

WHITE PAPER

January 2022

# Operation 2030: Scaling Building Decarbonization in Washington State

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## About the Clean Energy Transition Institute

The [Clean Energy Transition Institute](#) is a Seattle-based nonprofit organization whose mission is to accelerate an equitable clean energy transition in the Northwest (Idaho, Montana, Oregon, and Washington). We provide unbiased decarbonization research and analytics and convene decision-makers to evaluate low-carbon strategies and steer limited resources toward solutions that will best reduce energy sector emissions.

## About the 2050 Institute

The [2050 Institute](#) is a building decarbonization research and policy consulting network. The Institute partners with utilities, policymakers, and market actors to deliver building efficiency and decarbonization at scale in the Northwest and beyond. The Institute uses a “2050” lens and whole systems design to develop strategies, frameworks, policies, codes, and programs that interlock across regional, state, local, community, and utility programs and policies.

## About this Report

The Clean Energy Transition Institute and the 2050 Institute developed *Operation 2030: Scaling Building Decarbonization in Washington State* to frame and jumpstart multilevel mobilization to fully scale building decarbonization activities by 2030. The project is intended to help chart this path with a specific emphasis on time-critical strategic decisions and actions that must happen in the 2020s.

## About the Authors

**Lead Author:** Poppy Storm is Founder and Director of Innovation at 2050 Institute. She has worked in the building energy efficiency and decarbonization field for more than 15 years. Poppy has a background in policy research and analysis, strategy development, energy code design and evaluation, building performance standards, building stock and market assessments, and heat pump research and measure development. She uses a whole system approach and design thinking to identify the strategies and analysis necessary to align policy mechanisms with market transformation efforts and tangible energy and greenhouse gas reductions.

**Editor:** Eileen V. Quigley is the Founding Executive Director of the Clean Energy Transition Institute. She led the technical team that produced the analytics for the Washington 2021 State Energy Strategy. She is the author of several papers on clean energy solutions and a former magazine and newspaper journalist and editor.

## Acknowledgements

**Jeremy Hargreaves**, Principal at Evolved Energy Research, performed the technical modeling that underpins the analysis in this paper, and conducted a technical edit. **David Baylon** provided input on the technical and policy analysis. **Brendan McLaughlin** copyedited and proofread the paper. **Carol Maglitta** of One Visual Design designed the document, graphics, and infographics. Cover photo credit: Michael Sladek/[Shutterstock.com](#).

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## Executive Summary

To meet its carbon emissions limits, the State of Washington must decarbonize, maximize efficiency, and increase demand flexibility in more than three million buildings and homes by 2050,<sup>1</sup> a goal that demands large-scale collective action by state and local policymakers, market actors, advocates, and implementers.

**Operation 2030: Scaling Building Decarbonization in Washington State** aims to inform a common understanding of the state's building decarbonization opportunities and challenges and to set forth the interconnected and precise timing of various steps required to implement a building decarbonization strategy from now until 2030. To succeed, Washington must:

- **Adapt** to the scale and pace of decarbonization required;
- **Commit** to the most strategic and lowest cost decarbonization path;
- **Establish** and track building-specific measurable targets; and
- **Scale** equitable building decarbonization by 2030.

Washington state is well-positioned to scale up the technologies, workforce, and policy infrastructure required to transform the building sector. With such a short timeframe, it is imperative to quickly build an actionable consensus around the lowest cost, most strategic approach to building decarbonization and start operationalizing it as soon as possible. Washington must build both a policy platform and the necessary institutional and market capacity no later than 2030, while simultaneously decarbonizing as many buildings and housing units as possible.

The state can achieve this by: (1) aligning decarbonization goals and planning methodologies across multiple levels of the system; (2) structuring codes and standards to put all new and existing buildings on a trajectory to zero net carbon by 2050,<sup>2</sup> (3) recalibrating incentive structures so policy and utilities are incentivizing the right market shifts; (4) operationalizing large-scale decarbonization by 2030; and (5) establishing transparent tracking and accountability.

An analysis of the scenarios modeled in the Washington 2021 State Energy Strategy shows that electrification is the most efficient and cost-effective building decarbonization strategy for Washington state. It positions buildings as a critical resource for a rapidly decarbonizing grid, includes high levels of building energy efficiency, and identifies an aggressive timeline for the market transformation required to roll over enough equipment in time to meet the 2030 and 2050 state emissions limits.

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<sup>1</sup> Estimated by 2050 Institute based on the number of new and retrofit buildings and homes that must be zero net carbon by 2050 in order to achieve the building sector emissions reductions identified in the Washington 2021 State Energy Strategy <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>. The calculations were made using building population forecasts from the 2021 Northwest Power Plan supporting materials [https://www.nwcouncil.org/2021powerplan\\_forecast-commercial-floor-space-requirements#\\_ftnref1](https://www.nwcouncil.org/2021powerplan_forecast-commercial-floor-space-requirements#_ftnref1); [https://www.nwcouncil.org/2021powerplan\\_forecast-housing-stock](https://www.nwcouncil.org/2021powerplan_forecast-housing-stock).

<sup>2</sup> This paper proposes zero net carbon buildings as a means of assessing and establishing policy goals and trajectories to guide decision making. It is not intended to imply absolute achievement across all individual policies and buildings. We use Architecture 2030's definition of a zero net carbon building: "a highly energy efficient building that produces on-site, or procures, enough carbon-free renewable energy to meet building operations energy consumption annually" <https://architecture2030.org/zero-net-carbon-a-new-definition/>.

Market transformation to sales of mostly high-efficiency electric equipment and deep energy retrofits must be achieved by 2030 to decarbonize the building stock by 2050. Mass mobilization and collective action is required to achieve this transformation, and that action must begin now.

**Market transformation by 2030 delivers building decarbonization by 2050.**



Based on the building sector targets and retrofit rates proposed in this white paper, taking building decarbonization to scale by 2030 is defined by four essential and interconnected outcomes between now and 2030:

1. Building sector emissions are 60% less than 2020.
2. New and replacement space and water heating equipment produce zero emissions.
3. The transformation is strategically designed, managed, and tracked to support equitable outcomes.
4. The market is capable of decarbonizing the building stock at the target retrofit rate.

The Operation 2030 white paper recognizes the game-changing nature of Washington’s 2030 and 2050 timelines and lays out a vision for the structural change and essential policies capable of delivering on it. Every year that we wait, the more costly and disruptive the transition will be. If we do not start to rapidly replace fossil fuel equipment with electric equipment, we will commit to decades of fossil fuel use that will not be easy to unwind.

To operationalize this transformation, state policymakers and building sector stakeholders should approach the effort in three key phases. While Washington has nearly 30 years to decarbonize its building stock, it must take aggressive action in Phase 1 (2022-2025) to create a policy and planning platform that will drive and support at-scale building decarbonization by 2030.

**Three Key Phases to Decarbonize Buildings**



## *Operation 2030: Scaling Building Decarbonization in Washington State*

In Phase 2 (2026-2030), policies must be implemented and go into effect so that by 2030, the full ecosystem of policies, planning, and programs is activated to support at-scale retrofit rates. In Phase 3 (2031-2050), all buildings should be on a policy trajectory and have the market support required to steadily decarbonize by 2050.

If Washington state fails to build the capacity, policies, and programs to deliver the necessary level of zero net carbon retrofits, it will lock in higher energy use and emissions in later years. The state should establish statutory requirements that:

- Quantify the building stock in terms of building and equipment characteristics, energy use, and emissions.
- Establish building sector targets.
- Assign leadership responsibility and accountability for achieving the targets.
- Track progress against the targets in a transparent and timely way.
- Use the targets to directly inform regional, state, and utility energy and decarbonization planning and resource allocation.

Taking building decarbonization to scale in Washington state by 2030 will require a rapid coalescing of common purpose and coordination by government, market actors, and other stakeholders. To shift all new and replacement space and water heating sales to high-efficiency electric by 2030, we must maximize market innovation at all levels, focused on three critical implementation objectives: (1) dramatically reduce the cost of zero net carbon construction and retrofits; (2) rapidly accelerate the speed of zero net carbon retrofits; and (3) ensure workforce and community investment for equitable outcomes.

While challenging, these circumstances offer an opportunity for deep investment in market innovation, economic growth, and community resilience, as well as bold shifts in how Washington regulates, incentivizes, and funds building performance and decarbonization. Operation 2030 is intended to help chart this path with specific emphasis on time-critical strategic decisions and actions that must take place between now and 2030 to set the state up to achieve its 2050 emission limits.

# 1. Introduction

As part of its central strategy to meet economy-wide greenhouse gas emissions limits<sup>3</sup> Washington must decarbonize, maximize efficiency, and increase demand flexibility in more than three million buildings and homes by 2050.<sup>4</sup> To succeed with a technical and market transformation at this scale in less than 30 years, the state must rapidly complete an equitable building decarbonization policy platform and expand the institutional, market, and workforce capacity necessary to take building decarbonization efforts to scale no later than 2030—while decarbonizing as many buildings and housing units as possible in the process.

By design, this Operation 2030 white paper takes an analytical deep dive into the technical and market transformation mechanisms underpinning the conclusions and recommendations in the Washington 2021 State Energy Strategy.<sup>5</sup> This paper also leverages the deep decarbonization modeling outputs from the State’s strategy to propose building sector-specific emissions limits and zero net carbon new construction and retrofit rates at five-year intervals through 2050.

The paper’s analyses and recommendations are part of an effort to bring the technical aspects of Washington’s building sector transformation into clearer focus and contribute to a holistic discourse of the tightly interdependent technical and adaptive changes required to decarbonize Washington’s building stock equitably.

The authors want to emphasize that the paper is intended to promote and support dialogue. Rather than an end point, the paper is intended as a step toward future discussion with stakeholders along with additional research, analysis, and refinements to further overall building decarbonization project in Washington state. Reactions, considerations, gaps, questions, new ideas, etc., are welcome and encouraged and will help ensure that the Operation 2030 team can provide the most timely, responsive, and nuanced analytical support to the larger building decarbonization ecosystem.

As described throughout this white paper, market transformation to sales of mostly high-efficiency electric equipment and deep energy retrofits must be achieved by 2030 to decarbonize the building stock by 2050 (Figure 1). Mass mobilization and collective action is required to achieve this transformation, and that action must begin now.

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<sup>3</sup> Washington State Legislature, “Greenhouse Gas Emissions Reductions—Reporting Requirements, RCW 70A.45.020:” 2020, <https://apps.leg.wa.gov/rcw/default.aspx?cite=70A.45.020>.

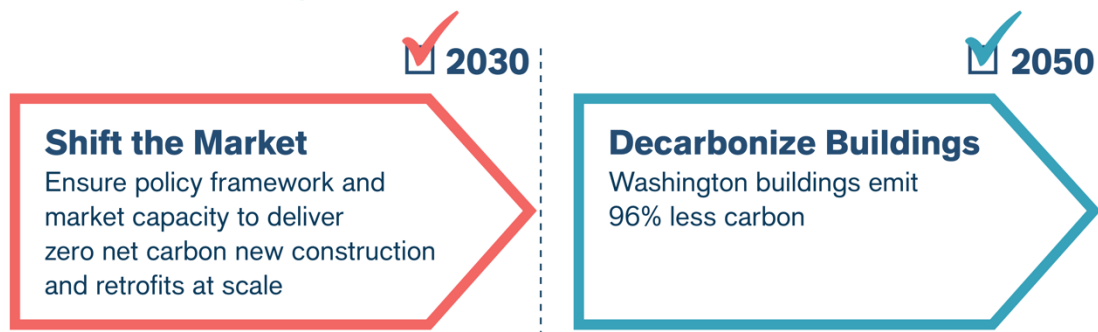
<sup>4</sup> Estimated by 2050 Institute based on the number of new and retrofit buildings and homes that must be zero net carbon by 2050 in order to achieve the building sector emissions reductions identified in the Washington 2021 State Energy Strategy <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>. The calculations were made using building population forecasts from the 2021 Northwest Power Plan supporting materials [https://www.nwcouncil.org/2021powerplan\\_forecast-commercial-floor-space-requirements#\\_ftnref1](https://www.nwcouncil.org/2021powerplan_forecast-commercial-floor-space-requirements#_ftnref1); [https://www.nwcouncil.org/2021powerplan\\_forecast-housing-stock](https://www.nwcouncil.org/2021powerplan_forecast-housing-stock).

<sup>5</sup> Washington State Department of Commerce, “Washington 2021 State Energy Strategy: Transitioning to an Equitable Clean Energy Future,” December 2020, <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>.



Figure 1. Major Market Shifts by 2030 Must Drive Building Decarbonization

## Market transformation by 2030 delivers building decarbonization by 2050.



Large-scale transformation of the building stock will be a planning and logistical challenge, requiring a high degree of public/private partnership and alignment of vision, goals, and implementation across all building sector agencies, organizations, and market actors. While challenging, these circumstances offer an opportunity for deep investment in market innovation, economic growth, and community resilience, as well as bold shifts in how Washington regulates, incentivizes, and funds building performance and decarbonization.

The Clean Energy Transition Institute and 2050 Institute developed this Operation 2030 white paper to help chart this path with a specific emphasis on time-critical strategic decisions and actions. It builds upon the Washington 2021 State Energy Strategy,<sup>6</sup> which is the state’s blueprint developed by the Washington State Department of Commerce in 2020 to decarbonize in accordance with its carbon emission reduction targets.

The paper is organized around four overarching actions needed to mobilize building decarbonization at a systemic level. To succeed, Washington must:

1. **Adapt to the scale and pace of decarbonization required** to embrace and implement systemic and equitable change on a relevant timeframe.
2. **Commit to the most strategic and lowest cost decarbonization path.** With fewer than 10 years to scale up zero net carbon new construction and retrofits,<sup>7</sup> delays in coalescing around a clear strategy will significantly hinder Washington’s ability to meet its emissions limits.
3. **Establish building-specific measurable targets** for emissions limits, zero net carbon new construction, and existing building retrofit rates to build market certainty and align policy, program, equity, and workforce expansion efforts across the full building decarbonization ecosystem.

<sup>6</sup> Washington State Department of Commerce, “Washington 2021 State Energy Strategy.”

<sup>7</sup> This paper proposes zero net carbon buildings as a means of assessing and establishing policy goals and trajectories to guide decision making. It is not intended to imply absolute achievement across all individual policies and buildings. We use Architecture 2030’s definition of a zero net carbon building: “a highly energy efficient building that produces on-site, or procures, enough carbon-free renewable energy to meet building operations energy consumption annually” <https://architecture2030.org/zero-net-carbon-a-new-definition/>.

4. **Scale building decarbonization by 2030** by aligning decarbonization goals and planning methodologies across multiple levels of the system; structuring codes and standards by 2030 to set all new and existing buildings on a trajectory to zero net carbon by 2050; recalibrating incentive structures and offerings so the state and utilities are incentivizing the right market shifts; and operationalizing large-scale, equitable decarbonization by 2030.

The policies and actions described in this white paper are drawn from the robust decarbonization modeling and recommendations in the Washington 2021 State Energy Strategy, as well other international, state, and municipal decarbonization studies. However, this paper is less about the nuts and bolts of these recommendations and more about the tight relationship between the rollover dynamics for high-efficiency electric equipment replacements and the timing for the most essential, high-impact policy and planning mechanisms needed to scale building decarbonization in the state by 2030. Most policy design and adoption for these actions must be completed by 2025 to allow time for regulatory rulemaking processes and market adaptation by 2030.

Many of the policy and implementation details to implement at-scale building decarbonization by 2030 must emerge from collective action and planning by state policymakers, market actors, advocates, and implementers. The goal of this paper, and Operation 2030 overall, is to support these efforts by informing a common understanding of the state's building decarbonization strategy and the interconnected and precise timing of various steps required to implement it.

The framing and recommendations within this paper can serve as a foundation for a series of Operation 2030 forums the Clean Energy Transition Institute and 2050 Institute aim to conduct with stakeholders to develop targeted policies, plans, and implementation strategies that recognize the scale, pace, and paradigm shifts required to successfully align and mobilize key segments of the building sector. The forum proceedings would be summarized in policy briefs throughout 2022.

## 2. Adapt to Decarbonization Scale and Pace

In 2020, the Washington State Legislature passed bills committing to a series of ambitious greenhouse gas emission reduction targets that culminate in a net-zero emissions target by 2050.<sup>8</sup> To meet the 2050 emissions limit, the state must reduce economy-wide emissions by 95% below 1990 levels.

This emission reduction commitment is not just a goal. It is a legal requirement that should drive a rapid acceleration in the volume and speed of market shifts and the physical transformation of the buildings and homes we work and live in. We have a narrow window in the 2020s to get on the required emissions trajectory.

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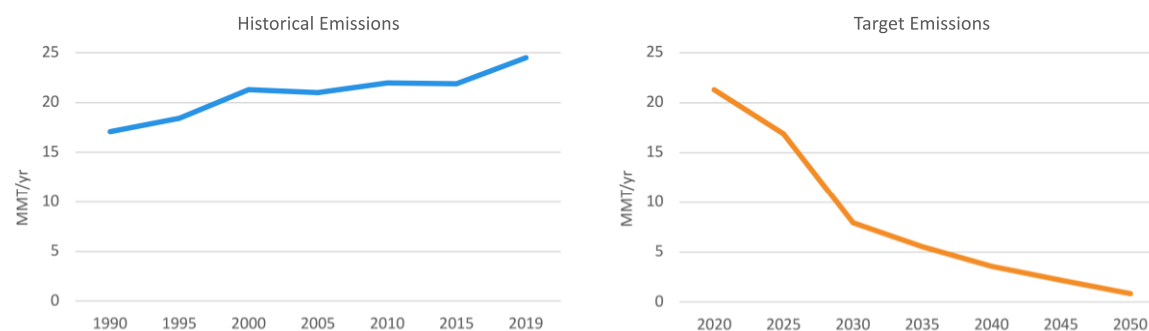
<sup>8</sup> Legislature, RCW 70A.45.020

## Historical Emissions

According to modeling performed in support of the Washington 2021 State Energy Strategy,<sup>9</sup> the lowest-cost path to meet state emissions limits requires deep building sector energy and emissions reductions. These reductions require a profound transformation of Washington’s homes and buildings in less than 30 years, the scale and pace of which contrast starkly with the large increases in buildings sector energy use and emissions over the last 30 years.

Although Washington state’s emissions increased by approximately 10% overall between 1990 and 2018,<sup>10</sup> building sector emissions increased 43% between 1990 and 2019. To achieve 2050 economy-wide emissions limits between 2020 to 2050, building sector emissions must decrease by approximately 96% below 2020 levels. (Figure 2)

**Figure 2. Shifting from Historically Increasing Building Sector Emissions (1990-2019) to Dramatically Decreasing Emissions (2020-2050)**



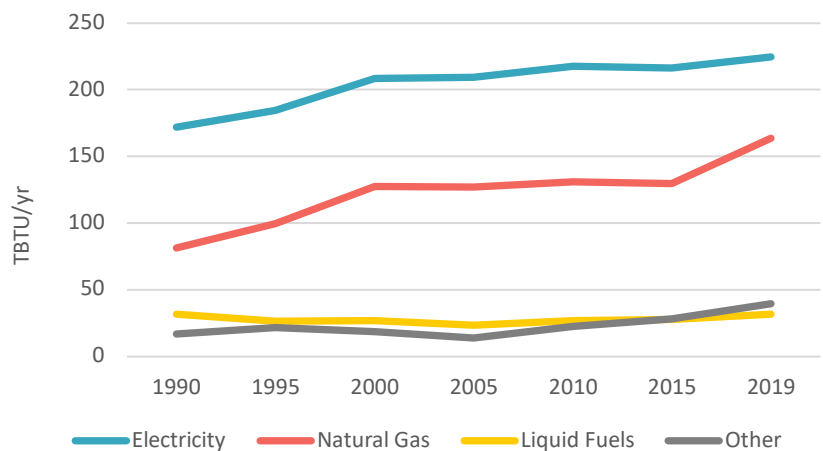
Sources: 2050 Institute analysis using historical energy use from U.S. Energy Information Administration (EIA) energy consumption data; and projected energy use from deep decarbonization modeling performed for the Washington 2021 State Energy Strategy: WA DDP Building Sector Energy Use and Sales Shares. Note that the deep decarbonization model assumes a 10% drop in demand in 2020 due to the COVID impact. Emissions factors are from EIA Carbon Dioxide Emissions Coefficients, the Environmental Protection Agency Emission Factors for Greenhouse Gas Inventories, average of historical WA electricity emission rates in the Department of Commerce Washington State Electric Utility Fuel Mix Disclosure Reports For Calendar Year 2017, Tables 2 and 3, and where relevant, future emissions rates for renewable fuels forecast in the Washington 2021 State Energy Strategy, Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet S7.

Large increases in natural gas use have driven building emissions over the past 30 years (Figure 3). Between 1990 and 2019, building sector electricity use increased by 30%, whereas building sector natural gas use doubled.

<sup>9</sup> Commerce, “Washington 2021 State Energy Strategy” Appendix A: Decarbonization Modeling Final Report, 53.

<sup>10</sup> Department of Ecology, State of Washington, “2018 Greenhouse Gas Data,” 2018, <https://ecology.wa.gov/Air-Climate/Climate-change/Tracking-greenhouse-gases/2018-Data>.

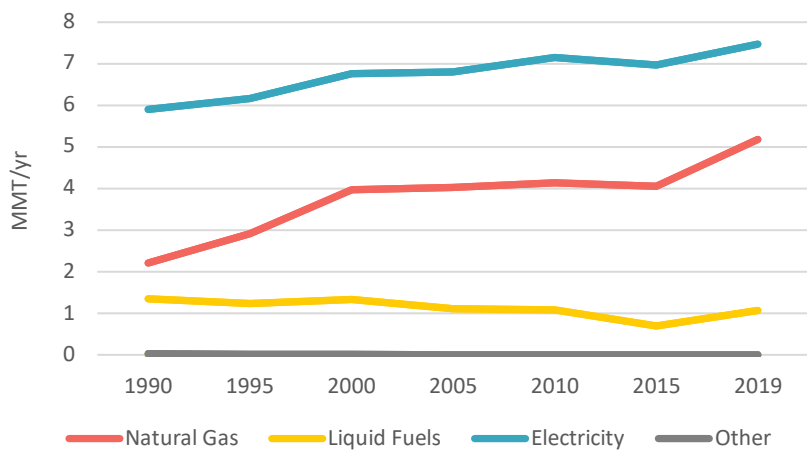
**Figure 3. Building Sector Energy Use by Fuel Type, 1990-2019**



Source: Data from U.S. Energy Information Administration energy consumption data. Note “Liquid Fuels” includes diesel and gasoline. “Other” includes miscellaneous energy use such as steam, residual fuel oil, and biomass.

Increases in natural gas use have led to a pronounced increase in residential emissions. Between 1990 and 2019, residential natural gas emissions increased by 235%, while residential electricity emissions increased by only 27%. During the same period, emissions from liquid fuels fell by about 20% (Figure 4).

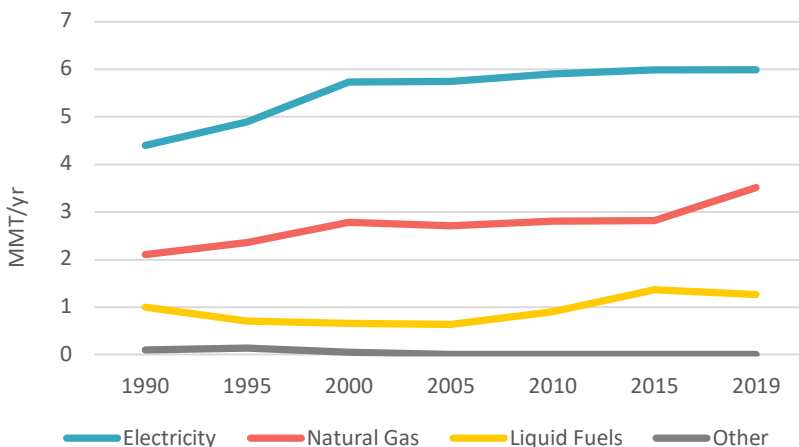
**Figure 4. Residential Sector Emissions by Fuel Type, 1990-2019**



Sources: 2050 Institute analysis using data from U.S. Energy Information Agency energy consumption data and various emissions factor sources (see Figure 2 for detailed sources).

Commercial sector natural gas emissions followed a similar trajectory to residential emissions, although to a lesser degree. Natural gas emissions increased by 66% between 1990 and 2019 (Figure 5).

**Figure 5. Commercial Sector Emissions by Fuel Type, 1990-2019**



Sources: 2050 Institute analysis using data from U.S. Energy Information Agency energy consumption data and various emissions factor sources (see Figure 2 for detailed sources).

## Shifting Gears

Over the last 30 years, Washington’s mix of energy codes, appliance standards, regional and state energy planning, utility programs, market transformation efforts, and other building-related policies may have incrementally slowed the increase in statewide commercial and residential sector energy use and emissions, but they have not reduced energy use or emissions from 1990 levels.

The disconnect between policy intentions and measured emissions raises a key strategic question for Washington: to what degree must energy efficiency and decarbonization planning, policies, and programs change to deliver a fundamentally different outcome—a shift from a historical 43% increase in building emissions to a decrease of nearly 96% over the same number of years?

**To what degree must energy efficiency and decarbonization planning, policies, and programs change to deliver a fundamentally different outcome?**

The last 30 years demonstrated that the 20<sup>th</sup> century model for reducing energy use cannot decarbonize the building sector at the scale and pace required, but it can be strategically reoriented and augmented to address this policy disconnect. Today, to meet the scale and pace of the decarbonization imperative, efficiency must be pursued within a strategic decarbonization paradigm. Washington must recognize the game-changing nature of the 2030 and 2050 timelines and embrace the structural change and essential policies capable of delivering on it.

Shifting from an efficiency-centric paradigm to a strategic decarbonization paradigm will require commitments to new goals and methodologies by regional, state, utility, and market actors, as well as the development of new organizational and business models. Policies, programs, and organizational capacity must be scaled with quantified projections to deliver emissions limits on a specific timeline.



### 3. Commit to the Most Strategic Path

Washington state is well-positioned to scale up the technologies, workforce, and policy infrastructure required to transform the building sector. With such a short timeframe, it is imperative to quickly build an actionable consensus around the lowest cost, most strategic approach to nearly zero out building emissions by 2050 and start operationalizing it as soon as possible. The Washington 2021 State Energy Strategy recommended electrification as the lowest cost and primary building decarbonization strategy for Washington state.<sup>11</sup> It positions buildings as a critical resource for a rapidly decarbonizing grid, includes high levels of building energy efficiency, and identifies an aggressive timeline for the market transformation required to roll over enough equipment in time to meet the 2030 and 2050 state emissions limits.

The Washington 2021 State Energy Strategy's building sector recommendations are based on deep decarbonization modeling. The modeling analyzed various pathways to achieve the economy-wide decarbonization required to meet state emissions limits, examining a total of five decarbonization scenarios, plus a Reference Scenario representing the business-as-usual case. Two scenarios specifically address building sector opportunities and challenges: the Electrification Scenario and the Gas in Buildings Scenario.

The Electrification Scenario ramps up electrification of space and water heating end uses in the 2020s and reaches high levels of electric equipment sales by 2030. With a sustained rate of electrification, most fossil fuel equipment is gradually replaced with high-efficiency electric equipment through 2050. A small amount of pipeline gas still serving the building sector in 2050 would be partly decarbonized with renewable natural gas.

In the Gas in Buildings Scenario, demand for gas remains in buildings through 2050.<sup>12</sup> Gas-consuming equipment is replaced with more efficient modern gas equipment<sup>13</sup> and the pipeline gas serving buildings is mostly decarbonized by 2050 with renewable biogas and other renewable sources.<sup>14</sup> Both the Gas in Buildings and Electrification scenarios assume some degree of equipment electrification, pipeline gas decarbonization, and deep levels of energy efficiency, including envelope, ventilation, and lighting upgrades, coupled with large-scale conversion of inefficient electric resistance space and water heating to high-efficiency electric. Both scenarios also assume some demand response and onsite renewables.

The Electrification Scenario quantifies shifts in the share of high-efficiency electric space and water heating purchased for new and replacement equipment. Successfully accelerating and managing this shift is critical to meeting the emissions reduction targets at the lowest cost. By 2050, the Electrification Scenario meets the state emissions limit with a cumulative savings of \$34 billion, compared to the Gas in Buildings Scenario where combustion equipment is mostly maintained in the building stock through 2050, thereby requiring a larger amount of pipeline gas to be decarbonized. The discussion below further illustrates why the Electrification Scenario is the most strategic decarbonization path for Washington state's building sector.

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<sup>11</sup> Commerce, "Washington 2021 State Energy Strategy," 19.

<sup>12</sup> Ibid, 34.

<sup>13</sup> Ibid, 36.

<sup>14</sup> Commerce, "Washington 2021 State Energy Strategy," Appendix A: Decarbonization Modeling Final Report, 42.

## Onsite Fossil Fuel Use Emits Nearly 100% of Building Emissions by 2030

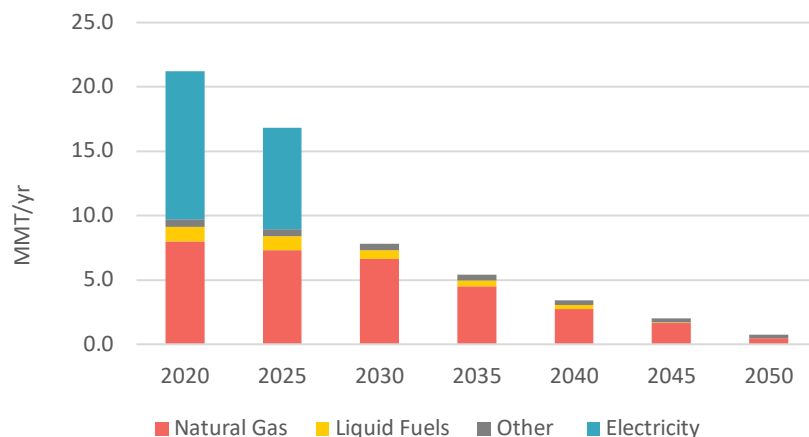
The Electrification Scenario projections in the Washington 2021 State Energy Strategy indicate that starting in 2030, onsite use of fossil fuels in equipment, such as space and water heating, will emit nearly 100% of all building sector emissions (Figure 6). This ratio is due to the impact of the Washington Clean Energy Transformation Act (CETA),<sup>15</sup> which requires carbon-neutral electricity by 2030.

In the Electrification Scenario, electricity accounts for approximately 49% of building energy use in the state in 2020 and 54% of building sector emissions, largely driven by coal- and gas-fired generation in the overall generation mix. Hence, by decarbonizing electricity—nearly half the energy load in buildings—CETA directly reduces building sector emissions 54% by 2030 (Figure 6). Starting in 2030, about 83% of remaining building emissions are from direct natural gas use combined with about 17% from various other fossil fuels, such as propane and diesel.

Within a context of decarbonized electricity, removing onsite fossil fuel emissions becomes central to decarbonizing buildings, and the policy structure and ecosystem of complementary policies and programs should be organized around that goal.

Within a context of decarbonized electricity, removing onsite fossil fuel emissions becomes central to decarbonizing buildings, and the policy structure and ecosystem of complementary policies and programs should be organized around that goal.

**Figure 6. Total Building Sector Emissions, Electrification Scenario<sup>16</sup>**



Source: 2050 Institute analysis using building sector energy use data from the deep decarbonization modeling performed for the Washington 2021 State Energy Strategy (See: WA DDP Building Sector Energy Demand and Sales Shares Data) and various emissions factor sources (see Figure 2 for detailed sources).

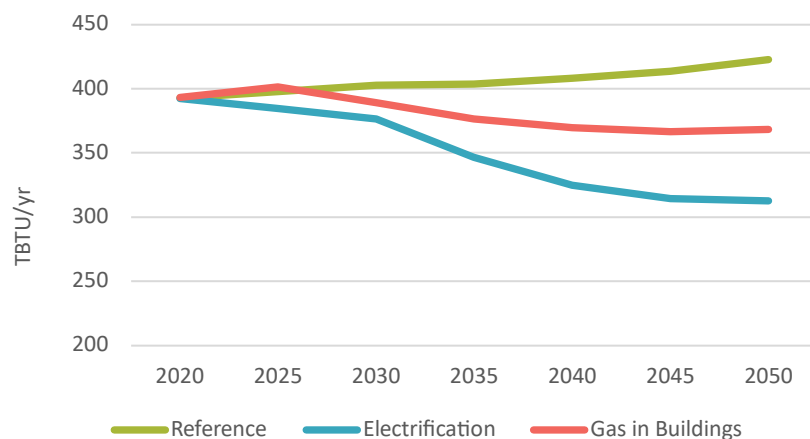
<sup>15</sup> Washington State Legislature, “Washington Clean Energy Transformation Act: Chapter 19.405 RCW,” 2019, <https://app.leg.wa.gov/RCW/default.aspx?cite=19.405>.

<sup>16</sup> Since this graphic summarizes emissions, not energy use, renewable natural gas is not included. For more detail on estimates of the distribution of natural gas and renewable natural gas in pipeline gas through 2050, see the Washington 2021 State Energy Strategy, Figure 11 on pg. 38 <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>. In that analysis, the DDP model projects that a high percentage of pipeline gas will be decarbonized in both the Electrification and Gas in Buildings scenarios; however, due to electrification of building end uses, a much smaller amount of pipeline gas is required to meet the remaining load and, therefore a much smaller amount of renewable natural gas is required to decarbonize the remaining pipeline gas.

## Electrification Deepens Energy Savings and Accelerates Emissions Reductions

Compared to the Gas in Buildings Scenario, building electrification saves more energy by 2050 and accelerates emissions reductions starting in 2030. In 2050 under the Electrification Scenario, building energy use is 21% less than in 2020, which is 26% less than the Reference Scenario in 2050, and 15% below the Gas in Buildings Scenario in 2050 (Figure 7).

**Figure 7. Total Building Sector Energy Reductions Across Scenarios**



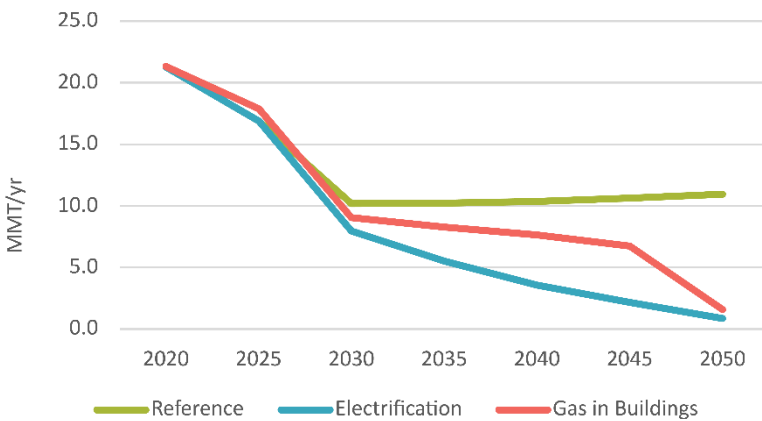
Source: Data from deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. See: WA DDP Building Sector Energy Demand and Sales Shares Data.

The Electrification Scenario reduces emissions 96% from 2020 (Figure 8). While the Electrification and Gas in Buildings Scenarios both reduce emissions over 90% by 2050, the Electrification Scenario decarbonizes buildings at a faster pace by 2030 and beyond, which reduces costs. Washington’s overall energy strategy requires clean fuels to decarbonize the economy from 2030 onwards.

By reducing emissions in buildings at a faster pace, the Electrification Scenario reduces the demand for expensive clean fuels needed to decarbonize pipeline gas and other fossil fuels, reducing decarbonization costs across the economy.

Emissions reductions in the Gas in Buildings Scenario between 2045 and 2050 come from decarbonizing pipeline gas, a more expensive solution than electrification at the volumes of clean gas required. While the results of the modeling for the Washington 2021 State Energy Strategy are only presented through 2050, the impact on pipeline gas supply in the Gas in Buildings Scenario will persist beyond 2050 at greater cost than an electrified buildings solution. Stock rollover dynamics mean that transitioning to electric equipment takes time, so beginning the transition later will lead to demand for expensive clean gas in the future.

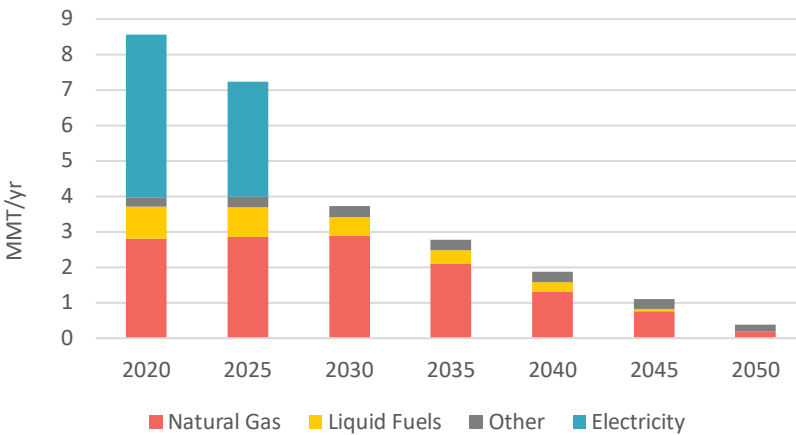
**Figure 8. Total Building Sector Emissions Reductions Across Scenarios**



Source: 2050 Institute analysis using building sector energy use data from the deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. (See: WA DDP Building Sector Energy Demand and Sales Shares Data) and various emissions factor sources (see Figure 2 for detailed sources).

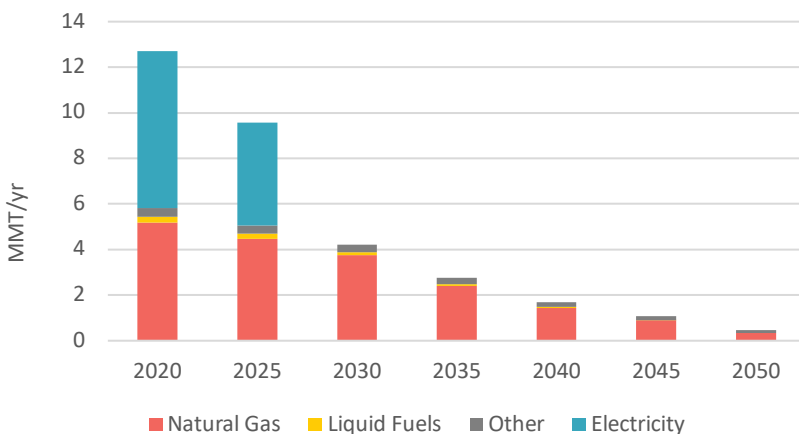
As with the other scenarios, the Electrification Scenario for the commercial and residential sectors benefits from electricity decarbonization by 2030 (due to CETA), and then steadily draws down the remaining emissions (mostly from natural gas) through 2050 (Figure 9 and Figure 10).

**Figure 9. Commercial Buildings Emissions, Electrification Scenario**



Source: 2050 Institute analysis using building sector energy use data from the deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. (See: WA DDP Building Sector Energy Demand and Sales Shares Data) and various emissions factor sources (see Figure 2 for detailed sources).

**Figure 10. Residential Buildings Emissions, Electrification Scenario**



Source: 2050 Institute analysis using building sector energy use data from the deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. (See: WA DDP Building Sector Energy Demand and Sales Shares Data) and various emissions factor sources (see Figure 2 for detailed sources).

### Equipment Rollover Dynamics Drive Scale and Pace

A deep energy efficiency and electrification strategy aligned with natural equipment replacement cycles will meet the 2050 decarbonization targets if we get on the path now and hit sales share targets every year until 2050.<sup>17</sup> With this approach, additional costs to decarbonize buildings are mainly the incremental costs of electrified equipment above the normal cost of the install, while the benefit versus other decarbonization strategies is to reduce overall economy-wide decarbonization costs.

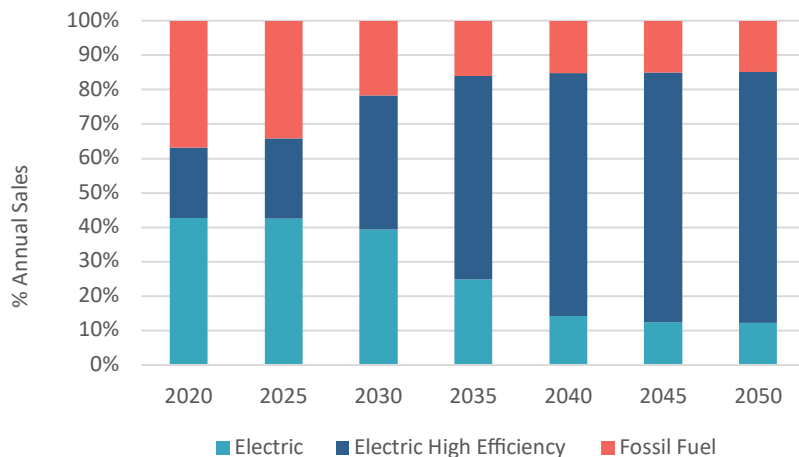
**A strategy aligned with natural equipment replacement schedules will meet the targets if we get on the path now and hit sales share targets every year until 2050.**

Increasing the share of high-efficiency electric equipment sold in Washington each year is a necessary policy objective and sales shares can be used as metrics to measure the success of various policies over time. In the Electrification Scenario, the sales share of new and replacement electric space heating equipment in residential units starts out at about 60% in 2020 and expands to almost 80% by 2030. The number of total sales that are high-efficiency electric is about 20% of all residential space heating equipment in 2020 and expands to nearly 40% in 2030, and more than 70% by 2040 (Figure 11).

<sup>17</sup> Commerce, “Washington 2021 State Energy Strategy,” 67–69.



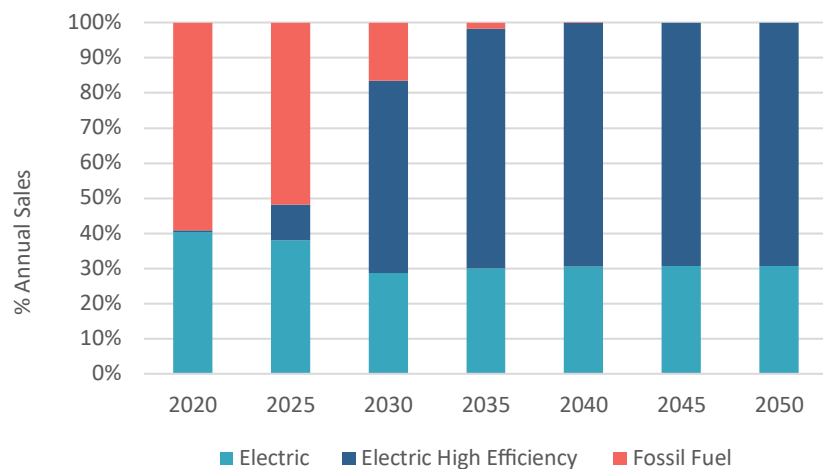
**Figure 11. Residential Space Heating Equipment Sales Shares, Electrification Scenario**



Source: Data from deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. See: WA DDP Building Sector Energy Demand and Sales Shares Data.

In the Electrification Scenario, residential water heating using high-efficiency electric water heaters is very low in 2020 (Figure 12) but increases rapidly to nearly 55% in 2030, and then to nearly 70% by 2050. By 2040 this technology would replace virtually all gas water heating sales, and electric water heaters and heat pump water heaters represent almost 100% of residential water heaters.

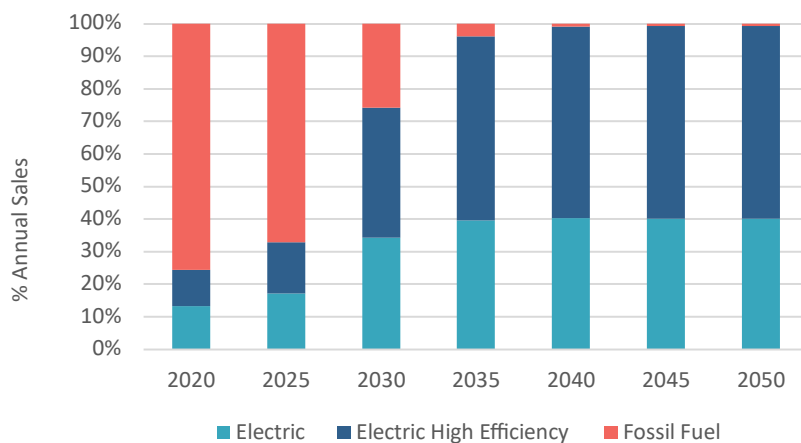
**Figure 12. Residential Water Heating Equipment Sales Shares, Electrification Scenario**



Source: Data from deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. See: WA DDP Building Sector Energy Demand and Sales Shares Data.

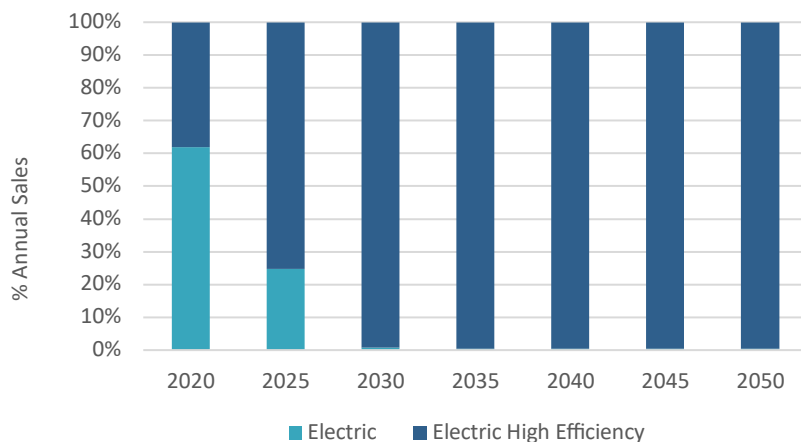
A similar trend would be required in the commercial sector (Figure 13). In the Electrification Scenario, sales of commercial electric space heating equipment would mirror the residential sector; however, whereas it starts at about 25% of total sales in 2020, by 2035 it replaces virtually all sales of gas heating equipment in the market. This approach would lead to a saturation of electric heating equipment (especially heat pumps), approaching 80% by 2040 and exceeding 95% by 2050. Commercial lighting is already dominated by high-efficiency LED lighting (Figure 14). This trend would lead to 100% saturation of high-efficiency lighting by 2030.

**Figure 13. Commercial Space Heating Sales Shares, Electrification Scenario**



Source: Data from deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. See: WA DDP Building Sector Energy Demand and Sales Shares Data.

**Figure 14. Commercial Lighting Sales Shares, Electrification Scenario**



Source: Data from deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. See: WA DDP Building Sector Energy Demand and Sales Shares Data.

Decarbonizing buildings is most cost effective when replacing equipment at the end of its life, but this will require early and aggressive action to increase sales shares of electric equipment and increase envelope and ventilation efficiency.<sup>18</sup> It will be challenging to meet these sales shares, which puts pressure on new construction to contribute as much of this shift as possible, as soon as possible.

Every year that we wait and do not put policies in place that can increase sales shares, the more costly and disruptive the transition will be. Due to replacement rates, it will be difficult to shift gears later. If we do not start rapidly replacing fossil fuel equipment with electric equipment, we are committing to decades of fossil fuel use that will not be easy to unwind.

<sup>18</sup> The deep decarbonization modeling assumes an approximately 30% increase in envelope and ventilation efficiency.

The Washington 2021 State Energy Strategy provides Washington with a valuable framework for understanding how our current actions affect the future. We have an increasingly narrow window of opportunity to maintain alignment with natural equipment replacement cycles. The equipment rollover imperative requires policy strategies that quickly increase these sales shares and set us on the path to deep building stock transformation by 2050. Policies and programs that influence how buildings are built and retrofitted should be structured to drive increases in electric sales shares and ensure no delays in equipment replacement.

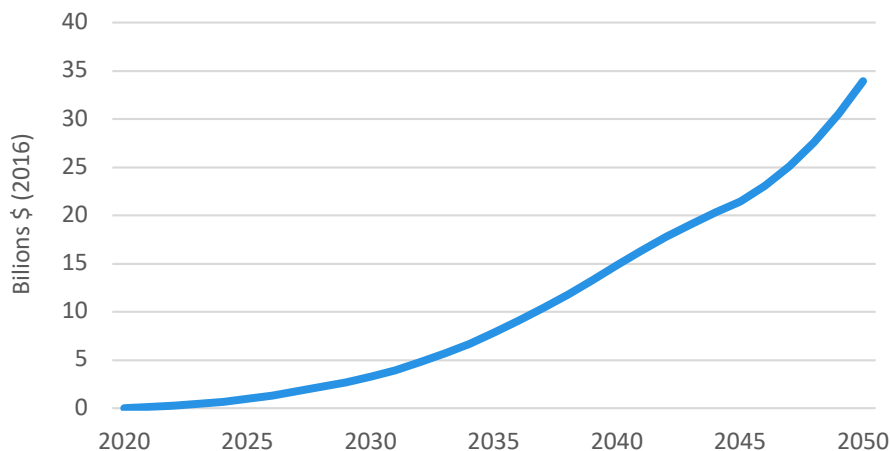
We have an increasingly narrow opportunity to maintain alignment with natural equipment replacement schedules.

### Electrification Saves \$34 Billion by 2050

It is important to fully account for the cumulative and long-lived costs of retaining gas in buildings and adjust policies accordingly as soon as possible in the 2020s. A primary strategy of retaining gas equipment in buildings and decarbonizing the pipeline over time is an expensive option for Washington state. By 2050, it could cost residents \$34 billion more than the Electrification Scenario (Figure 15).<sup>19</sup>

The deep decarbonization modeling cost analysis included direct infrastructure and operating costs such as supply-side equipment, more efficient or electrified demand-side equipment, transmission, clean fuels production infrastructure, operating costs, and fuel. As recommended in the 2021 State Energy Strategy, the cost analysis should be expanded in the future to encompass a more comprehensive spectrum of costs and benefits. However, the direct costs summarized here provide useful insight into the cost impacts for consumers.<sup>20</sup>

**Figure 15. Cumulative Incremental Costs of Gas in Buildings above Electrification Scenario (2016\$)**



Source: 2050 Institute summary of cost data from the Washington 2021 State Energy Strategy, Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet C4.

<sup>19</sup> Commerce, “Washington 2021 State Energy Strategy,” Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet C4.

<sup>20</sup> For more information on the cost analysis conducted in the deep decarbonization modeling, see <https://www.commerce.wa.gov/wp-content/uploads/2020/12/Washington-2021-State-Energy-Strategy-December-2020.pdf>, Section 2.4, pg. 39.

Electrification is the lowest cost strategy for Washington because of the delayed decarbonization in the Gas in Buildings Scenario, the lower efficiency of combustion equipment, and the high cost of biogas and hydrogen needed to decarbonize pipeline gas to meet economy-wide 2030 and 2050 emission limits.<sup>21</sup> For example, the additional clean fuels needed to decarbonize pipeline gas cost more than the electrification measures deployed in the Electrification Scenario.

Annual costs for the Gas in Buildings Scenario exceed the Electrification Scenario beginning in 2030 and by 2050 are approximately \$3.4 billion per year more expensive than electrification.<sup>22</sup> Assuming costs are roughly similar to those in 2050 for each year following, for each decade beyond 2050, retaining gas in buildings could cost nearly \$35 billion per decade more than the Electrification Scenario. The cost of the Gas in Buildings Scenario is driven by the development of renewable gas, which substantially increases fuel costs before 2050 and continues to increase costs as additional carbon is removed from the system. Most of this additional cost may be incurred by gas users in the form of increased energy costs.

In addition to the cost implications of retaining gas in buildings, it will be difficult to switch to electricity later as these costs become clearer to gas customers and policymakers. When Washington reaches these significantly higher costs in 2050, it will be difficult and costly to quickly shift these end uses off gas, since they are locked in by product lifespans and stock rollover dynamics. It would take another decade or two at a minimum to transition buildings to electricity, while paying significantly higher costs for clean gas during that whole period.

**It would take another decade or two to transition these buildings to electricity, while paying significantly higher costs for clean gas during that period.**

Both the Electrification and Gas in Buildings Scenarios include some amount of equipment electrification and decarbonization of pipeline gas. For example, in the Electrification Scenario, some pipeline gas use remains by 2050 and, although it is partly decarbonized, it is a much lower fraction of the energy used since electrification significantly reduces the volume of pipeline gas that must be decarbonized.<sup>23</sup>

In turn, the Gas in Buildings Scenario also assumes a certain amount of equipment electrification, indicating that a market shift toward electrification is already occurring. For example, the Gas in Buildings Scenario assumes an increase in residential high-efficiency electric space heating.<sup>24</sup> Without the additional energy reduction and displacement of pipeline gas resulting from this electrification, the Gas in Buildings approach would be even more expensive.

Overall, the Electrification Scenario has the lowest cost, and likely the most achievable, mix of both electrification and pipeline gas decarbonization. As a result, Washington must decide whether to choose a path that includes high electrification combined with decarbonization of a smaller, more manageable amount of pipeline gas to decarbonize or continue to use gas in buildings coupled with a low to moderate amount of electrification and decarbonization of a much larger amount of pipeline gas.

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<sup>21</sup> Commerce, "Washington 2021 State Energy Strategy," 46.

<sup>22</sup> Commerce, "Washington 2021 State Energy Strategy," Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet C4.

<sup>23</sup> Commerce, "Washington 2021 State Energy Strategy," Appendix A: Decarbonization Modeling Final Report, 42.

<sup>24</sup> Clean Energy Transition Institute, "WA DDP Building Sector Energy Demand and Sales Shares Data," November 17, 2021. <https://www.cleanenergytransition.org/files/wa-ddp-building-sector-energy-use-and-sales-shares>.

## Energy Efficiency Is Critical to Offsetting Electrification-Driven Load Growth

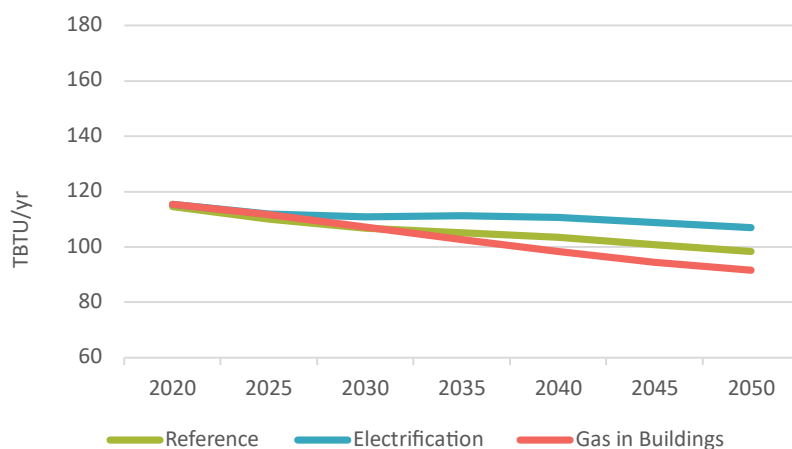
Efficiency, demand response, and onsite renewables are critically important because they collectively offset increased electricity demand on the grid in all deep decarbonization scenarios. This effect is particularly relevant in the Electrification Scenario. While electricity demand increases as building stock electrifies, in most cases installed equipment is two to three times more efficient than old style electric equipment, or gas equipment regardless of age or efficiency.

As a result of this additional efficiency, building sector electrification on its own makes up just over a quarter of the economy-wide increases in electricity demand in the Electrification Scenario.<sup>25</sup> The remaining increases are driven by extensive electrification in the transportation sector and, to a lesser degree, industry. Due to the building sector’s relatively small contribution to increasing electricity loads, the overall electricity demand in the Electrification Scenario is only about 11% more than the Gas in Buildings Scenario in 2050, while reducing overall energy use and cost.<sup>26</sup>

Part of the reason efficiency has such a big impact is because about 30-50% of space and water heating end uses in both residential and commercial buildings are already electric in Washington state.<sup>27</sup> Switching from low-efficiency electric equipment to higher-efficiency equipment for this large subset of the building stock significantly reduces aggregate electricity demand overall. Improved efficiency, coupled with demand response, onsite renewables, and more efficient envelopes, ventilation, and lighting significantly offsets electricity demand increases.

The effect of energy efficiency can be seen in the trajectory of residential electricity demand, which decreases between 2020 and 2050 in all three scenarios. As Figure 16 shows, despite extensive electrification of space and water heating and population growth, residential electricity demand in the Electrification Scenario decreases about 7% by 2050 and is projected to be only about 8% higher than the Reference Scenario.

**Figure 16. Residential Electricity Demand Across Scenarios**



Source: Data from Washington 2021 State Energy Strategy, Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet D2.

<sup>25</sup> Commerce, “Washington 2021 State Energy Strategy,” Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet D2.

<sup>26</sup> Ibid.

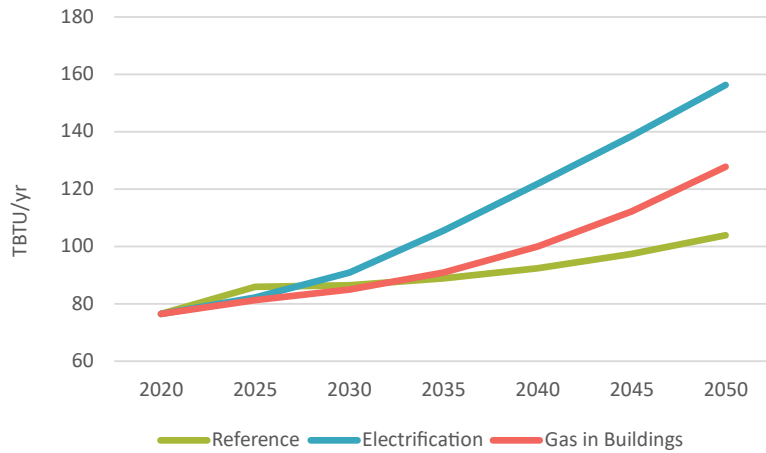
<sup>27</sup> WA DDP Building Sector Energy Demand and Sales Shares Data.



Unlike the residential sector, commercial sector electricity demand in the Electrification Scenario doubles between 2020 and 2050 (Figure 17). However, this increase is largely driven by significant growth in commercial floor area projected in Washington over the next 30 years, which also increases commercial sector electricity demand in the Gas in Buildings and Reference scenarios. For example, while commercial sector energy use doubles between 2020 and 2050, it is only about 50% higher than the Reference Case in 2050, and only about 22% higher than the Gas in Buildings Scenario (Figure 17).

Another key factor driving the increase in commercial sector electricity demand is that the deep decarbonization modeling assumes a much smaller ratio of high-efficiency electric equipment when electrifying gas equipment in the commercial sector than in the residential sector.<sup>28</sup> By prioritizing heat pumps in commercial sector electrification policies, Washington can offset more commercial sector demand than projected in the modeling.

**Figure 17. Commercial Electricity Demand Across Scenarios**



Source: Data from Washington 2021 State Energy Strategy, Appendix B: Data Accompanying Deep Modeling Technical Report, Sheet D2.

<sup>28</sup> Ibid.

## 4. Establish Measurable Targets

Washington’s strategic building decarbonization path relies on the building sector hitting equipment sales shares, having the capacity to achieve retrofit rates, and emissions reductions on a specific timeline. To operationalize this trajectory, both public and private actors need building-specific targets. These targets—coupled with transparency, accountability, and ongoing support for equity—are central to transforming the building stock. They should be established and used to inform decarbonization planning and track progress.

Washington’s strategic building decarbonization path relies on the building sector hitting equipment sales shares and emissions reductions on a specific timeline.

Building sector actors and regulatory agencies need clear direction and inputs for planning, policy, and program design. Washington state should establish a statutory requirement to:

- Characterize the building stock in terms of building and equipment characteristics, demographics, geography, energy use, and emissions.
- Establish building sector targets.
- Assign leadership responsibility and accountability for achieving the targets.
- Use the targets to directly inform regional, state, and utility energy and decarbonization planning and resource allocation.
- Track progress against the targets in a transparent and timely way.

Without early and frequent feedback loops to indicate whether the state is on track to meet building sector targets, the state can easily veer off track and fail to hit the economy-wide statutory emissions limits. Furthermore, without a clear trajectory of state building decarbonization commitments and investment priorities, it will be difficult for market actors and other stakeholders to swiftly take decarbonization to scale or to proactively plan for and address equity.

Targets, transparency, and accountability are central to transforming the building stock. They should be established to inform decarbonization planning and track progress.

In Table 1 we propose targets for emissions reductions and zero net carbon new construction and retrofits.<sup>29</sup> These targets are informed by the building sector modeling in the Washington 2021 State Energy Strategy and the emissions reductions and sales shares and stock rollover dynamics required in the Electrification Scenario at key points between 2020 and 2050.

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<sup>29</sup> In Table 1, zero net carbon retrofit targets encompass a mix of zero net carbon, whole building performance upgrades, and standalone replacement upgrades from electric resistance and fossil fuel equipment to efficient electric equipment.

**Table 1. Proposed Targets for Decarbonizing Washington’s Building Stock**

Targets	2025	2030	2035	2040	2045	2050
Total Building Sector Emissions Reduction	18%	60%	72%	82%	89%	96%
Commercial Emissions Reduction	14%	56%	68%	78%	87%	96%
Residential Emissions Reduction	20%	65%	77%	85%	91%	96%
Commercial Zero Net Carbon New Construction	50%	75%	100%	100%	100%	100%
Commercial Zero Net Carbon Retrofits (% sq. ft. per year)	1.2%	1.8%	1.7%	1.7%	1.6%	1.6%
Commercial Zero Net Carbon Retrofits (million sq. ft. per year)	24M	38M	38M	39M	40M	40M
Commercial Zero Net Carbon Retrofits (buildings per year)	1,400	2,400	2,300	2,500	2,500	2,500
Residential Zero Net Carbon New Construction	74%	100%	100%	100%	100%	100%
Residential Zero Net Carbon Retrofits (% units per year)	1.3%	3.1%	3.0%	2.8%	2.7%	2.3%
Residential Zero Net Carbon Retrofits (units per year)	42,000	110,000	110,000	110,000	110,000	99,000

Source: 2050 Institute analysis using building population forecasts from the 2021 Northwest Power Plan and projected energy use and sales shares from the deep decarbonization modeling performed for the Washington 2021 State Energy Strategy. See: WA DDP Building Sector Energy Demand and Sales Shares Data.

The proposed emissions reduction targets use 2020 as the reference year. Overall building sector emissions must be 60% less than 2020 by 2030, and 96% less by 2050. By 2030, commercial sector emissions must drop 56% and residential sector emissions must drop 65%.

The zero net carbon new construction targets are driven by a combination of the sales shares of electric equipment required in the Electrification Scenario, as well as forecasts of substantial increases in new commercial floor area and residential units in Washington state between 2020 and 2050.

This growth puts added pressure on policy mechanisms, such as the energy code, to ensure that large increases in new construction are zero net carbon and do not increase aggregate building sector emissions. For example, by 2050 Washington is estimated to add approximately 1.35 million new residential units, which

Since there is an average delay of three to five years between an energy code year and when it influences actual sales shares, zero net carbon code requirements must be fully in place by the 2027 energy code.

will represent approximately 30% of all residential units in 2050.<sup>30</sup> Washington is also estimated to add nearly 1 billion square feet of new commercial floor area,<sup>31</sup> which roughly equates to 60,000 new commercial buildings. Commercial buildings built between 2020 and 2050 will represent approximately 37% of all commercial floor space by 2050. To help mitigate the impact of this expansion in new construction, by 2030 new construction should make up a large share of overall sales for efficient electric equipment. This strategy will also provide some buffer for existing buildings to scale up retrofits by 2030.

In addition, since there is an average delay of three to five years between an energy code year and when it starts to influence actual sales shares, zero net carbon code requirements must be fully in place by the 2027 energy code and should be initiated as soon as the 2021 energy code, so they can be fully developed and applied comprehensively by 2027.

In contrast, the mandate currently guiding the development of the Washington State Energy Code requires buildings permitted to the 2030 code to use 70% less net energy than the 2006 energy code.<sup>32</sup> Even if the State Building Code Council adheres to this goal and timeline, the mandate does not require specific emissions reductions, and the energy reductions in the 2030 code would not affect equipment purchasing decisions in new residential and commercial buildings until approximately 2033 and 2035, respectively. At a minimum the mandate should include a carbon reduction requirement and should be accelerated by at least one code cycle.

Without this shift in the energy code, it will be significantly more difficult for Washington to meet the overall 2030 sales shares for existing and new construction combined. Since the sales shares are based on the sum of all new and existing buildings, if there is a delay in new construction going zero net carbon, the number of existing building retrofits will have to increase to make up the difference. Taking overall building decarbonization to scale by 2030 means that new construction must contribute as much of the sales share shift as possible, as soon as possible.

Retrofit rates are set to scale by 2030 and remain mostly stable through 2050. This approach has the effect of accelerating and deepening energy demand reductions, especially in the commercial sector, thereby offsetting more of the commercial sector electric demand growth than projected in the deep decarbonization modeling. This is an example of how demand reduction and decarbonization strategies—in terms of technologies, scale, and pace—can be structured to leverage buildings as an electric grid resource within the overall transition to a clean energy economy.

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<sup>30</sup> 2050 Institute calculations using housing stock forecasts from the 2021 Northwest Power Plan [https://www.nwcouncil.org/2021powerplan\\_forecast-housing-stock](https://www.nwcouncil.org/2021powerplan_forecast-housing-stock).

<sup>31</sup> 2050 Institute calculations using commercial floor area forecasts from the 2021 Northwest Power Plan [https://www.nwcouncil.org/2021powerplan\\_forecast-commercial-floor-space-requirements#\\_ftnref1](https://www.nwcouncil.org/2021powerplan_forecast-commercial-floor-space-requirements#_ftnref1).

<sup>32</sup> Washington State Legislature, “Residential and nonresidential construction—Energy consumption reduction—Council Report,” RCW 19.27A.160, 2009, <https://app.leg.wa.gov/RCW/default.aspx?cite=19.27A.160>.

Since the sales shares are based on the sum of all new and existing buildings, if there is a delay in new construction going zero net carbon, the number of retrofits of existing buildings will have to increase to make up the difference.

Retrofit rates must increase rapidly this decade, ultimately reaching 3.1% of residential units and 1.8% of commercial building floor area per year by 2030.<sup>33</sup> Considering the projected size of the commercial and residential building populations in 2030, these rates equate to nearly 40 million square feet of commercial floor area and about 110,000 residential units per year from 2030 to 2050.

The targets in Table 1 illustrate the type of quantified and measurable targets that should inform the design and evaluation of policies and programs. If Washington state fails to build the capacity, policies, and programs to deliver this level of zero net carbon retrofits, it will lock in higher energy use and emissions in later years.

In the future, aggregate targets should also be developed for other decarbonization-driven policy goals such as increased energy efficiency, grid integration, and onsite solar. For example, with more detailed analysis, demand response and onsite solar targets could be developed. Quantifying what demand response and solar policies should be delivering is imperative for developing comprehensive statewide strategies for these critical elements in the state’s building decarbonization effort. The state should also consider establishing retrofit rate targets for geographic, demographic, and economic segments of the larger building stock to better plan for and achieve equitable outcomes.

## 5. Scale Building Decarbonization by 2030

Based on the building sector targets required to meet 2030 and 2050 emissions limits, taking building decarbonization to scale by 2030 should be defined by four essential and interconnected outcomes:

1. Building sector emissions are 60% less than 2020.<sup>34</sup>
2. All sales of new and replacement space and water heating equipment are zero emission.<sup>35</sup>
3. The transformation is strategically designed, managed, and tracked to support equitable outcomes.
4. The market is capable of decarbonizing the building stock at the target retrofit rate.

All building sector planning, mandates, complementary policies and programs, market development, and tracking must be assessed based on their capacity to deliver these outcomes on this schedule. Anything less seriously jeopardizes the state’s ability to meet its emissions limits.

CETA will draw down building emissions significantly starting in 2030, thereby reducing some pressure on meeting the 2030 building emissions reduction target proposed in the previous section. Near-term efforts

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<sup>33</sup> It is difficult to estimate the current number of retrofits since Washington does not have targets or a tracking mechanism for zero net carbon retrofits. Moving forward, an increasing focus on whole building performance policies, programs, and tracking will help provide better feedback to policy makers and various stakeholders.

<sup>34</sup> Including the impact of carbon-neutral electricity generation required by CETA in 2030.

<sup>35</sup> Although the deep decarbonization modeling shows sales shares of electric and high-efficiency electric space and water heating hitting close to 100% between 2030 and 2035, for purposes of policy alignment and to provide buffer for leveraging rollover dynamics, in this paper we recommend 2030 for scaling up sales shares.



must focus on removing as much onsite fossil fuel emissions as possible by 2030. This reduction can be achieved by relying heavily on a shift to zero net carbon new construction in the mid to late 2020s and by leveraging other existing policies, such as the Clean Buildings Standard<sup>36</sup> and other municipal and state energy codes. It will also require calibrating incentive structures to emissions reduction goals to ensure programs promote absolute load and emissions reductions rather than just minimizing growth.

As CETA delivers carbon-neutral electricity and energy codes deliver zero net carbon new construction by 2030, eliminating nearly all remaining emissions in existing buildings between 2030 and 2050 will require more of a structural shift in how decarbonization is delivered. By 2030, Washington must build out the essential infrastructure of a new strategic building decarbonization framework capable of retrofitting a significant portion of the building stock between 2030 and 2050. This section proposes systemic change, policies, and a front-loaded timeline for adopting policies and building out retrofit capacity to position Washington state to take building decarbonization to scale by 2030.

To operationalize this transformation, the state and various stakeholders should approach the effort in three key phases (Figure 18). While Washington has nearly 30 years to decarbonize its building stock, it must take aggressive action in Phase 1 (2022-2025) to create a policy and planning platform that will drive and support at-scale building decarbonization by 2030. This phase must include passing all key decarbonization policies, aligning strategies and planning methodologies, and establishing a framework of targets, tracking, and accountability.

Figure 18. Three Key Phases for Building Decarbonization

## Three Key Phases to Decarbonize Buildings



<sup>36</sup> Washington State Legislature, “State Energy Performance Standard: Chapter 19.27A.210 RCW,” 2019, <https://app.leg.wa.gov/RCW/default.aspx?cite=19.27A.210> and <https://www.commerce.wa.gov/growing-the-economy/energy/buildings/clean-buildings-standards/>.

In Phase 2 (2026-2030), the policies must be implemented and go into effect so that by 2030 the full ecosystem of policies, planning, and programs is activated to support at-scale retrofit rates across all building types and segments.

In Phase 3 (2031-2050), by the end of 2030 all buildings should be on a policy trajectory and have the market support required to steadily decarbonize by 2050. As described in more detail in the sections below, this effort should be operationalized at a system-wide level.

## **Align Regional and Utility Energy Planning with the Building Decarbonization Imperative**

Thirty years of increasing emissions in the building sector means that Washington state now has limited time to accomplish deep reductions by 2050. The policy goal of meeting load growth—which has historically guided efficiency programs designed to meet 20<sup>th</sup> century energy sector goals—is not strategic within the context of fast-tracked decarbonization required in the 21<sup>st</sup> century. Regional, state, and utility energy planning must align around a new common goal: a 30-year building sector modernization project with clear design constraints for emissions limits, equity, and the physical transformation of buildings and homes throughout the state.

Since Washington’s power system and utilities operate within a regional Northwest planning framework, it will be difficult to scale building decarbonization in Washington if the regional and utility energy and conservation planning, program design, and evaluation methodologies are substantially out of sync with the required scale and pace—thereby potentially hindering swift, strategic, and transformational decarbonization.

**The regional and utility system in the Northwest must be reoriented toward decarbonization, and the foundational pieces of this transition must happen in the next three to five years.**

This white paper asserts that our regional and utility energy planning and efficiency ecosystem must be reoriented toward decarbonization, and the foundational pieces of this transition must happen in the next three to five years leading up to the development and release of the 2026 Northwest Power Plan. Regional targets and state policies must be tightly aligned with measurable decarbonization targets, and the building industry must be fully integrated into the strategy, planning, and implementation of the ramp up to 2030.

Although the 2021 Northwest Power Plan<sup>37</sup> includes decarbonization scenario planning for the first time since its original release in 1983, the plan itself does not align with the levels of efficiency and decarbonization implied by Washington state’s CETA emissions limits or the Washington 2021 State Energy Strategy.<sup>38</sup> Because the Northwest Power Plans have a strong influence on utilities, regulators, and policymakers, the disconnect between Washington’s 2021 State Energy Strategy and the 2021 Northwest Power Plan could undermine the

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<sup>37</sup> Northwest Power and Conservation Council, “Draft 2021 Northwest Power Plan For a Secure & Affordable Energy Future,” 2021, [https://www.nwcouncil.org/sites/default/files/2021powerplan\\_2021-5.pdf](https://www.nwcouncil.org/sites/default/files/2021powerplan_2021-5.pdf).

<sup>38</sup> For more details on the 2021 Northwest Power Plan recommendations regarding decarbonization and the role of efficiency, see Northwest Power and Conservation Council, Section 6, 6-75 to 6-84.

state’s decarbonization achievements. Washington should make an aggressive state-level effort to shift the methodology for the next power plan to be released in 2026.

To take building decarbonization to scale by 2030, regional, state, and utility plans must share common decarbonization targets. Washington can contribute significantly to an improved and decarbonization-centered 2026 Northwest Power Plan by developing its own state-level building decarbonization plans for the residential and commercial sectors and updating them every two to three years.<sup>39</sup> These plans must be completed by approximately the end of 2023 to inform analysis and development of the 2026 Power Plan.

The Washington building decarbonization plans should include development of decarbonization-centered, publicly accessible platform of data and analysis characterizing the state’s building sector market, populations, characteristics, energy use, and emissions. The plan methodology should be designed to inform a new decarbonization-centered methodology for utility conservation potential assessments in Washington, which have typically aligned with the Northwest Power Plan methodology and have focused almost exclusively on energy efficiency potential with no clear end point or timeline for achieving deep energy or emissions reductions. Like the state’s decarbonization plans, the utility building decarbonization plans should be designed to achieve interim and final emissions reduction targets and should include strategies and timelines for achieving, tracking, and reporting them.

## **Structure Codes and Standards to Scale Zero Net Carbon Buildings by 2030**

To achieve scale on a tight timeline, Washington needs a combination of mandatory emission-reduction policies with complementary incentives, investment, and a comprehensive network of codes and performance standards within a larger ecosystem of supportive policies, programs, and market development.

As recommended in the Washington 2021 State Energy Strategy, keystone policies, such as the energy code and building performance standards, must be designed to affect the entire building stock, including all new and existing buildings and all building types.<sup>40</sup> For this approach to be effective—especially in meeting 2030 emissions limits and taking high-efficiency electric equipment sales shares to scale by 2030—the structure of the energy codes and performance standards for accomplishing 2050 targets must be fully adopted and in effect by 2030.

The energy code must be on a steady march to zero net carbon starting with the 2021 code,<sup>41</sup> making additional interim progress in the 2024 code, and becoming fully zero net carbon by the 2027 code. To assist market adaptation, the legislature should allow Washington jurisdictions to adopt more stringent residential energy codes (current state law only allows them to adopt more stringent commercial codes).<sup>42</sup> The current 2018 energy code includes an optional appendix with a residential reach code requiring higher levels of efficiency than the main code. However, it can only be used voluntarily by builders. These reach codes will

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<sup>39</sup> Examples of similar plans include the New York Carbon Neutral Buildings Roadmap, which will be updated every few years <https://www.nyserda.ny.gov/All-Programs/Carbon-Neutral-Buildings> and the California Building Decarbonization Assessment <https://efiling.energy.ca.gov/GetDocument.aspx?tn=239311>.

<sup>40</sup> Commerce, “Washington 2021 State Energy Strategy,” 75.

<sup>41</sup> In 2022, the Washington State Building Code Council is scheduled to consider code change proposals (submitted for the 2021 Washington State Energy Code) to reduce electric resistance and fossil fuel space and water heating in commercial buildings.

<sup>42</sup> Washington State Legislature, “Energy Related Building Standards: Chapter 19.27A RCW,” 2009, <https://app.leg.wa.gov/rcw/default.aspx?cite=19.27A>.

better support the market if jurisdictions are allowed to accelerate the schedule to eliminate emissions from new homes and help prepare the market for the transition.

Washington state currently has a building performance standard (BPS) for commercial buildings greater than 50,000 square feet.<sup>43</sup> The Department of Commerce developed an energy use intensity baseline and targets framework that can be generalized for the entire commercial sector. For example, the BPS can be expanded to include smaller buildings. The BPS should be extended to play a more comprehensive role in regulating energy use and emissions in existing buildings.

To accelerate energy use and emissions reductions beyond the scale and pace of a mainly programmatic and market driven transition, the BPS could be structured to apply to all building types (including multifamily and, to a degree, other residential buildings) and sizes with tailored metrics and requirements depending on type and size.

The performance standard should be extended to multifamily buildings and to all buildings above 20,000 square feet with compliance years starting in 2030. The State should also consider extending the benchmarking and energy/decarbonization management requirements to buildings greater than 10,000 square feet. A BPS could also be set up for residential buildings, but it should be based on an asset performance score rather than operating performance, and should be triggered by key real estate events, such as point-of-sale and point-of-lease.

Important changes to the BPS also include adding additional key performance metrics, such as onsite greenhouse gas intensity and peak demand, and establishing a final performance standard for all metrics so buildings can develop longer-term strategic energy and decarbonization plans to meet 2050 emissions limits.<sup>44</sup> All essential components of the BPS, including the onsite greenhouse gas intensity metric, should be adopted by 2025.

There can be up to a five-year lag in the effective date of any new standards, making it crucial to prioritize development of a comprehensive BPS framework as soon as possible, including final performance standards for multiple metrics and a compliance trajectory. The BPS policy structure and timeline must put buildings on a path to make significant emissions reductions by 2030 and become zero net carbon by 2050.

## **Recalibrate Incentive Structures**

Complementary policies, programs, and investment should be prioritized that directly and substantially support the objectives and timeline of the energy code and building performance standards. Accordingly, the focus of these policies and programs should be to remove market incentives for fossil fuel equipment and increase market incentives for electric equipment.

Collectively, the following actions should be set in motion in the next couple of years, partly so they have time to take effect and have an impact between now and 2030, but also to be solidified in time to be accounted for

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<sup>43</sup> Washington State Legislature, "State Energy Performance Standard."

<sup>44</sup> Institute For Market Transformation, "Summary of Building Performance Standard Model Ordinance | IMT," 2021, 4, <https://www.imt.org/resources/imt-model-bps-ordinance-summary/>.

in the development of the 2026 Northwest Power Plan. Essential complementary policies and programs include:

- In 2022, gas utilities should be prohibited from expanding service territories and subsidizing line extension costs within existing service territories using line extension allowances. This will limit the expansion of existing gas service and remove an incentive for installing gas.<sup>45</sup>
- Utility and other programmatic incentives for new or replacement natural gas equipment should be discontinued by 2023. This will reinforce the energy code and performance standards by aligning market and program incentives with—rather than in direct opposition to—the requirements in the keystone policies and the overall state energy strategy.
- Market and program incentives for high-efficiency electric equipment must be added and/or augmented. For example, utilities must be allowed to provide electrification incentives to their customers, and utility program cost-effectiveness tests must be restructured as soon as possible to be fuel neutral and encompass a full spectrum of electrification, equity, and health benefits. California is changing the way it values energy efficiency with a total system benefit metric focused on reducing GHG emissions, supporting equity, and increasing grid stability.<sup>46</sup> State agencies should immediately begin to work with regional utilities and the Bonneville Power Administration to provide and implement incentives and program support to enable a strong decarbonization focus in utility programs across the state by 2023.
- Utilities should be allowed to incentivize first-year code compliance to help offset the initial cost and technical impact of high-efficiency electric equipment while the market adapts to new requirements such as heat pumps that can have higher initial costs than less efficient combustion equipment. This change should happen by 2022 so utilities can provide incentives starting in 2023 when the 2021 Washington State Energy Code is scheduled to go into effect.
- The state should develop and fund a large-scale heat pump program for new and existing buildings.<sup>47</sup> The program can be implemented by the utilities, but preferably would be structured as point-of-sale incentives to streamline market adoption, and should also receive additional incentive money, research, and market transformation support from the state. Incentives should be set to support rapid market shifts, address long-term affordability, be higher for low-to-moderate-income (LMI) households and businesses, cover circuit breaker boxes and other necessary upgrades, and be bundled with other efficiency upgrades.

The policies and programs described above are synergistic and would help create the conditions for Washington state utilities to play a more fundamental role in decarbonizing the building stock. With these changes in place by 2025, the state could significantly increase utility targets for efficiency, electrification, demand response, and overall energy optimization programs in support of building decarbonization through 2030 and beyond.

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<sup>45</sup> Commerce, “Washington 2021 State Energy Strategy,” 82.

<sup>46</sup> California Public Utilities Commission. CPUC Better Aligns Energy Efficiency Programs to Reduce GHG Emissions, Support Equity, and Increase Grid Stability,” May 20, 2021. <https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M385/K242/385242131.PDF>.

<sup>47</sup> Commerce, “Washington 2021 State Energy Strategy,” 77–78.

## Operationalize Large-Scale Implementation

Market transformation and workforce expansion efforts must become laser-focused on the implementation of large-scale decarbonization. Current market transformation models designed to deliver long-term change without a clear end point, targets, or timeline are out of sync with the scale and pace of change implied by the Washington 2021 State Energy Strategy.

Taking building decarbonization to scale in Washington state by 2030 will require a rapid coalescing of common purpose and coordination by government, market actors, and other stakeholders. To shift space and water heating sales to high-efficiency electric by 2030, we must maximize market innovation at all levels with a focus on three critical implementation objectives:

1. Dramatically reduce the cost of zero net carbon construction and retrofits;
2. Rapidly accelerate the speed of zero net carbon retrofits; and
3. Ensure workforce and community investment to achieve equitable outcomes.

Ultimately, the lion's share of innovation for decarbonizing Washington's building stock at this pace must come from the multitude of critical building sector industries and stakeholders, including:

- Real estate agents
- Developers
- Architects, engineers, and contractors
- Labor
- Manufacturers and distributors
- Finance and insurance managers
- Environmental justice and community advocates

To leverage the potential benefits of the building transformation, these industries and stakeholders must determine the role they will play in taking zero net carbon construction and retrofits to scale by 2030, their plan for achieving it, and how they can contribute to the objectives described above.

A key role for the state in this process is to prioritize and support the market development and innovation required to operationalize large-scale implementation. The state should continue to conduct outreach and coordination with building sector industries to obtain input for its building decarbonization planning, develop market transformation roadmaps, and provide continued market development and supply chain support.

As recommended in the Washington 2021 State Energy Strategy, the state should develop a dedicated building sector market transformation function.<sup>48</sup> The state should also work closely with the Northwest Energy Efficiency Alliance (NEEA) and consider becoming a NEEA funder separate from the Washington utilities that are already involved.

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<sup>48</sup> Ibid, 80.

It is beyond the scope of this white paper to propose specific market innovations, much of which should come from the building sector and other stakeholders through a targeted participatory process. However, there is a need for state support to establish clear market and workforce development goals, strategies, and a timeline for large-scale implementation. Examples of essential strategies that would help meet the moment of Washington's building decarbonization mission include:

- Mass customization for new construction and retrofits, including:
  - Systemization and increased productivity
  - Equipment cost reductions and/or bulk buys including point-of-sale incentives
  - Template designs and scalable technologies, assemblies, and packages for both new and existing construction
- Performance-based contracting at neighborhood/community scale.
- Updated business models and increased productivity for new construction and retrofits.
- Geographically and demographically targeted whole-building zero net carbon retrofits, e.g., building decarbonization ramp-up efforts in the 2020s could target LMI households and businesses with significantly increased incentives and transition support.
- A common building performance and asset-based labeling system to integrate across residential and commercial building energy code compliance certificates, building performance standards, and real estate and financing valuation and transaction requirements.

### **Establish Transparent Tracking and Accountability**

As natural gas use in buildings doubled, and overall building sector emissions increased by more than 40% over the past 30 years, the state lacked feedback mechanisms adequate to support effective adaptive management to counter this trend. To ensure the state meets its building-specific targets moving forward, it should develop a public facing progress-tracking dashboard and database of building sector data, analysis, targets, retrofit rates, emissions reductions, etc.

A tracking platform could draw upon readily available data such as energy use by fuel type for the residential and commercial sectors and other state and regional sources. The platform should also include building characteristics, geographic and demographic data, emissions factors, energy and emissions by fuel type, and other critical data needed for regional, state, utility, and market planning and implementation purposes.

## **6. Conclusion**

The deep decarbonization modeling conducted for the Washington 2021 State Energy Strategy illustrates the strategic role that space and water heating electrification and efficiency retrofits must play to reduce energy demand and decarbonize Washington's building stock. The modeling also crystalizes the time-sensitive scale and pace of transitioning to high-efficiency electric equipment in homes and buildings. Washington policymakers and stakeholders must act with urgency and collaborate to align planning, policies, programs, and investment with the zero net carbon new construction and retrofit rates required to meet 2050 emissions limits. Otherwise, it will be difficult for the state to catch up without pursuing a path of more costly and disruptive early replacements.



Restructuring Washington's building sector policy and planning ecosystem to deliver market transformation by 2030 will require a level of systemic change and coordination comparable to the tectonic shifts in Northwest power planning and conservation set in motion in the 1970s. Systemic change requires a high degree of commitment, focus, and common purpose across government agencies, private industries, and other stakeholders and market actors, and should not be downplayed in favor of more one-off, incremental approaches. With fewer than 10 years to scale building decarbonization in Washington, systemic change is essential to achieving emissions limits.

With an all-in effort, Washington can significantly broaden its energy efficiency policies, programs, research, and market transformation infrastructure to turbocharge equitable building decarbonization. In addition, involving the building sector industry will pay dividends in both innovation and market development around decarbonization. State leadership could provide pivotal support to key industries to develop plans for taking building decarbonization to scale by 2030.

Washington has a narrow window of opportunity to implement systemic change and proceed with a well-managed, equitable ramp up by 2030. The analysis and recommendations outlined in this white paper are not intended to be inclusive of all technical strategies, policies, or actions required to achieve this objective. The Operation 2030 imperatives and strategies emphasize the totality of the scale and pace of building decarbonization indicated by Washington's economy-wide emissions limits. There is an urgent need for a statewide, public, and private push to complete a policy platform and the institutional and market capacity to scale building decarbonization by 2030.

## 7. Operation 2030 Next Steps

To support this pivotal juncture in Washington's building decarbonization effort, the Clean Energy Transition Institute and 2050 Institute aim to launch targeted analysis, strategic forums, and a series of policy briefs in 2022. The goal will be to reach out to stakeholders, get input to better align future work with research and analysis needs, and refine Operation 2030 targets and strategies for scaling building decarbonization.

The strategic forums will focus on:

- Collective ideas for how to refine and operationalize the key strategies outlined in this white paper.
- Industry-specific outreach and dialogue to assess industry implications of Operation 2030 emissions reduction targets, target retrofit rates, strategies, and progress tracking.
- Outreach and dialogue with local, state, and regional organizations, including advocacy and BIPOC groups, to help sync up activities around essential targets and timelines.

Research will focus on assessing the technical and policy implications of:

- Energy efficiency, demand response, and onsite solar required to optimize grid interaction and help minimize electric load growth.
- Sensitivity analysis on Operation 2030 proposed retrofit targets and the role that buildings can play as a strategic grid resource.

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- The type and volume of new technologies and workforce levels required to meet zero net carbon new construction and retrofit rates for homes and buildings.
- A deeper understanding of the costs and benefits of building electrification, including workforce and health benefits, as well as how costs will be equitably distributed.
- Levels of investment in complementary programs and subsidies required to scale up and maintain retrofit rates.
- Costs, benefits, and the most strategic applications for decarbonized pipeline gas.

The Operation 2030 team welcomes and encourages white paper reactions, considerations, gaps, questions, and new ideas. Additional input and perspectives will help ensure that the Operation 2030 team provides the most timely, responsive, and nuanced analytical support to the larger building decarbonization ecosystem moving forward as we collectively build the technical, market, and workforce capacity to equitably decarbonize Washington's building stock.

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