 12/2/25. Pg 56.
25. Storm, Poppy and Eileen Quigley, "Operation 2030: Scaling Building Decarbonization in Washington State," Clean Energy Transition Institute (CETI), 2050 Institute, January 2022. Accessed 12/2/25. Pg. v, 19.
26. Covered employment: 1,449,797 King/3,577,071 state total. See WA Employment Security Department (ESD), "King County profile," posted October 2025; and WA ESD, "Washington state summary," posted October 2025. Accessed 12/2/25.
27. WA Department of Ecology (Ecology), "Total Emissions by reporter, sorted from largest to smallest," 2023 data. Accessed 11/3/25.
28. King County Assessor Office, "Industrial Specialty: Area 540," 2024 Assessment Year. Accessed 12/2/25. Pg 6.
29. Note that industrial designation by the King County Assessor's office does not mean the parcel is tracked as industrial energy user by respective utilities. For industrial definition, please see King County Assessor Office, "Industrial Specialty...," ibid. Accessed 12/2/25. Pg 7.
30. King County Assessor Office, "Industrial Specialty...," ibid. Accessed 12/2/25. Pg 6.

EXISTING EMISSIONS FROM BUILDINGS

Greenhouse gases (GHGs) are a category of gases that absorb heat energy emitted from the planet's surface, and they remain in Earth's atmosphere for a long time (from decades to centuries). Though they make up only a small portion of the atmosphere (less than 1% of all air molecules), GHGs absorb a significant amount of heat energy and re-radiate some of it back toward the surface. They're called "greenhouse gases" because they trap heat near the Earth's surface in a manner somewhat similar to how a greenhouse allows in the sun's rays and then holds in the resulting heat.[31]

Residential, commercial, and industrial buildings are among the largest sources of GHG emissions in King County, responsible for 43 percent of the County's total GHG emissions in 2023. Of the total building emissions, residential sector electricity and natural gas accounts for 40 percent of emissions, closely followed by the commercial sector at 35 percent. Industrial emissions and processes account for 15 percent and 2 percent of building emissions, respectively. Fuel oil and propane make up 3 percent of emissions; note that this data is not available by building sector. The distribution of emission sources by building sector varies greatly by jurisdiction, which may influence the individual policies and programs different jurisdictions pursue to reduce building emissions.

Emission patterns can also be assessed by fuel source alongside how those emission patterns have been influenced by state regulation. The primary 2023 sources of existing building emissions in King County are relatively comparable, with electricity and gas comprising 43 and 47 percent, respectively, though electricity has seen notable reductions in GHG emissions over time. The Washington State Clean Energy Transformation Act (CETA) has been and will continue to be the primary driver of emission reductions from electricity. There was a notable 34 percent reduction in electricity emissions from 2019 – 2023 in King County due to the closure of Puget Sound Energy (PSE) Colstrip 1 and Colstrip 2 plants, advancing

31. National Oceanic and Atmospheric Administration (NOAA), "What Are Greenhouse Gases and Why Do They Matter," (Archived). Accessed 10/31/25.

PSE compliance with CETA. At the end of 2025, PSE will transfer ownership of the remaining two Colstrip facilities, further reducing GHG emissions from electricity production for King County. Also notable are the Climate Commitment Act (CCA) and Utility Decarbonization Bill (HB 1589) requirements for PSE as the only gas utility operating in King County. The CCA requires gas utilities to either cut emissions or buy pollution allowances to meet emission reduction targets by industry actor.[32] HB 1589 requires an integrated system plan for PSE that considers both its gas and electric operations and helps prioritize CCA revenues for low-income bill assistance and electrification.[33]

The most common greenhouse gas is carbon dioxide (CO_2), followed closely by methane and nitrous oxide (N_2O); these respectively make up roughly 80, 11 and 6 percent of emitted GHGs in the United States (U.S.).[34] It should be noted, however, that different gases may have different potential to contribute to greenhouse warming based on chemical composition and their duration in the atmosphere; as such, it's common for these gases' impacts to be reported in an equivalent impact if emitted as carbon dioxide, or "CO_2e."[35]

While CETA requires that utility-supplied electricity be GHG-neutral by 2030, recent federal action presents significant threats to the ability of utilities to meet CETA requirements at an acceptable cost to rate payers.[36] Electricity demand is increasing due to the transition to electric vehicles and building systems, following a period of reduced demand from energy efficiency measures. Rising electricity demand, combined with a reduced electricity supply from fossil fuel sources, increases challenges for utilities to meet the GHG-neutrality and renewable energy commitments of CETA. At the same time, loss of federal tax credit incentives and federal approval restrictions for some renewable energy projects and interconnections will make it even more challenging and expensive for utilities to achieve CETA requirements.[37]

If CETA is successfully implemented, actions to increase renewable electricity sources or reduce building electricity usage could result in GHG reductions until, but not beyond, 2030. As such, emissions from natural gas and other onsite combustion emission sources—and the conversion of these appliances to electric fuel sources (also called electrification)—are a high priority for long-term building GHG reductions. Thus, these emissions are the principal focus of actions contemplated in this Strategy. However, anticipated strains on the electrical grid and continuing

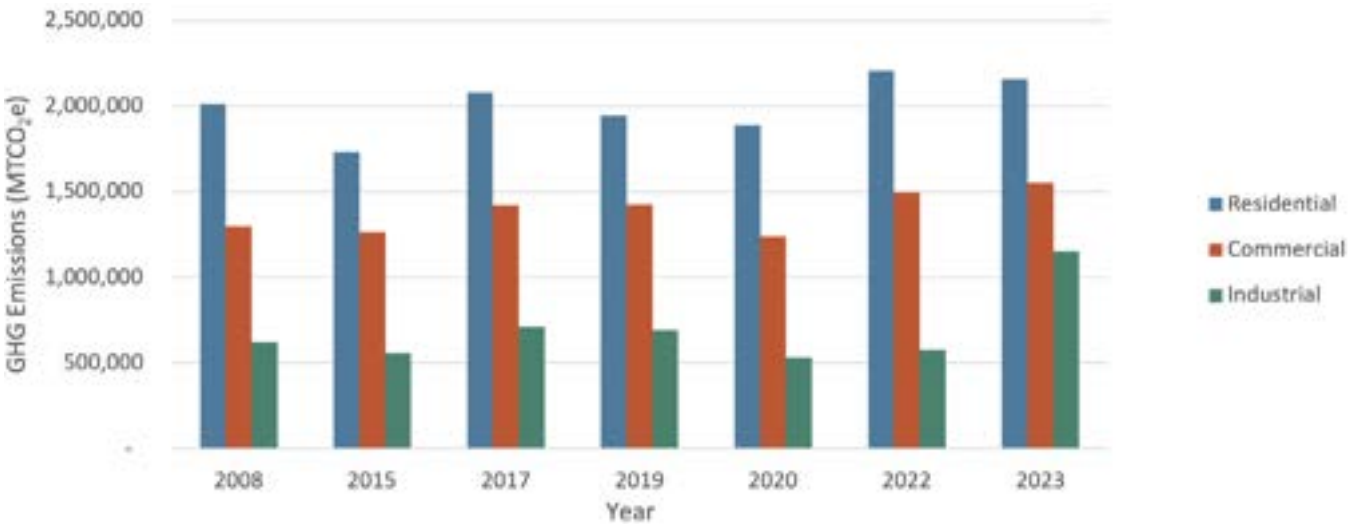
32. Wasberg, Jill and Will Gehrke, "Washington Utilities and Transportation Commission Issues Puget Sound Energy Risk-Sharing Order for Natural Gas Climate Commitment Act: Impact and Implications," NW Energy Coalition, February 25, 2025. Accessed 12/8/25.
33. Noren, Stephanie, "Washington deepens its commitment to clean energy with two new climate laws on the books," Climate Solutions, March 2, 2024. Accessed 12/8/25.
34. U.S. Environmental Protection Agency (EPA), "Overview of Greenhouse Gases," updated January 16, 2025. Accessed 10/31/25.
35. U.S. EPA, "Pollution Prevention Greenhouse Gas (GHG) Calculator Guidance," updated March, 2014. Accessed 10/31/25.
36. For CETA requirement re: 2030 GHG neutrality, see Washington Utilities and Transportation Commission, "Clean Energy Transformation Act," 2022, and Washington state Department of Commerce (WA Commerce), "Clean Energy Transformation Act," Accessed 12/18/25.
37. The White House, "Temporary withdrawal of all areas on the Outer Continental Shelf from offshore wind leasing and review of the federal government's leasing and permitting practices for wind projects." 2025. Accessed 11/17/25.

threats in achieving CETA requirements underscore the need to grow renewable energy generation and energy storage through battery systems as well; these actions remain of critical importance.

Reducing emissions from buildings has had uneven progress to date. Overall building emissions in King County have decreased three percent from 2007 to 2023. Electricity consumption has increased by three percent since 2008, exhibiting increases in the residential and commercial sector and decreases in industrial sector consumption. However, carbon intensities of electricity have fallen over this same time period resulting in overall electricity emission reductions of 23 percent. Natural gas consumption and emissions have increased by 25 percent over this same time period. Although other emissions sources also experienced variations during this period—such as industrial process emissions, emissions from fuel oil decreasing, and emissions from propane increasing—these sources account for four percent of the 2023 King County GHG inventory. As such, natural gas remains one of the largest portions of existing and anticipated GHG emissions, and its use is growing in every sector.

For more information on King County emission sources by fuel type and geography, see Appendix 1. Current Building Sector Emissions. See Figure A-1. for natural gas emission trends by sector.

Figure A-1: *Natural Gas Emission Trends, by Sector*



The transition of natural gas to electrical equipment in buildings will likely be the least expensive pathway to achieving GHG emission reduction levels needed to meet King County climate targets, based on analysis conducted at the state level. The Washington 2021 State Energy Strategy (SES) reviews and provides direction for the built environment sector, including high-level recommendations and key actions. One of the SES's priority recommendations is to "Transition the Fossil Natural Gas Industry," affirming that, "the state's long-term greenhouse gas emissions limits cannot be achieved while continuing current uses of this fuel."[38] Additionally, the State's Key Actions identified for buildings include supporting electric heat pump replacements for fossil fuel appliances and supporting strong energy efficiency programs. The SES models two cost scenarios to meet state GHG reduction targets, and the scenario that keeps gas appliances in buildings is more costly in 2030 and beyond than the scenario that pursues building electrification.[39] This is because gas appliances use significantly more energy than high efficiency electric appliances like heat pumps. Additionally, keeping gas appliances in buildings requires developing larger quantities of clean gas fuel in order to reduce emissions from these appliances, and developing these fuels are ultimately more expensive than electrification.[40]

38. Washington state Department of Commerce (WA Commerce), "Washington 2021 State Energy Strategy," December, 2020. [LINK]. Accessed 2/6/24. Pg 18.
39. Commerce, "Washington 2021 State Energy Strategy," December, 2020. Accessed 2/6/24. Pg 46.
40. Commerce, "Washington 2021 State Energy Strategy," December, 2020. Accessed 2/6/24. Pg 46.

BARRIERS TO BUILDING DECARBONIZATION

Building decarbonization faces many challenges that span across sectors, fuel types, and geographies. Many proposed programs and policy solutions must account for these barriers and develop means of addressing them. Below are some of the most common barriers in building decarbonization and some of the solutions to help address these barriers.

HIGH FINANCIAL COSTS: The high costs of building decarbonization technologies and labor pose some of the largest challenges to building decarbonization at scale.[41] For instance, gas furnaces cost $1,500 – $9,500 in the U.S., with an average installation cost of $4,800, while installing a standard heat pump system typically ranges from $3,500-$20,000, with an average cost of about $14,000 after rebates.[42] The capital required to cover such high upfront retrofit costs is a specific barrier, particularly for low-income and disadvantaged communities.[43] Even for large-scale commercial buildings, the high immediate costs of energy-efficient technologies, or converting fossil fuel systems to electric, may financially outweigh long-term cost savings, especially during periods of economic downturn in the commercial building market.[44]

SPLIT INCENTIVES: Buildings that are rented also face the issue of split incentives, which occur when, "tenants pay the utility bills (directly or indirectly) but have no control over capital investments that affect energy consumption."[45] This also means that building owners have a reduced incentive to make building improvements as they do not incur the costs of these energy inefficiencies, nor do they reap the benefits and cost savings of more energy efficient equipment.[46]

41. Washington State Department of Commerce (WA Commerce), "Residential Building Decarbonization Implementation Plan," July 2023. Accessed 1/31/25. Pg 13
42. See More-Bloom, Ruby, "Why Heat Pumps are Key to Building Decarbonization," Clean Energy Transition Institute, June 13, 2022. Also, Carthan, Alexis, "How Much Does a Furnace Cost? (2025 Pricing)," This Old House. Accessed 12/8/25.
43. Clarke et al., "Identifying Barriers That Impede Cost-Effective, Holistic, and Equitable Building Performance and Zero Carbon Goals in Low-Income and Disadvantaged Communities," American Council for an Energy-Efficient Economy (ACEEE), 2024. Accessed 1/31/25. Pg 9.
44. WA Commerce, "Clean Buildings Workgroup Report to the Legislature," November 2024. Accessed 1/31/25. Pg 9.
45. Hynek et al., "Follow the Money": Overcoming the Split Incentive for Effective Energy Efficiency Program Design in Multifamily Buildings," ACEEE, 2024. Accessed 2/12/25. Pg 136.
46. Hynek et al., "Follow the Money": Overcoming the Split Incentive...," ibid. Accessed 2/12/25. Pg 136.

LACK OF RESOURCES AND COMPETING PRIORITIES: Many buildings managers lack adequate resources to research, implement, and maintain building decarbonization technologies.[47] They might also be faced with competing priorities that outweigh building decarbonization goals. For example, for low-income residents, immediate needs such as food, energy bills, or debt make be a higher priority than building upgrades.[48] For larger building owners, avoiding disruptions to key services may be a priority.[49]

UNCOORDINATED PROGRAMS: While many programs address building decarbonization, the lack of coordination and alignment between programs is a barrier to residents trying to access programs. There are local, utility, state, and federal incentives and programs, but evaluating these options and qualifying for each can be onerous and time-consuming, particularly for low-income residents.[50] Navigating legislative or service territory overlap in a particular jurisdiction may also cause confusion, such as when two sets of requirements apply to one building (state laws and local laws), or when a utility service territory only covers part of a city, such that one set of rebates does not apply throughout the local government geography.[51]

LIMITED PROGRAM CAPACITY: There is limited funding for building decarbonization programs, which poses capacity constraints for programs' abilities to serve residents and building owners.[52] Programs specific to affordable housing are often under regulatory constraints, which limits funding access.[53] Additionally, although many programs have current state and federal sources of funding, the Washington state Department of Commerce (WA Commerce) reports have identified a need to establish a roadmap for providing long-term program funding, including expanded funding for local program administration costs.[54]

INSUFFICIENT WORKFORCE: Scaling the green building economy requires targeted workforce development and industry reskilling to ensure building decarbonization solutions can penetrate the market and remain affordable while benefiting our local economy. To date, there has been inadequate funding to ensure workforce stability and equitable distribution of benefits within the green building industry as the need for this work increases in our region.[55] Lack of workforce capacity and shortages could lead to higher costs as well as increased wait times for residents, delaying progress toward decarbonization goals, threatening policy compliance, and potential customer dissatisfaction with building decarbonization actions.[56]

47. WA Commerce, "Clean Buildings Workgroup...," ibid. Accessed 1/31/25. Pg 5
48. Clarke et al., "Identifying Barriers..," ibid. Accessed 1/31/25. Pg 10.
49. Hynek et al., "Follow the Money": Overcoming the Split Incentive...," ibid. Accessed 2/12/25. Pg 136.
50. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 38.
51. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 38.
52. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 25.
53. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 25.
54. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 39.
55. Quigley, Eileen, "Tackling Building Sector Emissions in Washington," May 2024. Accessed 1/31/25.
56. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 6, 25

POOR BUILDING CONDITIONS: Many buildings must meet certain health and safety requirements before accessing some types of decarbonization incentives such as weatherization assistance.[57] Low-income homeowners may face other barriers that raise the cost and effort to secure decarbonization retrofits. Barriers such as poor building conditions, roofing issues, poor weatherization or air-sealing, inadequate electrical panels, or the inability to conduct necessary repairs may dissuade or exclude low-income homeowners from participating in building decarbonization programs.[58] These challenges add costs to support decarbonization both for individual homeowners and for decarbonization programs.[59] If single-family homes apply for weatherization incentives, their application can be deferred if significant home repairs are needed. A National Public Radio news article notes that these numbers vary widely:

> *Around half of all weatherization assistance applications in Philadelphia result in a deferral, according to the Energy Coordinating Agency, which carries out the program in Philadelphia... Federal surveys of the states and local agencies that carry out the work show that those who do track it report a wide range of deferral rates, from under 5 percent to more than 20 percent. A 2017 survey in Pennsylvania found about 36 percent of homes in the state are rejected. At one point, an agency in western Wisconsin found it was deferring nearly 60 percent of homes.*[60]

Research also indicates that this barrier is not isolated to the residential sector as, "of the 77 percent of U.S. small commercial building stock (i.e., buildings between 1,000 and 5,000 sq. ft.) built before 2000, 64 percent have not been renovated since 2000."[61]

57. Clark et al., "Identifying Barriers..," ibid. Accessed 1/31/25. Pg 9.
58. WA Commerce, "Residential Building Decarbonization...," ibid. Accessed 1/31/25. Pg 25.
59. For example, the City of Berkeley cited that Home Repairs contributed significantly for overall residential decarbonization costs at 13 percent of the overall budget. See City of Berkeley, "The Berkeley Funding Gap Analysis for Residential Building Decarbonization," by the Building Electrification Institute. July 2022; Updated February 2023. Accessed 9/29/25. Pg 29.
60. Benshoff, Laura, "A low-income energy-efficiency program gets $3.5B boost, but leaves out many in need," National Public Radio, May 13, 2022. Accessed 9/29/25.
61. Clarke et al., "Identifying Barriers..," ibid. Accessed 1/31/25. Pg 2.

ADDRESSING SYSTEMIC BARRIERS

Many decarbonization barriers are systemic issues that will not be resolved by a single policy but instead require integrated approaches across multiple policies and programs. Below are approaches that King County and its partner agencies can take to address systemic issues.

COORDINATED PROGRAM ENROLLMENT

There are multiple programs operated by different entities to support decarbonization, especially for residential buildings. However, each program varies in how residents can apply; the income levels for which services are offered; the geography in which services are offered; the means of service offerings including rebates, loans, or direct installations; and the types of services offered, including weatherization and electrification depending on existing fuel sources. The 2025 King County Strategic Climate Action Plan (SCAP) commits to exploring this issue:

> *The County will explore and, if feasible, develop a collaborative, coordinated entry, and enrollment system for retrofit programs, or advocate for a state system. The program would support income-qualified individuals submitting a single application that enables a full application, or support applying in part, to all participating programs (i.e., Low Income Home Energy Assistance Program (LIHEAP), Seattle City Light, Puget Sound Energy (PSE), etc.) to reduce barriers and increase their knowledge of all incentives they may be able to pursue.*[62]

If successfully instituted, a coordinated enrollment approach would enable any entity to use a central portal to comprehensively apply to and qualify for all applicable programs, providing a streamlined application process that would lower barriers to accessing program benefits.

However, coordinated program enrollment will take time and resources to implement. In the interim, King County's residential decarbonization program Energize has coordinated, and will continue to coordinate, with other internal and external partner programs. This includes working with the King County Home Repair program to conduct electrification improvements for homes in need; receiving referrals from local nonprofits such as Habitat for Humanity; referring homes to the King County Housing Authority (KCHA) to secure weatherization improvements where available; and helping electrically heated homes apply to HomeWise and the Seattle Utility Discount Program (UDP) for weatherization and UDP electric bill reductions. Energize program operators

62. King County, "2025 Strategic Climate Action Plan," adopted October 21, 2025. Accessed 12/6/25. Pg 119.

also meet regularly with utilities and other program operators, including with City of Seattle and Energy Smart Eastside staff, to continue exploring additional means of coordination between residential improvement programs.

WORKFORCE DEVELOPMENT

Many building decarbonization programs and policies rely on a skilled workforce to implement existing and evolving green technologies. King County is taking steps to increase the workforce necessary to scale building decarbonization initiatives through planning efforts, such as the 2025 Climate and Workforce Strategy, which outlines a path to connect frontline communities to living-wage opportunities, building a skilled and diverse workforce across the career spectrum.

King County is also delivering on the Climate and Workforce Strategy through specific programs such as Jumpstart, which helps young adults start careers in clean energy and the skilled trades. Jumpstart participants first undergo primary education programs in the construction trades, earning OSHA-10, flagger, and forklift certificates. Afterwards, the participants are placed with local contractors to receive on-the-job training in electrical, HVAC, solar, and project management skills in a 240-hour paid position. Following this process, participants can be hired by their host contractor or complete an application clinic for relevant County positions and receive support connecting with local apprenticeship opportunities.

To support securing job placements for JumpStart participants, King County also requires contractors providing installations in its Energize program to accept up to two JumpStart participants per year. Although these efforts demonstrate King County's active and growing support to address building decarbonization workforce needs, additional programs or approaches might be necessary to support decarbonization workforce needs, such as supporting training for thermal energy network (TEN) installations, additional weatherization training, or other evolving technologies that support building electrification. Overall, workforce development initiatives should be supported with sustained investment to ensure long-term community economic vitality and local skill development to support broader building decarbonization action.

King County JumpStart Fall 2025 Cohort

HOME AND BUILDING REPAIR

King County aims to increase eligibility for decarbonization upgrades by integrating home repair measures in its retrofit programs. A study from the American Council for an Energy-Efficient Economy (ACEEE) noted that, with funding for repairs and weatherization-readiness, "homes could be repaired, leading to quality-of-life improvements, millions of dollars of financial savings, and major reductions in carbon emissions."[63] Where funding permissions have allowed, King County has addressed building health and safety concerns in decarbonization retrofits in single-family homes, adult family home operators, and family home childcares. Examples of potentially needed minor repairs include installing smoke detectors; addressing pest infestations; mitigating slip and fall hazards; addressing mold growth; conducting asbestos remediation; completing repairs that may indicate a permitting barrier such as electrical or fire hazards; addressing roof repairs; addressing structural defects; or attending to other identified life and safety repairs. These repairs not only improve safety and health outcomes for residents, but they also create improved working conditions for contractors and installers. The Energize program has also worked to internally coordinate with the King County Housing Repair Program (HRP), operated within the King County Department of Community and Human Services, to provide electrification for homes in the HRP, or to conversely refer homes to the HRP or to external Habitat for Humanity repair programs when it could not otherwise fund needed repairs. King County will continue to explore expanding home repair services through program and partner coordination.

INCREASING RESILIENCE

King County acknowledges that systemwide resilience and reliability is critical to the adoption of building decarbonization technologies. As outlined in the 2025 King County SCAP climate preparedness section, climate change is increasing the prevalence and severity of extreme weather scenarios, and designing sustainable systems that function during times of greatest need is imperative. Many emerging technologies enable the County to create distributed clean energy systems that are more resilient to shocks such as microgrids, thermal energy networks (TENs), solar, battery energy storage systems (BESS), two-way car charging, induction stoves with battery backup, and utility coordination on emergency response and undergrounding target powerlines.

Contractors installing a heat pump at a home in the King County Energize program

63. Reuven Sussman, "Need for Repairs is Blocking Weatherization in a Fifth of Eligible Home," ACEEE, June 2025. Accessed 7/9/25.

RESIDENTIAL DECARBONIZATION ACTIONS

RESIDENTIAL DECARBONIZATION ACTIONS

The residential sector accounted for 40 percent of King County's building emissions in 2023, though this sector itself has tremendous variety among its buildings, including the age and type of residential units. King County has approximately 1,060,800 housing units as of 2025, including the following:[64]

525,645 single-family homes.

17,875 mobile homes and special units including houseboats and floating homes.[65]

350,000 – 517,000 multifamily housing units, depending how data analysts classify a multifamily project.

There are 350,000 residential units housed in 9,425 apartment projects, with a "project" ranging from a "stand-alone 4-plex to a multi-building, multi-parcel complex." These counts are only for buildings with four or more units per buildings.[66]

The state lists more units in multi-unit buildings, though the state's estimate also includes duplexes and 3-unit housing. The state's projection is that there are 517,250 housing units among duplexes, fourplexes and apartment units.[67]

There are also 3,120 multifamily buildings that are over 20,000 sq. ft. in size and hence subject to the CBPS.[68]

As noted in the Strategy introduction, the distribution of emission sources by sector also varies greatly by jurisdiction, based on which utility serves a given jurisdiction and historical development patterns. This in turn may influence the individual policies and programs different jurisdictions pursue to reduce building emissions. For instance, residential emissions make up roughly 23 percent of Seattle's building emissions profile, whereas the residential sector represents 76 percent of unincorporated King County's building emissions. The primary sources of residential GHG emissions in 2023 were:

- **ELECTRICITY:** 1.99 million $MTCO_2e$ ($MMTCO_2e$)
- **NATURAL GAS:** 2.16 $MMTCO_2e$

A large portion of fuel oil (0.40 $MMTCO_2e$) and propane (0.22 $MMTCO_2e$) emissions are also attributed to the residential sector.

64. Numbers will not add precisely due to rounding. See Washington State Office of Financial Management, (WA OFM), "Housing Units," April 1, 2025. Accessed 11/9/25.
65. There are approximately 600 parcels for floating homes etc., including 500 con do and lease parcels which may host multiple structures. For more information on floating homes, see King County Assessor Office, "Floating Homes ...," ibid. Pg. 5. General information pulled from WA OFM "Census Tabulation Manual;" Census Sheet A – Field Enumeration. Pg. 4. Accessed 12/2/25.
66. King County Assessor Office, "Apartments: Specialty 100...," ibid. Accessed 12/2/25. Pg. 4.
67. WA OFM, "Housing Units," April 1, 2025. Accessed 11/9/25.
68. Pulled from King County Assessor data; for details on how numbers were derived, please see Appendix 2. Building Stock Analysis Using Geographic Information System (GIS) Data..

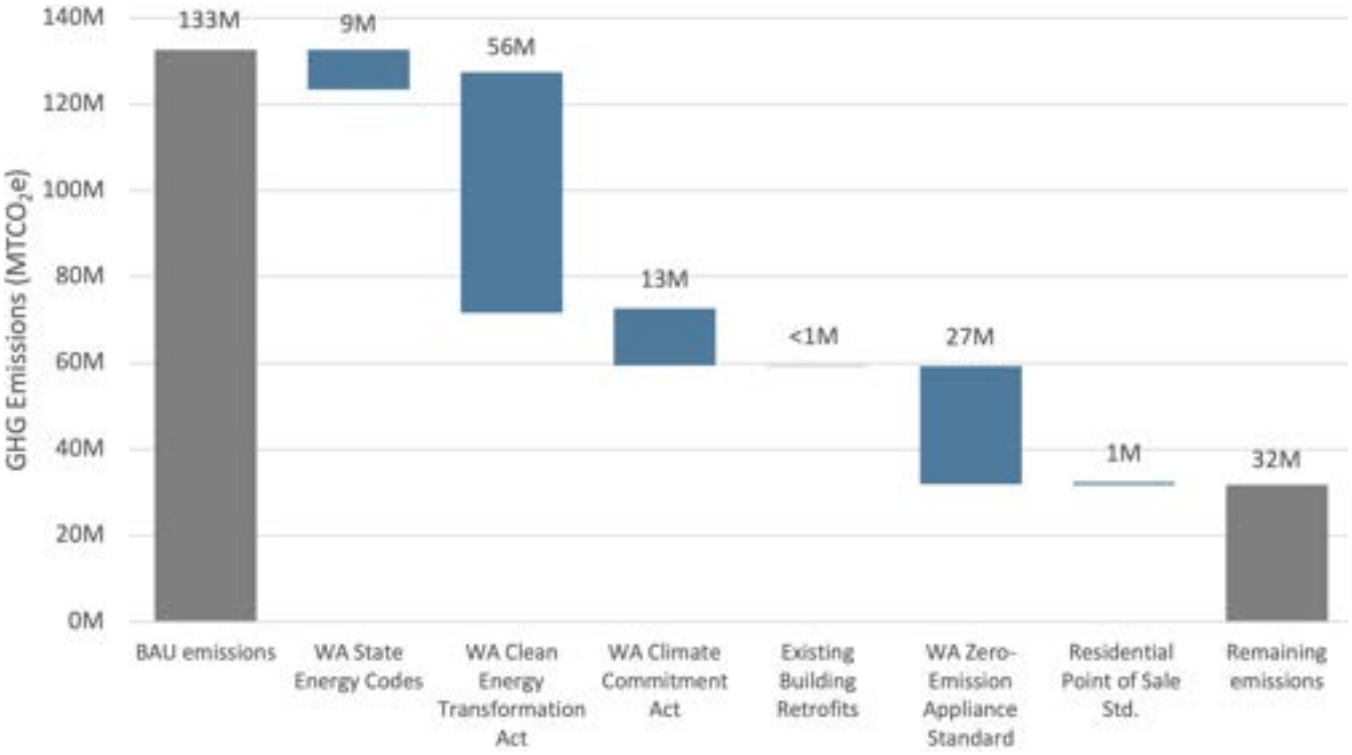
emissions individually reveals unique trends. From 2007 to 2023, residential emissions from electricity decreased by 18 percent, while natural gas emissions increased eight percent. The trend of growth in natural gas emissions is echoed across Washington state. Looking at a longer timeline between 1990 and 2019, statewide GHG emissions from residential electricity use increased by 27 percent, whereas emissions from natural gas increased by 235 percent.[69]

It should be noted that the residential sector faces unique challenges in reducing emissions compared to other building types. Although King County and its cities can modify energy code requirements for multifamily residential buildings four stories and taller, it is not able to modify energy codes for single-family homes or multifamily buildings three stories tall or below—reducing the County's ability to achieve GHG reductions through retrofits subject to energy code requirements. While emissions reductions can be achieved for some larger, lower-rise multifamily buildings through strategies listed in the Strategy Residential/Commercial section, there are few opportunities to address emissions from single-family and low-rise multifamily homes. Some actions for these parts of the residential sector are reviewed in both this Strategy section and section following.

69. Storm, Poppy and Eileen Quigley, "Operation 2030: Scaling Building Decarbonization in Washington State," Clean Energy Transition Institute. 2050 Institute, January 2022. Accessed 11/9/25. Pg. 5.

During the development of the King County 2023 GHG Emissions Analysis and development of the King County 2025 Strategic Climate Action Plan (SCAP), staff reviewed the potential emissions reductions of some residential section actions reviewed in this Strategy, namely the Zero Emissions Appliance Standard and a Home Energy Score (HES) program (referred to as "Residential Point of Sale Standard" in Figure B-1). The comparative GHG emissions reduction impacts of these actions compared to the business-as-usual (BAU) GHG emissions projection is shown in Figure B-1. for context.

Figure B-1: *Residential Built Environment Cumulative Emissions Reduction Potential by 2050. As shown in the King County 2023 GHG Emissions Analysis.*



Aside from the state Clean Energy Transformation Act and state Climate Commitment Act, one of the greatest areas for potential GHG reductions that can be achieved in the residential sector would be from a Zero Emissions Appliance Standard. As this action could also reduce commercial emissions, its implementation is discussed more in the Strategy section addressing this sector. Although a Residential Point of Sale Standard (discussed in this Strategy under an HES program) is not projected to achieve the same level of GHG reductions as other policies, the potential electricity reductions and its consequent benefits to grid stability make the pursuit of a HES program desirable.

Actions considered for the residential sector in this Strategy are as follows:

1. **Expand Energize**
2. **HES: Home Energy Scores**
3. **Appliance Loan Programs**

1. Expand Energize

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 28: Directly Facilitate Retrofits of Housing and Community Assets of Frontline Communities. Energize is King County's direct installation program helping achieve this work, historically in low- and moderate-income single-family homes. In 2025, the program expanded to serve adult family homes and family home childcares. From 2026-2028, the program is expanding to fund retrofits in affordable multifamily homes (both subsidized and non-) as well as in buildings providing community services and gathering spaces.

ACTION

Increase frontline community climate resilience and preparedness by expanding the Energize program to install more heat pump space heating and cooling and conduct other efficiency upgrades in frontline community households.

OVERVIEW

King County has approximately 1,040,150 housing units, of which 524,150, or roughly 50 percent, are estimated to be single-family homes.[70] As of 2021, approximately 35 percent of all households in King County are considered low-income, defined as earning 80 percent or less of the area median income (AMI).[71] One option to achieve greenhouse gas (GHG) reductions in these households would be for the County to directly fund decarbonization retrofits, such as through expansion of the County's Energize program. The proportion of low-income households living in single-family homes both as renters and owners (versus living in multifamily homes) is difficult to determine from existing data sources. The Energize program applies to both owned and rented single-family homes. When exclusively considering the proportion of low-income households in owned housing units, the potential single-family households to which Energize could apply is 24 percent of all owned units in King County, or 121,000 homes.[72]

70. WA State Office of Financial Management (OFM), "April 1 official population estimates, Housing Units [Excel]," June 2024. Accessed 12/09/24.
71. Maskin, Rebeccah, Demographic Planner, King County Office of Performance, Strategy and Budget, direct email message to author, December 3, 2025. Data pulled from Comprehensive Housing Affordability Strategy data used by the U.S. Department of Housing and Urban Development (HUD).
72. Maskin, Rebeccah, Demographic Planner...ibid. Direct email message to author, December 3, 2025.

BACKGROUND

The King County Energize program installs heat pumps and other home efficiency upgrades in low- and moderate-income homes, with a focus on replacing inefficient fossil fuel appliances at up to one hundred percent cost coverage. Heat pumps provide efficient heating and cooling while reducing emissions and sometimes lowering energy costs. Energize was initially piloted in the Skyway and White Center neighborhoods, but it has expanded to South King County. The program has additionally expanded services to family home childcares and adult family homes across the County.

Energize aligns with King County's Strategic Climate Action Plan (SCAP) commitments by:

- Preparing families for the impacts of climate change by ensuring more people have access to cooling on hot days and heating on cold ones.
- Advancing energy justice and reducing energy burdens in frontline communities, or those communities that will experience the earliest and most severe climate impacts.
- Creating jobs by hiring local contractors and providing work-based learning opportunities in skilled trades.
- Reducing GHG emissions and air pollution by replacing inefficient gas and oil heating systems with cleaner electric heating and cooling.

PROGRAM ACHIEVEMENTS

Over 18 months, the program has served approximately 220 homes, including 148 low-income and 22 moderate-income single-family homes, 40 adult family homes (AFHs) and 16 family home childcares (FHCCs). Between April 2024, when installations began, and November 2025, Energize has supported:

- ✓ 199 heat pump installations in single-family homes, AFHs and FHCCs.
- ✓ 17 heat pump installations through referrals to the partner programs of King County Housing Authority and Seattle HomeWise.
- ✓ 64 weatherization upgrades as well as 16 heat pump water heater and four induction stove installations.
- ✓ 33 homes received heating that did not have a working primary heating system previously, including 26 single-family homes, four AFHs, and three FHCCs. This means over 80 persons now have reliable heating due to Energize, including almost 30 seniors and over 30 children in FHCCs from low-income families.
- ✓ Five Energize contractors becoming successful JumpStart program host sites.
- ✓ 11 JumpStart trainees completing their 240-hour work-based learning placements with Energize contractor host sites, contributing to an almost 70 percent employment rate for participants in the JumpStart program.

Following the pilot phase, the program expanded to a network of 21 local installation contractors, with 20 percent of spending to date going to certified women- or minority-owned business enterprises. To support attracting program participation, Energize outreach materials are available in 11 languages, and the program has held 12 workshops with over 500 attendees.

On the right, you can see one of the couples who received a heat pump with the text as featured in the Seattle Times.[73]

Action Goals

This action aims to:

- *Explore or secure additional sustained funding to expand the Energize program.*
- *Provide additional opportunities for no- or low-cost retrofits of single-family homes.*

"Alexandra Lui and David Tam stand in front of their Skyway home with their new heat pump at left and electrical panels at right. A contractor installed a heat pump and upgraded the electrical panel in their Skyway home, which she and her husband bought together after getting married 40 years ago and have lived in ever since."

COST ESTIMATES

The program currently has two full-time employee (FTE) staff supporting 150 to 200 home installations per year, though this amount is strongly dependent on funding. Although the pilot program was initiated with $1.9 million in King County bond funding, the current installation model is almost entirely grant dependent. Including the pilot phase, Energize has helped inject $6 million into the local economy through contractor work. 2025-2026 program operations are currently funded through the following grant awards:

- **WA Department of Commerce (Commerce) Home Electrification and Appliance Rebates (HEAR) Grant:** $2,596,000
- **WA Commerce HEAR Grant for AFHs:** $1,500,000
- **WA Department of Ecology Indoor Air Quality Improvement Grant:** $1,718,000
- **Puget Sound Energy Climate Commitment Act Decarbonization Grant:** $1,000,000
- **Washington State University Community Energy Efficiency Program (CEEP) Grant:** $1,200,000

Funding for the Energize program beyond 2026 is dependent on additional grant and/or County funding mechanisms.

73. Breda, Isabella, "King County households can get low- to no-cost heat pumps," Seattle Times, June 2024. Accessed 6/27/25.

To evaluate the potential for expanding the Energize program, two expansion scenarios are modeled—one targeting 1,000 home retrofits per year (Model A), and the other exploring the maximum annual retrofits needed to achieve full electrification of low-income single-family homes by 2050 (Model B). GHG emission reductions are estimated in metric tons of carbon dioxide equivalent ($MTCO_2e$).

Model A

- **Cost:** $27M/yr
- **Installations:** 1,000/yr
- **Outcome:** retrofits 20 percent of low-income single-family homes
- **Outcome:** GHG reduction of 838,000 $MTCO_2e$

Model B

- **Cost:** $138M/yr
- **Installations:** 5,000/yr
- **Outcome:** retrofits all low-income single-family homes
- **Outcome:** GHG reduction of 4,211,000 $MTCO_2e$

Modeling showed that Model A would cost approximately $27 million annually to support installations of 1,000 homes per year, whereas Model B would require approximately $138 million annually. In Model A, approximately 20 percent of all low-income single-family homes would be served by 2050, whereas Model B would require serving approximately 5,000 homes per year.

Some program costs may temporarily be reduced through federal Inflation Reduction Act rebates, with Washington state estimated to receive a total of $166 million.[74] At roughly 34 percent of the state's population, King County is only anticipated to receive a portion of this retrofit funding, such that the ultimate retrofit funding need will far exceed current rebate totals.

For more information on assumptions used in the King County building stock analysis, see Appendix 6. Energize Expansion Assumptions.

ESTIMATED IMPACTS AND CO-BENEFITS

The GHG reduction estimate for this action received a light touch in analysis, as it is one of the more costly options for long-term GHG reductions. The action's estimate is a potential reduction of 838,000 $MTCO_2e$ for the 1,000 homes/year expansion, or 4,211,000 $MTCO_2e$ for the 5,000 homes/year expansion. This GHG emissions reduction estimate is likely somewhat high, as preliminary analysis relied on estimated impacts of actions based against Washington state utility emission averages developed by the National Renewable Energy Laboratory (NREL), rather than estimates that specifically blend Seattle City Light and Puget Sound Energy (PSE). However, the estimates' of magnitude is likely appropriate, given the large portion of King County served by PSE gas. Should

74. U.S. Department of Energy State and Community Energy Programs (DOE S-CEP), "IRA Home Energy Rebates State Allocations," updated May 23, 2024; PDF hosted by the National Association of State Energy Officials (NASEO). Accessed 11/25/25. Pg 2.

King County contemplate funding an expansion of the Energize program and should refined GHG estimates be desired for that contemplated expansion, the estimated impacts of this action can be revisited at that time. For more information on how these estimates were developed, see Appendix 6. Energize Expansion Assumptions.

Although this action is higher cost when compared to other contemplated Strategy actions, the co-benefits of Energize program expansion are also notable, including improved air quality, economic impacts and savings among low-income households, and improvements to the comfort and safety of County residents. For instance, replacing fossil fuel appliances and wood-burning stoves with efficient electrical systems reduces local air pollution. Energize work to date has concentrated in south King County, which has some of the highest rankings for environmental health disparities, environmental exposures, environmental effects, socioeconomic factors, and sensitive populations.[75] It also has higher concentrations of low-income households, so benefits of Energize operation and expansion naturally concentrate in this geography. The average Health Disparities map score of households served by Energize is 9.4, which rates impacts on a scale 1 – 10 with 10 being least healthy.

The program also yields economic benefits to low-income households and frontline communities. As of April 2025, Energize has helped 172 participants enroll in the City of Seattle's Utility Discount Program (UDP), reducing electricity costs for each participating household by 60 percent. The combined bill savings represents $125,000 annually for enrollees overall, allowing for funds that can be spent on other necessities or in the local community. To date, Energize has also helped 57 households convert from oil heating. Each household that converts off oil heat can save over $850–$1,000 annually, in addition to added savings for UDP enrollment, representing an added community savings of $48,000–$57,000 annually.[76]

Energize has also provided cooling to many households–a potentially life-saving feature, considering the 2021 Pacific Northwest heat wave or "heat dome," which caused 1,000 heat-related emergency room and in-patient admissions just in the City of Seattle. This event also caused over 160 deaths in Washington and Oregon, including at least 6 deaths in long-term care facilities for seniors.[77] Energize has provided air conditioning to 195 homes that did not already have some form of cooling, including over 270 senior residents spread across 140 single-family homes and 40 AFHs with senior residents and sometimes senior caretakers. For the over 50 adult family homes served by Energize so far, 91 percent of those residents are on Medicaid.

75. Washington state Department of Health, "Washington Environmental Health Disparities Map." Link navigates to map description with link to interactive map tool. Accessed 11/25/25.
76. Average oil fuel costs from Allen, Aadron, "Seattle Offers Up to $8,000 in Rebates for Residents to Switch from Oil Heat to Energy-Efficient Heat Pumps," The Seattle Medium, September 25, 2024. Also, City of Seattle, "Seattle's Clean Heat Program." Accessed 11/25/25
77. Wettstein, Zachary, et. al, "Impacts of the 2021 heat dome on emergency department visits, hospitalizations, and health system operations in three hospitals in Seattle, Washington," Journal of the American College of Emergency Physicians Open, February 2024; and Wittenberg, Ariel, "Deadly Heat Wave's Lesson," Climate Wire, June 23, 2022. Accessed 11/25/25.

EQUITY CONSIDERATIONS

The following have been identified as the most prevalent equity impacts for the Energize program.

Benefits include:

+ Increased resilience to extreme heat and air pollution due to installation of heat pump space heating and cooling and weatherization measures that help manage health impacts of these threats.[78]
+ Enhanced air quality for frontline communities through the reduction of polluting technologies such as gas stoves or gas and oil space heating and water heating.
+ Economic development and small contractor support through program procurement processes.

Potential unintended impacts include:

× Eligible demand for the expanded Energize program may still exceed allocated funding for program operations.
× Programming does not provide maintenance funding, potentially reducing the useful life of the product for recipients if they are unable to plan for or fund maintenance costs without assistance.

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Increase program funding through sustained budget allocations to ensure needs are met.
» Provide a cost-sharing option to help existing funds reach more households sustainably. One example of this is the Energy Smart Eastside program, which provides a fuel switch rebate of up to $6,000 for residents of Bellevue, Issaquah, Kirkland, Mercer Island, Redmond, and Sammamish earning at or below 150 percent AMI. This strategy expands program reach while reducing cost-coverage to maintain budget stability.[79]
» Assist with budgeting during post-installation resident education to encourage recipients to maintain equipment, supporting the equipment's useful life.

78. World Health Organization, "Heat and Health," March 28, 2024. Accessed 10/20/25.
79. Energy Smart Eastside, "$6,000 Fuel Switch Rebate Application", n.d. Accessed 11/9/25.

2. HES: Home Energy Scores

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 26: Implement a Residential Point of-Sale (POS) Energy Disclosure and Performance Standard Program. This Residential POS program is essentially a different name for an HES program. This Strategy explores additional information on how to operationalize such a program.

ACTION

Improve energy efficiency, reduce GHG emissions, and improve energy affordability of residential buildings by increasing access to home energy score (HES) ratings and encouraging investments in energy-saving technologies.

BACKGROUND

King County has approximately 1,060,800 housing units, of which roughly 50 percent (525,645 units) are estimated to be single-family homes.[80] In unincorporated King County alone, there are 94,850 housing units, including 80,550 single-family homes composing approximately 85 percent of the housing stock.[81] Per Northwest Multiple Listing Service (NWMLS), approximately 17,266 homes or roughly 3.4 percent of single-family home sales were closed in 2024 in all of King County, including cities.[82] For all of these single-family homes, a mandatory HES policy could provide home sellers and buyers information on the energy efficiency of their homes at time of sale, encouraging home investments and energy savings for home occupants.

80. Numbers will not add precisely due to rounding. See Washington State Office of Financial Management, (WA OFM), "Housing Units," April 1, 2025. Accessed 11/9/25.
81. WA OFM, "Housing Units," April 1, 2025. Accessed 11/9/25.
82. See Sold Listings. Northwest Multiple Listing Service, "Market Trends, Real Estate Statistics," 2025. Accessed 10/23/25

OVERVIEW

This policy would require home sellers to complete and submit a U.S. Department of Energy (DOE) HES report at time of listing, which rates homes on a national 1-10 scale to create a standard energy efficiency assessment across the housing market.[83] A DOE-certified HES assessor would score the home and provide reports including information on energy use and costs, recommended home energy efficiency improvements, and applicable financial incentives.[84]

Disclosure of home energy use, either under an HES or other requirement, has been broadly adopted at different levels of government in varying forms and across the U.S., such as the following:[85]

- **Requires disclosure of utility bills to homebuyers:** Alaska, Hawaii, Chicago, IL, and Montgomery County, MD.
- **Requires disclosure of home energy use information:** Montpelier, VT.
- **Requires disclosure of energy features (insulation R-value, heating system, etc.):** Maine.
- **Requires disclosure of full energy audit:** Austin, TX.

Jurisdictions that have adopted an HES policy specifically include Berkeley, CA; the cities of Bend, Hillsboro, Portland, and Milwaukie, OR; and Minneapolis, MN, though this last one varies from the HES approach by using a 100-point scale instead of a typical 10-point scale.[86]

Though requiring homes to meet a specific HES score via home improvements accompanying disclosure would result in stronger GHG reductions, requiring disclosure by itself has still led to "quality-improving residential investments in energy-saving technologies."[87] For instance, a 2023 assessment of 2,331 Portland, OR homes sold over five months showed that HES-inspected homes received 8.8 percent of energy efficiency rebates, versus 0.8 percent of rebates received by non-HES homes over a much longer three year period.[88] Similarly in Austin, TX, home sellers under an HES requirements were, "31% more likely to receive rebates from the utility for energy-saving measures than home sellers outside of Austin."[89] Similar policies in other cities and counties found between 12 percent to up to 37 percent of buyers were influenced by their HES reports. These studies indicate that a disclosure-only policy could positively influence home sellers and buyers to pursue home energy efficiency retrofits.[90] An additional or future extension of this policy could consist of requiring improvements to meet minimum scores, such as increasing home insulation up to building code standards. It should be noted that the American Council for an Energy-

83. U.S. Department of Energy (DOE), "Home Energy Score," August 2022. Accessed 1/21/25.
84. U.S. DOE, "Home Energy Score," August 2022. Accessed 1/21/25.
85. Nadel, Steven, "Energy Ratings for Home Sales," American Council for an Energy-Efficient Economy (ACEEE) White Paper, July 2025. Accessed 11/25/25. Pg 2, 3.
86. Nadel, Steven, "Energy Ratings...," ibid. Accessed 11/25/25. Pg 8 – 12.
87. Myers, Erica, et al., "Mandatory Energy Efficiency Disclosure in Housing Markets," May 2021. Accessed 1/21/25. Pg 30.
88. Nadel, Steven, "Energy Ratings...," ibid. Accessed 10/6/25. Pg 6.
89. Nadel, Steven, "Energy Ratings...," ibid. Accessed 10/6/25. Pg 6.
90. Nadel, Steven, "Energy Ratings...," ibid. Accessed 10/6/25. Pg 6.

Efficient Economy (ACEEE) recommends mandating HES reports rather than instituting voluntary reporting, as the latter typically yields HES reports with only a low percentage of home sales.[91]

HES programs can have varying cost and equity impacts depending on how they are developed, and they may be of varying interest as a policy approach to different jurisdictions. HES assessments are typically low-cost, between $150-$300 each; many programs add a fee (i.e., $35 to $80) to support program operation.[92] Some programs also cover HES report costs for low-income homes to advance equity outcomes at minimal cost to the jurisdiction.[93] HES policies are typically adopted at the local level, so it is anticipated an HES policy could be adopted in unincorporated King County, though additional cities could potentially adopt a policy as well.

Action Goals

This action would aim to:

- *Standardize a process for assessing home energy efficiency, including scoring homes before they are listed for sale.*
- *Increase transparency for home sellers and buyers on a home's energy use and its associated energy costs.*
- *Provide home sellers and buyers with a report on energy efficiency recommendations and financial incentives available to upgrade their home.*
- *Incentivize home energy improvements by highlighting information, such as an improved energy score, that makes a home more marketable to prospective buyers.*

COST ESTIMATES

The initial costs to establish this program include the following:

STAFFING: One full-time employee (FTE) at a project/program manager (PPM) I level to manage the program once instituted. Between 1.5 to 2.5 FTEs could be used for initial program design, though some cities also mitigate staff effort with consultant assistance, with costs hovering around $30,000.[94]

SOFTWARE: IT support can vary depending on anticipated services. Other jurisdictions expended $60,000, including $40,000 to establish an online payment system that integrated with existing payment systems, and $20,000 to establish a Salesforce database to track reporting and customer management for their HES program.[95]

91. Nadel, Steven, "Energy Ratings...," ibid. Accessed 10/8/25. Pg 7.
92. Thurston Climate Mitigation Collaborative (TCMC), "Home Energy Assessment (HES) Model Ordinance Policy Review, Version 2," June 2024. and ACEEE Fact Sheet, "Time-of-Sale Energy Disclosure Policies," April 2022. Pg 8. Accessed 1/21/25.
93. Portland offers to pay for ratings for households with incomes under 60%, though only 80 homes applied for this feature. Another city set aside $75,000 for low-income support, though $26,000 was used over three years. See Nadel, Steven, "Energy Ratings...," ibid. Accessed 10/6/25. Pg 9,16
94. American Council for an Energy-Efficient Economy (ACEEE) Fact Sheet, "Time-of-Sale Energy Disclosure Policies," n.d. Pg 2, 8. Accessed 11/16/25.
95. ACEEE Fact Sheet, "Time-of-Sale...," ibid. Pg 2. Accessed 11/16/25.

COMMUNITY ENGAGEMENT: Similar jurisdictions expended $5,000 on initial community engagement, with ongoing costs of approximately $2,000 per year, though some spent more on initial education and outreach with $50,000 budgeted.[96]

ONGOING COSTS: Continuing costs would include: (a) FTE salary, (b) ongoing Salesforce use costing $5,000, and (c) community outreach costing $2,000.[97] In case of a lower compliance rate, quality assurance/quality control (QA/QC) costs to verify or re-assess five percent of the homes are also possible, typically paid by a $35 fee to home sellers.[98]

FEES: A filing fee for each HES assessment would help offset program costs, though the cost would be determined closer to program inception. Analysis in this Strategy assumes an initial $65 filing fee, with $35 set aside for QA/QC, and net program revenues of $30 per filing for other program expenditures such as staff costs or consultant support.

- It is recommended a future program waive this fee or subsidize its cost for low-income households, estimated to be approximately 42 percent of home sales.[99]
- Non-compliance fees are typically also set at program inception, typically $500 in cities such as Portland, OR and Milwaukie, OR, or as a percent of the sale price.[100]

96. ACEEE Fact Sheet, "Time-of-Sale...," ibid. Pg 8; and Nadel, Steven, "Energy Ratings for Homes Sales," ACEEE, July 2025. Pg 24. Accessed 9/15/25.
97. ACEEE Fact Sheet, "Time-of-Sale...," ibid. Pg 2. Accessed 10/6/25.
98. U.S. DOE Better Buildings Solution Center, "Provide Quality Assurance for Home Energy Score," n.d.; ACEEE Fact Sheet, "Time-of-Sale ...," ibid. Pg 2. and Nadel, Steven, "Energy Ratings...," ibid. Pg 9. Accessed 11/16/25.
99. U.S. Census Bureau, "Income in the Past 12 Month (in 2023 Inflation-Adjusted Dollars)," American Community Survey, n.d. Accessed 1/21/25.
100. City of Milwaukie, OR Municipal Code, "MMC 16.40.060 Enforcement and Penalties,"; City of Portland, OR Municipal Code, "PMC 17.198.060 Enforcements and Waivers," and Nadel, Steven, "Energy Ratings...," ibid. Pg 9 Accessed 11/16/25.

Table 2-1. summarizes policy design and ongoing implementation cost estimates.

Table 2-1: *Home Energy Score Policy Cost Estimates**

Cost Description	Initial Design Cost	Ongoing Costs/Year*
IT Infrastructure[101]	$40,000	
Consultant Support	$30,000	$30,000
Salesforce Database[102]	$20,000	$5,000
Community Engagement[103]	$5,000	$2,000
Low-Income Subsidies[104]		$18,000
Subtotal		*$55,000*
Revenue: HES Assessment Fee ($30/ea.)[105]		**-$179,550**
Total	**$95,000**	**-$124,550**

** Does not include staff costs. Costs are scaled countywide and would be less for an unincorporated area-only program.*

ESTIMATED IMPACTS AND CO-BENEFITS

The primary benefit of HES is as a consumer awareness and education feature. It helps homeowners understand their projected energy costs prior to purchasing a home so they can weigh their ability to afford a mortgage and monthly energy bills at the same time. For instance, homeowners that have never owned an oil-heated home may not know they will spend $850 – $1,100 annually on heating system fuel alone, independent of other energy costs for the household.[106] An HES provides insight into future homeowner costs that could be crucial for supporting low-income homeowners.

Retrofits recommended by HES reports have the potential to reduce energy costs and increase home value. In a study of 100,000 home energy scores reported, the average home started with a score of 4.7 and had been given an updated score of 7.3 following upgrades.[107] If recommendations such as upgrading water heating, space heating, and air sealing were implemented, it could reduce energy use by 20 percent

101. ACEEE Fact Sheet, "Time-of-Sale Energy Disclosure Policies," April 2022. Pg 2. Accessed 10/6/25.
102. ACEEE Fact Sheet, "Time-of-Sale Energy Disclosure Policies," April 2022. Pg 2. Accessed 10/6/25.
103. City of Berkeley, Meeting with King County Executive Office Staff, 12/16/24.
104. A City with 10,000 annual home sales paid approximately $8,650 annually in low-income home subsidies. Multiplied by 1.7 to approximate King County sales of 17,200/year, with a 20% buffer results in a projected cost of approximately $18,000/ year. See Nadel, Steven, "Energy Ratings...," ibid. Pg 16. Accessed 10/6/25.
105. Assuming 60% compliance of 17,200 home sales for 10,320 baseline, minus 42% low-income homes results in 5,985 fees submitted, at $30 net revenue (after subtracting QA/QC costs) each results in $179,550 revenues.
106. Average oil fuel costs from Allen, Aadron, "Seattle Offers Up to $8,000 in Rebates for Residents to Switch from Oil Heat to Energy-Efficient Heat Pumps," The Seattle Medium, September 25, 2024. Also, City of Seattle, "Clean Heat Program." Accessed 12/10/25.
107. U.S. DOE, "100,000 Home Energy Scores so far and counting!" January 2019. Accessed 2/28/25.

and save $600 per year on energy costs.[108] Studies on mandatory HES policies across other jurisdictions have also indicated that, "a one-point increase in home energy score was associated with a 0.5 percent increase in sale price and a 5.5 percent reduction in the odds of a loan going 30 days delinquent."[109]

Table 2-2. summarizes the expected one-year results of enacting a HES policy in unincorporated King County. GHG emissions are shown in metric tons of carbon dioxide equivalent ($MTCO_2e$).

Table 2-2: *Expected Results of a HES Reporting Policy in Year One in King County*

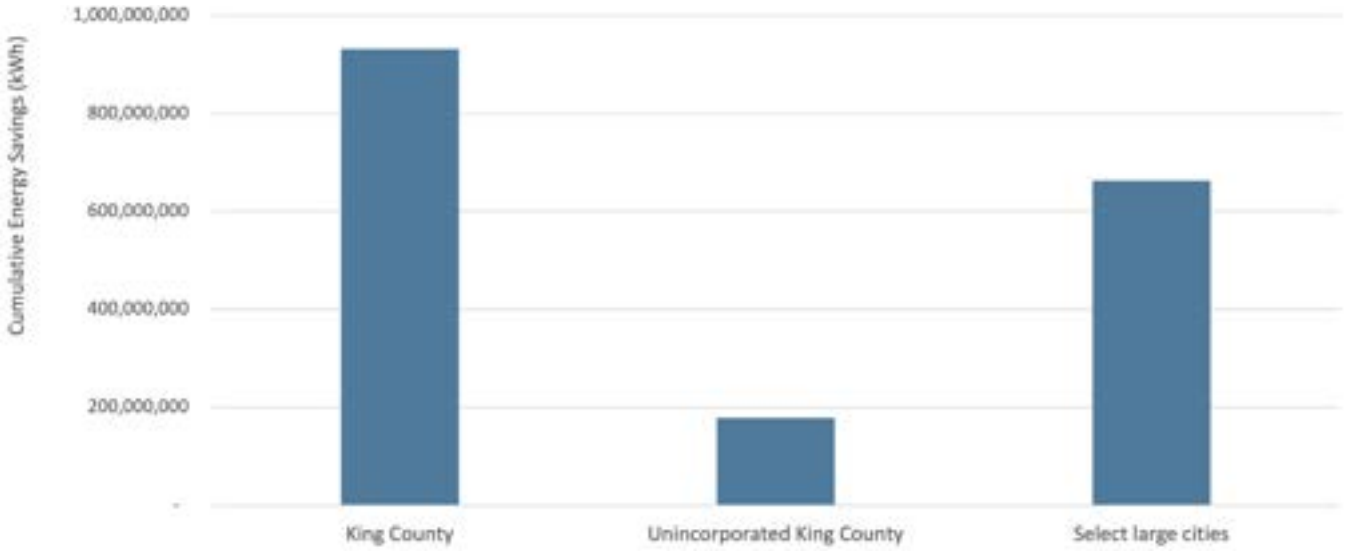
Attributes & Impact*	Low Adoption Scenario	Moderate Adoption Scenario	High Adoption Scenario
Homes Sold Annually in King County[110]		17,266	
HES Policy Compliance		75%	
Homes Rated		12,950	
Homes with HERS 5 score or lower **		6,475	
Retrofit Rate (optional retrofits)	8%	10%	12%
Homes Retrofitted (22% efficiency gain)	518	647	777
Electricity Savings (kwh)	3,645,265	4,556,581	5,467,897
Total Energy Savings (MMBtu)	26,061	32,576	39,092
Energy Cost Savings ($)	597,495.39	746,869.19	896,243.00
Carbon Reduction ($MTCO_2e$)	1,074	1,342	1,611

**Values based off model calculations assuming 75 percent HES audit compliance, while scaling low, moderate, and high optional retrofit rates for homes rated under HERS 5. For more information on sources and assumptions, see Appendix 4. HES Assumptions.*
***Assumes 50 percent of homes.*

108. Building Electrification Institute and City of Berkeley, "The Berkeley Funding Gap Analysis for Residential Building Decarbonization," February 2023. Accessed 4/21/25. Pg 8.
109. Lawrence Berkeley National Laboratory, "How Does Home Energy Score Affect Home Value and Mortgage Performance?" August 2022. Accessed 1/21/25. Pg. 3.
110. Northwest Multiple Listing Service, "Market Trends, Real Estate Statistics," n.d. Accessed 10/23/25

Although the annual GHG reduction of such an action is lower, partially due to assumed GHG-neutrality of electricity starting in 2030 per the Clean Energy Transformation Act (CETA), the potential electricity savings that could be achieved under HES is notable. Projected energy savings are shown in Figure 2-3 depending on whether all of King County adopted HES, only unincorporated King County adopted HES, or if some of the largest cities in King County adopted HES, with the largest projection for King County exceeding 9 megawatts.

Figure 2-3: *Cumulative 2028 – 2050 HES Energy Savings due to Projected Insulation Retrofits*



EQUITY CONSIDERATIONS

HES policy implementation may have varying equity impacts for both sellers and buyers of single-family homes in unincorporated King County.

Benefits include:

+ Increased transparency of operating costs for homeowners by understanding the home energy efficiency prior to purchase.
+ Increasing energy cost reliability and reducing needed operational investments for efficiency and comfort. HES policies may also encourage investments in high efficiency and lower GHG emitting equipment, reducing energy costs, promoting grid resiliency, and reducing use of polluting equipment that may adversely impact community health.[111]
+ Reduced mortgage default risk. A 5.5 percent reduction in mortgage loan delinquency was observed for each one-point HES increase.[112] This indicates that lower energy bills associated with higher HES ratings increase funds available for mortgage payments.

Potential unintended impacts include:

× Higher HES ratings are associated with elevated home prices, with one study in Portland, OR finding that for each one-point HES increase, home sale prices rose by 0.5 percent, or about $3,000 per HES point.[113]
× Home Energy Scores add an expense to the home selling process ($150 –$300) and adds a step that can also add time or delay in the sale process[114]

Potential mitigation strategies to increase equity outcomes associated with this action include:

» If a home cannot secure an energy audit within a week of desired listing date, allow home to be listed on MLS, highlighting that an HES has not yet been received. Sellers should file for a deferral with the HES administering office prior to listing.
» The administering agency may pay for the HES audit on behalf of the homeowner should the homeowner prove income qualification through tax documentation or enrollment in other income qualified programs such as LIHEAP or SNAP.

111. Nadel, Steven, "Energy Ratings for Home Sales," ibid. Accessed 10/15/25. Pg 6.
112. Nadel, Steven, "Energy Ratings for Home Sales," ibid. Accessed 10/15/25. Pg 6.
113. Nadel, Steven, "Energy Ratings for Home Sales," ibid. Accessed 10/15/25. Pg 4.
114. Nadel, Steven, "Energy Ratings for Home Sales," ibid. Accessed 10/15/25. Pg 17.

BEST PRACTICES

If adopted, King County should consider the following best practices for HES implementation.

- HES reports should:
  - Include customized information on GHG emissions reduction potential and available financial incentives.[115]
  - Be completed for new construction as well as existing single-family residential buildings including row houses, attached houses, duplexes, or townhomes.[116]
  - Exempt mobile, manufactured, and floating homes from the policy since they are not suitable for the HES tool.[117]
- Exempt home sellers in distressed sale situations (i.e. foreclosure) from the policy where policy administration may present challenges.[118]
- The policy should be effective starting at least one calendar year after passage, providing time to inform community members of compliance requirements.[119]
- King County should ensure that homes cannot be listed by NWMLS without prior completion of HES assessment to ensure high levels of policy compliance and to ease administrative burden.[120]

115. U.S. DOE, "Home Energy Score," August 2022. Accessed 1/21/25.
116. U.S. DOE, "Home Energy Score," August 2022. Accessed 1/21/25.
117. TCMC, "Home Energy Assessment (HES)..." ibid. Accessed 1/21/25.
118. TCMC, "Home Energy Assessment (HES)..." ibid. Accessed 1/21/25.
119. U.S. DOE, "Home Energy Score," August 2022. Accessed 1/21/25.
120. Staff from the Cities of Tumwater, Olympia and Lacey. Meeting with King County Executive Climate Office staff, 1/25/25.

3. Appliance Loan Programs

ACTION

Provide short term access to efficient, electric appliances through loan programs that support customer trial of new appliances and temporarily provide for home water heating needs during wait times for equipment delivery, reducing like-for-like fossil fuel appliance swaps due to sudden equipment failures.

BACKGROUND

Almost half of King County residents likely use fossil fuels for residential space and water heating, cooking, and other uses. In Washington state, approximately 40 percent of single-family homes are heated by natural gas, with another five percent using furnaces heated by other fossil fuels (i.e., propane, oil).[121] Review of King County assessor records indicates that, for residential buildings with three housing units or fewer, 74 percent of residential square footage was heated by natural gas, 9 percent by oil, and almost 17 percent by electricity. It should be noted that there are data inconsistencies in Assessor data, so some of these properties may have converted to other heating fuels and their corresponding records were not updated. In most cases, residents plan to replace appliances towards the end of their useful life, but many households do not proactively replace appliances, instead replacing at the time of a sudden or emergency failure.[122]

When residents want to switch from fossil fuels to efficient electric options for appliances, there can be time-consuming constraints, such as required electrical panel upgrades or additional time for technicians to procure the optimal electric appliance for their needs because installers may not have the units on-hand. Increased wait-times add pressure when a house or its running water is not heated. This added barrier for electrification

121. Northwest Energy Efficiency Alliance (NEEA), "2022 Residential Building Stock Assessment," April 2024. Accessed 12/2/25. Pg 16.
122. TECH Clean California, "The Key to Successfully Deploying Heat Pump Water Heaters? Funding Innovation," December 2024. Also: Hannah Belloli, "What Triggers a Homeowner to Replace HVAC Equipment?" Air Conditioning, Heating Refrigeration News, 9/3/24. Accessed 9/15/25

increases like-for-like (i.e., fossil fuel) replacements of existing appliances.[123] In other cases, residents have not previously used efficient electric appliances and opt for like-for-like replacements due to their familiarity. One programmatic option is for King County to implement an electric appliance loan program, which would enable residents to gain familiarity with electric appliances such as heat pump water heaters and induction stoves and assist residents during emergency appliance failures.

OVERVIEW

King County could design appliance loan programs available to all King County residents, enabling them to temporarily borrow electric appliances at no cost. Appliance loan programs have been implemented in multiple jurisdictions by lending electric cooking equipment and providing heat pump water heaters during emergency failures. Many cities in California, such as the city of San Jose, provide induction cooktops that residents can borrow from city hall for two-week periods.[124] The City of Berkeley also provides additional cooking appliances through tool libraries, including items such as air-fryers, Instant Pots, induction stovetops, and induction-ready cookware that can be used on induction stoves.[125] Some universities are piloting a lending library of home air quality monitors to help residents understand air quality impacts of cooking.[126] Yet another example is that some entities in California have piloted offering plug-in 120 volt (120V) heat pump water heaters for residents to install during water heater emergency failures, enabling residents to try the technology and provide time to identify the appliance that best suits their needs.[127]

Residents would be able to contact local contractors to request that a 120V heat pump water heater (HPWH) be installed in residences where and when a plug-in 120V HPWH is a viable temporary option. Although King County could purchase, store, maintain, and operate such a loaner program, it could also issue grants to plumbers to independently operate HPWH loaner programs. It should be noted that this program version would benefit from consultant support in program design, as 120V HPWHs cannot currently operate reliably through winter in Washington climates, and such would only be a short-term loan option; for more information, see Appendix 5. HPWH: 120V vs. 240V Technology Review.

Regardless of the model adopted, King County could pilot a similar appliance loan program for cooking equipment and heat pump water heaters, potentially beginning initially in unincorporated areas of the county and later expanding the program countywide.

123. Badger, Chris, et. al, "Emergency Replacement Heat Pump Water Heater Market Study," CalNEXT, June 26, 2024. Accessed 12/6/25. Pg iv.
124. Note: The cities of San Jose, San Mateo, Piedmont, Hayward, Berkeley, and utilities such as PG&E and Ava Community Energy each have loaner programs. Source for San Jose program citation: City of San Jose, "Induction Cooktop Checkout Program." Accessed 8/6/25
125. Berkeley Public Library, "Tools." Accessed 6/3/25
126. Dr. Curtis Nordgaard, University of Minnesota, presentation on September 22, 2025. Organized by Electrify Now.
127. TECH Clean California, "The Key to Successfully Deploying...," ibid. Accessed 12/6/25.

Action Goals

This action would aim to:

- *Provide King County residents with the ability to become familiar with electric appliances, which reduce air pollution and GHG emissions.*
- *Reduce the instance of like-for-like replacement of fossil fuel appliances in emergency appliance failures.*
- *Increase awareness and understanding of electric appliance options so residents can make informed purchases.*

COST ESTIMATES

If operated by King County, the material costs to set up a program are approximately $34,000, with estimated annual installation costs of $70,000 to install and remove temporary HPWHs.

Table 3-1: *Appliance Loan Program Cost Estimates*

Cost Description	Initial Costs/Year	Ongoing Costs/Year
Induction Cooktops (7)[128]	$1,000	
Air Fryers (2)[129]	$200	
Instant Pots (2)[130]	$300	
Induction-ready Pots/Pans (10)[131]	$1,500	
Plug-in 120V HPWHs (10)[132]	$31,000	
HPWH Installation Charges		$70,000
Total	**$34,000**	**$70,000**

128. San Mateo has two induction stove "kits" with a population of 745,100. For King County's 2,340,211 population, the same scale would indicate about seven induction stoves. Specific induction costs sourced from Amazon, "Duxtop Portable Induction Cooktop Burner, Induction Hot Plate with LCD Sensor Touch 1800 Watts, Silver 9600LS/BT-200D,". Accessed 6/3/25
129. Walmart, "Gourmia 6-Qt Digital Window Air Fryer with 12 Presets & Guided Cooking Black,". Accessed 6/3/25
130. Amazon, "Instant Pot Duo 7-in-1 Electric Pressure Cooker, Slow Cooker, Rice Cooker, Steamer, Sauté, Yogurt Maker, Warmer & Sterilizer,". Accessed 6/3/25
131. Amazon, "Amazon Basics Stainless Steel Cookware 11-Piece Set, Oven Safe, Pots and Pans, Induction-Ready, Even Heating, Easy to Clean, Heavy Duty, Silver,". Accessed 6/3/25
132. The Home Depot, "Performance Platinum ProTerra 80 Gal. 120-Volt Plug-in Smart Heat Pump Water Heater with 10-Year Warranty,". Accessed 6/3/25

INITIAL COSTS: Purchasing appliances and equipment for residents is a large component of the initial costs to run an appliance loan program, with plug-in HPWHs encompassing a large share of costs. Additionally, the program would require one program manager to engage contractors and residents, ensuring successful program operation.

ONGOING COSTS: These costs are derived from HPWH installation costs, which are estimated for 50 households at a projected cost of $1,400 per installation.[133] This is just an example annual target number for a pilot, and it could be adjusted up or down depending on program objectives. Since installers must uninstall and reinstall equipment, that may increase installation, maintenance, and replacement costs as well. Not included in this cost are any additional incentives; some CA programs also provided a $1,400 incentive to contractors when households ultimately installed a permanent HPWH.

ESTIMATED IMPACTS AND CO-BENEFITS

The primary benefit of this action would not be in its direct GHG reductions, but rather in how this action helps individual households to pursue decarbonization independent of broader government initiatives. Impacts are also hard to predict as, instead of replacing fossil fuel equipment, residents may supplement current fossil fuel appliances with electric appliances.

Cooktop or air quality monitor loaner programs would have less of a GHG-reduction impact than a HPWH program, however it could provide strong co-benefits. Combined, these present an opportunity for King County residents to gain exposure to the electric cooking technologies and have a better understanding of how they function. Furthermore, there are added indoor air quality benefits related to stove replacements and supplementation, as gas stoves are linked to higher childhood asthma rates and chronic lung disease.[134] Finally, such programs would also provide opportunities for King County to collect information on residents' interest in and capacity to use or implement these electric appliances, and this insight could enable the County to work to resolve other barriers to uptake.

133. Schipper. Rosanne, "How Much Does Water Heater Installation and Replacement Cost," Forbes, December 2024. Accessed 6/3/25
134. Bendix, Alex, "Gas and propane stoves linked to 50,000 cases of childhood asthma, study finds," NBC News, May 2024. Accessed 8/6/25.

EQUITY CONSIDERATIONS

Equity impacts of an appliance loan program are considered below.

Benefits include:

+ Reduce emergency purchases of high-cost equipment, reducing financial strain on households with limited budgets. Presently, approximately 71 percent of HVAC replacements occur when equipment is no longer working.[135]
+ Reduce short-term operating energy costs by implementing highly efficient electric technology, such as heat pump water heaters.
+ Improved air quality for residents and surrounding communities by reducing fossil fuel powered appliances. When considering an additional induction stove loaner program, these air quality benefits to the implementing residents are greater due to the potential emissions reduction from fossil fuel cooktops and associated health consequences.[136]

Potential unintended impacts include:

× New technologies may inadvertently benefit large contractors who have greater capacity to train employees in the installation of newer products offered through the loan program and to stock enough inventory to cover demand for the program. This may be at the expense of small contractors and suppliers.

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Offer small contractor technical assistance and training programs to ensure upskilling of small contractor workforce.

» Provide incentive points for King County certified small contractors and suppliers (SCS) in the contracting selection process to ensure competitiveness of SCS firms.

135. Hannah Belloli, "What Triggers a Homeowner to Replace HVAC Equipment?" ibid. Accessed 11/23/25
136. Bendix, Alex, "Gas and propane stoves linked to 50,000 cases of childhood asthma, study finds," NBC News, May 2024. Accessed 10/15/25.

BEST PRACTICES

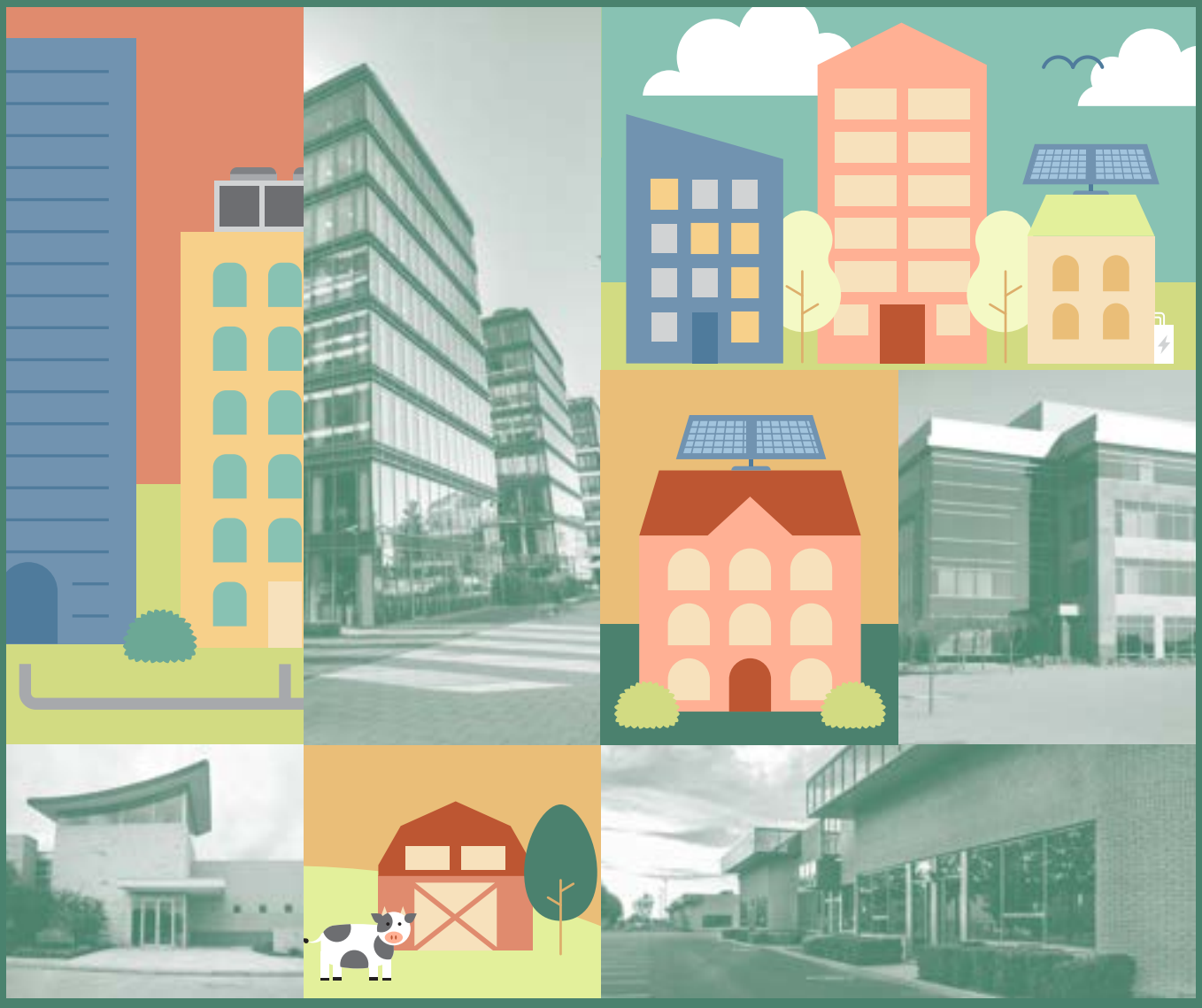
King County could consider the following best practices for an appliance loan program:

- Coordinate with local contractors and installers to provide emergency replacements directly through contractors. Contractors will evaluate homes to identify if they are suitable for heat pump water heaters and work with King County to cover installation costs.
- Provide cooking appliance loans through the King County Library System and public institutions that already have a tool library/lending program. Cooking appliance loans can be stored in bins with instructions for care and a few induction-stove compliant cookware examples, as induction stoves often require ferrous (iron-containing) pots and pans.
- Ensure that participants receive information on available rebates and financial incentives to purchase an electric appliance after their loaner appliance must be returned.
- Conduct surveys, particularly for cooking equipment loans, to understand the barriers to uptake for residents for electric cooking equipment. Some entities are also providing cash incentives for contractors when they install a HPWH after installation of an emergency loaner (also called a "midstream rebate"). King County may elect to provide incentives to contractors as part of this program.[137]

King County Energize program contractor starting work on outside improvements.

137. Tenney, Jenna, "MCE Launches Emergency Water Heater Loaner Program," Marin Clean Energy (MCE), September 2024. Accessed 6/3/25

RESIDENTIAL & COMMERCIAL DECARBONIZATION ACTIONS



RESIDENTIAL & COMMERCIAL DECARBONIZATION ACTIONS

The commercial sector accounted for 35 percent of the total King County building emissions, almost equal to residential sector, which is responsible for 42 percent of building emissions. The commercial sector has tremendous variety among its buildings, including the age, size and fuels, and use types of different commercial structures. Electricity consumption in commercial buildings has increased three percent since 2008. Natural gas emissions from commercial buildings have increased by 21 percent since 2008.

There is no definitive count of the number of commercial buildings in King County, though there is data on the number of buildings subject to state CBPS, categories of businesses in the County, and general patterns on fuel usage in commercial buildings. Based on internal analysis of King County Assessor data, it is estimated that there are 9,211 buildings in King County subject to CBPS, representing over 867 million sq. ft. It is notable that King County has a high number of large buildings compared to other counties in the state. For instance, there are approximately 5,690 – 6,090 buildings in King County under the state CBPS for tier one, which applies to commercial buildings larger than 50,000 sq. ft.; this is more than double the number of large buildings found in any other County in the state.[138]

In addition to strictly Commercial land uses, there are also approximately 155 residential/commercial mixed-use buildings that are also subject to CBPS requirements representing 15,430,000 sq. ft. For more information on assumptions supporting the above summary, see Appendix 2. Building Stock Analysis Using Geographic Information System (GIS) Data..

The King County Assessor Office also releases reports for different types of commercial land uses, providing additional insight on groups of enterprises in King County, which includes:

12,500 permitted food establishments.[139]

375 hotels and temporary lodging facilities.[140]

500 major retail facilities.[141]

282 business parks parcels, though some of these parcels may be concentrated together to comprise one perceived "park."[142]

138. 5,690 is a state estimate, while 6,090 is from an assessment of assessor data as completed by King County staff. For the latter, see Appendix 2. Building Stock Analysis Using Geographic Information System (GIS) Data. for analysis assumptions; for the first, see WA Commerce, "Clean Buildings Legislative Report," January 25, 2022. Accessed 1/3/2024. Pg 8.
139. Note: this number includes food trucks. See King County, "About the inspection reporting system," 2025. Accessed 12/2/25.
140. King County Assessor Office, "Temporary Lodging: Area 160," 2024 Assessment Year. Accessed 12/2/25. Pg 15.
141. Includes, "regional malls, single-tenant discount retailers, big box stores, large neighborhood/community retail centers, and stand-alone grocery stores." See King County Assessor Office, "Major Retail: Area 250," 2024 Assessment Year. Accessed 12/2/25. Pg 5, 6.
142. King County Assessor Office, "Business Parks: Area 520," 2024 Assessment Year. Accessed 12/2/25. Pg 11.

As noted in the Strategy introduction, the distribution of emission sources by sector varies greatly by jurisdiction, which may influence the individual policies and programs different jurisdictions pursue to reduce building emissions. The primary sources of commercial GHG emissions in 2023 were:

- **ELECTRICITY:** 2.05 million $MTCO_2e$ ($MMTCO_2e$)
- **NATURAL GAS:** 1.55 $MMTCO_2e$

A small amount of fuel oil (0.40 $MMTCO_2e$) and propane (0.22 $MMTCO_2e$) emissions are also attributed to the commercial sector.

The primary emission sources in the built environment are from electricity and natural gas.

When considering these two sources combined, commercial emissions decreased by 10 percent from 2007 to 2023 in King County. However, looking at these sources individually reveals unique trends; in this same time period, commercial emissions from electricity decreased by 24 percent, however emissions from natural gas increased 21 percent for commercial buildings. This growth in emissions associated with natural gas is echoed across Washington State. Looking at a longer timeline, between 1990 and 2019, statewide GHG emissions from commercial sector electricity use increased by approximately 30 percent, whereas emissions from natural gas increased by 66 percent.[143]

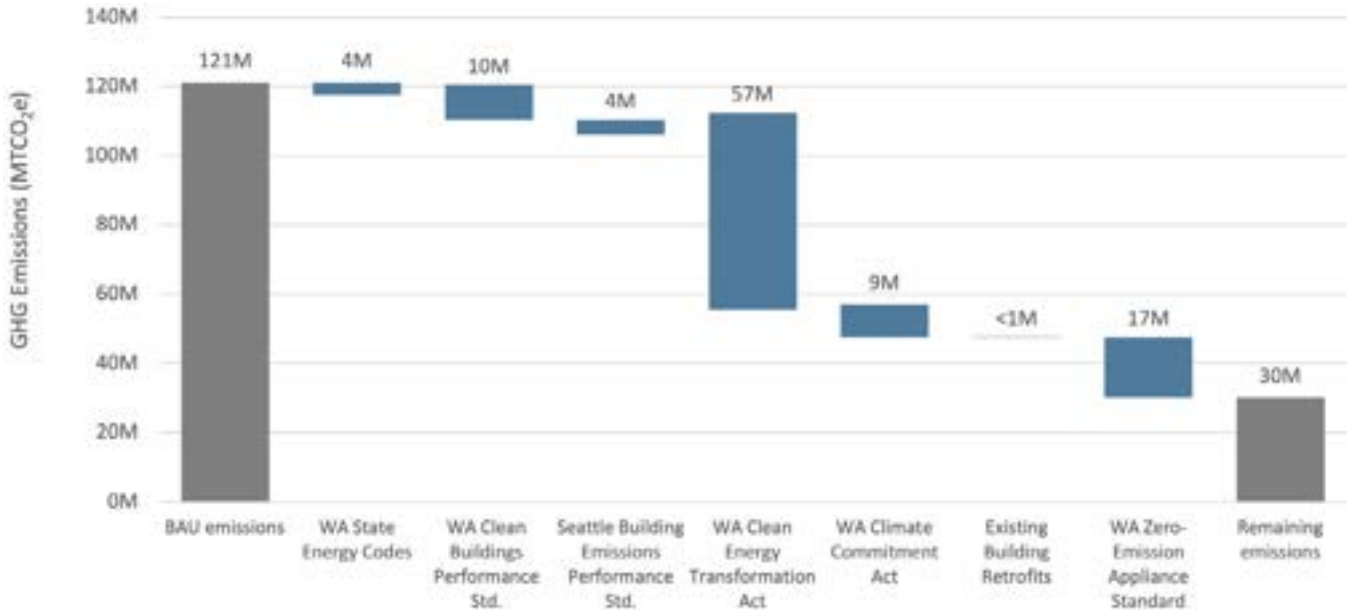
The Washington State 2021 Energy Strategy (SES) assessed and provided direction for the built environment sector, including high-level recommendations and key actions. The SES did not provide breakdowns of decarbonization needs by building sector. However, the Operation 2030 report by the Clean Energy Transition Institute developed a proposal that divided overall building emission reduction targets between the Commercial and Residential building sectors from 2025 to 2050, per the rate of electrification needed to meet State GHG reduction goals. Based on Operation 2030 Report goals, Washington state would need 1,400 and 2,400 buildings undergoing net zero carbon retrofits annually in 2025 and 2030, respectively, to achieve state GHG reduction goals.[144] If King County's commercial buildings proportion to the state commercial building stock was roughly equivalent to its proportion of the state's civilian labor force (34.6 percent), King County targets would be 470 buildings and 850 buildings undergoing net zero carbon retrofits annually in 2025 and 2030.[145]

During development of the King County 2023 GHG Emissions Analysis and 2025 Strategic Climate Action Plan (SCAP), staff reviewed the potential emissions reductions of some residential/commercial sector actions reviewed in this Strategy, namely the Zero Emissions Appliance Standard, the Seattle Buildings Emissions Performance Standard (BEPs), and additional state regulations.

143. Approximate values used for electricity of 5.9 MMT/yr in 1990 and 7.6 MMT/yr for 2019 based on depictions in Figure 4, Residential Sector Emissions by Fuel Types, 1990-2019. See Storm, Poppy and Eileen Quigley, "Operation 2030: Scaling Building Decarbonization in Washington State," Clean Energy Transition Institute. 2050 Institute, January 2022. Accessed 11/9/25. Pg. 5.
144. Cited figures represent 1.2% and 1.8% of commercial sq. ft./year, respectively. See Storm, Poppy and Eileen Quigley, "Operation 2030..." Ibid. Accessed 11/10/25. Pg. 19.
145. For proportion of the state civilian labor force (34.6%), see Washington State Employment Security Department, "Labor force by county snapshot," Monthly Employment Report, August, 2025. Accessed 11/10/25.

The comparative GHG emissions reduction impacts of these actions compared to the business-as-usual (BAU) GHG emissions projection is shown in Figure 3-2. for context.

Figure 3-2: *Commercial Built Environment Cumulative Emissions Reduction Potential by 2050.* *As shown in the King County 2023 GHG Emissions Analysis.*



Aside from the state Clean Energy Transformation Act, state Climate Commitment Act, and state energy codes, one of the greatest GHG reductions that can be achieved in the commercial sector would be from a Zero Emissions Appliance Standard. The relative GHG impact of this action is notably echoed in potential residential sector actions. The above graphic was developed in support of the King County 2023 GHG Emissions Analysis. Some commercial sector actions contemplated in this Strategy were not modeled as part of this analysis, specifically the BEPS and the Rooftop Units (RTUs) Initiative. Some GHG reduction projections of BEPS and RTUs have the potential to overlap with emissions reductions that may also be achieved under these above strategies. A future step could be to assess the net impact of these initiatives compared to other potential policies and programs, subtracting their overlapping influence on potential GHG reductions. In summary, the stand-alone impact of actions considered for the residential & commercial sectors in this Strategy are as follows:

4. **Zero Emissions Appliance Standard**
5. **BEPS: Building Emissions Performance Standards**
6. **Rooftop Units (RTUs) Initiative**
7. **Building Decarbonization Accelerator**

4. Zero Emissions Appliance Standards

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 25: Advocate for a State or Regional Adoption of a Zero Emissions Appliance Standard, another term for setting NOx emissions appliance limits. This Strategy provides additional background on this policy and explores best practices in establishing such a program.

ACTION

Reduce greenhouse gas (GHG) emissions and other pollutants harmful to community health and wellbeing from building appliances by requiring new residential and commercial space and water heating sold and installed to be low or zero emissions.

BACKGROUND

Regardless of how efficient a gas appliance is, there is currently no gas-fired household appliance that is clean-burning. All household gas and fossil fuel appliances emit air pollutants, among them NOx.[146] NOx emissions are a set of pollutant gases that result from burning fossil fuels, and they collectively refer to oxides of nitrogen such as nitric oxide (NO), nitrous oxide (N_2O), nitrogen dioxide (NO_2), and other nitrogen oxides that contribute to air pollution.[147] Nitrogen dioxide and nitrous oxide are both greenhouse gases; while nitrogen dioxide stays in the atmosphere a relatively short time, nitrous oxide stays in the atmosphere for an average of 121 years.[148] Nitrous oxide emissions are also increasing at an unprecedented rate, with emissions growing 40 percent from 1980 to 2020.[149]

146. United States (U.S.) Environmental Protection Agency (EPA), "Nitrogen Oxides Emissions," 2018. Note: Nitrous oxide (N_2O) can also be considered a nitrogen oxide, however for the purposes of this strategy, NOx indicates nitric oxide and nitrogen dioxide. See U.S. National Aeronautics and Space Administration (NASA), "Nitrogen Oxides," last updated November 18, 2025. [LINK]. Accessed 5/13/25.

147. U.S. EPA, "Nitrogen Oxides Emissions," 2018. Accessed 10/6/25.

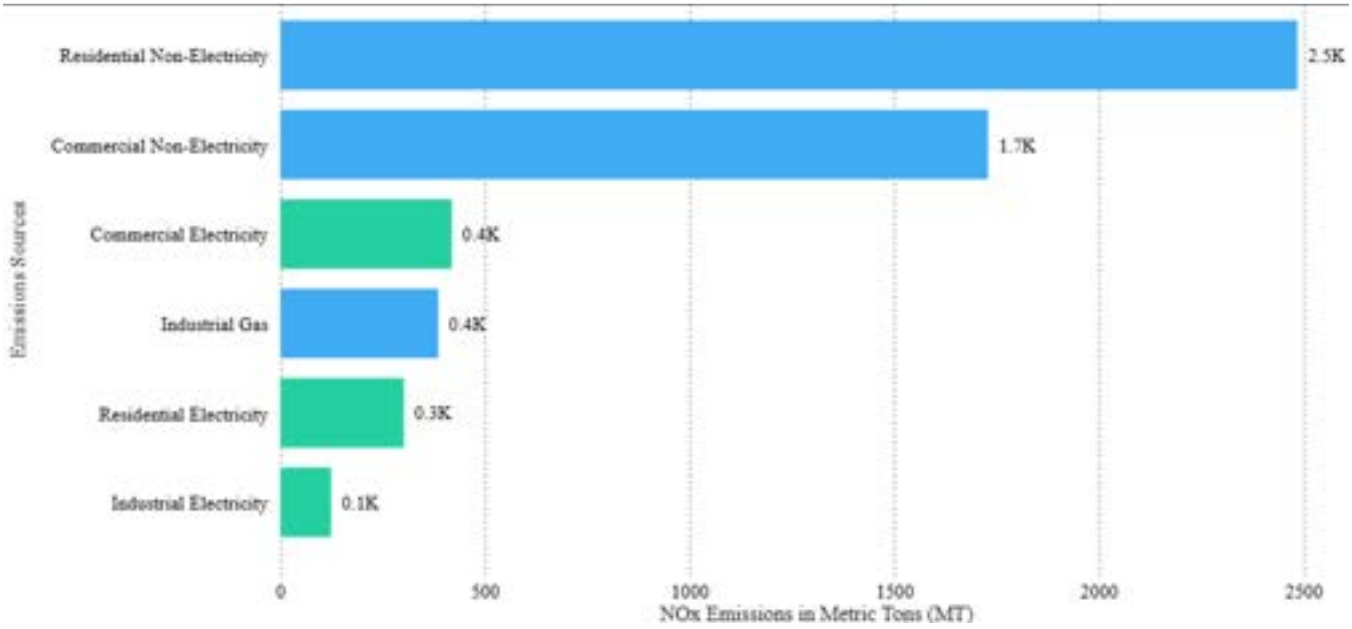
148. U.S. EPA, "Nitrogen Oxides Emissions," 2018. Also, Follette-Cook, Melanie et al, "Measuring Nitrogen Dioxide from Space," NASA, May 26 and 28, 2020. Page 34. Accessed 11/26/25.

149. U.S. National Oceanic and Atmospheric Administration (NOAA), "Nitrous oxide emissions grew 40 percent from 1980 to 2020, accelerating climate change," June 2024.

NO_x emissions have several negative environmental effects, including contributing to harmful ground-level ozone formation, acid rain deposition in lakes and streams, algal growth in water bodies such as coastal estuaries, and the formation of particulate matter and haze.[150] NOx emissions also have harmful health effects. For example, short-term exposure to NO_2 can, "aggravate respiratory diseases, particularly asthma, leading to respiratory symptoms (such as coughing, wheezing or difficulty breathing), hospital admissions, and visits to the emergency rooms."[151] Longer-term exposures contribute to the development of asthma and increase susceptibility to respiratory infections, particularly for children and older adults.[152]

As NOx emissions result from the combustion of fossil fuels, building appliances such as furnaces and water heaters that burn fossil fuels consequently also result in NOx emissions. The graph below indicates estimated NOx emissions from King County buildings countywide in 2025.[153] Blue bars represent NOx emissions from solid, liquid, and gaseous fuels and steam consumed by buildings, while the green bars represent NOx emissions from electricity. It should be noted that fuel combustion by transportation contributes to NOx pollution as well.

Figure 4-1: *2025 King County NOx Emissions from Buildings by Sector and Source*



150. U.S. EPA, "Nitrogen Oxides Emissions," 2018. Accessed 10/6/25.
151. U.S. EPA, "Basic Information about NO_2," July 2024. Accessed 5/13/25.
152. U.S. EPA, "Basic Information about NO_2," July 2024. Accessed 10/6/25.
153. U.S. National Renewable Energy Laboratory, "SLOPE: State and Local Planning for Energy," 2023. Accessed 5/13/25.

OVERVIEW

Fossil fuel-burning appliances produce substantial amounts of NOx emissions in indoor settings and contribute to outdoor pollution.[154] Consequently, many jurisdictions across the country have taken steps to limit NOx emissions from water and space heating appliances through regulations requiring low emissions or zero emissions from appliances. For example, Texas and Utah have had limits on NOx emissions from gas water heaters since 2000 and 2015 respectively.[155] Other states have followed suit, including Colorado which will be limiting emissions from space and water heaters in 2026.[156] Maryland is also planning to enact an ultra-low NOx limit, followed by a zero emissions heating equipment standard.[157] Additionally, nine California air districts regulate NOx emissions from gas-fueled space and water heaters, with California considering a statewide zero emissions space and water heater regulation.[158] NOx limits implemented by these jurisdictions do not require residents to replace existing appliances but do require new appliances sold to meet emissions limits, with limits typically phased in over many years to ensure a well-planned transition.[159] Although gas-burning stoves can contribute to the generation of indoor air pollution, no known regulations limiting emissions have been applied to cooking equipment by a state or local air agency at this time.[160] Low or zero emissions appliance standards could be pursued at various regulatory levels, such as at the state or by regional agencies such as the Puget Sound Clean Air Agency (PSCAA).

Action Goals

This action would aim to:

- *Advocate for the state or air quality regulator to establish emissions limits for new appliances sold within King County.*
- *Reduce NOx emissions from appliances, such as space and water heaters, which contribute to indoor and outdoor air pollution.*
- *Lower GHG emissions by reducing the combustion of fossil fuels in appliances.*

COST ESTIMATES

The baseline cost of this program to King County is estimated to be approximately 0.25 of a full-time employee (FTE) workload to pursue and support advocacy of an external entity instituting and managing this program.

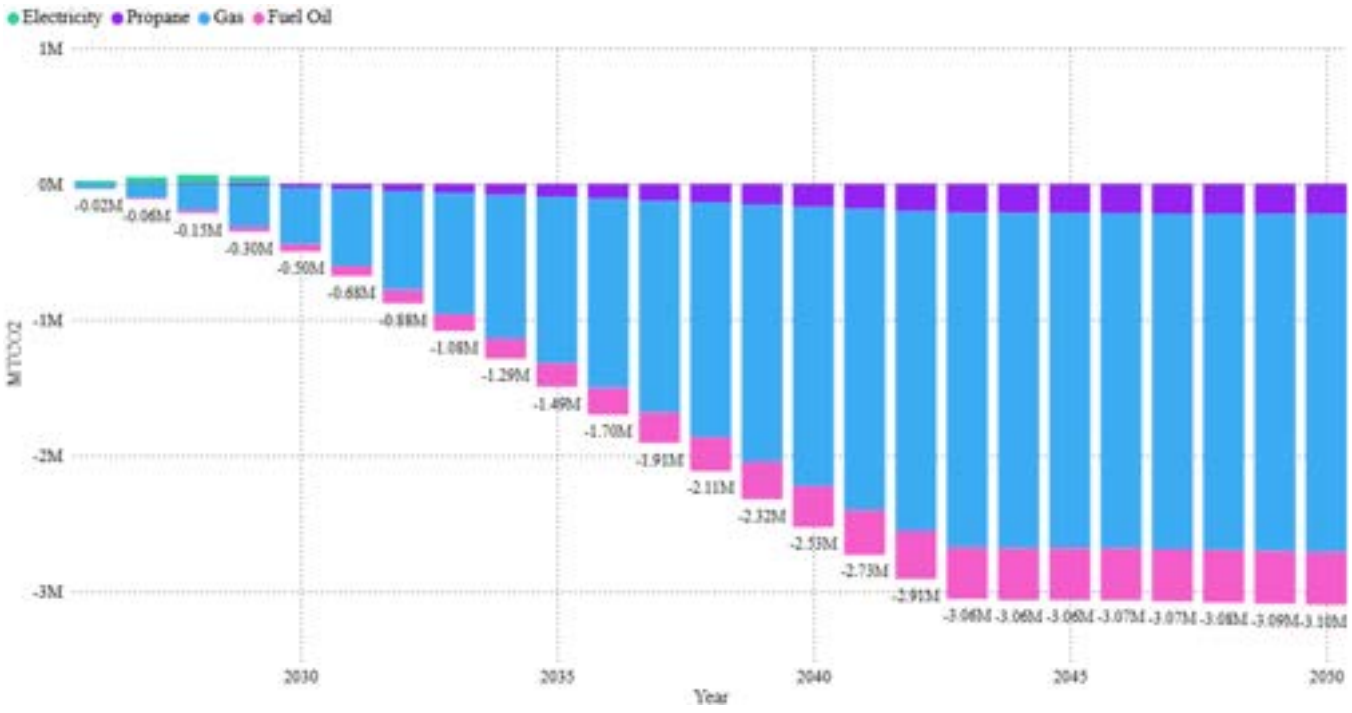
154. U.S. EPA, "Nitrogen Oxides Emissions," 2018. Accessed 10/6/25.
155. Shenot et al, "NOx Standards for Water Heaters: Model Rule Technical Support Document." Regulatory Assistance Project, February 2023. Accessed 5/13/25. Pg 8.
156. The General Assembly of the State of Colorado, "HOUSE BILL 23-1161." Accessed 5/13/25. Page 32.
157. Maryland Department of the Environment, "Clean Heat Rules." Accessed 5/13/25.
158. Shenot et al, "NOx Standards...," ibid. Pg 8. And California Air Resources Board (CARB), "Zero-emission Space and Water Heaters - Frequently Asked Questions (FAQs)." May 2023. Accessed 5/13/25.
159. Shenot et al, "NOx Standards...," ibid. Pg 7.; and CARB, "Zero-...," ibid. Accessed 10/6/25.
160. U.S. Government Accountability Office (GAO), "Gas Stoves: Risks and Safety Standards Related to Products and Ventilation," GAO-25-107514, March 18, 2025. Page 2. Accessed 10/6/25

ESTIMATED IMPACTS AND CO-BENEFITS

This action would reduce nearly 1.5 million metric tons of carbon dioxide equivalent ($MTCO_2e$) in GHG emissions annually by 2035, and over 3 million $MTCO_2e$ annually by 2050, per the below graph. These estimates are based on a 2026 adoption of a zero emissions appliance standard that would affect countywide emissions, where:

- All residential water heaters sales are electric by 2030.
- All residential and commercial furnace and space heating sales are electric by 2032.
- All commercial water heater sales are electric by 2034.

Figure 4-2: *Zero Emissions Appliance Standard in King County Estimated GHG Reductions*



A policy that limits air pollution emissions to zero would effectively ban appliances that combust gas to operate based on current technologies. Although GHG reduction estimates are based on the zero emissions appliance standard described above, King County may choose to advocate for the state or regional air quality regulators to implement emissions limits at different timelines, and/or with different emissions limits for each appliance type.

EQUITY CONSIDERATIONS

Zero emissions appliance standards may impact equity outcomes in the following ways.

Benefits include:

+ Emissions limits from fossil fuel powered equipment reduce health complications associated with respiratory diseases, such as asthma, that disproportionately impact frontline communities.[161]
+ High efficiency electric equipment, such as heat pump water heaters and space heaters, may have lower operations and maintenance costs than their gas and electric counterparts.[162]

Potential unintended impacts include:

× Upfront equipment costs are higher for low-emitting and zero-emitting equipment than their traditional gas counterparts.[163] These higher costs could present challenges for low-income communities when replacing broken or outdated equipment.

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Offer water heating rebates. Increasing rebate amounts for converting fossil fuel water heaters, reducing the upfront cost of installing low and zero emission electric equipment for water heating.[164] Heat pump water heater (HPWH) replacements cost $5,400 on average when converting from a gas water heater, versus a gas-to-gas replacement costing $2,600 on average.[165] With regional HPWH rebates of $750 per unit, rebates would need to increase by $2,000 for HPWH systems to reach parity with their gas counterparts.

» Develop a financing mechanism to support zero emissions equipment installations. A good example of this would be on-bill financing, where a utility or lender provides funding for retrofits or appliance installations, with the costs repaid via regular payments integrated on existing utility bills. This combines the benefits of a low-to-no interest loan with a simplified contracting and repayment structure.[166]

161. Khadke et al, "Environmental justice index and prevalence of asthma and COPD in US neighborhoods- a population-based study." National Library of Medicine, August 5, 2025. Accessed 10/15/25.
162. Breit, Raphael, "Lowering the Heat Pump Cost Barrier: A Chance to Save Big in the Long Run." Regulatory Assistance Project, January 9, 2025. Accessed 10/15/25.
163. Breit, Raphael, "Lowering the Heat Pump Cost Barrier..." ibid. Accessed 10/15/25.
164. Breit, Raphael, "Lowering the Heat Pump Cost Barrier..." ibid. Accessed 10/15/25.
165. Rewiring America, "How Much Does a Heat Pump Water Heater Cost?," 2023. Accessed 10/23/25.
166. U.S. Department of Energy (DOE), "Financing Navigator: What is On-Bill Financing/Repayment," August 23, 2023. Accessed 11/25/25.

- Offer space heating rebates. Increasing rebate amount for converting fossil fuel space heating equipment (commonly, gas furnaces), reducing the upfront cost of installing low- and no-emissions electric space heating equipment. Heat pump space heating conversion costs $13,400 on average for one-to-three zone systems, while the average fossil fuel systems with air conditioning costs about $9,000.[167] With regional rebates ranging from $2,400 - $6,000 for low income residents through government and utility programs, additional rebates of $2,000 at minimum would be needed for heat pump systems to reach cost parity with fossil fuel systems. However, it should be needed that heat pump installations are almost double this cost regionally, averaging closer to $25,000 per installation such that potential rebates may have to be much higher to achieve cost parity.
- Consider appliance subscription or leasing. While not as common in the U.S., some European organizations are discussing alternatives to homeowners owning installed appliances. Some homeowners already use a heat pump subscription model, "where homeowners pay a monthly fee covering the cost of the heat pump, as well as the installation and ongoing maintenance."[168] "Social leasing" would use a similar model save it is applied in social (i.e., subsidized) housing for low-income homeowners.[169] The primary different in this leasing model for low-income homes is that the latter could be government guaranteed.[170] It is notable that heat pump leasing is increasingly already in practice in the U.S. for commercial operators, particularly for geothermal heat pumps due to higher tax credits.[171]
- Additional mitigation options are also integrated in the following section on Best Practices for this action.

167. Breit, Raphael, "Lowering the Heat Pump Cost Barrier...," ibid. Accessed 10/15/25.
168. European Heat Pump Association (EHPA), "Bridging the Affordability Gap: Social Leasing for Heat Pumps," August 2025. Accessed 11/25/25. Pg 1.
169. Enrgiesprong Global Alliance, "Social leasing of heat pumps: Bridging the affordability gap for energy-efficient housing," October 15, 2025. Accessed 11/25/25.
170. EHPA, "Bridging the Affordability Gap: Social Leasing...," ibid. Accessed 11/25/25. Pg 1.
171. St. John, Jeff, "The loophole that could give clean heat a boost under Trump," November 3, 2025. Accessed 11/25/25.

BEST PRACTICES

King County could consider advocating for the following best practices in adoption of a Zero Emissions Appliance Standard by the state or regional air quality regulator:

- Researching various policy scenarios such as market development, grid and reliability impacts, workforce development, permitting, costs, challenging installation cases, potential housing impacts, and socioeconomic and environmental impacts.[172] These studies have been conducted by jurisdictions such as the Bay Area Air Quality Management District (BAAQMD), prior to enacting emissions limits.[173]
- Implement tenant protections to ensure that any emission limit compliance costs are not passed through to tenants, to mitigate displacement or eviction.[174]
- Address market development needs by incentivizing zero emissions equipment installers, building the workforce, ensuring utility rates are supportive, as well as expanding consumer incentives and education.[175]
- Exempt certain equipment, such as space heaters, wall heaters, stoves, and fireplaces which are typically not primary space/water heating sources and are often used for emergency or supplemental purposes. Industrial equipment and recreational vehicle (RV) heating equipment may also be exempt since these technologies are often designed for specialized purposes and dimensions.[176]
- Allow for temporary use of non-compliant equipment by registered providers after emissions limits are enacted in cases of emergency replacements, for up to six months. This provides building owners time to plan for electrical panel upgrades and install systems that may be necessary to comply with emissions limits.[177]
- Require manufacturers to apply for certification that appliances are compliant with Emissions limits and use procedures similar to existing regulations such as South Coast Air Quality Management District and BAAQMD's certification processes.[178]

172. Bay Area Air Quality Management District (BAAQMD), "Rules 9-4 and 9-6 Building Appliances," 2025. Accessed 5/13/25.
173. BAAQMD, "Rules 9-4 and 9-6 Building Appliances," 2025. Accessed 5/13/25.
174. Levin, Emily, et. al, "Zero-Emission Heating Equipment Standards...," ibid. Accessed 11/25/25. Pg 6.
175. California Air Resources Board (CARB), "Zero-emission Space and Water Heaters - Frequently Asked Questions (FAQs)," Last updated May 30, 2023. Accessed 12/10/25
176. NECAUM, "Model Rule 1.0...," ibid. December 2024. Accessed 5/13/25. Pg 25-26.
177. NECAUM, "Model Rule 1.0...," ibid. December 2024. Accessed 5/13/25. Pg 29.
178. NECAUM, "Model Rule 1.0...," ibid. December 2024. Accessed 5/13/25. Pg 30.

- Address cost barriers, particularly for frontline community members and low-income building owners to ensure that financial impacts of emissions limits do not overburden communities.[179] Socioeconomic studies by the BAAQMD estimate that the lifetime equipment and installation costs of switching from gas to electric heat pump appliances would be $2,824 for water heaters, and $8,027 for space heating.[180] Additionally, older homes would need to, "upgrade their electric service, at a cost of $4,256 for single-family units and $2,744 for multifamily units."[181] Means of addressing cost-barriers could include:
  - Providing accessible and reliably-funded financial incentive programs for efficient electric appliances, such as rebates and credits, to address equipment, installation costs, and electrical panel upgrades.
  - Identifying bill protection measures, such as utility discount programs, to ensure that all buildings have lower ongoing utility costs, especially for low-income households.[182] This may also reduce the number of building owners who choose to replace appliances with inefficient electric appliances, which have low equipment costs, but higher utility costs.[183]
  - Enacting conditional emissions limits in scenarios where the building owner or tenant's initial and ongoing costs of purchasing compliant appliances are higher than non-compliant appliances, using financial modeling. An example of this would be replacing gas heating with electric resistance heat such as baseboard heating. This model could account for fuel and electricity rates per utility provider, building size, and available incentives among other pertinent financial considerations. A model could then identify if complying with emissions limits are financially optimal for building owners and tenants and determine when/if they would need to comply.[184]
- Provide assistance/extension/exemptions for buildings that require extensive upgrades to comply with emissions limits, such as ductwork, electrical panel upgrades, weatherization, or priority health and safety upgrades especially if buildings are serving low-income residents or are considered affordable housing. Buildings that are off-grid or are currently compliant with Emissions limit should be exempt from compliance.[185]

179. Levin et al, "Zero-Emission Heating Equipment Standards: A New Tool in the Policy Toolbox," American Council for an Energy-Efficient Economy (ACEEE) Summer Study on Energy Efficient Buildings, 2024. Accessed 5/13/25. Pg 6.
180. Applied Development Economics, "Socioeconomic Impact Analysis of Proposed Amendments to Regulation 9, Rule 4: Residential Central Furnaces; and Regulation 9, Rule 6: Natural Gas-Fired Boilers and Water Heaters," December 2022. Accessed 5/13/25. Pg 19.
181. Applied Development Economics, "Socioeconomic Impact Analysis...," ibid. Accessed 5/13/25. Pg 19.
182. Levin, Emily, et. al, "Zero-Emission Heating Equipment Standards...," ibid. Accessed 11/25/25. Pg 6.
183. Northeast States for Coordinated Air Use Management (NECAUM), "Model Rule 1.0: NOx and GHG Emissions Standards for Space and Water Heaters," December 2024. Accessed 5/13/25. Pg 35.
184. NECAUM, "Model Rule 1.0: NOx and GHG Emissions...," ibid. Accessed 5/13/25. Pg 35.
185. NECAUM, "Model Rule 1.0...," ibid. December 2024. Accessed 5/13/25. Pg 33.

Regulations can be structured such that distributors, manufacturers, and retailers must collect information on the type of equipment sold, and identify the address to which the appliance is being sold, to ensure the unauthorized products are not sold within the jurisdiction boundary of the emissions regulation. If the appliance installation is temporary, this information is typically still recorded. Buildings that are exempt from the policy can be identified by the Zero Emissions policy implementer, and their addresses provided to appliance distributors, manufacturers, and retailers. Sales and shipment of unauthorized equipment to unauthorized locations, regardless of whether the seller is located outside of the regulated area, can face penalties if prohibited sales occur.[186]

186. NECAUM, "Model Rule 1.0...," ibid. December 2024. Accessed 5/13/25. Pg 31.

5. BEPS: Building Emissions Performance Standards

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 24: Defend and Strengthen Building Sector Incentives and Regulations. This Strategy Action explores the impacts of the Seattle BEPS, and the possible impacts of either local or regional adoption; either would strengthen the baseline impacts of the state CBPS regulation.

ACTION

Lower greenhouse gas (GHG) emissions and other pollutants from large commercial and residential buildings through standards of performance for building emissions based on building use type.

BACKGROUND

In 2019 and 2022 the Clean Buildings Act was passed and amended, respectively, establishing Washington State's Clean Building Performance Standards (CBPS).[187] Although these regulations will require energy reporting and improve energy efficiency in most buildings over 20,000 sq. ft., the GHG emissions reductions from this regulation is less ambitious than a Building Emissions Performance Standard (BEPS) that specifically requires GHG emissions reductions. For example, the City of Seattle's Office of Sustainability and the Environment (OSE) compared the state CBPS impacts with the projected impacts of its locally adopted BEPS policy:

> *Although the State energy performance standards are an important start, OSE projects will only result in about a 4% reduction by 2030 in meeting the City's 2050 carbon-neutral goal. In contrast, the BEPS greenhouse gas emissions standard for larger buildings could result in up to a 27% decrease across all building emissions by 2050...*[188]

As a note, BEPS is the acronym for the specific legislation passed by Seattle. However, this Strategy section uses this abbreviation to refer to the concept of either adopting similar

187. Washington state Department of Commerce, "Clean Buildings Performance Standard (CBPS)," 2025. Accessed 4/22/25.
188. City of Seattle Office of Sustainability & Environment (OSE), "Policy Background," n.d. Accessed 4/22/25.

legislation within King County or advocating for integrating its provisions at the state level.

OVERVIEW

In King County, an estimated 9,211 buildings are 20,000 sq. ft. or larger; approximately 265 or three percent of these buildings are in unincorporated areas of the county.[189] King County could establish a BEPS policy to set GHG emission reduction targets in these buildings with either commercial or multifamily occupancies, potentially in partnership with cities. Such a policy would help achieve higher GHG emissions reductions for retrofit projects pursued for larger buildings, and among building owners with greater probable access to capital funding to achieve such retrofits.

A BEPS policy would require that building owners meet emissions reductions targets in accordance with compliance timelines determined by the County or the State, depending on the regulator establishing BEPs targets. Similar building performance standards have been enacted in fourteen jurisdictions across the U.S. as of 2023.[190]

Locally, the City of Seattle adopted a BEPS policy in December of 2023.[191] Seattle's BEPS requires that building owners submit a benchmarking verification report to ensure accuracy of energy data, submit GHG emissions reports that calculate current emissions and emissions targets, and reduce emissions to meet targets.[192] Reporting and GHG emissions reduction deadlines vary based on tiers of building size. Following 2023 adoption, the largest buildings (220,001 sq. ft. or higher) have their first verification and reporting deadline in 2027 and are required to meet their first GHG intensity targets (or achieve alternative compliance) in 2031.[193] King County may pursue implementing a building emissions performance standard similar to Seattle's BEPS in unincorporated areas of the county. Alternatively, the County could plan this adoption in coordination with cities that have a higher volume of larger buildings or that are considering building decarbonization policies. A final option would be to advocate for amendment to the state CBPS, instituting a mandatory framework that focuses on emissions reductions rather than energy efficiency.

Action Goals

This action would aim to:

- *Reduce emissions from existing large buildings (over 20,000 sq. ft.) to meet emissions targets in accordance with compliance timelines.*

189. This estimate does not include agricultural or industrial structures, or federally- or tribally-owned buildings. Determined through internal analysis of assessor data; please see Appendix 2 for more information.
190. Clearly Energy & Northeast Energy Efficiency Partnerships (NEEP), "Climate Impacts of Building Performance Standards: Measuring the Pathway to Net-Zero," October 2023. Accessed 4/1/25. Page 6.
191. City of Seattle OSE, "Building Emissions Performance Standard," n.d. Accessed 4/1/25.
192. City of Seattle Municipal Code Chapter 22.925 – Building Emissions Performance Standard, "22.925.090 – Reporting obligations," n.d. Accessed 4/1/25.
193. City of Seattle OSE, "Seattle Building Emissions Performance Standard Guide to the New Policy," January 2024. Accessed 4/22/25. Pg 2.

- *Support benchmarking a building's energy data to accurately identify GHG emissions reduction targets.*
- *Provide flexible compliance pathways to encourage building owners to identify optimal emissions reduction mechanisms.*

COST ESTIMATES

The costs of this action would depend on the geography of its adoption among jurisdictions in King County. The different levels of adoption, and projected costs, are noted below.

LOWEST COST: The lowest cost option would be if the state amended the CBPS, instituting a mandatory framework that focuses on emissions reductions rather than energy efficiency. The probable interim cost prior would be at least 0.25 of a full-time employee (FTE) workload to pursue and support advocacy for state amendment of the CBPS.

ALL OF KING COUNTY: Were all of King County to adopt BEPS independently, approximately five FTEs would be needed for program support. This outcome could theoretically occur without state amendment to the CBPS, though adoption by all cities is unlikely as each would need to pass its own ordinance; instead, the cost of this option is estimated to provide a sense of the range of possibles costs for centralized BEPS support. Assuming Seattle retained its BEPS program for 4,100 buildings, a collaborative BEPS initiative for the remainder of King County would be responsible for approximately 3,600 buildings, or roughly 85 percent of the size of the BEPS program support.[194]

194. Seattle buildings count sourced from Kempe, Ysabelle, "Seattle requires large buildings to zero out greenhouse gas emissions by 2050," Smart Cities Dive, December 13, 2023. Accessed 11/30/25.

- The Seattle BEPS program budgeted approximately $830,000 in its initial year, including three FTEs for compliance outreach, program data analytics, and IT development; non-staffing funds included funding for short-term research support, stakeholder engagement, and consultants for the Seattle Clean Buildings Accelerator.[195] This Strategy evaluates the potential of an Accelerator service as a stand-alone action in the subsequent section, so an equivalent BEPS budget may vary from the Seattle Example – though an Accelerator program may be prudent to advance equity outcomes if BEPS were adopted.
- In the subsequent year following BEPS, three additional FTEs were planned, with one focused on technical support and building engineering expertise, and the other two supporting Seattle's third-party technical assistance provider, supporting enforcement and help desk capabilities.[196]
- A program scaled to be for 85 percent of the Seattle program represents 5.1 FTEs and a budget of approximately $700,000, though additional effort would be required to ensure the full salary, benefits and third-party support costs were adequately resourced with this budget.

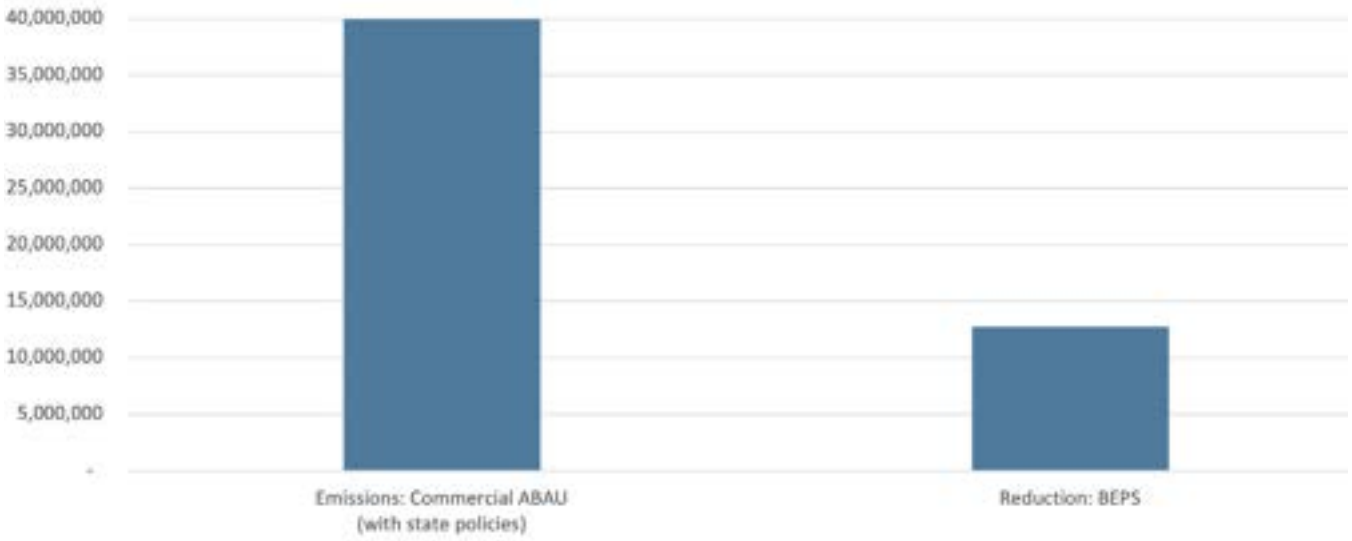
195. Majersik, Cliff and Rajiv Ravulapati, "Deciphering Seattle's BEPS: 2024. Accessed 11/30/25.
196. Majersik, Cliff and Rajiv Ravulapati, "Deciphering Seattle's BEPS..."

ESTIMATED IMPACTS AND CO-BENEFITS

The GHG reduction impact of this action would depend on the geography of its adoption among jurisdictions in King County. The greatest impact would be if all King County – the cities and unincorporated area – adopted BEPS together, either through local coordinated programs or updated state requirements. The second greatest impact would be if some of the largest cities in King County pursued BEPS, regardless of adoption in the unincorporated area.

When accounting for the remaining GHG reduction needed once all existing state policies are considered, a countywide BEPS adoption could address over 25 percent of the remaining GHG reduction needed for this sector. This estimated impact of this action is depicted in Figure 5-1 below.

Figure 5-1: *Cumulative 2026 – 2050 GHG Emission Reductions Estimates for Countywide BEPS*



Decarbonizing large buildings through a BEPS policy has multiple co-benefits, including projected improve air quality improvements and increases to building occupant comfort and productivity.[197] Buildings owners will also be able to plan for long-term upgrades that will stimulate the local economy.[198]

197. U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy, "Building Performance Standards," November 2023. Accessed 4/3/25.
198. Clearly Energy & NEEP, "Climate Impacts...," ibid. Accessed 4/1/25. Pg 7.

EQUITY CONSIDERATIONS

BEPS may have varying equity impacts for both building owners and tenants of covered buildings in unincorporated King County.

Benefits include:

+ In addition to reducing operational GHG emissions, BEPS reduces pollution of occupant spaces and the surrounding community, which can potentially yield health benefits for frontline communities.
+ Converting outdated and inefficient gas or oil systems to electric heat pump systems may reduce overall energy use, with the potential to reduce aggregate energy bills.[199]

Potential unintended impacts include:

× Buildings managed with lower operating budgets, such as due to affordability profiles, may have a more challenging time meeting requirements and be disproportionately impacted by non-compliance penalties.[200]
× Required system upgrades for BEPS compliance may result in increased tenant dues to recoup costs, which could negatively impact residential and commercial space rents. Furthermore, improvements may not be made due to the split incentive of improvements which incur capital costs on the landlord with savings often flowing to tenants.[201]

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Provide multiple compliance pathways to allow flexibility in meeting standards based on the circumstances of individual buildings, including deferrals if a building owner proves that their financial reserves are insufficient to cover upgrade costs.[202]
» Provide decarbonization technical assistance and other support services, such as through equity focused accelerator programs offered by King County or by local jurisdictions. See the subsequent Strategy action for more information on this mitigation.

199. U.S. DOE, "Heat Pumps Keep Homes Warm and Bills Low this Winter," January 18, 2023. Accessed 10/27/25.
200. Hart et al., "Understanding the Housing Affordability Risk Posed by Building Performance Policies," Institute for Market Transformation (IMT), 2020. Accessed 10/27/25. Pg. 3
201. Nedwick et al., "Mandating Building Efficiency while Preserving Affordable Housing: Opportunities and Challenges," Energy Efficiency for All, 2020. Accessed 10/27/25. Pg. 3
202. Hart et al., "Understanding the Housing Affordability...," ibid. Accessed 10/27/25. Pg. 13

BEST PRACTICES

King County could consider the following best practices for implementing BEPS as a local action, or in advocating for its integration into state regulations:

- The U.S. Environmental Protection Agency advises that, when initiating program development, policymakers should "align policy objectives with community priorities, gather input from individuals directly affected by the policy, and understand the needs of underserved groups."[203] One method to support this would be instituting a Community Accountability Board (CAB) "tasked with reviewing the ordinance's impact on disinvested communities and recommending programs, practices, and rule changes to reduce historical inequities."[204]

- Engage with building owners in multiple industries to allow for policy design modifications, such as cooking exemptions for the restaurant industry or special considerations for hospitals and affordable housing.[205]

- Join the National Building Performance Standards coalition, a voluntary group of state and local governments committed to building performance policies and programs support by IMT. As part of the coalition, King County could participate in "collaboration forums, technical and policy analysis, localized policy design, and support for stakeholder engagement."[206]

- Prior to enforcing compliance, require verification of energy use data, which is critical to calculate building emissions.[207] For example, a building owner would verify benchmarking data by validating baseline data and emissions target calculations.[208] The City of Seattle reported that 41 percent of energy benchmark reports for the city's Building Tune-Ups program required corrections and updates, and that the average cost for a building owner to secure report verification is $1,500.[209]

203. U.S. Environmental Protection Agency (EPA), "Building Performance Standards: Overview for State and Local Decision Makers," February 2021. Accessed 4/4/25. Pg 2.
204. IMT, "Summary of IMT's Model Ordinance for a Building Performance Standard," January 2021. Accessed 4/1/25. Pg 6.
205. City of Seattle, "Seattle Building Emissions Performance Standard Policy Proposal Director's Report," November 2023. Accessed 4/4/25. Pg 72.
206. National Building Performance Standards (BPS) Coalition, "About the National BPS Coalition," 2025. Accessed 4/4/25.
207. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 33.
208. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 33.
209. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 33, 34.

- BEPS compliance pathways should:
  - Account for "buildings use, size, type, ownership, age, and systems."[210] For example, Seattle's BEPS includes alternative compliance payments, and flexibility for extenuating circumstances.[211] Alternative compliance payments temporarily defer GHG reduction requirements, with the payment revenues used to fund technical assistance and supporting under-resourced buildings.[212]
  - Define, include and address affordable housing, to ensure building occupants benefit from BEPS. Extensive measures should be taken to increase compliance flexibility, provide financial and technical assistance, reduce energy burdens, and mitigate displacement – such as by capping costs that may be passed on to tenants.[213] Allocating non-compliance fines to fund affordable housing and buildings serving under-resourced communities, is another pertinent example from Seattle's BEPS.[214]
  - Clearly define exemptions, such as exemptions for financial distress, all-electric buildings, or newly constructed buildings that will meet GHG targets due to the state's advanced energy code.[215]
  - Follow a phased approach, providing a compliance timeline with five-year intervals by building size, in alignment with Washington State's Clean Buildings Performance Standard and Seattle's BEPS.[216] Timeline extensions should be considered for rural areas, smaller buildings, or other property types with limited operational or maintenance staff.[217] Extensions for unreinforced masonry (URM) buildings with required seismic upgrades should also be granted since upgrading for "both emissions reductions and for seismic safety could create greater complexity and cost impacts."[218]

210. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 7.
211. IMT, "Summary of IMT's Model Ordinance for a Building Performance Standard," January 2021. Accessed 4/1/25. Pg 6.
212. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 44.
213. Silverman et. al, "Building Performance Standard Module: Housing Affordability," Institute for Market Transformation (IMT) and Elevate, May 2022. Accessed 4/4/25. Pg 18.
214. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 20.
215. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 50.
216. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 34.
217. City of Bellevue, Meeting with King County Executive Climate Office Staff, 3/6/25.
218. City of Seattle, "Seattle Buildings Emissions...," ibid. Accessed 4/4/25. Pg 12.

6. Rooftop Units (RTUs) Initiative

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 27: Lower the Financial and Logistical Barriers for Building Decarbonization Retrofits. This Action lists multiple options to lowering barriers, including addressing service gaps for commercial and multifamily buildings. An RTU Initiative could support retrofits in small- and medium-sized commercial buildings.

ACTION

Reduce energy usage, greenhouse gas (GHG) emissions, and energy costs for commercial buildings by increasing access to electric heat pump rooftop units (RTUs) and transitioning away from gas RTUs.

BACKGROUND

Rooftop units (RTUs) are a common type of packaged heating, ventilation, and air conditioning (HVAC) equipment used for commercial buildings. Across the U.S., these HVAC systems serve approximately 50 percent of the commercial building floor area, as they are a standard HVAC solution for one- and two-story commercial spaces.[219] Although nationally it is estimated that packaged RTUs are used in 37 percent of all commercial buildings, some studies have indicated higher numbers, and these numbers can vary by region.[220] Although RTUs can be gas- or electrically-powered, it is estimated that 67 percent of commercial buildings use natural gas for heating in the Northwest – such that widespread retrofits and heat pump conversions of gas RTUs could be yield strong GHG reductions.[221]

219. Deru, Michael, et. al, "Long and Winding Road to Higher Efficiency—The RTU Story," National Renewable Energy Laboratory (NREL) CP-5500-77092, February 2021. Pg 1. Accessed 10/9/25.
220. Evergreen Economics, "Rooftop HVAC Market Characterization Study," Northwest Energy Efficiency Alliance (NEEA), Report #E17-346, February 16, 2017. Pg 2. Also, Chris, CaraDonna, Andrew Parker, Ryan Meyer, "Impact Analysis of Transitioning to Heat Pump Rooftop Units for the U.S. Commercial Building Stock," NREL. Pg 2. Accessed 10/9/25.
221. Evergreen Economics, "Rooftop HVAC Market...," NEEA ibid. Pg 3. Accessed 10/9/25.

It is estimated that heat pump RTUs can reduce GHG emissions and even energy costs by up to 50 percent compared to conventional gas RTUs.[222] In fact, RTU conversions could likely achieve operational savings in the Pacific Northwest even when not paired with features sometimes needed in other regions to achieve cost-neutrality, such as winter peak demand management, energy recovery ventilation (ERV), or rooftop solar.[223] Despite these benefits, improving efficiency and/or increasing conversion of gas RTUs to electric heat pumps has been historically challenging; fewer than 15 percent of U.S. commercial buildings use heat pumps.[224] The market has been slow to change partially due to, "low first cost, run-to-failure [practices, and a] like-for-like replacement mentality..."[225] Additionally RTUs face several common decarbonization barriers, including the issue of split incentives. Although heat pump RTUs save costs in the long run, they are less favored by building owners leasing their buildings because of higher upfront costs, with leasees traditionally paying the higher utility bills of the less-efficient units.[226]

OVERVIEW

There are many forms an RTU initiative could take, though all of them require additional investments in staff time and funding. The U.S. DOE launched a Commercial Building Heat Pump Accelerator in April 2024 with two primary components, one working with manufacturers to improve RTU efficiency on the market, and the other to help commercial building owners and operators adopt heat pump RTUs.[227] An RTU initiative undertaken by King County would likely focus on the latter, i.e. commercial building owner adoption. Such a program could also assess if any effort should include supporting retrofits for newer gas RTUs where complete replacement is less economical. These efforts could include adding multi-speed fan control, integrated economizer controls and demand control ventilation, which could yield energy savings of 24 to 35 percent.[228]

222. Turpin, Joanna, "Advances in Heap Pump Rooftop Units for Cold Climates," the Air Conditioning| Heating | Refrigeration News, August 21, 2024. Accessed 10/9/25
223. U.S. Department of Energy (DOE) Better Buildings, "Key Considerations for Adopting Commercial Heat Pump Rooftop Retrofit Units,". Pg 4. Also, RMI, "The Economics of Electrifying Buildings: Medium-Size Commercial Retrofits," September 2022, pg 20. Accessed 10/9/25.
224. Turpin, Joanna, "Advances in Heap Pump Rooftop Units...," ibid. Accessed 10/9/25.
225. Deru, Michael, et. al, "Long and Winding Road..." ibid. Pg 1. Accessed 10/9/25.
226. U.S. DOE Better Buildings, "Key Considerations...," ibid. Pg 4. Accessed 10/9/25
227. Paquet, Kathryn and Keller Brussoq, "CEE teams up with national partners for heat pump rooftop unit initiative," Center for Energy and Environment (CEE), August 27, 2024. Accessed 10/9/25
228. Agarwal, Shreya, et. al, "Through the looking glass: analyzing barriers to adoption of advanced rooftop unit controls through human-centered observational research," American Council for an Energy-Efficient Economy (ACEEE) Summar Study on Energy Efficiency in Buildings, 2024. Pg 1. Accessed 10/9/25

Regardless of the form of the initiative, there is ample opportunity for action. In King County, it is estimated that at least 4,300 buildings use RTUs, covering about 313 million gross sq. ft., or roughly 30 percent of the total commercial floor area. Seattle is estimated to have the highest number of RTU buildings (1,700), followed by Bellevue (330), Redmond (240), Kent (230), and Renton (200). Note these are only estimates based on projections from assessor data that indicate probable RTU use, such as original heating system, building year built or renovated, and building use.

COST ESTIMATES

The minimum primary cost of this action would be one full-time employees (FTE) to develop, launch and oversee the program, though time requirements might vary once this initiative was operational and depending on staff duties. It is projected a project/program manager (PPM) II-III level would likely be needed for engagement and leading this initiative. Additionally, an initial starting project budget of $30,000 – $50,000 would support program design with activities such as engaging consultant support, surveying small building owners, and developing contacts to help evaluate RTU initiative options. Note that, given the pace or volume of work that might be desired for action implementation, 1-2 additional FTE may be needed to support extensive building owner engagement.

Action Goals

This action would aim to:

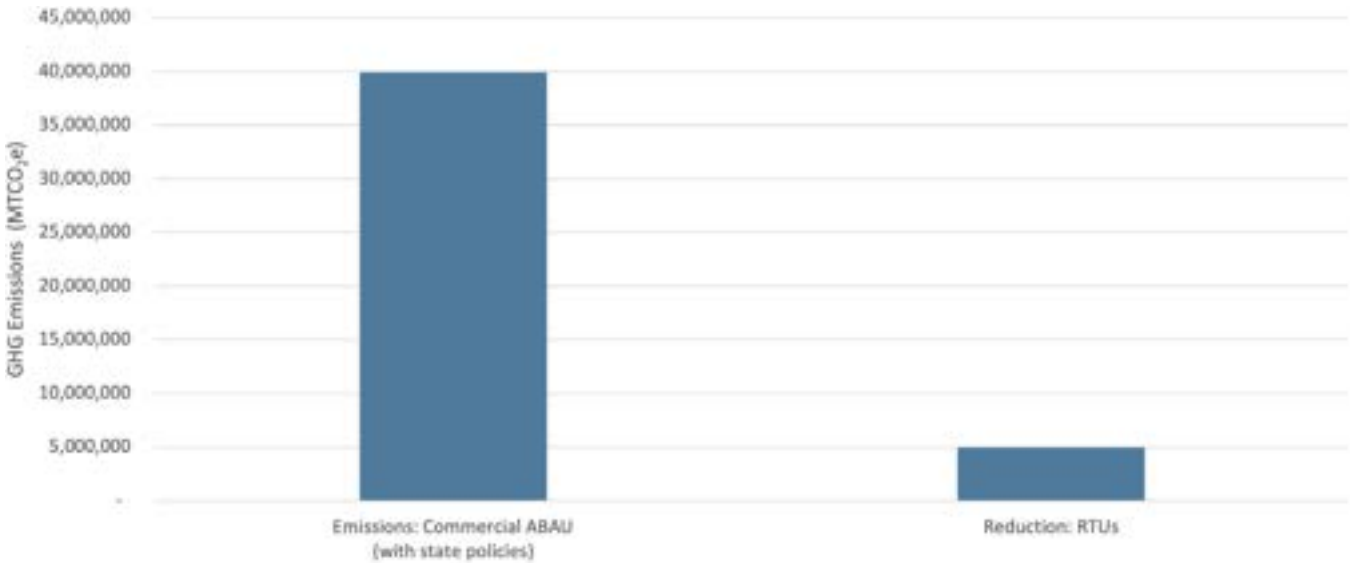
- *Enhance building owner and operator familiarity with building heating systems.*
- *Work with building owner and operators to develop maintenance and replacement plans for heat pump RTUs.*
- *Advance RTU replacement among frontline community business owners, reducing air pollution in areas with disproportionate air quality.*

RTU photo courtesy of Ecotope

ESTIMATED IMPACTS AND CO-BENEFITS

The impact of an RTU Initiative would depend on the level and type of resources dedicated, and its success in driving market change. If King County set up a program to successfully electrify all buildings with RTUs by 2050, assuming a 2026 start date, the program would need to convert approximately 175 buildings per year across the County. The estimated GHG reduction potential of this activity has ranged from between 3.5 to 9.5 million metric tons of carbon dioxide equivalent (MMTCO2e) by 2050, depending on the underlying assumptions of which buildings house RTUs. When accounting for the remaining GHG reduction is needed once all existing state policies are considered, it could address over 10 percent of the remaining GHG reduction needed for this sector. This estimated impact of this action, along with the potential impact of the previous action of a Building Emissions Performance Standard (BEPS) initiative, is depicted in Figure 6-1 below.

Figure 6-1: *Cumulative 2026 – 2050 GHG Emission Reductions Estimates for RTUs*



EQUITY CONSIDERATIONS

An RTU Initiative may have varying equity impacts depending on the building type and bill structure supporting its implementation.

Benefits include:

+ Heat pump RTUs may reduce the energy costs associated with the building due to higher operating efficiency of the equipment, which could benefit frontline community businesses and organizations.
+ These units may further improve occupant comfort, especially in buildings without previous all-weather conditioning.
+ Heat pump technology reduces air pollution associated with fossil fuel combustion, leading to improved air quality and positive community health outcomes.

Potential unintended impacts include:

× The cost of increased capital investments may be passed on to building tenants, which may have significant adverse impacts on small businesses and frontline community users.
× Heat pump RTU uptake may be slow given the split incentive experienced by the funder of the upfront costs (landlord) and the beneficiary of lower operating costs (tenant).

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Implement an energy efficiency as a service (EEaS) model, in partnership with relevant utilities, to incentivize landlord action on energy upgrades by creating an off-balance sheet investment owned by a third-party service provider, often an energy services company (ESCO).[229] This model relies on a partnership with an ESCO that owns and operates newly installed equipment, with the ESCO repaid over time with utility savings, rather than the landlord or renter paying for the equipment upgrade at time of installation.
» Implement affordability agreements for landlords receiving equipment incentives to ensure they do not raise rents, helping avoid potential displacement of frontline community tenants.

229. Henner, Nick and Howard, Bryan, "Utilities and Energy Efficiency as a Service: The Potential for Win-Win Partnerships," March 8, 2022. Accessed 10/28/25.

BEST PRACTICES

There are many forms an RTU initiative could take; below are some example best practices.

- Expand Education: Provide a series of educational trainings for contractors and building owners on RTU retrofit and heat pump conversions.[230]
- Lead with Leaders: Work with large institutions such as universities or corporations with ambitious climate reduction goals to conduct targeted evaluation, retrofits, promotion and education on RTU retrofit benefits.[231]
- Managing Managers: Develop market resources geared towards building managers, including "proactive RTU management models, leasing language, [and] case studies."[232]
- Provide Model Design Support: Develop model improvements for RTU Retrofits or consider developing standardized permitting support to make installations easier.
- Promote Proactive RTU Management: Support facility managers in inventorying RTUs, assessing their health, and developing a management plan for improvement. This can be intimidating for facility managers, but the Advanced RTU Campaign and its partners developed tool kits and a mobile app to help field technicians assess building RTUs.[233]
- Engage on Efficiency: Explore if there is a building code option to require increased efficiency standards for replacement RTUs, which drives manufacturer response.[234]
- Distributor Rebates: Evaluate the potential of upstream or distributor rebates, helping avoid the issue of buyer rebates which are typically not as useful in replacement-upon-failure scenarios that increase buyer urgency.[235]
- Engage Suppliers, Distributors, and Manufacturers: work to increase education, promotion, and stocks of heat pump RTUs and related potential efficiency upgrades.

230. Paquet, Kathryn and Keller Brussoq, "CEE teams up with national partners...," ibid. Accessed 10/9/25
231. Zhang, Tianyao, "Advancing the Electrification of RTUs in the Commercial and Industrial Market," Slipstream June 27, 2023. Accessed 10/9/25.
232. Deru, Michael, et. al, "Long and Winding Road..." ibid. Pg 6. Accessed 10/9/25.
233. Deru, Michael, et. al, "Long and Winding Road..." ibid. Pg 11. Accessed 10/9/25.
234. Deru, Michael, et. al, "Long and Winding Road..." ibid. Pg 4. Accessed 10/9/25.
235. Evergreen Economics, "Rooftop HVAC Market...," NEEA ibid. Pg 29. Also see, Deru, Michael, et. al, "Long and Winding Road..." ibid. Pg 27. Accessed 10/9/25.

7. Building Decarbonization Accelerator

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 27: Lower the Financial and Logistical Barriers for Building Decarbonization Retrofits. This Action lists multiple options to lowering barriers, including the potential to develop an Accelerator network, expanding service gaps for commercial and multifamily buildings.

ACTION

Provide technical support to under-resourced building owners and operators to expand capacity for compliance with building decarbonization and efficiency requirements and break down barriers to accessing building retrofit financing for program compliance.

BACKGROUND

Building owners and operators often require support services to understand and implement decarbonization pathways. Accelerator programs are built to deliver these services through a mix of education, technical assistance, and incentives. In a stakeholder workgroup evaluating Washington State's Clean Building Performance Standards (CBPS), participants identified fifteen goals to reduce barriers to building decarbonization, including the following:[236]

- "Ensure adequate public funding is available to support building owners and managers with compliance."
- Working with utilities to "enhance support programs for building owners and managers."
- "Simplify compliance by clarifying the legislation and making support resources more accessible."
- "Reach building owners and managers who may still be unaware of the legislation."
- "Eliminate legislative overlap and confusion."

236. Pulles et al., "Translating Potential into Performance: Assessing Compliance Costs and Policy Improvements to Maximize Building Performance Standards," 2024. Accessed 9/12/25. Pg 9.

King County could support programs through a building decarbonization accelerator program that would advance the above objectives, focused on commercial and community buildings larger than 20,000 sq. ft. in South King County jurisdictions.

OVERVIEW

In response to both City of Seattle's Building Emissions Performance Standard (BEPS) and the state's CBPS programs, multiple entities have provided accelerator services across the Puget Sound region. Puget Sound Energy (PSE), Cities of Seattle and Bellevue, as well as the state have provided services such as:

- Direct funding opportunities, including grants and financial assistance
- Guidance on accessing financial incentives and long-term financing
- Group coaching sessions, typically for buildings with similar use-cases
- Energy benchmarking and assessments to identify upgrade needs
- One-on-one coaching and personalized assistance navigating compliance
- Help desk or drop-in hours
- Pre-recorded videos and webinars, and other online educational resources

Many existing accelerator programs intend to support frontline communities and building owners who may lack resources to increase energy efficiency and decarbonize buildings on their own. This action would extend services to support large building owners in south King County jurisdictions and support their compliance with building performance standards.

Action Goals

This action would aim to:

- *Provide technical assistance to building owners to support compliance with building performance requirements in south King County.*
- *Support building owner access to financial incentives from various entities, including utilities and governments, to reduce upgrade costs.*

COST ESTIMATES

The cost of an accelerator program would vary depending on the size and scope of the services offered. Local accelerator programs typically budget between $75,000 – $300,000 annually to support between 30 to 60 buildings a year, with the higher budget including additional online web resources and features to help building owners. Assuming a lower cost of $1,200 per building for support and targeting five percent of south King County buildings (about 150 buildings/year), the annual budget would be $180,000/year. Additionally, at least 0.5 of a full-time employee (FTE) would be recommended to help launch and oversee the program, though time requirements might vary once the program was operational and depending on staff duties.

ESTIMATED IMPACTS AND CO-BENEFITS

The greenhouse gas (GHG) impacts of this action would be comparatively low, but they would help secure some GHG reductions in advance of state performance targets. They are also a means to reduce burden on building owners in frontline communities. For instance, initial program results from the Seattle Accelerator showed that, in their initial cohorts, over 50 percent of the buildings met at least one of their target criteria, namely:

- Buildings serving or owned by frontline communities
- Nonprofit-owned or operated
- Class B/C building
- Buildings located in neighborhoods with high race and social index area scores.[237]

237. Fowler, Amy, Strategic Advisor, Seattle Office of Sustainability and Environment, direct email message to author, August 14, 2025.

EQUITY CONSIDERATIONS

A Building Decarbonization Accelerator program may have varying equity impacts for both building owners and tenants of covered buildings in unincorporated King County.

Benefits include:

+ Easing the financial burden on under-resourced building owners and operators will improve potential access to decarbonization capacity, methods, and support. This increases the likelihood of building decarbonization, which may positively impact the health and quality of life of tenants and building users.
+ Collaborative learning through a cohort-style accelerator. This will help building owners and operators learn about decarbonization challenges and opportunities for under-resourced communities, and could highlight policy or program features that may, themselves, improve equity mitigation opportunities.

Potential unintended impacts include:

× Even with efforts to create centralized resources to engage frontline community buildings, buildings with greater internal organizational capacity are more likely to take advantage of a centralized building decarbonization accelerator. This highlights the need for additional individualized engagement of the hardest-to-reach buildings and communities.[238]
× Increasing the prevalence of decarbonization for community and cultural buildings could inadvertently raise costs on users of those spaces and lead to displacement without instituting effective anti-displacement measures.

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Implement protectionary measures, such as affordability agreements required with program participation, that can ensure that program participants commit to maintaining affordability for a given period for the users of their building.
» Conduct strong outreach campaigns, in partnership with trusted community-based organizations, that prioritize connecting with the less resourced buildings to encourage participation.
» Provide robust technical assistance available to small businesses, landlords, and other under-resourced owners and operators to lower access barriers and encourage participation.

238. Nedwick et al., "Mandating Building Efficiency while Preserving Affordable Housing: Opportunities and Challenges," Energy Efficiency for All, 2020. Accessed 10/27/25. Pg. 3.

BEST PRACTICES

King County could consider the following best practices for implementing a building decarbonization accelerator, largely based on practices identified by City of Seattle efforts.[239]

PRIORITY BUILDINGS FOCUS: Seattle prioritizes outreach and recruitment to under-resourced buildings that may be at a disadvantage to comply with performance standards, including buildings serving or owned by frontline communities; nonprofit-owned and -operated buildings; subsidized and unsubsidized low-income multifamily housing; class B and C office buildings; and buildings located in neighborhoods with a high Race and Social Equity (RSE) index.[240] Although the last is a Seattle-based tool, King County could develop similar specific analysis, and prioritize similar building types overall.

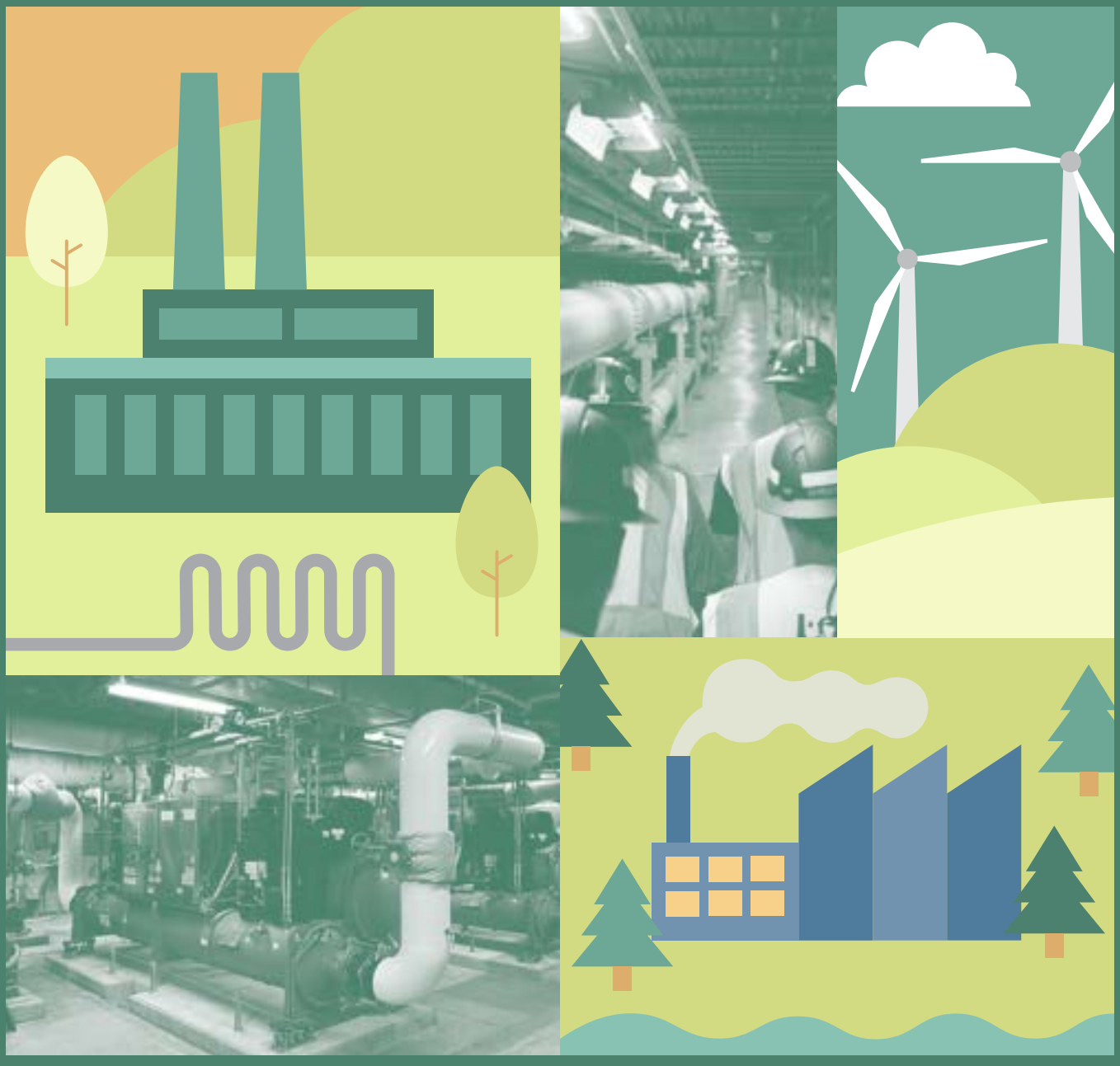
COHORT MODEL STRUCTURE: In City of Seattle implementation, cohort members benefit from a community of practice, where they learn from peers and build relationships with coaches providing hands-on expertise. King County could implement with a similar approach to Seattle, offering two cohort groupings: one for commercial buildings greater than 20,000 sq. ft. and one for multifamily buildings greater than 20,000 sq. ft.

COACHING ALIGNED WITH EXISTING REGULATIONS: The Seattle BEPS curriculum prepares participants to comply with both Seattle BEPS and Washington CBPS, including instruction on compliance requirements, pathways and timelines. As rulemaking for Seattle BEPS is completed, the curriculum will be updated to ensure compliance with the requirements and could provide a helpful baseline for King County to emulate.

FINANCIAL SUPPORT WHEN ABLE: In 2024 the Seattle Office of Sustainability and Environment (OSE) developed a new City-funded $4.5M/year incentive program for under-resourced owners of buildings in or serving frontline communities, as defined in the Seattle Green New Deal, to help them implement building upgrades to comply with state and now city energy and emissions reduction laws. Grants are funded by Seattle's Payroll Expense Tax and offered as part of OSE's Building Emissions Navigator. Free technical assistance is available to help building owners develop project ideas and gather information for the application.[241]

239. Fowler, Amy, Strategic Advisor, Seattle Office of Sustainability and Environment, direct email message to author, August 14, 2025.
240. Note: the RSE is a locally-developed index developed by the City of Seattle.
241. City of Seattle, "2025 Building Decarbonization Grant Application Now Open to Help Community Buildings Reduce Climate Pollution." Accessed 10/7/25.

INDUSTRIAL DECARBONIZATION ACTIONS



INDUSTRIAL DECARBONIZATION ACTIONS

Building on past Strategy review of the commercial building sector and potential activities to mitigate emissions, it should be noted that some shared activities can also achieve reductions for the industrial sector.

Industrial emissions and processes account for 15 percent and two percent of building sector emissions, respectively. The emissions from these sources in the industrial sector in 2023 were:

- **ELECTRICITY:** 0.37 million $MTCO_2e$ ($MMTCO_2e$)
- **NATURAL GAS:** 1.15 $MMTCO_2e$
- **INDUSTRIAL PROCESSES:** 0.42 $MMTCO_2e$

Decarbonizing heavy industry buildings, such as those producing chemicals, cement and steel, is key to reducing greenhouse gas (GHG) emissions.[242] Industrial processes account for "23% of U.S. GHG emissions and 24% of global GHG emissions (excluding emissions from industrial electricity use)."[243] At the state level, this share is estimated to be lower with the industrial sector accounting for approximately 15 percent of the state's energy-related GHG emissions (note this percentage does not include industrial process emissions).[244]

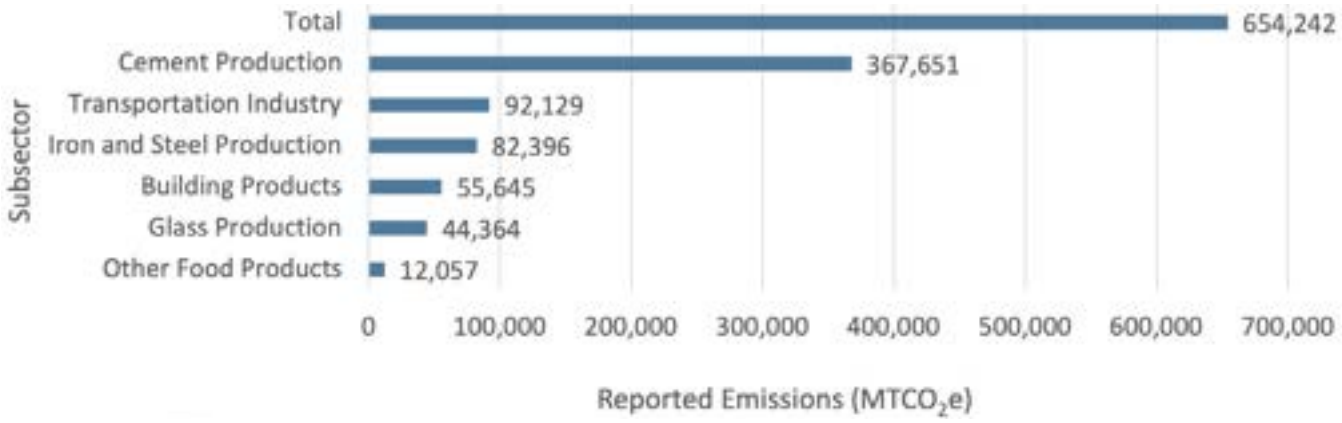
Large emitters, or any facility that emits more than 25,000 metric tons of carbon dioxide equivalent ($MTCO_2e$) annually is regulated under the state CCA. The Climate Commitment Act (CCA) sets a cap on carbon pollution, with "allowances" assigned per metric ton of carbon pollution that are then sold and purchased to cover GHG emissions.[245] Industrial facilities regulated under CCA are treated uniquely as Emissions Intensive Trade Exposed (EITE) entities; EITEs are discussed more under Advance Industrial Retrofits action in this Strategy. For a broader understanding of industrial emissions, there is also a subsequent level of reporting for entities required at 10,000 $MTCO_2e$.

Based on 2023 reports from the WA state Department of Ecology (WA Ecology), large industrial entities that emit over 10,000 $MTCO_2e$ annually account for 654,242 $MTCO_2e$ of emissions in King County; note these reports do not include emissions from electricity usage or process emissions.[246] There are approximately 110 industrial entities statewide that emit over 10,000 $MTCO_2e$ annually, with approximately 10 industrial sites of this emitting size located in King County.[247] To

242. World Resources Institute, "Industrial Decarbonization," n.d. Accessed 2/19/25.
243. World Resources Institute, "Industrial Decarbonization," n.d. Accessed 2/19/25.
244. Moors, Camilla, et al., "How States Can Lead the Charge on Industrial Decarbonization," RMI. June 30, 2025. Accessed 11/26/25.
245. Moore, Emily, "(Re)explaining Washington's Climate Commitment Act," Sightline Institute, October 8, 2024. Accessed 12/1/25.
246. WA Department of Ecology (WA Ecology), "GHG Reporting Program Map," February 2023. Accessed 2/19/25.
247. WA Ecology, "Total Emissions by reporter, sorted from largest to smallest," 2023 data. Accessed 11/3/25.

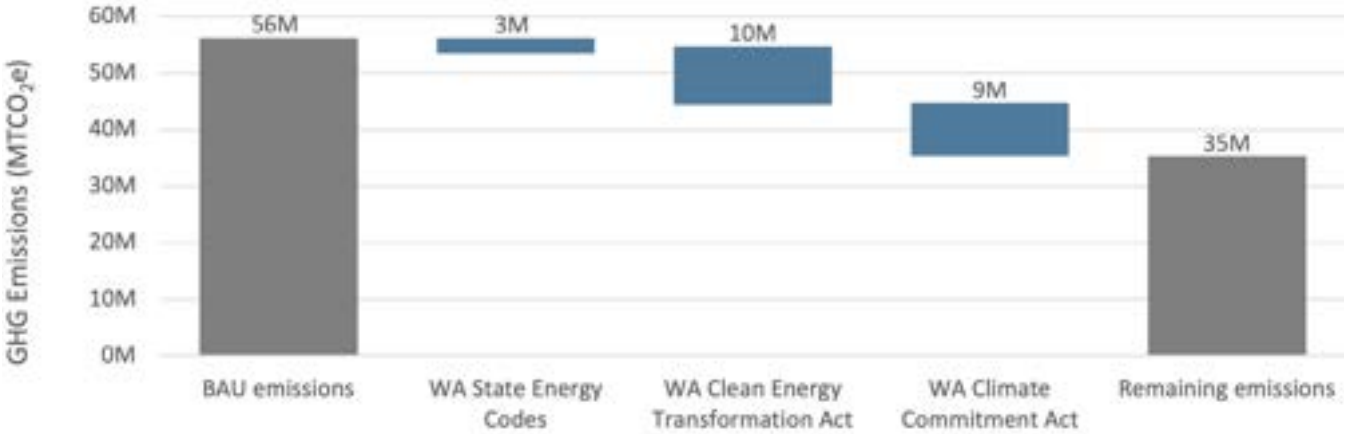
identify true industrial actors, assessed sites do not include landfills, universities, utilities, or power and gas distribution emitters. Emissions are consolidated by subsector in Figure C-1 per emissions reports to WA Ecology.

Figure C-1: *2023 Industrial Emissions in King County Reported to WA Ecology*



The King County 2023 GHG Emissions Analysis and development of the King County 2025 Strategic Climate Action Plan (SCAP) reviewed the potential emissions reductions of state regulations on the industrial sector. The comparative GHG emissions reduction impacts of state actions compared to the business-as-usual (BAU) GHG emissions projection is shown in Figure C-2. for context.

Figure C-2: ***Industrial Built Environment Cumulative Emissions Reduction Potential by 2050.*** *As shown in the King County 2023 GHG Emissions Analysis.*



Assessing the GHG reduction impacts of state energy codes, state Clean Energy Transformation Act, and state CCA revealed that additional action is needed to reduce sector emissions. Actions considered for the industrial sector in this Strategy are as follows:

8. **Advance Industrial Retrofits**
9. **Embodied Carbon Emission Reductions**

8. Advance Industrial Retrofits

ACTION

Reduce greenhouse gas (GHG) emissions and air pollution while supporting frontline community resilience and the industrial sector by implementing industrial retrofits to decrease use of fossil fuels for production of key products.

BACKGROUND

As indicated by Figure 8-1, some of the highest industrial emissions in King County are from industries producing building construction materials such as cement, steel, glass, and other building products. Addressing industrial emissions from manufacturers can reduce the embodied carbon of buildings constructed using these materials.

Although there are many existing building decarbonization policies, some of these have unique interactions or approaches with the industrial sector. For instance, the state Clean Buildings Performance Standards and City of Seattle's Building Emissions Performance Standards exempt industrial buildings.[248] Too, the state Climate Commitment Act (CCA) cap-and-trade policy addresses industrial emissions by giving "no-cost allowances" to Emissions Intensive Trade Exposed (EITE) industries until at least 2034 for about 40 facilities in the state; these cover between 94 to 100 percent of baseline emissions, depending on the reporting year.[249]

248. Washington state Department of Commerce, "Frequently Asked Questions," n.d. Accessed 2/20/25. Pg 11 and City of Seattle Office of Sustainability & Environment, "FAQs," n.d. Accessed 2/20/25.
249. Washington state Department of Ecology (WA Ecology), "Emissions Intensive Trade Exposed industries (EITEs)," n.d. Accessed 2/20/25.

Assessment of Canadian regulations similar to the CCA indicates that this legislative feature helps avoid excessive cost impacts to those facilities and avoid industry migration out of state.

> *Full carbon pollution pricing can pose competitiveness risks to facilities in EITE sectors if they are competing with facilities producing similar products in countries without equivalent carbon pricing in place, both in domestic and export markets. Carbon leakage occurs when production and investment shift to jurisdictions with similar or relatively higher emissions intensity of production due to less stringent carbon pricing. This weakens emissions reductions at the global level, together with a loss of economic activity in the jurisdiction with more stringent carbon pricing.*[250]

There are five industrial operations within King County likely considered EITEs including manufacturers of cement, steel, gypsum, glass and airplane components.[251] EITEs are theoretically incentivized to lower emissions in the short term because, "EITEs that emit fewer emissions than their allocation of no-cost allowances can save those allowances for future use, or they can sell them to other program participants."[252] However, conversely, they do not feel the same heightened pressure to reduce emissions as other entity types under CCA.

Outside of EITE industries under the CCA, there is a subsequent level of entities that must report emissions under the WA GHG Reporting Program managed by the Department of Ecology.[253] This requirement does not apply only to industrial entities, but instead any entity emitting 10,000-25,000 metric tons of carbon dioxide equivalent ($MTCO_2e$) must report their GHG emissions to the state. Of the ten additional entities in this reporting group, only between four to six of these entities are identified as a potential small industrial emitter, with over half of the sites owned/operated by one of the larger EITE industrial emitters identified previously.[254] As such, potential approaches to the industrial sector could likely focus on building relationships with the five industrial operations within King County considered EITEs.

OVERVIEW

This Action would dedicate staff time to developing relationships with large industrial actors in King County, track decarbonization status and planning, and work with these industries to decarbonize sites and facilities. Initial activities would likely start with planning and identifying smaller activities if pertinent, such as energy efficiency and decarbonization of office spaces heated by gas. Subsequent, longer-term planning could evaluate and develop strategies to decarbonize larger industrial operations, though such plans, opportunities, and costs tend to be highly dependent on specific operations industries. Staff could also advocate for

250. Environment and Climate Change Canada (ECCC), "Review of the OBPS Regulations: Consultation Paper," 2021. Page 11. Also see, Tempest, Kevin, Katelyn Roedner-Sutter, and Kjellen Belcher, "Policy Brief, Washington State's Climate Commitment Act," Environmental defense Fund (EDF), Low Carbon Prosperity Institute, September 2021. Page 8. Accessed 4/6/25.
251. WA Ecology, "Allowance Allocation to Emissions-Intensive, Trade-Exposed Industries: Vintage 2025," October 2024. Accessed 2/20/25. Table 2. Pg 3-4.
252. WA Ecology, "Emissions Intensive Trade Exposed industries (EITEs)," n.d. Accessed 11/25/25.
253. WA Ecology, "Mandatory greenhouse gas reports," n.d. Accessed 11/24/25.
254. Data.wa.gov, "GHG Reporting Program Publication." Accessed 11/24/25.

key sector support, policy changes and funding at the state level and from utilities to accelerate the ability of industries to decarbonize.

In exploration of this action, King County asked consultants to evaluate the potential for CCA emissions allowance sales by EITEs to help offset the costs of retrofit activities. Results indicated that, while the potential for CCA allowance sales were always beneficial in that they generated operational revenue, their ability to substantially impact retrofit costs was highly dependent on individual retrofit scenarios. Generally, energy efficiency projects showed higher probability of net savings. CCA allowance sales were not typically sufficient to offset the costs of electrification projects by themselves, indicating such projects would typically need additional sources of capital to attain cost parity. The County also asked consultants to develop cost and GHG reduction estimates for specific retrofit scenarios; several of these estimates are reviewed under 'Estimated Impacts and Co-Benefits' in this section.

COST ESTIMATES

The primary cost of this action would be at least 0.5 of a full-time employee (FTE) to help launch and oversee the program, though time requirements might vary once this initiative was operational and depending on staff duties.

Action Goals

This action would aim to:

- *Enhance awareness of decarbonization options among industrial operators.*
- *Advance decarbonization planning and support finding retrofit funding for industrial operators.*

ESTIMATED IMPACTS AND CO-BENEFITS

Overarching technological options for decarbonizing heavy industry include facility retrofits; energy efficiency; using non-fossil fuel sources; carbon capture, use, and sequestration; clean hydrogen; electrification with renewables; material efficiency and circularity. The GHG reduction impact of this action would depend on the scope and scale of retrofit activities undertaken by various industrial actors across King County. Assuming all industries attempted complete electrification, it could reduce GHG emissions by 1.15 million $MTCO_2e$ of GHG emissions annually, though a general cost estimate for all retrofits to achieve this reduction is $92 million.[255] The more cost-effective approach, however, would be to work with individual industries with site-specific analyses and pursue projects with higher anticipated GHG reductions. For instance:

Working with cement manufacturers to replace clinker with supplementary cement materials could yield an estimated annual emissions reduction of 115,000 $MTCO_2e$.[256] Clinker is an intermediate binding material in cement and is typically responsible for 70 percent of GHG emissions in cement production.[257] Abatement costs range from -$20/ ton to $25/ton, indicating the potential for savings by using lower cost materials.[258]

Pursuing general energy efficiency across all industries could yield estimated emissions reductions of 345,000 $MTCO_2e$ annually, also realizing potential cost savings by 2030.[259]

Pictured below: Nucor Steel Seattle. The Seattle Nucor facility has a carbon intensity that is 85% lower than the national average and is Washington State's largest recycler. The facility recycles half a million tons of steel annually.

255. Based on these costs per ton of GHG reduction: boiler electrification ($40-$70/ton); process heating equipment $60-$105/ton); heat pumps for low heat ($1-$21/ton); electric burners ($110-$160 ton). See U.S. Department of Energy (DOE), "Pathways to Commercial Liftoff: Industrial Decarbonization," September 2023. Accessed 11/26/25. See Appendix B.

256. Assumes a 35% GHG reduction; supplementary cement materials can reduce emissions by 4%–40%, with some pilot projects are aiming for a 70% reduction. See Moors, Camellia, et al., "Opportunities for Industrial Modernization in Washington," RMI, June 2025. Accessed 11/26/25. Pg 17.

257. Gangotra, Ankita, Kevin Kennedy and Willy Carlsen. "The US Needs to Lower Cement Emissions — 'Blended Cement' Can Help," World Resources Institute (WRI), May 9, 2024. Accessed 11/26/25

258. Moors, Camellia, et al., "Opportunities for Industrial Modernization...," ibid. Accessed 11/26/25. Pg 17.

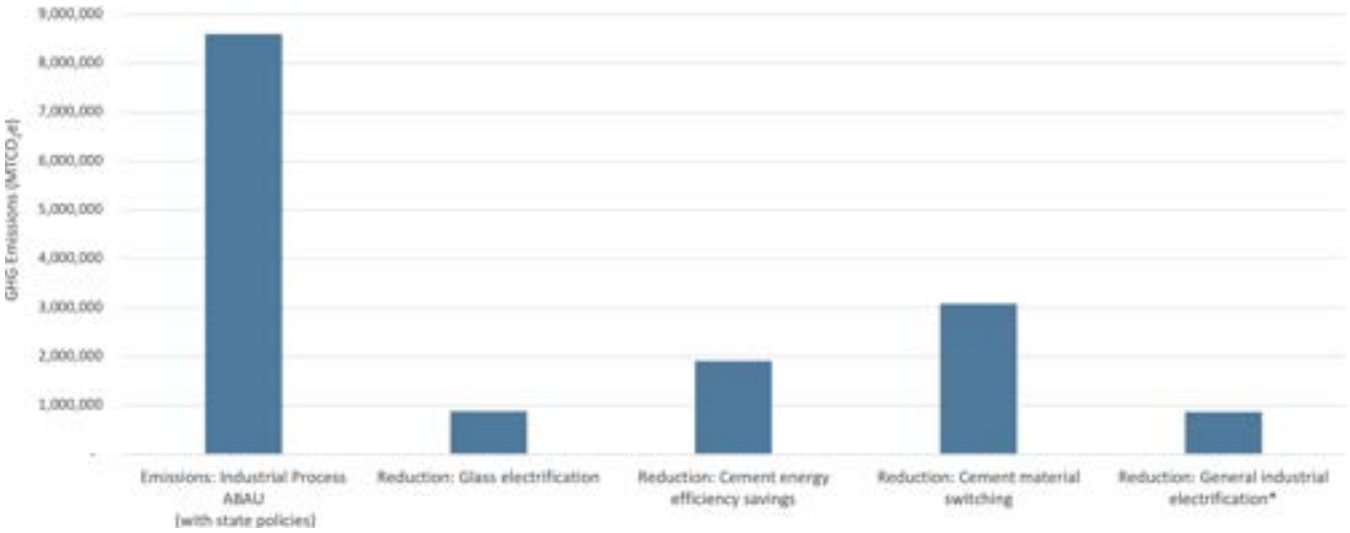
259. See Figure 3a.i.2 for net positive abatement costs. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 11/26/25. Pg 28.

Although the above examples yield cost savings, **many decarbonization projects take longer to realize payback,** or cannot achieve payback of the initial investment without additional subsidies at their current retrofit costs. A good example would be an option like switching to hydrogen fuel to support decarbonization of natural gas heating in industrial steel production. Although this activity can achieve a reduction of approximately 40,000 $MTCO_2e$ annually for an individual site, its estimated initial cost would be between $7 million to $14 million.[260] The lesser cost relies on a project using the Clean Hydrogen Production Credit production tax credit (45V), though recent legislation would now require that project to begin before the end of 2027.[261]

The complexity of individual industrial subsectors and sites, the details that influence financing retrofits, and the varying state policy options that could help advance industrial retrofits underscore the need for staffing to support this action if pursued.

In support of developing this Strategy, King County asked consultants to estimate possible GHG reductions for different retrofit options and sites in King County, some of which would retrofit building features and others might change operational or materials composition. While only general estimates can be achieved without specific site information, preliminary analysis yielded promising potential of between 700,000 to over 3 million $MTCO_2e$ cumulative emissions reductions for projects at individual sites between 2025-2030.

Figure 8-1: *Cumulative 2025-2050 GHG Reduction Estimates, Site-Specific*



**General industrial electrification is for a specific site; overall electrification GHG reduction estimates will vary depending on site details, including specific equipment and fuel usage.*

260. Assumes abatement cost range of $220–$500/tCO_2e for hydrogen heating; see Moors, Camellia, et al., "Opportunities for Industrial Modernization ...," ibid. Accessed 11/26/25. Pg 24.
261. Benson, Gregg and Helen Huang, "The OBBBA: A Major Shift in Federal Clean Energy Tax Incentives," JDSupra, September 17, 2025. Accessed 11/26/25.

There are many benefits to addressing industrial emissions beyond reducing GHGs, such as:

- **Reducing other air pollutants and particulate matter from industrial processes.**[262] Particulate matter is associated with increased mortality from all causes, including cardiovascular disease, respiratory disease, lung cancer, asthma, chronic obstructive pulmonary disease (COPD), heart attacks, strokes, and neurological effects.[263]
- **Addressing impacts to frontline communities, considering that, "disadvantaged communities are often located near industrial facilities and manufacturing plants..."** As such, reducing industrial pollution can create more equitable health outcomes.[264]
- **Increasing global competitiveness of local industries, especially when trading with countries that prioritize products with low embodied carbon (for more information, see the next Strategy Action).** A notable example of increasing global competitiveness is within the European Union (EU) whose Carbon Border Adjustment Mechanism (CBAM) goes fully into effect in 2026.[265] CBAM is mechanism to put a "price on the carbon emitted during the production of carbon intensive goods that are entering the EU, and to encourage cleaner industrial production in non-EU countries."[266]

262. Leane, Diane, et al., "Industry Must Decarbonize: Cross-Sector Initiative Shows the Way in New Blueprint," WRI, April 24, 2024. Accessed 2/19/25.
263. Leane, Diane, et al., "Industry Must Decarbonize...," ibid. Accessed 12/8/25.
264. University of California Berkeley, "New method for mapping air pollution reveals disproportionate burden in disadvantaged communities," September 2024. Accessed 2/19/25.
265. Leane, Diane, et al., "Industry Must Decarbonize...," ibid. Accessed 2/19/25.
266. European Commission Taxation and Customs Union, "Carbon Border Adjustment Mechanism," February 2025. Accessed 3/10/25.

EQUITY CONSIDERATIONS

Industrial decarbonization may have the following equity impacts.

Benefits include:

+ Reduced pollution and higher air quality in local industrial sites, often located near frontline communities that bear the burden of high-emitting manufacturing activities.[267]
+ Paired with workforce development initiatives, industrial decarbonization can bring new, green jobs to the region that can support frontline community economic development.

Potential unintended impacts include:

× Industrial decarbonization may lead to job loss and challenges reskilling workers to meet the demands of new workforce needs.
× Higher production costs associated with a decarbonized production line may lead to higher prices downstream for consumers in the short term.[268]

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Leverage local and county workforce development programs such as the King County Jumpstart program to reskill frontline communities, ensuring economic development and renewed job access.
» Provide public incentives for decarbonized production lines to keep downstream costs low for consumers until production lines meet cost parity with non-decarbonized lines.

POTENTIAL NEXT STEPS FOR THIS ACTION

- **Create an industrial decarbonization taskforce** to foster collaboration within and across industrial sectors. This can help King County identify viable technological options to support industry stakeholders with the decarbonization process.
- **Conduct feasibility studies on decarbonization for specific industries,** including possible retrofits for alternative fuels such as wastewater co-processing, hydrogen, and biofuel in industrial operations. Include analysis on the air quality and environmental impacts of potential industrial retrofits.
- **Identify long-term financial instruments** that can incentivize industrial decarbonization, for high-cost innovative technologies.

267. Mohai et al., "Racial and Socioeconomic Disparities in Residential Proximity to Polluting Industrial Facilities: Evidence from the Americans' Changing Lives Study," American Journal of Public Health. July 2008. Accessed 10/28/25
268. Attwood, J., "The Cost of Decarbonizing Industry is High, But Within Reach," BloombergNEF, July 2024. Accessed 11/9/25.

At the state level, a recent RMI report identified several activities that could support decarbonizing the industrial sector in Washington state. It should be noted this report also advocates for setting new benchmarks and no-cost allowance reduction schedules by industrial sector.[269] The RMI report recommendations for action at the state level are as follows:[270]

- **Essential activities focused on updating state standards and regulations, including:**
  - Expediting electrical grid enhancements for industrial electrification.
  - Accelerating permitting procedures for critical decarbonization projects.
- **Recommended activities included:**
  - Reforming industrial electricity tariffs and ratemaking
  - Updating existing rules on oil refineries
  - Setting up an industrially focused green bank
  - Increasing funding for the Hard-to-Decarbonize Sector Grants Program
- **Activities deemed "worth considering" include:**
  - Introducing a clean heat standard.
  - Expanding methane regulations.
  - Augmenting technical assistance planning grants for decarbonization.
  - Strengthening state procurement requirements.
  - Introducing tax credits for emissions-reducing equipment.
  - Introducing tax credits for clean manufacturing production.
  - Investing in common carrier infrastructure for transporting green hydrogen.
  - Incentivizing transitions of refineries to other functions.

Another potential action to help advance industrial retrofits would be to adopt low embodied carbon requirements for King County capital projects and private developments to incentivize facility GHG reductions. For more on this topic, see the subsequent Strategy action, Embodied Carbon Emission Reductions.

269. Moors, Camellia, et al., "Opportunities for Industrial Modernization...," ibid. Accessed 11/26/25. Pg 6.
270. Moors, Camellia, et al., "Opportunities for Industrial Modernization...," ibid. Accessed 11/26/25. Pg 7.

9. Embodied Carbon Emissions Reductions

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 33: Achieve Embodied Carbon Reductions Through Building Codes and Market Support; GHG 67 also addresses embodied carbon of materials used in County capital projects. This Strategy Action explores additional policy or program elements that could advance this SCAP Action.

ACTION

Reduce emissions associated with the building lifecycle by implementing embodied carbon requirements for public and private projects and build industry support to achieve reduced emissions and pollution and strengthen the local construction materials economy.

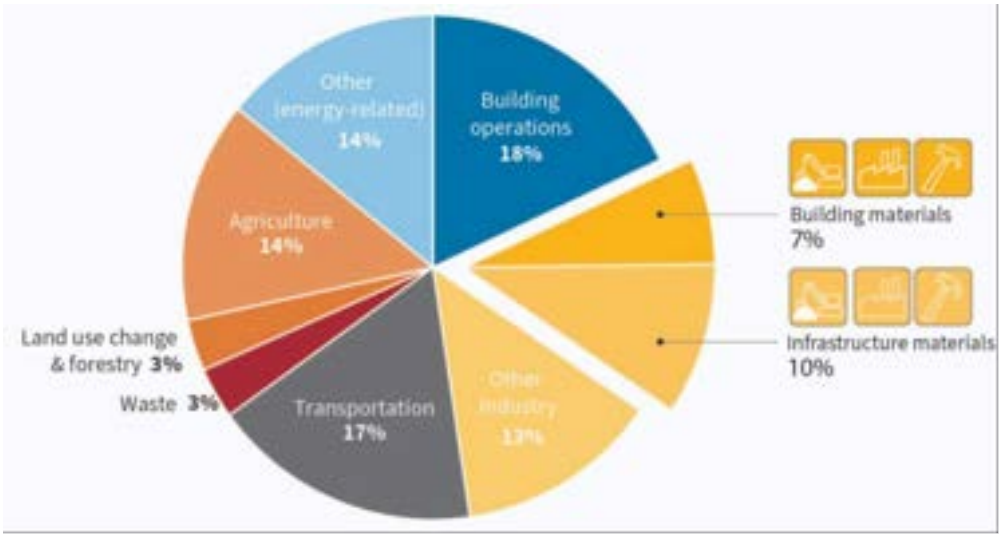
BACKGROUND

The U.S. Green Building Council and RMI define embodied carbon as, "the greenhouse gas emissions associated with material and construction processes throughout the whole lifecycle of a building, including raw material extraction, manufacturing and processing, transportation, installation, maintenance, repair, replacement, and waste processing."[271] Embodied carbon makes up a large percentage of global greenhouse gas (GHG) emissions, approximately 17 percent as shown in the pie chart on the following page.[272]

Policies and programs directed at reducing embodied carbon emissions not only can reduce emissions associated with building materials broadly but can also incentivize industrial actors to reduce emissions locally at manufacturing facilities. As indicated by Figure 8-1, some of the highest industrial emissions in King County are from entities manufacturing construction materials for buildings such as cement, steel, glass, and other products.

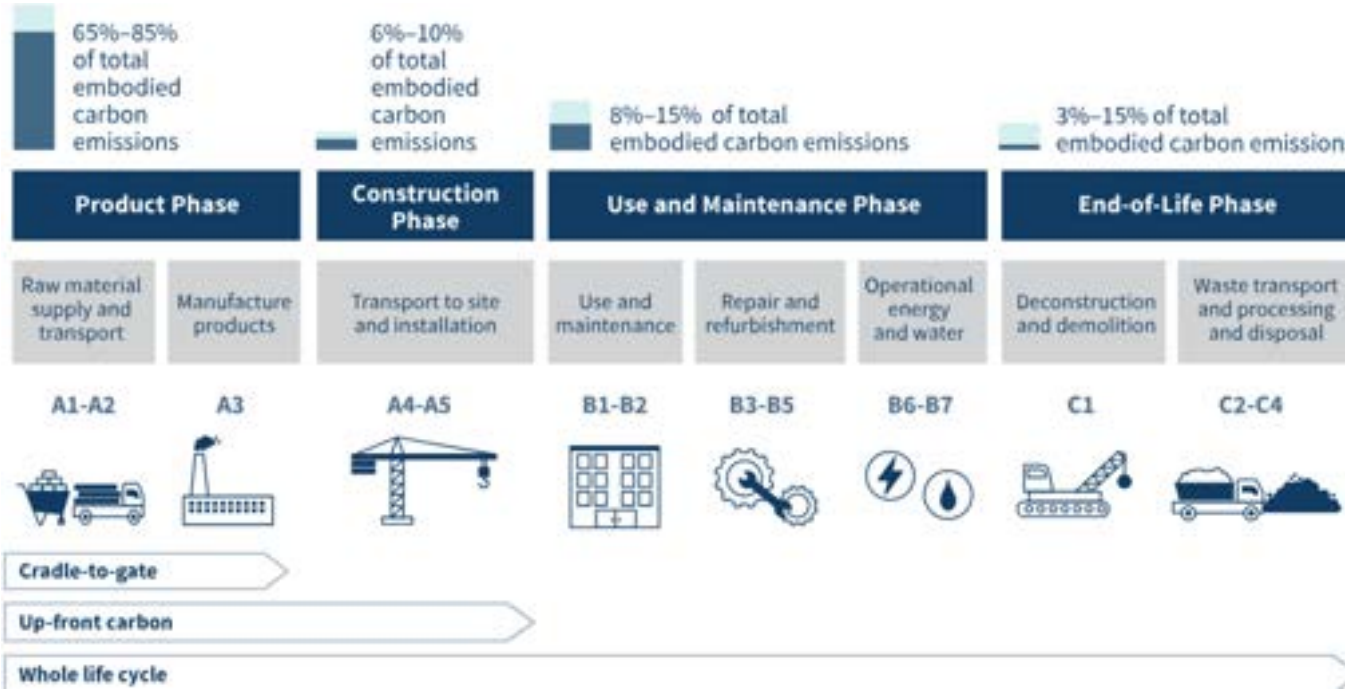
271. U.S. Green Building Council (USGBC) & RMI, "Driving Action on Embodied Carbon in Buildings," September 2023. Accessed 2/10/25. Pg 11.
272. Carbon Leadership Forum (CLF) et al., "A Study of the Language Addressing Embodied Carbon Used in the Building Codes in Other Jurisdictions," November 2024. Accessed 2/10/25. Pg 11.

Figure 9-1: *Global end-use GHG breakdown by sector in 2019.*[273]



Typically, most embodied carbon emissions in a building's lifecycle are associated with the product phase as outlined in the diagram below, which include both raw material supply as well as product manufacturing.[274]

Figure 9-2: *Life-Cycle Assessment Phases*[275]



Under the "Buy Clean Buy Fair Act," Washington State will requires that public construction and renovation projects report on environmental and labor standards performance, including reporting on the embodied carbon of building materials.[276]

273. Carbon Leadership Forum et al., "A Study of the Language Addressing Embodied Carbon Used in the Building Codes in Other Jurisdictions," November 2024. Accessed 2/10/25. Pg 11.
274. Rempher, Audrey, Rebecca Esau, and Madeline Weir, "Embodied Carbon 101: Building Materials," RMI, March 2023. Accessed 2/10/25.
275. Lifecycle assessment phases, source: Weir, Madeline et al., "Embodied Carbon 101: Building Materials," March 2023. Accessed 2/10/25.
276. 68th WA State Legislature, "Public Building Construction and Renovation – Environmental and Labor Reporting," H.B. 1282, 2024. Pg 2-3; Also, Carbon Leadership Forum (CLF) et al., "A Study of the Language Addressing Embodied Carbon Used in the Building Codes in Other Jurisdictions," November 2024. Pg 37. Accessed 2/10/25.

Specifically, this legislation requires facility-specific environmental product disclosures (EPDs) and the material quantity reporting for many commonly used construction materials.[277] Reporting started in January 2025 for public building construction over 100,000 sq. ft. in size, and will begin in January 2027 for public buildings construction over 50,000 sq. ft.[278] The law also establishes a database for tracking EPDs, a technical advisory committee which develops policy recommendations for building materials and their supply chains, and a supplier code of conduct or a manufacturer-created policy that outlines steps taken to ensure that its suppliers adhere to ethical practice.[279]

Overall, there is a wide range of policy options to address embodied carbon, as embodied carbon emissions occur across the building lifecycle. Some of these options include:[280]

- Supporting the reuse of existing building materials to extend their lifespan, limiting the necessity for new materials.
- Right-sizing construction projects to ensure that buildings are designed strategically to limit resource waste.
- Evaluating emissions and carbon storage potential when procuring building construction materials, along with typical criteria such as durability and cost.
- Incorporating circular-design principles during construction, to reuse building components at end-of-life

OVERVIEW

In 2024, King County was awarded a $50 million Climate Pollution Reduction Grant (CPRG) from the Environmental Protection Agency, funding an Embodied Carbon Program Manager tasked with:

1. Creating low embodied carbon requirements for King County government capital projects.
2. Pursuing embodied carbon requirements for private construction in King County and state building codes.
3. Supporting industry participation in efforts to reduce embodied carbon related to construction.

This action emphasizes the importance of this activity in the context of few existing policy and program options available at the local level to support industrial sector decarbonization. Although CPRG grant support is a good start, long-term funding to provide staff support of this action will be key for its successful implementation. Additional consultant support may also be needed for action implementation.

This action is aligned with goals in the 2025 Strategic Climate Action Plan (SCAP) which, under SCAP action GHG 67, directs King County agencies to reduce the embodied carbon of materials used in King County capital projects. All agencies

277. CLF et al., "A Study of the Language Addressing Embodied Carbon ..." ibid. Accessed 12/8/25. Pg 37.
278. CLF et al., "A Study of the Language Addressing Embodied Carbon ..." ibid. Accessed 12/8/25. Pg 37.
279. CLF et al., "A Study of the Language Addressing Embodied Carbon ..." ibid. Accessed 12/8/25. Pg 37.
280. USGBC & RMI, "Driving Action on Embodied Carbon...," ibid. Accessed 2/10/25. Pg 20.

with capital programs should evaluate which capital programs and projects in their Capital Improvement Program use the largest volumes of high-embodied carbon materials such as concrete, asphalt, carpet, steel, gypsum, rebar, and wood, and identify which capital projects and programs will use lower embodied carbon contract specifications for the highest-carbon materials. Agencies will coordinate with the CPRG Embodied Carbon Manager to evaluate materials, ensure alignment, and gather data on avoided embodied carbon emissions.

The SCAP also commits King County to achieving embodied carbon reductions through building codes and market support. Requiring embodied carbon reductions through building codes are a mechanism that helps incentivize manufacturers to develop low-carbon products. The County will work to reduce the embodied carbon of construction materials used in commercial and large multifamily buildings through building code amendments and supporting applicable state codes. In this code development process, King County will assess potential impacts to affordable housing and homeownership and explore the best practices to approach this market segment including, but not limited to, pursuit of additional revenue or rebates to offset added housing costs. The program will also support private industry in developing and publishing Environmental Product Declarations (EPDs) and set Global Warming Potential limits in public and private construction projects.

In terms of cost impacts to development projects, current research suggests that between 19 to 46 percent of embodied carbon emissions can be reduced at cost premiums of less than one percent to materials, with some of the most notable reductions possible in high-emitting areas of concrete and steel; see Figure 9-3 for more details by product types.[281]

Figure 9-3: *Reducing Embodied Carbon in Buildings*[282]

However, it is important to distinguish material costs from design costs, which can vary based on the types of products used, location, and reuse/design strategies, as well as the type of project analysis conducted, namely existing building reuse, individual EPD material review, or completing a whole building life cycle assessment (WBLCA):

281. Esau, Rebecca et al, "Reducing Embodied Carbon in Buildings," RMI, 2021. Accessed 2/10/25.
282. RMI, "Reducing Embodied Carbon in Buildings: Low Cost, High Value Opportunities" 2021. Accessed `12/19/2025.

- Building reuse costs are typically minimal, centering on staff time to calculate floor areas and complete relevant paperwork.[283]
- Material EPD review costs include staff time and often purchase or temporary access for assessment tools. Typical projects are constructed with multiple types of concrete, concrete masonry units (CMUs), rebar, steel, and wood products, requiring 32 EPDs for typical projects or up to 50 EPDs for complex projects. Without including overhead, these EPD review costs can range broadly from $2,500-$50,000.[284]
- Analysis for whole building life cycle assessments (WBLCAs) range between $15,000-$100,000 during the entire project timeline.[285]

Costs to manufacturers to generate EPDs for products vary depending on the type of material and individual facility history with EPD generation.

- First time, stand-alone EPD generation typically costs $20,000-$35,000, including a minimum of $15,000 for the initial product preparation from a facility, $5,000 for third party verification, and $1,000 for publication. After EPD creation, the product line EPD can continue for five years unless there are large changes to the product.
- EPD generator tools have achieved cost reductions, however, yielding EPDs under $1,000 apiece. These have a starting cost of $3,000-$6,000 for the manufacturing plant, a $1,000 verification fee, with a five-year access window to generate unlimited EPDs. This approach is very helpful when there is high variety across product generation, most notably, "ready-mixed concrete EPDs, which are often made custom for a project using EPD generator tools due to the wide range of mixes."

Some of these EPD generation options may translate into opportunities to reduce EPD costs for smaller manufacturers as King County continues to develop its embodied carbon programming.

Action Goals

This action would aim to:

- *Support and stimulate procurement of local green building materials and inspire local producers to pursue additional decarbonization measures.*
- *Provide education and technical assistance to support smaller businesses in complying with potential embodied carbon requirements.*

COSTS ESTIMATES

The program currently has one full-time employee (FTE) staff supporting the embodied carbon action, supported by the grant through October 2029. Approximately $275,000 was budgeted to assist with general program activities over

283. CLF et al., "A Study of the Language Addressing Embodied Carbon," ibid. Accessed 2/10/25. Pg 79.
284. CLF et al., "A Study of the Language Addressing Embodied Carbon," ibid. Accessed 2/10/25. Pg 79.
285. CLF et al., "A Study of the Language Addressing Embodied Carbon," ibid. Accessed 12/1/25. Pg 80.

the five-year grant (i.e., $55,000 annually), but these funds are for broad consultant assistance to establish the embodied carbon program. As specific activities are identified, additional funding may be needed such as support efforts for small business compliance. Finally, long-term funding will need to be identified to support FTEs and program activities after the grant term has ended.

ESTIMATED IMPACTS AND CO-BENEFITS

As various activities can be pursued under an embodied carbon program, there is a range of GHG reduction potential for individual activities. The below provides GHG reduction estimates that were developed for the CPRG grant, as well as initial estimates for activities developed with consultants in support of this Strategy. These activities estimate a potential reduction of:

- **58,000 metric tons of carbon dioxide equivalent ($MTCO_2e$)** from 2025-2030 through embodied carbon reductions in King County capital projects.[286]
- **130,000-245,000 $MTCO_2e$** annually by incentivizing deconstruction and renovation over demolition and building new structures for cement and steel, respectively.[287]
- **245,000 $MTCO_2e$** annually by setting an emissions standard for steel. This could also incentivize local steel procurement given the region's relatively low-GHG steel production.
- **200,000-520,000 $MTCO_2e$** annually by adopting procurement standards that requires a percentage of cement to be either blended cement or novel cement (which bypasses clinker entirely), respectively.

Embodied carbon programs can bring numerous other regional benefits beyond just GHG reduction, such as:

- **Incentivizing industrial retrofits that lower local air pollution levels.** This benefit is key as frontline communities are more likely to be located near industrial air pollution.[288]
- **Incentivizing increased sales** of locally manufactured low-emitting products.[289]
- **Supporting a competitive advantage in manufacturing** with increasing global demand for low embodied carbon products.[290]

286. Based on an internal 2021 report on 2019 operations and capital projects, matching construction contract expenses against the Environmental Protection Agency environmentally-extended input-output (USEEIO) goods and services based on based on County staff review of deliverables in physical construction, landscaping, equipment, and professional services in typical projects. This report found King County capital project embodied carbon equated to 58,380 $MTCO_2e$ annually. GHG reductions estimated a 10% embodied carbon reduction could be achieved in 2026, with another 10% annually thereafter through 2025.
287. Projections assumed a 20% reduction in cement demand and steel demand through activity implementation.
288. Goplerud, Dana, et. al, "The Spatial Relationship Between the Low-Income Housing Tax Credit Program and Industrial Air Pollution," Cityscape – a publication of the publication of the U.S. Department of Housing and Urban Development (HUD), 2022. Accessed 12/2/25. Pg 183.
289. Rempher, Audrey, Rebecca Esau, Madeline Weir, "Embodied Carbon 101...," ibid. Accessed 12/2/25.
290. Rempher, Audrey, Rebecca Esau, Madeline Weir, "Embodied Carbon 101...," ibid. Accessed 12/2/25.

EQUITY CONSIDERATIONS

Embodied carbon requirements may have the following equity impacts.

Benefits include:

+ Reduced pollution and higher air quality in local manufacturing sites, often located near frontline communities who bear the burden of high emitting activities.
+ Incentives for product reuse can strengthen local economies and catalyze development of new businesses to accommodate circular supply chains.

Potential unintended impacts include:

✖ Increased construction costs, reducing production of an already expensive market and potentially causing cost passthrough to future buyers and tenants.
✖ Small contractors may be at a disadvantage in consideration for contracts with heightened procurement policies.

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Implement small contractor support programs to upskill small contractors in sustainable purchasing and embodied carbon requirements.
» Pair embodied carbon requirements with anti-displacement and affordability incentives, including offering grants or subsidies to affordable developers committed to embodied carbon policies.

POTENTIAL NEXT STEPS FOR THIS ACTION

- **Amend King County's Green Building Ordinance to require assessments** (EPDs for high carbon materials or WBLCAs), with targets to reduce embodied carbon for King County's capital projects. Identify opportunities to reuse, right-size, and dematerialize King County-funded building construction.[291]
- **Provide publicly accessible local information,** tools such as the EC3 calculator, and contractor information for reducing embodied carbon emissions in a centralized web platform.
- **Permit and provide resources for developers** to incorporate adaptive reuse for buildings in unincorporated King County.[292] Incentivize deconstruction and renovation over demolition and building new.

291. USGBC & RMI, "Driving Action on Embodied Carbon...," ibid. Accessed 2/10/25. Pg 20.
292. City of Portland Bureau of Planning & Sustainability, "Recommendations to Reduce Embodied Carbon in the Built Environment." March 2024. Accessed 2/10/25. Pg 81.

- **Fast-track permits for buildings in unincorporated King County** that take specific measures to reduce embodied carbon.[293] Examples include:
  - Existing building certifications that incorporate embodied carbon measures.
  - Building reuse.
  - Mass timber usage.
  - Low-embodied carbon design measures.
  - Designs to support deconstruction.
  - Submission of EPDs for high carbon materials.
  - Submission of a WBLCA.
- **Conduct outreach to small building material suppliers** to support generating additional EPDs to aid compliance with potential embodied carbon requirements.
- **Implement green procurement initiatives,** such as requiring a percentage of cement used in a project to be blended or novel cement. Alternative or blended cements use a higher percentage of low-carbon materials, including waste byproducts such as slag and fly ash or natural materials such as clay, whereas novel cement avoids the use of clinker altogether.

293. City of Kirkland, "High Performing Green Building Program." 2025. Accessed 2/10/25.

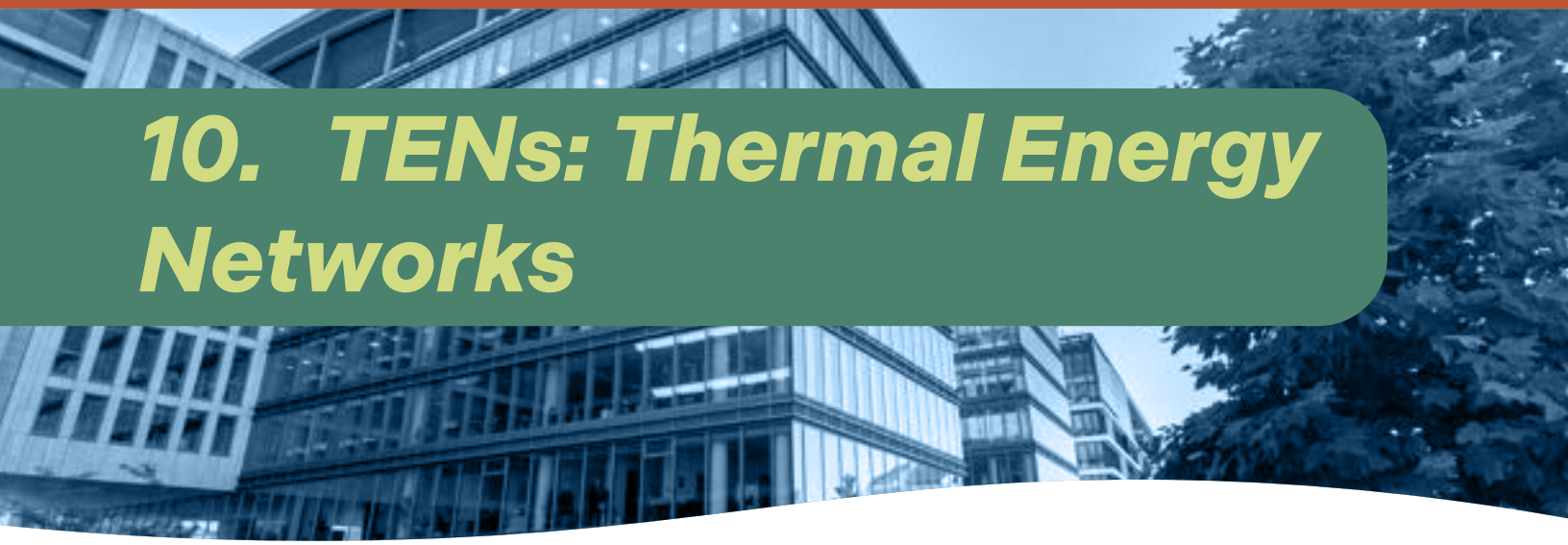
RESIDENTIAL, COMMERCIAL & INDUSTRIAL DECARBONIZATION ACTIONS

RESIDENTIAL, COMMERCIAL & INDUSTRIAL DECARBONIZATION ACTIONS

The characteristics and greenhouse gas (GHG) emissions of individual building sectors are reviewed in previous Strategy section introductions for the residential, commercial, and industrial sectors. See these summaries for more information.

This section is focused on the primary action to advance GHG reductions across all building sectors:

10. TENs: Thermal Energy Networks



10. TENs: Thermal Energy Networks

SCAP INTERSECTION

This activity intersects with King County Strategic Climate Action Plan (SCAP) Action GHG 39: Support District Energy and Thermal Energy Network Projects. This Strategy explores best practices and potential approaches to scale TENs in King County, providing rough magnitude estimates of their GHG reduction potential and implementation costs.

ACTION

Reduce the emissions, expended energy, and operating costs to heat and cool buildings through actions that help scale up the development and use of thermal energy networks (TENs).

BACKGROUND

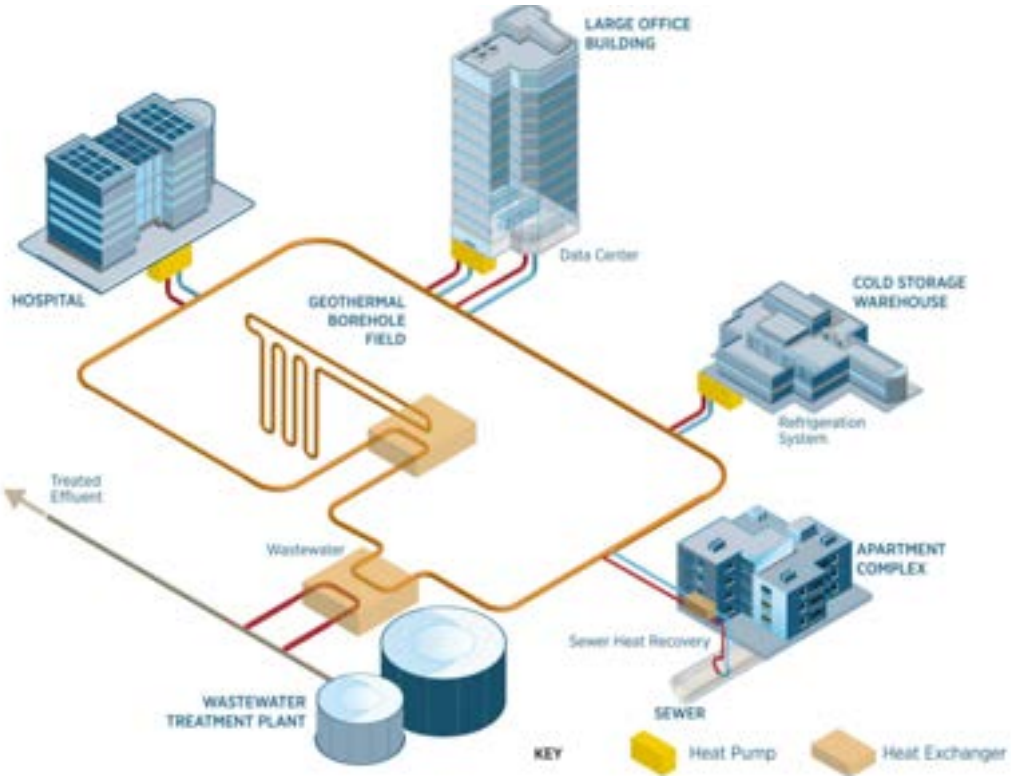
Thermal energy networks, or TENs, heat and cool multiple buildings through interconnected piped fluid, utilizing heating or cooling potential that would otherwise be wasted or go unused.[294] TENs are especially optimal in dense environments when multiple buildings with synergistic thermal load needs.[295] TENs are generally characterized by the ability to:[296]

- Couple heating and cooling loads across different applications via piped fluid, such as water. This allows systems to use one another as a sink or source for heat.
- Use heat pumps for heating and cooling distribution within each building while connected to a shared loop.
- Add borehole systems to store excess heating and cooling between seasons.

The diagram on the following page shows how buildings that generate waste heat as well as buildings with year-round cooling needs could be connected to a TENs system.

294. U.S. Department of Energy (US DOE), "Pathways to Commercial Liftoff: Geothermal Heating and Cooling Report #2," January 2025. Accessed 2/7/25. Pg 17.
295. Echoed by 4 out of the 5 interview calls made by consultants in exploration of this action. Also see Cohen, Nguyen, & Correll Smith, "Understanding thermal energy networks: A building decarbonization approach to achieving scale, equity, and high-quality union jobs," 2024. Accessed 12/5/25.
296. US DOE, "Pathways to Commercial Liftoff: Thermal," accessed 2/7/25. Pg 18.

Figure 10-1: *Thermal Energy Networks (TENs) Example*[297]



Although TENs are a newer concept, there is evidence that one category of TENs – district energy – was technically used by the Romans and in early France by circulating hot water among multiple houses.[298] Technically, TENs can cover a wide number of systems and heating sources, they merely have to distribute heat among a *network* of buildings and applications using noncombustible fluids such as water. Increasingly, TENs deploy very low and zero emissions sources of back-up or emergency power, further reducing reliance on natural gas.

> *Sources of thermal energy vary—from drawing heat from the earth through geothermal heat pumps to harnessing waste heat from industrial processes, sewage, or natural bodies of water.*

> *Thermal energy networks fall into two main categories, district energy and networked geothermal systems.*
>
> ***District energy systems** typically generate thermal energy centrally—often at industrial facilities—and distribute it through underground piping to residential and commercial customers. These established systems have served communities for decades, providing heat, cooling, or both to entities like universities and neighborhoods. As of 2022, district energy systems accounted for 9 percent of global final heating demand.*
>
> ***Networked geothermal** systems use ground-source heat pumps to provide heating and cooling to connected buildings via a shared underground loop. Heat pumps tap into the earth's constant temperature through shallow boreholes. This system uses distributed sources of heat rather than one central source.*[299]

297. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 18. Graphic adapted with permission by Marjorie Schott, National Renewable Energy Laboratory (NREL).
298. Danish Board for District Heating (DBDH), "District Heating History," 2025. Accessed 11/30/25.
299. Gajudhur, Nikhitha, "What's the deal with thermal energy networks?", Canadian Climate Institute, October 9, 2024. Accessed 11/30/25.

NETWORKED GEOTHERMAL: BENEFITS

As of 2025, at least 13 states were undertaking action to advance networked geothermal heat pump (GHP) systems, from supporting pilot projects, to explicitly allowing TENs development, to mandating utility design of TENs.[300] Other benefits include:

Emissions reductions ranging from 41 percent in the proposed Ulbrecht Heights multifamily project in Connecticut to 99 percent at Seattle's Alexandria Center for Life Sciences.[301]

High energy efficiency of TEN heating, typically four to five times more efficient compared to a natural gas boiler.[302]

Long lifespan of system components, as GHP components last an estimated 25 years, and ground loops have an estimated life of over 50 years.[303]

Accessibility to clean energy benefits such as improved indoor air quality, energy bill cost savings, and improved energy reliability for low- and moderate-income households and businesses who may not otherwise be able to afford the improvements.[304]

Job security and demand for workers with HVAC, drilling, and pipelaying and looping skills, which are often transferable from the gas industry.[305]

High energy efficiency of GHPs compared to both air source heat pumps and conventional fossil fueled heating and cooling systems, reducing the peak load on the grid in almost all climate zones and providing energy bill cost savings.[306] One study found that GHPs were 50 percent more efficient than air source heat pumps and realized up to 65 percent energy savings when compared to conventional fossil fueled systems.[307] Note that while GHPs may increase winter peak loads in cold climate zones, though these zones are not present in King County.[308]

Scalability to a larger set of buildings with different use-cases, including residential, commercial, and industrial buildings (such as wastewater facilities), with opportunities for long-term shared resource planning and bundling of procurement, demolition, and installation costs.[309]

300. Kim, June, "Underground thermal energy networks are becoming crucial to the US's energy future," MIT Technology Review, October 2023. Also, Building Decarbonization Coalition (BDC), "Thermal Energy Networks (TENs) State Legislation," 2025. Accessed 12/9/25.
301. Northeast Energy Efficiency Partnership (NEEP), "Connecticut Community Geothermal Case Study: Design and Feasibility," Connecticut Department of Energy and Environmental Protection, October 2024. Also, King County, "King County and Alexandria Real Estate Equities, Inc. launch sewer heat recovery at new South Lake Union campus, among first in the nation to tap wastewater heat for renewable energy," 2023. Accessed 12/9/25. Also, interviews with TEN developers, operators, and subject-matter experts, "Scaling TENs in King County," November 2025.
302. Interview with subject-matter expert, "Scaling TENs in King County," November 2025. Also, Cohen, Nguyen, & Correll Smith, "Understanding thermal energy...," ibid. Accessed 12/5/25. Cohen et al. cite Lopez (2024).
303. Massachusetts Department of Energy Resources, "Air and Ground Source Heat Pumps," 2025. Accessed 3/11/25.
304. Cohen, Nguyen, & Correll Smith, "Understanding thermal energy..." Accessed 12/5/25. Also, interviews with TENs developer and operator, and subject-matter expert, "Scaling TENs in King County," November 2025.
305. Cohen et al., "Understanding Thermal Energy Networks," Cornell University ILR Climate Jobs Institute, n.d. Accessed 2/7/25. Pg 11.
306. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 22.
307. Cohen, Nguyen, & Correll Smith, "Understanding thermal energy..." Accessed 12/5/25.
308. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 22. Also, "Why Knowing Your Climate Zone is Important," Northern Built, April 4, 2024. Accessed 11/30/25.
309. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 18.

EXISTING STATE POLICY ADDRESSING TENS

Passed in the state legislature in 2024, House Bill 2131 authorizes both electric and gas utilities to deploy TENs in Washington state.[310] The legislation also establishes a pilot program for TENs that prioritizes gas companies for grant funding, and allows gas companies to meet their "obligation to serve" through TENs.[311] The "obligation to serve" refers to a requirement that gas companies must, "provide gas and suitable facilities for providing gas to all people and corporations who may apply for gas service and be reasonably entitled to gas service."[312]

OVERVIEW

This Action would dedicate staff time to developing relationships with utilities, universities, potentially large industrial actors, large companies with sustainability or climate initiatives, TEN developers, and other frontline entities that are most likely to be active in the development of TENs in King County. Although there are already staff that have helped and continue to help track and support TENs development primarily as potential County capital projects, this action would benefit from a County staff member assigned to support TENs as a primary component of their duties.

Initial activities under this action would likely start with developing the current and potential TEN network, and outreach to other areas with TENs on specific code recommendations or incentives that would help support or accelerate TENs development. Subsequent, longer-term planning could advocate for additional activities at the state legislature or Utilities Transportation Commission to support TENs advancement; developing supportive financing models; streamlining and incentivizing TENs for utilities and developers; supporting workforce training; or seeking funding that would be integral in accelerating TENs scaling in the County.

In support of developing this Strategy, King County asked consultants to conduct national and local phone interviews on TENs developments and their potential for scaling in King County. A summary of interview outcomes is provided in the subsection, Potential Next Steps for this Action. The County also asked consultants to develop broad GHG reduction estimates for this effort, noted in the subsection of this action, Estimated Impacts and Co-Benefits.

EXAMPLES TENS PROJECT SCALES AND COSTS

Understanding the potential impact of TENs can be aided by understanding the range of projects sizes and building types that can be supported through TENs. The Building Decarbonization Coalition (BDC) is currently tracking 26 utility-led TENs pilots

310. Washington State Legislature (WA Legislature), "Promoting the establishment of thermal energy networks," H.B. 2131, 68th Legislature, 2024. Accessed 2/11/25. Pg 2-3.
311. WA Legislature, "Promoting the establishment...," ibid. Pg 7, and "Final Bill Report: Promoting the establishment of thermal energy networks," H.B. 2131, 64th Legislature, 2024. Pg 5. Accessed 2/11/25.
312. WA Legislature, "Final Bill Report: Promoting the establishment...," ibid. Accessed 2/11/25. Pg 5.

across in the U.S. across eight states.[313] TENs are being deployed across U.S. college campuses, military settings, and at a neighborhood scale.[314] Although these systems often have high upfront costs, the operating cost to users of current TENs systems is lower than typical systems due to their high efficiency levels.[315] Some national examples of TENs systems include:

Austin, TX: 800 homes are connected to the Whisper Valley, a neighborhood-scale networked geothermal sustainable development , with 7,500 housing units planned at full buildout.[316] The geothermal TENs grid is expanded at roughly 200-400 units at a time, with a one-time connection fee that transfers to the system owner-operator when the sale of a new home closes.[317] There is also a $60 average monthly fee to connect to the heating network that supports operations and maintenance, with the project citing a 50 percent cost reduction from a neighborhood system compared to installing GHPs per home.[318] Note that the $60 fee is in addition to monthly usage costs, which range from $45-$70 per month.[319] Approximately $2,000 is saved compared to the average home in the area, with 25-30 percent energy savings from the networked geothermal alone.

Framingham, MA: The nation's first and only operational utility-scale TEN connects 37 buildings, including 20 single-family homes, two duplexes, two public buildings, and five commercial buildings. The local utility Eversource serves 140 customers by the TENs system via 80 boreholes and 0.61 miles of main pipe. This system costs the utility between $15-$22 million, including construction and installation of the TEN system, energy efficiency upgrades, GHPs, and removal of fossil fuel equipment. Customers did not incur these upfront expenses, instead paying monthly fees of $8-$20 as determined by the utility.[320]

West Union, IA: A city-owned downtown TEN currently connects 11 commercial buildings but has the future potential to connect 56 buildings. The upfront TEN system cost was $2.2 million, with most of the project funding secured through federal grants. The 2019 operating cost for the system was $31,000, paid entirely by system users.[321] Annual savings range from $535 for a bank to $6,772 for the Courthouse compared to conventional natural gas heating.

In addition to these national examples, there are also several recent TENs projects in Washington state summarized on the following page.[322]

313. Bagdanov, Kristin and Kevin Carbonnier, "Momentum Q3 | 2025," BDC, October 7, 2025. Accessed 11/30/25.
314. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 27.
315. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 36.
316. BDC, "Case Study: Whisper Valley, Texas." Accessed 11/30/25.
317. BDC, "Case Study: Whisper Valley, Texas." Accessed 11/30/25.
318. Bagdanov, Kristin and Kevin Carbonnier, "Momentum Q3 | 2025," October 7, 2025. Accessed 11/30/25.
319. Jones, Terry, "It's Hot Everywhere Underground," Floodlight, June 26, 2025. Accessed 11/30/25.
320. Cohen et al., "Understanding Thermal Energy Networks," Cornell University ILR Climate Jobs Institute, n.d. Accessed 2/7/25. Pg 27. Also, $22M quote from BDC, "Case Study: Framingham, Massachusetts," Accessed 12/5/25.
321. Green Up West Union, "Frequently Asked Questions," 2025. Accessed 2/7/25
322. BDC, "Neighborhood-Scale Building Decarbonization Map," last updated October 7, 2025. Accessed 11/30/25.

- **OPERATIONAL PROJECTS:** Microsoft Redmond Campus, and the Amazon Seattle Headquarters and Alexandria Center for Life Science at South Lake Union, both in Seattle.
- **FILED PROJECTS:** Cascade Natural Gas project in Bellingham, Northwest Natural in Vancouver, and both the Maleng Regional Justice Center and Seattle University by Puget Sound Energy.

More information on the Alexandria Center for Life Science and Maleng Regional Justice Center projects can be found at the end of this Strategy section.

COST ESTIMATES

The baseline cost of this program to King County is estimated to be approximately 0.25 of a full-time employee (FTE) workload to pursue and support advocacy for TENs. Time requirements might vary depending on staff duties. For instance, more staff time would likely be needed if this position was asked to support locating funding or financing for projects, and additional capital planning and oversight staff might be needed if additional TENs pilots were pursued by King County.

Action Goals

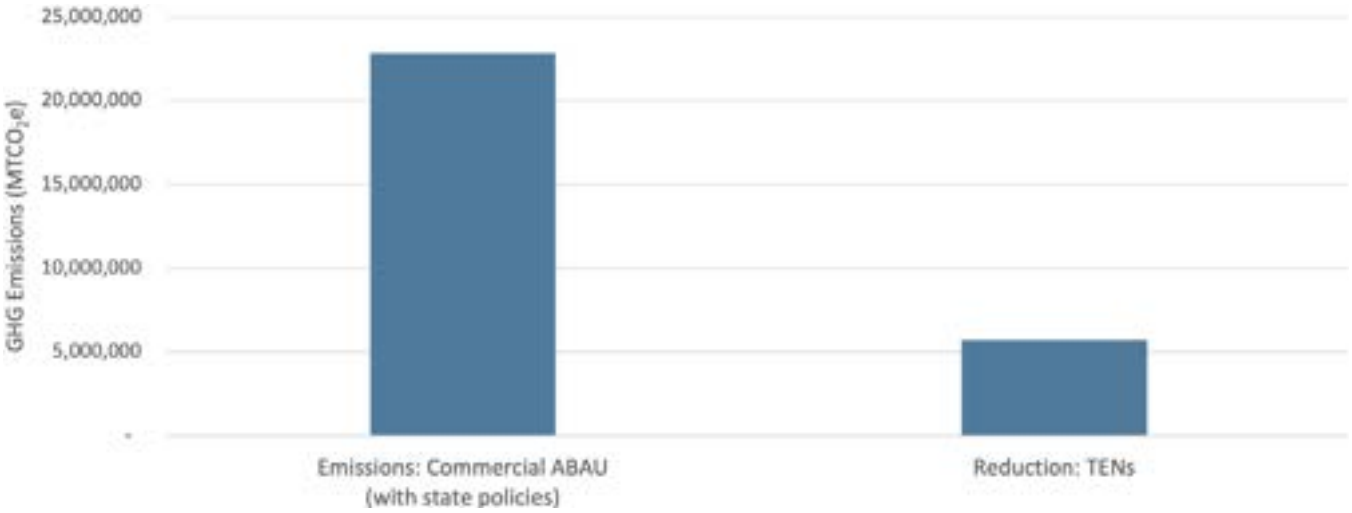
This action would aim to:

- *Develop policy and program elements to support expanded development of TENs both within King County and by external actors such as developers and utilities.*
- *Advocate for prudent policy measures at the state and with the Utilities and Transportation Commission (UTC) to support wider development of TENs projects.*

ESTIMATED IMPACTS AND CO-BENEFITS

The GHG reduction impact of this action would depend on the scope and scale of TENs adoption across King County. A broad, order-of-magnitude estimate is a potential reduction of 3.1-13.2 million $MTCO_2e$ in commercial building emissions reductions from 2035 to 2050, equivalent to a 14 percent to 58 percent emissions reduction in commercial building emissions. A 2035 start year was assumed as the date for broad implementation due to the added time to support technological adoption. When accounting for the remaining GHG reduction need once all existing state policies are taken into account, it could address over 20 percent of the remaining GHG reduction need for this sector. It should also be noted that this estimate is only for commercial emissions. Additional emissions reductions are possible for the residential and industrial sectors, however these emissions impacts are not currently estimated due to a lack of extensive published data for these building types thus far.

Figure 10-2: *GHG Reductions from Broad TENs Adoption, Cumulative 2035-2050*



EQUITY CONSIDERATIONS

TENs may have the following equity impacts.

Benefits include:

+ TENs can lead to lower operating costs for space and water heating through retrofit projects, replacing lower-efficiency gas appliances and electrical systems.
+ Replacing traditional gas networks, TENs reduce operational emissions from fossil fuels and lead to improved air quality and health outcomes.
+ Due to the higher efficiency of TENs systems, they can play a key role in decarbonizing utilities in the energy transition, leading to lower gas and electricity pricing long-term.

Potential unintended impacts include:

× High initial investments can exclude lower resourced developers and projects from instituting TENs.

Potential mitigation strategies to increase equity outcomes associated with this action include:

» Provide government incentives for TENs that specifically benefit frontline communities, such as waiving energy transfer fees or surcharges for developments that support low-income or senior housing.
» Integrate equity screening criteria into siting for potential projects to ensure TENs projects either benefit frontline communities or, at a minimum, avoid adverse construction impacts.

POTENTIAL NEXT STEPS FOR THIS ACTION

- **Evaluate codes** to ensure that local laws in unincorporated King County are conducive for developers to build TEN systems between buildings (such as right-of-way laws, incentives for thermal readiness in existing buildings, etc.).[323] King County could also consider requiring thermal readiness for some types of new developments.
- **Evaluate potential for King County to connect to TENs** via King County's wastewater treatment facilities, King County's sewer network, or other buildings that are uniquely positioned to support TEN systems.

323. Real Estate Solutions for Infrastructure, "The Crucial Role of Right of Way in Supporting Renewable Energy Projects," July 10, 2023. Also, Haakon Hagemeister, "Navigating Right of Way Challenges in Utility and Renewable Energy Projects," Steigerwaldt, November 2, 2023. Accessed 11/30/25.

- **Convene private and public sector entities** to identify potential pilot project opportunities such as hospitals, data centers, utility projects, etc.
- **Increase awareness, training, and skills** for the clean energy workforce to scale TENs adoption. Support for training could include encouraging and coordinating with regional workforce boards, relevant local unions, and energy efficiency programs to identify, develop, and implement needed trainings. Support for recruitment could include working to ensure at least 40 percent of candidates are from overburdened communities and providing wrap-around services and subsidies for recruitment and training endeavors.[324] Skilled HVAC technicians, heat pump installers, electricians, drillers, pipelayers, developers, and general contractors are vital for the implementation of TENs.[325]
- **Identify financial mechanisms or other incentives** to lower upfront costs of constructing TENs, including engaging with entities who may have capital to help address upfront costs such as colleges, utilities or government facility operators.[326]

In exploration of this action, King County asked consultants to conduct phone interviews with national and local stakeholders on their perspectives on TENs developments, as well as activities to help support broader scaling of TENs in King County.

Key roles for the County:

Regional outlook. Overall, the region is doing well on enabling policy and code.

Utility coordination. King County can work with utilities and developers to identify TEN opportunities, streamline permitting, align trenching and other work to reduce costs, smooth conflicts in the right of way, and otherwise incentivize and facilitate TEN projects. Thermal readiness. One option that could help would be laying pipe when streets are open in capital projects to make them thermal-ready, saving significant future costs for TENs supporting existing buildings King County could be the builder and owner of TEN piping, or could work with the private sector to install piping. Although some of those interviewed said existing gas infrastructure can be used for TENs, others thought it either should not use existing infrastructure or would not be ideal.

Incentive development. Explore and implement options that increase developer appeal to install or use TENs, such as through development incentives, exemptions for exceeding code minimums, example code to make developments thermal-ready, and so forth.

324. The 40% recommendation stems originally from alignment the Ulbrecht Heights project in Connecticut; see "Ulbrich Heights Geothermal Project Workforce Development and Training Plan". Accessed 12/10/25.
325. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 41.
326. U.S. DOE, "Pathways to Commercial Liftoff...," ibid. Accessed 2/7/25. Pg 56.

Funding and financing:

Public bonding. Many of those interviewed cited that King County could be a possible financer for private projects to complete projects up front through bonds, though this option would need to be vetted by legal counsel to ensure arrangements are technically feasible and so that County costs could be repaid. Municipal bonds were cited as a financing option of particular interest because they are a reliable source of long-term, low-interest financing.

Investment tax credit. In situations where the County could fully own the TEN or support another entity such as a developer to fully own the TEN, the project would be eligible for the federal investment tax credit (ITC) which typically provides at least a 30 percent and up to 50 percent tax credit for project costs.

Costs over time. Generally, any funding source that spreads costs over time was considered desirable. It is also beneficial when the ratepayers that bear the system cost over time also directly receive the system benefits.

Utility ownership versus external ownership. Some utilities do not yet want to own these systems as they are still relatively new and considered riskier, though this may shift in the next five or ten years once they are more common. For now, many utilities prefer a rate-recovery model where a private entity develops, owns and operates the system, charges the utility for the clean energy, and then that utility passes its costs on to customers. King County could also own sewer heat or wastewater TENs or pursue hybrid ownership structures where the County may lease land, sell its thermal resources, provide financing not accessible to other project partners, or simply support the partnership and permitting process.

There were diverging opinions on back-up power source for TEN systems:

Gas. Some entities recommended gas for resilience, though this would counter the driving impetus for TENs which is to reduce and hopefully eliminate reliance on fossil gas.

Other backups. There are examples of TENs using batteries, or thermal storage through means like water tanks. At a minimum, projects should be encouraged to cost out multiple options, using gas only as last resort given a range of other options, and preferably biogenic gas if needed.

Interviews also identified initial, ideal conditions developing for TEN systems:

Dense. Higher density areas, as it increases the thermal loads for those buildings.

Synergistic. Counterbalanced thermal loading (i.e., some buildings needing more heat and some needing more cooling) reduces electric loads.

Pipe-proximal. For sewer heat systems, relative proximity to existing pipe systems reduces costs.

Building type. There are diverging opinions on whether these systems are good for primarily single-family developments. While some systems have made it work (such as the Austin, TX. development of Whisper Valley), other experts advocate that more diverse building types, diverse thermal load needs, and higher building density is better.

Partnerships. Finally, and fundamentally, willing partners are key, as these systems do not work everywhere.

BUILDING DECARBONIZATION IN ACTION: KING COUNTY SEWER HEAT RECOVERY TEN

King County has piloted and plans to expand low-emissions district heating systems across the county in the coming years.

In 2023, King County announced it was launching a sewer heat recovery system in the five-building, 1.6 million sq. ft. Alexandria Center for Life Science—South Lake Union campus in downtown Seattle.[327] Sewer heat recovery draws heat from the sewer system and provides space heating and cooling to a campus of buildings, through a closed, odorless network of pipes.[328] The sewer heat recovery system installed by the County is projected to reduce emissions by 99 percent compared to a typical Seattle laboratory building while supplying 70 percent of the campus' heating needs.[329] King County is also supporting piloting thermal energy networks through using sewer heat recovery, in the Harborview Medical Center and the Maleng Regional Justice Center.

BENEFITS OF KING COUNTY'S SEWER HEAT RECOVERY (SHR) PILOT

Through a public-private partnership between King County and Alexandria Real Estate Equities Inc, the SHR will reduce energy costs to produce potable water. To support the project, King County waived an energy transfer fee for the first three years of operation.[330] This pilot was one of first SHR systems in the U.S. in a large commercial project and a dense urban environment.[331] The project is anticipated to become operational in 2026.[332]

Featured on King 5 News[333]

> *"'It's actually one of the first in the nation where we've been able to have a public-private partnership to allow private property owners to connect into the public sewer infrastructure, to use the heat that's traveling in those pipes underground,' Policy and Research Unit Supervisor Erika Kinno said."*

327. King County, "King County and Alexandria Real Estate Equities, Inc. launch sewer heat recovery at new South Lake Union campus, among first in the nation to tap wastewater heat for renewable energy," 2023. Accessed 7/11/25.
328. Swanson, Conrad, "Seattle pilot project uses the sewer to warm office buildings." The Seattle Times, October 2023. Accessed 7/11/25.
329. King County, "King County and Alexandria...," ibid. Accessed 7/11/25.
330. King County, "King County and Alexandria...," ibid. Accessed 7/11/25.
331. King County, "King County and Alexandria...," ibid. Accessed 7/11/25.
332. Thompson, Drew, Resource Recovery Project Manager, King County, direct email message to author, August 21, 2025.
333. Zucco, Erica, "New program will use heat from King County sewers to warm privately owned buildings," KING 5 News, October 2023. Accessed 7/2/25.

THERMAL ENERGY NETWORK (TENS) PILOT PLANS

King County is exploring TENs in some capital projects.

Harborview Medical Campus is a thirteen-acre medical campus and level 1 trauma center.[334] King County has issued a Request for Information to identify how a TEN could be designed to support reliable operations for up to five existing, and potentially two future buildings.

Maleng Regional Justice Center is a county detention center and courthouse owned by King County. Previously, Puget Sound Energy (PSE) proposed installing a TENs system to serve the justice center that could achieve, "a 31 percent reduction in energy, and a 90 percent reduction in fossil fuel use by 2050.[335] King County is currently exploring its options for TENs at this facility.

334. King County, "Request for Information Solicitation: Harborview Medical Center Energy District," May 2025. Accessed 7/11/25.
335. Washington Utilities and Transportation Commission (UTC), "Letter of Intent by Puget Sound Energy Inc. to Deploy a Thermal Energy Network Pilot Project," Docket No. UG-250455. Accessed 7/11/25.

ACRONYMS AND UNITS

ACEEE: American Council for an Energy-Efficient Economy

AMI: area median income

BAAQMD: Bay Area Air Quality Management District

BAU: business-as-usual

BEPS: Building Emissions Performance Standard

BESS: battery energy storage system

BTU: British thermal unit

CCA: Washington state Climate Commitment Act

CETA: Washington state Clean Energy Transformation Act

CBPS: Clean Building Performance Standards

CBAM: Carbon Border Adjustment Mechanism

CLF: Carbon Leadership Forum

CO2: carbon dioxide

CO2E: carbon dioxide equivalent

CPRG: Climate Pollution Reduction Grant

DOE: U.S. Department of Energy

EC3: Embodied Carbon in Construction Calculator

EITE: emissions-intensive trade-exposed

EPD: environmental product declaration

EPA: U.S. Environmental Protection Agency

ERV: Energy Recovery Ventilation

ESCO: energy services company

EU: European Union

FTE: full time employee

GHG: greenhouse gas

GHP : geothermal heat pump

GIS: geographic information systems

GWP: global warming potential

HES: Home Energy Score

HPWH: heat pump water heater

HRP: King County Housing Repair Program

HVAC: heating, ventilation, and air conditioning

KBTU: thousand British thermal units

LIHEAP: Low-Income Home Energy Assistance Program

MIT: Massachusetts Institute of Technology

MMBTU: million British thermal units

$MTCO_2E$: metric tons carbon dioxide equivalent

N_2O: Nitrous oxide

NOx: oxides of nitrogen, i.e., nitric oxide (NO), nitrogen dioxide (NO_2), other nitrogen oxides

NECAUM: Northeast States for Coordinated Air Use Management

NEEA: Northwest Energy Efficiency Alliance

NREL: National Renewable Energy Laboratory

NWMLS: Northwest Multiple Listing Service

OSE: City of Seattle Office of Sustainability and the Environment

PSCAA: Puget Sound Clean Air Agency

PSE: Puget Sound Energy

RTU: rooftop unit

RCW: Revised Code of Washington

SBCC: State Building Code Council

SCAP: Strategic Climate Action Plan

SEPA: State Environmental Policy Act

SES: Washington State Energy Strategy

SQ. FT.: square feet

TCMC: Thurston Climate Mitigation Collaborative

TENS: thermal energy networks

U.S.: United States

WA COMMERCE: Washington state Department of Commerce

WA ECOLOGY: Washington state Department of Ecology

WA OFM: Washington state Office of Financial Management

WA UTC: Washington state Utilities Transportation Commission

WBE: whole building electrification

WBLCA: whole building life cycle assessment

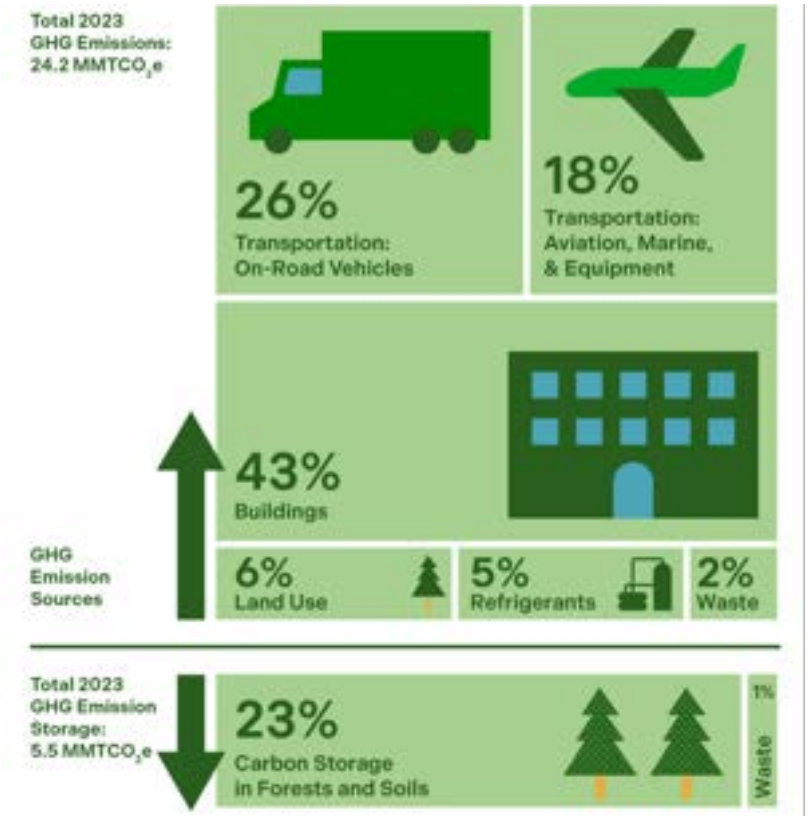
APPENDIX

APPENDIX 1. CURRENT BUILDING SECTOR EMISSIONS

EMISSION SOURCES

In 2023, greenhouse gas (GHG) emissions in King County were 24.2 million metric tons of carbon dioxide equivalent ($MTCO_2e$). Total emissions grew 4 percent compared to the 2007 baseline, though the population grew 25 percent over the same time period. Emissions from the built environment were 10.32 million metric tons of carbon dioxide equivalent ($MTCO_2e$) in 2023. This constitutes 43 percent of King County's overall emissions, making buildings the second largest source of emissions in the county. The emissions from King County buildings alone are equivalent to over 2.4 million gasoline powered passenger vehicles driven for a year.[336] King County emissions per source are indicated in Figure AA1-1 below.

Figure AA1-1: *2023 King County GHG Emissions by Source ($MTCO_2e$).*



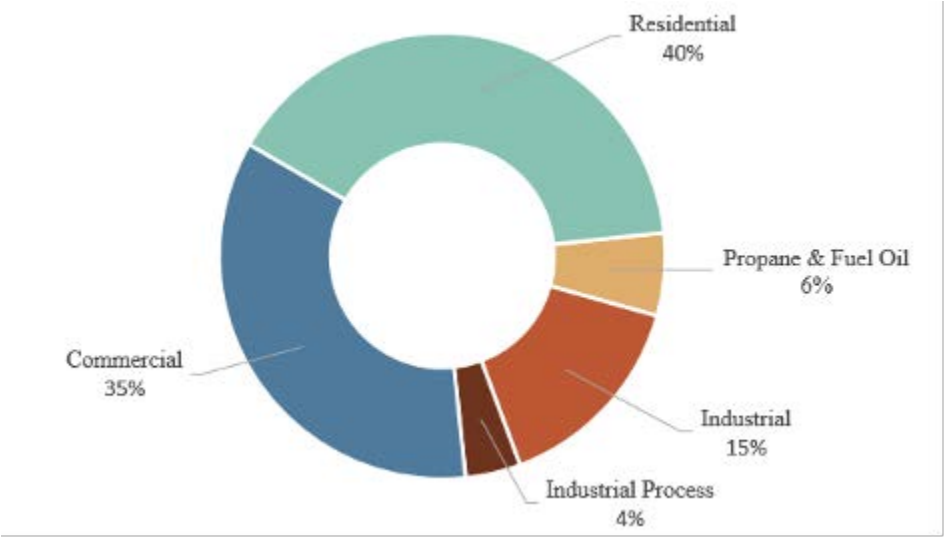
336. United States Environmental Protection Agency (U.S. EPA), "Greenhouse Gas Equivalencies Calculator," November 2024. Accessed 5/5/25.

BUILDING EMISSIONS BY SECTOR

The built environment is typically evaluated by varying building uses or sectors, such as residential, commercial, and industrial buildings, as well as industrial processes. Industrial process emissions are from chemical and physical processes that emit GHGs—such as when a cement plant heats limestone to create lime (calcium oxide) as an ingredient to form clinker, but the process of heating the limestone releases carbon dioxide. In contrast, industrial emissions refer to the emissions from energy sources required to operate the building and industrial equipment.

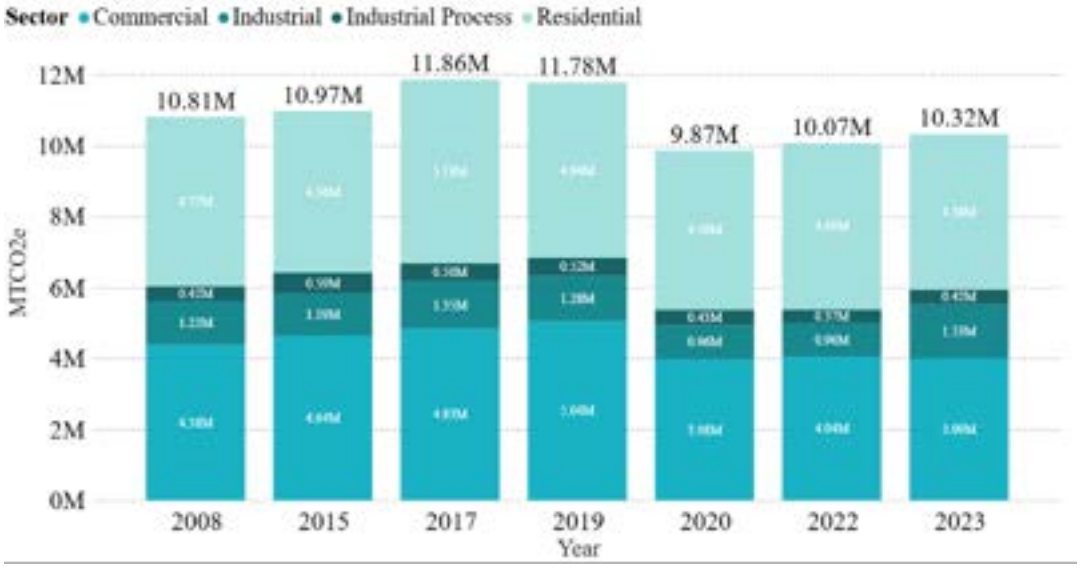
In King County, the residential sector comprises 40 percent of emissions, closely followed by the commercial sector which comprises 35 percent. Industrial emissions and processes account for 15 percent and 4 percent of emissions, respectively. Propane and fuel oil make up 6 percent of emissions, from a range of sectors. This data is represented in the Figure AA1-2 below.

Figure AA1-2: *King County GHG Emissions by Sector ($MTCO_2e$).*



King County has conducted emissions inventories since 2008, using a base year of 2007, where building emissions have declined 3 percent since 2007 and declined 12 percent since 2019. Emissions decreased in the residential and commercial sectors from 2007 to 2023, by 6 and 10 percent, respectively (and by 12 and 24 percent, respectively, since 2019). Industrial building emissions have increased over time 25 percent since 2007 and 59 percent since 2019. These trends are depicted in Figure AA1-3.

Figure AA1-3: *King County Total GHG Emissions from Buildings by Sector ($MTCO_2e$).*



BUILDING EMISSIONS BY FUEL TYPE

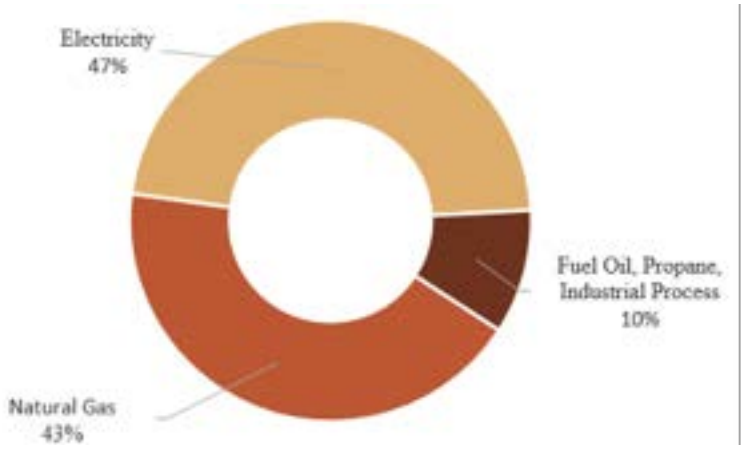
Fuels are used in buildings for multiple purposes, including heating or cooling space and water, cooking, lighting, and much more. Fuel types included in King County emissions inventories are electricity, natural gas, emissions from gas transmission and distribution, fuel oil, and propane.[337] Although industrial process emissions are not fuels, and gas lost through transmission and distribution systems are not ultimately utilized as fuel, these emissions are a byproduct of building operations and as such they are included to provide complete emissions inventories in the figures below. Alternative fuel sources such as wood are not included in the figure below, as data on wood fuel use for heating is not available.

Electricity and natural gas each comprise 43 and 47 percent of building sector emissions in 2023 in King County, making these fuels the highest source of emissions from buildings. As electricity in Washington shifts to more renewable sources, in compliance with the Clean Energy Transformation Act (CETA) requirements to be carbon neutral by 2030, it is expected that natural gas will make up an increasing percentage of emissions from buildings.[338] Fuel oil, propane, and industrial processes combined made up ten percent of King County's building emissions. This data is also shown in Figure AA1-4.

Propane and fuel oil contributions to emissions remain minimal in comparison to electricity and gas.

337. Gas inevitably leaks when it is transmitted and distributed. The gas leakage rate for Puget Sound Energy (PSE) is 0.93%; this is integrated in the King County emissions inventory and sourced originally from the PSE Integrated Resource Plan (IRP). See the "Plan" (IRP) filing on 3/31/2023 with the Utilities Transportation Commission, File Name: UG-220242-PSE-2023-IRP-Chapters-(03-31-2023).pdf. Section 5.9 Loss Factors, Pg 5.20. Leaked gas is composed of 93% methane which, although is only lasts a decade in the atmosphere, absorbs much more energy giving it a higher global warming potential (GWP) than carbon dioxide. To learn more, see Massachusetts Institute of Technology (MIT) Climate Portal, "How much does natural gas contribute to climate change through CO_2 emissions when the fuel is burned, and how much through methane leaks?" July, 2023. Accessed 7/31/25.
338. Washington Utilities and Transportation Commission (WA UTC), "Clean Energy Transformation Act." Accessed 9/15/25.

Figure AA1-4: *2023 King County GHG Emissions from Buildings by Fuel ($MTCO_2e$).*



ELECTRICITY

Several energy providers deliver electricity throughout King County, including Seattle City Light (SCL), Puget Sound Energy (PSE), Tanner Electric Cooperative, and the City of Milton's Electric Division. Electricity accounted for 18 percent of King County's total communitywide GHG emissions in 2023. Electricity emissions in 2023 decreased 23 percent since 2007 and decreased 34 percent since 2019. This reduction in electricity emissions can be attributed to decreases in industrial electricity consumption Figure AA1-6 and the carbon intensity of utility electricity fuel sources Figure AA1-7. The most significant change in emissions since 2019 stems from the closure of PSE's coal-fired power plants, Colstrip Units 1 and 2. These units were retired at the end of 2019, resulting in a sharp reduction in coal-fired generation. This reflects directly in Figure AA1-7, which shows a steep decline in carbon intensity beginning in 2019. A second major transition is planned for 2025, when ownership of the remaining Colstrip Units 3 and 4 will be transferred.

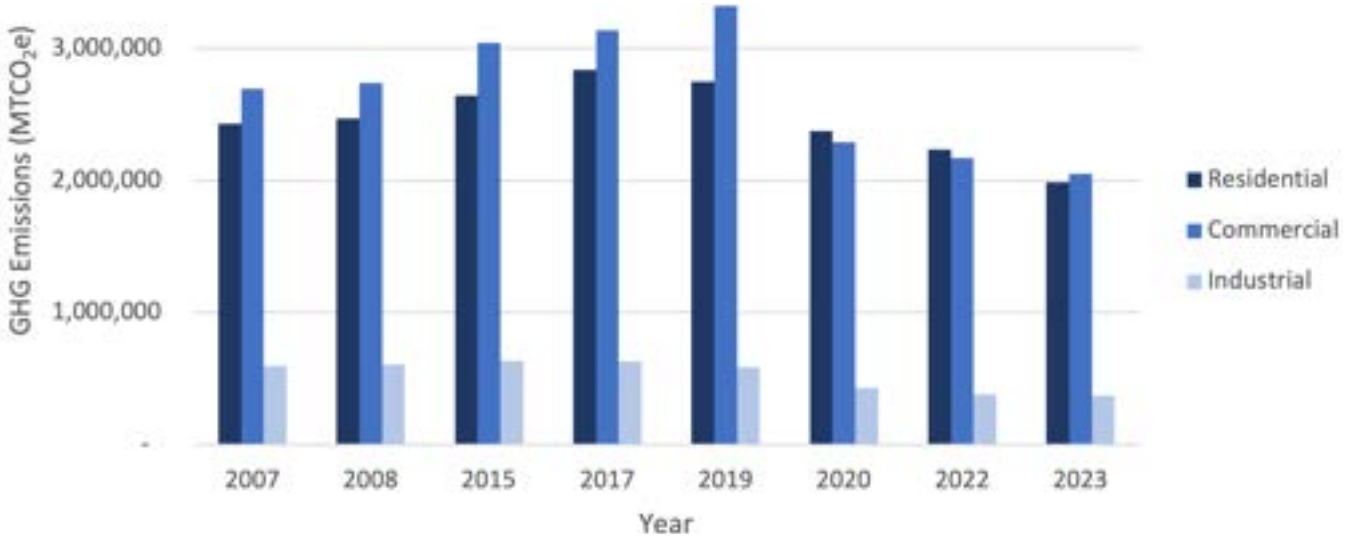


Figure AA1-6: *Electricity Consumption Trends by Sector.*[339]

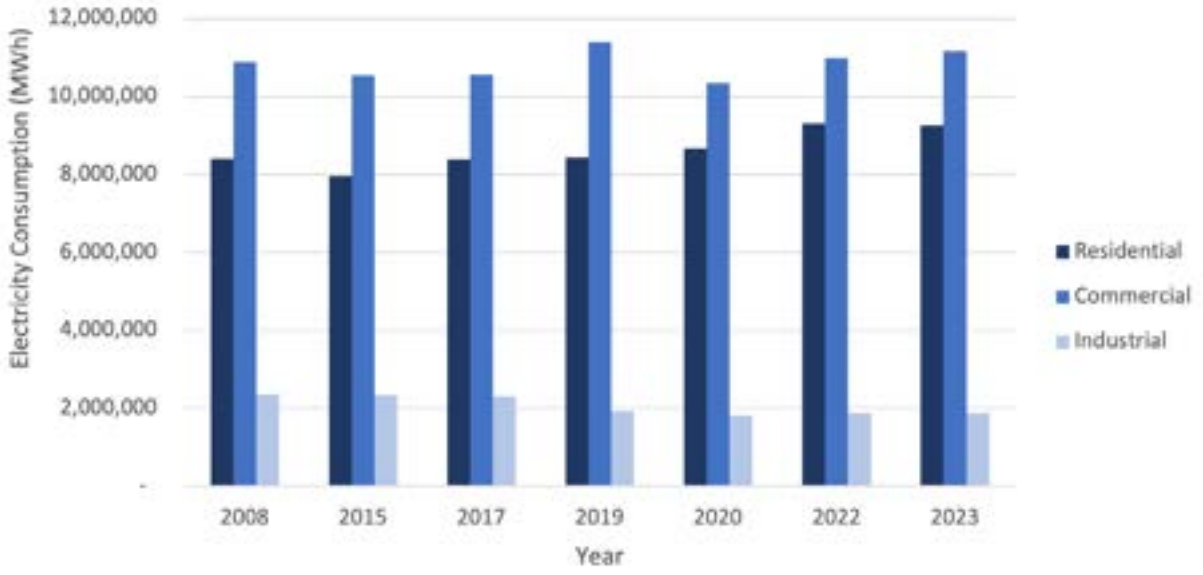
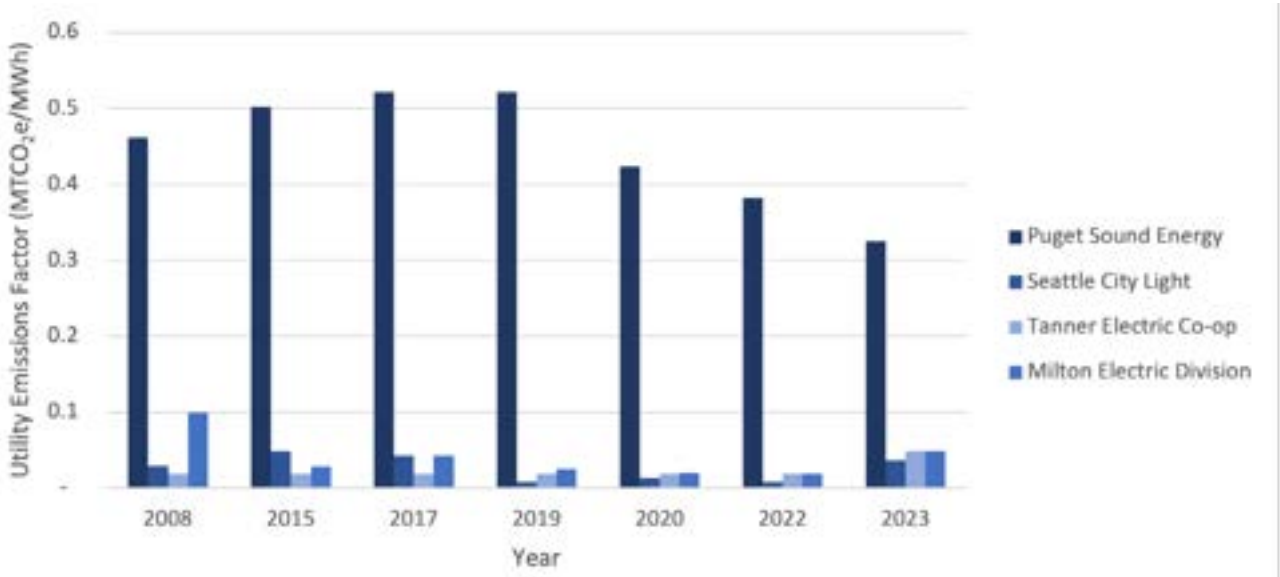


Figure AA1-7: *Electricity Carbon Intensities for King County Electricity Utilities.*[340]

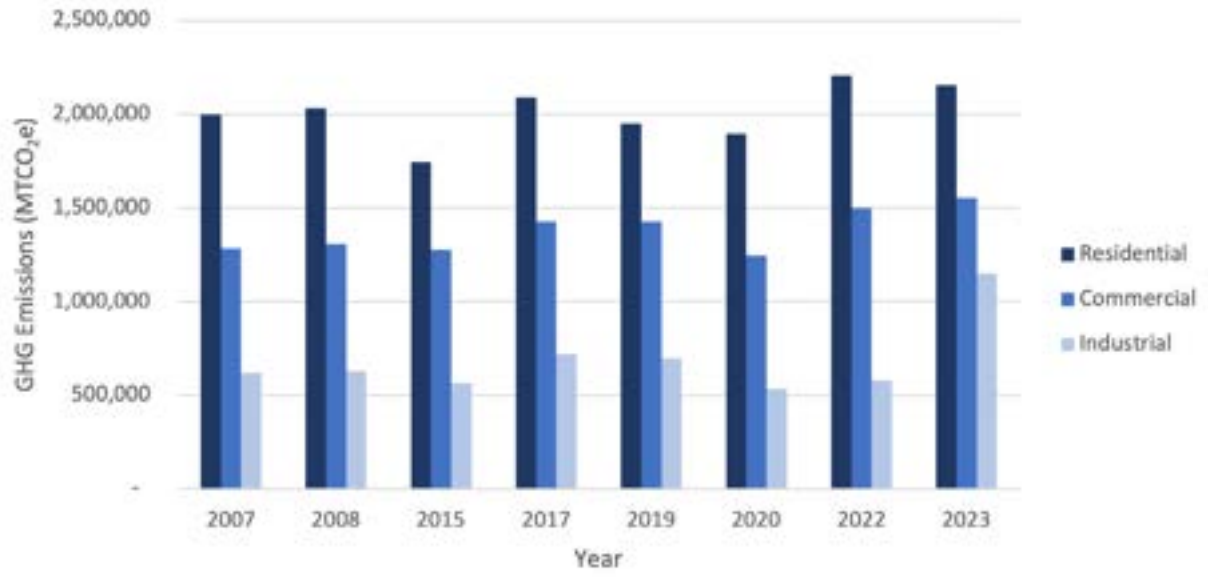


339. When assessing progress toward overall countywide GHG emissions reduction targets, comparisons are made to 2007 based on estimated 2007 GHG emissions by sector for that year. However, activity data (for example, electricity consumption) and emissions factors are not available for the year 2007.
340. When assessing progress toward overall countywide GHG emissions reduction targets, comparisons are made to 2007 based on estimated 2007 GHG emissions by sector for that year. However, activity data (for example, electricity consumption) and emissions factors are not available for the year 2007.

NATURAL GAS

Puget Sound Energy (PSE) delivers King County's natural gas. Natural gas accounted for 19 percent of King County's total communitywide GHG emissions in 2023. Natural gas emissions in 2023 increased 25 percent since 2007 and increased 19 percent since 2019 Figure AA1-8. Within the residential sector, natural gas consumption has fluctuated slightly but overall increased by 8 percent from 2007 to 2023 and increased 11 percent from 2019 to 2023. Commercial natural gas consumption has varied more significantly, increasing 21 percent from 2007 to 2023 and 9 percent from 2019 to 2023. Industrial natural gas consumption has varied the most significantly, increasing 86 percent from 2007 to 2023 and 66 percent from 2019 to 2023.

Figure AA1-8: *Natural Gas Emission Trends by Sector.*



APPENDIX 2. BUILDING STOCK ANALYSIS USING GEOGRAPHIC INFORMATION SYSTEM (GIS) DATA.

BACKGROUND

The intent of building stock analysis performed in support of this Strategy was to provide a broad understanding of building counts by King County jurisdiction, with specific focus on providing baseline estimates of buildings that must comply with the Washington State Clean Building Performance Standards (CBPS). The analysis is based on King County Assessor data.

The King County Assessor's Office, or the Department of Assessments, inspects properties to calculate property tax calculations. Building characteristics collected by field inspectors are stored and linked with mapping or Geographic Information System (GIS) data. This property assessment GIS data was used to create a building stock analysis to help inform aspects of the building decarbonization strategy. GIS and assessor data have limitations in their applicability; for instance, both commercial and residential properties are typically physically assessed every six years and there would be an opportunity to update during that assessment. Certain events may trigger a new inspection by a field assessor sooner than the six-year timeframe, such as property sales, outstanding building permits, property value appeals, destroyed properties, or a characteristic review typically initiated by a property owner claiming that county data is erroneous. Despite these limitations, assessor information is a consistent data source to develop a snapshot of buildings across King County and its incorporated cities that can support planning efforts. Additional caveats and considerations of using GIS data to identify buildings that are covered by Washington State's CBPS are described in the following sections.

CBPS EXEMPTIONS INTEGRATED IN BUILDING STOCK ANALYSIS

CBPS exempts certain buildings from meeting CBPS compliance standards. Some of these exemption criteria cannot be integrated in the building stock analysis. For instance, GIS data was not available to ascertain buildings that are exempt due there being no certificate of occupancy, less than 50 percent physical occupancy, buildings pending demolition, and financial hardship by the building owner.341 There are likely buildings exempt from CBPS compliance that are included in King County's data presentation.

FEDERAL BUILDINGS AND BUILDINGS OWNED BY FEDERALLY RECOGNIZED TRIBES

Washington State does not require federal buildings and buildings owned by federally recognized tribes to comply with CBPS.[342] King County excluded federal buildings, buildings on reservation lands and tribally owned buildings not on reservation lands from the data presented.

UNCONDITIONED SPACES

Buildings where the sum of the building's gross floor area is less than 50,000 sq. ft., after subtracting unconditioned and semi-conditioned spaces as defined in the Washington State Energy Code are exempt from CBPS.[343] However, GIS data was not available to determine what portions of buildings are considered unconditioned or semi-conditioned as defined by the energy code. Buildings where the heating type was marked as "no heat" or "ventilation only" were not included. However, other buildings that may be exempt were likely included in King County's presentation of the data.

MANUFACTURING

Buildings where more than 50 percent of the gross floor area of the building is primarily used for manufacturing or other industrial purposes, as defined under the following use designations of the Washington state edition of the International Building Code Factory Group F or High hazard Group H are exempt from CBPS.[344] Factory Group F designated buildings are buildings that are used for manufacturing. Although King County does not have information on the manufacturing type of each building, buildings largely categorized under manufacturing were not included in King County's presentation of CBPS data. King County was unable to obtain information on buildings designated as High Hazard Group H for this analysis, and those buildings were not included.

341. Washington State Department of Commerce (WA Commerce), "Compliance through Exemption," n.d. Accessed 4/7/25. P2.
342. WA Commerce, "CBPS Tier 1 Compliance," n.d. Accessed 4/7/25.
343. WA Commerce,, "Compliance through Exemption," n.d. Accessed 4/7/25. Page 2.
344 WA Commerce, "Compliance through Exemption," n.d. Accessed 4/7/25. Page 2.

AGRICULTURAL STRUCTURE

CBPS defines an agricultural structure as a structure designed and constructed to house farm implements, hay, grain, poultry, livestock, or other horticultural products, and is not a place used by the public or a place of human habitation or employment where agricultural products are processed, treated, or packaged.[345] This exemption also includes barns, grain silos, livestock shelters, sheds, stables, tanks, and towers.[346] The following building classifications were marked as agricultural structures and were not included in King County data:

- **Barn, general purpose**
- **Barn, special purpose**
- **Milkhouse shed**
- **Individual livestock shelter**
- **Greenhouse, hoop, arch-rib, small**
- **Greenhouse, hoop, arch-rib, medium**
- **Barn**
- **Creamery**
- **Dairy**
- **Stable**
- **Poultry house-floor operation**
- **Farm utility building**
- **Farm utility storage shed**

345 WA Commerce, "Guidance Document CBPS 021-E: Tier 1 Exemption certification for agricultural structures," July 18, 2024. Accessed 4/7/25. Page 4.
346 WA Commerce, "Guidance Document," December 2024. Accessed 4/7/25. Page 2

CONDOMINIUMS

Condominium units are often owned by the individual unit occupants, which exempts most of these units from CBPS compliance.[347] However, such buildings may be subject to CBPS compliance when five or more interconnected condominium units are owned by a single entity, or when common spaces or included commercial spaces exceed the CBPS sq. ft. compliance thresholds.[348] King County's GIS data does not have information that would account for these criteria, though they were considered less common overall among condominiums; as such, all buildings with condominium units were not included in King County's data for the CBPS analysis.

STRIP MALLS

In certain scenarios, strip malls may need to comply with CBPS. Identifying which malls may need to comply requires information on the interconnectedness and thermal isolation of buildings, which is not included in GIS data.[349] Considering that the average strip mall is 13,218 sq. ft., and buildings larger than 20,000 sq. ft. must comply with CBPS, King County did not include strip malls in the data presented.[350]

COLLECTION OF BUILDINGS

Many buildings may be grouped based on them being part of a campus, performing the same primary function, or for other reasons.[351] These buildings are addressed by CBPS based on many different factors such as building type, interconnectedness, or use of the same utility systems. King County did not identify or exclude these buildings. However, this nuance is noted here to underscore that CBPS compliance pathways for these building types are complex and may not be accurately reflected by the data presented.

SENIOR CARE FACILITIES

In accordance with CBPS guidelines, King County classified skilled nursing facilities and senior care or assisted living facilities as non-residential buildings, covered by Tier 1.[352] Residential communities intended for independent living are considered residential occupancies, covered by Tier 2.[353]

347. WA Commerce, "Guidance Document CBPS 034: Condo Building Owners, Authorized Representative, and General Public," December 12, 2024. Accessed 4/7/25. Page 2.
348 WA Commerce, "Frequently Asked Questions," n.d. Accessed 4/7/25. Page 9.
349. WA Commerce, "Frequently Asked Questions," n.d. Accessed 4/7/25. Page 9.
350. International Council of Shopping Centers "U.S. Shopping-Center Classification and Characteristics," January 2017. Accessed 4/7/25.
351 WA Commerce, "Frequently Asked Questions," n.d. Accessed 4/7/25. Page 9.
352. WA Commerce, "Frequently Asked...," ibid. Accessed 4/7/25. Page 8.
353 WA Commerce, "Frequently Asked...," ibid. Accessed 4/7/25. Page 8.

OTHER GIS DATA CONSIDERATIONS

UTILITY BOUNDARIES

King County GIS analysts were unable to obtain Puget Sound Energy's (PSE) current utility service boundaries. Instead, GIS analysts used publicly published PSE maps to make assumptions about its current service boundaries.[354] Boundaries for Seattle City Light were based on a high resolution publicly available map, and Tanner Electric Cooperative's boundaries were provided directly to GIS analysts.

HEATING TYPE

Residential buildings that are three units or less have associated data that indicates heat sources, or the fuel sources used to heat buildings such electricity, gas, heating oil, etc. For larger buildings, heating type information was available, however heating source information was not indicated.

354. Puget Sound Energy, "Puget Sound Energy service area," June 2019. Accessed 4/7/25.

APPENDIX 3. EXISTING DECARBONIZATION ACTIVITIES

This section summarizes building decarbonization policies and retrofit programs that are in effect or are planned for the near term. The following are reviewed in this section:

- **Performance Standards**
- **Accelerator Programs**
- **Navigator Programs**
- **Direct Retrofit Programs**
- **Utility Incentive Programs**
- **Short-Term Financial Incentive Programs**
- **Long-Term Financial Incentive Programs**
- **Government Funding**
- **Climate Pollution Reduction Grant-Funded Programs**
- **Building Codes**

PERFORMANCE STANDARDS

Washington State and the City of Seattle use performance standards to reduce emissions/energy use from large buildings within King County's jurisdiction.

WASHINGTON STATE'S CLEAN BUILDING PERFORMANCE STANDARDS (CBPS)

This law requires buildings meeting the definition of a Tier 1, Tier 2, or state campus district energy system to comply with performance standards on individual timelines as outlined by Washington State.[355] Tier 1 and Tier 2 buildings are required to be benchmarked, implement an operations and maintenance program, and have an energy management plan to meet targets; Tier 1 and Tier 2 definitions are noted in Table AA3-1.[356] Applicable district energy systems are also required to develop, submit, and report on progress and completion of a decarbonization plan.[357]

355. WA Commerce, "CPBS Tier 1 Compliance," 2024; and "CPBS Tier 2 Compliance," 2024; and "Decarbonization of District Energy Systems," 2024. Accessed 1/13/25.
356. WA Commerce, "CPBS Tier 1 Compliance," 2024; and "CPBS Tier 2 Compliance," 2024. Accessed 1/13/25.
357. WA Commerce, "Decarbonization of District Energy Systems," 2024. Accessed 1/13/25.

Table AA3-1: *CBPS Program Summary.*

Program Name	Start Date	End Date	Building Type
CBPS Tier 1	6/1/2026	Ongoing	Nonresidential, hotel, motel, and dormitory buildings larger than 50,000 gross sq. ft.[358]
CBPS Tier 2	7/1/2027	Ongoing	Multifamily residential, nonresidential, hotel, motel, and dormitory buildings between 20,000 and 50,000 gross sq. ft.[359]
CBPS District Energy Systems	6/30/2040	7/1/2024	State campus district energy system.

CITY OF SEATTLE'S BUILDINGS EMISSIONS PERFORMANCE STANDARD (BEPS)

The City of Seattle requires non-residential and multifamily residential buildings larger than 20,000 sq. ft. to meet greenhouse gas (GHG) emissions standards set by the city.[360] This policy directly addresses GHG emissions; buildings subject to City of Seattle BEPs requirements must also still meet the Washington State Clean Building Performance Standards.

Table AA3-2: City of Seattle BEPS Program Summary

Program Name	Start Date	End Date	Building Type
BEPS -Nonresidential	10/1/2027	10/1/2045	Nonresidential buildings larger than 20,000 sq. ft.
BEPS - Multifamily	10/1/2027	10/1/2050	Multifamily residential buildings larger than 20,000 sq. ft.

358. WA Commerce, "CPBS Tier 1 Compliance," 2024. Accessed 1/13/25.
359. WA Commerce, "CPBS Tier 2 Compliance," 2024. Accessed 1/13/25.
360. City of Seattle, "Seattle Building Emissions Performance Standard Policy Background," n.d. Accessed 1/13/25.

ACCELERATOR PROGRAMS

Within King County, accelerator programs provide building owners and managers with support services to decarbonize buildings such as technical assistance, energy benchmarking, incentive navigation, or compliance assistance for local laws. These services are tailored to specific building types or a cohort of similar buildings, such as small businesses. Current accelerator programs are supported by City of Seattle, City of Bellevue, and Puget Sound Energy.

Table AA3-3: *Accelerator Program Summary, all programs current and ongoing.*

Program Name	Jurisdiction	Building Type
Clean Buildings Accelerator	City of Seattle	Buildings larger than 20,000 sq. ft.[361]
Clean Buildings Incentive Program	City of Bellevue	Buildings larger than 20,000 sq. ft.[362]
Clean Buildings Accelerator	Puget Sound Energy	Building larger than 50,000 sq. ft. and must be a PSE electric or gas customer or Seattle City Light electric customer.[363]

NAVIGATOR PROGRAMS

Navigator programs aim to create a centralized information hub for residents to access building decarbonization resources. These platforms often list available financial incentives or rebates, assist in finding contractors, and educate users on smaller-scale building decarbonization projects. In 2024 –June2025, many jurisdictions supported the Switch Is On (SIO) navigator in the Puget Sound, including King, Pierce, and Thurston counties; the cities of Olympia, Seattle, and Tacoma; and the King County-Cities Climate Collaboration (K4C).[364] Unfortunately, the SIO effort had to be discontinued due to lack of funding. Through the Climate Commitment Act, Washington State budgeted $3.5 million to "provide and facilitate access to energy assistance programs, including incentives, energy audits, and rebate programs to retrofit home and small businesses" through 2027.[365] These funds may be utilized to create a statewide navigator program to, "facilitate access to energy incentive programs."[366]

361. City of Seattle, "Seattle Clean Buildings Accelerator", n.d. Accessed 1/13/25.
362. City of Bellevue, "Clean Buildings Incentive Program", 2024. Accessed 1/13/25.
363. Puget Sound Energy, "Clean Buildings Accelerator", 25. Accessed 1/13/25.
364. Switch Is On WA, "About Us", n.d. Accessed 1/13/25.
365. WA State Senate, "Engrossed Substitute Senate Bill 5950", 2024. Accessed 1/13/25. Pg 148.
366. NW Energy Coalition, "2024 Washington Legislative Session Wrap Up", 2024. Accessed 1/13/25.

DIRECT RETROFIT PROGRAMS

Many local governments, including King County, are conducting direct retrofit programs that upgrade buildings to reduce their reliance on fossil fuels. These programs are differentiated from rebate programs since the government entity pays for most or all the costs associated with retrofits, in most cases through compensating contractors directly for their labor and equipment costs. The primary program focus is typically residential buildings, as these programs often support decarbonization of low-income or disadvantaged households, though some programs also provide retrofit services within small businesses or community buildings.

Table AA3-4: *Direct Retrofit Program Summary, all programs ongoing.*

Program Name	Jurisdictions	Start Date	Building Type
HomeWise Multifamily Weatherization	City of Seattle Office of Housing	Current	Multifamily buildings.[367]
Energize Program	King County	8/1/23	Single-family buildings, in-home daycares, adult family homes.[368]
Energy Smart Eastside	Bellevue, Issaquah, Kirkland, Mercer Island, Redmond, Sammamish	2022	Residential buildings and affordable housing.[369]
Clean Heat Program	City of Seattle	2017	Residential buildings.[370]

367. Seattle Office of Housing (OH), "Multifamily Weatherization", n.d. Also see Seattle OH, "Weatherization Program", n.d. Accessed 1/14/25.
368. King County, "Energize Heat Pump Program", 25. Accessed 1/14/25.
369. Energy Smart Eastside, "Who We Are", n.d. Accessed 1/14/25.
370. City of Seattle, "Seattle's Clean Heat Program", n.d. Accessed 1/14/25.

UTILITY INCENTIVE PROGRAMS

Local utilities serving King County residents offer incentives for building decarbonization projects to their customers. The two major utilities providing these incentives include Seattle City Light (City Light) and Puget Sound Energy (PSE). These incentives are often short-term rebates or other financial incentives to offset equipment purchases by the building owner.

Table AA3-5: *Utility Incentive Programs Summary; all programs current & ongoing.*

Program Name	Utility	Building Type
Income Eligible Programs	PSE	Income qualified residential buildings; focus on single-family.[371]
Home Energy Efficiency Rebates	PSE	Residential buildings (single-family, multifamily, apartments, condos) and businesses buildings.[372]
Multifamily Retrofit	PSE	Multifamily residential buildings.[373]
Commercial Incentives/Rebates	PSE	Commercial buildings.[374]
Industrial Programs	PSE	Industrial buildings.[375]
Home Energy Rebates	City Light	Single-family residential buildings.[376]
Commercial and Industrial Retrofit Programs	City Light	Commercial, industrial, and multifamily buildings.23
Commercial Rebates	City Light	Commercial buildings.[377]
Existing Building Commissioning Program	City Light	Buildings larger than 50,000 sq. ft. of conditioned space.[378]

371. Puget Sound Energy, "Needing Help With Your Energy Bills", 25. Accessed 1/14/25.
372. Puget Sound Energy, "Rebates & Offers", 25. Accessed 1/14/25.
373. Puget Sound Energy, "Multifamily Retrofit", 25. Accessed 1/14/25.
374. Puget Sound Energy, "Efficiency Incentives for your Business", 25. Accessed 1/14/25.
375. Puget Sound Energy, "Industrial Program", 25. Accessed 1/14/25.
376. Seattle City Light, "Home Energy Solutions", n.d. Accessed 1/14/25.
377. Seattle City Light, "Large Commercial and Industrial Business Solutions", n.d. Accessed 1/14/25.
378. Seattle City Light, "Existing Building Commissioning Program Requirements", 2021. Accessed 1/14/25.

SHORT-TERM FINANCIAL INCENTIVE PROGRAMS

Other short-term financial incentives are also available for building owners when they purchase electric appliances and make other building upgrades. The Washington State Home Electrification and Appliance Rebates (HEAR) program is funded by the Climate Commitment Act.[379] The Home Electrification and Appliance Rebates as well as Whole Home Efficiency Rebates (HOME) are funded by the Inflation Reduction Act.[380]

Table AA3-6: *Short-Term Financial Incentive Program Summary; all for single-family and multifamily residential buildings.*

Program Name	Jurisdiction	Start Date	End Date
State Home Electrification and Appliance Rebates (HEAR)	WA State	Current	Ongoing
Home Efficiency Rebates (HOMES)	Federal	Early 2025	TBD
Home Electrification and Appliance Rebates	Federal	Early 2026	TBD

LONG-TERM FINANCIAL INCENTIVE PROGRAMS

Financial incentives for longer-term projects are also available to residents who can pay back the cost of upgrades over a longer period. These incentives are often low-interest loans or other financial instruments, which take multiple years or longer to complete. Often, these are incentives for larger capital projects and upgrades but can be for smaller projects as well.

Table AA3-7: *Long-Term Financial Incentive Program Summary, all programs ongoing*

Program Name	Jurisdiction	Start Date	Building Type
Deep Retrofit Pay for Performance	City Light	2013	Buildings larger than 50,000 sq. ft. of conditioned space, with interval meter and stable building energy use.[381]

379. WA Commerce, "State Home Electrification and Appliance Rebates Program (HEAR)", 25. Accessed 1/14/25.
380. WA Commerce, "Inflation Reduction Act Home Energy Rebates", 2024. Accessed 1/14/25.
381. Seattle City Light, "Deep Retrofit Pay for Performance", 201. Accessed 1/14/25.

Program Name	Jurisdiction	Start Date	Building Type
C-PACER	King County	Current	Commercial, industrial, agricultural, and multifamily properties.[382]
Low Interest Lending - Puget Sound Cooperative Credit Union (PSCCU)	WA State	Current	Focus on residential buildings.[383]

GOVERNMENT FUNDING

Additional government funding is available to local governments and other entities to accelerate building decarbonization. These and other funding opportunities provide King County with the opportunity to consider large-scale programs to benefits to residents.

Table AA3-8: *Government Funding Summary*

Program Name	Jurisdiction	Start Date	End Date	Building Type
Energy Efficiency Retrofits Grants	WA State	10/7/2024	Ongoing	Public buildings and facilities.[384]
Community Energy Efficiency Program	WA State	Current	Ongoing	Residential and small business buildings.[385]
Energy Efficiency Conservation Block Grants Program	Federal	Current	Ongoing	Commercial and residential buildings.[386]

382. King County, "C-PACER Financing Program", 25. Accessed 1/14/25.
383. Puget Sound Cooperative Credit Union, "Energy-Smart Loans", 25. Accessed 1/14/25.
384. WA Commerce, "Energy Efficiency Retrofits Grants", 25. Accessed 1/14/25.
385. Washington State University, "Community Energy Efficiency Program", 25. Accessed 1/14/25.
386. WA Commerce, "Energy Efficiency Conservation Block Grants Program (EECBG)", 25. Accessed 1/14/25.

CLIMATE POLLUTION REDUCTION GRANT-FUNDED PROGRAMS

In 2024, King County and local partner jurisdictions were awarded a $50 million Climate Pollution Reduction Grant (CPRG) from the Environmental Protection Agency fund multiple programs to "accelerate equitable building decarbonization throughout the building lifecycle." CPRG programs will retrofit existing buildings to reduce operational emissions, as well as reducing the embodied carbon of new building products and redirecting salvaged lumber to reduce emissions at the end of building life. Combined, CPRG programs will reduce an estimated 0.34 million metric tons of CO_2 equivalent by 2050. These funds will be administered over a five-year period from October 1st, 2024, through October 1st, 2029.

Table AA3-9: *Climate Pollution Reduction Grant-Funded Programs Summary*

Program Name	Program Type	Building Type
Multifamily Homes	Direct Retrofits	Multifamily residential buildings
Community Spaces	Direct Retrofits	Multifamily residential buildings
Technical Assistance	Technical Assistance	Multifamily residential buildings
Community Decarbonization	Grants	Government-owned spaces providing community services or gathering spaces.
Embodied Carbon Program	Embodied Carbon redress	N/A; reduces emissions of building materials.
Circular Economy Salvaged Lumber Program	Salvaged Lumber redress	N/A; reduces emissions of building deconstruction process.
Financing Program	Long-Term Financial Solutions	Multifamily residential, commercial, and community buildings

BUILDING CODES

Building codes are standards for new construction and certain renovation projects, that are in force at time of permit issuance. Although the federal government does not mandate the use of specific codes, most states modify International Code Council codes for use in that state – and Washington is no exception. The Washington State Energy Code is a code modified in-state to improve energy efficiency and reduce GHG emissions.[387]

387. State Building Code Council (SBCC), "State Building Code", State Codes, Regulations & Guidelines." Accessed 1/27/25.

Washington State regulation requires a "70 percent reduction in net annual energy consumption in newly constructed residential and nonresidential buildings by 2031, compared to the 2006 Washington State Energy Code." The State also requires that "the Washington state energy code shall be designed to construct increasingly energy efficient homes and buildings that help achieve the broader goal of building zero fossil fuel GHG emission homes and buildings by the year 2031." [388]

In 2021, the Washington State Energy Code is predicted to achieve approximately 57.6 percent energy reductions in residential buildings, and 47 percent energy reductions in commercial buildings compared to a 2006 baseline. The 2024 Washington State Energy Code will likely build on goals outlined in 2021 and is planned to be effective in November 2026.[389]

Although local governments in Washington state may amend codes for commercial and multifamily buildings of a certain size, it is difficult for local governments to amend code requirements for single-family or multifamily residential construction (three stories and below). Such code amendments must undergo review from the State Building Code Council and must be related to unique local conditions.[390] This essentially prohibits local governments such as King County from amending codes for single-family and multifamily residential construction three stories and below in most cases.

388. Required per RCW 19.27A.020(2)(a). See Doan, Tony and Stoyan Bumbalov, "2021 Washington State Energy Code Progress Toward 2030," SBCC, 2023. Accessed 1/27/25. Pg 2.
389. SBCC, "2024 Code Review and Adoption Schedule". Accessed 1/27/25. Pg 2.
390. SBCC, "Forms," Local Residential Amendments. Accessed 5/24/2022.

APPENDIX 4. HES ASSUMPTIONS

The Home Energy Score policy refers to the requirement that a home must receive a home energy score prior to being listed on the multiple listing service (MLS). Retrofits for homes scoring below an average HES are not mandatory under this policy recommendation.

The following assumptions were used to calculate energy savings, cost savings, and greenhouse gas (GHG) emissions reductions resulting from a Home Energy Score policy under different retrofit scenarios.

- Compliance with the policy is assumed to be 75 percent if an HES score is required to be obtained prior to listing on the MLS.
- Half of all homes rated are expected to fall below the average score of HERS 5.
- 90 percent of homes that choose to retrofit after receiving their HERS score will choose to add insulation to their homes with a 12 percent efficiency gain (i.e. reduced energy used for space heating).
- 10 percent of homes that choose to retrofit after receiving their HERS score will upgrade to efficient electric equipment, assuming 4 percent will choose heat pump space heating, while 6 percent will choose heat pump water heaters.
- Total efficiency gain is estimated to be 22 percent across all measures for homes conducting retrofits.
- Average cost per kwh for electricity is calculated at $0.1639 per kwh, based on the weighted average of rates for:[391]
  - Tanner Electric, representing 1 percent if King County electricity use.
  - City of Milton WA, representing 1 percent of King County electricity use.
  - Seattle City Light, representing 36 percent of King County electricity use.
  - Puget Sound Energy, representing 62 percent of King County electricity use.

When homes conduct retrofits that convert from natural gas to electric equipment, although it will reduce natural gas fuel use, it will increase electricity consumption for the new equipment, and affect costs in both reduced and increased fuels used. Cost savings are calculated as a function of electricity reduction only, as gas-to-electric transferring systems may increase costs for operating energy.

391. See Tanner Electric Cooperative, "Electrical Rates & Fee Schedules" n.d.; City of Milton, "Electric utility – Regular and commercial service rates," n.d. § 13.08.280. Seattle City Light, "Residential Rates," n.d., and Puget Sound Energy, "Important notice for Puget Sound Energy customers about changes in electric rate," n.d. Accessed 11/25/2025

APPENDIX 5. HPWH: 120V VS. 240V TECHNOLOGY REVIEW

Heat pump water heaters (HPWHs) are essential technology for decarbonizing the building stock. Two types of HPWH voltages are currently available on the market: 120-volt (120V) units and 240-volt (240V) units. The 120V unit is a "plug and play" solution for fossil fuel-powered water heater conversions; since they require minimal electrical work, they can reduce costs and increase HPWH installation overall. Still, 120V systems have limitations for operation in King County when accounting for operating temperature and draw size.

HPWH BENEFITS: 120V VS. 240V

120V HPWHs have a distinct benefit when considering fuel switching from gas-powered to electric water heaters. Although gas-powered water heaters primarily consume natural gas to heat water, they require an electrical component to make the unit fully operational, often using a 120V circuit. To switch from a gas-powered water heater to a HPWH, a 120V water heater requires no electrical upgrades. This significantly reduces cost of gas-to-HPWH unit swaps by as much as $2,900, encouraging fuel switching at unit failure, where often a new unit is needed immediately and one-to-one replacements are often preferred due to ease and cost.[392]

A crucial feature is that 120V HPWH units show optimal performance when ambient air temperatures around the unit are at or above 68 degrees Fahrenheit, indicating that spaces such as basements or insulated garages where temperatures never drop below this threshold would be optimal locations for 120V HPWH installation.[393]

POTENTIAL CONCERNS WITH BROAD 120V HPWH USE IN KING COUNTY

While 120V HPWHs show promise for fuel switching water heaters, there are limitations to using this technology in the Pacific Northwest. A 120V unit operates by relying solely on heat pump technology, while a 240V system uses the same technology with an added electric resistance unit to support performance in cold weather or for large water draw events to improve performance and recovery time. Due to the lacking this electric resistance difference, 120V units may have a shutoff point when ambient temperatures fall too low, suck that the unit may stop heating water (rather than just reduced efficiency

392. Rewiring America, "How much does a heat pump water heater cost," n.d. Accessed 11/09/25.
393. Larson, B. and Larson, Sam., "Plug-In Heat Pump Water Heaters: An Early Look to 120-Volt Products," Northwest Energy Efficiency Alliance (NEEA), August 30, 2022. Accessed 11/09/25. Pg 18.

while still heating water, such as occurs in 240V units).[394] Common models on the market are rated for ambient temperature down to 37 degrees, indicating the unit will have significantly reduced efficiency if ambient temperatures drop below this threshold, if not shut off completely.

At baseline 120V units also have a slower recovery time than 240V units, which can significantly impact performance during large water drawdown events. In a study run by the Northwest Energy Efficiency Alliance (NEEA) at 68 degrees Fahrenheit, they found that while the total recovery time between a 120V on a dedicated circuit and 240V system is roughly equivalent, the 120V system has significantly lower performance in the 10-20 minute period following a large water draw event.[395] Additionally, NEEA found that within 10 min, the 240V unit has 7.5 usable gallons of hot water, while the 120V would not have any usable hot water until after 20 minutes of recovery.

While 120V systems may benefit low-draw households when installed in well-insulated areas that do not reach ambient temperatures below the unit shutoff point, 240V systems may be more beneficial for larger households and installed in areas with lower ambient temperatures.

394. Larson, B and Larson, Sam, "Plug-In Heat Pump Water Heaters...," ibid. Accessed 11/09/25. Pg 22.
395. Larson, B and Larson, Sam, "Plug-In Heat Pump Water Heaters...," ibid. Accessed 11/09/25. Pg 20.

APPENDIX 6. ENERGIZE EXPANSION ASSUMPTIONS

Two scenarios were modeled to explore expanding the Energize program. One targeted 1,000 home retrofits per year, and the other explored the maximum annual retrofits needed to achieve full electrification of low-income single-family homes by 2050. Note that both scenarios include the following assumptions:

- Five to ten percent of homes served by Energize would be electrically-heated. Although almost 20 percent of homes in King County are electrically heated, and heat pump installations reduce electricity consumption, the Energize program would internally set and track targets in an expansion to focus on converting homes off fossil fuels. This is because electricity will become greenhouse gas (GHG)-neutral starting in 2030 due to the Clean Energy Transformation Act (CETA), noted in the introduction to this Strategy.
- 10 to 15 percent of homes would receive Whole Building Electrification (WBE), including heat pump water heaters, insulation and weatherization.
- 20 percent of homes would require an electrical panel upgrade.
- Three percent annual inflation.
- Added administrative cost of approximately ten percent that of installation costs.
- The following cost assumptions are also integrated in both scenarios, drawing from average expenses experienced in the current Energize program. These include:
  - $8,500 per electrical panel upgrade.
  - $25,000 per heat pump.
  - $33,000 for WBE projects (not including an electrical panel upgrade).

GHG reduction estimates are based on the State Level Residential Building Stock and Energy Efficiencies and Electrification Packages Analysis Tool developed by the National Renewable Energy Laboratory (NREL). Emissions estimates used values associated with the High Efficiency heat pump with electric back up for heat pumps, and Minimum efficiency whole home electrification for WBE.

Finally, it should be noted that – while weatherization, fuel source and electrical upgrades can affect the costs of individual homes – the greatest determinant of potential program expansion costs by order-of-magnitude is the volume or number of houses served.

RESULTS

Scenario 1, modeling 1,000 home retrofits per year, would cost approximately $27M annually to fund. By 2050, approximately 20 percent of all low-income single-family homes would be served through the Energize program.

Scenario 2, targeting upgrades to all low-income single-family homes by 2050, would require upgrades to approximately 5,000 homes per year. It would cost approximately $138M annually to fund.

See the following pages for specific numbers and additional sources that helped inform these projections.

Table AA6-1: *Energize Expansion: Baseline Target, Qualifying Homes*

Description	Gas	Oil	Electric	Total
Number of Single-Family (SF) Homes[396]	359,449	59,643	103,657	523,230
Subtract: Number of SF Homes with Heat Pumps	-28,018	-470	-32,640	-61,161
Total SF Homes w/o Heat Pumps	331,431	59,173	71,017	462,069
Target Population: Households w/ Income Under 80% AMI[397]	106,058	18,935	22,725	147,862

Table AA6-2: *Energize Expansion Scenario 1: Upgrade 1,000 Low-Income Homes/Year*

Description	Gas	Oil	Electric	Total
Heat Pump Installations Per Year	700	125	25	850
Heat Pump Annual Installation Cost Estimate	$17,500,000	$3,125,000	$625,000	$21,250,000
Electrical Panel Upgrade Costs	$1,190,000	$212,500	$42,500	$1,445,000
Percent of Eligible SF Homes w/ Heat Pumps After 25 Years	16.50%	16.50%	2.75%	14.37%

396. Based on King County Assessor data. Omits 481 "other" fuel types. Closely correlated with 2025 one-unit housing units estimate for King County from WA Office of Financial Management (OFM), "Housing units," April 1, 2025. Accessed 10/27/25.
397. King County, "Demographics;" see Households by Income Category, 2018. Accessed 10/28/25.

Description	Gas	Oil	Electric	Total
WBE Installations Per Year	100	25	25	150
WBE Annual Cost Estimate	$3,375,000	$843,750	$843,750	$5,062,500
Percent of Eligible Buildings w/ WBE After 25 Years	2.36%	3.30%	2.75%	2.54%
Heat Pump & WBE Annual Cost Estimate	$22,065,000	$4,181,250	$1,511,250	$27,757,500
Heat Pump & WBE Annual Cost w/ Admin Cost	$24,271,500	$4,599,375	$1,662,375	$30,533,250
Heat Pump & WBE Cost Including Total Admin & Inflation Costs over 25 Years	$935,740,165	$177,319,899	$64,089,614	$1,177,149,677
Annual Avg GHG Reduction $MTCO_2e$	2.635	1.584	1.391	-
GHG Reductions Over 25 Years – Heat Pump Installations	599,442	64,358	11,303	675,104
Annual Avg GHG Reduction $MTCO_2e$ – WBE	3.827	2.627	2.125	-
GHG Reductions Over 25 Years from WBE	124,388	21,340	17,263	162,992
GHG Reduction Over 25 Years $MTCO_2e$ – Heat Pump & WBE	723,830	85,699	28,566	838,095
Cost for Each $MTCO_2e$ of GHGs Reduced over 25 years from Heat Pump &WBE	$1,293	$2,069	$2,244	$1,405
GHG Reductions from Heat Pumps at Year 2050	46,111	4,951	869	51,931

Description	Gas	Oil	Electric	Total
GHG Reductions from WBE at Year 2050	9,568	1,642	1,328	12,538
GHG Reductions from Heat Pumps & WBE at Year 2050	55,679	6,592	2,197	64,469

Table AA6-3: *Energize Expansion Scenario 2: Upgrade All Low-Income Homes by 2050*

Description	Gas	Oil	Electric	Total
Heat Pump Installations Per Year	3,900	675	25	4,600
Heat Pump Annual Installation Cost Estimate	$97,500,000	$16,875,000	$625,000	$115,000,000
Electrical Panel Upgrade Costs	$6,630,000	$1,147,500	$42,500	$7,820,000
Percent of Eligible SF Homes w/ Heat Pumps After 25 Years	91.93%	89.12%	2.75%	77.78%
WBE Installations Per Year	350	70	25	445
WBE Annual Cost Estimate	$11,812,500	$2,362,500	$843,750	$15,018,750
Percent of Eligible Buildings w/ WBE After 25 Years	8.25%	9.24%	2.75%	7.52%
Heat Pump & WBE Annual Cost Estimate	$115,942,500	$20,385,000	$1,511,250	$137,838,750
Heat Pump & WBE Annual Cost w/ Admin Cost	$127,536,750	$22,423,500	$1,662,375	$151,622,625
Heat Pump & WBE Cost Including Total Admin & Inflation Costs over 25 Years	$4,916,929,711	$864,494,143	$64,089,614	$5,845,513,468
Annual Avg GHG Reduction MTCO2	2.635	1.584	1.391	-

Description	Gas	Oil	Electric	Total
GHG Reductions Over 25 Years – Heat Pump Installations	3,339,750	347,536	11,303	3,698,588
Annual Avg GHG Reduction $MTCO_2e$ – WBE	3.827	2.627	2.125	-
GHG Reductions Over 25 Years from WBE	435,359	59,753	17,263	512,375
GHG Reduction Over 25 Years $MTCO_2e$ - Heat Pump & WBE	3,775,108	407,289	28,566	4,210,963
Cost for Each $MTCO_2e$ of GHGs Reduced over 25 years from Heat Pump &WBE	$1,302	$2,123	$2,244	$1,388
GHG Reductions from Heat Pumps at Year X	256,904	26,734	869	284,507
GHG Reductions from WBE at Year X	33,489	4,596	1,328	39,413
GHG Reductions from Heat Pumps & WBE at Year X	290,393	31,330	2,197	323,920

APPENDIX 7. APPLIANCE SALES

Appliance sale trends illustrate overall market activity, reflecting both regulatory influences as well as general market factors such as pricing, consumer opinion and behavior, and equipment supply. Understanding appliance sales provides insights into decarbonization retrofits undertaken by individuals often outside of direct installation programs and sometimes without rebates or other forms of assistance.

Government activity and decisions may impact overall market trends, and Washington state is moving to track and support market transformation. As of 2025, Washington signed a multistate memorandum of understanding (MOU) committing to residential decarbonization targets, including the goals that:398

- By 2030, at least 65 percent of residential-scale heating, air conditioning, and water heating equipment shipments will be zero emission heat pump equipment.
- By 2040, at least 90 percent of residential-scale shipments to be zero emission heat pumps by 2040.

While not legally binding, this action still serves as a strong market signal to manufacturers and provides a framework for collaborative action planning among the participating states.

REGIONAL SALES

Current sales of heat pumps in the Northwest are already approaching the above MOU target, with heat pumps representing 62 percent of sales.[399] Additionally, the more efficient variable-speed heat pumps (VSHPs) area an even larger portion of sales than previously, currently representing 44 percent of ducted heat pump sales, up from 8 percent in 2016.[400] Finally heat pumps outsold gas furnaces and central air conditioners (CACs) for two years in a row as of 2023, after being steady since 2016.[401]

398. Northeast States for Coordinated Air Use Management (NESCAUM), "Multistate Memorandum of Understanding: Accelerating the Transition to Zero-Emission Residential Buildings," 2025. Accessed 12/9/25
399. Bonneville Power Administration (BPA), "Northwest HVAC Sales Insights," April 2025. Accessed 12/10/25. Pg 12. 14.
400. BPA, "Northwest HVAC Sales Insights," April 2025. Accessed 12/10/25. Pg 9, 10.
401. BPA, "Northwest HVAC Sales Insights," April 2025. Accessed 12/10/25. Pg 12.

Figure AA7-1: *Mix of Key Residential Heating and Cooling Technologies, as show in the Bonneville Power Administration (BPA) report "Northwest HVAC Sales Insights," April 2025.*[402]

NATIONAL SALES

In recent years, electric appliances are beginning to outstrip sales of gas appliances at the national scale more notably for water heating (central air conditioning (AC) may be combined with gas heating), though gas appliance sales remain high. The following graphs display appliance shipment trends to the U.S. for heating and cooling equipment (combined), and water heating broken out for residential and commercial 2005 to 2024.

402. MSHP: Mini-Split Heat Pumps; ASHP: Air-Source Heat Pumps (ducted). See BPA, "Northwest HVAC Sales Insights," April 2025. Accessed 12/10/25. Pg 7.

Figure AA7-2: *Space Heating and Cooling Appliance Shipments to the U.S. from 2005 –2024*[403]

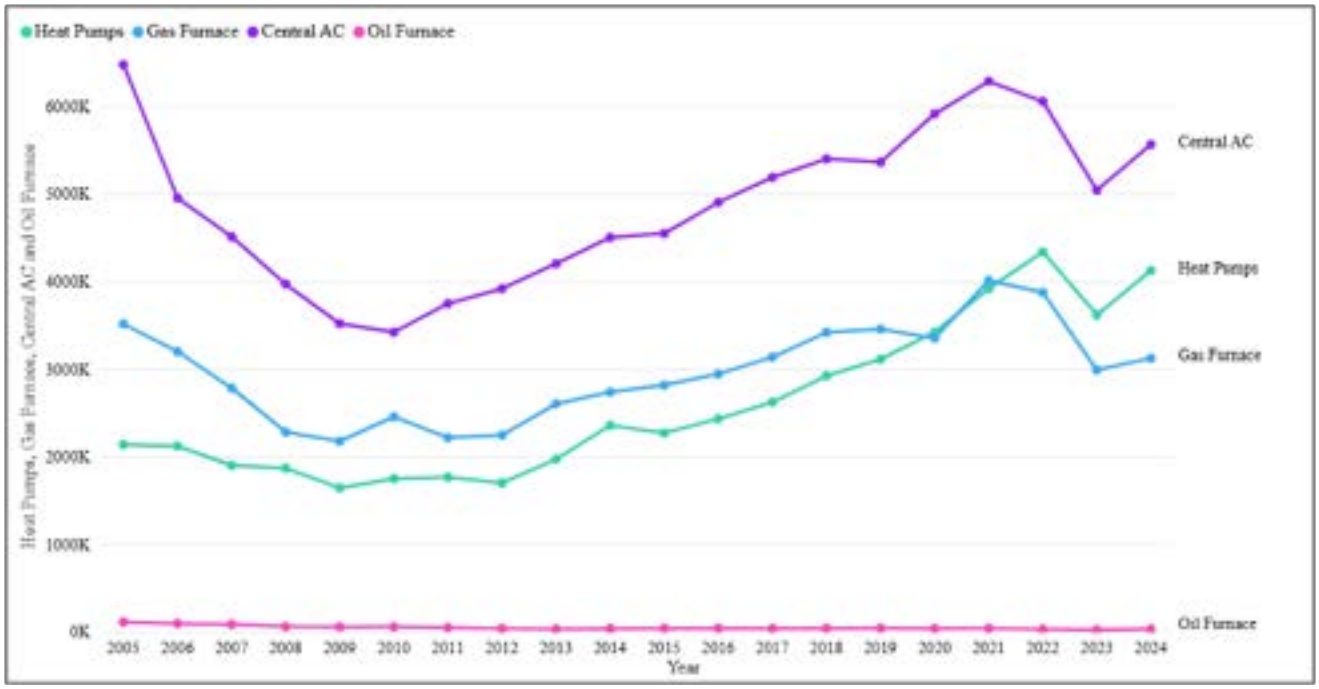
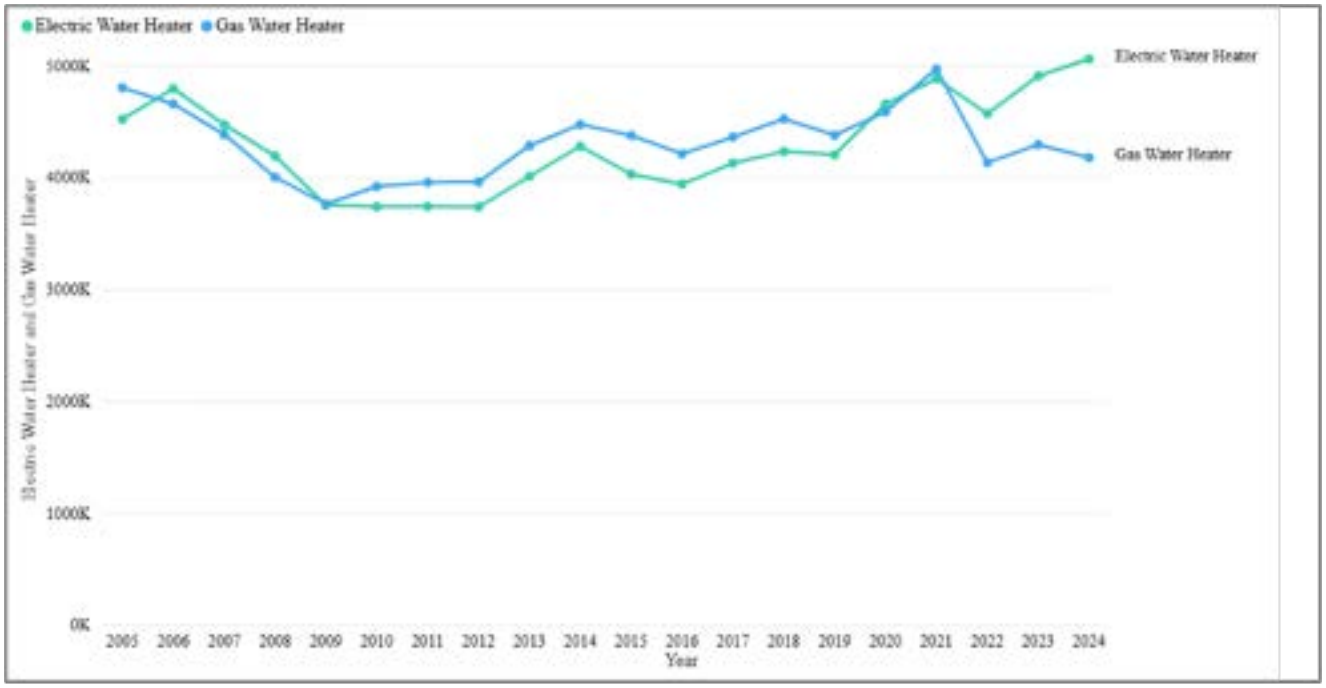
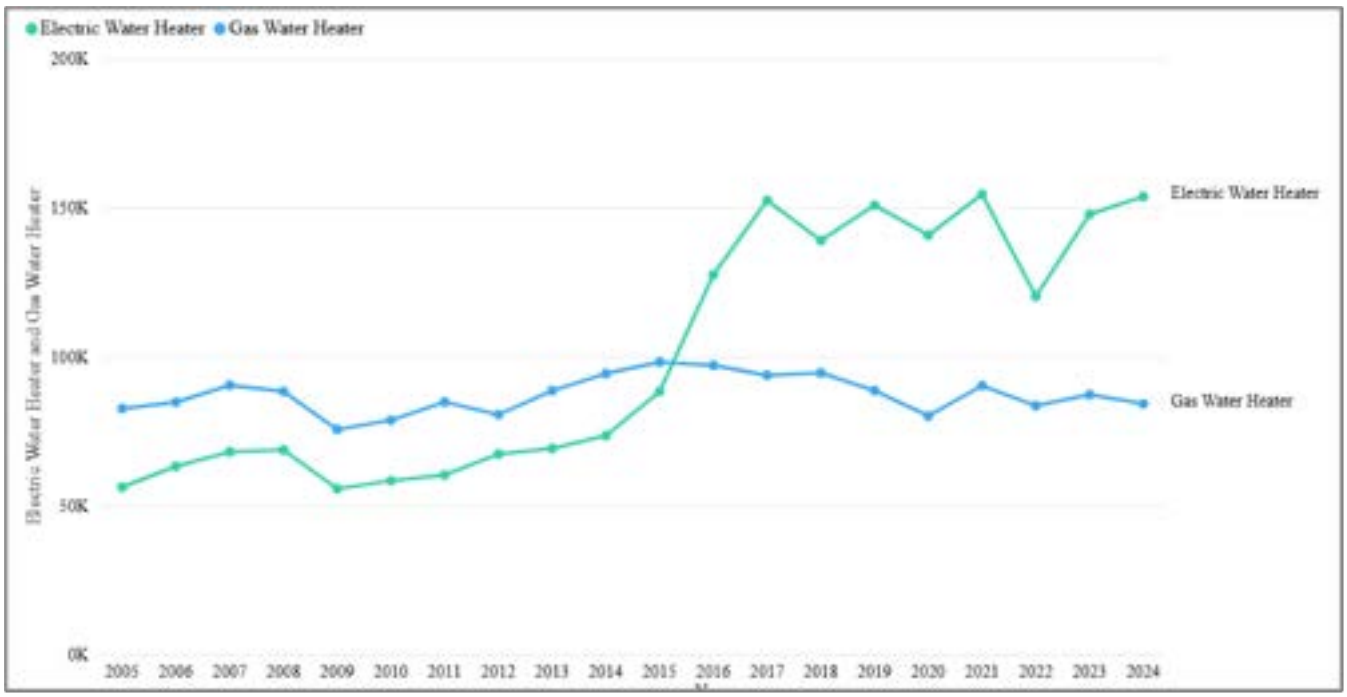


Figure AA7-3: *Residential Storage Water Heating Shipments to the U.S. from 2005 –2024*[404]



403. Note: Window and wall type room air conditioners not included in the data. Sourced from the Air Conditioning, Heating and Refrigeration Institute (AHRI), "Central Air Conditioners and Air-Source Heat Pumps," and "Furnaces Historical Data." Accessed 12/9/25.
404. Data sourced from the AHRI, "Residential Automatic Storage Water Heaters Historical Data." Accessed 12/9/25.

Figure AA7-4: *Commercial Storage Water Heating Shipments to the U.S. from 2005 –2024*[405]



405. Data sourced from the AHRI, "Commercial Storage Water Heaters Historical Data." Accessed 12/9/25.

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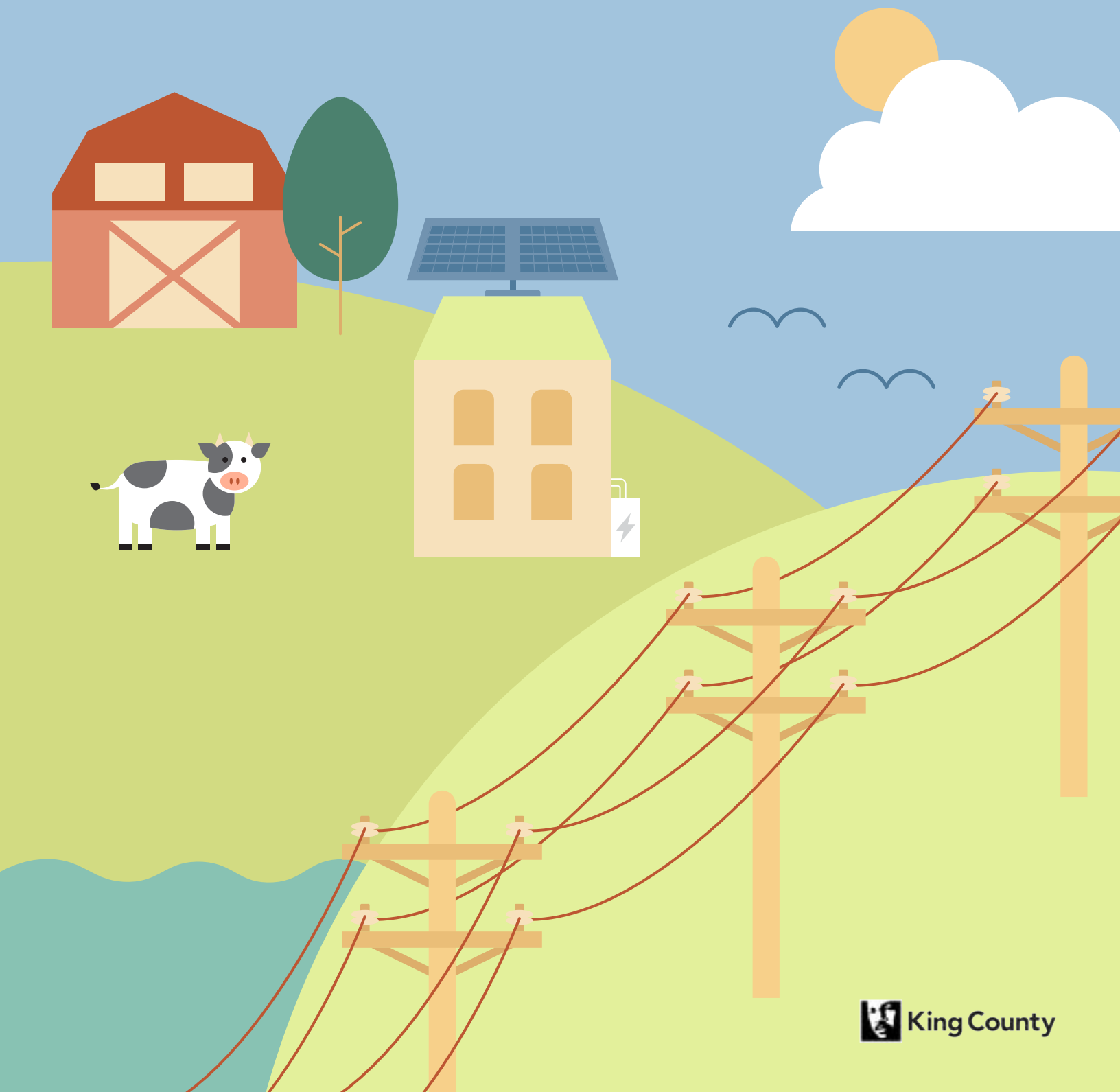

King County