DOCKETED	
Docket Number:	21-lEPR-06
Project Title:	Building Decarbonization and Energy Efficiency
TN #:	239705
Document Title:	Comments from the Natural Resources Defense Council
Description:	N/A
Filer:	System
Organization:	NRDC/Alexander Hillbrand
Submitter Role:	Public
Submission Date:	9/14/2021 1:48:51 PM
Docketed Date:	9/14/2021

Comment Received From: Alexander Hillbrand
Submitted On: 9/14/2021
Docket Number: 21-IEPR-06

Comments from the Natural Resources Defense Council

Additional submitted attachment is included below.

September 14, 2021

Energy Commission Workshop on Refrigerants & Building Decarbonization

Comments from the Natural Resources Defense Council

On behalf of the Natural Resources Defense Council (NRDC), we submit the following comments on the role of refrigerants in building decarbonization in California, as part of the 2021 Integrated Energy Policy Report proceeding.

NRDC holds as two high priorities the decarbonization of buildings and the phasedown of hydrofluorocarbons (HFCs), which are chemicals used as refrigerants, in insulating foam production, and more.

Deploying heat pumps across California and beyond as fast as we can is essential to achieving our goals in the fight against climate change. The ability to heat our homes and buildings without relying on onsite combustion of fossil fuel is a crucial step in lowering emissions from the buildings sector, which contributes a quarter of total climate pollution in California.

Refrigerants are a key technological aspect of the vapor compression cycle used in all air conditioning technologies, including heat pumps. It is thanks to refrigerants that we have a market-ready, well-understood heat pump technology that can provide a cost-effective decarbonization pathway for heat and hot water in buildings.

And yet refrigerants are well known for the harms they can cause. Predecessors to HFCs damaged earth's protective stratospheric ozone layer. HFCs contribute significantly to climate change, with each pound of a typical HFC refrigerant contained in HVAC systems, R-410A, contributing about 2,000 times the climate impact of one pound of CO2 over a one-hundred-year period. HFCs' warming effect is even greater in the near term.

For these reasons, HFCs are being phased down internationally under the Kigali Amendment to the Montreal Protocol and in the U.S. under the American Innovation and Manufacturing (AIM) Act of 2020. In their stead, climate-friendlier alternatives to HFCs are beginning to roll out across the country in a variety of appliances, a transition that is only set to accelerate as the decade continues.

Thus, we are looking ahead at a period in which we'll be phasing down HFCs while simultaneously 'phasing up' heat pumps as fast as we can. As we proceed in doing so, there are some important guidelines that can help keep these parallel endeavors on a very close track without any interruptions.

1. **Climate-friendlier alternatives to traditional HFCs are coming in response to the AIM Act HFC phasedown, but still need building codes updates to permit them on the market.**

The AIM Act is phasing down the supply of HFCs, weighted by their global warming potential (GWP), in the U.S. by 85% over the next 15 years, shown graphically in Annex A. Additional federal regulations will accompany this supply phasedown, such as prohibitions on high-GWP HFCs in new equipment, regulations limiting allowable leaks from HFC-containing appliances and other maintenance and handling requirements, and requirements for HFC recovery and reuse. The supply phasedown is expected to begin at the start of 2022, and the additional regulations are expected to follow in the coming year or two.

The HFC phasedown will be implemented by adopting climate-friendlier refrigerant alternatives. Several are on the cusp of debut in the U.S.: major HVAC manufacturers, for example, have announced plans to unveil air conditioners and heat pumps using R-32 and R-454B, both with about 75% less climate potency over a 100-year horizon than R-410A. These alternative refrigerants are as good as or better than the incumbents at delivering efficient, high-capacity cooling and heating.

For California's market to open to these climate-friendlier refrigerants, however, updates must be made to the state building code to permit them. These refrigerants carry a "2L" flammability designation, which means they are mildly flammable. Their safety has been demonstrated at length over more than a decade of industry and third-party testing, and both Underwriters Laboratories (UL) and the American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE) have approved their use. And they are much safer than the highly flammable methane gas that they are replacing.

Roughly one-third of the U.S. population now lives in a state where building codes permit use of these alternatives. These necessary updates, however, are currently still pending in California. Building code revisions processes can be contentious and, and times, political, and the process in California could benefit from strong alignment across California government agencies.

2. Not all refrigerant used for building decarbonization is additional.

California, as with the rest of the nation, already relies on a tremendous amount of refrigerant to support modern life. For example, most homes and buildings already have air conditioning. In communities that don't have near-universal adoption – such as California's coastal and other marine areas – a warming climate is expected to drive significant rates of air conditioner adoption over the coming decade and beyond. Forthcoming research from U.C. Davis depicts the situation graphically, shown in Annex B.

Homes that previously had, or would anyway acquire, air conditioning that instead adopt heat pumps will only see a marginal increase in refrigerant charge – namely, the difference between the refrigerant charge rate of an air conditioner and a heat pump, plus any additional refrigerant resulting from increasing the heating and cooling capacity of the unit relative to the previous.

Reported charge rate differences between otherwise-equivalent heat pump and air conditioner models vary widely. In some cases, the difference is negligible, or perhaps about a 20% increase. In other cases heat pump models may use significantly more refrigerant – 50% or more. The variance is so wide that it suggests that something other than inherent 'need' for refrigerant in the system design is the cause. Policymakers and environmental stakeholders therefore have the opportunity to partner with the HVAC manufacturing industry to better understand this issue and promote low-refrigerant-charge design.

Regarding equipment sizing, the average U.S. central air conditioner is oversized significantly, perhaps by 30-50%. Standard industry practice is to size heat pumps to 40% above the peak cooling load. As a result, as air conditioners are swapped for heat pumps, contractors will be able to size units approximately the same as those units being replaced in many circumstances, further suggesting that additional refrigerant due to increased unit size is not a foregone conclusion.

The point of these comparisons is to demonstrate that the act of electrifying heating, i.e. switching from a gas furnace + AC system to heat pumps, need not be considered accountable for all the refrigerant that heat pumps will ultimately use. The mere act of switching to a heat pump does is only responsible

for introducing a fraction of the total refrigerant contained within the unit. And as the HFC phasedown progresses, this already-modest contribution to climate change is expected to fall significantly.

3. **As for building decarbonization, workforce development for climate-friendly refrigerants is needed.**

The HVAC industry is in the midst of an effort to build a workforce that includes a diverse set of people across age groups, demographics, and more. At the same time, new technologies – including both heat pumps in space and water heating as well as systems that use alternative refrigerants – are demanding new skills of installation and maintenance technicians, and provide an opportunity for a younger, more diverse generation technical professionals to gain prominence.

There are many benefits to a large, well-trained workforce in this area. Better system design can lead to smaller units being installed, which saves cost, energy, and refrigerant charge. Better installation can result in more energy efficient operation, increased comfort, and greater reliability and lifetime. It can also result in lower rates of refrigerant leakage and end-of-life emissions; leak prevention is increasingly important as the HVAC industry switches to mildly flammable refrigerants.

Workforce development efforts in the name of building decarbonization should band together with similar efforts in the name of the HFC phasedown for maximum impact.

4. **In some cases, well-designed incentives can be used to mitigate cost increases for systems that use climate-friendly refrigerants and/or which are heat pump enabled, but one should never get in the way of the other.**

Both heat pump and alternative refrigerant-based systems can carry higher upfront costs, at least until the market is better developed. Incentives can help buy down incremental costs and speed up adoption of the better technologies, but a few rules of the road should be followed to ensure success.

In general, when considering incentives for climate-friendlier refrigerant-based systems, it is important to consider that federal law currently requires an aggressive HFC phasedown – 85% over 15 years – and California has major regulations to restrict HFCs as well. As a result, the space conditioning industry, for example, is planning an all-out push to transition to climate-friendlier air conditioners and heat pumps by 2025 in the current business-as-usual. Deployment incentives must consider this high baseline pace of transition built into current regulations and product planning and may be wise to direct valuable dollars to a higher-impact area unless it can be clearly shown that additional expenditure will have a major additional impact.

That said, in certain cases incentives programs can greatly help implement and expedite the transition away from HFCs. In particular, sectors with notable costs and/or emissions reduction potential are good candidates for incentives, such as low-GWP commercial refrigeration systems using transcritical carbon dioxide or hydrocarbon refrigerants. California's F-Gas Reduction Incentives Program has started up and begun focusing in this area, with potential to expand next year depending on the outcome of budget negotiations. These should sunset when regulatory requirements to the same effect enter force.

Any incentives programs should focus first on helping facilities transition that are located in low income communities and communities of color to make sure those communities are able to transition first and will not be saddled with aging, HFC-based infrastructure that costs more to maintain as HFCs become

scarcer and more costly. Facilities and homes in these communities may be more sensitive to the potential increase in upfront cost, so dedicated action to avoid leaving them behind is essential for an equitable transition.

Finally, and crucially, there should be no mandatory requirements for program eligibility that require a heat pump to use an alternative refrigerant, nor a mandatory requirement that an alternative refrigerant-based system be a heat pump. The former is more likely and is risky: anything that could diminish – at all – the scope and success of decarbonization incentives programs must be avoided.

The HFC phasedown is underway and, barring the unforeseen, will happen. Thus it is not necessary to slow down the heat pump phase-up in the name of the HFC phasedown. In addition, in every case we've been able to analyze, the benefits of transitioning to heat pumps exceeds any potential refrigerant 'penalty' associated with increased use of HFC refrigerants. A good example is water heaters: the extra one and a half pounds of refrigerant, even if entirely emitted, only offset approximately 10 percent of the climate benefits of the dramatic reductions in energy use heat pump water heaters can achieve. A forthcoming study from the U.C. Davis Western Cooling Efficiency Center, with summary slides previously docketed with CEC, describes a similar situation for residential space conditioning.[1]

Additional incentives – kickers or adders – for low-GWP systems, however, are appropriate and can be a good way to drive markets towards the very best alternative refrigerant systems, not middle-ground temporary solutions.

5. **Every appliance using an HFC will need to transition to a climate-friendlier alternative, so it's time to make a plan.**

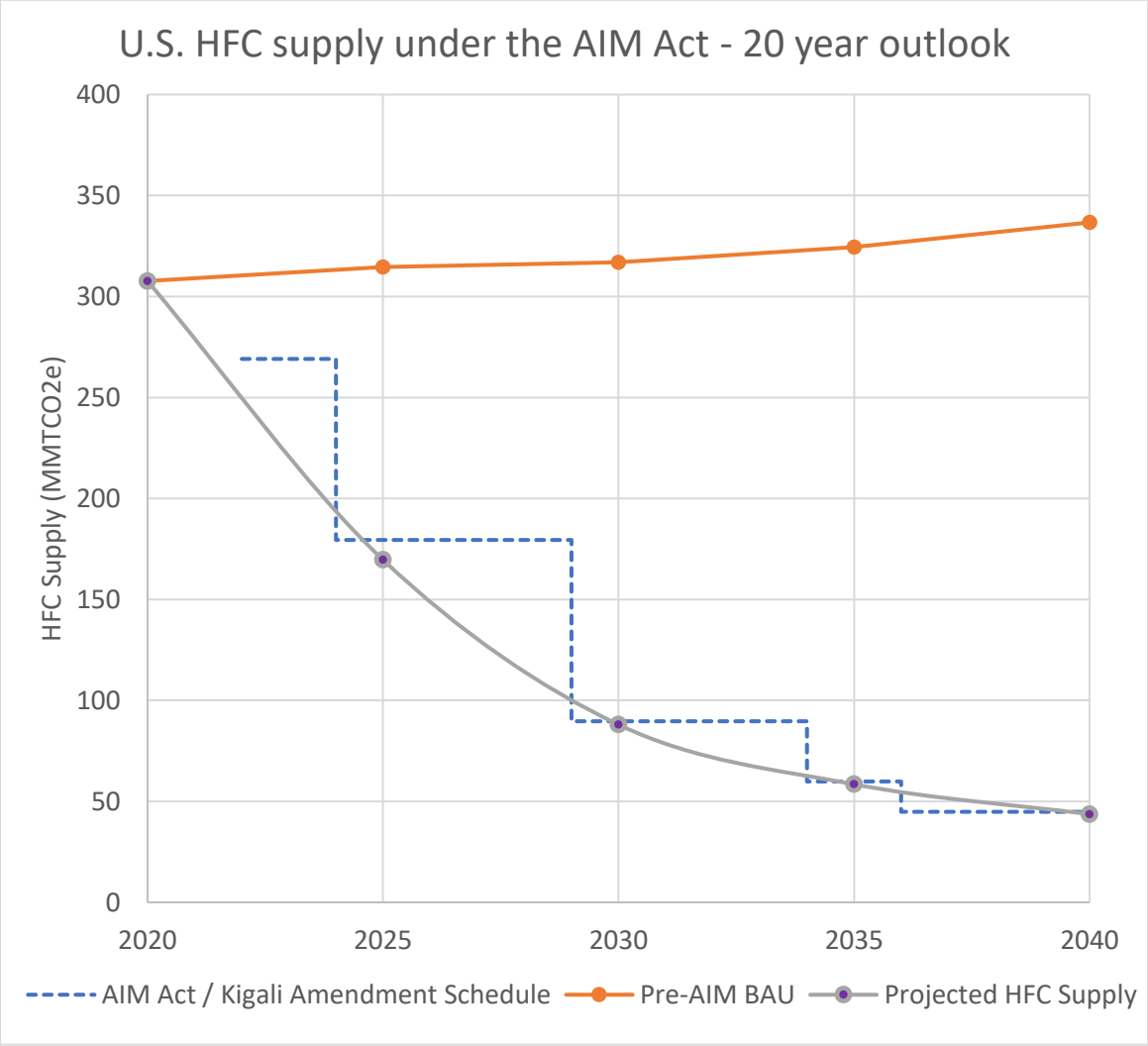
The HFC phasedown schedule under the AIM Act is ambitious, and it will result in the need for every major appliance category using HFCs today to transition to climate-friendlier alternatives.

In general, the order in which appliance categories are forced to move to alternatives will be proportional to their exposure to a supply phasedown: sectors that use a small amount of refrigerant will have longer to transition than large refrigerant users.

There is a caveat to this principle. U.S. EPA will, as the California Air Resources Board already has, likely set prohibitions on sale of new equipment using HFCs starting at particular dates in the future. These 'sector bans' are meant to help drive down HFC demand at the same time supply is falling, which should help avoid unwanted disruptions to the refrigerant market. These regulations may or may not follow the 'biggest first' approach that the supply phasedown alone would have, so it's important for refrigerant and decarbonization stakeholders to engage in the regulatory process together to ensure an adequate refrigerant transition glide path for all heat pump appliance sectors.

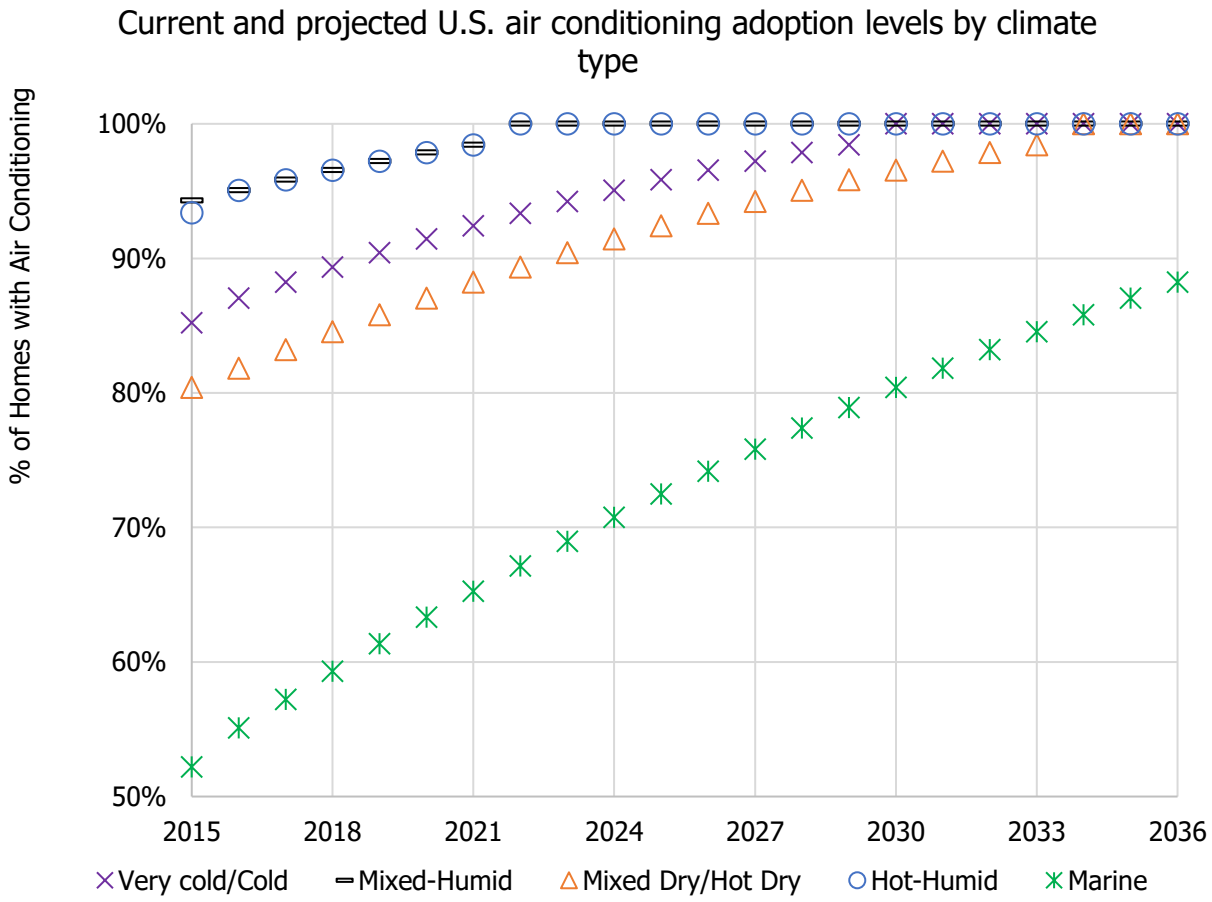
[1] Available at https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=21-BSTD-02.

Annex A



Source: NRDC analysis of EPA data under the AIM Act allocation rulemaking, 2021. Note: the "Projected HFC Supply" curve is required to stay *under* the "AIM Act/Kigali Amendment Schedule." The "Projected HFC Supply" data points are connected by a curved line for visual effect only; data for intervening years has not been estimated.

Annex B



Source: Forthcoming research by U.C. Davis Western Cooling Efficiency Center, 2021. CEC docket link provided in Footnote 1.