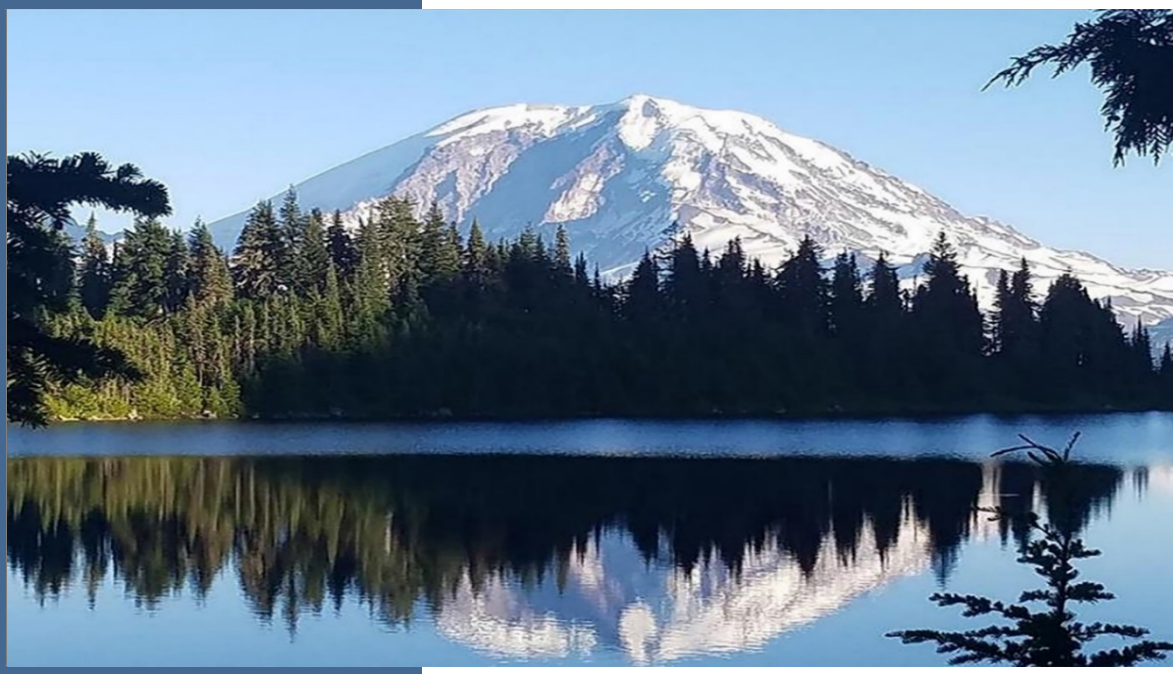

Report to the Legislature
The Hydrofluorocarbon Transition

Background and Recommendations for Incentive-Based Policies and Programs

By

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For the

Air Quality Program

Washington State Department of Ecology

Olympia, Washington

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Executive Summary

Hydrofluorocarbons (HFCs) are chemicals used in air conditioning and refrigeration, in producing insulating foams, and as propellants in aerosol products. Although HFC emissions are only a few percent of greenhouse gas emissions, HFCs are hundreds to thousands of times more powerful in warming the planet than carbon dioxide. HFCs contribute about 4 million metric tons of greenhouse gases (carbon dioxide equivalent, or CO_2e) per year in Washington, but in the absence of taking action would grow by at least a third over the next fifteen years.

In 2019 the Legislature adopted E2SHB 1112 (now codified as RCW 70A.45.080) to transition Washington away from many major uses of HFCs. Effective July 28, 2019, the law requires that a variety of products and equipment eliminate or limit the use of HFCs to minimize their impact on the climate. The restrictions phase in over five years with compliance for the first set of products starting in 2020. This should reduce HFC emissions in Washington by 1.2 million metric tons of greenhouse gases (CO_2e) by 2035. The law also directs Ecology to evaluate incentive-based strategies to continue reducing the use of HFCs, which is the focus of this report.

Developing a climate-friendly refrigerant incentive program as part of broader energy efficiency market transformation efforts would reinforce the regulatory structure of Washington's HFC transition law. Funding and additional research would increase the effectiveness of such a program. The most important products to target through an incentive program are residential heat pumps, since they are not currently required to transition away from the use of HFCs. Their use will also likely expand as the state continues to encourage building electrification.

Updating Washington's laws to address end-of-life disposal and venting of refrigerants would target the largest source of HFC emissions. Based on other countries' experience an incentive-based approach incorporating extended producer responsibility may maximize the recovery and disposal of refrigerants. A fee-based program that provides incentives to consumers and businesses for proper refrigerant disposal, recovery, reclaim, and reuse would significantly reduce HFC emissions. Emissions reduced in Washington from a fully implemented end-of-life program could be as high as 2.9 million metric tons of greenhouse gases (CO_2e) by 2035.

Other considerations include changes to the disclosure requirements in Washington's HFC transition law as to how products and equipment should be labelled and implementing a leak management regulatory program for large refrigeration equipment in Washington that could achieve an additional 0.3 million metric tons of greenhouse gas reductions (CO_2e) by 2035.

Implementing the policies proposed in this report would put Washington on a course to achieve a similar level of reductions as the countries that have signed the Kigali Amendment, an international HFC reduction agreement that the U.S. has failed to consider or ratify.

Background

What are Hydrofluorocarbons (HFCs)?

In the 1980s scientists discovered that chemical compounds used in aerosols and other products - chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) - were depleting the ozone layer. This layer of gases high in the atmosphere acts as a global sunscreen, shielding us from many of the sun's harmful rays. These chemicals are also greenhouse gases, harming the climate. In response, countries around the world adopted the Montreal Protocol that phased out the use of CFCs and HCFCs in favor of newly developed chemical compounds and natural alternatives. These newly created compounds – hydrofluorocarbons (HFCs) – were designed to be less harmful to the earth's protective ozone layer. However, they are still greenhouse gases that contribute to climate change.

HFCs consist of hydrogen, fluorine, and carbon. They are used in air conditioning and refrigeration products, in producing insulating foams, and as propellants in aerosol products. Although HFC emissions make up only a small percent of total greenhouse gas emissions, both in Washington and globally, HFCs are hundreds to thousands of times more powerful in warming the planet than carbon dioxide. The use of air conditioning and refrigeration is increasing globally, so HFC emissions are also growing rapidly.[2] If their use is not curbed, HFC emissions are expected to increase from around one percent of global greenhouse gas emissions today to between 7 to 19 percent of global greenhouse gas emissions by 2050.[3]

Statutory Direction for this Report

This report provides context and data for understanding HFC policy and responds to the direction to Ecology in Section 8, Chapter 284, of the Laws of 2019 requiring that:

> *The department of ecology, in consultation with the department of commerce and the utilities and transportation commission, must complete a report addressing how to increase the use of refrigerants with a low global warming potential in mobile sources, utility equipment, and consumer appliances, and how to reduce other uses of hydrofluorocarbons in Washington. The report must be submitted to the legislature consistent with RCW 43.01.036 by December 1, 2020, and must include recommendations for how to fund, structure, and prioritize a state program that incentivizes or provides grants to support the elimination of legacy uses of hydrofluorocarbons regulated under section 3 of this act or uses of hydrofluorocarbons not covered by section 3 of this act.*

[2] United Nations Environment Programme and International Energy Agency (2020). *Cooling Emissions and Policy Synthesis Report*. UNEP, Nairobi and IEA, Paris.
[3] Environmental Investigation Agency, 2015. https://eia-global.org/campaigns/Climate/what-are-hydrofluorocarbons

Legislative Action on HFCs in Washington

In 2019 the Washington Legislature adopted E2SHB 1112 (now codified as RCW 70A.45.080) to transition away from many major uses of HFCs. The law went into effect on July 28, 2019 and requires that a variety of products and equipment sold in Washington eliminate or limit the use HFCs to minimize their impact on the climate. Products and equipment affected by the law include residential and commercial refrigeration, certain commercial cooling technologies, a variety of foam products, and a small number of aerosol propellants.

The restrictions phase in over five years with compliance for the first set of products having begun on Jan. 1, 2020. Ecology has adopted emergency rules since the law went into effect, while completing permanent rulemaking, to clarify implementation details. Ecology also aligned this rule with existing industry practices and the HFC regulations of other states. The rulemaking process included extensive stakeholder engagement since the fall of 2019. Ecology adopted the final rule in December of 2020.

Besides requiring this report, the law also addresses the HFC transition in other ways:

- **Building Codes:** The law directed the Washington State Building Code Council to ensure that building codes are not a barrier to the HFC transition. As a first step, the council adopted a new code change to allow the use of climate-friendly HFC alternative refrigerants in building refrigeration and air conditioning systems. Washington is the first state to adopt this important code change.
- **State Procurement:** As directed in the law the Washington Department of Enterprise Services modified state procurement policies to require that new products use climate-friendly alternatives to HFCs or, if necessary, products that minimize the use of HFCs.

HFC Emissions in Washington

HFCs in Washington contribute about 4 million metric tons of greenhouse gases (CO_2e) per year.[4] However, emissions from HFCs in Washington will likely grow by at least a third over the next fifteen years in the absence of policy action (see Figure 1). The easiest way to understand how those emissions occur, and where they come from, is to focus on the end uses of HFCs. Figure 2 shows the emissions proportion for each individual end use.

Refrigeration and Air Conditioning

Most HFC-related emissions come from refrigeration and air conditioning, with commercial refrigeration representing the largest portion. Some examples of end uses in this sector are:

- Chillers
- Cold storage warehouses
- Household refrigerators and freezers

[4] https://ecology.wa.gov/Air-Climate/Climate-change/Greenhouse-gases/Greenhouse-gas-reporting/Inventories

- Residential and light commercial air conditioning and heat pumps
- Retail food refrigeration
- Vending machines

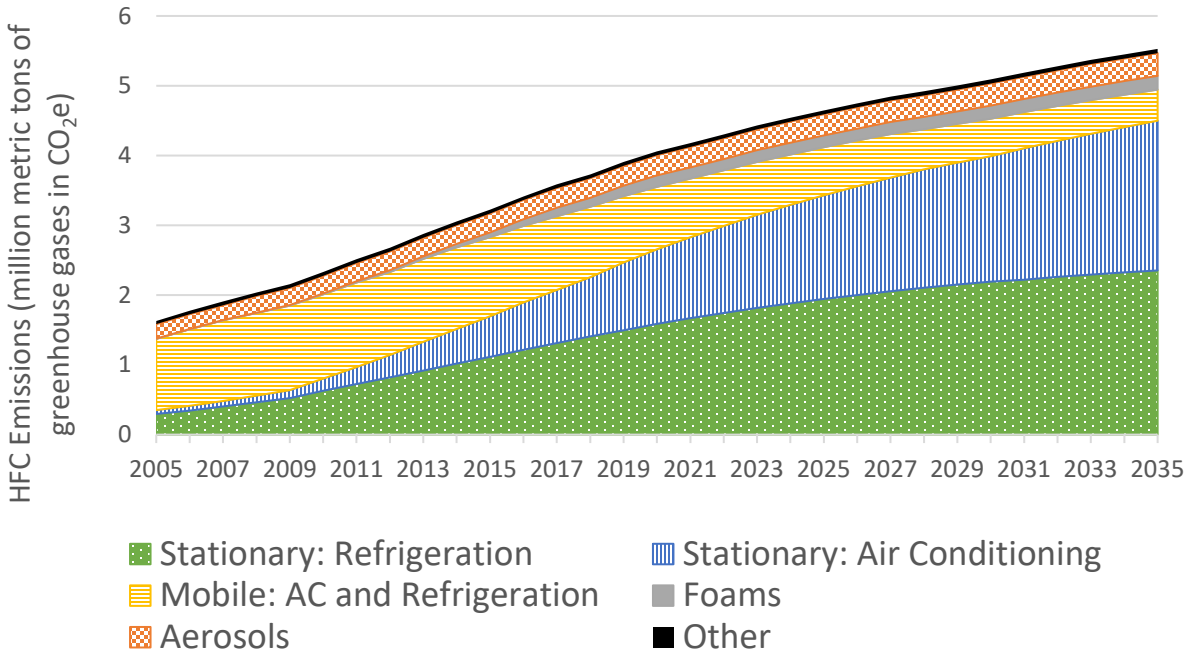

Figure 1: Estimated Washington HFC Emissions by Category (with no policy action[5])

Foams

Foam blowing agents create structure and provide insulation in a wide range of foam and foam products, including:

- Rigid polyurethane (e.g., spray, sandwich panels, refrigerator and freezer foam, marine floatation, slabstock)
- Flexible polyurethane
- Integral skin polyurethane
- Polystyrene (e.g., extruded sheet extruded sheet and boardstock)
- Polyolefin

These foams are often found in roofing and walls, as well as pipe insulation and heating and cooling systems. Other uses for foam include shoe soles, buoys, car steering wheels, and a wide range of other products.

[5] The statement "without policy action" means a business-as-usual scenario where no policy action, including the effects of RCW 70A.45.080, is assumed to be in place. Policy impacts on emissions are presented later in the report.

Mobile Sources

HFCs are used in mobile source applications such as motor vehicle air conditioning systems (MVAC), insulation of aircraft cargo holds, and refrigerators in aircraft galleys. Industries that manufacture mobile sources are generally transitioning away from HFCs already because of the availability of alternatives, as well as global regulatory and economic trends.

Aerosol Propellants

Aerosols canisters and misters contain products such as hair spray, pepper spray, bear spray, and medication (e.g., inhalers). These substances are pressurized in the container. When the container's valve is opened, a propellant helps force the substance out of the container as a spray or mist. Many aerosol products have already transitioned away from HFCs, or never used them in the first place. Some of these products are designated as an "acceptable use" under Washington law, allowing them to be exempt since there are not suitable alternatives.

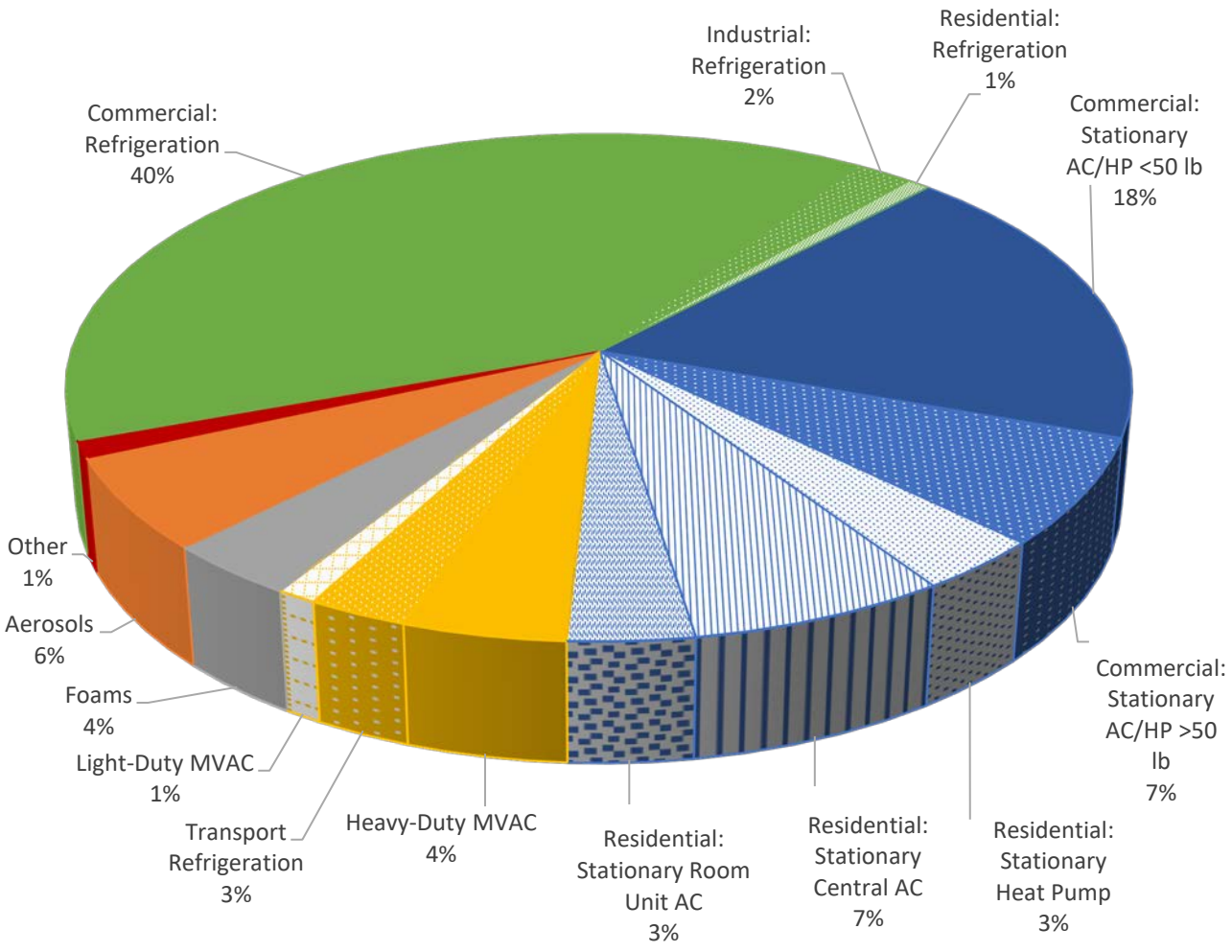

Figure 2: Projected 2035 Washington HFC Emission Share by End Use (with no policy action)

Utility Equipment

Utility equipment, such as transformers and transmission infrastructure, does not use HFCs. Instead, electrical transmission equipment uses another fluorinated gas, sulfur hexafluoride (SF_6). Different policies and programs address this related emissions source. Because this report focuses on HFCs, it does not address SF_6 in utility equipment.

Reducing HFC Emissions

For products and equipment that contain or use HFCs, there are three key stages of a product's life. Each stage provides opportunities to reduce HFC emissions:

- Product design and sale
- Operation and maintenance
- Disposal and reclamation ("end of life")

Each of these stages lends itself to unique policy approaches. The current Washington HFC transition law focuses on the first stage. It encourages engineering products to use climate-friendly compounds by restricting the sale of certain HFC-based products. Federal policy, and policies in other states and countries, provide examples for actions that can address HFC emissions associated with the other stages.

Federal Policy

Under section 612 of the Clean Air Act of 1990, the U.S. Environmental Protection Agency (EPA) is required to evaluate substances for their ability to deplete the ozone layer. The agency adopted the Significant New Alternatives Program (SNAP) to consider various alternatives to ozone-depleting substances, and to approve or deny them for use. Originally, HFCs were an acceptable alternative since they do not harm the ozone layer. However, given the climate impact of HFCs, the EPA later decided to regulate the use of HFCs in many end uses.

As a result, in 2015 the EPA modified the SNAP regulations, adding two rules to manage the transition away from HFCs: Rules 20 and 21. However, in 2017, the U.S. District Court for the District of Columbia vacated these two sections, finding that the EPA lacked the authority to prohibit HFCs. More recently, the U.S. Court of Appeals for the D.C. Circuit restored a small grant of authority, finding that EPA does have the authority to require legacy uses of CFCs and HCFCs to transition away from HFCs, but still lacks the authority to require existing uses of HFCs to transition to HFC alternatives or to the least harmful HFC compounds.

In addition to the SNAP regulations that address product design, EPA has developed regulations under Section 608 of the Clean Air Act that prohibit the intentional venting of ozone-depleting substances during maintenance, repair, or operation of air-conditioning and refrigeration equipment. There are also other federal and state regulations addressing the operation of equipment that contains HFCs and other refrigerants, and the disposal of refrigerants.

State Policy

Given the uncertain legal future of the federal SNAP regulations, Washington and other states have stepped in to meet the goals of SNAP by putting in place functionally identical or substantially similar state requirements. Some states are choosing to go beyond SNAP.

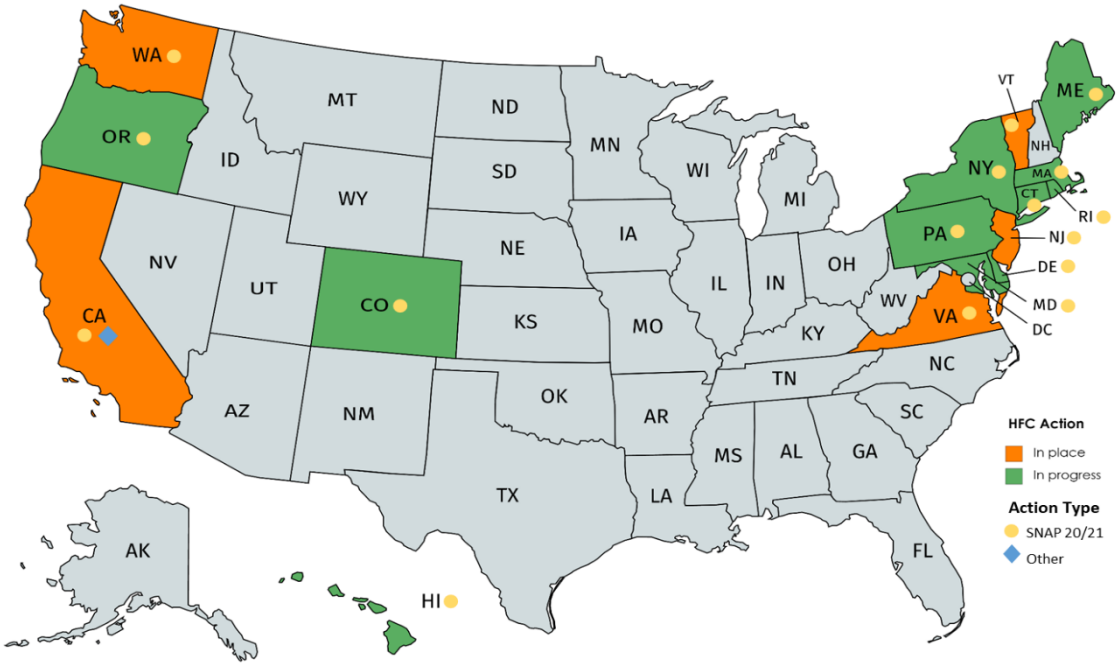

Figure 3: States Taking Action on HFC Policy[6]

Washington and the U.S. Climate Alliance

The U.S. Climate Alliance (USCA) is a coalition of states and territories committed to taking action on climate, aiming to reduce greenhouse gas emissions by at least 26-28 percent below 2005 levels by 2025. State governments are working together through the USCA to coordinate policy and regulatory efforts across jurisdictions.[7] Figure 3 shows the USCA states that are currently taking action on HFCs (in orange), or are in the planning stages (in green).

Ecology has engaged with the USCA and its member states to share information, discuss challenges, and work to meet state HFC policy goals. As one of the first states to adopt a HFC policy, Washington is in a leadership position. Through the USCA Ecology has given guidance to other states that are in the process of developing policies to phase out the use of HFCs.

[6] Compiled from United States Climate Alliance information.
[7] States and territories in the USCA include California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Puerto Rico, Rhode Island, Vermont, Virginia, Washington, and Wisconsin.

Ecology also helped draft a model HFC rule through the USCA. The model rule provides a template for states working to adopt SNAP or SNAP-like regulations. It incorporates technical definitions and information from industry experts as well as a policy framework to ensure the regulated community does not have to comply with a mix of different regulations in each state. Although Washington and other states have significant differences in their respective policies, the model rule provides a common foundation so that states do not have to start from scratch.

California

After the courts vacated SNAP rules 20 and 21, California was the first state to adopt a rule to serve the same purpose as the federal SNAP regulations. California has recently adopted rule language that goes further than the SNAP rules. This includes adopting a global warming potential (GWP)[8] threshold for new refrigeration systems and air conditioning systems, starting in 2022 and 2025, respectively. After this date, new supermarket and other large commercial refrigeration systems will not be able to use refrigerants with a GWP higher than 150. Similarly, new air conditioning systems will not be able to use refrigerants with a GWP higher than 750. Because the threshold only applies to new equipment, this prevents the regulated community from having to retrofit or replace existing systems.

Global Policies

In response to the growing threat to the climate posed by HFCs an international agreement was reached in 2016, the Kigali Amendment to the Montreal Protocol on Substances that Destroy the Ozone Layer.[9] Signatory countries agree to help reduce the global production and consumption of HFCs by more than 80 percent over the next 30 years.[10] Actions under the Kigali Amendment have the potential to avoid up to 0.4°C of global warming by 2100.[11] Over 100 countries have ratified the amendment, but the United States is not among them.[12]

Even before the Kigali Amendment a number of countries were already phasing down HFCs, most notably in the European Union. The European Union has adopted stricter HFC guidelines than the U.S. By 2030 the European Union's HFC emissions will be cut by two-thirds compared with 2014 levels.[13] Australia, Canada, Japan, and other countries have also implemented HFC phase-down policies and programs. The prevalence of policies to phase down HFCs has pushed many manufacturing companies that operate internationally to transition away from the use of HFCs in their products and applications, especially in passenger cars.

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[8] Global warming potential is a measure of how much a given greenhouse gas warms the planet relative to carbon dioxide. A GWP threshold of 150 means the refrigerant in use can't be more than 150 times stronger than CO_2.
[9] https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-2-f&chapter=27&clang=_en
[10] https://www.unenvironment.org/news-and-stories/press-release/world-takes-stand-against-powerful-greenhouse-gases-implementation
[11] United Nations Environment Programme and International Energy Agency (2020). *Cooling Emissions and Policy Synthesis Report*. UNEP, Nairobi and IEA, Paris.
[12] https://www.unenvironment.org/news-and-stories/press-release/kigali-amendment-hits-milestone-100th-ratification-boosting-climate
[13] https://ec.europa.eu/clima/policies/f-gas_en

Policy Recommendations

Although there are numerous policies and programs that can address HFC emissions, Ecology was directed to focus on recommendations for incentive-based approaches. Therefore, Ecology makes two recommendations for policies that rely on incentives. We also note some additional considerations if the Legislature chooses to revisit HFC legislation.

Restructure Energy Efficiency Programs to Incentivize Using Climate-Friendly Refrigerants

All investor-owned utilities in Washington, and most of the larger consumer-owned utilities, offer various incentives and rebates for energy-efficient appliances. They are part of a wider market transformation model developed by the region's utilities to capture energy efficiency benefits. The Northwest Energy Efficiency Alliance, efficiency organizations, utilities, laboratories and others work together and pool their resources to identify and refine technologies that perform well and save energy for Northwest consumers, while decreasing risks for the region. Demonstration projects and market interventions, as well as training for professional and trade allies, follow these initial steps. End users who adopt the technologies are supported by financial incentives provided by utilities.

We recommend expanding the focus of market transformation efforts. The equipment and appliance types for which market transformation programs are offered typically use refrigerants, most notably heating and air conditioning equipment (like heat pumps) and refrigerators. Many of the refrigerants used by this equipment are HFC-based. Energy regulatory agencies and policy bodies should consider adding new climate-friendly refrigerant use criteria to appliance rebate and incentive programs. These new criteria would work in tandem with the existing energy-efficiency criteria to encourage acquiring new appliances and equipment that use less damaging refrigerants to the climate, and that do not use HFCs. This would help optimize energy efficiency and greenhouse gas reductions goals concurrently.

Enabling a successful market transformation approach for climate-friendly refrigerants will require funding and additional research. Using state funds, utility funds through a cost recovery mechanism, or some combination are all feasible options. Legislation or regulations allowing utilities to participate would need to be established. Incremental funding could add a greater incentive for products that meet or exceed both an energy-efficiency and a climate-friendly refrigerant benchmark. However, with or without new funding, adding climate-friendly refrigerant criteria to energy efficiency market transformation programs makes sense.

Before initiating any changes to existing energy efficiency programs, further study will be required. The climate impact of refrigerants is well understood, but selection of an appropriate criterion to maximize both energy efficiency and climate benefits may be complicated. A

growing body of research in this area provides an important foundation to assist in this task.[14] It will be important to ensure that any new criteria do not negatively affect existing energy efficiency efforts and are consistent with the goals of the State Energy Strategy.[15]

An expanded program could apply across a wide range of products and equipment, but would be most useful for residential heat pumps since they are not covered by RCW 70A.45.080. In addition, their use will likely increase significantly in the coming decades. The increased use of heat pumps in buildings has been central to energy policy in the Pacific Northwest for over a decade. As electrification of the building sector continues, the switch away from fossil fuels and its associated decrease in greenhouse gas emissions may be offset in part by an increase in refrigerant emissions from heat pumps. Minimizing that risk is possible if incentives to use the most climate-friendly refrigerants in the next generation of heat pumps are in place.

This approach could also lay the foundation for more targeted incentive programs in the future. For example, carbon dioxide heat pumps show tremendous promise and carbon dioxide has the lowest climate impact of any refrigerant. By capturing carbon dioxide from the atmosphere, and using it as a substitute for more harmful refrigerants, this technology offers a double benefit for the climate. Eventually, a heat pump incentive program could target cutting-edge technologies like carbon dioxide heat pumps to encourage their use.

Address End-of-Life Issues Associated with Products Containing HFCs

How products and equipment containing refrigerants are treated at the end of their life is the largest potential source of avoidable emissions from HFCs (and older ozone-depleting substances like CFCs and HCFCs). The best way to prevent refrigerants in products and equipment from entering the atmosphere is to recover and reclaim them, or to destroy them. In the US there are over 75 million metric tons of greenhouse gas emissions from refrigerants that are recoverable every year. Of that amount, only about one-fifth is reclaimed and used again, and only about 5 percent is appropriately destroyed.[16] Because CFCs and HCFCs (the ozone-depleting substances) are rapidly disappearing after decades of transition, HFCs will represent the dominant end-of-life issue for refrigerants in the future.

Under federal and state laws and rules, it is illegal to dispose of refrigerants improperly. However, enforcement of these laws and regulations is difficult. A fee associated with the disposal of refrigeration equipment can act as a disincentive to proper disposal. In the case of commercial equipment, there may be little incentive for a maintenance company to follow proper protocols if the liability lies with the owner of the equipment. Therefore, the entire

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[14] S., Nihar, N. Khanna, N. Karali, W.Y. Park, Y. Qu, and N. Zhou. *Opportunities for Simultaneous Efficiency Improvement and Refrigerant Transition in Air Conditioning.* 2017. Lawrence Berkeley National Laboratory, LBNL-2001021.

[15] See https://www.commerce.wa.gov/growing-the-economy/energy/2021-state-energy-strategy/

[16] Environmental Investigation Agency, *Search, Reuse, and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem*, Feb. 14, 2019, found at: https://eia-global.org/reports/20190214-search-reuse-destroy.

refrigerant load in a product or a piece of equipment is normally assumed to eventually enter the atmosphere since in so many cases it is likely that the refrigerant load will not be handled correctly when the product or equipment is disposed of.

A proven solution to address this issue is to put in place an extended producer responsibility (EPR) incentive program. This type of program, which is now common in the U.S. for products like electronic waste and mercury automotive switches[17], has a simple structure. A fee is placed on the product, equipment, or chemical at the point of sale. The revenue from that fee funds a rebate or other incentive given to an individual or company to ensure that the product, equipment, or chemical is disposed of or reclaimed and reused in a responsible manner. Revenue from the fee can cover the administrative and other costs of the EPR program.

Several countries have established this type of program for refrigerant disposal, reclaim, and recycling.[18] Australia has what may be the most successful program for recovering spent refrigerants, most of which are HFC-based. Refrigerant Reclaim Australia has been successfully recovering between 50 to 70 percent of refrigerants since 2014.[19] A fee is charged on the refrigerants when they are imported in their chemical state, or on the products or equipment that contain refrigerants. A non-profit organization made up of end users, importers, contractors, and other companies runs recovery, destruction, and recycling programs that incentivize appropriate end-of-life refrigerant treatment. Canada has also implemented a similar program called Refrigerant Management Canada. Denmark and Norway have both implemented simpler tax and refund EPR arrangements for refrigerant recovery that do not rely on a non-profit organization to implement the program.

Additional Policy Considerations

From our policy review and rule development process for the Washington HFC transition law (RCW 70A.45.080), we note several additional issues the Legislature may consider if it revisits policies related to the HFC transition.

Product Labeling

Washington's HFC transition law requires that the HFC or substitute chemical name be listed directly on a product label. No other state requires this, which has made it challenging to meet the Washington statutory labeling requirement while also meeting the statutory directive to align the rule language with other states.

For many consumer products this is not an issue, since existing safety labels contain this information. However, for other products, especially multi-piece commercial refrigeration equipment and foam products, there may not be existing product labels. In some cases, there is

[17] For example, here in Washington: https://ecology.wa.gov/Regulations-Permits/Guidance-technical-assistance/Dangerous-waste-guidance/Common-dangerous-waste/Mercury/Automotive-mercury-switch-removal
[18] Air-Conditioning, Heating, and Refrigeration Institute, *AHRI Project 8018 Final Report, Review of Refrigerant Management Programs*, January 2016.
[19] Ibid.

not a realistic way to attach a label to a product, or the products come in bundles or other groupings. In other cases, the product is a component of a larger piece of equipment and the label does not reach the consumer. Existing regulations from other agencies, such as federal drug regulators, may also make altering existing labels impractical.

In its current rulemaking process Ecology has worked to find a solution that meets the regulatory requirements of the law, the constraints of existing labeling practices across industries, and the contrary requirements of other state governments. It would ease both the regulatory process and stakeholder concerns if the statute gave more latitude to determine the way in which labelling and disclosure should occur for each type of end use. At a minimum, allowing a different kind of label. Most other states are allowing the compliance status of the product to be indicated on a label or disclosure instead of, or in addition to, the specific chemical in use. This approach may be more useful to consumers, since arcane chemical names are not likely as understandable as iconic program symbols (like the Energy Star label) or simple compliance statements.

Refrigerant Management Programs

The two policy recommendations in this report demonstrate how incentive-based policies can address both product beginning-of-life (i.e., sale and design) and end-of-life issues. Incentive-based policies are, however, less suited to the operation and maintenance of products and equipment. Regulatory approaches to refrigerant management can fill this gap.

Both EPA and California implement “Refrigerant Management Programs” as regulatory approaches to measure, track, and report the use of refrigerants in large commercial and industrial refrigeration equipment. The California program includes aggressive procedures for leak detection and reporting, including inspections and tracking refrigerants. However, the California program is limited to large-scale refrigeration and does not include air conditioning.

Updating Ozone Depleting Substance Laws

In the late 1980s and early 1990s, policy solutions to ozone-depleting substances were a priority. At that time, the federal Clean Air Act was amended to address the issue, and Washington updated its statute in a like manner. However, the resulting Washington laws have never been updated to reflect the transition from ozone-depleting substances to HFCs and other substitutes as the dominant refrigerants in use. Those Washington laws include:

- 70A.15.6410 Chlorofluorocarbons—Ozone—Refrigerants regulated.
- 70A.15.6420 Refrigerants—Unlawful acts.
- 70A.15.6430 Refrigerants—Rules—Enforcement provisions, limitations.

Updating these laws would be an important step so that all refrigerants – regardless of whether they are legacy ozone-depleting substances or the newer generation of refrigerants like HFCs – are treated appropriately at all stages of their creation, installation, use, disposal, recovery, and destruction. A strong deterrent to disposing refrigerant improperly is especially important.

Emissions Impact of Policy Recommendations

It is important to understand how the existing and proposed polices described in this section could affect HFC emissions. Figure 4 summarizes the possible HFC emission reductions from the policies in this report, relative to the business as usual (BAU, or no policy) case.[20] The line labelled as SNAP represent the impacts of the federal SNAP regulations, which Washington has adopted through the passage of RCW 70A.45.080. This policy should reduce HFC emissions in Washington by 1.2 million metric tons (MMT) of greenhouse gases (CO_2e) by 2035.

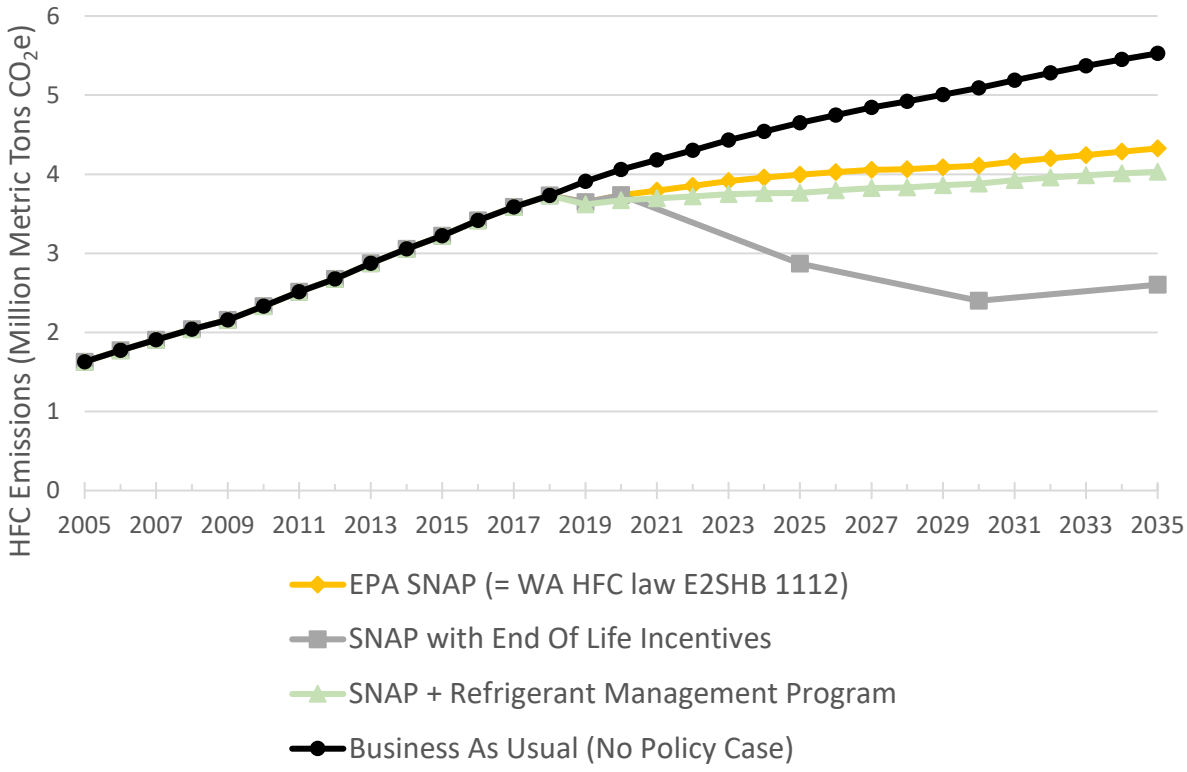

Figure 4: Estimated HFC Emissions – Without Policy Action (BAU) and With Policy Scenarios

Figure 4 shows the emission reductions possible by implementing a refrigerant management program (RMP) in Washington. Potential emissions reductions are estimated to be an additional 0.3 million metric tons of greenhouse gases (CO_2e) by 2035 relative to the emission reductions already achieved by the SNAP regulations (RCW 70A.45.080). The SNAP regulations reduces the emission reduction potential of the RMP program because they ensure that the emissions over time from refrigerants used in equipment are less harmful than would be the case otherwise. By contrast, the RMP program in Washington would reduce 0.5 million metric tons of greenhouse gases (CO_2e) relative to the BAU by 2035 (i.e., a scenario without SNAP).

[20] It is not possible to calculate the effects of the proposed changes to incentive programs without more specifics about what the incentive or incentives might be and the product classes that the incentive program would apply to.

The largest emission reduction potential comes from the introduction of end-of-life measures, the lowest line in Figure 4. This analysis assumes that an end-of-life program would coexist with the SNAP regulations that RCW 70A.45.080 has put in place for Washington.[21] If these measures reached their full potential (i.e., a program or suite of policies was able to facilitate all economically feasible refrigerant recovery or reclaim), Washington could reduce greenhouse gas emissions (CO_2e) in the state by 2.9 million metric tons by 2035. [22]

Conclusion

Washington has taken an important step toward transitioning away from the use of HFCs to more climate-friendly options by putting in place RCW 70A.45.080. The Legislature and policy makers can take additional actions to reduce HFC emissions in Washington further.

We can create a climate friendly refrigerant incentive program as part of market transformation efforts for energy-efficient appliances. This would reinforce the regulatory structure of RCW 70A.45.080. Funding and additional research would increase the effectiveness of such a program. The most important products to target through an incentive program are residential heat pumps, since they are not currently required to transition away from the use of HFCs. Their use will also likely expand as the state continues to encourage building electrification.

We can update Washington's laws to address end-of-life disposal and venting of refrigerants in order to target the largest source of HFC emissions. Based on other countries' experience an incentive-based approach incorporating extended producer responsibility may maximize the recovery and disposal of refrigerants. A fee-based program that provides incentives to consumers and businesses for proper refrigerant disposal, recovery, reclaim, and reuse would significantly reduce HFC emissions.

If Washington implemented the end-of-life programs proposed in this report, the resulting greenhouse gas emissions reductions (on top of the SNAP reductions achieved by RCW 70A.45.080) could be roughly the same as the emission reductions in Washington if the U.S. were to adopt the Kigali Amendment and put in place enforcement rules or laws. Figure 5 shows the potential emissions reductions from the policies described in the previous section relative to those achievable through the Kigali Amendment.

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[21] It was not possible to quantify the interaction effects of the RMP program with potential end-of-life programs.
[22] Emission reduction potential for end of life measures in Washington determined by extrapolating national estimates for the BAU scenario[8] and reduction potentials[9] to the state level assuming the same distribution of HFCs across sectors. The GWP of the most commonly used refrigerant for each sector was used to convert to CO2e.[10]
[8]California Air Resources Board, HFC Forecasting Tool (7/20/19 version).
[9]ICF Consulting, ODS Destruction in the United States and Abroad (February 2018). Available at: https://www.epa.gov/sites/production/files/2018-03/documents/ods-destruction-in-the-us-and-abroad_feb2018.pdf (accessed 10/2/20).
[10] Environmental Investigation Agency, *Search, Reuse, and Destroy: How States Can Take the Lead on a 100 Billion Ton Climate Problem*, Feb. 14, 2019, found at: https://eia-global.org/reports/20190214-search-reuse-destroy.

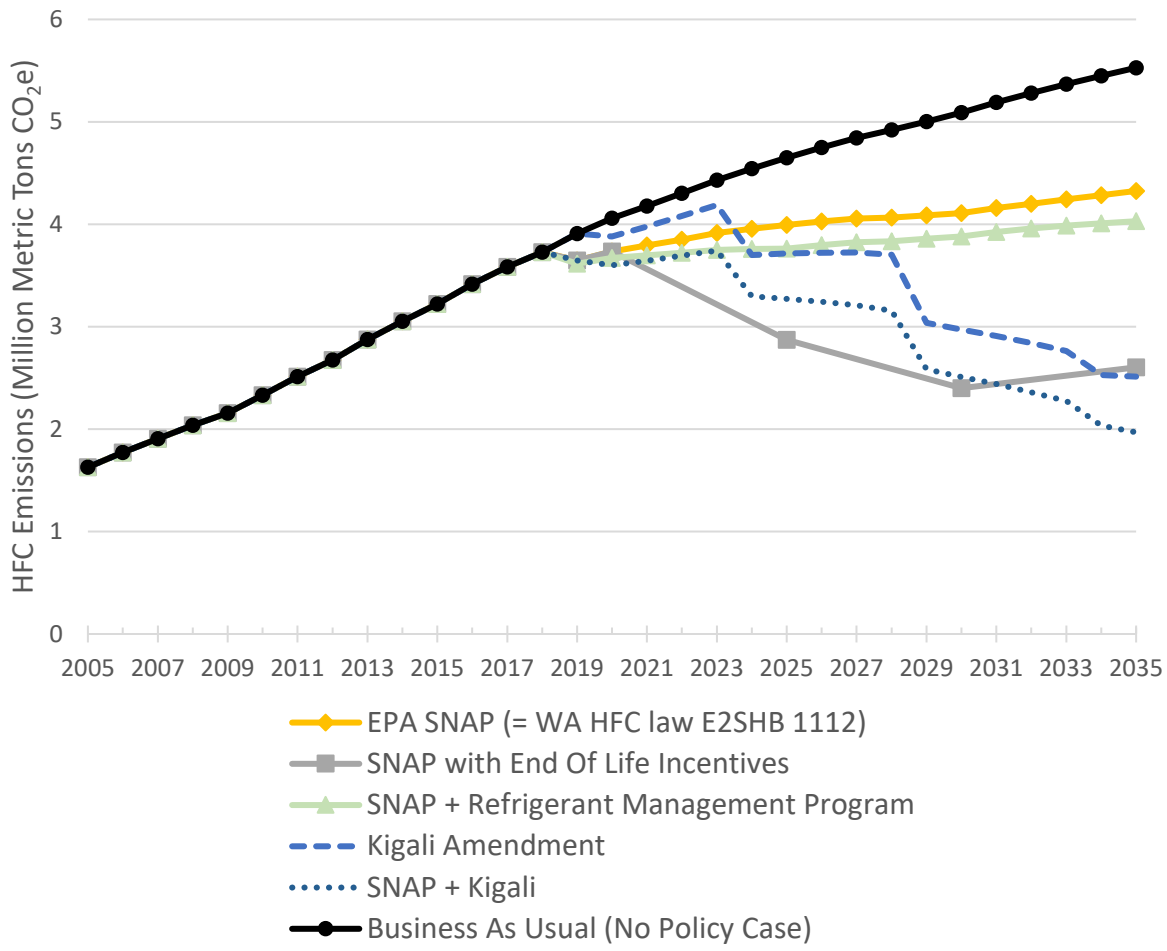

Figure 5: HFC Emissions Reduction Policies Relative to International Kigali Agreement

At this point ratification of the Kigali Amendment by the U.S. is uncertain.[23] However, a recently passed federal HFC phase down law could eventually achieve comparable emission reductions to the Kigali Amendment.[24] This does not mean that additional action is unwarranted. Because refrigerant management and end of life policies largely affect existing equipment, Washington is in a unique position to achieve significant emission reductions beyond those achieved by federal and state HFC phase down requirements for new equipment.

[23] A treaty requires two-thirds of the Senate to concur and, even in light of the upcoming changes in federal government, there remains complex and partisan opposition to signing a climate change treaty.
[24] A long-dormant HFC bill passed into law as this report was receiving final approval. The Energy Act of 2020 requires EPA to implement an 85 percent phase down of HFC production and use by 2036. The law does not have any significant preemption effect on Washington's existing HFC transition law. For background see: https://www.scientificamerican.com/article/congress-passes-major-climate-legislation-in-year-end-omnibus.