BUILDING ENERGY TRANSITION PLAN

DISCUSSION DRAFT

September 3, 2021

Background

The combustion of fossil fuels in buildings is a substantial source of emissions in Maryland. Most of this energy use is for space and water heating. Maryland's 2030 Greenhouse Gas Reduction Act (GGRA) Plan calls for reducing emissions from residential and commercial buildings through energy efficiency and by converting fossil fuel heating systems to efficient electric heat pumps that are powered by increasingly clean and renewable electricity. The 2030 GGRA Plan anticipates that approximately 80 percent of residential space heating systems will be heat pumps by 2050.

Programs are not yet in place to achieve the building energy transition envisioned by the 2030 GGRA Plan and additional building emissions reductions will be needed for Maryland to achieve post-2030 GGRA targets. More clarity is needed on the levels of efficiency, electrification, and renewable fuels that will be necessary for Maryland to achieve its long-range emissions reduction goals while keeping energy costs affordable for Marylanders.

The Maryland Commission on Climate Change (MCCC) launched a Buildings Sub-Group in 2020 to explore pathways to attain deeper emissions reductions from buildings. The Sub-Group's work led to a report, Decarbonizing Buildings in Maryland, including recommendations for next-step actions. At the MCCC's request, the Sub-Group continued its work in 2021 to develop this Building Energy Transition Plan to serve as a roadmap for reaching net-zero emissions from residential and commercial buildings by 2045, aligning with the MCCC's recommendation that Maryland should achieve net-zero emissions economywide by that year.

The Maryland Department of the Environment (MDE) – with support from the U.S. Climate Alliance, The Nature Conservancy, and Towson University – contracted Energy + Environmental Economics (E3) to conduct a Maryland Building Decarbonization Study, which serves as the foundation for this Building Energy Transition Plan. The Buildings Sub-Group provided guidance and review of E3's work from March through August 2021. The contents of this Building Energy Transition Plan reflect findings from E3's study, the Sub-Group's proceedings over the past two years, and building decarbonization policies developed by other states.

Study Results: The Lowest-Cost Scenario

E3 modeled three scenarios selected by the Buildings Sub-Group. Each scenario achieves net-zero emissions by 2045 for the residential and commercial buildings sectors. The scenarios are:

- **High Electrification** – Almost all building energy use is electric. High efficiency through building shell improvements. All-electric new construction.
- **Electrification with Fuel Backup** – Existing buildings use heat pumps for cooling and for most of the annual heating load, but existing furnaces and boilers provide backup heating in the coldest hours of the year. Fossil fuels are gradually replaced by low-carbon renewable fuels. All-electric new construction.
- **High Decarbonized Methane** – Most buildings use fuel for heating. Fossil fuels are gradually replaced by low-carbon renewable fuels. High efficiency through building shell improvements.

The Electrification with Fuel Backup scenario is modeled to be the lowest-cost and lowest-risk path among the three scenarios (see figure 1). Electricity system cost is minimal because heating loads are only electrified to the point that winter and summer peak electricity demand match, which takes advantage of existing electricity system infrastructure. Shell improvements (part of "Equipment Cost" in figure 1), which are important in the High Electrification and High Decarbonized Methane scenarios to reduce total cost, are less necessary in the Electrification with Fuel Backup scenario. Gas system cost increases due to the high cost of low-carbon fuels Uncertainty about low-carbon fuel costs leads to a wide range of total incremental cost.

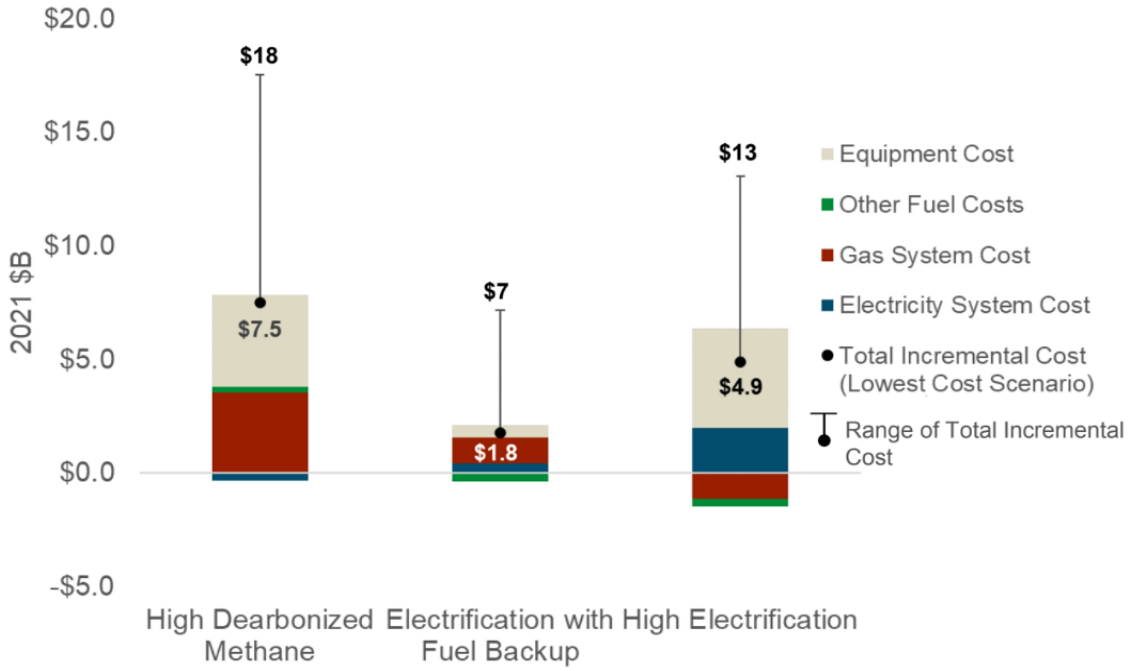


Figure 1. Incremental Total Resource Costs for Buildings in 2045 ($2021 Billions per year). Total cost range reflects assumptions regarding fuel costs, equipment costs, and heat pump installation practices. Incremental resource costs for each scenario are compared to a reference scenario.

Note that there is **significant overlap in the ranges of total incremental cost between the High Electrification and Electrification with Fuel Backup scenarios** (see figure 1). Low-carbon fuel costs may come in on the high-end of the range considered in the study. In that case, it is possible that a High Electrification pathway could be the lowest-cost pathway for Maryland, especially if federal funding is available for electricity grid infrastructure projects and if distributed energy resources (ex. electric vehicles with vehicle-to-grid charging and other localized energy storage solutions) become significant factors for managing winter peak electricity demand.

A recent filing by Pepco in a Washington DC Public Service Commission case suggests that electricity system upgrades in a high electrification scenario would be manageable. A study called *An Assessment of Electrification Impacts on the Pepco DC System* found that within a high electrification scenario (including 100 percent of light duty vehicles and 95 percent of the District's building heating demand being electrified), the additional load growth of Pepco's system is below historic growth rates. Further, the study found that growth in demand can be mitigated by deployment of energy efficiency and load flexibility measures like time-of-use rates, behind-the-meter storage, and smart thermostat integration.

This Building Energy Transition Plan is developed with both possible futures in mind.

Study Results: Construction and Retrofit Costs

E3 finds that in Maryland, **all-electric new single-family homes cost less to construct than new mixed-fuel homes** (see figure 3). E3 also finds that for existing single-family homes, **the retrofit cost to install a heat pump is close to the cost of replacing both an air conditioner (AC) and gas furnace** (see figure 2).

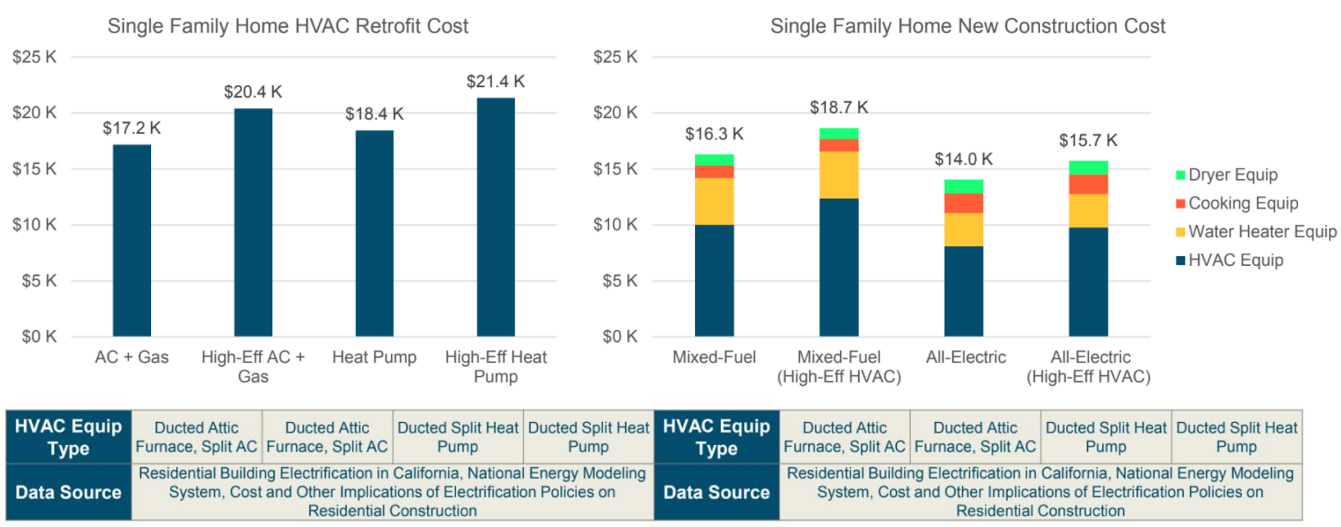
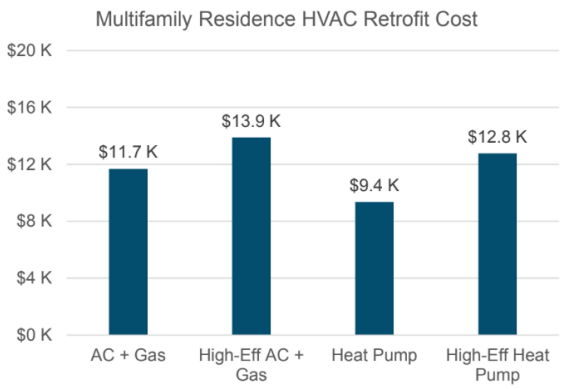
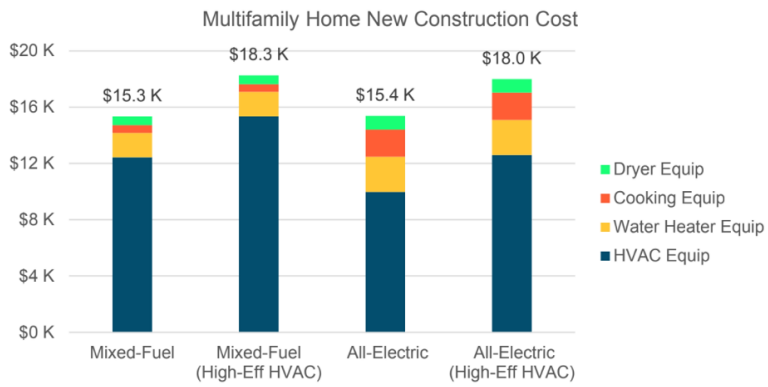


Figure 2 (left). HVAC equipment retrofit costs for single-family homes.
Figure 3 (right). Total new construction equipment costs for single-family homes.

The results for multi-family homes are slightly different. E3 finds that **the cost to construct all-electric or mixed-fuel multi-family homes is nearly identical** (see figure 5). **The retrofit cost of installing heat pumps can be significantly less expensive than replacing existing AC and gas systems** (see figure 4).





HVAC Equip Type	Hydronic AHU In-Unit, Split AC	Hydronic AHU In-Unit, Split AC	Package Terminal Heat Pump	Package Terminal Heat Pump
Data Source	Residential Building Electrification in California, National Energy Modeling System, Building Sector Report: A Technical Report of the Massachusetts 2050 Decarbonization Roadmap Study			

HVAC Equip Type	Ducted In-Unit Furnace, Split AC	Ducted In-Unit Furnace, Split AC	Ducted Mini-Split Heat Pump	Ducted Mini-Split Heat Pump
Data Source	Residential Building Electrification in California, National Energy Modeling System, Building Sector Report: A Technical Report of the Massachusetts 2050 Decarbonization Roadmap Study			

Figure 4 (left). HVAC equipment retrofit costs for multi-family homes.
Figure 5 (right). Total new construction equipment costs for multi-family homes.

The equipment and installation costs of heat pumps and other electric appliances will likely decrease as those technologies become more broadly adopted in the market in the future. This would make construction of all-electric buildings and retrofit for heat pumps even more economical.

Construction and retrofit costs for all-electric and mixed-fuel commercial buildings vary based on building type and use but findings suggest that **all-electric commercial buildings often have higher capital costs than mixed-fuel commercial buildings**. However, as shown in the Consumer Costs section below, new all-electric commercial buildings could have lower total annual costs than new mixed-fuel commercial buildings in the Electrification with Fuel Backup or High Electrification scenario. Work is ongoing to identify the most cost-effective solutions for decarbonizing commercial buildings across the range of buildings in that sector.

Study Results: Consumer Costs

E3 finds that in the Electrification with Fuel Backup and High Electrification scenarios, **all-electric new buildings – including single-family homes, multi-family homes, small commercial, and large commercial – would have the lowest total annual costs**. The following set of figures illustrate E3's findings for new construction.

Figure 6. New Single-Family Home

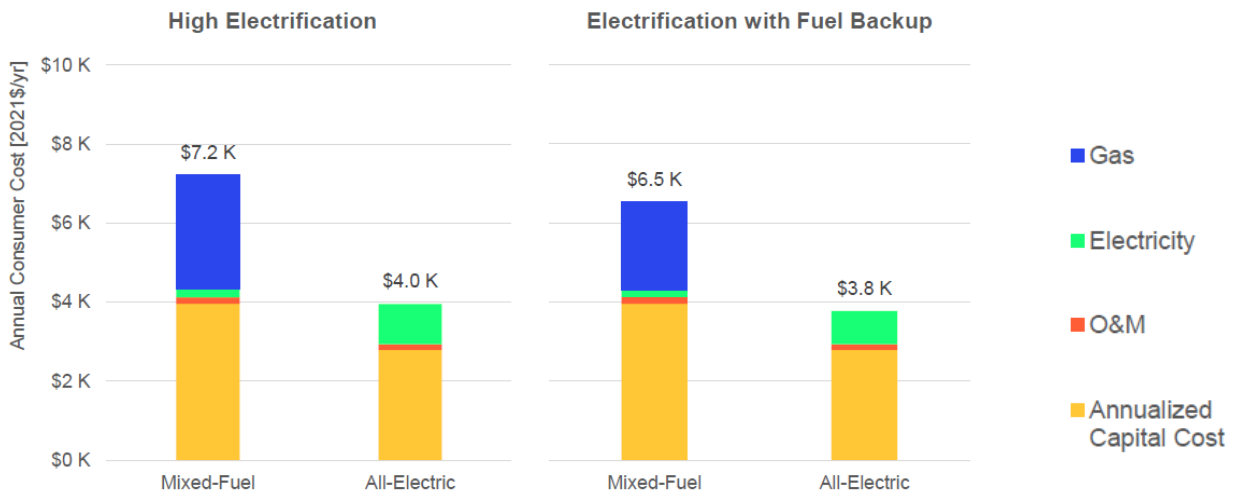


Figure 7. New Multi-Family Home

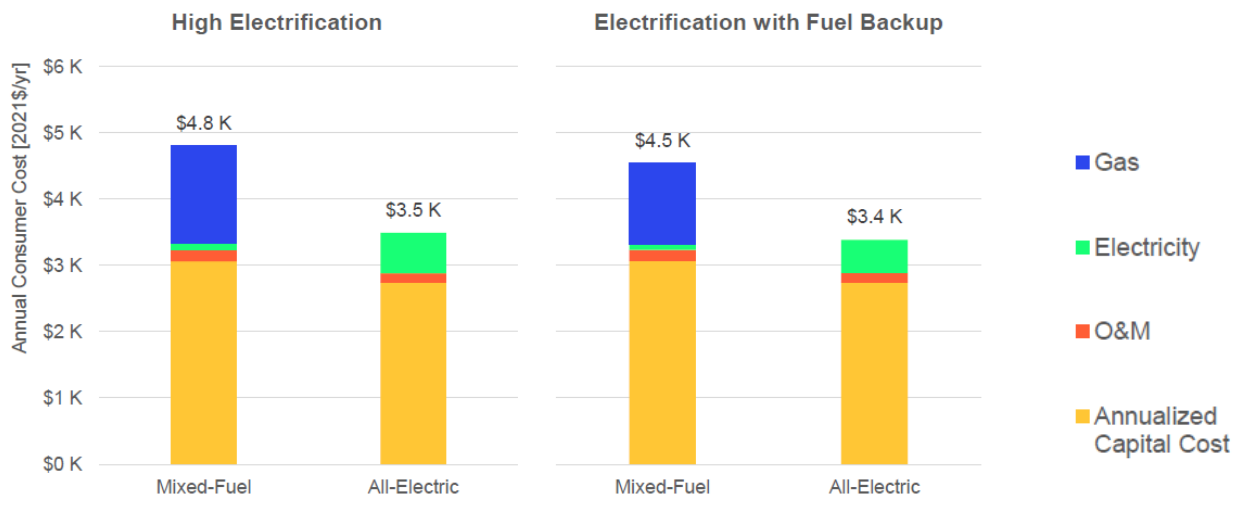


Figure 8. New Small Commercial

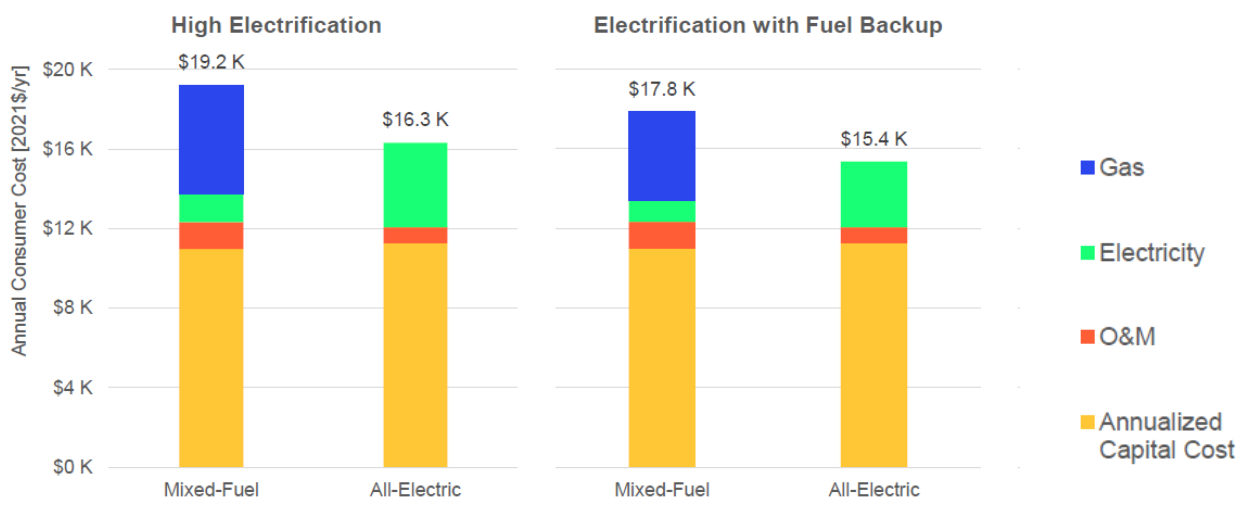
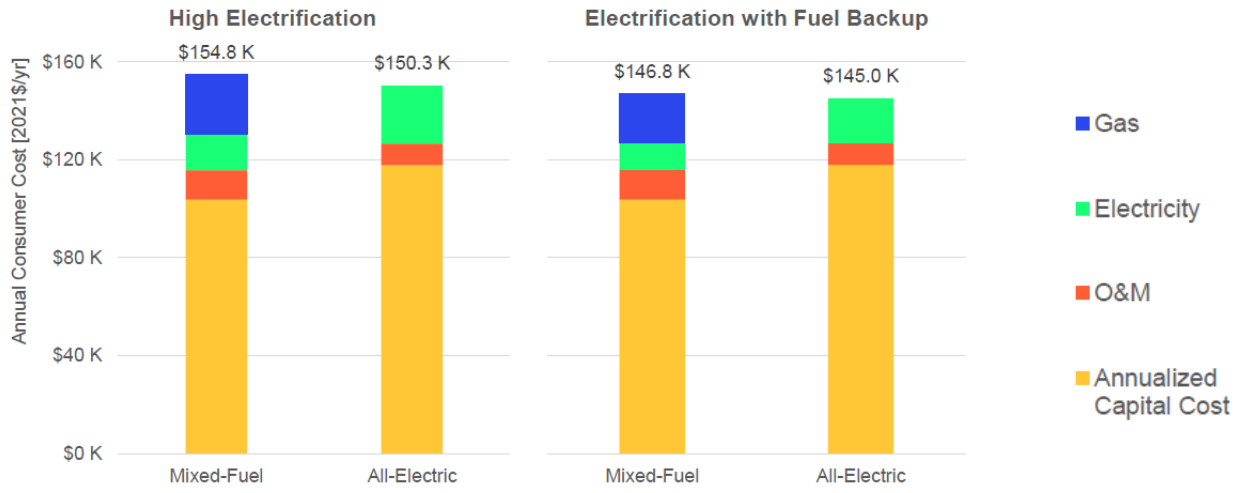


Figure 9. New Large Commercial



Figures 6-9. Annual Consumer Costs for New Buildings. Gas costs, electricity costs, and equipment costs are based on 2035 rates; Gas costs represent an optimistic rate scenario.

When retrofitting existing buildings, using heat pumps with fuel backup would result in the lowest total annual costs for all building types. The following set of figures illustrate E3's findings for retrofitted buildings. Note that capital costs are lower for buildings with fuel backup based on the assumption that these buildings would avoid expensive shell improvements.

Figure 10. Existing Single-Family Home Retrofit

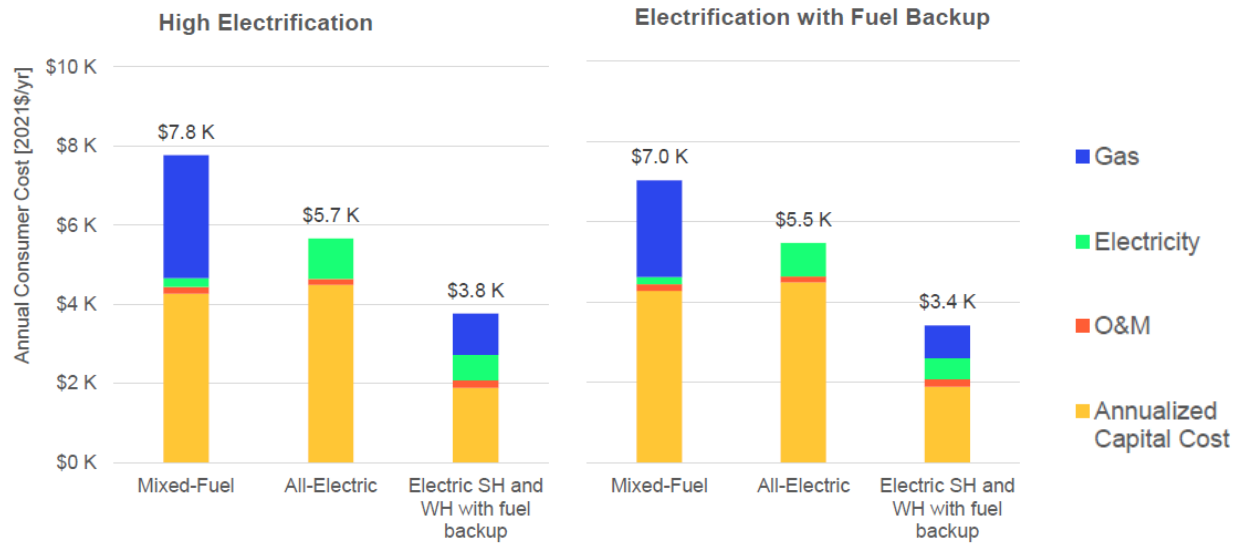


Figure 11. Existing Multi-Family Home Retrofit

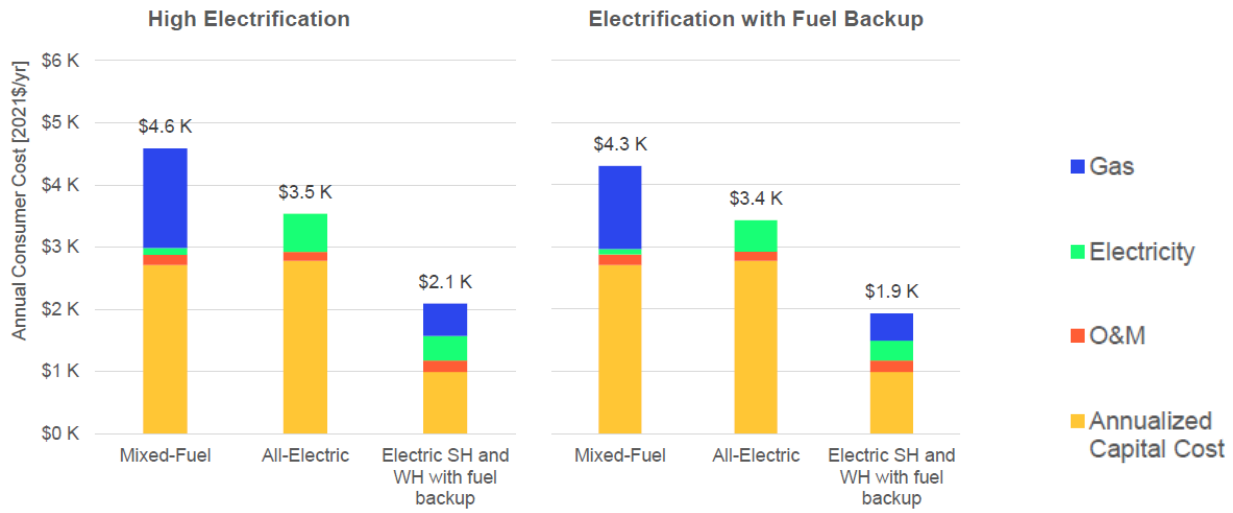


Figure 12. Existing Small Commercial Retrofit

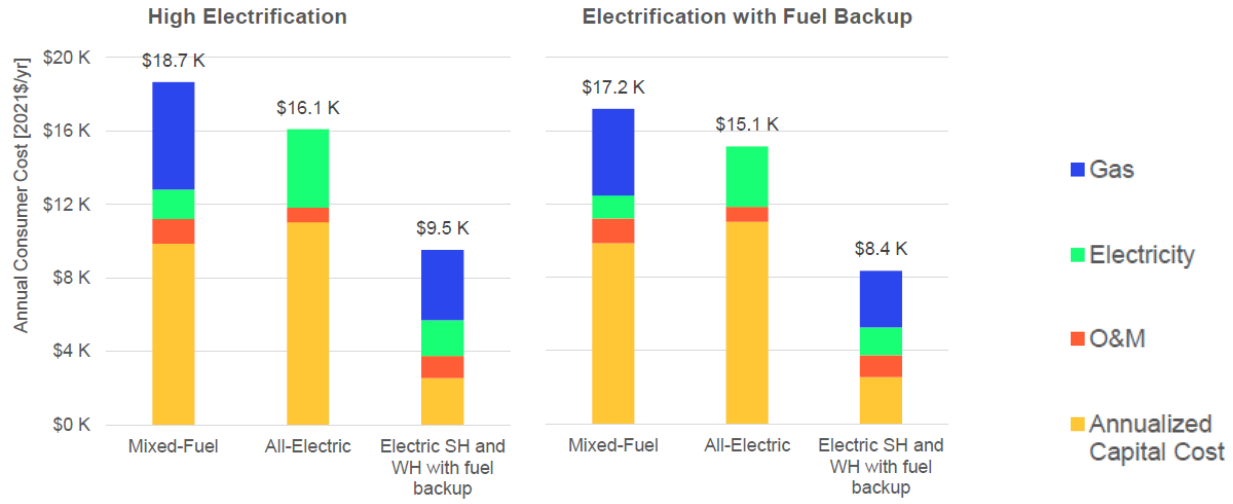
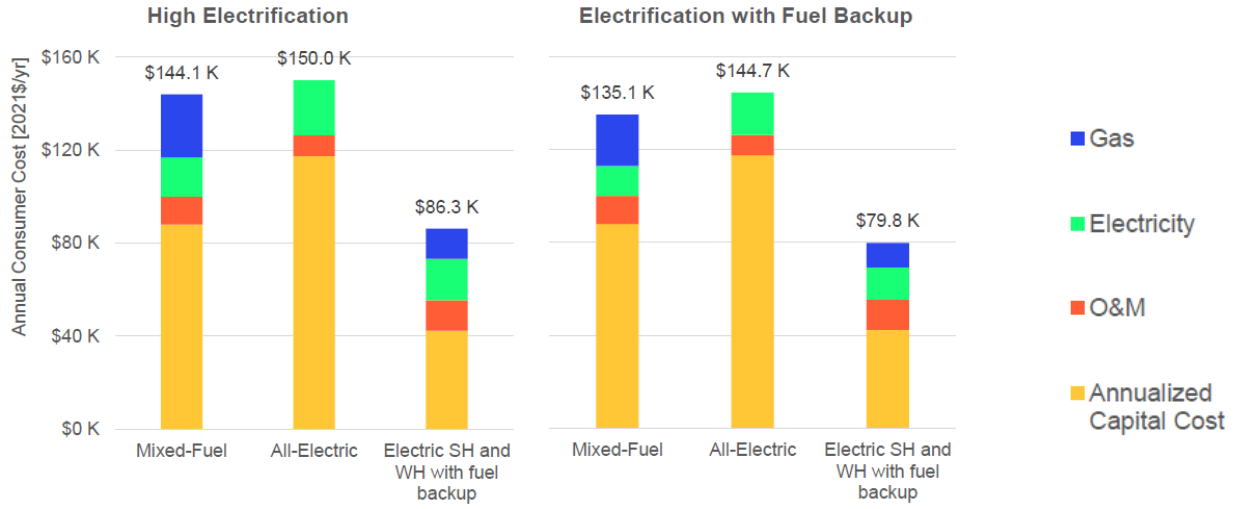


Figure 13. Existing Large Commercial Retrofit



Figures 10-13. Annual Consumer Costs for Retrofitted Existing Buildings. Gas costs, electricity costs, and equipment costs are based on 2035 rates; Gas costs represent an optimistic rate scenario.

Study Results: Utility Rate Structure

E3 estimates that by the 2030's, gas rates could begin increasing as expensive low-carbon fuels are mixed into the gas distribution system. *Under the current ratemaking model*, gas-heated buildings could see gas costs increase significantly while all-electric buildings could see virtually no increase in energy costs in any scenario (see figure 14). Unless rate structures change, building owners could decide to abandon gas service altogether and convert to all-electric systems to reduce costs.

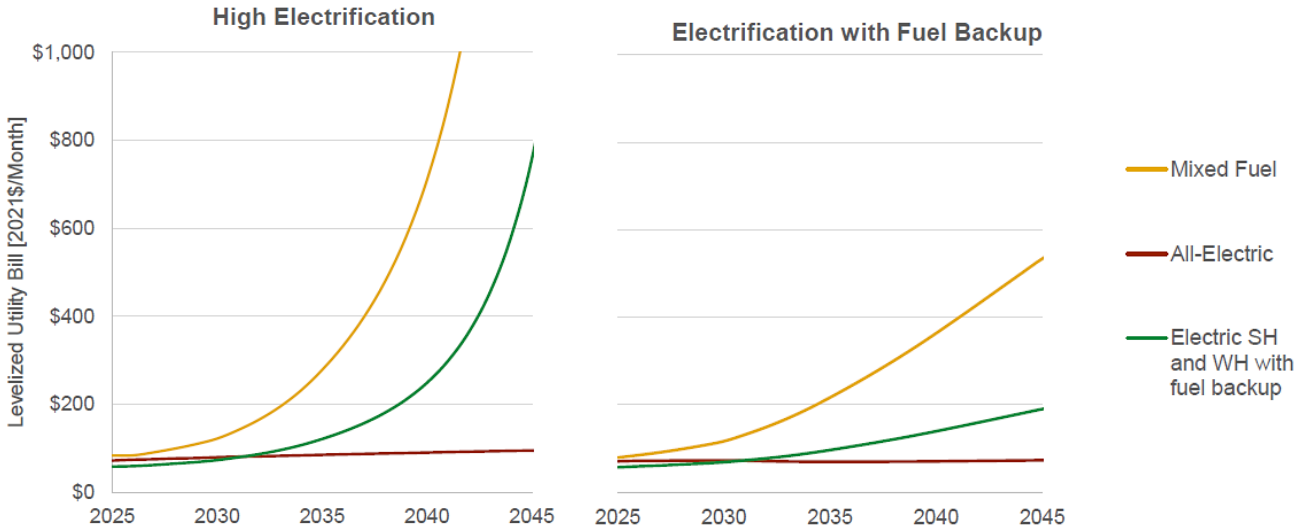


Figure 14. Illustrative customer bill impacts for residential single-family home. NOTE: These are *not* predictions of customer bills, but a representation of the potential dynamics under the current ratemaking model. These results indicate the potential equity and affordability challenges that will require systemic changes to the current dynamics.

Therein lies a core challenge of achieving the Electrification with Fuel Backup scenario, which is modeled to have the lowest total cost only *if* existing building owners maintain and use fuel burning equipment for backup heating. If gas rates are too high and incentives are not in place to encourage the use of expensive low-carbon fuel during the coldest hours of the year, then building owners could decide to run heat pumps instead of gas backup systems, leading to a strain on the electricity system. If that occurred, then additional investments in electricity system infrastructure and building shell improvements could be necessary, leading to the outcomes described in the High Electrification scenario.

As E3 put it in the conclusion of their study, "**Achieving the Electrification with Fuel Backup pathway would require careful policy design that incentivizes consumers to employ dual fuel heating systems** … the current ratemaking model likely needs to be revisited, so that the right price signals are reflected in gas and electric rates to incentivize consumers to switch to fuel backups during cold hours." This issue is revisited in the Recommendations section.

Readers should view the full results of E3's Maryland Building Decarbonization Study for more information on scenario design, emissions and energy consumption, electricity system peak impact, system cost and rate impact, consumer economics, and conclusions. The information included here is just a short summary of some of E3's findings.

Study Results: Key Conclusions

E3's study brings into focus a pathway for fully decarbonizing the residential and commercial buildings sectors in Maryland. Key conclusions include:

- New residential buildings should be all-electric.
- New commercial buildings should be all-electric when cost-effective.
- Space and water heating loads should be met with efficient electric heat pumps, at least to the point when winter and summer peak electricity demand are roughly equal.
- Achieving greater electrification of heating loads (when winter peak electricity demand would exceed current electricity system capacity) could become the lowest-cost pathway if federal funding for electricity system improvements becomes available, building shell improvement costs are reduced, utility demand management is enhanced, and/or low-carbon fuel costs come in on the high end of the price range.
- Planning for both the Electrification with Fuel Backup and High Electrification scenarios could be wise. To achieve the lowest-cost pathway to decarbonize buildings, it is critical to ensure efficient price signals are conveyed in electric and gas rates that align individual consumer choices with minimizing overall system costs.
- Gas consumption in buildings would decrease between 62 percent in the Electrification with Fuel Backup scenario and 96 percent in the High Electrification scenario.
- Fossil fuels should be replaced with low-carbon renewable fuels by 2045.
- A well-coordinated utility transition plan in critical to protect ratepayers.

These conclusions form the foundation of a roadmap to net-zero emissions buildings.

Building Decarbonization Roadmap for Maryland

New Homes	All-Electric Construction Code [P] Heat pumps for space heating/cooling and water heating Ready for solar, EV charging, and building-grid interaction	Zero direct emissions beginning in 2024
New Commercial	All-Electric Construction Code when cost-effective [P] Heat pumps other clean energy technologies where practical Ready for solar, EV charging, and building-grid interaction	Zero to low direct emissions beginning in 2024
Existing Homes	Clean Heat Retrofit Program [P] Incentives for heat pump space heating/cooling and water heating [E] Existing heating system used for backup space heating	Most heating demand met by heat pumps by 2045
Existing Commercial	Building Emissions Standard [P] Flexible, technology-neutral program Owners choose the best path for their buildings	Net-zero emissions by 2045
Electricity Supply	Clean and Renewable Energy Standard [L] Renewable Portfolio Standard [S] Regional Greenhouse Gas Initiative [S]	Zero emissions by 2040 [G]
Heating Fuel Supply	Clean Heat Standard [P] Fossil fuels replaced with low-carbon renewable fuels 62-96 percent reduction in gas consumption	Net-zero emissions by 2045

Legend: P = Proposed herein E = Existing but should be strengthened G = GGRA Plan target L = Legislation introduced S = In statute

Core Recommendations

Each of the following recommendations correspond with a critical component of the Building Decarbonization Roadmap for Maryland (above), which presents a suite of policies that would collectively guide Maryland's residential and commercial building sectors to net-zero emissions by 2045.

1. **Adopt an All-Electric Construction Code**

   The General Assembly should require the Maryland Building Code Administration to adopt a code that ensures that new buildings meet all water and space heating demand without the use of fossil fuels (allowing for the use of electric heat pumps, solar thermal, and other existing and potential clean energy systems) and are ready for solar, electric vehicle charging, and building-grid interaction. This code shall apply to all new buildings and major renovations beginning in 2024. The Building Code Administration shall also develop and implement training courses on the benefits of all-electric and electric-ready buildings for building developers, realtors, real estate appraisers, and lenders.

   The Building Code Administration shall develop a cost-effectiveness test to allow building projects to seek variances to code requirements while maintaining electric-ready standards. New commercial buildings that produce greenhouse gas emissions on-site would participate in the Building Emissions Standard (proposed herein) and follow their own tailored plan for reaching net-zero emissions.

   Discussion: A recommendation to adopt an all-electric construction code was supported by the MWG in 2020 but the MCCC wanted to see this Building Energy Transition Plan before voting on this measure. Studies including E3's Maryland Buildings Decarbonization Study and RMI's The New Economics of Electrifying Buildings add to a body of work demonstrating that all-electric new homes have lower construction and energy costs than mixed-fuel homes. This means that all-electric new homes could help improve housing affordability and local air quality while reducing greenhouse gas emissions in Maryland.

   For commercial construction, all-electric design can increase construction and/or energy costs, which is why a test is proposed to help commercial building developers identify cost-effective clean energy solutions.

   The New Building Institute's Building Decarbonization Code, which is an overlay to the 2021 International Energy Conservation Code (IECC) and compatible with ASHRAE 90.1, includes an all-electric pathway that is one possible solution for code adoption. California and Washington recently adopted building energy efficiency codes and EV infrastructure codes. Municipalities such as Berkely, CA, San Jose, CA, and Seattle, WA have also adopted energy efficiency, electric construction, and solar readiness codes.

2. **Develop a Clean Heat Retrofit Program**

The General Assembly should require state agencies including the Public Service Commission (PSC) and Maryland Energy Administration (MEA) to work with electric and gas utilities to develop and implement a Clean Heat Program that meets the following targets:

A. **Allow fuel-switching through EmPOWER beginning in 2024** (MCCC recommendation from 2020) – Require incentives for the electrification of existing fossil fuel systems through the EmPOWER program and direct the PSC to require the electric utilities to proactively encourage customers with propane or oil heating systems to replace or supplement those systems with electric heat pumps, especially for low-income households and consumers. State agencies also should modify programs they manage to facilitate fuel-switching if not already allowed.

   Discussion: Approved by the MWG and MCCC in 2020. Not yet enacted in state policy. Currently being discussed by the PSC's EmPOWER Future Programming Work Group.

B. **Allow beneficial electrification through EmPOWER beginning in 2024** (MCCC recommendation from 2020) – Require that the core objective of EmPOWER change from electricity reduction to a portfolio of mutually reinforcing goals, including GHG emissions reduction, energy savings, net customer benefits, and reaching underserved customers. Allow for beneficial electrification, which are strategies that provide three forms of societal benefits: reduced energy consumption (total source BTUs), lower consumer costs, and reduced GHG emissions. Beneficial electrification programs should be prioritized first for low-income households and consumers and should be aligned with other health and safety upgrades to consider a whole-home or whole-building retrofit approach to ensure cost-effectiveness and a focus on benefitting underserved homes and businesses first.

   Discussion: Approved by the MWG and MCCC in 2020. Not yet enacted in state policy. Currently being discussed by the PSC's EmPOWER Future Programming Work Group.

C. **Target 50 percent of residential AC and water heater sales to be heat pumps by 2025, 100 percent by 2030** (modified MCCC recommendation from 2020) – Require that incentives through EmPOWER and other programs are sufficient to meet a target of 50 percent of AC and water heater sales to be electric heat pumps by 2025 and 100 percent by 2030. Require that electric utilities provide payment options such as on-bill financing to spread out upfront costs of heat pump installations including electrical upgrades. These targets apply to residential systems but consideration should also be given to developing proper incentives and financing options for commercial system electrification.

   Discussion: In 2020, the MWG and MCCC approved a recommendation that 50 percent of space heater sales should be heat pumps by 2025. The target probably makes more

sense as an AC sales target to align with E3's conclusion that heat pumps should provide all cooling and most heating for existing buildings, and that existing combustion systems could stay in place for backup heating. Heat pump water heaters are added to the proposal this year. If 100 percent of AC and water heater sales are heat pumps in 2030, then most existing buildings should be retrofit with heat pumps by 2045 based on typical equipment replacement schedules.

D. **Direct more Strategic Energy Investment Fund (SEIF) funding to energy efficiency and beneficial electrification** – Require MEA and the SEIF Board to make more SEIF funds available to energy efficiency and beneficial electrification programs and to end investments in natural gas expansion.

Discussion: In 2019, Maryland devoted 29% of SEIF funds to energy efficiency compared with 40% by all RGGI states in aggregate. In 2020, MEA devoted $4M to the Maryland Energy Infrastructure Program for the purpose of promoting natural gas distribution.

3. **Create a Building Emissions Standard**

The General Assembly should require commercial buildings to achieve net-zero greenhouse gas emissions by 2045 through a technology-neutral Building Emissions Standard. State-owned buildings should meet this standard by 2040. This would give commercial and institutional building owners the greatest flexibility in bringing their buildings in line with the state's emerging net-zero emissions target. The standard would include measurement and reporting of direct (on-site) emissions, development of plans to achieve net-zero direct emissions, and support from the state to implement the plans. Emissions mitigation measures include but are not limited to:

- Retro-commissioning building energy systems
- Making building shell improvements
- Replacing fuel burning equipment with efficient electric equipment
- Installing variable refrigerant flow (VRF) and similar systems that capture and repurpose waste heat
- Replacing fossil fuels with low-carbon renewable fuels that are:
    - Produced on-site,
    - Delivered by a third-party, or
    - Delivered by the standard offer gas/oil/propane service if a Clean Heat Standard (proposed herein) is enacted in Maryland
- Installing carbon capture systems (possibly for facilities like large combined heat and power or district energy plants)

Buildings that participate in the Building Emissions Standard would:

- Measure and report direct emissions to MDE annually starting in 2025
- Submit a net-zero emissions draft plan to MDE by 2030
- Submit a final net-zero emissions draft plan to MDE by 2035
- Achieve net-zero emissions by 2045 at the latest (2040 for state-owned buildings)

The General Assembly should also provide resources to MEA to offer technical advice and financial support to help owners of covered buildings develop and implement their net-zero emissions plans. Fees for non-compliance should be reasonable, perhaps corresponding with the cost of implementing additional carbon sequestration or negative emissions technologies in Maryland. The state should create commercial tax credits and direct subsidy payments for upgrades related to building decarbonization projects large enough to reduce the simple payback period to between 3 and 7 years.

Discussion: New York City and Boston are among the U.S. jurisdictions that have implemented building performance standards aimed at guiding commercial buildings to net-zero emissions by mid-century. Building performance standards commonly include interim targets for energy intensity or emissions – thresholds that decrease every five years or so. This proposal does not include interim targets in recognition that some buildings will undergo only one major renovation or HVAC system replacement between now and 2045. Building owners need time and support to develop and implement a net-zero emissions plan. Including interim targets could be an unreasonable burden.

Note: If Maryland creates a Clean Heat Standard, then it could become the default pathway to net-zero emissions for all buildings. However, the state would need to educate buildings owners about the impact such a program could have on heating fuel rates and help buildings owners make informed investment decisions based on projected energy costs.

4. **Create a Clean Heat Standard**

The General Assembly should design a Clean Heat Standard. Similar in concept to the Renewable Portfolio Standard, which effectively shifts Maryland's electricity supply from fossil fuel to renewable energy sources, a Clean Heat Standard would slowly transition Maryland's heating fuel supplies from fossil to low-carbon renewable sources. The standard would apply to all heating fuels sold in the state including gas, heating oil, and propane. The carbon intensity of heating fuels would slowly ratchet down, aiming for net-zero emissions by 2045. Here is one possible schedule which would apply to each type of heating fuel:

- 20 percent carbon intensity reduction by 2030 (from a 2020 baseline)
- 50 percent carbon intensity reduction by 2035
- 80 percent carbon intensity reduction by 2040

- Net-zero carbon intensity in 2045 and beyond

While the vast majority of the fossil fuels consumed in Maryland come from out-of-state sources, a Clean Heat Standard could create opportunities to grow renewable energy businesses within Maryland. Sources of renewable fuels include landfills, wastewater treatment plants, agricultural waste, animal waste, used cooking oil, energy crops, forest products, and other sources common to Maryland.

Discussion: E3's Maryland Building Decarbonization Study shows that in any scenario, replacing fossil fuels with low-carbon renewable fuels is essential for achieving net-zero emissions within the building sector. Colorado's Clean Heat Standard could be a model for Maryland to follow. However, as described earlier, it is critical that a transition to low-carbon heating fuels be done with affordability and justice as core objectives, which leads to the next recommendation.

5. **Develop a Utility Transition Plan**

The General Assembly should require the PSC to oversee a process whereby the electric and gas utility companies develop a unified plan for achieving the goal of a mostly to fully electrified building sector in Maryland. Key components of that plan include:

- Ratepayer protections especially for low to moderate income (LMI) Marylanders
- Rate structures that can facilitate electrification with fuel backup
- Appropriate gas system investments/divestments
- Electric system enhancements
- Demand management solutions to reduce winter peak electricity demand

Discussion: E3 estimates that gas consumption would decrease around 62 percent by electrifying building heating loads to the point when summer and winter peak electricity demand is roughly equal, which is considered a no-regret action by ICF for decarbonizing buildings. E3 also estimates that gas consumption would decrease around 96 percent by 2045 if costs associated with the High Electrification scenario can be reduced or supported with federal funds. In any scenario, Maryland should expect a significant reduction in gas consumption and should plan for that transition.

Some states have started planning for natural gas and gas utility business model in a decarbonized future. California, New York, Colorado, Massachusetts all have gas planning dockets to explore the long-term future of gas planning and the role of gas in decarbonization.

Additional Recommendations

The recommendations in this section further support building decarbonization in Maryland and are complementary to the Core Recommendations above. Some of the following are MCCC recommendations from 2020 that are not yet enacted by the state, and some are recommendations offered by participants of the Buildings Sub-Group.

6. **Offer incentives for net-zero energy all-electric new buildings** (MCCC recommendation from 2020)

   The Maryland Building Codes Administration should develop optional codes and standards for all electric net-zero energy buildings, including allowance of near-site renewable energy systems such as community solar projects, and determine how to incentivize builders to design to those standards. This work should be coordinated with the Maryland Department of Housing and Community Development (DHCD) in shaping incentive offerings since DHCD already has a Net Zero Loan Program in place and could provide useful insights on program design and existing market gaps to increase the reach of other incentive efforts.

   Discussion: Net-zero energy all-electric buildings go further than an all-electric building code because the net-zero energy aspect introduces a requirement for on- or near-site solar.

7. **Lead by example through the electrification and decarbonization of state buildings** (modified MCCC recommendation from 2020)

   The General Assembly should require that all new state-owned buildings and major renovations to existing state-owned buildings use efficient electric systems for primary space and water heating unless granted an exception based on cost or building characteristics that would make an electric system impractical, including existing use of district heat or combined heat and power. This requirement should apply to projects covered by the Maryland High Performance Building Act.

   Climate change mitigation, adaptation and resiliency, including contributing to Maryland's greenhouse gas reduction goals, should be demonstrably central design goals in any building construction or renovation procured with any funds, loans, grants, tax or other benefit from the State of Maryland.

   Discussion: The first paragraph is a MCCC recommendation from 2020. The second paragraph is offered by a Buildings Sub-Group participant.

8. **Prioritize an equitable level of benefits for all Marylanders** (MCCC recommendation from 2020)

   The Governor, State Agencies, Commissions, and General Assembly should ensure that all policy decisions to reduce GHG emissions from the building sector in Maryland, including

those within these recommendations, prioritize an equitable level of benefits to limited income households, the state's affordable and multi-family housing stock, and low-income ratepayers, and concurrently with the benefits provided to others.

Discussion:

9. **Improve interagency coordination for holistic building retrofits** (MCCC recommendation from 2020)

   The Governor, via Executive Order, or General Assembly, via legislation, should revive an Interagency Task Force with the goal of increased and consistent coordination across programs, policies, and funding streams to retrofit Maryland's existing residential and commercial buildings to achieve healthier, safer, more efficient, and climate-friendly homes and businesses. This Green and Healthy Task Force would identify opportunities to align lead, mold, asbestos, and indoor air quality remediation intervention schedules with energy efficiency upgrades and electrification retrofit programs to ensure a more cost-effective, whole-building retrofit program that meets Maryland's various health, safety, affordability, and climate action goals. Progress should be tracked and measured through a public state dashboard. Funding should be provided to make holistic improvements to every limited income and affordable housing unit in the state by 2030.

   Discussion: The last sentence of this recommendation was added based on Buildings Sub-Group participant comments in 2021. The rest was approved by the MCCC in 2020.

10. **Allow local jurisdictions to set higher fines for non-compliance on building performance**

    The General Assembly should create enabling legislation to allow local jurisdictions to set higher fines for non-compliance with local building energy/emissions performance standards. The current limit is $500.

    Discussion: This Montgomery County has proposed to create Building Energy Performance Standards to guide commercial and multi-family buildings to greater energy efficiency and lower emissions. Counties including Montgomery are unable to levy a fine for non-compliance that is sufficient to motivate compliance with the standards.

11. **Sunset financial subsidies for fossil fuel appliances within EmPOWER**

    EmPOWER Maryland and other energy programs in the state should be focused on providing financial assistance only to non-fossil fuel equipment, appliances, and infrastructure associated with the building sector and any and all incentives and subsidies for fossil fuel systems should be eliminated. This should be paired with an increased incentive size for non-fossil appliances and systems installed for limited income consumers.

    Discussion:

12. **Use federal funds for comprehensive retrofits of low-income housing**

    Maryland should prioritize the use of any relevant federal resources coming from the budget reconciliation process to perform comprehensive health, safety, efficiency, and electrification retrofits for affordable housing and should ensure that any new federal funds are not used to support the expansion or installation of new fossil fuel infrastructure or appliances.

    Discussion:

13. **Offer tax credits or other incentives for enhanced energy efficiency in new construction**

    Several Maryland counties provide property tax credits or other incentives for energy efficient and green buildings. State funding for these incentives in addition to the county support would encourage other counties to act similarly. Montgomery County, which is committed to an 80 percent reduction in greenhouse gas emissions by 2027 and zero emissions by 2035, has property tax credits for new and existing multifamily and commercial buildings based on energy reductions and certifications, and is looking at expanding incentives. Anne Arundel, Baltimore, and Howard Counties offer a tax credit for high performance homes and Anne Arundel and Baltimore Counties award a higher tax credit for a higher performance score.

    Discussion:

14. **Allow above-code green programs to comply with the state-adopted IECC**

    The State can ease the path to building more energy efficient homes by declaring that residential buildings constructed to above-code green programs comply with the State-adopted International Energy Conservation Code (IECC). The ANSI-approved ICC 700 National Green Building Standard, Energy Star certifications, and Leadership in Energy and Environmental Design (LEED) rating system are nationally recognized above-code programs. These programs work with experts to ensure that energy and other targets are met and are performing properly. They can help accelerate growth to homes reaching Zero Energy because certifications under above code programs are supported by appraisers and lenders recognizing the greater value of highly efficient buildings. The GSE Fannie Mae has developed Single-Family Green Mortgage-Backed Securities (MBS) that link to Energy Star certifications and is expected to include other green certifications. Fannie Mae already has Multifamily Green MBS that recognize multiple green building certifications.

    Discussion:

15. Allow a portfolio approach to renewable energy generation

On-site energy generation and sharing of energy among a portfolio of buildings should be incentivized by lifting the limitations on net metering, virtual net metering, and meter aggregation that apply to commercial property. The state should work to address or mitigate the unfavorable Federal tax treatment that limits on-site energy generation by real estate investment trusts.

Discussion:

16. Evaluate property tax assessment processes to support decarbonization efforts

Local governments should begin to evaluate and make contingencies for changes to building valuations and tax base resulting from obsolescence or reduced operating income as well as the possible need to increase the use of real estate tax credits to offset the costs and reduce the payback periods of building decarbonization projects.

Discussion:

17. Identify locations that need grid upgrades to accommodate new all-electric buildings

Electricity utilities should provide information about locations where the grid is not sufficient to serve new construction of multi-story, all-electric commercial buildings with electric vehicle charging and a method to determine the cost and timetable for necessary upgrades.

Discussion:

18. Accelerate development of low-carbon fuels

The state should study and accelerate development of feedstocks for biofuels, generation of green hydrogen, and other clean fuel technologies that economize compliance costs by using fuel-based backup equipment for heating and the existing gas utility infrastructure to deliver low and then net-zero carbon fuels.

Discussion:

Building Decarbonization Policies in Other States

California

- **New Construction – Heat Pumps and EV-Ready Building Codes**: In August 2021, California adopted its 2022 building energy efficiency standards for new and existing buildings, becoming the first state to establish electric heat pumps as a baseline technology in its building codes.[1] The codes also establish "electric-ready" requirements so homes are able to support EV charging and electric heating and cooking, in addition to expanding standards for onsite solar and battery storage and strengthening ventilation standards.[2] After the code becomes effective in 2023, experts estimate that this combination of standards will lead most new homes and buildings to be built gas-free, which is an already established trend that this code will reinforce. The 2022 code is estimated to provide $1.5 billion in consumer benefits and reduce 10 million metric tons of greenhouse gases over the course of 30 years.[3]

Colorado

- **Building Standards – Statewide Performance Standards**: In June 2021, Colorado became the second state to advance a statewide building performance standard with its passage of legislation that calls for the development of standards that achieve a 7 percent reduction in GHG emissions by 2025 and a 20 percent reduction by 2030, below 2021 levels. This bill also requires annual energy use reporting from owners of buildings larger than 50,000 square feet, beginning in 2022.[4]
- **Energy Efficiency for Gas Utilities**: In June 2021, Colorado adapted their energy efficiency policies to better support greenhouse gas reductions.[5]
    - Senate Bill 21-264 requires gas utilities to file and implement first-in-the-nation "Clean Heat Plans" that may utilize electrification, efficiency, leak reduction, and recovered methane or biomethane to reduce GHG emissions 4 percent by 2025 and 22 percent by 2030;
    - Senate Bill 21-246 requires electric utilities to file plans that support cost-effective beneficial electrification and directs the Public Utilities Commission

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[1] Natural Resources Defense Council. "California Passes Nation's First Building Code that Establishes Pollution-free Electric Heat Pumps as Baseline Technology; Leads Transition Off of Fossil Fuels in New Homes." August 11, 2021. https://www.nrdc.org/media/2021/210811-0.
[2] California Energy Commission. "Energy Commission Adopts Updated Building Standards to Improve Efficiency, Reduce Emissions From Homes and Businesses." August 11, 2021. https://www.energy.ca.gov/news/2021-08/energy-commission-adopts-updated-building-standards-improve-efficiency-reduce-0.
[3] California Energy Commission, 2022 Building Energy Efficiency Standards Summary, https://www.energy.ca.gov/sites/default/files/2021-08/CEC_2022_EnergyCodeUpdateSummary_ADA.pdf
[4] Colorado General Assembly. "HB21-1286: Energy Performance For Buildings." Accessed August 31, 2021. https://leg.colorado.gov/bills/hb21-1286.
[5] Colorado Energy Office. "Colorado adopts nation-leading policies to reduce GHG pollution from buildings." June 8, 2021. https://energyoffice.colorado.gov/press-releases/colorado-adopts-nation-leading-policies-to-reduce-ghg-pollution-from-buildings.

(PUC) to include the social cost of carbon and methane emissions in its cost-effectiveness tests; and

- House Bill 21-1238 directs the PUC to set energy savings targets for gas utility demand-side management (DSM) programs, requiring the use of the social cost of carbon and of methane in its cost-effectiveness evaluations. These bills also implemented labor standards for certain commercial electrification and DSM projects. Colorado also passed several bills to finance and fund building transformation, including a bill to fund low-income weatherization assistance grants and another to support low-income energy efficiency, electrification, and renewable energy programs.

Maine

- **Heat Pump Programs**: Maine has set goals to aggressively pursue the installation and use of heat pumps. Between 2013 and 2019, the Efficiency Maine Trust incentivized over 46,000 installations, putting a heat pump in almost 10% of Maine homes. In 2019, the Maine Legislature established the goal to install 100,000 new high-performance heat pumps over five years in Maine through the legislatively enacted LD 1766: An Act to Transform Maine's Heat Pump Market to Advance Economic Security and Climate Objectives. This legislation provides supplementary funding for the Efficiency Maine Trust's incentive programs.[6]

Massachusetts

- **New Construction – Stretch Codes:** In its comprehensive climate bill enacted in March 2021, Massachusetts authorized its energy department to establish, by 2023, a "highly efficient stretch energy code" for new buildings that municipalities may adopt.[7]
    - "Under the Mass Save program, the state's utilities promote new construction meeting Passive House standards. The program was launched in July 2019. As of May 2020, about 50 projects had enrolled in the program, and it hopes to complete more than 4,000 units by 2023. The program began with training for builders in Passive House design and construction techniques. The program will help pay for a project feasibility study (up to $5,000) and for energy modeling (75% up to $20,000). Financial incentives of $3,000 per unit are offered for meeting Passive House standards. Upon completion of a design that meets program standards, an incentive of $500 per unit is paid. The remaining $2,500 per unit is paid upon completion of construction and a final inspection, including a blower door test. In addition, performance incentives of $0.75 per kilowatt-hour

[6] The Efficiency Maine Trust (2019). Beneficial Electrification: Barriers and Opportunities in Maine. https://www.efficiencymaine.com/docs/EMT_BeneficialElectrification-Study_2020_1_31.pdf
[7] Office of Governor Charlie Baker. "Governor Baker Signs Climate Legislation to Reduce Greenhouse Gas Emissions, Protect Environmental Justice Communities." March 26, 2021. https://www.mass.gov/news/governor-baker-signs-climate-legislation-to-reduce-greenhouse-gas-emissions-protect-environmental-justice-communities.

(kWh) and $7.50 per therm are paid for actual first-year energy savings (Mass Save 2020). The feasibility studies have been helpful. Builders appreciate knowing up front the per-unit incentives. And 15 program leaders have found that it is possible to exceed the Passive House standards."[8]

- **Energy Efficiency for Electric and Gas Utilities**: In July 2021, the Baker-Polito Administration established GHG reduction goals for its statewide, three-year energy efficiency plan. The plan, which will cover the years 2022 through 2024 and guide the deployment of ratepayer-funded building efficiency programs, must be designed such that electric and gas utilities reduce 504,000 and 341,000 metric tons of CO_2e, respectively. Investments will include building retrofits and weatherization, building electrification, and equitable workforce development.[9]

New York

- **Heat Pump Programs**: In 2019, New York passed the New York Climate Leadership and Community Protection Act. The Act aims to achieve 40% emissions reductions by 2030. The Act established economy-wide and electric sector targets that includes goals for energy efficiency, renewable energy, and energy storage technology. Notably, New York's Public Service Commission has created incentives and targets for heat pumps under their energy efficiency programs (Wilt 2020[10]; New York PSC 2020[11]).
    - Committed financial incentives: "This Commission order will direct nearly $2 billion in additional utility energy efficiency and electrification actions: $893 million for electric energy efficiency; $553 million for gas energy efficiency; and $454 million for heat pumps through 2025." [12]
    - Energy Savings Targets for Heat Pumps: "New York's electric utilities and NYSERDA are directed to jointly develop a consistent statewide heat pump program framework to be administered by the utilities in their service territories and combined with LIPA sets a minimum target of 4.6 TBtu for savings from heat pump installations across the state." NYSERDA is seeking to invest $200 million in market development programs to increase consumer awareness of heat pumps, increase skilled workers in the clean heating and cooling industry,

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[8] Nadel, S. 2020. Programs to Promote Zero-Energy New Homes and Buildings. Washington, DC: American Council for an Energy-Efficient Economy. September 2020. https://www.aceee.org/sites/default/files/pdfs/zeb_topic_brief_final_9-29-20.pdf

[9] Massachusetts Executive Office of Energy and Environmental Affairs. "Baker-Polito Administration Sets Ambitious Emissions Reduction Goal for Energy Efficiency Plan." July 15, 2021. https://www.mass.gov/news/baker-polito-administration-sets-ambitious-emissions-reduction-goal-for-energy-efficiency-plan.

[10] The Natural Resources Defense Council, More Efficiency for New York Means More Savings, Carbon & $, January 16, 2020. https://www.nrdc.org/experts/samantha-wilt/win-nyers-new-energy-efficiency-order-saves-ghg.

[11] New York State Clean Heat Program, https://saveenergy.ny.gov/NYScleanheat/

[12] Press Release - Governor Cuomo Announces Additional $2 Billion in Utility Energy Efficiency and Building Electrification Initiatives to Combat Climate Change, January 16, 2020. https://documents.dps.ny.gov/public/MatterManagement/CaseMaster.aspx?MatterCaseNo=18-M-0084&submit=Search.

provide technical assistance, and increase the benefits for low to moderate income customers

  - Proven Industry Growth: "The contractor industry has grown substantially in New York State since 2017, with 112 ground-source heat pump installers and more than 350 air-source heat pump contractors participating in NYSERDA's heat pump programs as of March 2020. Through 2019, nearly 11,000 program participants received incentives and services under NYSERDA's programs, supporting approximately 21,500 heat pump installations."[13]

- **Carbon Neutral Buildings Roadmap**: To meet the ambitious goals of the Climate Act, the Carbon Neutral Buildings Roadmap was created to identify pathways to decarbonize New York's building stock by 2050.[14]
  - Development of the Roadmap includes analyzing the state's entire building stock, researching critical building decarbonization barriers, modeling various solutions sets, and developing technology and policy recommendations to achieve the Climate Act goals, with a primary focus on four building typologies: Single Family Homes, Multifamily Residential (Low and mid-rise), Commercial Office (Low and mid-rise), and Higher Education.
  - The Roadmap will be updated approximately every 2 – 3 years to account for policy, market, and technological developments, and to analyze additional building typologies. The Roadmap is intended to:
    - Provide cutting-edge research related to building decarbonization
    - Send market signals to the real estate, finance, manufacturing, and construction sectors
    - Spur economic development and the creation of quality clean energy jobs; and raise awareness of the benefits to deep decarbonization, such as: Energy savings; Health & safety, comfort, and productivity; Resilience; and Provide guidance for other state agencies and local governments.

- **New Construction - Buildings of Excellence Competition:** The Buildings of Excellence competition began in 2019 and provides up to $40 million in monetary awards to visionary architects and developers that design and construct low or zero carbon emitting multifamily buildings. The competition is meant to recognize and encourage best practices for sustainable buildings. [15]

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[13] Nadel, S. 2020. Programs to Electrify Space Heating in Homes and Buildings. Washington, DC: American Council for an Energy-Efficient Economy. June 2020. https://www.aceee.org/sites/default/files/pdfs/programs_to_electrify_space_heating_brief_final_6-23-20.pdf.
[14] New York State Energy Research and Development Authority, Program: Carbon Neutral Buildings, https://www.nyserda.ny.gov/All-Programs/Programs/Carbon-Neutral-Buildings
[15] New York State Energy Research and Development Authority, Program: Buildings of Excellence, https://www.nyserda.ny.gov/all-programs/programs/multifamily-buildings-of-excellence

Washington

- **Building Standards – First Statewide Commercial Buildings Performance Standard**: In December 2020, Washington finalized the rules to implement its first-in-the-nation Commercial Clean Buildings Performance Standard, which the state enacted in 2019 legislation. The rules set a state target 15% below the 2009 to 2018 energy use average of commercial buildings larger than 50,000 square feet.[16]

[16] Washington State Department of Commerce. "Clean Buildings Standards." N.d. Accessed August 31, 2021. https://www.commerce.wa.gov/growing-the-economy/energy/buildings/clean-buildings-standards/.