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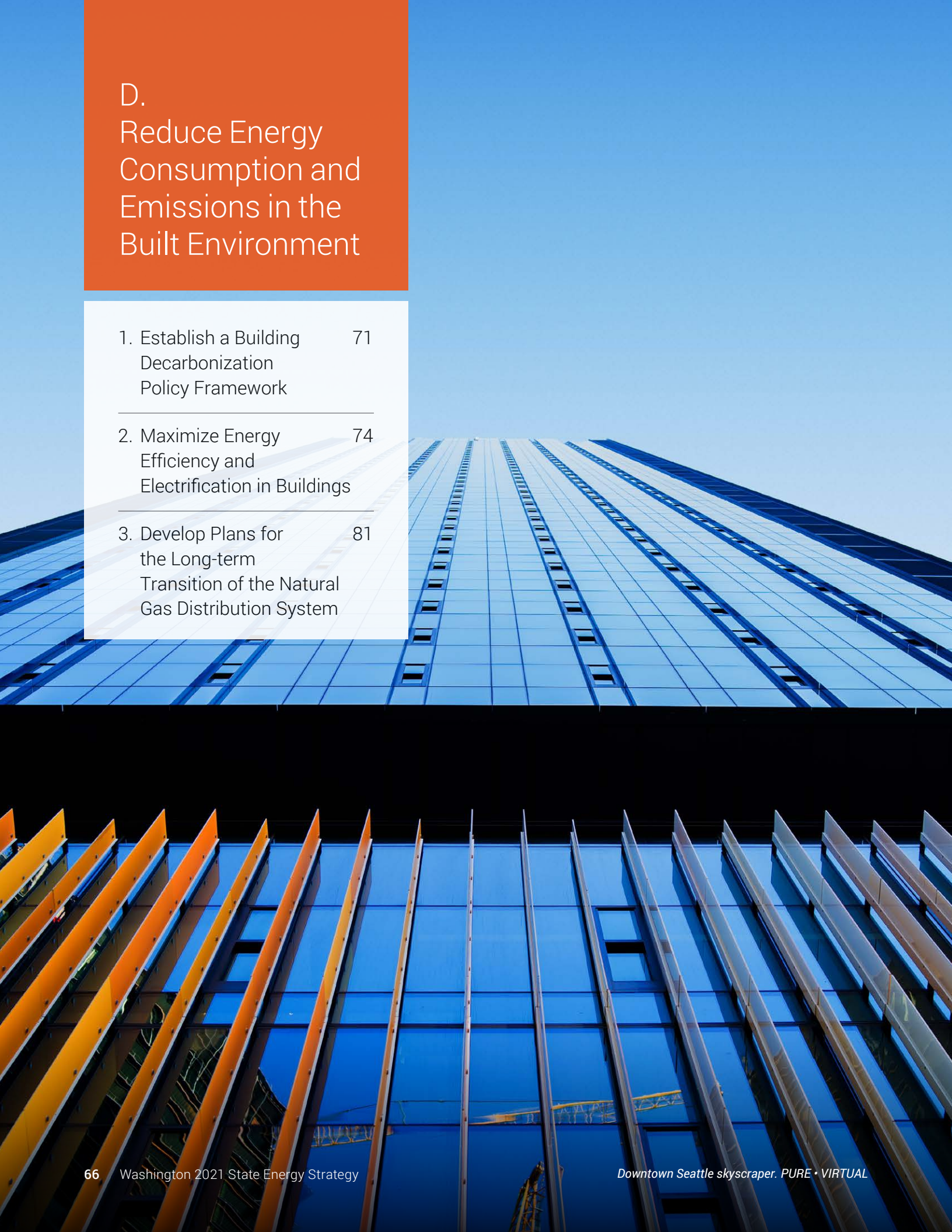


Downtown Seattle skyscraper. PURE • VIRTUAL

D. Reduce Energy Consumption and Emissions in the Built Environment

Buildings represent approximately one-fifth of Washington's greenhouse gas emissions. This includes emissions related to electric generation. The greatest portion of the sector's emissions come from the direct combustion of natural gas and other fossil fuels in buildings for space heating, water heating and cooking.

The deep decarbonization modeling analysis described in Chapter B-Achieve the State's Greenhouse Gas Emission Limits identified a combination of energy efficiency and electrification as the least-cost strategy to meet the state's greenhouse gas emissions limits for buildings. Consistent with this finding, this chapter recommends policies and actions required to implement an electrification strategy in Washington buildings.

A buildings electrification strategy presents a suite of opportunities and challenges. Increasing the adoption of energy efficiency and converting space and water heating to high efficiency heat pumps[82] requires refocusing energy efficiency policies to carbon reduction policies. Market transformation efforts will be required to prepare contractor infrastructure, pilot innovations and drive consumer acceptance. Capital investments must be made with full consideration of equity and distributional cost impacts. Building upgrades will need to be scheduled to avoid housing or business disruptions.

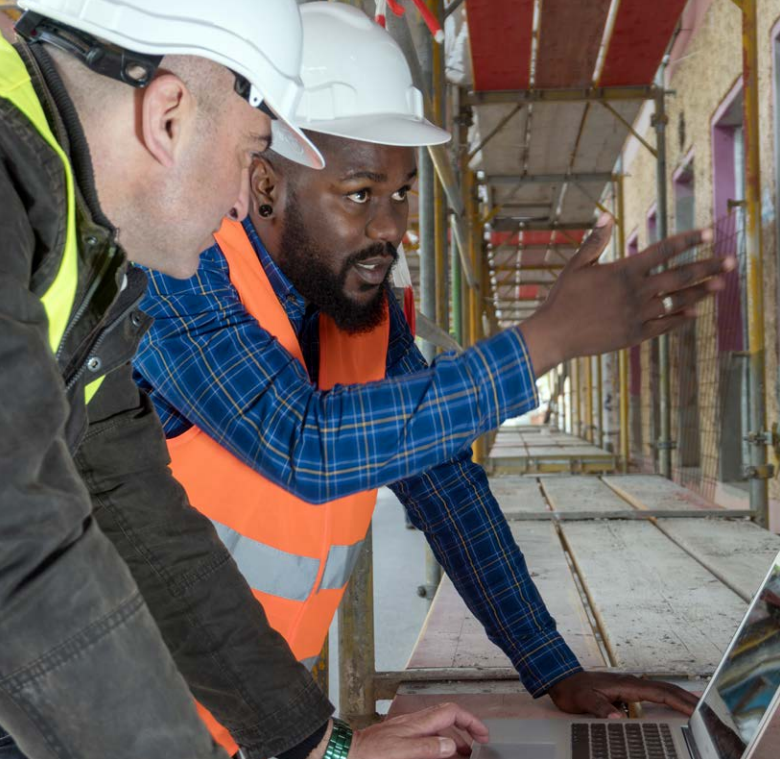
The buildings sector relies on and creates opportunities to support policies from other sections of the state energy strategy. Decarbonizing buildings depends on the electricity sector to provide clean electricity, requires the industrial sector to provide low-carbon building materials and refrigerants and supports deploying distributed energy resources, including renewables and load control services, such as solar and battery storage systems. Buildings will also serve as a distribution hub for electric vehicle charging.

Rooftop gardens in Seattle, WA. Danita Delimont/Alamy Stock Photo

Decarbonizing the building sector requires the state to:

- Maximize energy efficiency
- Maximize electrification
- Optimize buildings as grid resources
- Minimize embodied carbon and refrigerant emissions

[82] A description of the wide range of heat pump and chiller applications for buildings and district heating systems is included in Appendix D – Heat Pumps.

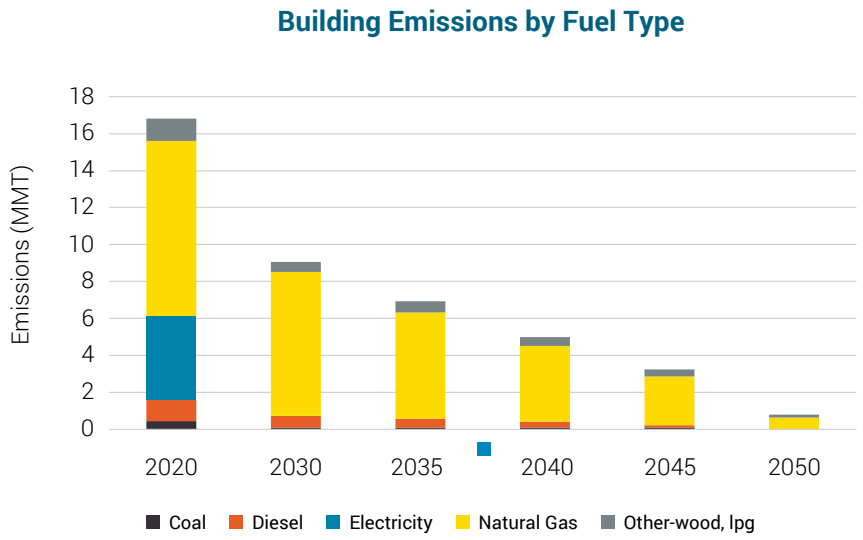


Construction workers. Cineberg/iStock

The following three figures illustrate the challenge and pace of implementing the Electrification Scenario in buildings. Currently, electricity contributes 27% of building energy greenhouse gas emissions, natural gas contributes 56% and a combination of diesel oil, propane and other fuels contribute the remaining 17%. Implementing CETA will reduce emissions from electricity generation to carbon neutral by 2030. To meet the state's greenhouse gas reduction limits, emissions from gas in buildings must decline 14% by 2030 and continue to decline at an increasing rate through 2050 (Figure 18).

To meet the 2030 limits, high-efficiency electric strategies will need be implemented at every available opportunity. Ideally, this would mean every time fossil fuel or electric resistance equipment is scheduled for renewal, it would be replaced with high-efficiency electric equipment. All new construction would need to be designed and constructed to meet low-energy, zero-carbon standards.

FIGURE 18. ELECTRIFICATION SCENARIO: BUILDING SECTOR EMISSIONS BY FUEL TYPE



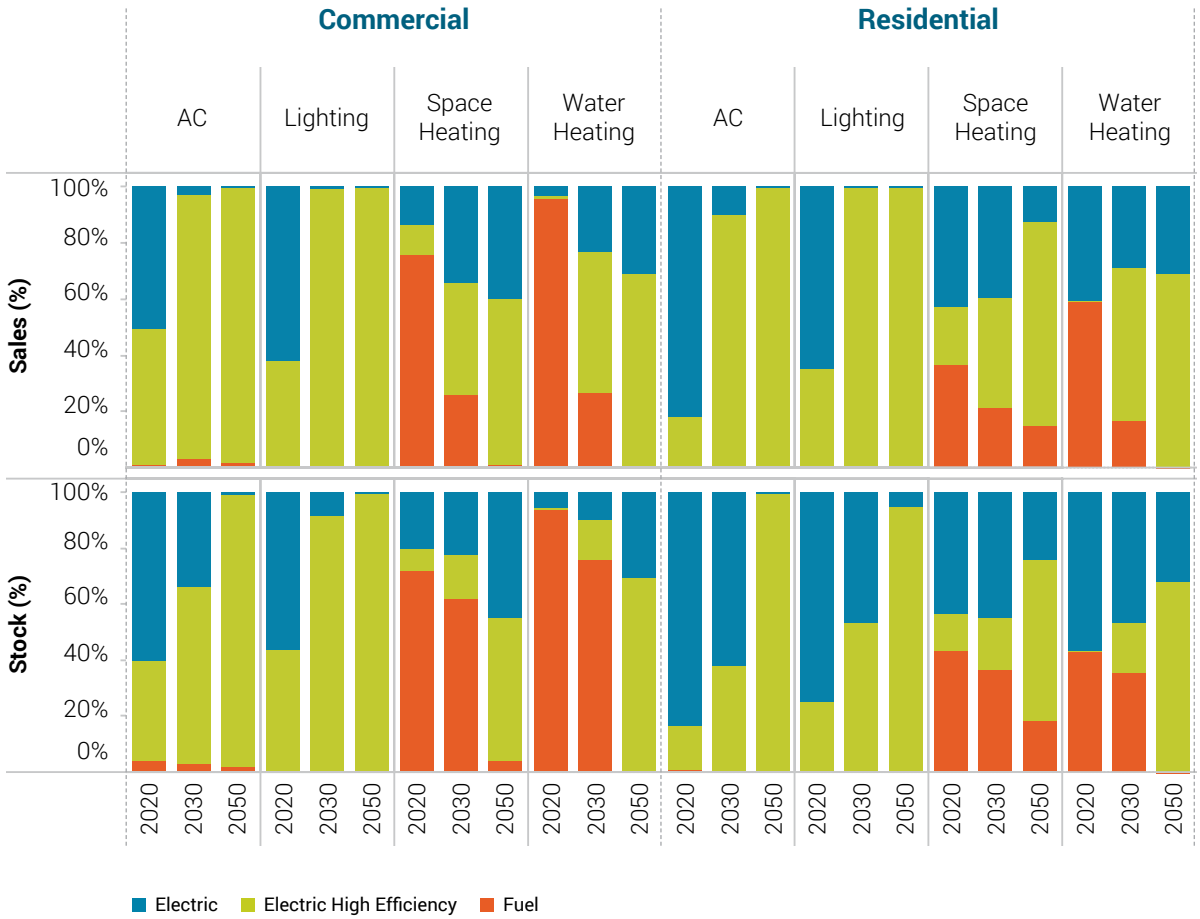
Source: Appendix A – Deep Decarbonization Pathways Modeling Report, December 11, 2020.

Buildings represent approximately one-fifth of Washington's greenhouse gas emissions with the greatest proportion coming from direct combustion of natural gas and other fossil fuels in buildings for space heating, water heating and cooking.

Figure 19 demonstrates how the shift in equipment sales in the Electrification Scenario drives energy and emission reductions in the decarbonization modeling described in Chapter B.

Attic insulation with Weather Assistance Program. Department of Commerce

FIGURE 19. BUILDING EQUIPMENT SALES AND STOCK SHARES DRIVING ENERGY AND EMISSIONS REDUCTIONS IN THE ELECTRIFICATION SCENARIO



Source: Appendix A – Deep Decarbonization Pathways Modeling Report, December 11, 2020.

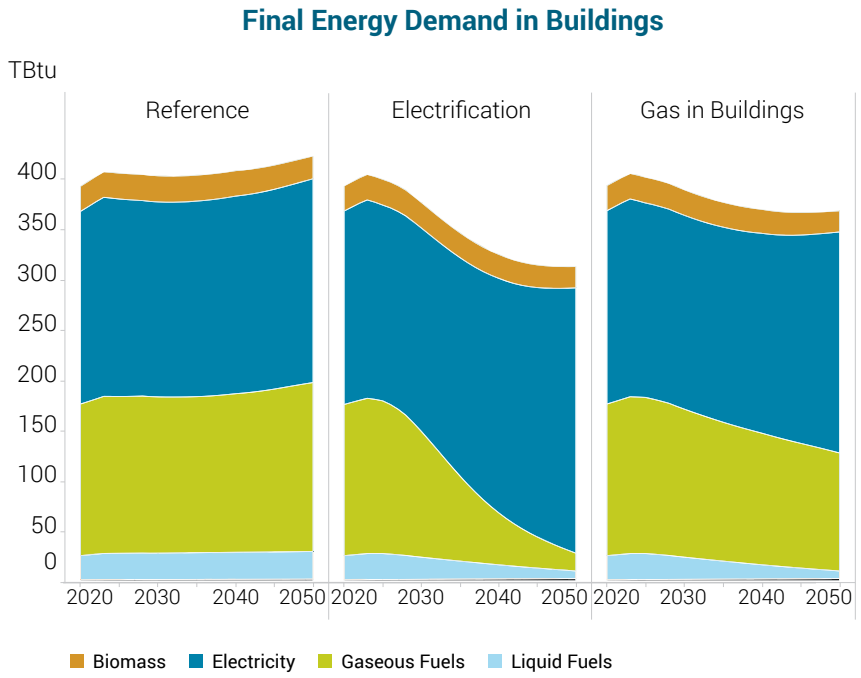
In Figure 20, the Electrification Scenario results in the building sector reducing all energy loads by 26% in 2050 with energy efficiency actions. This will be a combination of building improvements and conversion of existing electric resistance space and water heating to heat pump technologies. The loads currently served by fossil fuels must be converted to high efficiency electricity. This results in an increase in electricity requirements of 30% compared to the Reference Scenario.

In addition to energy use, buildings contribute to greenhouse gas emissions through the manufacturing of construction materials and carbon embedded in refrigerants used in heat pumps and cooling systems.

Embodied carbon — carbon emissions attributed to construction materials — accounts for 11% of annual global emissions.[83] Furthermore, Hydrofluorocarbon (HFC) refrigerants are a very potent greenhouse gas. Building policies and programs must drive demand for lower carbon building materials and encourage the transition to less harmful refrigerants.

> A building decarbonization policy framework must be fast-tracked to meet the 2030 greenhouse gas emissions limits.

FIGURE 20. SCALE AND PACE OF ENERGY USE REDUCTIONS REQUIRED TO MEET ECONOMY-WIDE EMISSIONS LIMITS



Source: Appendix A – Deep Decarbonization Pathways Modeling Report, December 11, 2020.

[83] "Why the Building Sector?" (Architecture 2030, n.d.), https://architecture2030.org/buildings_problem_why/.

1. Establish a Building Decarbonization Policy Framework

Washington's building policies need to directly address the state's greenhouse gas emissions limits. Over the last 40 years, Northwest states and utilities have developed a robust regional power and energy efficiency planning and delivery system. However, this system does not address greenhouse gas emissions directly. The central elements of a building decarbonization policy framework must be fast-tracked to meet the 2030 greenhouse gas emissions limits. At the same time, institutional and market capacity development is needed to meet the 2050 limits.

Building up manufacturing and retrofitting capacity to transform the building stock is a significant task requiring market predictability and longer lead times. It is critical that the state adopts the basic structure of the building sector transition now, so policies, codes and standards can be put in place on a timeline that provides predictability in the form of clear signals that building owners and market forces can respond to.

The state needs a new policy framework harmonizing and delivering deep energy and greenhouse gas savings. Optimizing energy use, rather than just reducing it, will decarbonize the building sector. This means switching away from programs based solely on reducing energy use to programs that value outcomes based on energy utilization and greenhouse gas emissions limits. There needs to be a shift to standardized performance-based metrics and labeling across all policies and programs.

The transition to a more efficient, decarbonized building stock will succeed only if all Washingtonians have a stake in its success and the transition benefits all Washington communities. Energy efficiency programs have focused primarily on reducing energy use or costs, while in many cases ignoring the co-benefits of improved resiliency, public health and climate adaptability. Building electrification and energy efficiency policies and programs should enable equitable outcomes for low-income communities, including improvements in public health outcomes, increases in energy affordability and making homes more comfortable.

1.1. Expand Building Decarbonization Leadership Capacity

State government will need to increase its role in energy planning, energy code development and program implementation for the state to meet its greenhouse gas reduction limits in the building sector. Much of the leadership, research, analysis and planning for the current Northwest energy efficiency industry is conducted at the regional level as part of the power planning process required by the 1980 Northwest Power Act.[84]

Energy efficiency in buildings is evaluated as a least-cost resource rather than a decarbonization imperative that must be accelerated. Washington state government will need to build off of the infrastructure currently supporting efficiency and provide the resources and policies necessary to support decarbonization efforts in the building sector.

ACTIONS

- Expand and clarify the roles and responsibilities for the state energy office and other state agencies to provide analytical and planning capabilities that directly support building decarbonization.
- Work with regional organizations to align energy efficiency research, planning and market transformation efforts. Create situational awareness with data resources supporting policy development and implementation plans.
- The state should strategically amplify, fund and align with efforts of existing organizations and alliances, including workforce development and community organizations, ensuring the availability of necessary financial, technical and human resources.

[84] "Northwest Power Act" (Northwest Power and Conservation Council, n.d.), https://www.nwcouncil.org/reports/columbia-river-history/northwestpoweract.

1.2. Develop a Detailed Washington Building Decarbonization Plan

This state energy strategy lays out a high-level roadmap and set of policy recommendations for the building sector. The state needs to further develop a more detailed building decarbonization plan. California's Assembly Bill 3232[85] requires the California Energy Commission to develop a detailed plan to reduce building sector emissions by 50% by 2030. The California plan must include detailed building characterization, segmentation, technical and fiscal analysis and set emissions reduction targets.

Washington needs to develop a comparable plan with the expectation that it will be reviewed periodically to assure continued effectiveness. A wide-ranging group of stakeholders will need to be brought into the effort to assure success. Planning should uniquely address the challenges that the clean energy transition poses for single and multi-family residences, various sizes of commercial buildings, campus or district configurations, private and public owners, rural and urban locations, highly impacted populations and low-income communities.

Washington's building decarbonization strategy must couple non-energy policy with energy policy, such as energy efficiency mandates that protect against increases in rent leading to displacement, and support for workforce development efforts to ensure equitable access to career-track jobs in and beyond building decarbonization.

ACTIONS

- Develop a state decarbonization plan for buildings covering each part of the buildings sector in every region of the state.
- Within the plan, establish clear energy utilization targets and greenhouse gas emissions limits for buildings by type, including interim and final targets. Include methods for incorporating campus or district thermal distribution systems. Use these targets to guide adoption of mandatory energy codes, building performance standards and utility program designs.
- Develop an electrification and heat pump program to electrify the building sector using the least cost and

[85] "Zero-Emissions Buildings and Sources of Heat Energy," Pub. L. No. AB-3232 (2018), https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232.Zero-emissions buildings and sources of heat energy (Chapter 373). https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB3232.

Houseboat with solar on Lake Union, Seattle, WA. PhilAugustavo/iStock

most strategic approach, while addressing equity, consumer access and market capacity considerations.

- Develop market transformation roadmaps to identify the interventions required in technology, supply chain delivery, contractor education and consumer marketing.
- Explore increasing consumer and business financing options. For example, develop residential PACE financing programs similar to the recently adopted CPACER option.[86] Consider on-bill financing administered by utilities or other mechanisms.
- The plan should be developed with an inclusive public process addressing specific needs of communities, with focus on equity and inclusion.
- The plan should be developed in consultation with industry professionals to assure plans address technical, design and construction applicability specific to building end uses.

1.3. Align Utility Ratepayer Programs around Decarbonization Performance Outcomes

Utilities will play a significant role in taking building decarbonization to scale. Utilities work within an existing energy and conservation planning framework and have programmatic mechanisms for reducing energy use. By virtue of their customer base, they have direct relationships with every residential and commercial building owner in the state.

Energy conservation potential is developed in the context of each utility resource plan. Conservation is chosen when it provides the least-cost resource. The social cost of carbon has recently been added as a consideration during this planning, increasing the value of conservation compared with alternate approaches, which can result in continued greenhouse gas emissions.

The existing framework may lead to increased utility participation in conservation acquisition, although these impacts will not be uniform across all utility service territories or across all buildings in the state. Utility planning and efficiency efforts also need to be structured to achieve building performance energy utilization targets and greenhouse gas emissions limits.

ACTIONS

- Structure performance-based mandates as the critical path for each building segment to meet the state's low-energy and zero-carbon building targets. Utility programs and market transformation efforts should then be required to directly align with and support the success of the mandates in drawing down energy use and emissions.
- Adopt policies and programs for determining baselines, attribution, energy and greenhouse gas emission reductions and the determination of least-cost approaches.
- Develop structures that assure funding allocations respond to the needs of low-income and other vulnerable customers.
- Identify utility regulation or utility performance incentives required to assure outcomes.

1.4. Accelerate Adoption of Low Greenhouse Gas Emissions Refrigerants and Equipment

In addition to energy use, buildings contribute to greenhouse gas emissions through the manufacturing of construction materials as well as refrigerants used in heat pumps and cooling systems. Manufacturing techniques have been developed to control or reduce these emissions. Businesses can now manufacture concrete with reduced environmental impacts. Cross-laminated timber provides a zero-carbon wood product that can be used in building construction. Regulations to control and eventually eliminate HFCs are being developed and implemented.[87] Meanwhile, a global initiative to reduce the impacts of refrigerants has been adopted under the Montreal Protocol,[88] which continues to spur chemical and equipment manufacturers to develop products that use less harmful constituents.

[86] "Concerning Commercial Property Assessed Clean Energy and Resilience.," Pub. L. No. HB 2405 (2020), https://app.leg.wa.gov/billsummary?BillNumber=2405&Year=2019.

[87] Chapter 173-443 WAC.

[88] "About Montreal Protocol," UN Environment Programme, n.d., https://www.unenvironment.org/ozonaction/who-we-are/about-montreal-protocol.

Washington adopted regulations to reduce the impacts of refrigeration chemicals through HB 1112 (2019).[89] The statute requires less damaging HFCs, or suitable substitutes to be used in various equipment applications, and implements refrigerant management processes. Relatedly, the Washington State Building Code Council has voted to adopt a reference standard that will allow the use of A2L refrigerants in refrigeration and air-conditioning including the use in occupied dwellings.[90] The scope of these efforts is limited but encouraging. As new equipment is developed and made available, Washington's laws and rules will need to take advantage of new opportunities while continuing to manage refrigeration systems.

ACTIONS

- The State Building Code Council should adopt the most recent editions of national equipment standards allowing installation of low emissions refrigerants in buildings.
- The State Energy Office should incorporate low emissions refrigeration opportunities as they become available as part of market transformation efforts.
- The State Board of Community and Technical Colleges should incorporate application of state regulations for refrigerant management in industry-related coursework. The board should support training programs related to new equipment as they become available. Capacity building and training for minority- and women-owned construction businesses and contractors should be prioritized for development.

> Washington's energy code and performance standards should be revised or adopted to incorporate the state's greenhouse gas emissions limits.

2. Maximize Energy Efficiency and Electrification in Buildings

Washington's core strategy for meeting its greenhouse gas limits must focus on retiring and replacing equipment in buildings with high-efficiency electric systems and achieving deep energy efficiency savings to reduce electric loads. The existing utility programs, energy code and building energy performance standards provide a good foundation for this transition. However, these policies and programs cannot deliver the increased sales share of high-efficiency technologies and electrification needed to meet the 2030 and 2050 greenhouse gas emissions reduction limits.

To meet these limits, Washington will need a comprehensive suite of revamped and new policies that put the building sector on a path to meet the 2030 and 2050 limits. Consideration should be given to the challenges posed for single-family, multifamily, various sizes of commercial buildings, campus or district, private and public ownership, rural and urban locations and highly impacted populations. To increase the resiliency of the building stock for occupants, energy policy must be coupled with affordable housing, public health and anti-displacement policies.

This strategy flows from the proposed building decarbonization policy framework described above. It is designed to reduce the risk of locking in carbon-emitting technologies and practices that will hold back Washington's ability to meet greenhouse gas limits. The strategy includes the following components to support the development of a robust policy and market for each building type and size: performance disclosure, mandates, complementary utility programs, accelerated market transformation and financing.

Energy efficiency and electrification programs need to be focused on metrics, such as public health outcomes to track progress toward increasing equitable outcomes, as there is a known gap in the data available regarding the efficacy of building electrification efforts for low-income communities.

[89] "Hydrofluorocarbon Greenhouse Gas Emissions," Pub. L. No. House Bill 1112 (2019), http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/House/1112-S2.SL.pdf?q=20201129212221.

[90] Alex Ayers, "WA Code Council Paves the Way for Use of A2L Refrigerants," November 13, 2019, https://blog.hardinet.org/wa-code-council-refrigerants.

2.1. Strengthen and Expand Energy Codes and Standards

Washington's energy code and performance standards should be revised or adopted to incorporate the state's greenhouse gas emissions limits. The Washington State Energy Code[91] regulates the construction of new residential and nonresidential buildings, additions and major renovations and establishes equipment replacement efficiency criteria.

The state building energy performance standard[92] (BPS) implements a strategic energy management program to improve the energy performance of existing nonresidential buildings greater than 50,000 square feet in floor area. Both the energy code and the BPS are structured primarily as energy efficiency standards rather than as explicit carbon emissions standards. Washington has not adopted a residential building performance standard.

Codes are an important element of providing broad benefits to all housing types and are the least-cost approach to implementing energy efficiency and carbon reduction in buildings. Codes and standards will also be important elements of deploying EV charging infrastructure and distributed energy resources (DER) technologies. The state building code already includes requirements to develop EV charging infrastructure, including in apartments[93] and incentives for renewable energy generation. But other DER features, such as load control, are not similarly incentivized.

ACTIONS

- The Legislature should revise the energy code to require the state Building Code Council to adopt zero-carbon and all-electric construction and efficiency mandates no later than the 2027 code, fully achieving incremental improvements each code cycle from 2021 to 2027. Funding for technical development, code implementation and evaluation of progress should be provided.
- Consider additional energy code provisions to expand deployment of DER technologies, such as on-site generation and utility-integrated load control.

Zero-net energy townhomes in Issaquah, WA. Chuck Murray

- Continue to evaluate the role of net zero energy buildings[94] as a resource in the context of building and DER policies.
- Continue to evaluate the implementation of standards that lead to increased use of building materials with low embodied carbon emissions.
- Expand the scope of the BPS to include buildings with less than 50,000 square feet with a stepped path to low energy and zero carbon by 2050. Modify the BPS with provisions specific to smaller buildings.
- Adopt a mandatory residential performance standard to scale up the residential retrofit market. Include comprehensive equity and workforce provisions for both rental and owner-occupied homes and identify the unique opportunities and challenges faced by all residential segments including single family, multifamily and manufactured housing.
- Dissemination of information should be operationalized at the state level through training programs.

[91] Chapter 19.27a.020 RCW.
[92] Chapter 19.27a.210 RCW.
[93] Chapter 51-50-0427 WAC, Section 429.
[94] Net zero energy buildings use very little energy and include renewable onsite generation resulting in annual net zero energy consumption on site.

Technician measuring air conditioning equipment.

- To ensure affordable housing units in Washington are able to comply with the building performance disclosure policies, there should be flexibility in compliance timelines and targeted education and training programs in multiple languages.
- Capacity building and training for minority- and women-owned construction businesses and contractors should be prioritized during policy development. Design training programs for energy audits with incentives or requirements to hire from low-income and frontline communities.
- Customize performance standards for affordable housing and rent-stabilized units to reduce displacement and enable streamlined compliance. Integrate benchmarking requirements into qualified allocation plans (QAPs) that determine low-income housing tax credit (LIHTC) allocations.[95]
- Ensure inclusion of local and Tribal government representatives during the process of developing the energy code and building performance standards framework and strategy.

2.2. Lead by Example with Public Capital Projects and Energy Management

The state capital budget provides funding for new construction, major renovations and minor works projects in the public sector. This includes projects for state, local and Tribal government, higher education and K-12 schools, low-income housing and nonprofit institutions. Given their long service life, the allocation of capital funds for these public projects should include requirements for planning, construction and operation consistent with achieving the state's greenhouse gas emissions limits and build on existing efforts to lead by example.

Participation of multiple state agencies and coordination with local governments would support the transition. The State Efficiency and Environmental Performance (SEEP) Office[96] coordinates with partners across the state government to reduce greenhouse gas emissions, reduce energy costs and eliminate solid waste and toxic materials from state agency operations. The Energy Savings Performance Contracting program at the Department of Enterprise Services and financing provided by the State Treasurer's Office support state and local government efficiency programs. The Housing Trust Fund and Office of Superintendent of Public Instruction (OSPI) manage allocations to low-income housing and K-12 education.

ACTIONS

- Update Office of Financial Management requirements for capital budget requests to include electrification in all applicable projects.
- Require all new public buildings funded by the capital budget to be all-electric and zero-carbon.
- Require existing public buildings to minimize building energy loads and convert carbon-based fuel systems to all electric high-efficiency systems.
- Require implementation of standards that lead to increased use of building materials with low embodied carbon emissions.

[95] Andrea Krukowski and Andrew Burr, "Energy Transparency in the Multifamily Housing Sector: Assessing Benchmarking and Disclosure Policy" (Institute for Market Transformation, 2012).

[96] SEEP was initiated by EO 20-01. For program details see: https://www.commerce.wa.gov/growing-the-economy/energy/state-efficiency-and-environmental-performance-seep/.

- Transition campus district heating and cooling systems to zero-carbon by reducing total heating demand, reducing or eliminating peak demands, converting district steam to hot water or electrifying central heating systems.
- Implement robust energy management and operations and maintenance programs for each public building or site consistent with the state BPS and to work towards low or zero greenhouse gas emissions.
- Prioritize decarbonization of public buildings in low-income communities, specifically public schools and hospitals.
- Ensure funding is available for building efficiency projects in all communities.
- Continue to coordinate state efforts through SEEP and consider additional support to align all projects funded through the state capital budget with the state's greenhouse gas emissions limits.
- Ensure decarbonization for rural public buildings through funding allocations.

2.3. Align Utility Programs with State Mandates

This strategy would expand the share of Washington's building stock covered by state mandates before 2030. State mandates consist of the energy code and the BPS, including performance disclosure requirements. The mandates will be structured to progressively reduce energy use and carbon in buildings with the ultimate goal of low-energy, zero-carbon buildings by 2050.

Utility programs and regulation must be similarly structured to reduce energy and emissions consistent with meeting the 2030 and subsequent greenhouse gas emissions limits. The energy code should be strengthened to hit low-energy zero-carbon. This must be done in the three remaining three-year code cycles (2021, 2024 and 2027).

Utilities and the Northwest Energy Efficiency Alliance have been key partners in encouraging technology development and adoption to improve energy efficiency. Strategic energy management has also been deployed. These strategies are structured to achieve incremental savings compared to the code or existing building baseline. Utilities can continue to drive and accelerate achieving building-specific energy and greenhouse gas emission limits to be developed further during the detailed energy planning described above in section 1.2.

ACTIONS

- Utility building efficiency programs should be designed to achieve energy utilization and greenhouse gas emission limits as is already recognized in utility conservation potential assessments and conservation program implementation plans.
- The Utilities and Transportation Commission (UTC), State Energy Office and interested participants should develop targets and processes to support utility efforts, including revisions of utility conservation planning and cost recovery mechanisms.

2.4. Create and Fund a High Efficiency Electrification Program

To reach building electrification targets, an electrification program should be developed and implemented. The program should provide funding generated from all building energy end uses, including electric, gas and liquid petroleum through a public benefits charge, carbon fee or economy-wide cap and trade program. Funds would be allocated to end-use customers who install high-efficiency heat pumps for space and water heating, convert gas cooking to electric cooking and/or choose other identified electrification opportunities.

Current utility efficiency programs are often siloed by fuel source and may be constrained by regulations that limit funding cross-sector fuel conversions. Liquid petroleum and transportation-only electric and gas customers fall outside of the scope of utility efficiency programs. A crosscutting electrification program would overcome these constraints and could be operated as an independent customer distribution plan, or through existing utility programs.

The program should include mechanisms to ensure participation by low-income households, based on input from organizations that represent their interests and communities. Implementation should involve utilities, market transformation experts and heating, ventilation and air conditioning (HVAC) professionals.

A program that implements high-efficiency electric space and water heating will impact most building energy customers in the state, given that the majority of electric heating still uses electric resistance heating equipment. Gas and oil heating and hot water systems will need to be replaced by heat pumps.

ACTIONS

- The State Energy Office should develop and implement a high-efficiency electrification program to incentivize adoption of heat pump technology in existing residential and nonresidential buildings, including marketing, workforce development and certification and equitable distribution of incentives.
- In anticipation of increased workforce demand, the State Board of Community and Technical Colleges should develop a heat pump training and certification program for contemporary heat pump installation and maintenance. Training will need to be broadly distributed throughout the state and designed to assure opportunities are provided to highly impacted populations.

2.5. Broaden the Scope and Scale of the Low-Income Household Energy Programs

Low-income households bear a disproportionate housing and energy cost burden relative to other households. Existing sources of energy assistance, including both federally-funded and utility-funded assistance, do not adequately address the home energy affordability gap in Washington.

The number of Washington households participating in the state's Weatherization Assistance Program (WAP) each year represents just a fraction of eligible households. According to the 2019 Home Energy Affordability Gap data, there are 749,112 households living at or below the income qualification threshold to receive WAP services.[97] Public funding at existing levels is insufficient to provide the scale and scope of services needed.

Commerce administers the state's WAP services with funding from U.S. Department of Energy's WAP, the U.S. Department of Health and Human Services' Low Income Home Energy Assistance Program (LIHEAP), the Bonneville Power Administration (BPA) and the state-funded Weatherization Plus Health Matchmaker Program. These four funding sources are highly leveraged with utility conservation funds from many, but not all, utilities in the state.

Services provided by WAP, while important to reduce energy burden, are insufficient to address the statewide needs from deferred maintenance in affordable housing stock and the negative health impacts of substandard housing. The program is not currently structured to allow for broad electrification, or to increase access to renewable energy resources that would lower household energy burden and energy inefficiency.[98]

The state has made two important changes to broaden the scope of the weatherization program in recent years. In 2015, House Bill 1720[99] allowed funding to include healthy housing improvements. In 2017, Senate Bill 5647[100] created a home rehabilitation revolving loan program for low-income owner-occupied households in rural communities. There is more work remaining to expand the scope and funding scale for these critical services.

In addition to a lack of access to energy assistance and weatherization programs, low-income and rural communities often lack access to high-quality broadband services, which acts as a barrier to participation in energy efficiency benefits.

[97] "Home Energy Affordability Gap" (Fisher, Sheehan & Colton: Public Finance & General Economics, n.d.), http://www.homeenergyaffordabilitygap.com/03a_affordabilityData.html.

[98] "2019 Biennial Energy Report: Issues, Analysis and Updates" (Washington State Department of Commerce, December 2018), https://www.commerce.wa.gov/wp-content/uploads/2013/01/COMMERCE-Biennial-Energy.pdf.

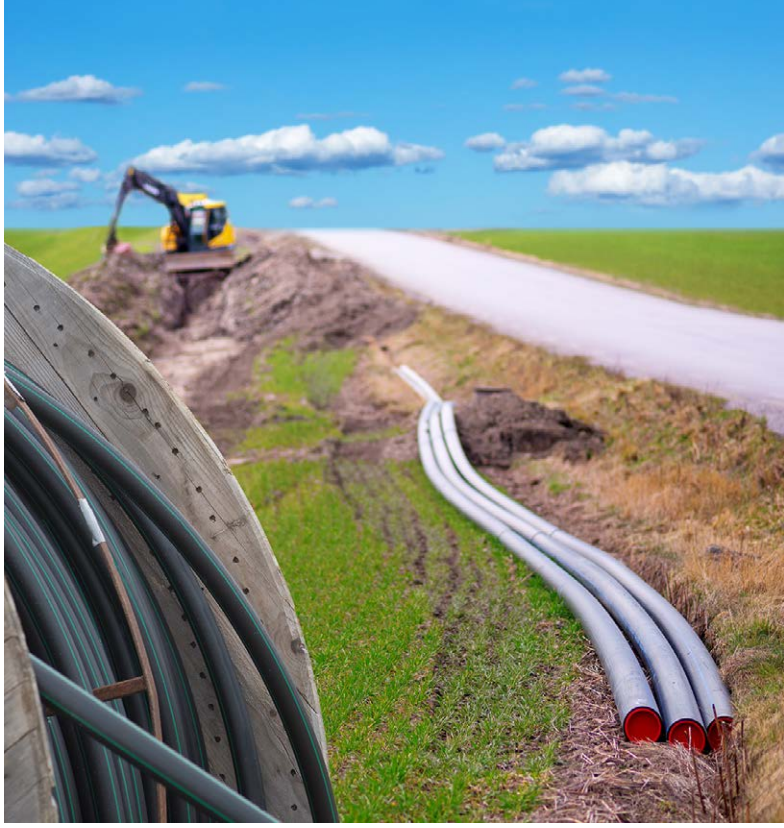
[99] "HB 1720: Concerning Healthy Housing" (2015), https://app.leg.wa.gov/billsummary?year=2015&billnumber=1720&initiative=false.

[100] "SB 5647: Creating a Low-Income Home Rehabilitation Revolving Loan Program" (2017), https://app.leg.wa.gov/billsummary/?BillNumber=5647&Year=2017&Initiative=false.

ACTIONS

- Increase funding for low-income weatherization to address a minimum 10% of eligible households annually and continue decoupling the program's eligibility requirements from federal requirements to increase flexibility, allow for re-weatherization and include households that fall just above the income threshold to receive low-income services.
- Facilitate meaningful participation by highly impacted populations to explore solutions to address historic barriers to accessing the limited resources currently available for weatherization.
- Conduct ongoing engagement with Tribal Governments to explore approaches to systematically expand services to and within Tribal communities. Invest in and leverage workforce capacity within these communities.
- Address the breadth of need for deferred maintenance to make households ready for weatherization by expanding the home rehabilitation revolving loan program statewide and beyond owner-occupied single-family homes. This expansion should include Tribal communities, rental housing and manufactured housing.
- Prioritize services to underserved households within highly impacted populations, including rental housing, multifamily housing, non-electrically heated housing and high-energy burden households.
- Provide innovative financing models that can be used to provide low-income households the access to capital needed to decarbonize their homes.

> Low-income and rural communities lack access to high-quality broadband services, which prevents participation in energy efficiency benefits.



Digging for broadband.

- Expand funding for the state's successful Weatherization Plus Health program as part of a broader strategy to reduce energy burden and improve health outcomes for low-income households impacted by the COVID-19 pandemic.
- The Legislature should provide universal access to high quality broadband to enable grid integration of appliances and equipment, optimizing buildings and managing load.

2.6. Create Market Transformation in Support of Eliminating Greenhouse Gas Emissions

Market transformation is the strategic process of intervening in a market to create lasting change.[101] As shown in the deep decarbonization modeling, meeting 2030 building energy and emissions reductions goals will require a shift to 100% sales of high-efficiency electric equipment by 2030. High-efficiency electric space and water heating equipment currently holds a relativity small share of market sales compared to fossil and electric resistance equipment, which needs to change, as does market adoption of other products and practices that improve the energy efficiency of buildings.

Efforts to increase market penetration include interventions, such as product standards, pilot programs, training for design, sales and installation contractors and incentives for end users. In some cases, market transformation requires earlier interventions that bring new products to the market. Market transformation efforts bring competence, scale and competition to the market, delivering quality services at least cost.

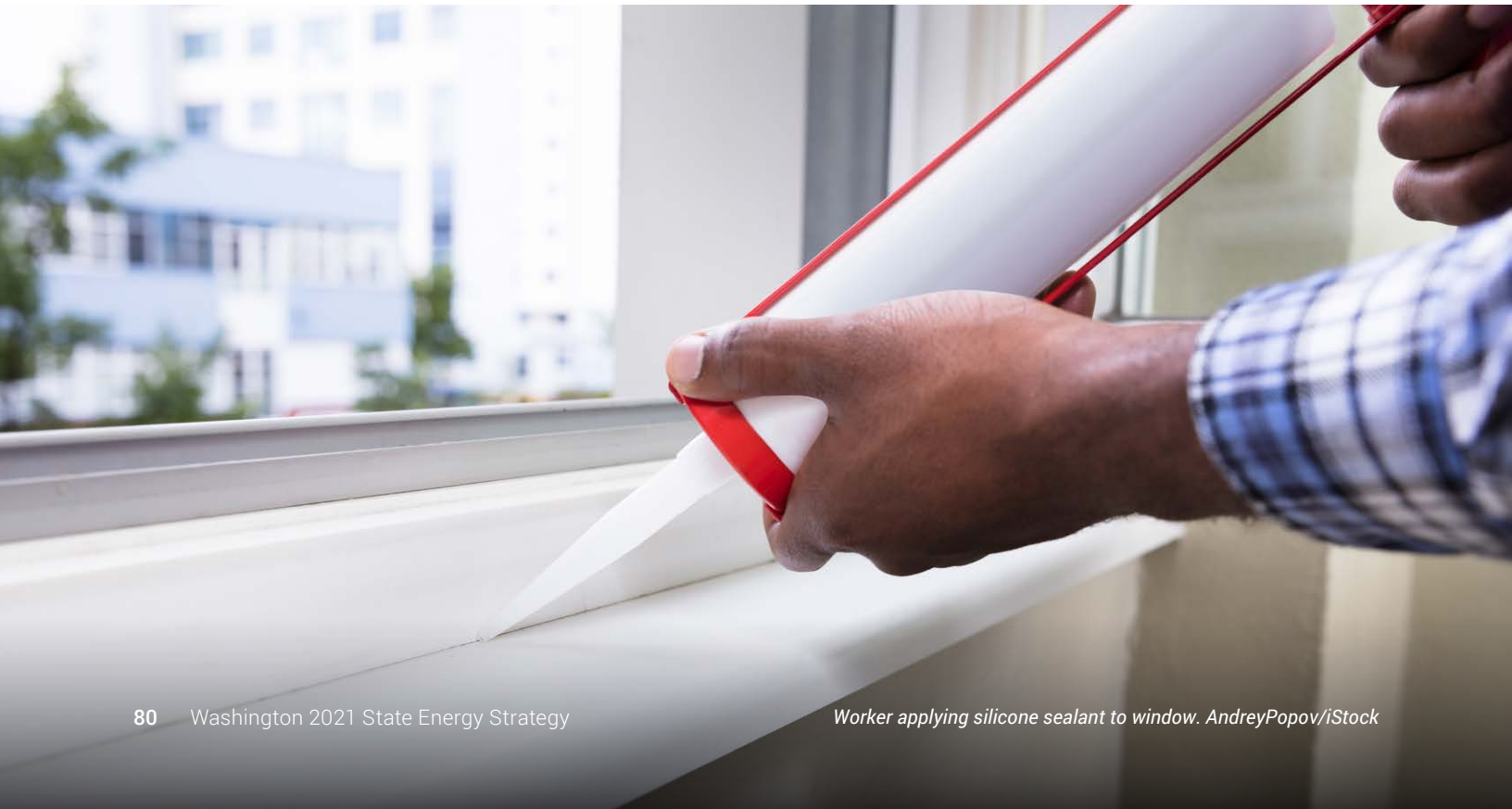
The Northwest Energy Efficiency Alliance, which is funded by the region's gas and electric utilities, has led the energy efficiency market transformation efforts in the region for more than two decades. This organization could be a primary collaborator.

Developing a state market transformation effort is proposed to reflect the electrification outcomes recommended in this strategy. Market transformation must explicitly focus on decarbonization strategies to meet the greenhouse gas emissions limits. The project objective should ensure that each state mandate has a clear and funded market transformation plan for building market capacity and removing technical and financial barriers. In addition, the strategy should identify and create the numerous collaborations required to implement a market transformation effort and a clear funding plan.

ACTIONS

- The state should develop a market transformation team within the State Energy Office. The office will be charged with guiding the collaborations required to implement a market transformation intervention.
- Ensure market transformation programs have carve-outs and direct funding for low- and moderate- income households and Tribal nations.

[101] "NEEA Standard Definitions," NEEA, n.d., https://neea.org/definitions.



Worker applying silicone sealant to window. AndreyPopov/iStock

3. Develop Plans for the Long-term Transition of the Natural Gas Distribution System

Most of the greenhouse gas emissions in residential and commercial buildings are from combustion of natural gas, so emissions reductions in this sector raise important questions about the future of the natural gas distribution system. Fossil natural gas accounts for 80% of the non-electric emissions in the residential and commercial sectors.[102] The uses account for 63% of the non-electric consumption of fossil natural gas.[103]

As Figure 18 illustrates, the mix of energy used in buildings is expected to shift dramatically as the state reduces its greenhouse gas emissions with greater use of clean electricity in place of fossil natural gas. This could result in a substantial change in the role of the natural gas distribution system that currently provides energy to 1.2 million residential and 107,000 commercial customers.[104] Four natural gas distribution utilities deliver fossil natural gas to these customers, who use the fuel for space heating, water heating, cooking and a variety of commercial purposes. Emissions from natural gas used by residential and commercial customers account for 7.2% of the state's total emissions.[105]

The deep decarbonization modeling analysis considered two scenarios for reducing emissions in the buildings sector to meet the state's overall emissions limits. The Electrification Scenario assumes gas-consuming appliances in buildings are replaced with electric equipment as they are retired. The Gas in Buildings Scenario would retain use of pipeline gas to heat air and water in buildings, maintaining use of gas in appliances at the levels they are at today. Both scenarios assume the same levels of appliance efficiency by technology.[106]

To retain use of fossil natural gas and still meet the emissions targets, the Gas in Buildings Scenario makes greater use of synthetic fuels and biofuels in transportation. Starting in 2045, fossil gas is replaced with biogas in the buildings sector. The projected overall cost is higher in the scenario that retains gas pipelines as a means of delivering energy to residential and commercial customers. Under either scenario, the amount of fossil natural gas delivered in 2050 is about 90% lower than in the Reference Scenario.

These two scenarios present a balanced analysis of the options to reduce greenhouse gas emissions from fossil natural gas. The model evaluates alternative solutions using the best available information about costs and technology and it looks at all sectors of the economy together to arrive at an overall result. The results indicate that conversion from fossil natural gas to electricity results in lower costs. The analysis assumes energy efficiency improvements by technology across all scenarios are the same, where newly installed appliances are highly efficient. With these efficiency assumptions, the Gas in Buildings Scenario yields a 45% reduction in gas consumption compared to the Reference Scenario.

These two scenarios are also consistent in their consideration of the cost of investments already made in distribution system infrastructure. These investments are substantial: The four distribution companies have invested $6.2 billion in gas utility infrastructure and the undepreciated portion is $4 billion.[107] The latter amount represents an average investment of about $3,000 per customer. The deep decarbonization analysis does not assume that these costs could be avoided under any scenario. They are sunk costs that exist under every scenario.

The 2021 State Energy Strategy does not call for any specific outcome concerning the long-term use of the existing gas distribution system. It does, however, identify benefits in shifting over time from fossil natural gas

[102] Figure 7, "Washington State Greenhouse Gas Emissions Inventory: 1990-2015" (Washington State Department of Ecology, December 2018), https://fortress.wa.gov/ecy/publications/documents/1802043.pdf.

[103] "Natural Gas Consumption by End Use," U.S. Energy Information Administration, n.d., https://www.eia.gov/dnav/ng/ng_cons_sum_dcu_swa_a.htm.

[104] "Number of Natural Gas Customers," U.S. Energy Information Administration, n.d., https://www.eia.gov/dnav/ng/ng_cons_num_a_EPG0_VN5_Count_a.htm.

[105] Figure 7, "Washington State Greenhouse Gas Emissions Inventory: 1990-2015."

[106] The initial specification of the Gas in Buildings Scenario reflected a lower level of energy efficiency, consistent with historical differences in energy efficiency programs between electric and gas utilities. Electric utilities in Washington achieved efficiency savings, as a percent of delivered energy, five times the rate achieved by natural gas utilities. See tables 7 and 9 in: Weston Berg et al., "The 2019 State Energy Efficiency Scorecard" (American Council for an Energy-Efficient Economy (ACEEE), 2019), https://www.aceee.org/sites/default/files/publications/researchreports/u1908.pdf.

[107] Calculated using reports submitted to the UTC and available at: https://www.utc.wa.gov/regulatedIndustries/utilities/energy/Pages/CompanyAnnualReports.aspx.

to electricity. This approach appears to serve the state's consumers and businesses better than one where non-fossil gas is manufactured and delivered by pipeline to end users. Retaining gas as an energy form requires more overall energy, both the energy used in the gas production process and the energy lost in combustion at the point of use. Delaying the transition from fossil gas also requires greater and more costly emissions reductions in the transportation sector to meet the overall emissions limits.

The near-term actions suggested in this strategy would result in a gradual transition, over two to three decades, from fossil natural gas as a fuel source. The natural gas industry has advocated for an approach closer to the Gas in Buildings Scenario, and there is opportunity in the near term for the industry to pursue actions consistent with its preferred approach:

- Increase energy efficiency to match or exceed the levels assumed in the Gas in Buildings Scenario. This would include both the efficiency of end-use equipment and the efficiency of the building stock.
- Reduce the greenhouse gas content of its product by incorporating hydrogen and renewable natural gas, using the authority provided by the Legislature two years ago.[108]
- Invest in research and development of green hydrogen and other clean fuels, with the aim of improving the financial viability of gas as a non-emitting energy form.
- Proactively support customers converting to zero-emission heating options, such as solar thermal and geothermal.

These actions make sense under either an electrification approach or a long-term approach that uses non-fossil gas, and they would help test the feasibility of decarbonizing pipeline gas as a long-term solution.

In the meantime, the Legislature should consider whether to restrict growth of the natural gas system and the use of fossil natural gas where zero-emission options are available. Residential and commercial natural gas customer growth has slowed in the past decade, but this trend could reverse absent policy action.

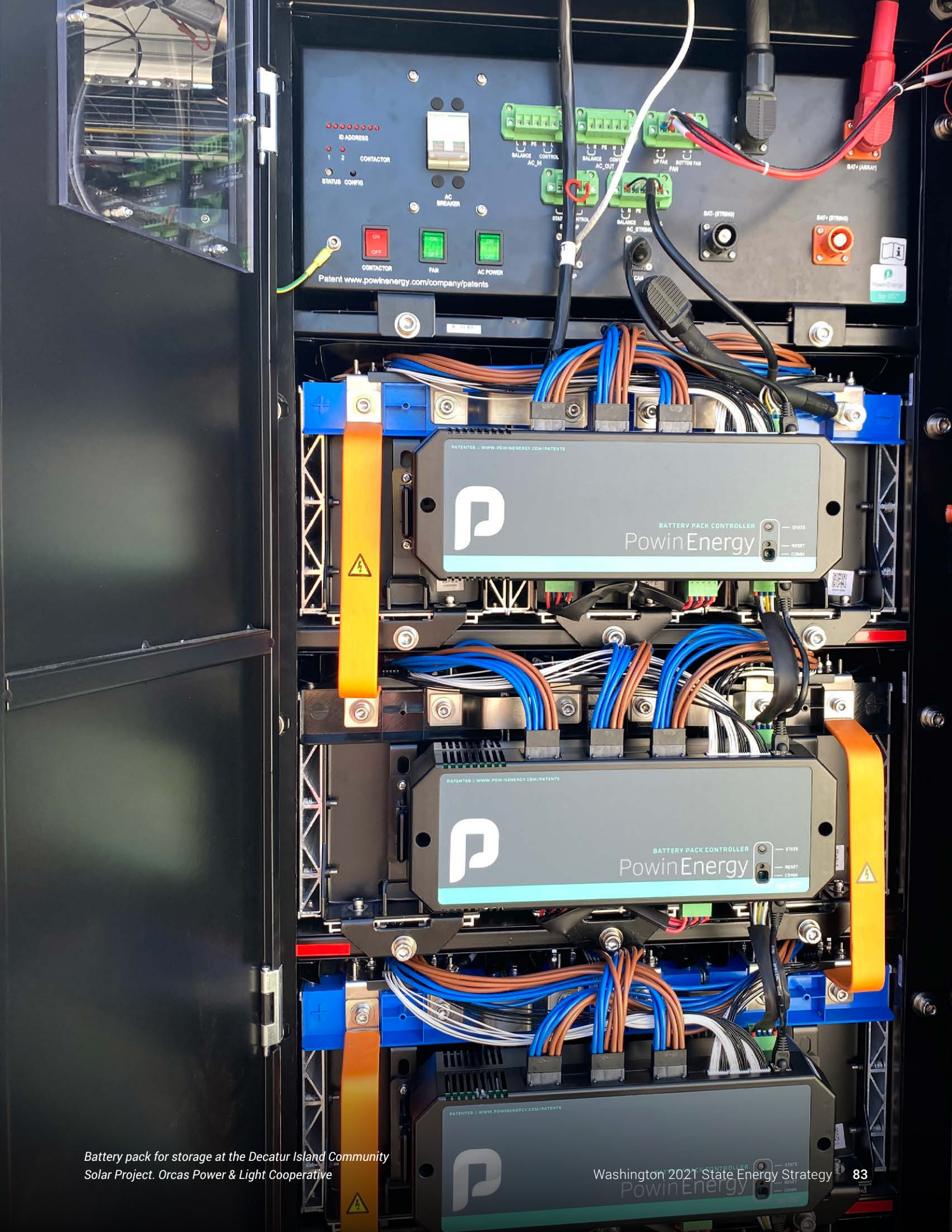
A limit on growth would provide the industry, regulators and customers the time needed to clarify public policy concerning the use of natural gas and develop a long-term transformation approach that is consistent with the state's climate and economic policies. A transition plan could be developed as part of the utility's integrated resource plan and should consider multiple approaches to emissions reduction, including:

- Financing, incentives and other mechanisms to protect members of highly impacted populations.
- Energy efficiency measures evaluated to reflect the cost of non-fossil gas in the future.
- Conversion from gas to electric when equipment is replaced, including geographically targeted conversions.
- Limitations on service area expansion and line extension.
- Rate structures to align customer decisions with expected future costs of pipeline gas.
- Use of hydrogen and renewable natural gas to reduce the greenhouse gas content of the gas product delivered to customers.
- Measures to support gas company workforce transition.
- Accelerated depreciation of gas distribution plants to reduce stranded assets.

ACTIONS

- Natural gas distribution companies should increase energy efficiency and use of hydrogen and renewable natural gas to achieve near-term reductions in greenhouse gas emissions from fossil natural gas.
- The Legislature and the UTC should ensure that the state's climate policy and emissions limits are reflected in the regulation of natural gas companies and explore legislative and regulatory actions to restrict growth of the natural gas system and the use of fossil natural gas where zero-emission options are available.
- Natural gas distribution companies should work with regulators and stakeholders to develop comprehensive and equitable plans to transition from the use of fossil natural gas.

[108] Chapter 80.28.390 RCW.



Battery pack for storage at the Decatur Island Community Solar Project. Orcas Power & Light Cooperative